

Artificial Touch in Contemporary Art and Culture

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This article explores the complexity of artificial touch technologies through a phenomenological and transmaterialist lens. Artificial touch is never neutral: it reflects cultural assumptions about the body, sensation and proximity, often reinforcing the hegemony of vision while rendering touch datafiable and programmable. Tracing a trajectory from the interrogations of touch seen in 19th-century psychophysics to contemporary touch devices, the article analyses three types of biomachine: artificial-intelligence skin pads, artist Paula Gaetano Adi's kinetic sculpture *Anima*, and haptic intimacy devices such as Kissenger and Huggy Pajama. The term 'biomachine' here refers to technologies that have life-simulating capabilities. Exploring theoretical as well as historical frameworks for approaching the novel relationships and entanglements to which these new biomachines give rise, the article asks: what forms of reduction of the complexity of touch sensation are operating in each biomachine analysed? Drawing on author Helen Keller's tactile epistemology, the analysis examines how technological simulations of haptic communication or intimacy often reduce the multisensory, hormonal and affective dimensions of touch to mechanistic proxies. Based on this examination, the article critiques a persistent visual and surface-oriented bias and argues for an understanding of touch as a simultaneously spatial, atmospheric and temporal event that is irreducible to contact alone.

Haptic AI Biomachines and the Reduction of Touch

Aristotle designated touch the most primitive sense – not due to its crudeness, but because of its primal nature as a holistic or 'common' sense (Fretwell, 2020). This article explores the complexities of

mimicking touch within the context of artificial intelligence (AI). As machine learning integrates with sensor technology, AI's capabilities are expanding beyond text and visual generation to encompass multisensory experiences. In developing these multisensory interfaces, researchers have optimised artificial skin sensors that detect touch and can recognise handwriting on the surface of 'skin pads' (Balaji & Peh, 2023). The article investigates a logic of touch emerging from such technological advancements through case studies of artificial skin pads, the artistic endeavour of creating an artificial creature with perspiring skin, and long-distance kissing and hugging devices. We refer to these different cases as biomachines. The concept of the biomachine here refers to technologies that have life-simulating capabilities. We investigate the techno-mimetic functionalities of AI technologies that simulate touch sensation, specifically from an aesthetic perspective – that is, with a particular focus not only on how the biomachines communicate to the senses but also on how they simulate sense perception and communication. We follow Caroline A. Jones's concept of aesthetics as sensorium in that we perceive biomachines as technological expansions of the human sensorium. As Jones (2006: 82) states: 'The sensorium should be seen at any historical moment as shifting, contingent, dynamic, and alive. It lives only in us and through us, enhanced by our technologies and extended prosthetically'. Coming from this understanding, we explore theoretical as well as historical frameworks for grasping the novel relationships and entanglements to which these new biomachines give rise. Each in their own way, the biomachines we discuss in this article renegotiate entanglements between technologies and human senses. We discuss these entanglements via Karen Barad and Teresa Brennan, among others.

Throughout the article, we focus on a logic of touch that is prevalent in haptic AI biomachines and to which we refer as a logic of touch reduction. This concept, which we unfold throughout the article, refers to a reduction that takes place when attempts are made to translate human touch sensations into datafied technological simulations. The complexity of touch is reduced in the cases we discuss, as we argue throughout our analysis. To render this reduction visible, we begin by mapping out the complexity of touch sensation as something that is composed of various dimensions. In our analysis of haptic AI biomachines, we discuss how these different dimensions are reduced in technological simulations of touch, as well as how such technological expansions of the haptic sensorium affect our concept and understanding of touch.

The historical foundations of converting touch into data can be traced back to 19th-century psychophysics, which aimed to

objectively measure subjective human sensation through controlled experimentation in a laboratory setting (Fretwell, 2020). We historically contextualise our analyses of contemporary devices by drawing on the history of psychophysics, as well as by drawing parallels with the American writer Helen Keller (1880–1968), who, being deafblind, learned Braille through touch, which served as her primary interface with the world. Keller functions as a figure and analytical reference through which we develop a deeper understanding of the complexity of the sense of touch. Throughout the article, as we engage with our chosen cases, we continually ask: what forms of reduction are operating in each instance? Which properties of touch are prioritised, and which are left out? This ultimately enables a discussion of the reduction of touch in AI haptic tools.

State of the Art

Within the field of artificial touch, technological progress has accelerated rapidly in recent years. Yet the replication of tactile sensation remains considerably more complex than the simulation of semantic, visual or auditory sensations. This is due in part to the spatially distributed nature of the sense of touch. As Heather Culbertson *et al.* (2018: 386–387) observe, touch is not confined to a single organ but spans the surface and depth of the human body: ‘The sense of touch is not localized to a specific region of the body; instead, it is distributed across the entire body through the touch sensory organ, our skin, and in our joints, muscles, and tendons’. They distinguish between kinaesthetic sensations, which are sensed in joints and muscles, and tactile sensations, which are sensed through mechanoreceptors embedded in the skin. This complexity presents significant technical and epistemological challenges. As Giulia Pasquale (2019: 638) notes, while artificial vision and auditory processing have benefitted from large, structured data sets and advanced machine learning models, the field of tactile sensing still struggles to integrate flexible electronics into responsive materials. Despite these limitations, recent advances in materials such as stretchable silicone, and the application of deep learning models to tactile data sets, have made it possible to develop artificial skin pads that not only sense pressure and vibration, but also recognise gestures or handwriting on the skin surface (Balaji & Peh, 2023). We will analyse this case in the next section.

This technological development raises a set of conceptual questions: how is touch reconfigured in the process of being made machine-readable? What ontologies of the body and the senses are implied in

this reconfiguration, to which we refer as a reduction? What becomes of the subjective, affective and situated dimensions of touch once they are formalised as signal and data?

These questions resonate with longer histories of attempts to quantify sensation. Psychophysics, for example, sought to correlate subjective sensory perception with objective stimuli, exemplified by instruments such as the aesthesiometer, a device developed to measure skin sensitivity that we will introduce in the next section. As Erica Fretwell (2020) argues, such technologies not only measured touch but also produced new conceptions of the sensing subject. Similarly, the contemporary datafication of touch risks encoding a model of the body that privileges external measurement over lived experience – a model in which the body is increasingly approached as a surface for extraction.

Mark B. N. Hansen (2015) has argued that the rise of predictive and ambient sensing technologies marks a shift in the logic of mediation. Where older media interfaced primarily with perception and cognition, contemporary systems engage preconscious, affective and bodily registers of experience. In this context, artificial touch becomes part of a broader transformation in how media interface with the human sensorium. The computational rendering of touch does not merely simulate a sensory modality; it enacts a reconfiguration of embodied relationality and environmental embeddedness.

The examples discussed in this article – from artificial skin and robotic kissing devices to artistic experiments with sweating synthetic sculptures – must be read within this context of technological acceleration and epistemic reduction. Together, they illuminate how the reproduction of touch is not only a technical problem but also a site of phenomenological negotiation. In the following case analyses, we explore which entanglements are allowed for and what reductions of touch are produced in each of the specific cases.

First Biomachine: Touch Understood as Text

In the article ‘AI-On-Skin: Towards Enabling Fast and Scalable On-Body AI Inference for Wearable On-Skin Interfaces’, computer engineers and scientists Ananta Narayanan Balaji and Li-Shiuan Peh from the National University of Singapore describe their research on and development of AI-on-skin technologies. Artificial skins are being developed for applications in healthcare (for prosthetic limbs), as well as in gaming, sports training and more. Examples include sensing gloves for object identification and patches enabling

handwritten word recognition. Researchers have been developing prototypes and regard skin as ‘the most user-friendly biological interface for sensing and communicating with the outside world’ (Balaji & Peh, 2023: 2). However, what their prototypes demonstrate is that what Aristotle called the most primitive human sense also seems to be the most difficult and complex to reproduce artificially.

According to Balaji and Peh (2023: 2), ‘artificial skins have recently been developed that can sense touch much faster than the human nervous system’. This raises a crucial question: how did speed become a quality of touch? The claim implies that touch is understood narrowly as information, as data. This is indeed confirmed by the researchers, who state that they focus on computing rather than sensory aspects. When touch is understood as data, and speed becomes an indicator of sensitivity, touch is reduced to a surface-level phenomenon. But as we have already seen, touch is more complex than that. If artificial skin sensors are developed to ‘mimic the properties of human skin’, as Balaji and Peh (2023: 3) write, our analytical interest lies in understanding which properties of human skin are being targeted. When something is transformed into data, a selection and/or reduction necessarily occurs. What selections and reductions are at stake here? We are specifically interested in analysing touchpads for handwriting in the quest to answer the question: which of skin’s qualities are being artificially reconstructed? Thus, we are interested in exploring which properties of human skin are prioritised and imitated when artificial skin is created.

But how does human touch actually feel? It seems relevant to interrogate the primordial aspect of human sensation as if it were new. The human through whom we have chosen to investigate this is the fascinating figure of Keller. To compare the reduction that takes place in AI haptic devices against what is reduced (i.e. the human touch sensation), we draw parallels with Keller’s experience of the world, since an engagement with her descriptions of touch sensation allows us to unfold a very complex conceptualisation of the sense of touch and the haptic.

At 19 months, Keller suffered an illness that left her deafblind. She remained deafblind for the rest of her life, with her remaining senses being her only access to the external world. This also meant that these senses, including touch, were elevated and refined by comparison with people who have all five senses intact, making Keller’s descriptions of her own senses particularly useful for building an understanding of touch sensation. When she was six years old, Keller’s family employed the visually impaired teacher Anne Sullivan, who taught Keller to read and write using Braille, that is, by touch

through the hands. Keller invented her own 'private science of palmistry' (Keller 1908: 30), positioning herself as a valuable figure in the context of artificial skin pads: she was a unique human being, extremely sensitive to touch, but also a master of language; her knowledge of the world and language came through touch. She understood the world via books and other people's verbal descriptions of visual objects and auditory phenomena.

Keller wrote several books. *The Story of My Life* (1903) is autobiography in the classic narrative sense (a recounting of events), but the book that is of particular interest for us is *The World I Live in* (1908), which dives into deep descriptions of Keller's extraordinary way of sensing, with chapters such as 'The Seeing Hand', 'The Power of Touch' and 'The Finer Vibrations'. Here is an example of one of those descriptions:

I have just touched my dog. He was rolling in the grass, with pleasure in every muscle and limb. I wanted to catch a picture of him in my fingers, and I touched him as lightly as I would cobwebs; but lo, his fat body revolved, stiffened and solidified into an upright position, and his tongue gave my hand a lick! He pressed close to me, as if he were fain to crowd himself into my hand. He loved it with his tail, with his paw, with his tongue. If he could speak, I believe he would say with me that paradise is attained by touch; for in touch is all love intelligence. (Keller, 1908: 7)

Here we already begin to grasp that touch is never just a mere reading, a datafication. Touch always means being in touch, being in relation. The dog is not just a dog; it is a touched dog. It is affected as it enters into relation with the one who touches it, and it changes its behaviour accordingly, licking Keller's hand affectionately. Toucher and touched meet in the sense of touch, making the entanglements between subject and object immensely complicated. To map out touch sensation in all its complexity, then, we can begin by stating that touch – phenomenologically speaking – is relational in nature. The relational dimension of touch implies that touching something or someone is always a being in touch.

Keller (1908: 19–20) further describes tactile vibrations which do not belong to skin-touch, as she describes her own vibrotactility: 'Every atom of my body is a vibroscope'. She describes the body as a vibrating, resonating whole: 'There are tactual vibrations which do not belong to skin-touch. They penetrate the skin, the nerves, the bones, like pain, heat, and cold. The beat of a drum smites me through from the chest to the shoulder-blades' (Keller, 1908: 19–20).

Following this, and going back to our map of touch sensation, we can add that touch is vibrational in the sense that it goes beyond skin surface and reaches way down into the body – into the organs, the bones and the entire nervous system. We refer to this as a vibrational dimension of touch.

By reading Keller's descriptions in *The World I Live in*, we become aware of her experience of spaces such as homes. When a subject, a human body, lacks the visual ability to take in the entire space at once, the atmosphere of the space is perceived differently because, as Keller (1908: 9) herself writes, she can only touch one object after another in other people's homes: 'It is not a complete conception, but a collection of object-impressions which, as they come to me, are disconnected and isolated'. The impression of a home, therefore, takes on a temporal, sequential nature, whereas in the sensory system of visual people, it would be experienced as spacious. This adds a third dimension to our map of touch sensation: touch has a sequential nature. Particularly interesting in relation to artificial touch is Keller's description of how her inner concept of a home (or house) is constructed: 'My mind is full of associations, sensations, theories, and with them it constructs the house'. This passage highlights the inherently complex nature of sensation, which is shaped by the interplay between sensation (Keller's sense of touch when given an object) and what she terms 'my mind'.

Psychophysicists were interested in Keller as a case study. According to Fretwell (2020: 228), E. H. Weber conducted the first psychophysicist studies with the ambition to produce 'a body of knowledge about human sensation based on experimental methods for measuring subjective experience'. His books *De Tactu* ('Concerning Touch', 1834) and *Der Tastsinn und das Gemeingefühl* ('The Sense of Touch and the Common Sensibility', 1846) marked a 'germinal moment in not only the history of touch but also natural science' (Fretwell, 2020: 228). In some of his experiments, Weber blindfolded his subjects to test skin sensitivity using callipers, a tool with two movable compass points. Subjects were asked whether they felt one or two contacts when the calipers were applied to various parts of the body. Weber was interested in determining the "two-point threshold", the smallest distance apart at which the compass points could still be perceived as distinct' (Fretwell, 2020: 229). He considered the two-point threshold to be the threshold of consciousness. If you attempt to replicate this experiment with a friend by having them press two pens against your skin, you will probably find that human skin is relatively poor at detecting two points, even when those points are placed at distances

visible to the eye. That is, a distance visible to the eye may not necessarily be perceptible on the skin.



Figure 1. Example of an aesthesiometer, a device to measure skin sensitivity. 19th century. From the Parkes Weber collection. Photographer Jennie Hills. © Science Museum, London Science and Society Picture Library.

In the mid-19th century, calipers were redesigned into an instrument called the aesthesiometer (Figure 1), and here we approach the main critical point of Fretwell's book, which is to highlight how psychophysics was used in discriminatory and prejudiced ways to establish taxonomies based on gender and race. Some sensory methods and sensitivities were deemed to belong to specific groups and were considered more refined than others. The development of the aesthesiometer extended the experimental dimension into a more pathological domain:

In the 1880s, Jastrow made some improvements to the aesthesiometer, and soon after, educators like Montessori began using it to train children's tactile sensitivity. Outside the school and in more clinical settings, however, tactile sensitivity was not a faculty to be cultivated but a symptom of nervous sensitivity. When Wilhelm Wundt used Weber's two-point method in his 1858 dissertation on the touch sensitivity of hysterics, he inaugurated the aesthesiometer as a tool for diagnosing abnormal minds. (Fretwell, 2020: 229)

The main point here is that high sensitivity to touch was not historically regarded as a particularly admirable trait, but Keller was popular and respected – perhaps because of her linguistic abilities. It is interesting, therefore, that Balaji and Peh are trying to artificially construct skin that can sense handwriting. Perhaps some readers will recall childhood games where one person draws or writes on another's back, and the person whose back it is tries to guess what has been written. The game is fun because it is so challenging for the skin to sense something that we are used to reading visually. When the skin is reduced to a mere visual surface, its ability to sense something is weakened. As a sense organ it is not very fit for 'complete conception', as Keller (1908: 9) terms it, but rather for sequentially integrating the impression of a 'collection of object-impressions'.

Thus, the AI touchpad for handwriting may fail precisely because it has been designed too visually. Skin is not (only) a large surface to be written on; it invites sequentiality and depth, vibration and relationality. It seems there is a difference between designing something based on the sight of skin and doing so based on the experience of having skin. The AI touchpads establish a reduced entanglement between toucher and touched, between subject and object – an entanglement that in touch sensation is far more complicated.

We have analysed the AI handwriting pad for artificial touch to understand which characteristics of skin are prioritised in the artificial imitation of skin. We have pointed out that prioritising certain properties of skin in order to understand something visually is not something to which skin is particularly suited. Skin struggles to read like a visual surface. A handwriting pad is one of the least obvious things to imitate artificially if you need a signal for writing; there are simpler ways to communicate writing to consciousness than through skin. Despite the experiments conducted to test the effectiveness of these touchpads, as we have pointed out, speed and sensitivity are not necessarily the primary properties of human skin. Fretwell (2020) distinguishes between flesh and skin, where flesh is depth and skin is

surface. The handwriting pad treats skin as surface, not as flesh. In what follows, we focus on a biomachine that is far 'fleshier'.

Second Biomachine: *Anima* and the Primacy of Touch – Soft and Mestizo Robotics

Anima is a soft robot and kinetic sculpture developed by artist Paula Gaetano Adi. When a visitor approaches the sculpture, it begins to breathe. As the viewer touches the surface of the soft silicone body, it swells and contracts with artificial respiration. At a certain moment, a small orifice in the skin begins to sweat. The robot thus presents a form of artificial skin that is responsive and soft – not simply a surface, but a material capable of interactivity, reaction and expression. Gaetano Adi's *Anima* stages the body not as an object, but as an agent of encounter and entanglement.

In contrast to robotics that prioritise data, computation or language, *Anima* breathes. It is respiratory. The mechanism behind this artificial body is deliberately simple: images on Gaetano Adi's website reveal a basic skeletal frame with a motor and microcontroller. Its affective force lies precisely in this demonstrative minimalism, in its insistence on a single, primal sensory function. As Jones (2022: 16) writes, 'we sense, in a pre-verbal way, the life-worlds of other creatures'. This preverbal sensing is also central to Aristotle's designation of touch as the most primal of the senses (Fretwell, 2020: 222). *Anima* thus enacts a sensory reduction: it homes in on the most basic relational function of skin – touch – and allows it to emerge as the interface through which human and machine encounter one another.

This emphasis on touch can also be read as a countermove to the dominance of vision in the aesthetic regimes of the art world. As Jones has observed elsewhere, the prevalence of 'Do Not Touch' signs in what she terms 'our visual mausoleums' testifies to visuality's hegemony and the exclusion of bodily relation from the aesthetic experience. She argues that 'we participate in ocular fantasies of unmediated knowledge, still imagining ourselves as free and untethered from the sensory viscera mediating (and thereby producing) our only conceivable relation to the real' (Jones, 2010: 98). *Anima* actively disrupts these ocular fantasies by demanding proximity, contact and sensory involvement. Its insistence on corporeal engagement challenges the historical fear within the art world of collapsing the distance between viewer and work.

This fear of collapsing critical distance has a long genealogy. As Christina Grammatikopolou (2016: 46) notes in her discussion of participatory and immersive art practices, ‘these new artworks faced a certain amount of skepticism from some critics. Theodor Adorno for example stated that “just as artworks cannot intervene, the subject cannot intervene in them; distance is the primary condition for any closeness to the content of works”’. Grammatikopolou (2016: 43) also references Oliver Grau’s concern that immersive artworks are ‘characterized by diminishing critical distance to what is shown and increasing emotional involvement in what is happening’ – a trait which, he worried, might prevent such ephemeral artworks from entering historical memory. *Anima*, however, embraces this ephemerality. Rather than trying to secure its place in an archival canon, it exists in the moment of contact – fleeting, contingent and affective.

While the previous example of artificial handwriting pads foregrounded skin as a medium for data exchange or as a visual script, *Anima* does not simulate language. Rather, it exaggerates the skin’s expressive qualities, evoking a non-verbal, embodied relation between viewer and artefact. This exaggeration – the visible, almost theatrical sweat – invites reflection on the difficulty of reproducing the body’s most elemental and intimate modes of communication.

The rhetorical register of the work itself foregrounds this primacy. In its own documentation, *Anima* is described as ‘a living organism in its simplest expression’ (Gaetano Adi 2025: 3). Touching it triggers not only movement, but an uncanny affective feedback: the soft surface seems to yield, react and breathe. Its power lies in its ability to evoke life through minimal technological intervention. This is reminiscent of Keller’s account of the body as a vibrating, resonating whole. With the sweating, we also become aware of temperature as an important modality when it comes to touch – yet another dimension we can add to our mapping of its complexity. Other dimensions of touch mentioned in the literature on the subject are texture and moisture, as well as atmospheric and hormonal exchanges (Cheok, 2010). Brennan (2004) points to exchanges related to hormonal, pheromonal and scent-related dimensions. All of these dimensions of touch are in many ways atmospheric, biochemical and often subconscious entanglements between touching matters. Luce Irigaray’s work on touch emphasises that touch is not merely a physical act, but a profound interaction involving both body and soul. As a culture, we have forgotten that touch is foundational:

Instead of reaching the spirit which corresponds with our nature, have we not imposed on the latter structures to free ourselves from it and dominate it, the most important of them being language, a language which codifies the real in a more or less arbitrary way, and which worries little about connecting our brain with our body, about uniting, in us and between us, physical materiality with mental aptitudes. (Irigaray, 2024: 9–10)

As a further conceptual framework, Gaetano Adi in collaboration with Gustavo Crembil has developed the notion of mestizo robotics, a form of robotics that resists the totalising ambitions of fully autonomous systems. In their work *TZ' IJK*, the artists presented an installation composed of autonomous deafblind agents whose 'skin' was made of mud. The piece was realised in the Peruvian Amazon and explicitly contrasted high and low technologies. In their words, mestizo robotics 'embraces the handmade, the rudimentary, and the imperfect' (Adi & Crembil, 2017: 133), drawing from Latin American histories of hybridity and resistance. *Anima* shares this logic: it is at once organic and synthetic, sophisticated and rudimentary. Rather than conceal its mechanisms in pursuit of technological illusionism, it foregrounds them in a gesture of aesthetic honesty.

In this way, Gaetano Adi's robot resists the performative ambition of technologies such as high-fidelity artificial skin, or the remote robotic kisses we interrogate below. These often promise sensory realism, but in doing so they risk failure when they do not deliver. *Anima*, by contrast, is powerful because it remains basic, simple. It embraces the elemental – breath, touch, sweat – and in doing so stages what Bernadette Wegenstein (2010: 33) calls 'the skin as porous and fluid, the site of encounter and exposure between body and media rather than a site of exclusion and closure'. *Anima*'s fluid mode of sweating makes us aware that this property is most often absent from other versions of artificial skin.

There is a reduction going on in Gaetano Adi's *Anima*. However, that reduction – the homing-in on the most basic relational function of skin, namely touch – serves the purpose of *not* reducing the complexity of touch sensation. In *Anima*'s simplicity, the complexity of touch is foregrounded – touch as a relational, vibrational entanglement in all its complexity of atmospheric, subconscious, hormonal and pheromonal exchanges

Third Biomachine: Touching as Distant Kissing and Hugging

Two haptic technologies designed to mediate affective touch across spatial distance are Kissenger and Huggy Pajama. These biomachines exemplify a growing interest in the engineering of intimacy through digital and robotic means, particularly in the context of long-distance relationships and affective telepresence. Kissenger is a small, mobile-connected device created to simulate a kiss (Cheok & Zhang, 2019). It consists of a silicone pad that receives pressure from the user's lips, which is then sensed and translated into motion by embedded actuators in a corresponding device held by another user. The system allows two people, potentially continents apart, to engage in a tactile exchange that mimics the form and timing of a kiss. Huggy Pajama, originally developed for children separated from their parents (for example, while the parents are working late or travelling), consists of a soft wearable suit embedded with haptic actuators and connected to a plush toy (Cheok, 2010). When the adult squeezes the toy, the garment worn by the child inflates or tightens at certain points, mimicking the sensation of a hug. These technologies aim not simply to reproduce the physical sensation of touch, but to facilitate a sense of affective presence in the absence of bodily proximity. They render touch not only a sensory phenomenon but a problem of mediation, translation and technological orchestration.

Rather than viewing these systems as partial or flawed substitutes for 'authentic' touch, we can approach them through Barad's theory of intra-action in order to complicate and nuance our understanding of subject-object entanglements in touch sensation. Barad's framework, grounded in quantum physics and feminist theory, departs from traditional notions of interaction, which presuppose the existence of discrete entities that then relate. Intra-action, by contrast, posits that entities do not precede their relations; rather, they emerge through specific material-discursive entanglements.

According to Barad (2015: 396), physically there has always been – and will always be – a theoretical distance between agents that touch each other. This point may serve to nuance our critical analysis of new technologies that attempt to simulate touch. While it may be true that such devices produce a superficial and reduced form of touch and arguably introduce a kind of distance between toucher and touched, Barad's account allows us to argue that, theoretically speaking, there is always already a physical distance between the two. Particles, in theory, can never actually touch:

A common explanation for the physics of touching is that one thing it does not involve is ... well, touching. That is, there is no actual contact involved. You may think that you are touching a coffee mug when you are about to raise it to your mouth, but your hand is not actually touching the mug. Sure, you can feel the smooth surface of the mug's exterior right where your fingers come into contact with it (or seem to), but what you are actually sensing, physicists tell us, is the electromagnetic repulsion between the electrons of the atoms that make up your fingers and those that make up the mug. (Barad, 2015: 396, Barad's ellipsis)

What we feel when we touch other objects or actors (non-human or human) in the world, Barad explains, is merely 'an effect of *electromagnetic repulsion*' (Barad, 2015: 396, our italics). So, there are repulsion and distance between all things in the world. At the same time, as Barad (2015: 397) writes, 'repulsion is at the core of attraction'. She explains the attraction between matters as 'intra-actions' (Barad, 2015: 399). The electron, she writes, electromagnetically intra-acts with itself through the emission and reabsorption of photons. She refers to this as 'self-energy' or 'self-touching'. According to Barad (2015: 399), there is an 'infinite set of possibilities' of intra-actions that can take place. She ultimately reads this as everything being in touch with everything, including itself – a kind of butterfly effect at the particle level. Touching, as Barad conceptualises it through quantum physics, is always already happening, and it is infinitely deep – reaching far into the body, but also bridging all bodies and matters of the world. All matter is already in touch with itself and other matters around it, in an outwards opening sequence. This means that beings and non-beings alike are endlessly interconnected in the deep modality of touch sensation: 'All touching entails an infinite alterity, so that touching the other is touching all others, including the "self"' (Barad, 2015: 401). This is what Barad refers to as 'entanglement', 'patchwork' and 'queer kinship'. She understands entanglement as the condition in which separations (or distances) between actors in the world – between toucher and touched, between subject and object, or between parts – are always also a 'holding together'. All parts of the world are always already part-ing; they are held 'together-apart' through what she calls intra-actions, forming a kind of patchwork (Barad, 2015: 406).

When Barad describes the world and its many human and non-human matters as a patchwork, she is not suggesting that a number of individual and clearly delineated pieces are sewn together into a larger whole. Rather, she argues, all these parts are, at a fundamental

physical level, always already held together through electromagnetic repulsion/attraction intra-actions. She refers to this as 'the transmaterial'. Transmateriality denotes the fact that matters transmit to one another, that there are transfers and exchanges between matters, that matters touch each other in continuous transformation. The term 'transmaterialities' also gestures towards the word 'reality', and she splits the term into 'trans-matter-reality' (Barad, 2015: 411) to indicate that this transbehaviour of matter means that 'reality' cannot be understood as 'actual lived reality' with stable matter and being (Barad, 2015: 410). In line with her reading of quantum field theory, Barad (2015: 411) reconceptualises being as an ongoing un/doing – a continuous double act of simultaneous doing (transforming, becoming) and undoing (reabsorbing), a together-apartness.

Barad writes about this in a very concrete context: she is writing about trans matters for a lesbian and gay studies journal. Hence, she develops her argument to break with the logic of gender as a fixed, stable biological entity – even if, as she writes, matter sometimes (for instance, when a scalpel is required to change biological gender) seems 'impossibly hard and fixed' (Barad, 2015: 411). In the context of devices such as Kissenger and Huggy Pajama, Barad's conceptual apparatus helps us to nuance an analysis that could easily critique such devices as a loss or superficial mediation of touch – as a reduction of touch, that is, to surface and superficial datafication. Barad helps us understand touch in all its complexity as an entanglement of matters that reaches beyond subject-object categories. The Kissenger device is not a passive conduit between two already-constituted subjects, but part of a relational apparatus through which subjectivity, affect and materiality co-constitute one another. The kiss that takes place via Kissenger is not a mechanical reproduction of a pre-existing act, but an event through which the very notion of a kiss – and of a subject who kisses – is materially produced. Similarly, Huggy Pajama does not simply transfer a gesture from one body to another, but enacts a distributed choreography involving textile sensors, microcontrollers, bodily responses, memory and care. The hug, in this context, is not simply displaced, but reconfigured through a dynamic constellation of technical and affective forces.

Barad's theory provides a means to understand these reconfigurations as sites of generativity. In this view, phenomena are not self-contained events but the smallest ontological units – relational becomings that include both matter and meaning. Technologies such as Kissenger and Huggy Pajama, then, do not merely carry affect; they are part of the apparatuses through which

affect is enacted. These are what Barad calls phenomenal practices: specific material-discursive arrangements that give rise to particular configurations of experience, embodiment and relationality. What is touched in a Kissenger-enabled kiss is not simply another person, but a materially entangled field in which bodies, sensations and circuits intra-act to produce the conditions for touch to be meaningful. Likewise, the embrace produced by Huggy Pajama is not reducible to either the initiating or receiving subject; it is an emergent event in which technical systems, bodily memories and emotional investments coalesce to produce the feeling of closeness.

Such events exemplify what Barad terms transmateriality – the recognition that matter is not passive or inert, but actively participates in the formation of experience. In transmaterial touch, affect is distributed across the entire apparatus, not located solely in human bodies. The kiss and the hug do not originate in human intention and then travel through a technological medium; they are enacted through an ongoing process of material negotiation. This perspective challenges anthropocentric accounts of technology as either tools for or threats to human intimacy. Instead, it insists on the co-constitution of the human and the non-human, the affective and the technical, the embodied and the machinic. The kiss is not diminished by being rerouted through silicone and software; rather, it is materially reconstituted through their involvement.

The implications of this account are twofold. First, these systems shift our understanding of what touch is – of the relational dimension of touch. No longer merely a property of the skin or nervous system, touch emerges as a relationally distributed and contingent phenomenon. Second, they complicate the boundaries between self and other, user and device, signal and sensation. By foregrounding the material agencies of sensors, actuators, network protocols and synthetic surfaces, these biomachines invite us to reconsider the ontological status of intimate acts themselves. They prompt a rethinking of presence – not as a binary of here or there, not as a contrast to absence or distance, but as a modulated field of affective intra-action.

Thus, we can view Kissenger and Huggy Pajama as accentuating the complexity of touch: the depth of the butterfly effect, spreading throughout matters. Our analysis of these devices points to the relationality of touch as a relationality not merely between two discrete actors, but between and across an extended, theoretically unending field of matters. To revisit an image given by Keller, it points not to a dog touching a woman, or a woman touching a dog, but to a depth of entanglement that collapses those categories into a

mutual connectedness of things. The sensorium of touch, as grasped through the analysis of this type of biomachine, invites us to reflect on the possibilities of techno-mimetic expansions of the haptic.

Throughout this article and our analyses of various versions of artificial touch, we have consistently posed the question: what reduction is taking place here? While we have chosen not to understand devices such as Kissenger and Huggy Pajama as mediations of or replacements for touch, we nonetheless ask: which aspects of human touch are *not* prioritised in these devices? In *The Transmission of Affect*, Brennan (2004) argues that affect is not merely internal or psychological but materially transmitted between bodies via hormones, pheromones and scent – through the air itself. According to Brennan, we do not just feel in isolation; rather, we are continually absorbing and being affected by others' bodily states, often unconsciously. This hormonal transmission, she suggests, is part of how we sense the atmosphere in a room or intuitively pick up on another's mood. In contrast to our emphasis (via Barad's theory of intra-action) on entanglement through apparatuses and material-discursive relations, Brennan's framework calls attention to a visceral, biochemical form of proximity, one that presupposes physical co-presence, breath and shared air.

In relation to technologies such as Huggy Pajama and the Kissenger device – both of which are designed to simulate intimacy across distance – Brennan's theory prompts us to ask what kinds of affective transmission are not captured by haptic or robotic interfaces. While such devices may reproduce pressure, movement and even synchronised affect, they bypass the hormonal dimensions of being-together. They bypass temperature, moistness. The engineers behind both Kissenger and Huggy Pajama seem fully aware of this. The Kissenger device has an integrated scent module (Cheok & Zhang, 2019: 87); the creators' evaluation of Huggy Pajama notes that 'additionally, we could also add other aspects of touch such as texture, temperature, and moisture' (Cheok, 2010: 189). In this sense, remote touch systems may come to entangle bodies on a mechanical or computational level, but they cannot (yet) replicate the atmospheric, hormonal mingling that, for Brennan, constitutes a fundamental layer of affective life. What might get lost is not only the warmth of proximity but the subtle transmission of affect that takes place in the air between us.

Conclusion: Touch as a Distributed, Interrelational, Many-Dimensional Sensorium

With reference to the aesthesiometer, Chris Salter (2023) notes:

Psychophysics is very much alive in the most unimagined of places. In the labyrinths of behavioral research at Facebook Reality Labs, for example, scientists with PhDs in neuroscience, applied perception research, robotics, and computer science still draw (albeit with updates) on the quantitative modeling of sensation, stimuli, and perception that Fechner discovered in the late 19th century.

The aesthesiometer was an early haptic biomachine. We have interrogated three new AI-engendered biomachines that simulate touch sensation. Through our analysis, we have pointed towards their different ways of prioritising certain dimensions of touch.

In the first case, we saw how AI-on-skin pads reduce touch to a set of quantifiable data points, treating the skin as an interface for visual-semantic recognition. Drawing on historical perspectives from psychophysics, and on phenomenological accounts by Keller, we demonstrated that these technologies inherit a legacy that privileges visibility and cognition over the affective and embodied dimensions of touch. Through the conversion of touch into text, the skin becomes a readable surface rather than a deeply complex sensuous organ.

In the second case, we saw how Gaetano Adi's *Anima* resists reduction by embracing softness and opacity. Her soft robotic sculpture undoes the instrumental logic of robotic responsiveness, instead enacting a form of touch that is relational, vibrant and moist. *Anima* gestures towards forms of tactile knowing that are relational, entangled and non-representational.

In the third case, we analysed the remote haptic intimacy technologies Kissenger and Huggy Pajama and their attempt to simulate affective closeness across spatial distance. While these biomachines may seem to offer only partial substitutes for 'real' touch, we argued – drawing on Barad's theory of intra-action and transmateriality – that such technologies reconfigure rather than simply mediate touch. The kisses and hugs transmitted through these systems are not degraded copies but emergent phenomena: distributed, entangled events involving sensors, circuits, bodies and memory. At the same time, through Brennan's theory of affective

transmission, we noted what is *not* captured in such technologies: the hormonal and atmospheric dimensions of proximity, which remain beyond the reach of current haptic engineering.

Across our analysis of all three biomachines, and via our reading of Keller's testimonies, a central insight emerges: touch technologies do not simply replicate physical contact, but reconfigure, and thereby reimagine, what touch is and can be. They make visible the underlying assumptions – sensorial, epistemological, affective – that shape our understandings of embodied tactile experience. While each system introduces forms of reduction, they also generate new possibilities for thinking about contact, care, intimacy and connection in an increasingly mediated world. Rather than dismissing the haptic biomachines analysed above as insufficient imitations of the real, we propose reading them as material-discursive sites where the boundaries between biology and machine are actively negotiated.

'I wanted to catch a picture of him in my fingers', Keller (1908: 7) writes when she describes her encounter with her dog. But touching someone or something (no matter how lightly), as Keller herself notes, always already means changing, affecting, that picture. This relationality – the reciprocity of touch or, with Barad, its inherently intra-active nature – makes touch a site that is not very fit for fixed information or the determined interpretations dreamed of by Balaji and Peh. Instead – and Gaetano Adi's *Anima* and the Kissenger and Huggy Pajama devices help us think this through – touch is a distributed, interrelational and many-dimensional site of ambiguous communication.

References

- Adi, P. G. & Crembil G. (2017) 'Mestizo Robotics', *Leonardo* 50, 2: 132-137.
- Adi, P. G. (2025) 'Anima', paulagaetanoadi.com (Oct 2025). https://static1.squarespace.com/static/62c85c54112ed547c23c0e3b/t/63cbd23a765ca36bceac97fe/1674302042408/PGA_Anima.pdf
- Balaji, A. N., & Peh, L.-S. (2023) 'AI-On-Skin: Towards Enabling Fast and Scalable On-Body AI Inference for Wearable On-Skin Interfaces', *Proceedings of the ACM on Human-Computer Interaction* Vol. 7, Issue EICS, Article No. 187: 1-34.

- Barad, K. (2015) 'Transmaterialities: Trans*/Matter/Realities and Queer Political Imaginings', *GLQ: A Journal of Lesbian and Gay Studies* 21, 2–3: 387–422.
- Brennan, T. (2004) *The Transmission of Affect*. Ithaca, NY: Cornell University Press.
- Cheok, A. D. (2010) 'Huggy Pajama: A Remote Interactive Touch and Hugging System', in A. D. Cheok, *Art and Technology of Entertainment Computing and Communication*. London: Springer.
- Cheok, A. D., & Zhang, E. Y. (2019) 'Kissenger: Transmitting Kiss Through the Internet', in A. D. Cheok & E. Y. Zhang, *Human-Robot Intimate Relationships*. Cham: Springer.
- Culbertson, H. et al. (2018) 'Haptics: The Present and Future of Artificial Touch Sensation', *Annual Review of Control, Robotics, and Autonomous Systems* 1: 12.1-12.25.
- Fretwell, E. (2020) *Sensory Experiments: Psychophysics, Race and the Aesthetics of Feeling*. Durham, NC: Duke University Press.
- Grammatikopolou, C. (2016) 'Breathing Art: Art as an Encompassing and Participatory Experience', in C. van den Akker & S. Legêne (eds), *Museums in a Digital Culture: How Art and Heritage Become Meaningful*. Amsterdam: Amsterdam University Press.
- Hansen, M. B. N. (2015) *Feed-Forward: On the Future of Twenty-First-Century Media*. Chicago: University of Chicago Press.
- Irigaray, L. (2024) 'Introduction: Expelled from the Nest', in L. Irigaray, *The Mediation of Touch*. Cham, Switzerland: Palgrave Macmillan.
- Jones, C.A. (2010) 'Senses', in M. B. N. Hansen & W. J. T. Mitchell (eds), *Critical Terms for Media Studies*. Chicago: University of Chicago Press.
- Jones, C. A. (2006) 'Sensorium: New Media Complexities for Embodied Experience', *Parachute* 121: 80–97.
- Jones, C. A. (2022) 'Symbiontics: A Polemic for Our Time', in C. A. Jones et al. (eds) *Symbionts: Contemporary Artists and the Biosphere*. Cambridge, MA: MIT Press.
- Keller, H. (2000/1903) *The Story of My Life*. The Project Gutenberg eBook.
- Keller, H. (1908) *The World I Live in*. New York: Century Co.
- Pasquale, G. (2019) 'A Step Forward for Artificial Touch Systems', *Nature* 569, 3: 638–639.
- Salter, C. (2023) 'The Two-Century Quest to Quantify Our Senses', *The MIT Press Reader* (May 17). <https://thereader.mitpress.mit.edu/the-two-century-quest-to-quantify-our-senses/>

Wegenstein, B. (2010) 'Body', in M. B. N. Hansen & W. J. T. Mitchell (eds), *Critical Terms for Media Studies*. Chicago: University of Chicago Press.