Embodied Care and Consent in Mediated Social Touch Interactions: A Study of the Interactive Artwork *The Alien Between Us*

Laura A Dima (A), Nathan Marcus (B), Daniel Shor (C), Gijs Huisman (D)

***Abstract*—*The Alien Between Us is an* interactive art installation created by multidisciplinary artist Laura A Dima. It explores how technology can facilitate intimate co-located interactions beyond traditional (audio-visual) communication systems. This art project uses haptic technologies and biofeedback to simultaneously connect two audience members. Two identical sculptures serve as interfaces that simulate biometric data, such as heart and breathing rates, to create emotional feedback loops between participants. The project investigates how mediated social touch (MST) and physiological mirroring can attune participants to each other's affective states. The installation offers a somatic language of mutual care to be incorporated alongside consent protocols. It challenges the disembodied nature of digital culture by emphasising bodily awareness and interconnectedness. The sculptures are not merely passive haptic devices; rather, they play an active role in the interaction. Their agency is expressed through a self-defence mechanism that deploys transcutaneous electrical nerve stimulation (TENS) when boundaries are breached, signalling discomfort. In this way, the technological bodies actively participate and assist human participants in navigating the ethics of touch. This paper documents the conceptual framework, technical design, and public reception of the work using a research-through-design approach. It contributes to discussions on digital intimacy, embodied interaction, and the role of artworks as haptic interfaces in cultivating empathy towards the human and non-human agents alike.**

I. INTRODUCTION

The Alien Between Us is an interactive multimedia art project investigating embodied interaction and technologically mediated forms of intimacy.

First A. Author is an independent artist and researcher based in The Hague, The Netherlands (e-mail: info@lauraadima.com).

Second B. Author is an independent creative technologist based in Amsterdam, The Netherlands (e-mail: info@nathanmarcus.nl).

Third C. Author is affiliated with Sorbonne Université/Ohmnum UG, France (e-mail: daniel.e.shor@gmail.com).

Fourth D. Author is affiliated with Delft University of Technology, The Netherlands (e-mail: G.Huisman@tudelft.nl).

It uses a pair of responsive sculptures that can be held in one's arms. The work foregrounds the physical dimension of communication, rather than treating technology as an abstract interface or disembodied channel. The project asks what it means to encounter another person through technological mediation.

It questions how shared bodily awareness can become a site of intimacy, vulnerability, and ethical responsibility. Through tactile interfaces, the installation invites participants to connect not through representation (images or language) or identity, but through the body itself.

Contemporary communication technologies are increasingly integrated into daily life, yet most rely on linguistic or audiovisual representation. Theorists of embodiment, such as Merleau-Ponty, argue that perception is grounded in the lived body rather than detached cognition [1]. Similarly, haptics scholars note that touch is not merely secondary to perception but fundamental to relational experience, arguing that (mediated) social touch is best understood through an interaction theory lens, emphasising that touch is intrinsically participatory and shapes the dynamics between individuals in real time (Huisman, 2022). [2] Interactive media artworks offer exactly that opportunity for real-world interactions that are valuable for research, as they create novel experiences and enhance the consciousness of a diverse audience by integrating and examining design concepts in practice [3].

By placing touch at the centre of interaction, *The Alien Between Us* challenges the dominance of audiovisual communication and the notion of the visitor as a passive viewer. It highlights the embodied nature of human connection and demonstrates the potential for transformation and adaptive behaviour as audience members become active participants in the interaction [3]. The project invites them to become aware of their own bodies, the bodies of others, and the interdependence that arises from tactile exchange.

Interpersonal touch, however, is never neutral. In real-life situations, power differences—such as those related to gender, ability, or ethnicity—shape social interactions and influence how we perceive, approach, and respond to others. Feminist and gender scholars such as Judith Butler and Sara Ahmed remind us that bodies are historically and politically situated; every touch is embedded in social norms that structure desire, vulnerability, and ultimately, consent and agency [4, 5].

Recent phenomenological feminist work on consent, such as Anderson (2022) and Garcia (2023), positions consent not as a concrete moment or agreement, but as an ongoing, context-sensitive, and embodied process [6, 7, 8]. Brancazio's analysis of agency complements this perspective by arguing that agency itself is thoroughly relational, embodied, and context-dependent—emerging from the dynamic interplay between brain, body, and environment [9]. Anderson foregrounds the lived, felt experience of consent, while Garcia's philosophy frames positive (sexual) experiences as rooted in the continuous, mutual negotiation of boundaries, pleasure, and autonomy. By integrating these perspectives, we clarify how our approach to haptic interaction is shaped by, and contributes to, feminist discourse on consent, agency, and embodied relationality. We do not dismiss the necessity of explicit consent; rather, we propose an alternative approach for situations where permission-giving is not desirable or possible.

By employing a Mediated Social Touch (MST) framework, the present work examines whether bodily communication can bridge differences, unsettle social hierarchies and power imbalances. An MST system facilitates interaction using Social Touch Technology (SST), which refers to devices that transmit tactile feedback digitally between users, whether co-located or remote. With this technology, it is possible to obscure identifying features such as race, gender, or physical strength [10]. Instead of face-to-face meetings, participants interact through tactile feedback (accompanied by visual feedback via LEDs) transmitted by the devices. The project explores whether such a mediated touch setup can temporarily suspend certain identity markers, allowing participants to focus on affective resonance rather than social categorisation, and thus enable a more equal mode of interaction beyond social hierarchies [11].

Nevertheless, it cannot be assumed that all technological systems eliminate power asymmetries, and we must remain aware of such loopholes. Interfaces have a history of manipulative structures that assign unequal roles or privilege certain information, shaping users' behaviour and limiting their agency [12, 13, 14]. This issue is widely recognised in the literature on dark patterns and manipulative UX design (Zaheer, 2019; Venkatraj et al., 2025; Mathur et al., 2019), as well as in critical design and Human Computer Interaction (HCI) research (Gray et al., 2018) [15]. In haptic and embodied systems, these imbalances can be amplified, as touch-based interactions are especially intimate and can heighten issues of consent, vulnerability, and control (Kolesnyk et al., 2025) [16]. Feminist HCI and design ethics emphasise the politics of touch, safety, and the importance of agency and ongoing negotiation of consent (Bardzell, 2010). For example, Strengers et al. (2021) advocate for a feminist, processual understanding of embodied consent in technology-mediated interactions, while Bardzell (2010) calls for more reflexive, participatory, and ethical design practices in HCI [17, 18].

In *The Alien Between Us*, we address these concerns by making consent, agency, and bodily autonomy foundational to the installation's interactional logic. These dimensions are continually negotiated through embodied, relational experience, aligning with recent calls in feminist phenomenological and HCI literature for more ethical, reflexive, and fluid approaches to interaction design and research. Importantly, by centring these values, the project also aims to equalise gendered power dynamics. That is why insights from gender and feminist studies are critical for designing haptic interactions that resist reproducing societal hierarchies and support more equitable, inclusive forms of embodied communication through technology.

B. Paper outline

The remainder of this paper is structured as follows. Section II, RELATED WORK, reviews earlier works by the artist and other related projects that explore consent and utilise haptics to build trust and empathy with both human and more-than-human participants. Section III, THE ALIEN BETWEEN US, explains the project, detailing its conceptual framework, research questions, technical system, ethical considerations, and interaction design. Section IV, RESULTS, presents insights from public exhibitions, including analyses of participant responses and qualitative feedback. Section V, DISCUSSION, addresses both technical and conceptual challenges and outlines future development plans. Section VI, CONCLUSION, reflects on the broader implications

of such art science projects, highlighting the role of artworks as embodied interfaces for intimacy, ethics, and human-computer interaction.

II. RELATED WORK

This section places *The Alien Between Us* in the context of prior artistic and research experiments on embodied interaction, mediated social touch (MST), and consent. The artist's earlier works provide important theoretical and practical grounding for the current project.

A. Previous Artistic Experiments

Future Affair (2021–2022) was developed during the COVID-19 lockdown and later exhibited at EuroHaptics 2022 at the Hamburg University of Technology (TUHH). The installation enabled two participants to give and receive affective touch (touch that conveys emotion or social connection) at a distance through its interactive components [19]. A ceramic sculpture functioned as a control panel for a caressing machine. Stroking its curved surface activated three heated silicone fingers in the caressing machine. These fingers moved across the other participant's arm at a constant speed of 3.1 cm/s. This speed is optimal for stimulating C-Tactile Afferents, a type of nerve ending that responds best to slow, gentle touch and is associated with pleasant touch [20, 21].

The second prototype added separate cabins to conceal participants from one another and introduced a consent mechanism that gave the receiver a more active role (bi-directional interaction). Touching the conductive embroidery on a cushion allowed the participant to grant or withdraw consent; lifting the hand retracted the silicone fingers, disabled the control panel, and dimmed the lights in both cabins. Observations from exhibitions revealed gendered differences: many women felt empowered by the ability to withdraw consent, whereas some men initially dismissed the mechanism but later appreciated its reflective effect. [22]

Building on these insights, the *Consent Pods* made consent more interactive and playful. Two participants must simultaneously activate the switches (in the shape of a thumb) on the pods to consent. When both agree, the devices light up, pulse with a simulated heartbeat, and move with a pre-programmed breathing rhythm. Withdrawal triggers an alarm, signalling touch without permission and drawing public attention to the non-consensual interaction. The design equalises roles by making the pods identical, preventing persistent power imbalances between participants. In doing so, the pods aim to show that the meaning of touch is context-dependent: a touch can be comforting and pleasant when wanted, but the same touch can become unsettling or alarming if it is unwelcome.

Bellies (exhibited at EuroHaptics 2024, Lille) further developed the concept by introducing personalised biofeedback for each participant and removing both the alarm and the explicit consent button. Sculptural devices worn on the abdomen resembled pregnant bellies, symbolising the merging of two bodies through technology [23]. This work explored whether tactile and physiological feedback alone could foster empathy, accountability, and mutual awareness. It marked the artist's first use of personalised biofeedback, laying the conceptual and technical groundwork for *The Alien Between Us.*

What sets *The Alien Between Us* apart from previous projects is the depth of its affective resonance. Unlike earlier works, where responses sometimes reflected gendered patterns or playful, game-like dynamics, participants in this installation consistently described a "strange kind of intimacy" and reported forming an emotional connection with the non-human object itself, treating it as if it were alive. The system integrates multiple affective channels, inviting both self-reflection and heightened awareness of the other—whether human or non-human—present in the interaction. Crucially, omitting an explicit consent button during the interaction moves the experience beyond binary, gamified consent mechanisms; instead, participants have to negotiate boundaries and take on responsibility in a more nuanced, open-ended way. Although it is more ambiguous, this design shift leads to a more reflective engagement, encouraging participants to take the interaction and their own agency seriously as well as to consider the ethical and relational dimensions of their touch.

B. Empathy and Consent in Related Projects

A growing body of interactive art projects demonstrates the unique potential of touch-based systems to foster empathy and inspire audiences to reflect on personal boundaries and relationships with both other humans and non-human entities. Unlike visually mediated works, haptic and interactive installations require active bodily engagement,

making the negotiation of consent, trust, and vulnerability central to the experience. Importantly, such works move participants beyond the role of passive viewers: as Ahmedien notes, quoting media theorist Andy Cameron, true interactivity means participants are integral to the system itself, intervening in and shaping the unfolding experience. These technological mediators extend the human body's perceptual and expressive capabilities, inviting participants to become embodied agents whose actions and emotions are entangled with the system. [3]

Fig. 1. EuroHaptics 2024 Conference attendee wearing one of the two interactive sculptures from the *Bellies* project, Lille.

For example, Lancel & Maat's *TELE_TRUST* project and its DataVeils empower participants to control the extent of their self-disclosure by touching themselves through wearable "second skins", the veils, foregrounding the layered and relational nature of consent [24]. In *The Blind Robot* by Louis-Philippe Demers, participants surrender control to a robotic arm that gently caresses their faces. Visitors must trust the mechanical arm, teleoperated by Demers, not to hurt them, even as they remain exposed and vulnerable in a public setting [25]. *HuggieBot* (a project by K. J. Kuchenbecker et al. at the Max Planck Institute), a human-sized robot designed for hugging, allows participants to end the embrace with a retreat gesture. However, this gesture must be precisely synchronised and intentional; otherwise, it may be misinterpreted by the robot, which could retract its arms prematurely and end the interaction abruptly—even if the user did not intend to end the embrace [26].

Touch My Touch by Lancel & Maat (2021) further explores co-created intimacy and the dissolution of self-other boundaries through a ritual of co-caressing, where users' self-images merge into shared selfies and the sensation of touch transcends the individual body. [24] These and similar projects highlight how haptic systems can create models of interaction to build trust, empathy, and intimacy.

The Alien Between Us builds on and extends this lineage. Like these works, the installation is designed to help participants explore the relational dynamics of touch—inviting them to reflect on their roles and responsibilities in encounters with both human and non-human others. Drawing inspiration from affective haptics (Hayes and Rajko, 2017), as well as projects such as *Myconnect* (2013) by Saša Spacal, Mirjan Švagelj, and Anil Podgornik, which enables participants to feel the electrical impulses of mycelium networks and connect with more-than-human life, our work foregrounds the emotional resonance and ethical complexity of embodied human-to-human and human-computer interaction. Both works propose a haptic aesthetics that is not based on taxonomic categorisation, but it is personal (and personalised), felt, and used to connect humans to the more-than-human [27, 28]. Similarly, *Spirit Systems of Soft Knowing* (2023–2024), an installation by art collective Keikan, explores the more-than-human connection, where visitors feel animal sounds through wearables placed on their abdomens, equipped with tactile transducers, while listening to them through headphones. [29] This work further demonstrates how haptic devices can expand empathy and communication beyond the human sphere. By channelling the feedback directly into the participants' bodies, the work invites them to feel as if they are inhabiting or communicating with and from another species' perspective.

The Machine to Be Another by BeAnotherLab (2013) similarly informs our concept of empathy and *the other.* In this installation, two participants wear VR headsets and see the world through each other's eyes, while their movements are synchronised through careful choreography and real-time video streaming. [30] This immersive setup allows users to experience what it feels like to inhabit another person's body, challenging fixed notions of self and the other. Although it is mainly a visual interaction, most

visitors use touch to explore the other, creating dissonance between what they saw (the other) and what they felt (their body). The project has been shown to foster empathy and self-reflection, as participants not only see through another's eyes but also feel their own boundaries blur and shift. By inviting participants to negotiate shared agency, vulnerability, and bodily autonomy, *The Machine to Be Another* offers a powerful example of how technologically mediated embodiment can transform our understanding of the self in relation to the other.

In *The Alien Between Us,* the haptic system extends one visitor's body to connect with another by sharing their bio-signals. The sculptures function not only as a medium for connection but also as active participants, responding through touch and employing defensive mechanisms that allow the technological body to express agency and establish its own boundaries. This dynamic invites visitors to participate in ongoing negotiation, adjust their behaviour, and expand the relational possibilities among interconnected participants.

By situating *The Alien Between Us* in dialogue with these projects, we show how haptic art can challenge and enrich our understanding of agency, care, and intimacy—encouraging audiences to build emotional connections (beyond the human sphere), question established boundaries (self/other), and reflect on their ethical relations with both the human and the non-human others.

III. THE ALIEN BETWEEN US

A. Concept and research questions

The Alien Between Us investigates the role of technological devices in delivering affective touch between two co-located participants. The technology becomes *the strange* object, *the alien* between the people involved, and a metaphor for all the devices we use today to stay in contact. [31]

The central research question investigates how consent can be made less explicit during interactions (after visitors have expressed clear approval to participate) and instead be inferred from the live streaming of biofeedback and mutual somatic regulation. A further inquiry considers whether empathy can be cultivated, manifesting as a sense of care directed toward the other participant and the device itself. We also examine the effectiveness of corrective mechanisms, such as delivering uncomfortable stimuli when the sculptures are mistreated. These mechanisms are meant to foster a sense of responsibility and ensure that participants take the interaction seriously rather than gamifying it.

The project shows how art objects can function as interfaces for building human connections. A hand-crafted, organic sculpture made from soft materials evokes the experience of interacting with a real body rather than a conventional machine made from cold metal and hard materials. The project proposes that engaging with soft, warm objects as interfaces, sized like a pet (cat, small dog) or a baby, consciously or unconsciously, inspires a nurturing attitude in people when they hold them.

B. Sculpture Fabrication

The installation comprises two identical sculptures that enable two individuals to interact simultaneously from a distance. Their shape evokes *a foetus*, an alien creature, or an internal organ. Each artwork is handcrafted by the artist, sculpted in oil-based clay and cast in silicone using moulds to achieve its final shape and textures.

The body is formed to resemble the size of a baby or a cat, so it can be comfortably held in one's arms. The outer layer is made from Special Effects silicone (Dragon Skin NV 10 from Smooth-On), creating a soft, skin-like surface. Its pattern is achieved using rubber moulds taken from leaves. Clay pressed into these moulds is then shaped by the artist into the sculpture's body. The silicone provides the softness of skin, while the leaf pattern, reminiscent of veins, adds an engaging quality that encourages tactile exploration. The material's translucency allows light from the embedded LEDs to pass through, diffusing the light, making it a uniform colour rather than seeing the individual LEDs. The sculpture is hollow, filled with foam to maintain its body shape, and 3D-printed enclosures that house all the electronics.

C. Sensing and Actuation

The art objects function here as haptic interfaces for the interaction that employ both sensing and actuation. The sculptures are animated by the presence of visitors' bodies using a 60 GHz mmWave Sensor (Human Static Sleep Breathing and Heartbeat Monitoring, MR60BHA1), commercially available from Seeed Studio. This radar module uses FMCW

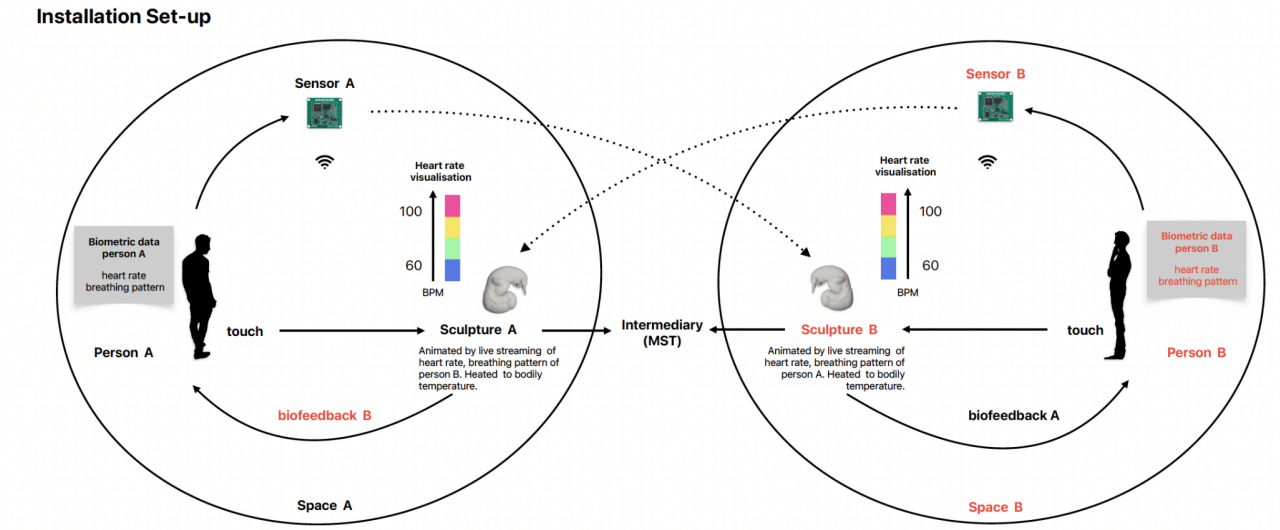

Fig. 2. Overview of the interaction model and how the different elements interact with each other following the direction of the bio-feedback from person A (written in black) to sculpture B (written in red). The defence mechanism is not illustrated here.

(Frequency-Modulated Continuous Wave) detection to accurately measure breathing and heart rate contactlessly, offering a non-invasive, private and secure sensing environment unaffected by external noise. It is a standard biotic radar system used in consumer electronics, healthcare, and industrial applications. [32]

When the sensor detects a visitor approaching (up to 2 meters), it sends the biometric data to the other station using the ESP-NOW protocol, which enables wireless communication between the ESP32 boards used in the installation. [33] This transmission activates the sculpture at the other station, which responds by turning on its lights, starts *to breathe*, and produces a heartbeat synchronised with the data received from the remote participant's sensor (see **fig. 2**). The visitor can then feel the breath and pulse by holding the sculpture. If no one is present in the other space, the sculpture remains inactive with the lights off, meaning that interaction occurs only when both spaces are simultaneously occupied.

The heartbeat simulation is generated using an HF2-50WB electromagnetic actuator from Grewus GmbH. [34] The actuator has a very low resonance frequency (50Hz) and is embedded in a foam pocket within the sculpture to prevent it from moving and transmit vibrations more pleasantly. It pulsates,

Fig. 3. Laura A Dima holding one of the sculptures in her arms, Quartair, The Hague, 2025.

updating its rhythm to match the other participant's heart rate. This actuator is controlled by an M5Stack Atom Echo, which contains an ESP32 and an amplifier board that modulates the playback interval of a heartbeat sample in response to the incoming values. The breathing pattern is simulated using DC motor pumps that inflate and deflate a silicone, lung-like chamber within the sculpture in response to incoming breathing data, measured in breaths per minute. (see **fig. 5)** This mechanism produces a

rising-and-falling motion, simulating the living body's inhaling and exhaling.

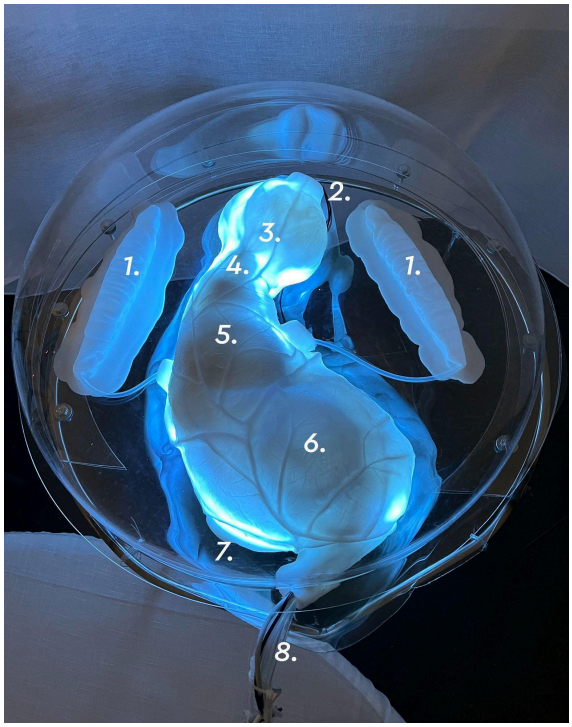

Fig. 4. Components of the sculpture: 1. *Tentacles* – Inflate when the other participant touches specific areas of their sculpture, signalling touch and engagement. 2. TENS wires and electrodes – Deliver electrical stimulation when the defence mechanism is triggered. 3. *Head* – Embedded with conductive wires in the silicone skin for capacitive touch sensing. 4. *Neck* – Contains a force sensor that activates the defence mechanism when excessive force is applied. 5. *Chest* – Houses the haptic actuator that transmits heartbeat feedback. 6. *Abdomen* – Contains an inflatable air chamber simulating breathing through rhythmic expansion and contraction. 7. LED lights – Embedded within the body; they change colour in response to incoming heart data. 8. Heating wires, power cables, and air tubes – Supply warmth, electrical power, and airflow to the sculpture.

The tactile feedback is distributed across localised areas of the sculpture's body. The heartbeat is diffused throughout the foam but is most prominent in the central, narrowed area of the sculpture, suggestive of a *chest* and *shoulder* region (5 in **fig. 4**). The breathing mechanism is located lower down, where the rounded shape protruding outwards resembles an abdomen (6 in **fig. 4**). The different feedback corresponding to isolated areas of the sculpture's body makes the perception of the stimuli clearer and more focused than in the previous work, *Bellies,* when all feedback was felt simultaneously throughout the whole shape.

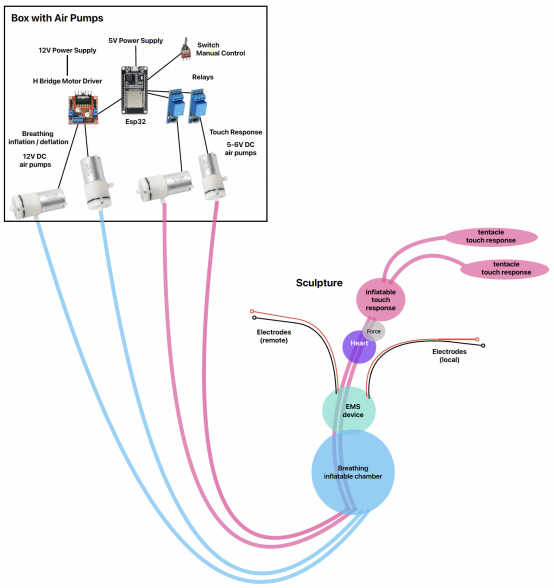

Fig. 5. Visuals showing the system using an ESP32 microcontroller and four DC air pumps for creating the breathing movement and the touch response through inflatables. The air tubes are connected to the different air chambers inside the body of the sculpture, blue for breathing and magenta for touch response. The breathing simulation uses a single air chamber, whereas the touch response has three connected chambers. The air travels first into a chamber inside the *head* of the sculpture, and then it moves to the extremities, *the tentacles.*

Additionally, the sculptures have a head-like form, encouraging visitors to hold them with care, as one might cradle a baby. Integrated into the silicone skin are conductive wires for capacitive sensing. When a person touches the *head* (3 in **fig. 4**), tentacle-like elements on the other sculpture begin to inflate and shift in shape, curling up to indicate the other person's active engagement (**fig. 6, 7**). This behaviour signals a positive interaction, symbolising arousal. Participants can then convey subtle signals by touching or releasing the sculpture's *head*. These changes are not only experienced through haptic feedback as pressure increases, but are also visually evident as *the tentacles* inflate and reshape. The state of the touch sensors is measured at startup and assumed to represent the "not-touched" baseline. Any subsequent deviation from this initial state is interpreted as an indication of touch, triggering the inflation of the air chambers in the other sculpture.

The biometric data is further analysed to detect variations in heart rate and breathing patterns, which may indicate changes in the participant's affective state. To enhance legibility, accompanying the haptic feedback is a visualisation of these shifts through changing the colours of LEDs. Inspired by Paul Ekman's *Atlas of Emotions*, a digital tool for mapping

affective states [35], different colours are associated with varying heart rate levels: a bluish hue indicates a calm, relaxed state; yellow-green suggests increased excitement; and magenta-red signals a higher pulse as a possible sign of stress. The sculpture's lights are also animated to fade in and out in sync with the breathing rate, emphasising its rhythms.

Incorporating visual cues alongside haptic feedback is essential, as it makes changes clearer and easier to detect, providing a better understanding of the feedback in general. It enables participants to observe and experience fluctuations in one another's heart rates in real time without much effort.

D. Consent beyond permission

Although the more explicit consent mechanisms featured in earlier works, such as *Future Affair* and the *Consent Pods,* functioned well and are undeniably useful, their binary on/off system proved too limiting as it stops any further interaction - it works as an on and off switch, similar to permission giving. Alternatively, consent could be understood as a continuous dialogue and ongoing negotiation between individuals. We are not arguing here that a verbal, unambiguous moment of consent has no place whatsoever in intimate interactions, and the previous artworks proved how effective that was. We primarily aim to show that this is merely one understanding of consent and that other valuable views are also possible and can co-exist.

Using a button to grant permission made the interaction predictable, even gimmicky. It raised ethical concerns by reducing consent to a simple act of granting permission. Phenomenological and feminist studies emphasise that consent is much more than that: it is about bodily communication and the ongoing adjustment to each other's states. [5, 6, 7, 8] It even argues that, even in situations when verbal permission is given, the body might express quite the opposite. This is why the straightforward solution of a button or switch alone is not enough, and it doesn't align with the project's current scope, which is to create a deeper awareness of one's desires, boundaries, and attitudes—realms that are rarely clear-cut. Another argument against treating consent only as giving permission here is the cerebral nature of the act: people need to think about the situation and make a rational choice about whether to consent, which takes them away from the embodied experience. The goal is to model interactions that are more fluid, dynamic, and open-ended, in which technology serves not as a controller but feels more like a body among other bodies (part of a shared eco-system). Participants here take ownership of the interface, shaping the interaction through their personal engagement.

Fig. 6 - 7. The tentacles of the sculpture inflate as a sign of arousal. When one participant touches specific areas of their sculpture, the pneumatic system activates, causing the other sculpture's extremities to inflate, thereby creating a form of tactile communication between the two sculptures. The above image shows *the tentacles* attached to the side of the sculpture; below it, they are attached to *the head* and placed around the visitor's neck.

The hypothesis is that by tuning into each other's physiological patterns through the sculpture, participants become more aware of and sensitive to subtle signals and can learn to adjust their behaviour to accommodate the other, as their bio-data and touch are their main channels of communication. For example, if one person experiences discomfort or stress, it may manifest as altered breathing or a fast pulse [36], which is both felt and visualised in the sculpture's changing colours and rhythms. With this information, the other participant can respond by changing their touch patterns and modulating their bio-data as much as possible to make the other person feel better, if that is their intention; the opposite can also be true.

E. Defence mechanism

Adding another layer to the interaction, the sculptures incorporate a self-defence mechanism. When abusive touch or rough handling is detected, it delivers an intense but brief electrical stimulation (ES) signal via electrodes attached to the participant's hands, using a Transcutaneous Electrical Nerve Stimulation (TENS) device, a medically approved device.

Although most TENS machines are used to treat chronic pain, in this setup, they serve as a warning signal. The TENS feedback is not painful but rather uncomfortable. What is interesting about it is that motor-level TENS, stimulation above the sensory threshold, produces involuntary muscle contractions, distinguishing it from sensory-level TENS, which does not elicit such responses. [37] Twitches or spasms caused by the ES could temporarily disrupt voluntary hand movement and prevent continued contact [38]. This warning signal is also transmitted to the other participant, meaning that if one person abuses the sculpture, both will experience *the punishment* simultaneously.

It is not clearly communicated what constitutes *abuse*. The artist intends to make the audience question the nature of such behaviour. Technically, electrical stimulation is triggered by repeatedly applying excessive pressure to the sculpture's upper body or neck (4 in fig. 4). If a visitor is aggressive or attempts to choke the sculpture, the pressure exceeds a defined threshold (detected using a force sensor embedded in the foam), activating the defensive response.

Psychologically, the defence mechanism had a profound impact. Once participants were informed about this feature, although *abuse* was not clearly defined and left to their own interpretation, they approached the interaction with heightened attentiveness and seriousness. Many reported experiencing ethical dilemmas, often mixed with curiosity about *the punishment.* They were informed that their behaviour had direct, tangible consequences not only for themselves but also for the other participant, who could be affected by their choices. This layer of the experience compelled individuals to take responsibility for their actions. This awareness inspired a time-based tactile exploration: some tested the sculpture's limits by applying pressure or probing different parts of the body. In contrast, others refrained entirely, treating it with care and respect.

Tweaking the intensity of the electrical stimulation proved critical to eliciting the desired response. While the pulse width was fixed at 50 μs and the frequency at 120 Hz, the intensity was adjustable across 7 levels, meaning the output voltage was adjustable from 0 to 40V (peak-to-peak 7.9V rms into a 500 ohm load, each channel). In an earlier test, the electrical stimulation response was directly mapped to the amount of pressure applied to the sculpture, as detected by the force sensor. But this mechanism was perceived as playful, a kind of game. In the current iteration, the system was calibrated to respond only to forceful, high-impact handling, with sensitivity adjusted based on the applied force and touch location. While the electrical stimulation was not harmful, it was deliberately uncomfortable enough to discourage repeated provocation without necessarily causing pain (reaching the maximum intensity on the TENS machine when the maximum force value was detected).

F. Interaction Design and Experience Set-up

The installation discussed here comprised two stations—two architectural structures suspended from the ceiling and located a few meters apart in the same room. Draped with semi-transparent white textiles that hang like curtains, each forms a spiral-like tunnel that lures visitors in, giving them a moment to adjust to the new situation as they walk inside. At the centre of each structure lied the interactive sculpture placed in a custom-made *crib* or *incubator* made out of transparent perspex. Participants were invited to sit comfortably on a foam cushion and hold the sculpture in their arms. The curtains provided a sense of enclosure, ensuring intimacy and obscuring the other participant's identity, while still reminding them of each other's presence; only the other sculpture's lights were distinguishable, and sometimes the silhouettes.

After receiving instructions and providing consent, visitors interacted within *the cocoons* while assistants observed discreetly through the fabric. At no point were visitors left completely alone. This approach balanced participant safety with the need for an intimate, comfortable setting, given the nature of the work. Participants were free to take as much time as they needed and to engage with the sculptures in any way they pleased. However, if they had questions, the assistants were available to address them and help at any time.

Fig. 8. The setup of *the The Alien Between Us* installation with both stations in view, Dutch Design Week, Eindhoven, 2025.

Meanwhile, without seeing one another, the two participants begin to exchange biometric data. This data is translated into tactile feedback, felt through the sculptures' bodies, which start to behave more like living creatures than lifeless objects. This is also due to their warmth, maintained at a constant temperature of 34-36 °C [39], using heating wires integrated into the sculptures and a thermostat located outside regulating the temperature.

By stroking and responding to the artworks, visitors engage in a form of somatic communication, discovering moments of resonance and sometimes even synchronisation. It was observed that some visitors began meditating, slowing their breath and focusing inward to bring themselves into harmony with the other. This somatic adjustment became a form of mutual care. Participants needed to take responsibility for their actions and for one another.

G. Ethical and safety discussion

Although the system explains the use of TENS, electrodes on the hands, and inflatable elements wrapped around people's bodies, which might seem quite invasive, significant measures were taken to ensure participants' safety and get their informed permission before any of these elements were attached to their bodies.

Officially, the system was assessed and approved by the safety and ethics commission at the University of the Arts, The Hague, prior to the graduation show in July 2025, where the artist finalised her master's degree. The TENS system was tested and approved by the committee as safe for use during exhibitions, provided people are informed and give explicit consent.

During the exhibition, every visitor was asked a couple of questions and given the opportunity to consent. During this questionnaire, the system was explained to them, as was how their data was detected, to demonstrate transparency and move away from a black-box system. Permission was granted verbally to the assistant before any interaction started or any equipment was attached. During this stage, visitors were also screened for safety and health issues such as pregnancy, epilepsy and whether they had a pacemaker. If any of these options were true, no TENS electrodes were connected. The same went for young children.

Important to note that people could opt out at any time. When they wanted to stop, they just had to signal the assistants by lifting an arm, who would come and help them. They were also told that if they were not comfortable with the electric stimulation, they could remove the electrodes themselves or ask for an assistant to do it for them. Meaning that people were never left unattended or completely alone. The assistants went outside their space of interaction but watched them through the fabric. There were always assistants making sure the participants were safe.

Finally, neither the biometric nor the interaction data was recorded. The biometrics were just detected, transmitted, and simulated in the sculptures' bodies. People were informed of this and shown the range of the sensor, so they could choose whether to participate or stay outside the sensor's range.

IV. RESULTS

A. Previous iterations

The artist or her assistants were present to observe how people engaged with the artwork and to make notes of their responses. Visitors could also write their feedback in a notebook. The installation was tested with the public during several art and design events and conferences in 2025 and 2026.

The first time it was tested in April 2025, it was alongside an earlier version that featured one of the sculptures from the previous work, *Bellies*. In this first version, the defence mechanism was localised—meaning that if abuse were detected, only the person handling their sculpture would feel the electrical stimulation. The touch response indicators consisted of a single inflatable *tentacle* attached to the sculpture's *head*.

In the second iteration in July 2025, the *tentacles* were attached to the sides of the body, becoming more like arms that would curl up when inflated. From this version onwards, the defence was also transmitted, meaning that both participants would feel *the punishment* if one of them abused their sculpture.

Later, the *tentacles* were again attached to the sculpture's *head* and placed around the participant's neck, making sure it was not too tight or uncomfortable. This provided support, allowing the sculpture to remain in place even when unsupported, so participants could see and feel the *tentacles* inflating more clearly around their necks. This also allowed them to free their hands, enabling tactile exploration of the sculpture. The pressure of the tentacles wrapping around the neck was felt as a gentle yet tight embrace, similar to how a baby or small animal might hold someone, according to visitors' reports.

B. Visitor's Feedback

The data-gathering protocol was qualitative, using feedback notes to collect people's experiences and analyse them. A notebook was placed at a distance or even outside the exhibition space, where visitors could write down their reflections after the interaction if they wanted to. This was done intentionally to create a moment of distance from the work itself, allowing participants to articulate their thoughts more freely and without immediate social pressure, such as the presence of the artist or facilitators, which might influence their responses. In total, 55 written responses were collected across three different exhibitions, forming a diverse set of impressions that capture both immediate emotional reactions and more considered reflections on the experience.

What stood out immediately in participants' responses is not just that people "liked" the work, but that many describe it as something that happened to them, an experience that unfolded physically, emotionally, and sometimes unexpectedly. They were surprised by how it felt, compared to how they expected it to feel before touching it.

A dominant thread is the level of intimacy and connection felt, often with a stranger. Several participants explicitly reflect on how unusual this is: "a totally different way to meet a stranger," "very intimate," or "I felt very connected physically to someone I never usually would." The shared heartbeat and breathing appeared to function as a kind of non-verbal communication system, bypassing identity and language. This aligns strongly with the embodied intention of the work: people are not just understanding the concept, they are feeling it. In general, people saw potential for possible use in long-distance relationships or even therapeutic contexts.

Closely tied to this is the inclination for care, nurturing, and maternal affect. Many describe the sculptures as "like real babies," "an alien baby," or something that evokes tenderness and protection. Interestingly, several participants note that this feeling was unexpected or unfamiliar to them, especially those who do not associate themselves with this feeling. The work seems to create a safe space where care can be explored without social roles or expectations. At the same time, this nurturing impulse is not one-dimensional: a few responses reveal ambivalence or even darker urges ("I wanted to hurt it… the longer I sat there, the more I wanted to hurt the baby"), suggesting that the piece also surfaces complex and sometimes uncomfortable aspects of the human psyche.

Another strong experiential layer is calmness and regulation. Words like "calming," "reassuring," "mindful," and "meditative" recur throughout the feedback. The rhythmic elements—heartbeat, breathing— and the warmth appear to have a soothing effect, with some visitors describing it as "a walk into the heart" or "a home that can only be found in the arms of another." This points to the installation's ability to modulate internal states and offer comfort. The suggestion to integrate meditation or enhance sensory layers (like adding a scent)

reinforces the perception that visitors see the work as something that could deepen into a full-body, immersive ritual, which is also the plan for future exhibitions.

At the same time, there are technical and sensory frictions that shape the experience. Some participants report inconsistencies in feedback (missing shocks, delayed responses, unclear communication) that occasionally disrupt immersion. Others comment on practical aspects, such as long waiting times, or one person mentioned the overpowering smell of silicone. These remarks are valuable because they show how sensitive the experience is to continuity and subtlety; small breaks in the feedback loop can weaken the sense of connection and overall immersion.

A particularly interesting dimension is how visitors interpret the work's conceptual and societal implications. Some immediately see applications beyond art, such as neonatal care or long-distance relationships. Others reflect on themes of trust, consent, and embodiment, suggesting that the installation gives "deeper definition" to these concepts. It also inspired visitors to rethink their relationship with technology, recognising a more positive side of mediated interactions.

Finally, there is a recurring sense of novelty and memorability. Many describe the experience as "unique," "unforgettable," or even transformative ("I felt alive again"). The blend of the familiar (heartbeat, warmth, touch) with the unfamiliar (alien-like forms, mediated touch) creates a tension that people describe as "creepy and endearing," "mystical," or reminiscent of speculative fiction (e.g., the *ExistenZ* film by David Cronenberg). [40] This tension between comfort and strangeness seems to be a key component of the experience as it draws people in through recognition, then destabilises that recognition just enough to provoke reflection.

Overall, the feedback suggests that the installation created an embodied, affective encounter in which the haptic technology facilitated an intimate connection rather than acting as a barrier (something in between). It reveals how physiological signals (heartbeat, breathing, warmth), in combination with a punitive element framed as a defence mechanism, can generate complex emotional landscapes, ranging from care and connection to curiosity, discomfort, and even aggression. At the same time, it highlights the importance of optimisation, calibration, and overall refinement of the technology, as the experience depends heavily on clear and continuous feedback. These reactions show that the work is not only understood but also felt, critically questioned, and carried away by its participants.

V. DISCUSSION

The digital system demonstrates high reliability because all operations are executed in embedded software. Communication between microcontrollers is direct, without the need for intermediate routers or network infrastructure, and no additional operating systems (such as Windows or Linux) are required for the sculptures to function.

Despite this stability, further optimisation is necessary for long-term deployment and broader accessibility. Improvements in calibration, temperature control, and overall robustness are needed to reduce the need for supervision and visitor guidance, thereby increasing scalability and ease of exhibition. Visitor feedback highlights the importance of intuitive interaction and clear instructions, which will guide future design choices as the project continues to develop.

To address current limitations, future versions will integrate more complex biosensing technologies. Electrodes will be built into custom-made bracelets with PCBs to sense multiple biosignals, including skin conductance (EDA/GSR), heart rate variability, and movement. These enhancements aim to enable more accurate and nuanced physiological analysis, providing deeper insight into how bio-data can be used as a feedback system to negotiate consent and increase awareness of subtle affective states. [41] With this information, visitors can make more informed choices about their boundaries, consent, and agency. While we plan to introduce additional biosensing technologies, participant comfort, privacy, and data protection will remain a priority as the system evolves.

We are also considering expanding the system to support multiple simultaneous interactions, which could open new avenues for exploring complex social dynamics and group empathy within the installation.

In upcoming exhibitions, the experience itself is evolving into a more ritualistic journey that guides visitors through distinct stages of interaction. Each stage—such as receiving instructions, individual calibration, engagement with the sculptures, and a dedicated space for reflection and aftercare—will be

given its own time and space. This more comprehensive approach aims to enhance both audience engagement and research outcomes.

Future presentations will prioritise clearer instructions—delivered through video or written guides—and more structured research frameworks, including pre- and post-interaction forms for participants to complete. These improvements aim not only to increase the installation's reliability and user accessibility, but also to facilitate richer data collection and a more rigorous analysis.

Looking ahead, further development of this haptic installation could extend its value beyond the art domain. The technical platform may serve as a research tool for interdisciplinary studies in psychology, neuroscience, and human-computer interaction, contributing to broader understandings of embodied communication and empathy—including interactions with both human and non-human entities. By situating haptic interaction in real-world, participatory contexts, the project offers valuable opportunities for interdisciplinary collaboration and advances in both artistic practice and academic research.

VI. CONCLUSION

The Alien Between Us demonstrates the potential of haptic interfaces to cultivate empathy and foster connection between participants. By making the body central to technologically mediated interaction, this Art Science project challenges conventional, static conceptions of interfaces and instead proposes that interfaces can be embodied—soft, adaptive, and responsive. Through the use of biofeedback and tactile communication, the work enables participants to attune to one another's affective states and experience somatic resonance in real time.

Importantly, *The Alien Between Us* situates these embodied encounters within real-world contexts and can offer valuable insights for haptics research and design. Unlike laboratory-based studies, this installation creates social situations in which participants must continuously reflect on and negotiate boundaries, consent, and care. Observations from public exhibitions indicate that these interactions not only facilitate mutual responsibility and ethical reflection, but also provoke a deeper attunement to the responses of others—human and nonhuman alike.

The project also highlights the agency of technology itself in mediating and shaping these relationships. Inspired by practices in interactive new media art, technology is envisioned as an active participant assisting participants, making them aware of the presence of the other, and acting when boundaries are crossed. This supports the creation of new collaboration patterns between humans and nonhumans, broadening the spectrum of possible relations and proposing a more symbiotic ecology with technology. [3] By embracing ambiguity and the unknown, and by expanding the meanings of consent and care to include technological entities, the installation advances the discourse on empathy, multi-species collaboration, and ethics of touch-based human-computer interaction.

Ultimately, *The Alien Between Us* offers a model for how haptic systems can support perspective-shifting, transformation, and embodied ethical engagement. It demonstrates the value of real-world, participatory interactions for advancing both artistic practice and haptics research alike, and suggests possible new directions for designing technologies that foster empathy and human connection in our ever-digitalising world.

REFERENCES

[1] M. Merleau-Ponty, Phenomenology of Perception, C. Smith, Trans. London, U.K.: Routledge & Kegan Paul, 1962.

[2] G. Huisman, "An Interaction Theory Account of (Mediated) Social Touch," Frontiers in Psychology, vol. 13, Art. no. 830193, 2022. doi: 10.3389/fpsyg.2022.830193.

[3] D. A. M. Ahmedien, "A drop of light: an interactive new media art investigation of human-technology symbiosis," Humanities and Social Sciences Communications, vol. 11, art. no. 721, 2024. doi: 10.1057/s41599-024-03206-y.

[4] S. Ahmed and J. Stacey, Eds., Thinking Through the Skin. London, U.K. and New York, NY: Routledge, 2001.

[5] J. Butler, Bodies That Matter: On the Discursive Limits of "Sex". New York, NY: Routledge, 1993.

[6] E. Anderson, "A Phenomenological Approach to Sexual Consent," Feminist Philosophy Quarterly, vol. 8, no. 2, 2022. doi: 10.5206/fpq/2022.2.14239.

[7] M. Garcia, The Joy of Consent: A Philosophy of Good Sex. Cambridge, MA: Belknap Press, 2023.

[8] A. Saketopoulou, Sexuality Beyond Consent: Risk, Race, Traumatophilia. New York, NY: NYU Press, 2023.

[9] N. Brancazio, "Gender and the Senses of Agency," Ph.D. dissertation, School of Humanities and Social Inquiry, University of Wollongong, NSW, Australia, 2019. [Online]. Available:

https://www.researchgate.net/publication/325718684_Gender_and_the_senses_of_agency

[10] J. B. F. van Erp and A. Toet, "Social touch in human–computer interaction," Frontiers in Digital Humanities, vol. 2, Art. no. 2, 2015. doi: 10.3389/fdigh.2015.00002.

[11] M. van der Horst and A. Puzio, "Queering Sex Robots Beyond Diversifying Design? Insights From Queer Lacanian Psychoanalysis and New Materialism," Philosophy & Technology, vol. 39, art. no. 47, 2026. doi: 10.1007/s13347-026-01037-0.

[12] S. Zaheer, Ethical UX Design: Preventing Manipulative Interfaces and Promoting User Trust, vol. 3, p. 43, 2019. doi: 10.5281/zenodo.15251712.

[13] K. P. Venkatraj, C. Schneegass, G. Huisman, and A. El Ali, "Demonstrating Dark Haptics Scenarios for Future XR Advertising," in Proc. CHIWORK '25 Adjunct: 4th Annual Symposium on Human-Computer Interaction for Work (CHIWORK 2025), Amsterdam, Netherlands, June 23–25, 2025, New York, NY: ACM, 2025, pp. 1–3. doi: 10.1145/3707640.3731926.

[14] A. Mathur, G. Acar, M. Friedman, E. Lucherini, J. Mayer, M. Chetty, and A. Narayanan, "Dark patterns at scale: Findings from a crawl of 11K shopping websites," Proceedings of the ACM on Human-Computer Interaction, vol. 3, no. CSCW, Art. no. 81, pp. 1–32, Nov. 2019. doi: 10.1145/3359183.

[15] C. M. Gray, Y. Kou, B. Battles, J. Hoggatt, and A. L. Toombs, "The dark (patterns) side of UX design," in Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18), Montreal, QC, Canada, 2018, pp. 1–14. doi: 10.1145/3173574.317410.

[16] D. S. Kolesnyk, A. Mader, and M. van Doorn, "Designing consensual mediated social touch interactions," Journal of Information, Communication and Ethics in Society, vol. 23, no. 4, pp. 495–506, Aug. 2025. doi: 10.1108/JICES-12-2024-0193.

[17] S. Bardzell, "Feminist HCI: taking stock and outlining an agenda for design," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10), New York, NY, USA: ACM, 2010, pp. 1301–1310. doi: 10.1145/1753326.1753521.

[18] Y. Strengers, J. Sadowski, Z. Li, A. Shimshak, and F. 'Floyd' Mueller, "What Can HCI Learn from Sexual Consent? A Feminist Process of Embodied Consent for Interactions with Emerging Technologies," in Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21), New York, NY, USA: ACM, 2021, Art. no. 405, pp. 1–13. doi: 10.1145/3411764.3445107.

[19] A. den Dekker, L. A. Dima, G. Huisman, and D. Shor, "Future Affair: An Artistic Exploration of Socially Distanced Affective Touch via Forearm Stimulation," in 2021 IEEE World Haptics Conference (WHC), Montreal, QC, Canada, 2021, pp. 877–877. doi: 10.1109/WHC49131.2021.9517135.

[20] R. Ackerley, K. Saar, F. McGlone, and H. Backlund Wasling, "Quantifying the sensory and emotional perception of touch: differences between glabrous and hairy skin," Frontiers in Behavioral Neuroscience, vol. 8, art. no. 34, Feb. 2014. doi: 10.3389/fnbeh.2014.00034.

[21] H. Olausson, J. Wessberg, I. Morrison, and F. McGlone, Affective Touch and the Neurophysiology of CT Afferents. New York, NY, USA: Springer, 2016. doi: 10.1007/978-1-4939-6418-5.

[22] L. A. Dima, "The Alien Between Us," Research Catalogue, pp. 60–61, Jun. 20, 2025. [Online]. Available: https://www.researchcatalogue.net/view/3765341/3765340. [Accessed: Aug. 28, 2025].

[23] L. A. Dima, "Bellies," EuroHaptics 2024 Art & Design Track, University of Lille, Campus Pont de Bois, Lille, France, Jul. 1–3, 2024. [Online]. Available: https://eurohaptics.org/ehc2024/art-design-track-2/ [Accessed: Aug. 28, 2025].

[24] K. Lancel, "Can I Touch You Online? Embodied, Empathic Intimate Experience of Shared Social Touch in Hybrid Connections," Ph.D. dissertation, Delft Univ. of Technology, 2023.

[25] L.-P. Demers, "Up-Close Experiences with Robots," in Art Machines: Exploring the Intersection of Art and Robotics, R. W. Allen, Ed., Hong Kong: School of Creative Media, City University of Hong Kong, 2018, pp. 151–153

[26] A. E. Block, H. Seifi, S. Christen, B. Javot, and K. J. Kuchenbecker, "Huguenot: A human-sized haptic interface," hands-on demonstration presented at EuroHaptics, Hamburg, Germany, May 2022 (Awarded Best Hands-on Demonstration).

[27] L. Hayes and J. Rajko, "Towards an Aesthetics of Touch," in Proceedings of the 4th International Conference on Movement Computing (MOCO 2017), K. Niehaus, Ed., ACM International Conference Proceeding Series, Vol. Part F129150, Article 3078028, Association for Computing Machinery, 2017, pp. 1-8. doi: 10.1145/3077981.3078028.

[28] D. Xu, M. H. Lamers, E. Van Der Heide, and F. J. Verbeek, "A Relational Look at Interactions between Humans and Nonhuman Organisms in Interactive Art," Leonardo, vol. 58, no. 3, pp. 294–302, 2025. doi: 10.1162/leon_a_02660.

[29] "Keiken—Spirit Systems of Soft Knowing," e-flux, [Online]. Available: https://www.e-flux.com/announcements/621673/keikenspirit-systems-of-soft-knowing [Accessed: May 13, 2026].

[30] P. Bertrand, "The Machine to Be Another: Embodiment Performance to Promote Empathy among Individuals."

[31] L. A. Dima, "The Alien Between Us," Research Catalogue, pp. 13–26, Jun. 20, 2025. [Online]. Available: https://www.researchcatalogue.net/view/3765341/3765340. [Accessed: Aug. 28, 2025].

[32] Seeed Studio, MR60BHA1 60 GHz mmWave Sensor – Human Static Sleep Breathing and Heartbeat Monitoring, user manual, V1.9, pp. 2–3, Jul. 28, 2023. [Online]. Available: https://wiki.seeedstudio.com/Radar_MR60BHA1/ [Accessed: Aug. 28, 2025].

[33] Espressif Systems, "ESP-NOW," Espressif Solutions – Low-Power Wireless Communication Protocol, 2025. [Online]. Available: https://www.espressif.com/en/solutions/low-power-solutions/esp-now. [Accessed: Aug. 28, 2025].

[34] Grewus GmbH, HapForce 2 – Haptic Voice Coil Actuator (50 Hz), product datasheet, 2023. [Online]. Available: https://www.grewus.de/products/hapforce. [Accessed: Aug. 28, 2025].

[35] P. Ekman and E. Ekman, Atlas of Emotions. Dalai Lama Trust. [Online]. Available: https://atlasofemotions.org/. [Accessed: Aug. 28, 2025].

[36] I. Homma and Y. Masaoka, "Breathing rhythms and emotions," Experimental Physiology, vol. 93, no. 9, pp. 1011–1021, 2008. doi: 10.1113/expphysiol.2008.041065.

[37] J. P. Johnson, "Transcutaneous Electrical Nerve Stimulation: Mechanisms, Clinical Application and Evidence," Rev Pain, vol. 1, no. 1, pp. 7–11, 2007.

[38] S. R. Chipchase, T. Schabrun, and P. W. Hodges, "Cortical plasticity in response to peripheral electrical stimulation: A systematic review of stimulus parameters," Clinical Neurophysiology, vol. 122, no. 3, pp. 456–463, 2011. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4616091/

[39] U. Sailer, Y. Friedrich, F. Asgari, M. Hassenzahl, and I. Croy, "Determinants for positive and negative experiences of interpersonal touch: Context matters," Cognition and Emotion, 2024.

[40] D. Cronenberg, eXistenZ [Film], Alliance Atlantis, Canada/UK, 1999.

[41] B. Massumi, "The Autonomy of Affect," Cultural Critique, no. 31, The Politics of Systems and Environments, Part II, pp. 83-109, Autumn 1995. Published by University of Minnesota Press