When A Robot Blushes

Irem Bugdayci

***Abstract*— The tacit, dynamic and affective dimensions of our visual system constitute the basis of our rich perceptions of the world. There is a growing danger in treating technologies that have become a part of our visual system as disembodied and alarmingly machinic, a symptom of the persisting cartesian agenda that draws impermeable boundaries between the mind and the body. It is here where artists working with interactive media, and vision technologies come in to reclaim the affective registers of perception in an increasingly paranoid techno-culture complex. Me and my colleagues at the Interactive Architecture Lab Anne-Héloise Dautel and Robert Wuss, have been researching various ways of utilizing eye tracking technology in robotics to create non-trivial, meaningful interactions. Investing in the affective, haptic and bodily underpinnings of vision and perception, our projects explore the embodied dimensions of using eye-tracking as an interface for robotics. Through a discussion of the interactive installation Entangled Eye this paper looks at ways in which we can negotiate digital and immaterial processes of technology as affective, embodied actions to illustrate how technology is inherently bound with human embodiment.**

I. The Entangled Eye

A. Previous Work

Our first project "Your Eye's Motion by Luna" was developed at the Interactive Architecture Lab at UCL, as an exploration of human perception through robotic motion. The installation used eye tracking as an input for controlling a small robotic arm (Luna), mapping the eye movements of the observer onto the range of motion of the robot. As the observer navigated the enclosed space of Luna with her eyes, Luna followed her gaze, pointing a light in that direction to create an extension of the observer's eye. The project investigated the affective potential of eye movement as an interface for robotics and the pronounced subjectivity, its partiality and the phenomenology of sensory experience. The expressive and incipient animacy of our little robot Luna and her capacity to connect with audiences emerged as the starting point for our next project "The Entangled Eye."

Fig. 1: The Entangled Eye, Installation view at Ars Electronica, 2019 (©Irem Bugdayci, Anne-Heloise Dautel and Robert Wuss)

Fig. 2: Leika and creator Anne-Heloise Dautel (©Bugdayci, Dautel and Wuss)

B. Conversations with Robots

Inspired by the characteristics and incipient animacy of our little robot Luna, exploring narrative, behavioral, and conversational qualities of human-robot interaction in relation to vision and perception seemed like a natural course of progression for the next iteration of our research project. For our new installation "the Entangled Eye" exhibited at the Barbican Centre as a part of the AI More Than Human program, later Ars Electronica, Out of the Box (2019) and Istanbul Airport (2020) we designed and fabricated two robotic creatures - Luna II and Leika - with expressive, playful behavior programmed to elicit the observer's attention. The direction of the observer's attention dictated the motion of two whimsical machines that only moved when not looked at. Our main premise for the dialectical model of pausing and playing driven by attention vectors and gaze direction was to create a sense of frustration in the observer who would only have limited access to the scene through peripheral vision, while having a glimpsing awareness of the totality of the scene. This aimed to illustrate how an observer constructs a coherent and practical sense of the world through a temporal and layered unfolding of robotic motion and optical phenomena.

II. The Machinic Eye

A. Recoding vision

The growing concern with automation and the deterritorialization of vision and the body in disciplines of visual studies, and new media studies can be symptomatic of a cartesian definition of vision that isolates matter and information. To briefly overview, latest vision technologies produce mathematical abstractions from images guided by metadata that is managed by algorithms. The process of machines and computers to process information to render and analyze scenes cannot be compared to an embodied subject's

Irem Bugdayci is an artist and researcher previously at Interactive Architecture Lab, UCL, London, UK. (Email: irem.bugdayci.18@ucl.ac.uk)

Fig. 3: Observer looking through the viewport, The Entangled Eye at Ars Electronica, 2019 (©Irem Bugdayci, Anne-Heloise Dautel and Robert Wuss)

Fig. 4: View inside the viewport, The Entangled Eye at Ars Electronica, 2019 (©Irem Bugdayci, Anne-Heloise Dautel and Robert Wuss)

capacity to frame visual information. Manovic is among the scholars arguing that: “The field of computer vision can be seen as the culmination of at least two centuries-long histories. The first is the history of mechanical devices designed to aid human perception, such as Renaissance perspectival machines. This history reaches its final stage with computer vision, which aims to replace human sight altogether”[1]. To suggest that computer vision could replace human sight would be to return back to the argument that a camera is an eye. As George Miller, a pioneer of cognitive psychology points: “how computers works seems to have no relevance to how the mind works, any more than a wheel shows how people walk”[2]. To constitute a computer’s high level capacity to understand digital images and videos to human visual experience, that comes from a body equipped with various sensorimotor capacities situated in an environment would be to comply with a computational, cognitivist agenda that scholar and artists discussed here have argued against.

Can what Johnston calls “machinic vision” or “non-human vision” be mediated in interactive artworks to reach embodied capacities and recode new ways of seeing? [3] Expanding on the importance of looking at the recursive effects of automation of sight on the human experience of vision rather than “how human prefigures the machinic,” Hansen writes: “As interventions in today's informational ecology, both [new media artists and machine vision researchers] exploit the homology between human perception and machinic rendering; yet whereas the project of automation pushes this homology to its breaking point, with the result that it brackets out the human altogether, new media art explores the creative potential implicit within the reconceptualizing of (human) perception as an active (and fully embodied) rendering of data”[4]. Hansen’s post-humanist agenda is ultimately driven to re-inscribe the human in a machinic ecology. Reconceptualizing perception in this context is essential to understanding our relationship with images in the saturated age of technologically mediated environments.

B. Tactile Perception

Among the contemporary artists working with new media, and the latest visual technologies of the day, Memo Akten’s work can guide us in negotiating for an affective dimension of machine or non-human vision systems. Working in the fields of Artificial Intelligence (AI) and Machine Learning (ML), Memo Akten’s research investigates our relationship with nature and technology through the creative dimensions of AI - in particular Deep Learning algorithms. In a recent project *Learning to See* Akten trained a number of neural networks to analyze everyday objects and render them in realtime to reveal how the machine “sees” the same scene organized by an observer. The setup of the interactive installation comprises of a set of everyday objects laid out on a table for the observer to manipulate, a live camera feed pointed at the table that provides digital input for the neural networks to analyse and generate real-time scenic representation of the objects, and a corresponding display of the scenery as it is, and as it is reinterpreted by the neural networks. Through this setup, Akten couples the tactile, hands-on experience of manipulating objects with perceptual reconstruction of the scene creating a continuity of body and virtual space through a dynamic image interface. The observer’s central role in shaping and sculpting the scenery and what the machine sees collapses the virtual space of perception with the skillful tactile actions of the observer offering an alternative to the discourse of computer vision and AI as exclusively "disembodied explicit data manipulation."

At the heart of this piece is a question of how we see and how we learn to see. Beyond the virtualization of the tactile experience of an observer, and the affective registers of physically sculpting digital imagery, “Learning to See” reveals the subjective, processural nature of human and machinic vision alike. Akten’s interest in neural networks comes from a deep ambition of trying to understand the way we see and make sense of the world. What we see as pens and cloths on the table, the machine sees as idyllic natural scenes. This is due to the fact that each vision network has been trained with different datasets from oceans to fire, flowers, space imagery. Correspondingly each network sees the same scene differently, based on how it was trained to see. The fundamental noncompliance of two systems of vision - machinic and human - ultimately exposes the subjective and limited nature of vision itself. As Nöe, Pessoa and Thompson pose: “We could not have perceptual experiences which represent the environment in high-resolution detail if we lacked the neural representations necessary to produce them” illustrating why Akten’s machine cannot see a pen as we see. The essential value of Akten’s work comes from his ability to create an embodied experience by negotiating two radically different systems of

Fig. 5: The Entangled Eye at Ars Electronica, 2019 (©Irem Bugdayci, Anne-Heloise Dautel and Robert Wuss)

Fig. 6: The Entangled Eye at Ars Electronica, 2019 (©Irem Bugdayci, Anne-Heloise Dautel and Robert Wuss)

vision (machinic and human) to effectively debunk the myth of objectivity instilled in sight and later machines, and "eyes" of technology.

In his work *On Optics* Descartes notes on the relationship between vision and touch making an analogy between the two by proposing the concept of "seeing with the Hands." French philosopher and art critic Diderot similarly comments on the haptic experience of perception, posing touch as a similar path to knowledge [5]. Akten's *Learning to See* precisely alludes to this relationship between our senses of touch and sight that has long provoked many philosophical debates, radically expanding the "cold," "alien" domains of machinic vision to the "warm," and "familiar" of tactile sensory experience. Then, our previous agenda of uncovering the affective, dynamic, subjective modalities of vision can be potentially extended to encapsulate machinic vision. Here the intent is not to create an overarching doctrine of vision, but to illustrate the various ways in which we can instill the human in the current climate of growing concern about the violent disembodiment caused by visual technologies to reconfigure our understanding of vision.

III. Embodied Machines

A. *Robotic Puppetry*

The relevance of this project to our research is twofold: first, the tangible process of programming behaviour and second, the visual experience of the interaction. The process of programming behaviour could be linked to Akten's humorous installation where everyday objects become sculptable interfaces for generating machinic imagery. For programming our two robots, we adopted a similar technique of tactile manipulation to create life-like behavior, transforming the object (the robots) into a tool in the process. Creating a script that recorded and played back motor positions with timestamps, we were able to puppeteer our robots to portray the animate, curious and playful characteristics we saw in them. Not dissimilar to how children craft a story when playing with dolls and other inanimate toys, my research colleague Anne-Heloise and I created recordings of different behaviors, constructing a relational narrative dialogue between us and the robot puppets by playfully manipulated them. Director of the Interactive Architecture Lab, Ruairi Glynn notes "The result of a well- manipulated puppet or robot cannot be replicated by digital simulation and robotics thus we adopted a puppeteering approach to robotics"[6]. By puppeteering our robots we were able to subscribe tacit, embodied, life-like qualities to the machinic. The fascinating topics of animacy, puppeteering and the uncanny behavior emerged naturally through our process of designing robots and playing using eye tracking as an interface. An important feature of the process of imbuing personality and creating a conversational attitude between our robots came from the tacit knowledge embedded in these "robotic puppets." Then, the second concern was: how can we include an observer in this machinic conversation and where does the observer's role fall in this machinic dialogue?

B. *Cinematics of Interaction*

In 24-Hour Psycho (1993) acclaimed artist Douglas Gordon appropriates Alfred Hitchcock's Psycho slowing its projection speed to 2 frames per second to make the film run its course in an entire day. The radically decelerated and amorphous film footage unfolds the "space" or the "interstice" between the two image frames relativizing time to induce a perceptual shift. Tapping into the potential of our body's internal sensorimotor rhythms and cues, Gordon utilizes the embodied, affective perceptual capacities of the observer to incite an anticipation and construe meaning independent of Hitchcock's original narrative. As media theorist Mark B. M. Hansen points out, "Since the time any viewer has to devote to 24-Hour-Psycho is limited, her capacity to perceive the work is itself severely constrained and radically dependent on where precisely the film is in its progression when she enters to perceive it" [7]. Similarly, the recorded conversation between Luna and Leika, is presented in interslices, accessed in partial glimpses depending on the direction of the observer's attention. The observer is denied access to the coherent totality of the puppeteered conversation between the two robots, creating a temporal discordance of their coupled behavior. This intends to borrow from Gordon's tactic of constructing temporally stretched filmic sequences "on the basis of refined sensorimotor interval[s]," assigning the task of stitching a narrative to the embodied observer. Cinematic techniques such as decreasing the frame rate of moving images illustrates the temporal dimension of the human processing of information, tapping into the potential of the body to exceed its own contracted habits and rhythms in order to imbue a sense of continuity. Thus, the partial observer becomes the site of narrative, continuously orchestrating a dialogue by knowingly or unknowingly misaligning two sets looped of behavior data with her gaze. A non-trivial narrative in this context is achieved not through "generative" programming or complex simulations and state machines but through a simple logic of

Fig. 7: Robotic Creature Concept Design (©Irem Bugdayci, Anne-Heloise Dautel and Robert Wuss)

intercepting a looped dialogue. As explored by many media scholars, cinematic techniques provide an invaluable resource for thinking about perception and can be applied to imagine novel ways of interaction.

IV. Observations

Over the course of our public exhibitions we observed the capacity of Luna and Leika to organize, isolate, and situate observers - in order to suspend one's attention. We treated attention as a strictly visual problem aligning with Crary's definition as put forward in his recent book Modernity and the Problem of Attention; "an imprecise way of designating the relative capacity of a subject to selectively isolate certain contents of a sensory field at the expense of others in the interests of maintaining an orderly and productive world" [8]. Through the period of our five-day exhibition at Ars Electronica, we found that Luna and Leika were successful at gathering an observer's attention through correlating time-consciousness with eye movement and behavioral affectivity. The biggest difference between our last project "Your Eye's Motion by Luna" and "The Entangled Eye" had been re-orienting our creatures to look at the observer. This reconfiguration radically changed the connection an observer could have with a machinic creature. Whereas many optical devices, projected outward from a single source, Luna and Laika projected inward. As a result, Luna and Leika became whimsical robots that construed affect through utilizing the direction of one's gaze, proving a cybernetic loop of looking at yourself looking, to evoke a non-trivial source of affect. Many people personified our robots by characterizing them as cute, shy, mature, wild, tired and even depressed at times when Leika's beak (the light source) loosened, pointing down. One of my favorite moments was when a little girl who was overjoyed by Luna and Leika, characterized our aluminum, and steel robots as "blushing" in regard to the light interaction that dimmed down when you looked at one. It was heartwarming to see the affect generated from coincidental behaviors of the robots such as nodding, or turning to the observer to "make eye contact". In a sense people were trying to get their attention rather than paying attention; thus our narrative that started as robots fighting for your gazing attention turned into robots and the observer fighting for attention. As a result, the observer effectively found its central place within the system. The installation exhibited the collaborative nature of vision shaped through a dialogue between the observing agent and the machinic creatives to reject a disembodied condition that is increasingly attributed to machinic ecologies.

IV. Conclusion

Beyond an instrumental or prosthetic relation, the dynamic model of how observing bodies accommodate feedback from embodied actions to cognition serves a positive agenda for embracing the rich materiality of technology. This agenda deeply inscribes our bodies in a machinic ecology to carve out a familiar, and intuitional space, articulating a mixed state of agency and unity within the boundaries of human and machinic. Within this space, the body emerges as the source of affect and exhibits incredible feats of flexibility to adapt and permeate personality to other agents. The perceived curiosity and incipent animacy of Luna has kept us wondering the nature of these impressions and the very source of feelings.

Acknowledgment

The projects were designed, developed and executed by Anne-Heloise Dautel, Robert Wuss and myself. It is also a part of my ongoing research "Instruments of Vision" carried out at the Interactive Architecture Lab, under the supervision of Jessica In, and Ruairi Glynn.

References

1. Manovich, Lev. "Automation of Sight: From Photography to Computer Vision," n.d. http://manovich.net/content/04-projects/014-automation-of-sight-from-photography-to-comp uter-vision/11_article_1997.pdf.
2. Ferrell, T. (1982, October 12). *PIONEERING COGNITIVE PSYCHOLOGIST HAS EVERYONE'S MIND ON HIS*. The New York Times. https://www.nytimes.com/1982/10/12/science/pioneering-cognitive-psychologist-has-everyone-s-mind-on-his.html.
3. Johnston, John. "Machinic Vision." *Critical Inquiry* 26, no. 1 (1999): 27–48. https://doi.org/10.1086/448951.
4. Hansen, Mark B. N. *New Philosophy for New Media*. Cambridge, MA: MIT Press, 2006.
5. Lindberg, David C. *Theories of Vision from Al-Kindi to Kepler* . Chicago, Ill: University of Chicago Press, 1996.
6. Glynn, Ruairi P. "The Irresistible Animacy of Lively Artefacts." PhD diss., University College London Bartlett School of Architecture, 2019.
7. Hansen, Mark B. N. *New Philosophy for New Media*. Cambridge, MA: MIT Press, 2006.
8. Crary, Jonathan. Suspensions of Perception: Attention, Spectacle, and Modern Culture. Cambridge, MA: MIT Press, 2001.
9. Oregan, J. Kevin, and Alva Noë. "A Sensorimotor Account of Vision and Visual Consciousness." *Behavioral and Brain Sciences* 24, no. 5 (2001): 939–73. https://doi.org/10.1017/ s0140525x01000115.
10. Penny, Simon. Making Sense: Cognition, Computing, Art, and Embodiment. MA: MIT PRESS, 2019.
11. Clark, Andy. Being There Putting Brain, Body, and World Together Again . Cambridge, MA: MIT Press, 2001.
12. Clark, Andy, and David J. Chalmers. "The Extended Mind." *The Extended Mind* , 2010, 26–42. https://doi.org/10.7551/mitpress/9780262014038.003.0002.