Urban Cyborganics: Engendering Sympoietic Experiences through Body-worn Digital Artifacts in a Rewilded City

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Abstract

Loss of biodiversity is posing an immense threat to the ecosystem, in particular the drastic decline in insect population endangers both the natural food-chain and crop production. In response to this development many cities have started rewilding efforts, aimed at increasing biodiversity. In this paper, I introduce and discuss the Urban Cyborganics project, which makes these nonhuman urban spaces available to human perception and experience through sensing technology, online connectivity and haptic output. As a speculative design project, the Cyborganic concept presents a fictitious nature-human-machine hybrid, deployed as a form of material and experiential storytelling. Leaning on Haraway's notion of sympoeisis, i.e becoming-with and making-kin, the device emulates an insect-like perception of the urban landscape, prompting a change in perception of the city space and promotes a reevaluation of how we align ourselves with other species in a built habitat. Building on Fernandez- Armesto and Ingold, I discuss the act of creation, of both cities and artifacts, as an ongoing negotiation between humans and the material agencies embedded in the environment. Lastly, I examine the Cyborganic in relation to traditional and indigenous practices.

Keywords

Insects, Cyborganics, Urban Space, Speculative Design, Craft, Nonhumans, Sympoieis, Wearables, Biodiversity, Digital-Material Story Telling.

Introduction

Insect decline has been in the public focus for some time, in particular massive honey-bee colony collapses. [1, 2] According to a recent German study, the general insect population has dropped by 75% over the last three decades. The loss of insect diversity and abundance poses a severe threat to the ecosystem as insects play a vital part in its maintenance as pollinators, food source, predators and decomposers. The cause of the decline is not clear, however the authors behind the German study suspect industrial scale use of pesticides constituting the main factor, supported by loss of habitat and to a lesser extend climatic changes. [3]

As a response to the loss of insect diversity in Aarhus, Denmark, a number of sites throughout the city are being rewilded in an initiative between the city council and the Natural History Museum. [4] In this paper, I describe an ongoing project, Urban Cyborganics, which engages in alternative forms of material storytelling around biodiversity and the rewilded, feral city. In a series of walks, human participants are asked to wear a device that can sense proximity to these rewilded sites.

The device, shown in figure 1, encapsulates the head and reacts to sites of favorable conditions for insect-life with a rattling and vibrating sound. The handwoven artifact is a design fiction where technology is used to transgress boundaries between human and nonhuman, digital and craft, and notions of natural and artificial environments.

The project extends beyond the physical artifact with an online presence and an audiovisual teaser, which can be viewed here: www.frankjaer.de/cyborganics/.

Fig 1. *The Bamboo Whisper, © author.*

Research Approach and Structure of the Paper

In this paper, I describe an ongoing speculative design project, Urban Cyborganics, as a form of applied digital-material storytelling. The encounters generated through the design artifact generates new perspectives of the urban landscape and its nonhuman inhabitants. I present and analyze the cyborganic artifact, its process of creation, and the interactions fostered between rewilded city spaces and the human wearers of the devices in the city of Aarhus, in western Denmark.

Thereafter, I position the Urban Cyborganics project

in relation to Donna Haraway's call for engaging in acts of sympoieisis and kin-making across species boundaries, followed by a discussion of the act of creation in relation to both artifacts and cities, as an ongoing process of human negotiation with materials and environments. Lastly, I examine the relationship between the cyborganic device and traditional and indigenous ritual practices.

Related Work

The Poetic-Kinaesthetic Interface project by Wilde and Underwood, uses handcrafted appendages to "provoke shifts in attitudes and viewpoints around notions of body-typical, ability and disability" by giving the wearer "the experience of moving in someone else's body, with the associated abilities and constraints." [5]

The Eyes of the Animal by Marshmallow Laser Feast, is a Virtual Reality(VR) based art project, which allows the wearer of an oculus rift headset embedded in a full-head helmet to experience a piece of woodland through the eyes of a mosquito, a dragonfly, a frog or an owl. The visual interpretation of the animals' experience of their environment is complimented by a binaural soundscape using audio forest recordings and a vibrating backpack, simulating the movement of the animal. The installation is situated in the forest itself, i.e. the VR experience is haptically and visually embedded in a real environment. The footage and soundtracks can be accessed online on the project website. [6]

The Flora Luma by Frankjaer and Kitel, is a light-object fashioned of a handwoven fibre-optic fabric. The fabric can be illuminated and is connected to a plant controlling the animation of the multicolored light inside the fabric through the variance of its emitted electrical signal. As plants are sensitive to touch, humans can interact with the plants, receiving immediate visual feedback of the plants' response, "discovering plants as sentient beings through a first-hand experience." [7]

MyConnect by Spačal, Švagelj and Podgornik consists of a human-sized pod fitted with an aray of petridishes filled with mycelium and a berth. The mycelium, like plants and animals, uses electrical signalling to communicate between different parts of itself. In the MyConnect, the heartbeat signal of a person lying on the berth is transferred to the mycelium, which in turn generates a temporal offset, that is transferred back to the human body via sound, light and haptic impulses. [8] The MyConnect and the Flora Luma, are devices that engender experiences of 'the other' by allowing humans to interact with other species, in a way that is accessible to the human senses. The Poetic-Kinaesthetic Interface and The Eyes of the Animal, akin to the bamboo headdress used in the Urban Cyborganics project, explore 'otherness', whether human or nonhuman through immersive experiences emulating its target subject's sensory perception and to an extent its physical abilities.

Characteristic to all these projects are their sympoietic nature, i.e. they are 'acts of becoming-with' as their primary function is to facilitate experiences of human or nonhuman others, as a way to build relationships and engender empathy. Urban Cyborganics extends on this work by incorporating the built environment into the sympoietic experience. I expand on the cyborganic and sympoietic notions in the following section.

Urban Cyborganics

Cyborganics

The cyborganic is a design fiction from the field of tangible and body-worn digital artifacts. The term cyborganic conjoins the notion of the cyborg with the organic to create a fictional character, transcending human, nature, machine boundaries. The term cyborg is short for "cybernetic organism" and was introduced by Clynes and Kline in their 1960 paper *Cyborgs and space*, arguing for enhancing humans with bio-mechatronic body parts to adapt them to life in outer space as a more viable option for extraterrestrial colonization than providing an earthly environment to the space traveler. Hence adding the 'anic' to cyborg may at first glance seem superfluous as 'organism' is already contained within the term. However, though closely related organic has a different meaning than organism, an organism is an organic entity, a life form. Something organic is of or relating to an organism, whereas organic matter is matter that has come from a once-living organism, is capable of decay or the product of decay, or is composed of organic compounds. [9] In common usage organic refers to agricultural produce that has been grown or raised without the use of artificial fertilizers and pest control and is related to environmentalism. Cybernetics, which is commonly taken to denote digital technology – prefix anything by the word 'cyber' and it is embedded within the internet – actually refers to how a system controls itself and communicates with other systems. The term was originally introduced by Wiener in 1948 as "the scientific study of control and communication in the animal and the machine" and regards any system as self-regulatory and closed, i.e. as autopoietic. [10, 11] Disapproving the perception of living organisms as autopoietic, Dempster introduces the term 'sympoietic' as a better way to conceptualize complex living systems, which are characterized by permeability and boundarylessness. [12] Haraway defines sympoiesis as "thinking beyond individualism into relationships by fostering relations and making kin with 'all kinds', both human and nonhuman." [13]

It should at this point be noted that as a design fiction, the device is not truly cyborganic, i.e. implanted into the human body, but emulates a cyborganic experience.

Sympoietic Devices

In her 2016 book, *Staying with trouble: making kin in the Chtulhucene,* Donna Haraway encourages engagement in sympoietic acts, i.e. becoming-with in kin-making processes across species boundaries, to address the ongoing environmental destruction. She calls for storytelling for collective world making, i.e. telling speculative stories transforming our sense of the possible. Whilst Haraway acknowledges the usefulness of the Anthropocene for gathering the arts, humanities, and social sciences around environmental questions, with the notion of the Chuthulucene, she moves beyond problem diagnostics and embraces the human as a technoscientic fabulist, that must learn to tell stories that strengthen ecological response-ability. [14] Together with the examples presented in the Related Work section, we position the cyborganic as a sympoietic device, a design fiction, which enables a form of digital-material storytelling, transforming its wearer's sense of self to become-with and make-kin with all the unacknowledged companion species that make up our life-world. In Haraways' view companion species are anything that makes human existence possible, ranging from gut-bacteria to rice, mice and cows. [15]

The Bamboo Whisper

The cyborganic project grew out of a series of material experimentations during a workshop on haptic interfaces as a collaborative exploration of how traditional crafts, organic materials and digital technology could blend and augment the human body. During the creative process, we allowed the materials to "take the lead" in an open-ended process, where the material agencies and emerging properties as computational composites are seen as co-designers in the design process. [16, 17]

From these explorations emerged the Bamboo Whisper, a bonnet-like headpiece woven from bamboo reeds and dried grasses. In its initial application, it explored the kineaesthetic experience of a human 'other' in a pair of devices, where voice input is translated into percussive rhythm of a second device as is shown in figure 2.

The strong insect-like qualities of the devices, in particular the emitted rattling sound, evocative of a stridulating insect, but also the encapsulating rigidity, reminiscent of an exoskeleton led us to redesign the functionality of the Bamboo Whisper to explore insects and insect being. We were interested in insects "in the wild" and initially envisioned some kind of sensing equipment connecting with activities in a hives.

However, the vast majority of insects are singular and do not live in hives. In addition, as insects are generally very small, their emissions, i.e. sound and vibration are practically impossible to capture in an open environment with numerous other sources generating similar data.

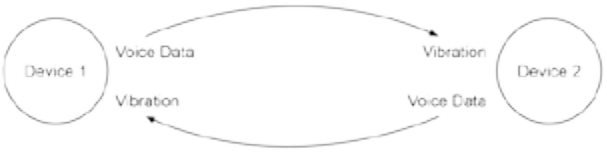

Figure 2. *Function diagram Bamboo Whisper version 1.*

We therefore chose a different approach and emulated insect response to its environment, by querying an array of meteorological conditions through an online weather service, as well as using local sensor data to establish conditions as favorable or unfavorable to insect activity, as listed in figure 3. In case of favorable conditions, the device responds to areas of high biodiversity, indicating increased insect activity, detected through the inbuilt GPS, as shown in figure 4.

Weather conditions	**Favorable**
Precipitation	Less than 2mm within last hour
Wind	Less than 7 m/s
Temperature	Above 12°C in spring and autumn, 18°C in summer

Figure 3. *Weather conditions table.*

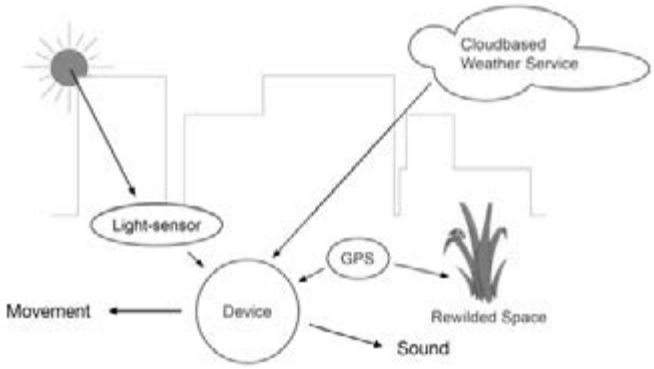

Figure 4. *Function diagram Bamboo Whisper version 2.*

Cyborganic Aarhus

In Aarhus, the Rethink Urban Habitat project led by the Natural History Museum has 42 rewilded sites scattered around the small city in western Denmark. The initiatives range from actively building structures to aid biodiversity, so-called "insect-hotels", the greening of fountains and even a cow-pasture, to simply refraining from tending and cutting back wild growth in certain areas. Additionally, several citizen-led greening and rewilding initiatives have been initiated, many of them undocumented. The Bamboo Whisper device responds to these areas when in close proximity, i.e. it 'awakens' when discovering space habitable to insects and gets 'excited' as it gets closer. In a preliminary study, two

volunteers, walked a two-kilometer route encountering 6 sites of biodiversity, shown in figure 5. The cyborganic walkers were later interviewed about their experience which they described as having a different perspective of both the city and their own bodies, whilst conjuring associations of crickets and other insects. The walkers were neither instructed into the functionality of the devices beforehand nor about the conceptual reasoning behind the project.

Figure 5. *Cyborganic Walkers in Aarhus, © author.*

Liminality and being-other

Traditional and indigenous cultures know about the deep value of 'becoming-other', often in rites of passage, such as the Ulwaluko carried out by the South African Xhosa. Homecoming initiates carry a reed crown when returning from their month long secluded stay in the bush, where they are stripped of both their clothing and their identity to become men. [18] Concealment often plays and important role, the Xhosa boys are covered in white clay and wrapped in blankets and in Malawi Yao boys wear reed outfits during the rites, as seen in figure 6, similar to the raffia grass worn by female Ngbende initiates in the northern Congo, which includes a grass fringe covering their faces. The grass conceals the juvenile identity of the initiate until the ritual is complete and she is reborn as a woman. [19] The transitional stage in these rituals is marked by liminality, a condition of ambiguity or disorientation, where the initiates are in-between identities. "Liminal entities are neither here nor there; they are betwixt and between the positions assigned and arrayed by law, custom, convention, and ceremonial" (sic). [20 p.95] Hybrids, such as cyborgs are equally liminal beings, characterized by being neither one or the other of its kind. Other kinds of hybrids such as the American shamans, have the ability to shapeshift, i.e. enter animal forms, a skill shared by their bronze-age counter parts who lived just south of today's Aarhus.

Molting, the act of metamorphosing into another creature seen in a wide array of invertebrates, to the

Figure 6: *Malawi boys in initiation ritual, Steve Evans [CC BY 2.0 (http://creativecommons.org/licenses/by/2.0)].*

shaman means access to other worlds. Shamanism is about transcendence and in shamanistic cosmology, all living beings have the same kind of soul, whereas it is the body, which shapes the perspective through which we perceive the world.

By gaining access to other bodies, one gains access to other worlds, which enables communication between the living and dead, humans and spirits, humans and animals. [21] Similarly, the cyborganic human- machine-nature hybrid, is in a state of liminality, neither technological, nor natural, nor human, nor machine, but comprising parts of everything. The transformation is not complete, but a temporary condition, after-all the device can be removed at any time. This temporary condition, which in itself is liminal, can be likened to play, representing a surreal or 'not-quite-real' reality, where the strictures of known realities may be loosened, opening up for possibilities of reconfiguration. [22 pp.25- 26]

In western traditions, the Carnival is today associated with costumed street-parties and colorful parades, however the masked celebration which marks the beginning of Lent, was traditionally a reversal ritual, where all rules are suspended or inverted and any identity could be freely assumed. In pre-Christian times these rituals were thought to chase away the winter spirits and return the spring and the crops. [23] Nature in this view is not independent of humans but exists in a sympoietic relationship, where human actions are of utmost importance to ensure the benevolence of the earthly spirits. Much like in many African countries, when visiting the local shebeen (bar/pub) the first sip of a beer is poured on the ground to appease the ancestors. Seen from a secular point of view, these notions may easily be dismissed as superstitious and outdated, however the responsibility of the human to make space for the nonhumans in order to ensure the continuous working of the ecosystem, such as maintaining an environment that is habitable to insects, is becoming increasingly — and painfully — clear. This recognition is reflected in recent developments in various parts of the world; over the last

few years New Zealand has granted legal personhood to a national park, a river and a mountain following Maori cosmology that understands the natural environment as kin; Ecuador has granted the environment institutional rights independent of consequences to humans; and in the Swiss constitution all living beings have been granted
the right to dignity. [24-26]

Correspondingly, in academia, particularly within the humanities, there is an increasing resistance against reductionist, dualist thinking and a call for moving towards a non-anthropocentric, posthumanist worldview, including a growing interest in indigenous knowledge systems as providing informative models of living sustainably with, and in, the natural environment. [27-29]

Discussion: Decivilizing and rewilding

The Urban Cyborganics project explores cyborganic being in relation to urban space, extending from human-machine-nature into the build environment. Since the emergence of agriculture, the settlement is a paramount factor in contemporary human cultures and is one of the defining criteria of that constitutes a civilization. Etymologically the word civilized, derives from the Latin civilis, meaning civil, which is related to civis, i.e. citizen and civitas, the city. [30 p.73]

"Civilization makes its own habitat" writes Fernandez-Armesto and asserts that a civilization presents "a relationship between one species and the rest of nature, an environment refashioned to suit human uses." [31 pp. 4-5] Fernandez-Armesto's somewhat unorthodox organization of the different types of human societies by geographical categories rather than location or time-period, reflects an understanding of creation as a response to materials, as opposed to the more common hylomorphic perception ingrained in western thought.

The hylomporphic model, as introduced by Aristotle, asserts that being is comprised of two compounds, form and matter, where form is seen as pure and intentional thought, and matter as inert and passive. In this model, creation happens when form is imposed onto matter, like the architect designing a theoretical building, which is then subsequently and separately manifested, i.e. built by workers. [32] In contrast Deleuze and Guattari argue that in a world of life the essential relation is between materials and forces and not between matter and form. [33 p.377] The world is not a static abstraction reducible to simple formulas, rather "it is about the way in which materials of all sorts, energized by cosmic forces and with variable properties, mix and meld with one another in the generation of things." [32 p.92]

This view of creation as a reciprocal and fluid negotiation between maker and materials, resonates with the creative approach described in the Bamboo Whisper section, where the materials are allowed to "take the lead" in an open-ended process where material agency and the properties of the artifact are regarded as co-designers in the creative process. Breaking with the dualistic hylomorphic model, where matter is seen as an inert and passive recipient of the will of conscious and intentional (human) thought, towards accepting and embracing the agency of matter leads to a more balanced and less anthropocentric world-view more in line with indigenous animist cosmologies, such as e.g. the Maori of New Zealand described in the previous section.

In the understanding of Fernandez-Armesto, civilization is measured as proportional to the distance to the natural environment, where 'more civilized' indicates the degree of denaturing of the human and the constructed habitus, and not as a value judgement. Since the Neolithic revolution 12.000 years ago there has been an ongoing attempt to denature and domesticate humanity, culminating with the ideal of the Enlightenment, to domesticate anything which is wild or savage. [31 p.15] Most recent developments in this trajectory can be seen in the transhumanist movement which believes in transgressing the biological aspect of the human through technology, to achieve immortality and enhanced sensory capabilities, thereby effectively severing the link to the biological world. [34]

In contrast, sympoietic projects, such as Urban Cyborganics, Flora Luma, Eyes of the Animal and MyConnect, acknowledge that humans are sociotechnical beings, whilst illustrating that technology does not necessarily denature us, but can be applied as an experiential bridge and means of temporary transcendence from an overly civilized and isolated human realm, into a complex sympoietic habitat comprised of interlocking and coexisting techno-mechanical and organic systems and beings.

During the interview following the walk through Aarhus, one of the participants explained how the headdress integrated with her body, and how she had to get used to "having a different[ly] shaped head" where the restrictions imposed by the device afforded her a very different perspective of the city, whilst it during the walk became apparent that the at first random seemingly vibration, had a distinct pattern to it.

Whilst the decoding of the pattern and its triggers remained outside the participants understanding, the sound and the rattling conjured up memories of childhood camping trips and crickets in the grass. The second participant explains "we experienced the city in a different way, how we think about [the] invisible and what might be the value of the invisible and how might we give a voice to the invisible" adding that "it's also a way to maybe easier communicate to the audience as well because it's so sense-able, you know you can sense it. And it's not something we show up there [projected on a wall or screen] that's abstract. It's just so concrete." Meaning that the physical experience of wearing the device and engaging with the city through the body had a greater impact than using audiovisual material.

She adds that although there was an element of loss of control "[it] is so different from [using the] eyes and also hearing. I mean, you can close your eyes or you can turn the other way around right? But with the head-thing, you're just forced to be alert you know, you're just forced to wander around like so", referring to the restrictions imposed by the headdress, it was not intimidating. Walker one explains "the design doesn't look threatening, even if it's unfamiliar and it's not a hat I would regularly wear, it doesn't look threatening. I don't know if it's the materials or anything." Similarly, in the Poetic-Kinaesthetic Interface project, the researchers describe how handcrafting the artifacts opened up for conversations that otherwise may have been difficult to have through the inherent accessibility, non-threatening and inclusive nature of craft. Similarly, the cyborganic proposes an alternative story to the transhumanist narrative of technological augmentation of the human body, through the deployment of a handcrafted device made of organic materials.

Conclusion

Environmental issues, such as insect decline are threatening to collapse our ecosystems. In Aarhus, the city has responded to these challenges are 'de-civilizing', i.e. opening up to nature and actively rewilding the urban landscape. In this paper, I have presented a speculative design project Urban Cyborganics, consisting of a headworn device fashioned of bamboo-reeds, as sympoietic device that allows its wearer to experience the rewilded islands in the urban landscape through a nonhuman perspective. I have discussed the device and its application as part of Rewilding Aarhus, as well as its relationship to the notion of sympoieisis as introduced by Dempster and Haraway. Furthermore, I have discussed the etymological roots of cyborganics, within organics and cybernetics and related the urban cyborganics project to traditional and indigenous practices of ritually altered and liminal identities. Leaning on Fernandez-Armesto and Ingold I have then discussed creation of both cities and artifacts as constituting a continuous negotiation between humans, materials and the natural environment. Lastly, I have and discussed the cyborganic experience as rewilding and decivilizing of technology in relation to the human. As a form of material storytelling and technological fabulation, as an experiential engagement with the city and its nonhuman spaces, the Urban Cyborganic project enables an experience of the city from a nonhuman perspective, through a temporarily liminal body facilitated through the sympoietic artifact.

Acknowledgments

The Bamboo Whisper was created in collaboration with Patricia Flanagan at the Haptic Interface Workshop in Hong Kong 2014. The Cyborganics project is supported by the Human Futures Research Group, Aarhus University.

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