SHErobots
Ecologies of Care

12 February to 30 May 2024

TU Delft Library,
Delft, The Netherlands

Curators:
Dagmar Reinhardt [The University of Sydney]
Lian Loke [The University of Sydney]
Deborah Turnbull Tillman [University of New South Wales]
Vincent Cellucci [TU Delft Library]
The world is in TROUBLE,
capital ‘T’-rouble: global conflicts, resource shortages, climate chaos, extinction, denaturation, and runaway technology.

Women have long been held responsible for society writ large, while men remain charged with the current state of the global economy, military actions, and contemporary politics. We have been made material as property to trade for breeding, social advantage and emotional, as well as physical, surrogacy. Our value remains most qualified as non-expressive and decorative, measured by physical traits and how we enhance and present ourselves. However, throughout history, women have been making trouble, being trouble, solving trouble(s); acting as makers, artists, thinkers, and political advocates.

As equality with men looms closer on the horizon, a female-led overview of how women are working in emerging technologies surrounding Robotic Fabrication, Social Robotics, and AI is timely and revealing. With the ability to now outsource traditionally domestic duties to machines, the technology readily available to automate this labour, and with higher education and research grants open to all genders, a platform emerges for women to lead in creative thought, in socio-technical constructs, and in the use of materials to design a way forward for socio-collaborative existences between human beings and our newest labourers: robots. Whilst this isn’t always a straight and simple path, revered feminist theorist Donna Haraway recommends keeping with it, worrying it, troubling the problem until we find ourselves as required, “…staying with the trouble… making oddkin; that is, we require each other in unexpected collaborations and combinations, in hot compost piles. We become - with each other or not at all...”.

Haraway charges women with this social experiment, with making strange and with making kin, and then, with either coming together or flying apart from the living beings inhabiting the planet. She charges us with making trouble. The curators of SHErobots accept this challenge, with collaborations alongside the uncanny, and by creating SHErobots: Ecologies of Care.

This exhibition explores women who robot (she ‘robots’, a verb), using robotics within the broader context of ecologies, as multi-species and environmental entanglements, encompassing care for both humans and non-humans. It is composed of three core themes: Strange Bodies, Systems Care, and Materialities Reset. Each showcases thought-provoking works that provide insight into our evolving understanding of these complex dynamics, with art videos, process videos, physical objects fabricated for and by robots, customised end effectors for robots, robot bodies, and origin stories of research, art, and design.
List of Works

1. **Code Red (2021)**
   Lian Loke, Dagmar Reinhardt
   
   HD video, sound [1:49]
   Silicon printed faces
   This project is supported by DMaF, The University of Sydney.

   The ritual of a woman wearing lipstick is at once a highly personal act of identity, yet a common marker of socially constructed femininity. We ask, what does it mean for a robot to replace the human hand in such an act?

2a. **Circle E: Fragile Balances (2009)**
   Mari Velonaki, David Rye
   
   Interactive installation: Custom wooden table incorporating rotating brass drum; motor, micro controller, felt, paper, pencils.
   Handwritten paper archive from previous exhibition

   Circle E: Fragile Balances, is an interface for visitors to handwrite and ‘post’ your own messages to the Fish and Bird robotic characters, or to your loved ones. You can donate your letter to the project by feeding it through the slot in the drum when it pauses momentarily.

2b. **Fish-Bird**
   **Circle B–Movement C (2003)**
   Mari Velonaki, David Rye
   
   Text printouts produced by dialogue between Fish and Bird
   Video [7:40]

   Fish-Bird Circle B–Movement C investigates the dialogical possibilities that exist between autokinetic objects (two motorised wheelchairs). The wheelchairs write poetic texts, impersonating two characters, Fish and Bird, who fall in love but cannot be together due to ‘technical’ difficulties. In their shared isolation, Fish and Bird communicate intimately with one another and their visitors via movement and text.

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1. **List of Works**
   
   **Concept:** Lian Loke, Dagmar Reinhardt
   **Cinematography and Video Edit:** Paul Warren
   **Sound:** Lindsay Webb
   **Performer:** Susana Alarcon Licona
   **Robot Programmer:** Lynn Masuda

   Supported by DMaF, The University of Sydney.

2a. **Circle E: Fragile Balances (2009)**
   **Concept:** Mari Velonaki
   **Mechatronic Design:** David Rye
   **Metal Fabrication:** Bruce Crundwell
   **Custom Bag Fabrication:** Elizabeth Kemp

   Supported by the Australian Centre for Field Robotics, The University of Sydney.

2b. **Fish-Bird**
   **Circle B–Movement C (2003)**
   **Mechatronic Design:** David Rye
   **Systems Architecture:** Steve Scheding
   **Vision Systems:** Stefan Williams

   Supported by:
   - Australia Research Council
   - Australia Council for the Arts
   - Australian Centre for Field Robotics, The University of Sydney
**Human-Robot DadAIsm (2024)**

*Petra Gemeinboeck, Rob Saunders*

A triptych of human/AI-generated prints [900x900mm]

Partially supported by the Australian Government through the Australian Research Council, the Austrian Science Fund, and the EU Framework Programme.

Human-Robot DadAIsm expands our sociotechnical imaginaries of human-robot relationships, venturing into a surreal realm that materialises the ethico-onto-epistemological mess shaping our future fantasies.

**Pathetic Fallacy (2014)**

*Elena Knox*

HD video, stereo [4:12]

Pathetic Fallacy is an intergenerational dialogue about growing old. Youth doesn’t believe it will age. Age believes it knows best. Humans believe in the pathos of humanity. And the cycle continues.

Pathetic Fallacy was the first dialogue drama created for screen involving an Actroid (Geminoid-F by Ishiguro Laboratories). A conventional mother-daughter, or Juliet-Nurse, figuration is applied to an unconventional scenario, revealing a new human-machine relationship.

**Gynoid Survival Kit (2016)**

*Elena Knox*

Objects: Bronze, glass, ink, linen, plastic, rhodium, silver, steel.

Courtesy of artist and ANOMALY.

Within The Gynoid’s Guide to Continuous Service, I continue to create a Gynoid Survival Kit. This kit comprises prototyped jewellery and accessories that may be covertly worn by a robot sex worker to ensure both its ‘personal’ safety and sustained functional operation. These objects are speculative, as of course are android sex workers with any degree of individual or collective entitlement or autonomy.
iRat: A Bio-inspired Robot (2010-2024)
David Ball, Scott Heath, Wiles Lab UQ, Chiba Lab UCSD

Small robot
Supported by the Australian Research Council Special Research Initiative on Thinking Systems, NSF Science of Learning Temporal Dynamics of Learning Center, and Kavli Institute for Brain and Mind.

The rat-sized iRat is both a machine and yet also a social agent. If the robot exhibits pro-social behaviour, would a rat reciprocate? Would you?

Robotum Exuviae (2024) and Still, Life (2022)
Belinda J Dunstan

Specimens: Silicone rubber, gel medium, tubing, resin, acrylic, foam core, specimen pins, sheet metal, copper mesh.
Video of Still, Life [2:09]

Robotum Exuviae features documentation of the lifecycle of a pod of soft robots, including a preserved infant, discarded exoskeletons from seasonal metamorphosis, and a dissected deceased adult. How might we consider and treat robots in the future if they were no longer in a productivity dynamic with humans?

Multi-agent Robotic Building 2.0: Rhizome 1.0 (2022)
Henriette Bier et al.

Video [3:18]

This project is a multi-disciplinary collaboration between Architecture, Robotics/Mechanical Engineering, and Aerospace Engineering faculties at TU Delft. Its focus is the development of a Martian habitat using 3D-printed components and in-situ resource utilization. The assembly of components is implemented with HRI support and rovers that are equipped with various robotic tools.
**Multi-agent Robotic Building 2.0: Bio-Cyber-Physical Planetoid (2021)**

Henriette Bier et al.

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3D printed prototype, wood-based biopolymers and sensors [700 dia]
Video [0:36]

The 3D printed Bio-Cyber-Physical Planetoid implements minimum interventions that stimulate both biodiversity and social accessibility of residual places. It is printed using wood-based biopolymers and incorporates sensors to monitor the climate, flora, and fauna to inform neighbours and passersby about conditions that may require their intervention.

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**Additive Manufacturing for Repair (2023)**

Ruxandra Chiujdea, Mette Ramsgaard Thomsen, Stine Dalager Nielsen, Konrad Sonne, Carl Eppinger, Paul Nicholas

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3D printed biocomposite panel [400 x 250]
Video [2:32]

Eco-Metabolistic Architecture project examines repair as a particular instantiation of circular design principles allowing us to challenge the fixity and permanence of architectural artefacts. This project presents the application of robotic 3D printing in the context of repair and maintenance for biocomposite materials. Repair is here understood as a practice of continual construction.

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**ZOE (2022)**

Noor Stenfert Kroese, Amir Bastan

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Datacarpets: Tufting fabric, wool, latex.
Video [2:57]

In co-production with Creative Robotics, KUKA CEE and Mushroom Research Center Austria.

A temporary co-existence between reishi mushrooms and a custom-made robotic system. The first step in ongoing research of Fungi-Inspired Bio-Computing and More-Than-Human Interactions with Industrial Robots. The data carpets were created from the data of the reishi signals in relation to their environment.
**ECOTOPIA (2022)**
Gili Ron, Irina Bogdan

HD video, sound [5:32]

Ecotopia speculates on near-future entanglements of humans, nature, and technology.

The video presents artwork of robots enmeshed with nature. We ask, what would feminist, eco-centric, and nurturing technology look like?

**Co-workers (2024)**
Lynn Hyun Kieffer, Jakob Sieder-Semlitsch

3 printed elements of fungus/bacteria co-culture [150 x 150]
Video [3:28]

We show testing samples of an ongoing research, which tries to understand the relationships taking place during a material forming process including living microbes, designers/architects, and digital fabrication. We question how processes and tools need to change to adapt to the living and to becoming co-workers?

**Magic Queen / Sylva (2021)**
Daniela Mitterberger, Tiziano Derme

Magic Queen video, sound [4:09]
Sylva video, sound [5:26]

Projects by MAEID Büro für Architektur und Transmediale Kunst.

Magic Queen supported by:
ABB, Bundeskanzleramt Wien / Federal Chancellery Republic of Austria, Universität für Angewandte Kunst Wien, Stadt Graz, Land Steiermark, Leopold-Franzens-Universität Innsbruck – Institut für Experimentelle Architektur, Department of Microbiology

Sylva sponsored by:
ABB, Inxpect

**A robotic garden is a performative architecture that connects people, machines, and sensors with other living systems.**

**Concept: Lynn Hyun Kieffer, Jakob Sieder-Semlitsch (Aarhus School of Architecture)**

Material Research: Lynn Hyun Kieffer
Printing Unit Development and Programming: Jakob Sieder-Semlitsch
Design and Fabrication: Lynn Hyun Kieffer, Jakob Sieder-Semlitsch

**ECOTOPIA (2022)**
Gili Ron and Irina Bogdan

Cinematography and Video Edit: Matias Jelfs
Sound: Zoe Polanski

RoboBlox Sustained (2022)
Müge Belek Fialho Teixeira, Glenda Caldwell, Jared Donovan, Frederico Fialho, Maryam Shafiei, Ahmed Sakr

Blocks printed with clay, bagasse, fly ash, mill mud, mycelium, algae.
Video, sound [11:56]

RoboBlox are sustainable breeze blocks created via ruled-based story making. As a continuous workflow from digital design to robotic fabrication, RoboBlox is exploring materiality by asking “how can we utilize waste materials to create high value products?”, and through investigations of material recipes based on local and agricultural waste materials.

DIA TOMA (2023)
Shabnam Lotfian, Müge Belek Fialho Teixeira, Jared Donovan

Aluminium, steel
Video [0:32]
Supported by Building 4.0 CRC, QUT.

The conversion of diatom principles into tangible, lightweight structural components occurs through the integration of biomimetic design, generative design, and robotic fabrication. Here, robots not only facilitate the fabrication process, but also define surface patterns and enhance aesthetics.

Printsugi Rock Tower & Rubble Tiling (2024)
Nadja Gaudillière-Jami, Max Benjamin Eschenbach, Peng Jiaxian

Rubble, clay, wood
Video, sound [5:46]

Leveraging 3D-printing and computational design strategies, our research utilises ‘matter as met’, as found on site. Rock Tower sources stones and clay from the forest nearby. Rubble Tiling sources waste from pavement demolition. Methods of disassembly and reassembly of materials enable less transformation of the materials used, and thus, less energy consumption in building processes.
To address the climate crisis we need to change the way we build our cities and homes. Earth building is a sustainable, economical means of building. Computationally designed 3D printed earth homes allow for customisation and optimisation of designs and detailing, and the use of sustainable site sourced materials that replace high CO₂ emitting materials such as concrete and steel.

The prints investigate under-extrusion and over-extrusion for acoustic treatment. The panel prototypes harness these qualities through micro-perforations and detailed surface patterns that can diffuse and absorb sound. Prototypes are recycled PETG plastic, ensuring every prototype can be disassembled, re-ground, and re-printed, embodying our ethos of reducing waste and promoting reuse.

RobotKitchen extends beyond traditional kitchens to include workshop and fabrication scenarios with robots. Co-opting the workflows and tool adaptations from robotic fabrication and manufacturing tasks, the kitchen is re-imagined as a collaborative workspace. Humans and robots figure out how to make food – or make a mess – with fluid and liquid materials.
**Terrain Translations: Mapping Multispecies Connectivity via Technological Narratives (2023)**
Tracey Woods

A hexaptych of black/white night camera images.

Terrain translations is a representation of hope and renewal, a remediation of distressed landscapes via the collaboration of multiple species and technology. In this juxtaposition of ancient landscapes with novel technologies, multi-species and plant life exist synergistically.

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**Robothabitat: Repairing Distressed Landscapes (2023)**
Dagmar Reinhardt, Tracey Woods, Lynn Masuda, Yi Zhao

Gardening tools, 3D printed plastic end effectors for robots

Bridging geographical formations, animal movements, and plant seedlings, robots support animal ecosystem engineers in shaping environments. KUKA and UR robots equipped with garden tools like shovels and rakes aid ecological restoration, working alongside human efforts. By leveraging dynamic scalable patterns found in nature, these robotic interventions become catalysts for resilient ecosystems, promoting sustainable harmony.

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**Robot Seedling (2024)**
Dagmar Reinhardt, Henriette Bier, Charlotte Firth, Arwin Hidding, Micah Prendergast

Live demonstration with KUKA iiwa robot, 13 February 2024

This live demonstration will unpack some of the exhibition’s themes related to using robotics as a catalyst to innovate a future that deeply cares for humankind, partner plant species, and our finite environment.
Repeat After Me (2024)
Lian Loke

Live performance at Exhibition Opening,
12 February 2024

I often wished for a third arm, to make my life easier. Getting up in the morning, grooming and getting ready for the day … surely more efficient with the help of a robotic arm. But I forgot about the training!

Using improvised performance as a research methodology, I enquire into future worlds, where humans and robots live with, learn from, and adapt to each other. Raising questions as to who is becoming-human, or indeed, who or what is becoming-robot.

KUKA iIwa robot courtesy of Micah Prendergast, Cognitive Robotics Lab (TUD).

Robot Programming: Charlotte Firth (UNSW), Lynn Masuda (USYD), Yi Zhao (USYD)
Music: Lindsay Webb, Bronwyn Turnbull
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