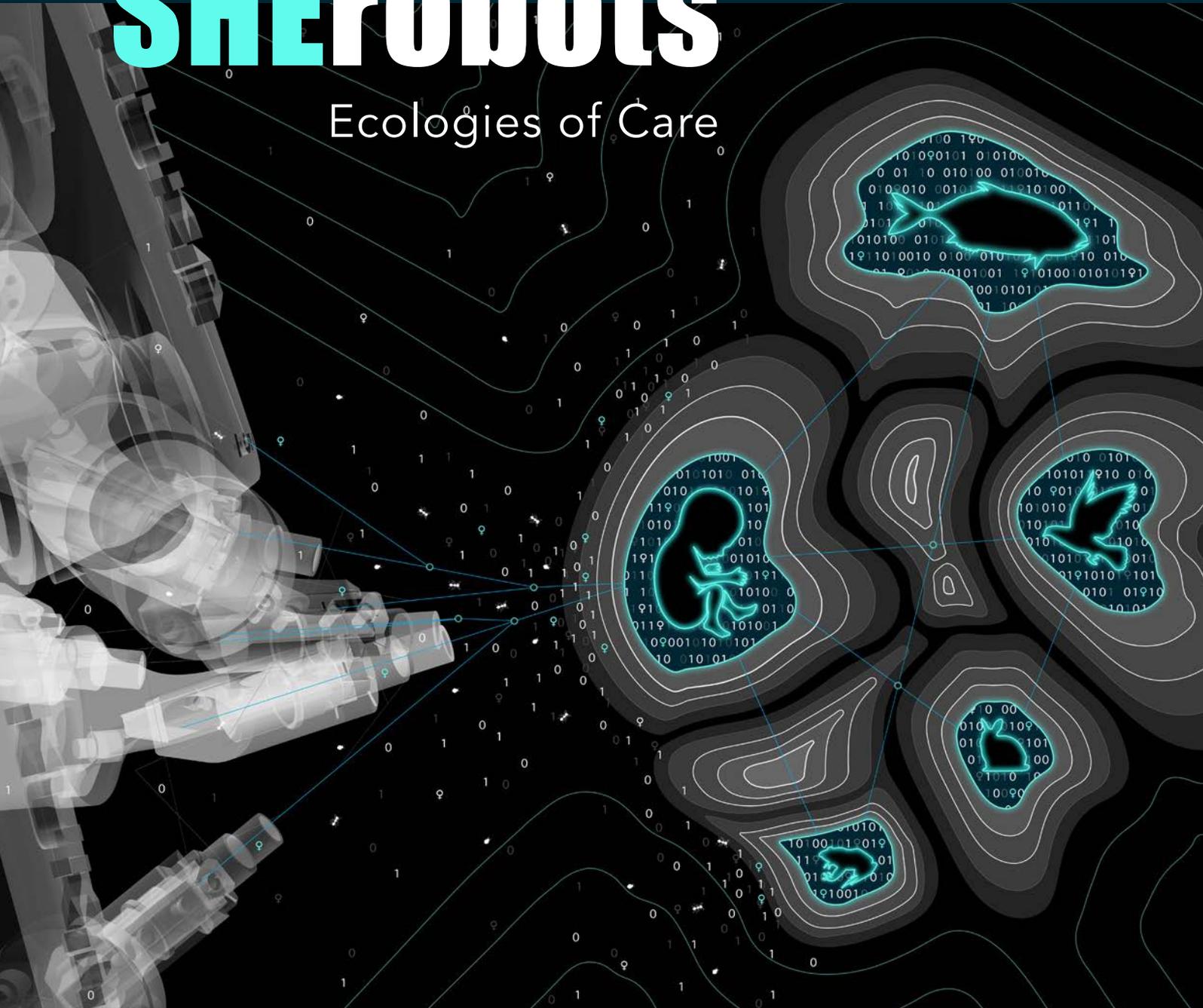


# SHERobots

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.

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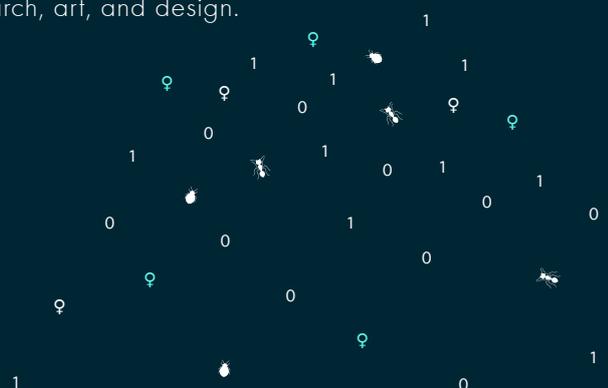
Women have long been held responsible for society writ large, while men remain charged with the current state of the global economy, military actions, and contemporary politics. We have been made material as property to trade for breeding, social advantage and emotional, as well as physical, surrogacy. 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?



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

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.



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)

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.



Mechatronic Design: David Rye  
Systems Architecture: Steve Scheduling  
Vision Systems: Stefan Williams

Supported by:  
Australia Research Council  
Australia Council for the Arts  
Australian Centre for Field Robotics,  
The University of Sydney

3

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



Concept, Posthuman Dramaturgy, and Co-choreography: Petra Gemeinboeck  
Dancers (Depicted): Felix Palmerson and Audrey Rochette  
Creative Robotics: Rob Saunders  
AI Prompt Curation: Petra Gemeinboeck

4a

## 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.



Light and Camera: Campbell Drummond  
Assist: Lindsay Webb,  
Maylei Hunt Ursula, Maggie Blinco  
Actroid Operator: Kirsten Packham

Robot: Hiroshi Ishiguro Laboratories  
Permissions: National Institute of Advanced Industrial Science and Technology (AIST) Japan, + Creative Robotics Lab, National Institute for Experimental Arts, UNSW Art & Design, Australia

4b

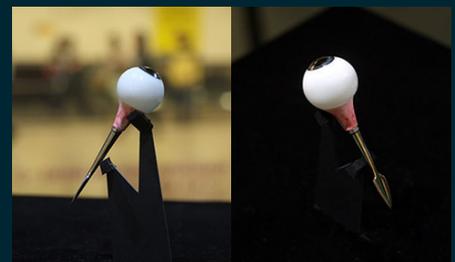
## Gynoid Survival Kit (2016)

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.



5

## 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?



Concept: David Ball, Janet Wiles  
Robot Engineering: David Ball,  
Gordon Wyeth, Pauline Pounds,  
Jonathon Taufatofua, Carlos Ramirez  
Robot Programming: Scott Heath,  
Joshua Arnold, and Wiles Lab students  
Rat-iRat Studies: Laleh Quinn, Eric Leonardis,  
Andrea Chiba, and the Chiba Lab students

6a

## Robotum Exuviae (2024) and Still, Life (2022)

Belinda J Dunstan

6b

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



Credits: UNSW Creative Robotics Lab

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?

7a

## 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.



Project Leader: Henriette Bier (TU Delft)  
Project Team: Henriette Bier, Arwin Hidding,  
Max Latour, Vera Laszlo, and MSc students  
from BK; Angelo Cervone, Roland Schmehl,  
and BSc students from AE; Luka Peternel,  
Micah Prendergast, and MSc students  
from 3ME, TU Delft.

Co-funding Partners: ESA and Vertico

7b

## Multi-agent Robotic Building 2.0: Bio-Cyber-Physical Planetoid (2021)

Henriette Bier et al.

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.



Project Leader and Team IA, TU Delft: Pierre Oskam  
Project Leader RB, TU Delft: Henriette Bier  
Project Team RB, TU Delft: Arwin Hidding,  
Max Latour, Vera Laszlo, and MSc students

Collaborators/Partners: Unifri (Hamed Alavi and  
Denis Lalanne), Tokencube (Klaus Starnberger),  
3D Robot Printing/Dutch Growth Factory (Arwin  
Hidding, Jasper Menger, and Rene Ritmeijer)

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## Additive Manufacturing for Repair (2023)

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

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

Project funded by European Research Council.

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.



Concept: Ruxandra Chiujea, Mette Ramsgaard  
Thomsen, Stine Dalager Nielsen, Konrad Sonne,  
Carl Eppinger, Paul Nicholas (CITA/Royal  
Danish Academy), students at Computation in  
Architecture (Royal Danish Academy)

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## ZOE (2022)

Noor Stenfert Kroese, Amir Bastan

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.



Concept: Noor Stenfert Kroese, Amir Bastan

Produced by Productiehuis Theater Rotterdam  
with support from Municipality of the City of  
Rotterdam, Fonds 21 EXTRA, and Art Climate  
& Transition - EU Creative Europe project.

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## 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?



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

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## Magic Queen / Sylva (2021)

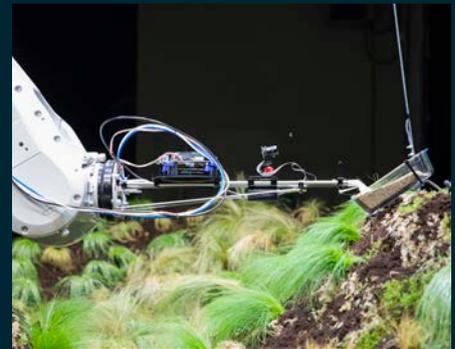
Daniela Mitterberger, Tiziano Derme

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.

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## 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?



Concept and Design: Gili Ron and Irina Bogdan  
Cinematography and Video Edit: Matias Jeffs  
Sound: Zoe Polanski

Supported by Die Stiftung Kunst und Natur,  
Nantesbuch (2022).

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## 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.



Concept: Müge Belek Fialho Teixeira, Glenda Caldwell, Jared Donovan, Frederico Fialho  
Cinematography and Video Edit: Shuwei Zhang,  
Maryam Shafiei, Shabnam Loffian  
Material Mixes: Ahmed Sakr  
and Maryam Shafiei  
Code: Müge Belek Fialho Teixeira, Jared  
Donovan, Ayman Wagdy, Maryam Shafiei

Supported by QUT School of  
Architecture and Built Environment.

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## DIATOMA (2023)

Shabnam Loffian, 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.



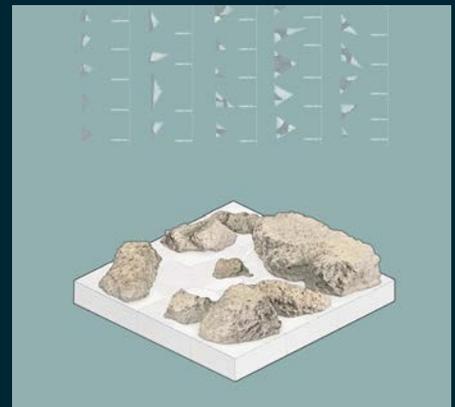
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## Printsugi Rock Tower & Rubble Tiling (2024)

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.



Team (Digital Design Unit,  
TU Darmstadt):  
Prof. Dr.-Ing Oliver Tessmann,  
Dr. Nadja Gaudillière-Jami,  
Max Benjamin Eschenbach,  
Peng Jiaxian

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## TerraFab (2022)

Kate Dunn, Charlotte Firth

3D printed bricks: Soil waste from sand mining, sand, hemp fibre, terracotta clay.

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 CO<sup>2</sup> emitting materials such as concrete and steel.



Concept: Kate Dunn and Charlotte Firth  
(University of New South Wales)

Supported by UNSW Design Research  
Fellowship Funding.  
Supported by the Design Futures Lab,  
University of New South Wales.

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## Re-Print (2023)

Charlotte Firth

3D print PETG recycled plastic  
Video [0:40]

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.



Collaborators: Dagmar Reinhardt, Densil  
Cabrera, Jonathan Holmes, Hank Hæusler

Sponsor: Arch\_Manu ARC Centre for  
Next-Gen Architectural Manufacturing  
Supported by the Design Futures Lab,  
University of New South Wales.

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## RobotKitchen (2022)

Dagmar Reinhardt, Lynn Masuda

3D printed plastic end effectors for robot  
Various kitchen and workshop tools  
Video [3:26]

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.



DMaF Lab,  
Sydney School of Architecture,  
Design and Planning,  
The University of Sydney

Funded by Bosch Grant (2020).

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## Terrain Translations: Mapping Multispecies Connectivity via Technological Narratives (2023)

Tracey Woods

A hexptych of black/white night camera images.

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



Concept: Tracey Woods

PhD Supervisors:  
Dagmar Reinhardt,  
Dieter Hochuli, and  
Henriette Bier

20

## Robohabitat: Repairing Distressed Landscapes (2023)

Dagmar Reinhardt, Tracey Woods,  
Lynn Masuda, Yi Zhao

Gardening tools, 3D printed plastic end effectors for robot

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.



Robot Workshop:  
Dagmar Reinhardt and Tracey Woods

Concept: Tracey Woods  
Robot programmer: Lynn Masuda and Yi Zhao

Participants:  
Students of C2P Elective, 2023,  
The University of Sydney

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## Robot Seedling (2024)

Dagmar Reinhardt, Henriette Bier, Charlotte Firth, Arwin Hidding, Micah Prendergast

Live demonstration with KUKA liwa 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.



The University of Sydney  
TU Delft  
ArchManu, University of New South Wales

Image Credit: CV-supported robotic planting approach developed at CoR and RB labs (TUD)

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## 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



This exhibition would  
not have been possible  
without the support of:



Professor Henriette Bier (TUD)  
Dr Micah Prendergast (TUD)  
Professor Mari Velonaki (UNSW)  
Creative Robotics Lab (UNSW)  
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