SAMPLING THE FUTURE

ARTWORK LABELS

Sampling the Future

Twenty-first-century designers are increasingly driven by a desire to achieve greater efficiency, sustainability and ethical impact.

Bridging the worlds of design, technology and science, this exhibition presents a selection of works from the NGV Collection, alongside new projects by leading experimental and speculative designers who are ‘sampling’ the future. From 3D-printed corals and modular underwater reef structures to robotically printed and knitted architecture, the exhibition reveals some of the many ways that digital technologies and advanced manufacturing are transforming how designers and architects operate. We see how designers are reimagining how and why objects, structures and buildings are designed and made. Each project gives us a glimpse of exciting possibilities ahead.

A set of speculative design projects focused on supply chains, extraction and materials reveal how designers use their ideas and skills to offer us objects, environments and images that expand our understanding of design’s place in the world. These designers question how people in a distant future might make sense of today – through the materials, waste and relics we have left behind. They ask what are the ritual objects and related beliefs that might define tomorrow.

Collaboration and invention

In a search for ways to combat climate change, biodiversity loss and pollution, Pirjo Haikola and Alex Goad operate at the intersection of science, engineering and technology – joining forces with other disciplines as creative innovators in two groundbreaking underwater design projects. Their high-resolution productions successfully emulate nature in structures that can heal damaged ecosystems and accelerate biodiversity.

Similarly, Roland Snooks, Leanne Zilka and Jenny Underwood examine how, in our digital age, small-scale, distributed and high-tech manufacturing within a circular economy may replace the large-scale factory production that defined the last century. These wnew systems for high-strength, lightweight construction promise a more ecologically balanced future. This future will be defined by material efficiency, minimal waste and the capacity to manufacture and build considering the common needs of people, ecosystems and other species.

Shifting from global supply chains and outmoded assembly lines, each of these projects reveal that it is now software, cloud computing, algorithms, 3D printers, robots, polymers and composite materials that are the tools of the twenty-first-century designer. Coupled with the evocative and troubling sound work of Philip Samartzis, these samples demonstrate the imminent application and advantages of digital tools and systems.

Future material histories

It is increasingly common for designers who practice in a field known as ‘critical design’ to use their design skills to communicate and open conversations. Striving towards systemic change, the designers presented within this space each achieve their goals through a mix of design research, reflection, experimentation and making. The intention of these projects is to awaken the public consciousness to important contemporary issues.

Drawing on history, mythology, material and making, a set of ‘critical design’ projects reminds us of our relationship to and reliance on natural resources, while considering the central role that materials have always played in shaping the tools and artefacts of human civilisation.

Extracted, manufactured and proliferated through the epoch now called the Anthropocene, how will the materials that define our current age, including highly processed metals, alloys and plastics, be read or understood in the distant future? What will our material legacy tell us about today?

Pirjo Haikola

Finland born 1979, arrived Australia 2019

Urchin corals

2020–2021

purple sea urchin (*Heliocidaris erythrogramma*), black sea urchin (*Centrostephanus rodgersii*), biopolymers

Photography and photogrammetry of *Acropora Humilis*, *Acropora spathulata* and *Acropora sp*: Pirjo Haikola; Photogrammetry and 3D models of the *Montipora sp.* and *Pocillopora sp.*: The Hydrous; Research and production assistant: Javier de Urquijo Isoard; Research partner and supply of the *Heliocidaris erythrogramma* sea urchins: Fletcher Warren-Myers and Sustainable Aquaculture Laboratory – Temperate and Tropical (SALTT), School of BioSciences, The University of Melbourne School of Design, and College of Design and Social Context, RMIT University.

Commissioned by the National Gallery of Victoria, Melbourne
Purchased with funds donated by Brendan and Grace O'Brien, 2020

Combining her skills as a designer, researcher and scuba diving instructor, Dr Pirjo Haikola is developing new uses for sea urchins, a species that has overrun parts of southern Australia's waters. Haikola is testing how parts of sea urchin shells and biopolymers can be used for coral reef restoration projects. The urchin corals

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in this installation are 3D printed with open-source print files and additional 3D scans of corals taken by Haikola on a 2020 trip to the Great Barrier Reef. These coral structures are made from the shells and spikes of the purple sea urchin (*Heliocidaris erythrogramma*) and the black sea urchin (*Centrostephanus rodgersii*) mixed with organic plastics called biopolymers.

Pirjo Haikola

Finland born 1979, arrived Australia 2019

Acropora sp. photogrammetry

2021

colour digital animation

Underwater photography: Pirjo Haikola
Animation: Javier Urquijo Isoard

Collection of the artist

Pirjo Haikola

Finland born 1979, arrived Australia 2019

Material experiments

2020–2021
biopolymers, sea urchin shell and sea urchin pigment (*Heliocidaris erythrogramma*), black sea urchin (*Centrostephanus rodgersii*), and natural wax

Research and production assistant:
Javier de Urquijo Isoard

An important aspect of Dr Pirjo Haikola's ongoing research project is developing a variety of 3D-printable biopolymer sea urchin blends, materials and coatings that may be used for a range of industrial applications. This series of tiles are material experiments that test the aesthetic and functional properties of the different biopolymer, sea urchin and wax combinations. Each tile undergoes a series of tests, such as capacity to resist algae growth, to ascertain its suitability for use in coral restoration. The reddish-brown colour of some of the tiles is derived from sea urchin pigment.

Pirjo Haikola

Finland born 1979, arrived Australia 2019

Urchin corals

2020–2021

purple sea urchin (*Heliocidaris erythrogramma*), black sea urchin (*Centrostephanus rodgersii*), biopolymers

Commissioned by the National Gallery of Victoria, Melbourne
Purchased with funds donated by Brendan and Grace O'Brien, 2020

Pirjo Haikola

Finland born 1979, arrived Australia 2019

Calcifiers of change no. 1

2019
colour digital video, sound
6 min 12 sec

Cinematographer: Tom Park
Research partner: Fletcher Warren-Myers and Sustainable Aquaculture Laboratory – Temperate and Tropical (SALTT), School of Biosciences, The University of Melbourne
Boat and crew: RMIT Underwater Club
and Qing Hong Loh, Chris Peterson, Jack McQuinn

Purchased with funds donated by Brendan and Grace O'Brien, 2020

This film shows Dr Pirjo Haikola collecting sea urchins in Port Phillip Bay for use in the production of the material she utilises to 3D print her urchin corals. In the cool waters of Victoria, Tasmania and South Australia, rising ocean temperatures and excess nutrient levels coupled with reduced numbers of predators due to overfishing are causing an explosion in sea urchin populations. The soaring sea urchin populations overeat kelp forests and seaweed habitats, creating underwater wastelands called barrens.

Pirjo Haikola

Finland born 1979, arrived Australia 2019

Calcifiers of change no. 2

2020
colour digital video, sound
6 min 12 sec

Cinematographer: Tom Park
Vessel and Crew: Coral Sea Dreaming

Purchased with funds donated by Brendan and Grace O'Brien, 2020

This film illustrates the process of photogrammetry underlying the production of Dr Pirjo Haikola's *Urchin corals*. Haikola is seen photographing living corals on Queensland's Great Barrier Reef. These photographs are then imported into digital software and used to generate a 3D file. This direct translation from actual corals to 3D-artificial corals maximises the possibility for the designer to recreate realistic natural structure and surface skin patterns.

Alex Goad designer
Australian born 1989
Reef Design Lab design studio
Australia est. 2016

Modular Artificial Reef Structure (MARS) material study no. 1 (4 unit setup)

2021
gypsum, ceramic

Collection of the artist

Initially developed for coral transplanting and reef restoration in tropical waters, this most recent MARS system has been designed for use in cool and temperate environments, such as coastal Victoria and Port Phillip Bay. Highlighting the potential of digital design and 3D printing to enable iterative adjustments and refinement, the surface skin of the temperate water module has a pattern and texture to suit new ecological factors. Mimicking natural habitat, these modules have been designed to provide the most appropriate surface geometry for the growth of oysters and mussels. Other surface patterns are in development to suit other ecological contexts and applications.

Alex Goad designer
Australian born 1989
Reef Design Lab design studio
Australia est. 2016

Modular Artificial Reef Structure (MARS)

2021
ceramic, steel, concrete

Fabrication: Reef Design Lab, Klei on Beach
Research partner: Summer Island Maldives, Arjan Sierink
Structural Engineer: Creo Consultants

Commissioned by the National Gallery of Victoria, Melbourne

Helping mitigate the increasing effects of human activity on marine ecosystems, this 3D-printed modular system is designed for constructing reef habitats in tropical and temperate waters without the need for heavy-duty equipment. The innovative reconfigurable design creates a large surface area within a small footprint, while also providing protection for smaller fish species. The detailed surface skin pattern of the modules is designed to aid the colonisation of coral and filter feeding species, such as oysters and mussels. This system could be strategically positioned to reintroduce biodiversity in ecosystems damaged by coastal development or act as

natural filters for waterways experiencing increased sediment deposits. The modular design enables endless configurations to suit varying scales, situations and topographies.

Alex Goad designer
Australian born 1989
Reef Design Lab design studio
Australia est. 2016

Modular Artificial Reef Structure (MARS) wave attenuation

2021
colour digital animation

Animation: Chuan Jiang, Alex Goad
Location: Multiple
Research partner: Reef Design Lab

These animations show how optimised geometric systems, such as MARS can be used as wave-attenuating structures, which are heavy objects that form barriers designed to reduce the force of waves to protect vulnerable shorelines. These optimised structures are designed to increase ecological growth through the colonisation of aquatic biomass, such as plants and shellfish, to strengthen the structure and improve wave attenuation. Significant ‘bio attenuation’ of waves occurs naturally along the edges of coral reef flats, oyster/mussel reefs and mangrove forests. Each of these habitat types are under threat from human development and climate change.

Alex Goad designer
Australian born 1989
Reef Design Lab design studio
Australia est. 2016

Modular Artificial Reef Structure (MARS) evolution

2019–2021
digital video, 2 mins 44 sec

Footage: Alex Goad, Arjan Sierink
Location: Coral farm, Summer Islands, Maldives

This video shows footage of the MARS system evolving over a period of three years. Installed on Summer Island's coral farm in the Maldives, built by Dive Leader Arjan Sierink, the system is being used as a permanent farming device and habitat for sea creatures. The damage to coral reefs globally is a well-documented reality caused by a myriad of environmental pressures. These include ocean acidification, river sedimentation run-off, destructive fishing practices, invasive species and most critically of all is coral bleaching caused by warming ocean temperatures because of climate change.

Alex Goad designer
Australian born 1989
Reef Design Lab design studio
Australia est. 2016

Living seawall project sponge fingers
2019
marine concrete

Living seawall project honeycomb
2019
marine concrete

Living seawall project kelp holdfast
2019
marine concrete

Living seawall project rockpool large
2019
marine concrete

Living seawall project rockpool small
2019
marine concrete

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Living seawall project rockpool recycled oyster

2019

marine concrete, oyster shell

Fabrication: Reef Design Lab, SVC Products
Research partner: Sydney Institute of Marine Science, Dr A/Prof Melanie Bishop, Dr Katherine Dafforn, Dr Mariana Mayer Pinto, Dr Maria Vozzo
Structural Engineer: GHD

Collection of the artist

Smooth concrete coastal infrastructure, such as pylons, sea walls, and channels forms an extensive part of the hard ‘edge’ of coastal cities. Designed to protect ports and coastal communities, these utilitarian barriers and structures are not designed with other species in mind. Through the introduction of new 3D-surface patterns, these large tiles can increase the biodiversity of altered coastal areas by providing new ecological niches for plants and creatures. If used at scale, this system could return vast human-made surfaces to productive ecosystems, increasing biodiversity and water quality in urban contexts.

Roland Snooks architect
Australia born 1978
RMIT School of Architecture & Urban Design research and fabrication
Australia est. 1934

Unclear cloud

2021
3D-printed polymer, carbon fibre,
3D-printed steel, concrete, acrylic paint

Commissioned by the National Gallery of Victoria, Melbourne

This structure uses an experimental technique of infusing a carbon fibre structural skeleton within robotic 3D-printed polymer skins. It illustrates how digital design processes, 3D printing and composite materials could transform the production of architecture. New methods of digital fabrication are increasingly available, allowing structural performance, ornament and architectural expression, once separate ‘layers’ within a building, to become one integrated whole. This holistic approach to design and fabrication is made possible using generative design algorithms and robotics. The sound work embedded within the architecture reminds us that a future increasingly defined by big data and interconnected digital systems (the cloud) must also consider the accelerating data-carbon footprint of architecture and design.

Philip Samartzis sound artist
Australia born 1963

Unclear cloud
2021
seven-channel audio, 41 minutes (looped)

Research partner: Creative Victoria, Swiss National Science Foundation, the Bogong Centre for Sound Culture, Institute of Computer Music and Sound Technology at the Zurich University of the Arts, RMIT University School of Art

Commissioned by the National Gallery of Victoria, Melbourne

Primarily recorded at the High-Altitude Research Station at Jungfraujoch in the Bernese Alps, *Unclear cloud* invites you into the extreme environment of an alpine ecosystem under climate change stress. Wild winds and the sounds of surfaces melting and freezing express the precarious nature of life, while scientific instrumentation reminds us of the search to understand the long-term consequences of greenhouse gas emissions. The composition is a sound portrait of the Great Aletsch Glacier – the longest glacier in Europe at approximately 23 kilometres long, 1.5 kilometres wide, and 900 metres at its thickest point. Based on atmospheric carbon trajectories, a future without this epic ice sheet may be inevitable.

Roland Snooks architect
Australia born 1978
RMIT School of Architecture & Urban Design research and fabrication
Australia est. 1934

Unclear cloud production

2021
digital video, 3 mins 04 sec

Film production: Max Robins,
Daniel Nganeko

Building layer by layer, this film shows molten plastic dispensed from a custom-designed polymer extruder fixed to a Kuka six-axis industrial robot. The 3D-printed polymer used in this project uses plastic that has been recycled, and reprinted, from a previous structure by the architect exhibited at the NGV, *Floe,* 2018.

Leanne Zilka architect
Australia born 1972
Jenny Underwood textile designer
Australia born 1971

Knitted architecture

2021
wool, cotton, acrylic, steel, wood

Assistants: Ron Ellazam, Students from architecture at RMIT University
Research partner: School of Architecture, RMIT University and School of Fashion and Textiles, RMIT University

Commissioned by the National Gallery of Victoria, Melbourne

These textile structures investigate the use of digital design and 3D-knitting technologies as an architectural system. Seamless knitting technologies, which ‘print’ 3D forms stitch by stitch (pixel by pixel) allow the designers to produce whole pieces of extruded textile tubes. Combining the scale of architecture with the whole garment technology in textile design garment technology, each piece expresses shape using different yarns and threads that have the potential to perform as structures. These works are prototypes of textile ‘skins’ that once combined with emerging digital design and advanced fibres, such as carbon fibre and Dyneema yarns, could feasibly offer ways to rapidly knit high-strength,

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Leanne Zilka architect
Australia born 1972
Jenny Underwood textile designer
Australia born 1971

Knitted architecture production

2021
digital video

Film production: Matt Richards,
Max Robins

This Shima Seki 3D-knitting machine located within the RMIT University School of Fashion and Textile Design is typically used for mass-producing knitted garments in the fashion industry. Reimagined as an advanced fabrication technology for architecture, it has the capacity to rapidly create large-scale elements for architectural applications. Combined with digital design tools intended for architecture, this machine offers new possibilities for knitting complex forms intended as lightweight fabric-based architecture.

Kyoko Hashimoto
Japan born 1980, arrived Australia 1991
Guy Keulemans
Australia born 1975
Matt Harkness
Canada born 1992, arrived Australia 2018

Polylactic acid chain
2021
PLA plastic

Commissioned by the National Gallery of Victoria, Melbourne

PLA (polylactic acid) is the most popular form of plastic used in 3D printers. These machines eat and excrete tonnes of PLA daily in thousands of maker-spaces around the world. Manufactured within a mix of petrochemical and biochemical supply chains, it is both recyclable and biodegradable in theory, but rarely done so in practice. These necklaces present recycled PLA sourced from maker-spaces in the form of uniquely patterned beads captured in 3D-printed collars. Practically, the work demonstrates new uses for waste PLA. Each bead in the necklace is shaped like a sphere, enivsaged by the designer as a fundamental shape representing the universe.

Kyoko Hashimoto

Japan born 1980, arrived Australia 1991

Guy Keulemans

Australia born 1975

Ritual objects for the time of fossil capital

2018

plastic, cement, sand, oxide, resin, synthetic polymer rope, resin, steel

Purchased, Victorian Foundation for Living Australian Artists, 2018

2018.503.1-3

The collaborations between jeweller Kyoko Hashimoto and designer and artist Guy Keulemans examine and critique the waste generated by industrial materials and processes. This group of works reinterprets three Buddhist ritual objects from Japan, originally designed for use in reflection and prayer. The objects are made from concrete, minerals and broken plastic toys. In contrasting the ecologically damaging modern materials the objects are made from with their ritualistic and contemplative use, the designers challenge contemporary, industrial ideas of value, waste and efficiency.

Kyoko Hashimoto

Japan born 1980, arrived Australia 1991

Guy Keulemans

Australia born 1975

Round aluminium and bauxite mirror

2021

polished aluminium, bauxite

Commissioned by the National Gallery of Victoria, Melbourne

Hashimoto and Keulemans want to understand the flow of materials across space and time. They want to map them, as they move, form and transform around the world, but also through history and into the future. As the world is to contend with a climate emergency that may disrupt global supply chains, the designers speculate that it is beneficial to understand the resources available underfoot. Digging up their own materials, and being forced to deal with the consequences of local extraction, illuminated to the designers are the hypocrisies and injustices of placing the burdens of unsustainable production disproportionally on the environment and less-developed countries.

Kyoko Hashimoto

Japan born 1980, arrived Australia 1991

Guy Keulemans

Australia born 1975

Metalloplastiglomerate *vases* I & II

2021

aluminium, plastic, copper, iron

Commissioned by the National Gallery of Victoria, Melbourne

‘Our cities undergo persistent decay and entropy. Waste is continually generated and ejected. Projecting far enough into the future, all cities now standing will collapse’, explain Hashimoto and Keulemans. As natural processes degrade artificial materials into finer and finer particulates, new forms of sedimentary rock will emerge, perhaps dormant under oceans and rivers. What might this material look like and how might it be used by our far future descendants? These vases are designed as a simulation of this process. Materials found in the city, including aluminium, waste plastic, copper and iron debris are rolled, pressed and hammered in mimicry of geological sedimentation, and then milled by machine.

Kyoko Hashimoto

Japan born 1980, arrived Australia 1991

Guy Keulemans

Australia born 1975

Terra rings 1–15

2017

sterling silver, concrete, iron oxide, borosilicate glass, brass, paint, oil sandstone, marble powder, calcite crystal (Bulgaria), polyurethane, limestone (Spain), optical calcite crystal (Brazil), heavy crude oil (United States), light crude oil (Ecuador), steel, polyester resin, epoxy resin, magnets

Purchased, Victorian Foundation for Living Australian Artists, 2017

2017.406.a-dd

These rings seek to highlight the relationship between raw materials and their manufactured products. They are made from materials commonly used in the built environment and which are typically considered artificial: concrete, plastic and paint. In fact, concrete comes from limestone that is made from the fossilised bodies of sea animals, sedimented into rock over millions of years. Paints and plastics derive from petrochemicals, refined from crude oil, constituted through millions of years of dinosaur bones, ancient planktons and plants, compressed underground. The designers encourage us to connect the processed materials with their organic and vibrant origins.

Kyoko Hashimoto

Japan born 1980, arrived Australia 1991

Guy Keulemans

Australia born 1975

Bioregional rings 1–12

2021

coal, Yellowblock sandstone, Hawkesbury sandstone, oyster shell, coral, beach stone, drift wood, sea sponge, fishing line, sand, ash, neodymium magnet, glue and sterling silver

Collection of the artists

The origins of most commonly used materials go deep underground and far back, deep into geological and evolutionary time. In the contemporary world of globalised commerce and long supply chains, these origins are often obscured. These rings attempt to uncover the relations of materials foraged within the one bioregion; a region defined by environmental boundaries, rather than by human-made borders. The Sydney Basin bioregion is characterised by the visible presence of sandstone, but also coal, a material geologically formed millions of years ago from decomposing wood. Sydney has many other less obvious materials for design, including coral and oyster shells that are used here as a substitute for limestone in the creation of artisanal concrete.

Kyoko Hashimoto

Japan born 1980, arrived Australia 1991

Guy Keulemans

Australia born 1975

Square aluminium and bauxite mirror

2021

polished aluminium, bauxite

Commissioned by the National Gallery of Victoria, Melbourne

Australia is the world's largest miner and exporter of bauxite, the ore from which aluminium is extracted. Aluminium is recyclable and of the 75% of aluminium that has been produced throughout history, around 746 million tonnes is in current use and available for recycling. That is about 80 kg for every person alive. Relying on this existing material would motivate better care and consideration for the metal, reducing waste. Slowing and then stopping new aluminium production could be part of a shift to a circular economy.

Elliat Rich designer
France, born 1978, arrived Australia 1979

Weaver patterning
2020
mirror, glass

Weaver earthly state / honeyeater
2020
mirror, glass, gold leaf, paint

Weaver becoming matter
2020
mirror, glass

Weaver ethereal
2020
mirror, acrylic fibre

Sound composition: Bree van Reyk
Fabricator: Luke Price

Proposed acquisition, National Gallery of Victoria 2021

These mirrors are offered as artefacts from a future and/or parallel society where Western and non-Western scientific knowledge converge and find equilibrium. This convergence is expressed in this work as a mythological

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story in which human beings reach a point of spiritual clarity and truly accept and understand their place within the cosmos. The mirrors and accompanying story of the Weaver offer a ‘mythic lens’ to ‘reweave’ ourselves, as one of the trillions of ‘patterns’ that make up the living world. Looking into the mirrors is intended as a ritual of reconnection to the ancient world. The viewer gazes beyond the here and now into eternity – a reminder of all that wraps around and within the viewer and the object.

Georgia Nowak artist
Australia born 1983
Eugene Perepletchikov filmmaker
Ukraine born 1984

Aurum

2020
digital video, 21 mins 19 sec

Script: Nic Low
Sound design: Byron Dean
Narration: Katherine Tonkin
Drone operation: Jaxon Roberts

Purchased by NGV Foundation, 2021

A symbol of power and wealth, the lure of gold has shaped civilisations since ancient times. This film juxtaposes today's extraction and production processes against historical narratives and mythologies, revealing the power of gold to transform societies. Today the demand for gold continues to rise; it is essential in the manufacture of electronics and is increasingly attractive to investors as a safe haven. Old goldfields are reignited, and new open pits spread through the landscape, as we once again bank on the stability of gold to see us through the uncertain times of COVID-19 and the pending environmental threats to come.

Georgia Nowak artist
Australia born 1983
Eugene Perepletchikov filmmaker
Ukraine born 1984

Token
2021
gold coin, peer-to-peer servers

Collection of the artists

The collectable coin presented here was forged at the Perth Mint, a key filming location in *Aurum*. Inscribed on the coin is the unique contact address linked to an online Non Fungible Token (NFT) marketplace, where an edition of *Aurum* has been ‘minted’. An NFT attaches a unique code to a digital artwork using blockchain – a tamper-resistant digital public ledger – making it collectable and scarce. These decentralised ‘crypto’ networks offer new models of production and trade, speculation and investment. As we move deeper into the mining of digital forms of wealth it is possible that server farms may replace gold as a store of wealth.

lightweight forms for columns and other architectural elements with material efficiency and minimal waste.