Overview and History of the Art/Science Residency Programme

Prepared by:

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1. Introduction and Background

The Art/Science Residency (ASR) Programme took roots in 2008, when Singapore won the bid to host the International Symposium on Electronic Art (ISEA), the world's premier media arts event for the critical discussion and showcase of creative productions applying new technologies in interactive and digital media (http://www.isea2008singapore.org). The National University of Singapore hosted 16 international and local artists in its research facilities, putting creative scientific and artistic minds together for three months prior to the conference. The resulting sixteen works were showcased successfully during ISEA2008 at the National Museum of Singapore. An additional 9 artists have visited for semester-long research lab residencies over the past decade (see Annex A).

Currently, the ASR programme is jointly organised by the Arts and Creativity Lab, the Department of Communications and New Media, and Tembusu College, National University of Singapore. To date, 25 outstanding regional and international artists, working in the realms of science and technology, have spent between one to four months each, living among undergraduates, engaging with students, researchers, faculty and the public through workshops, seminars, and gallery exhibitions (see Annex B, C & D). Initiated with support from the ODPRT, other funding sources since have included the National Arts Council Singapore and the ArtScience Museum at Marina Bay Sands.

The objectives of the ASR programme are to:

a) Expand the space of creative practices for both artists and researchers in their areas of study and development;
b) Support cutting edge artwork exploring scientific methods, knowledge, technologies, and recent developments;
c) Give students and faculty a platform to engage with interdisciplinary artists, the museum, and vice versa;
d) Raise the profile of the supporting institutions and Singapore as innovators in creative and scientific work;
e) Provide an engaging conduit of understanding between the public and the worlds of scientific research through innovative art practices.

2. Benefits to NUS Funding of the ASR Programme

From 2013, the ASR programme was conducted with funding from the ArtScience Museum. For the museum, the connection to NUS, a world-class scientific research institution, is a natural part of a network that can provide human and knowledge capital, and a strong connection to the local community. The university student body also offers potential for audience development. For the ASR programme, the museum is an excellent funding source, and venue for reaching a public audience through workshops, speaker series and/or exhibitions. However, we would like to approach NUS to consider taking over the funding of the programme. The benefits of NUS funding the ASR programme include:

a. Placing NUS on the global map of creative, innovative and thoughtful research

There are many ways in which the interests, methods, and processes of artistic and scientific cultures mutually inform and support each other. Beyond the mere exploitation of new tools and domains, artistic practices play an important role in interpreting and critiquing the strange new worlds into which science and technology are pushing. While science and technology are providing new and complex understanding about our body and our environment, they alone do not tell us what it all means to our practical everyday experience of life, nor about how to use our knowledge to create the world we want to live in. Art can enrich scientific and technological research. Historically, artists have played key roles in the development of video (e.g. Nam Jun Paik's video synthesizer) and audio (e.g. Jean Claude Risset's computational physical instrument modelling at Bell Labs) technologies. The creativity at the heart of finding and making meaning knows no disciplinary boundaries.

Collaborations between artists and scientists are also becoming deeper and more common, and the results are providing new ways to engage the public in the important ideas that are shaping the future of humankind. Collaborations through long-term artist residencies at scientific research and technological development centres are growing in number and impact. Artist-in-Residence programmes that have a long track record of bringing together the arts, technology and science, include the Interactive Institute in Sweden (http://www.tii.se), the Swiss Artists-In-Labs programme (http://www.artistsinlabs.ch/en/) run in cooperation with the Swiss Science Laboratories, the AIR programme at Eyebeam (http://www.eyebeam.org) in New York City, and SymbioticA at the University of Western Australia (http://www.symbiotica.uwa.edu.au/). CERN (The European Organization for Nuclear Research) had a successful programme of collaborating with artists over a decade ago and are currently designing a new Cultural Strategy that includes an Artist-in-Residence programme. Other historical programmes include the Xeorx PARC PAIR programme, and the ATR Lab in Japan. These leading institutions have all benefited directly from the involvement of artists in research, as well as indirectly from the international visibility for the cultures of creativity these programmes represent, and the innovative way they bring the experience of science and arts to the public.

More recently and closer to home, Nanyang Technological University announced the setting up of a global digital art prize, in conjunction with its ambition to become a global leader in technological innovation and the study of the impact of technological revolution on society.

In other words, artists working at the cross-roads of art, science and technology have become highly sort after outside the art context. Artist-scientist Angelo Vermeulen, for example, has been creating Biomodd systems at various universities, intricately interconnecting biological living systems with recycled computer systems (left). Vermeulen's works, incorporating notions of energy recycling, computer recycling, ecological growth and non-oppositional relationship between computer electronics and biology, have attracted the attention of the European Space Agency for its MELiSSA (Micro-Ecological Life Support System Alternative) programme focused on developing regenerative life support systems to enable future long-term manned space missions.

Hosting such artists at NUS would not only increase the university's profile (see Annex E for media coverage), but also inspire students and faculty alike on interdisciplinary and unconventional approaches to research and innovation.

b. Enriching the pedagogical environment for NUS students

So far, the international artists we bring to Singapore are seasoned hands at involving students in interdisciplinary creative work. While being hosted at one of the research centres here, and housed at one of the NUS residential colleges, these artists, depending on their length of stay, engage our students in a number of ways – by sharing their works and experiences through talks, being involved in modules and/or by conducting workshops for our students outside of the classroom.

In 2013 and 2015, with the funding from ArtScience Museum and support from Tembusu College, the ASR programme was able to host three artists in Singapore for four months each. Having these artists stay at Tembusu College for the entire semester enabled the artists more time to not only meet the requirements of the museum, but also connect with our students in deeper and richer ways. It also provided faculty opportunities to work out innovative pedagogies that tap on the expertise of the artists. For example, in 2013, Michael Doherty (USA), an artist-engineer and co-founder of engineering hardware company Bitpoinic, and Catherine Young (Philippines), a multimedia artist, worked on themes that were crafted to match Tembusu College's *Climate Change* and *Singapore as "Model" City?* senior seminars. While Michael focused on the theme of "Contemporary Asian and Future Cities", using technology for sustainable living, Catherine operated under the theme of "Climate Change and Environmental Futures", encouraging students to approach the notion of Climate Change in a non-didactic and fun way by designing fashion for the apocalypse. Students from both senior seminars really benefitted from interacting with the resident-artists. Select students' works from both senior seminars were also shown together with the artists' works, during the Sunday Showcase at the ArtScience Museum.

Michael and Catherine giving students from the Singapore as "Model" City? pointers on their intervention projects (top) and holding out-of-classroom workshops for Tembusu College students and faculty (bottom).

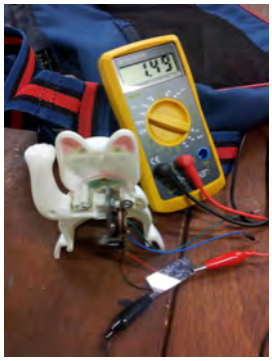
Students, from the two senior seminars, showcasing their works together with the artists at the ArtScience Museum (top). Catherine with her "Apocalypse Squad" (bottom), a team of student volunteers who worked with her for the exhibition at ArtScience Museum. For more details of the exhibition, see https://theperceptionalist.com/tag/sunday-showcase-at-artscience-museum/ and https://tembusu.nus.edu.sg/news/2014/sunday-showcase-at-the-artscience-museum-ft-tembusu-college.

One lasting result of Michael Doherty's engagement with Tembusu College students is the building of an aquaponic pond at level 3, Tembusu residential block, which now affords the Tembusu urban farmers a space to experiment with soil and soil-less farming and learn about sustainable food source.



Michael showing students the mechanics of an off-the-shelf hydroponic system and eventually adapting it into an aquaponics system (top). Two wooden flood-tanks built by Michael (bottom left) and students experimenting with growing different fruits and vegetables (bottom right). For more details on the Tembusu urban farmers' learning journey, see their blog here: https://tembusugardens.tumblr.com.

Italian artist Maurizio Martinucci, aka TeZ, was the resident-artist for 2015, and like Catherine and Michael before him, stayed at Tembusu College for four months. During his stay, Tez engaged passionately with Tembusu College students on several experimental workshops, including hacking the Maneki Neko (fortune cat) to turn it from a battery-operated to a solar-powered object, and systematically testing if electricity, magnetism, monochrome light, and sound can improve plant health. Apart from interacting with Tembusu students, TeZ also worked with CNM students, and one Tembusu College Graduate Fellow and contributed to the Department of Sociology Graduate Students Research Seminar Series as a speaker (see Annex D).


TeZ conducting workshops with Tembusu College students. See https://tembusu.nus.edu.sg/event/experimental-electroculture-exec-workshop and being featured with Tembusu College students in the Business Times http://www.businesstimes.com.sg/lifestyle/arts-entertainment/the-art-of-sound.

3. Budget

We have found that hosting artists within the residential colleges for at least one semester (3-4 months), if not longer, is ideal to give artists, students, and faculty enough time to build rapport, and come up with concrete action plans for deep, as opposed to superficial, engagements all round. The budget breakdown below is based on hosting one artist per semester:

Item	Remarks	Costs
Flight ticket	Round-trip economy flight by most direct route on a reimbursement basis	SGD1000-SGD2000
Honorarium of SGD3000/month	For four months (taxes to be borne by recipient)	SGD12,000
Material Cost	"Materials" are directly associated with the construction of a piece or running workshops and seminars, and may include outsourcing, student-helper hourly fees, computer software, and local transportation (on a pre-approval and reimbursement basis)	SGD4000
Accommodation	Sponsored by the residential colleges	Value ~= SGD3000/mo = 12K/residency

4. Summary

Worldwide, and particularly in Singapore, there is clear recognition the fourth industrial revolution will bring opportunities as well as disruptions to societies. Educational institutions are gearing up in leading research and preparing students well in the subjects of Science, Technology, Engineering and Mathematics (STEM). However, we need to also bring Art into the STEM conversation (STEAM). The arts have the potential to cultivate exploration of the uncertain, tolerance for ambiguity, deviation from prescribed rules, and empathy to the Other in self-reflexive ways. These are important values to cultivate in students and to have in interdisciplinary enquiry. Although NUS does not have a dedicated art department, the ASR programme is well established and well placed to help bring the arts into the picture and, in turn, put NUS on the global map of creative, innovative and thoughtful research and pedagogy.

Annex A

Details of the 2008 Art/Science Residency Programme (prior to ISEA2008)

Appropriate Response
Zach Poff + N.B. Aldrich (USA)
Collaborated with: IDMI Arts & Creativity Lab as well as Dr. Li Haizhou from the I^{2}R, Human Language Technology Department and Joseph Moore (joseph-moore.com)

Appropriate Response is a generative audio installation that creates an ongoing, dynamic conversation between three modified television sets. Using sound clips harvested from local broadcast media, the televisions will act as individuals engaged in an evolving topical debate. Every individual will share a basic set of rules on how to proceed and a "cultural database" from which to derive responses while also developing a "personality" that will guide specific choices. The

sound-archive that the installation draws from will evolve over the course of the exhibition, allowing new information to be gathered, and old information to be "forgotten".

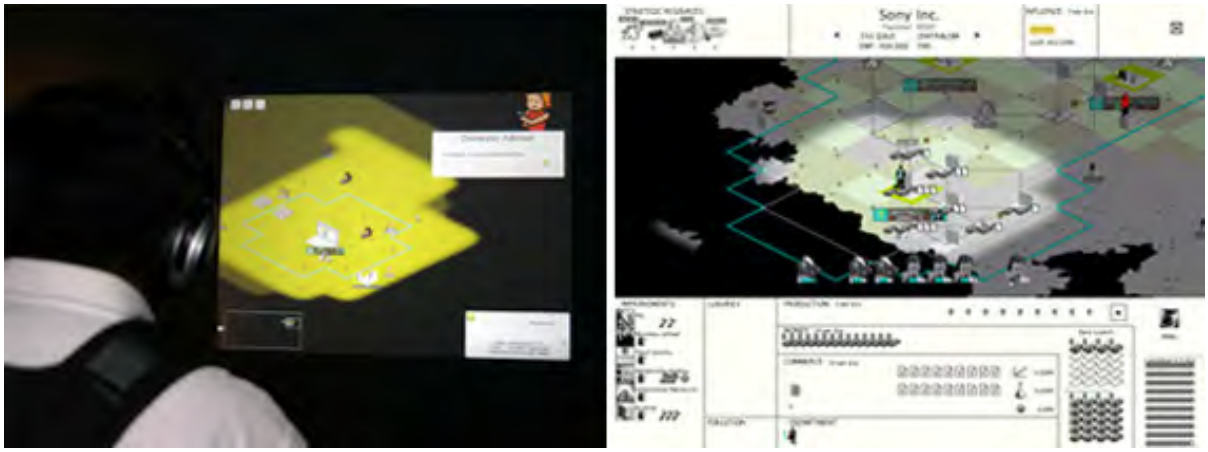
Inspired by the proliferation of media in our information-saturated world, the artwork comments on a cut-and-paste ethic that has arisen in contemporary discourse. It often seems a "logic of selection" is employed through which the juxtaposition of existing information fragments has become an accepted form of constructing an argument, without the need for synthesis or a cumulative rationale. Can it be appropriate to simply appropriate a response?
Zach Poff (zachpoff.com) and N.B. Aldrich (nbaldrich.com) have been collaborating for years creating audio, video, performance and installation work primarily in the areas of New Media. Their work has been shown at such venues as Artists Space, Art Interactive, Hallwalls Contemporary Arts Center, the Center for Maine Contemporary Art, the Bates College Museum of Art, the Polli Talu Arts Center.

Aurora Consurgens
Horia Cosmin Samoila (Romania/France) & Marie Christine Driesen (France)
Collaborated with: Mixed Reality Lab

The energy given off by bodies, objects, particles, and electrical charges of all kinds produces the electro-magnetic field that surrounds us. An invisible landscape that exists within our more tangible, physical environment. The artists are focusing on another wave that opens the doors of the inner realms. This installation offers an alternative way to render the different states of consciousness through the exploration of cognitive conglomerates. The observer is invited to explore a paradoxical place of creation where the brain waves articulate the evocations of archetypal constructions and where consciousness, spared of the coagulation of representation, go back to its incommunicable and fundamental origin.

Marie Christine Driesen and Horia Cosmin Samoila explore within the GhostLab (ghostlab.org), the full spectrum of electromagnetic landscapes, its beyond, and cognitive limits. Their work in this area has manifest themselves in video, performance, installations, and other new media projects.

Civilisation V
Eastwood – Real Time Strategy Group: Kristian Lukic & Vladan Joler (Serbia)
Collaborated with: G^3 Lab



In Eastwood's earlier "modification" of Sid Meier's seminal computer strategy game *Civilization*, *Civilization IV* players took the role of corporate IT workers. This work continues their project of mapping the aggressive military-capitalist tendencies of "real-time" strategy and online worlds. *Civilization V* is a game that self-reflexively addresses the competition for dominance between new media companies working with so-called Web 2.0 technologies, such as Facebook, YouTube, and persistently online games such as *Second Life* and *World of Warcraft*. In order to advance through the game, companies will have to use tactics like "emotional blackmail", "tribal marketing" and "love bombing". The project uses researches and developments in the field of digital economy, online marketing and social networking.

Eastwood – Real Time Strategy Group was founded by Kristian Lukic and Vladan Joler in 2002. In their collaborative projects they create and use computer games as a tool for new visions of art and cultural practice.

DIY GORI: seed_1216976400
Jee Hyun Oh (South Korea)
Collaborated with: Laboratory of Control and Mechatronics

The World Wide Web is an open environment capable of distributing information in a decentralized manner, allowing participation and the constant transformation of its content. DIY GORI focuses on the very nature of the Internet as "Open Source Culture", the creative practice of appropriation and free sharing of found and created contents; and it experiments with the idea that objects exist as evolving pieces of digital data in cyberspace where they are continually remixed by users.

As a first experiment for *DIY GORI* a "seed" was prepared for distribution throughout the Internet. The term "Gori" means open hook in Korean and is often used to refer to the "fastening" and "loosening" of human relationships. The seed to be planted in cyberspace is a blueprint for GORI, a new media plant of physical computing, growing up or dying, fed by network data, connected to the Internet by USB. The blueprint is published on a Wiki site to introduce the project development process and technical details to the net-public/the self-evolving environment for free distribution that any net-citizen can browse and design on their own. At ISEA2008, a selected version of the blueprint is presented as an installation where its Wiki contents are printed and exhibited on a more traditional medium. *Seed 1216976400* is the name of the installation and the 10 digits "1216976400" indicate one specific point in time of Wiki history, as a still frame of the seed evolution. It is in fact the converted Unix time stamp of 2008-07-25 00:00:00 GMT (Greenwich Mean Time) which is the first day of ISEA2008.

Jee H Oh is a media practitioner with an interest in presenting a conceptualized network culture in artistic physical spaces. She is currently working in London as a designer.

Does it make scents to have fun?
Lai Mei Kei (Macau)
Collaborated with: Mixed Reality Lab

Computer games, along with most other digital interfaces, are primarily about sight, sound and physical movement, so it's only logical that other senses could play their part as well. The artist is interested in how smell, the olfactory, can be incorporated into gameplay, not just as a novel addition, but as an integral element within the interaction between the player, the game and other players. In this artwork, players will need to navigate their way around a virtual environment using their sense of smell. Sniffing becomes a radical new interface for play, as players will need to recall certain scents in order to accomplish tasks. Players can communicate by triggering these aromas, deciding when and what scents to be emitted during the virtual navigation. Is olfactory gameplay fun or unpleasant? Does it increase immersion in the virtual? This is an ambitious and highly original experiment that reaches into areas of interactivity that are just starting to be explored.

Lai Mei Kei is a lecturer in the School of Arts at Macau Polytechnic Institute. She is interested in exploring various kinds of non-conventional interfaces, especially olfactory display.

Exodus
Metahaven (Netherlands/Belgium) & Tsila Hassine (Israel)
Hosted by: Lab for Media Search

Power, authority, and influence increasingly rely on information networks. Although networks seem to have abolished the old hierarchical structures, such structures are now recast through networking effects that reproduce the power divide between central actors and peripheral content. The race for visibility, both for ranking high in search engines and for accumulating influence in social networking platforms, produces an implicit behaviour of accumulation of links or "friends". The resulting "self-referentiality" is aimed at confirming one's own position in the network and linking to actors who are always already central. The power gained by connections to and from these centres overrules most of peripheral connectivity and suppresses the potential for dissent within a sphere of influence. This social phenomenon directly accounts for the creation of new public spheres of a global order, which include the production of borders between these spheres. *Exodus* is the compound name for a "research engine" into algorithms and visual strategies for searching the internet, revealing the structural properties of web content and its inherent distribution of influence. *Exodus* promotes bridging behaviour across the web's new borders of power.

Metahaven is a design research collective founded in 2006, it consists of Vinca Kruk, Daniel van der Velden and Gon Zifroni. Their works connect graphic design with architecture, and is concerned with their political and ideological interdependencies. For *Exodus* they collaborated with Tsila Hassine (information artist and developer, Israel), Maurits de Bruijn (web developer, Rotterdam), Edward Zimmermann and Norbert Poëllmann (search engineers, BSn.com, Munich), Florian Schneider (Kein.org, Munich) and Zhou Xiangdong (information retrieval scientist, Fudan University, China).

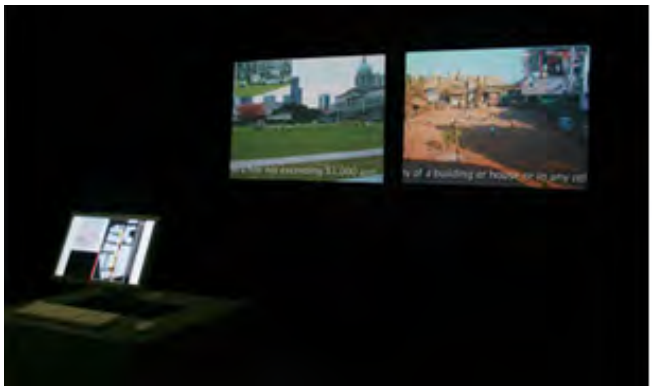
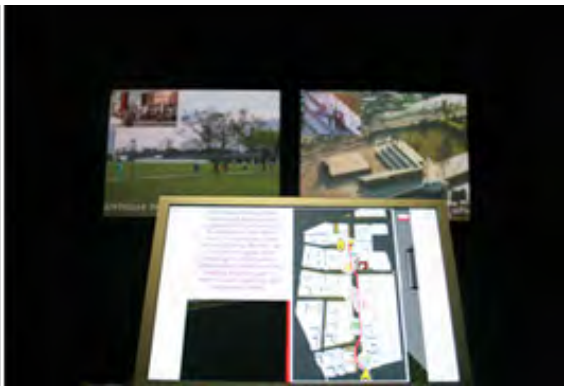
Finally, We Hear One Another
Kelly Jaclynn Andres (Canada)
Collaborated with: Mixed Reality Lab

Let me walk in your shoes for a day, while you walk in mine. I can hear all of your conversations, intimate and banal; I hear your silences, while simultaneously, you listen to mine. I know where you travel; I listen to your friends, your family, and those who meet you for the first time. We exchange our lives aurally and experience each other's realities while remaining fixed in our own physical existence. The ability to understand another's location begins through direct immersion into a new environment. To create meaning, one must be able to experience empathy, an exchange or sensitivity that could be lost in this world of strangers and friends.

In this artwork, pairs of visitors are equipped with mobile telephony garments that remotely transmit their own auditory environments to each other. Through this interactive audio exchange, which oscillates between disorientation, intimate surveillance and a new form of communication, the artwork questions our relationship to space and place, sound and technology.

Kelly Jaclynn Andres (kellyandres.com) is a multi-disciplinary artist whose work explores issues surrounding technology, portability and location.

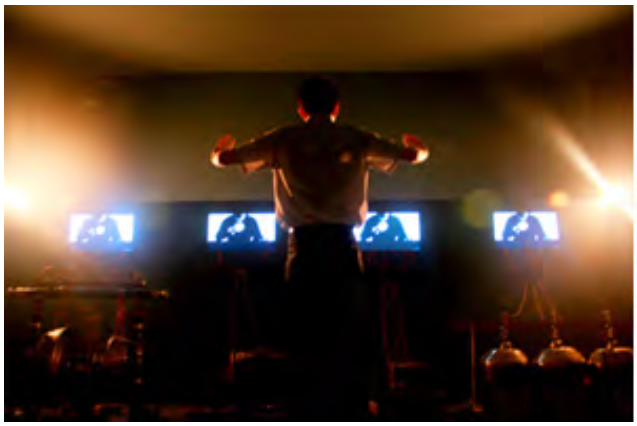
Gendered Strategies for Loitering
Shilpa Phadke, Shilpa Ranade & Sameera Khan (India)
Collaborated with: University Scholars Programme Cyberart Studio

Like Singapore, Mumbai is reputed to be one of the safest cities in the world for women, and yet through extensive research the artists have observed that this does not translate to an equal claim to public space. The act of loitering, "hanging around" on the streets, for example, is still very much seen as an occupation exclusively for men. Women who appear to "purposelessly" inhabit public space are looked upon with deep suspicion. Loitering is certainly not the act of a respectable woman. This artwork aims to question some of the underlying assumptions about public space and gender in both Singapore and Mumbai. The installation ironically gestures to the impossibility of loitering for women. It will be complemented by time-lapse video footage that explores the gendered inhabitation of public spaces in the two cities. Through the idea of loitering, the artwork asks questions about pleasure, risk, and citizenship.

Shilpa Phadke**,** Shilpa Ranade and Sameera Khan have collaborated on a research project about women in public space, under the aegis of PUKAR, an inter-disciplinary urban research group based in Mumbai, India.

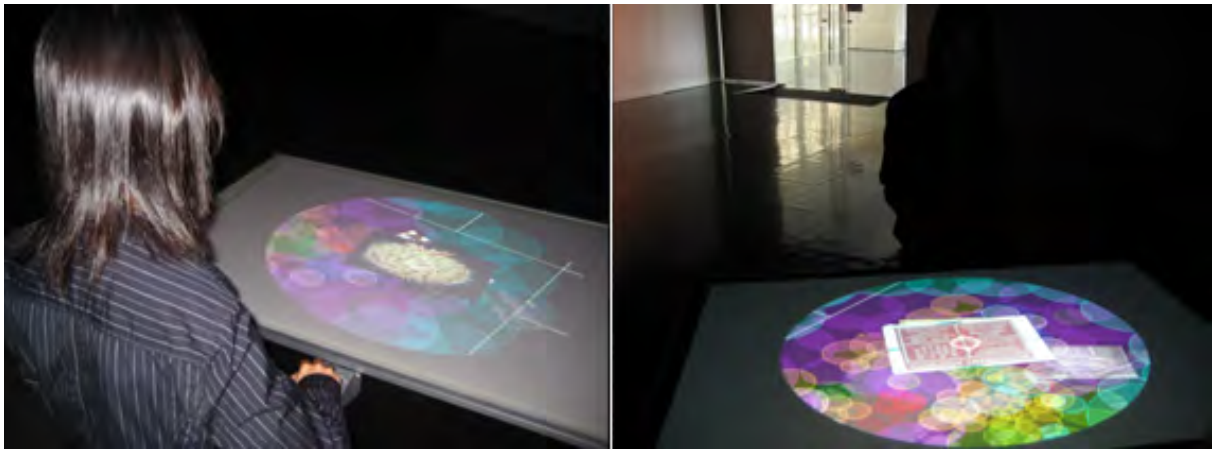
Quartet
Tad Ermitano (Philippines)
Collaborated with: Personal 3D Entertainment Systems Project at A-STAR Institute for Infocomm Research (I^2R)




An interactive video installation that brings together sound and image allowing the viewer to conduct a "virtual" quartet. Four video screens are arranged in the space, each one playing a different percussive instrument by triggering photo-sensors attached to the screens. In this way video images, traditionally conceived as powerless ghosts, are given the ability to affect and even strike physical objects in the real world. The viewers' gestures at the screens are captured to enable alterations of the musical behaviour of the virtual musicians creating a rich interaction between real actions and virtual objects.

Tad Ermitano (cavemanifesto.blogspot.com) is a media artist and sound designer whose single channel videos have been screened at a number of international festivals.

Run Silent; Run Deep
Nigel Helyer (UK/Australia) and the AudioNomad Research Group
Collaborated with: Marine Mammal Research Laboratory, TMSI, Acoustic Research Laboratory of Singapore



The title is an ironic reference to the motto of submarine captains in WWII who knew that the silence of their craft was the key to remaining undetected. In contrast, this artwork is a whole-hearted embrace of the richly sonic world deep within the ocean.

The work is an "audio portrait" of the Singapore harbour created by recording underwater acoustics, running the gamut from sonar to whale song. This library of sounds has been further "composed" as a virtual cartographic environment, which invites the visitor to navigate space and simultaneously create a dynamic 3-dimensional soundscape. The project employs the AudioNomad system to geo-spatially locate hydrophone recordings and other marine audio data, rendering this into a rich map-based composition that allows live "mixing" in the form of Virtual marine journeys. AudioNomad is a collaborative Art + Science Research and development project between the artist (Sonic Objects: Sonic Architecture) and Dr Daniel Woo of the School of Computer Science and Engineering, at the University of New South Wales, Sydney, Australia.

Dr Nigel Helyer a.k.a. Dr Sonique is an independent Sydney-based sculptor and sound-artist who creates large-scale sound-sculpture installations, public art and environmental works as well as interactive new media projects. His practice is actively inter-disciplinary linking creative practice with scientific research and development. *Run Silent Run Deep* is a co-production between Dr Nigel Helyer of Sonic Objects; Sonic Architecture (sonicobjects.com)

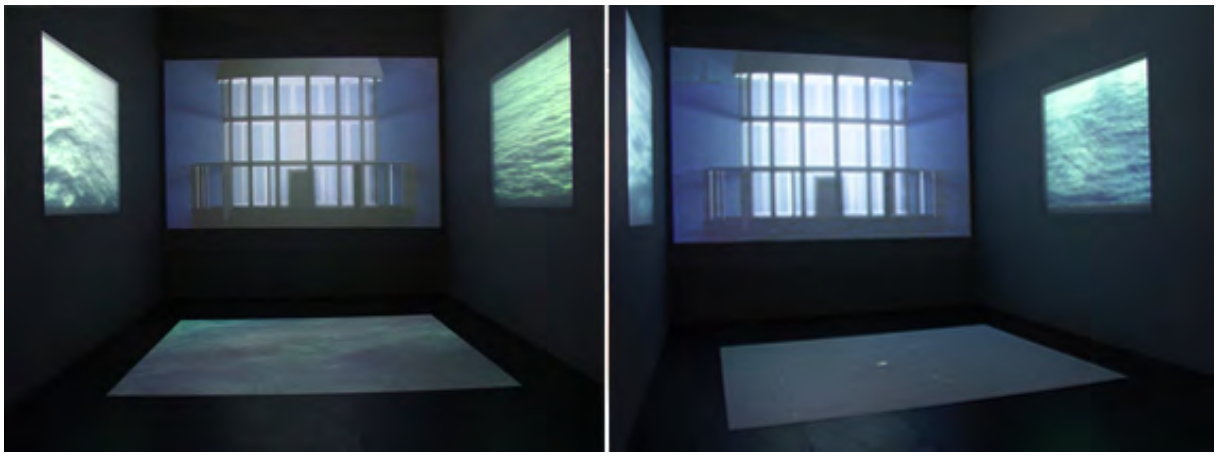
and the AudioNomad Research Group of the University of New South Wales (Dr Daniel Woo, Michael Lake, James Salter).

Smile :-), Wear It Like a Costume!
Momoyo Torimitsu (Japan/USA)
Collaborated with: NUS Face Group

The smile is probably the most powerful expression we have in our repertoire of facial gestures. It can be used to socially break the ice, to seduce and charm, and to indicate real and fake pleasure and enjoyment. Different professions can be said to have their own particular brand of 'smile' which is like a costume or work uniform; from corporate executives to nursery school teachers to exotic dancers. This artwork is an exploration of the subtle messages of compliance, attraction, persuasion and power that the smile sends out, and how our society interprets them. Collecting smiles from residents in Singapore, the artwork results in a gallery installation that involves the projection of 'smiling patterns', which the audience will be able to recognize and match with their own smiles.

Momoyo Torimitsu (momoyotorimitsu.com) is an artist who presents her work through installation, video, performance, photography and consumable materials. Her recent works have investigated and critiqued global corporate culture.

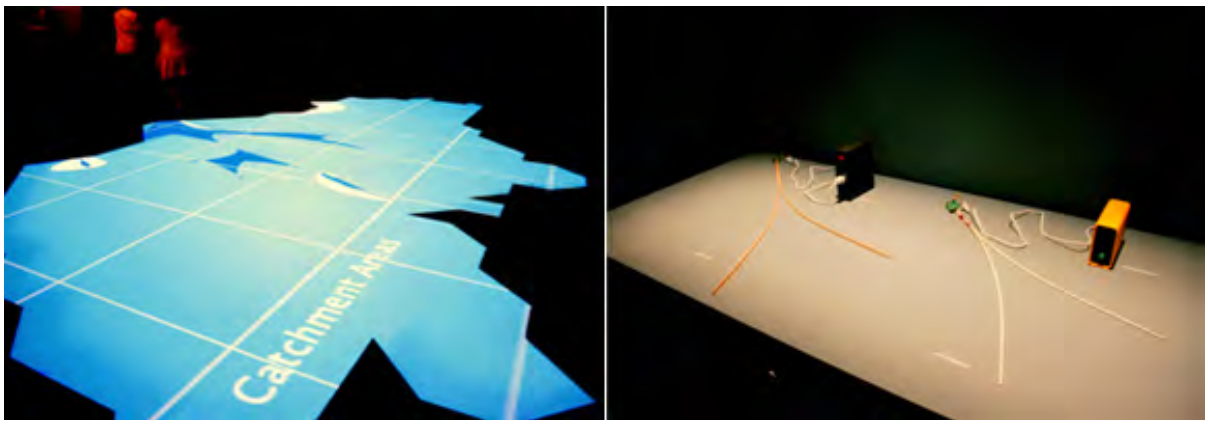
So Close the Desert Isle
Jason Wee (Singapore)
Collaborated with: Centre for Remote Imaging, Sensing & Processing (CRISP)



Deserted islands have long fuelled our imaginations with the romantic promise of idyllic isolation, although in reality their discovery often leads to territorial disputes and conflicts between states. For this artwork, Jason Wee has chosen one such space, a "white rock"

located off the southwestern tip of the Malayan Peninsula. Contested by both Singapore and Malaysia, it is known by two names, Pedra Branca (for Singapore) and Pulau Batu Puteh (for Malaysia). The artist booked time on a satellite, and had it flown over the contested territory. The satellite is capable of identifying ships by their wake. He then chartered a boat to enter the contested waters, thus crossing paths with the satellite. The satellite capture is shown in the gallery, while the island and its surrounding waters is re-mapped in the form of a 3D CG model so that virtual images are placed alongside the real ones. This artwork is a critical exploration of borders and territories, both actual and imagined.

Sourcing Water
Georg Tremmel (Austria/Japan), Shiho Fukuhara (Japan) & Yousuke Nagao (Japan)
Hosted by: Singapore-Delft Water Alliance (SDWA)



Water in Singapore can never be taken for granted. Most of it is brought into the country from Malaysia, but the city-state is always looking for ways to produce its own supplies, with reverse osmosis being the most recent method. As a metaphor of this ongoing "search for water", the artists are sourcing for water across Singapore using an ancient, albeit completely un-scientific technique. Dowsing is the practice of using a flexible rod to "divine" the location of water underground. It was believed that the dowsing rods acts as an amplifier of the body's "natural" sensing of underground water.

As a fusion of body, instrument and landscape, dowsing was a pre-scientific form of location-positioning technology, and - for the artwork – the artists tried to combine this age old "technology" with modern sensing methods. The dowsing rods were enhanced with GPS and Motion Sensors, allowing data to be collected, correlated and juxtaposed to hard scientific water data to create a map of potential water sources. And if all goes well, we could end up with "new" newater!

Shiho Fukuhara and Georg Tremmel have been collaborating on projects involving art and science since 2001. They have founded Biopresence BCL, an artistic research laboratory and open development platform dedicated to exploring the interfaces between art, science, design, technology and society. Yousuke Nagao has a background in Information Design (Kyushu Institute of Design) and Media Art (IAMAS). In his work he is concerned with the mediation of technological tools, human relations and social dialogues.

The Global Bridge Symphony
Jodi Rose (Australia/Germany)
Collaborated with: Ambient Intelligence Lab and Communications Laboratory

Anyone who has walked along a large bridge will know that bridges make sounds – what we can't hear is the tension of the cables in the atmosphere, which create sonic vibrations across a range of frequencies. Understanding these sounds as a form of music, the artist recorded the song of her first bridge in 1995 and has been engaged with the *Singing Bridges* project ever since, capturing the unique voices of bridges all over the world. Rose sees each bridge as a musical instrument, and collectively the bridges she has recorded as urban temples, each one an instrument in *The Global Bridge Symphony*. The culmination of *Singing Bridges* is the proposed *The Global Bridge Symphony*, linking together the music of bridges internationally. The artist worked in collaboration with bridge engineers and artists in Singapore using sensor monitoring equipment to explore the technical, philosophical and musical aspects of the cable vibrations through local and global transmissions.

Jodi Rose (myspace.com/globalbridgesymphony) is a sound artist, writer, broadcaster and composer, working collaboratively to produce experimental music, radio, public and sonic art events.

The Water Book (An Encyclopedia of Water)
Clea T. Waite (USA / Germany)
Collaborated with: Singapore-Delft Water Alliance (SDWA)

Water is an elemental force of life and destruction; it's also a key component in the environmental transformation that the planet is now experiencing. It is the most powerful symbol of flow, purity and survival, and plays essential roles in our daily life as well as global geopolitics. The artwork is an interactive film installation which takes water as its subject matter, as well as its substance and the interface by which users experience the artwork. Visitors to the gallery can touch and activate the “water touch pad” onto which

words are projected; their movements and choices will call up a wide range of images, texts and moving images that relate to the theme of water. These will be generated and edited dynamically in real-time, producing an unpredictable, unique experience for every user.

Clea T. Waite (clea-t.de) a research-artist whose computer animation, stereoscopic, multi-channel video-installation, hemispherical digital-film, and a collaboration with several hundred tropical spiders examine the meta-meanings found in unlikely correspondences between science and myth.

SYNTBOUTIQUE
Syntfarm: Andreas Schlegel (Germany/Singapore) & Vladimir Todorovic (Serbia/Singapore)
Collaborated with: NUS Environmental Research Institute

On this occasion, Syntfarm focuses on bringing you a glimpse of an alternative lifestyle. *SYNTBOUTIQUE* is a specialized showroom that collects recipes, methods, myths and platforms for sustainable lifestyles that we are not used to. In *SYNTBOUTIQUE*, you will be able to interact with fantastical allegories through videos and rapidly prototyped replicas of objects, tools and landscapes that are found and used by people who don't have access to information technologies, electricity and mass media, and are still living in a mutually beneficial relationship with their surroundings. The historical, anthropological, functional, and aesthetical values of these found objects, along with their alive-ness and complexity, are reduced to a series of pure singular expressions. This occurs as they are fabricated into the raw synthetic forms of rapid prototypes. The singular structures and layers of the transformed artefacts can help us to see and get closer to experiencing the use of human-appropriated objects from nature.

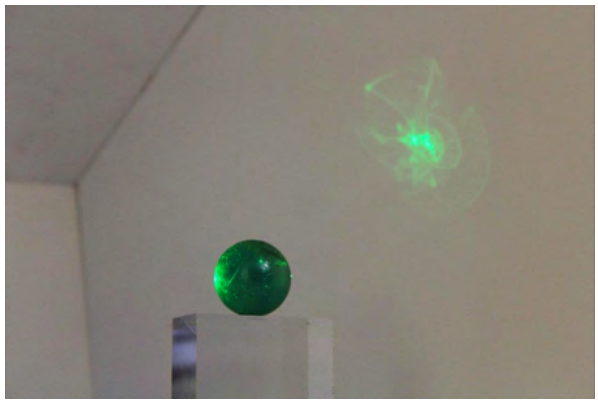
One of the main aims of *SYNTBOUTIQUE* is to promote and encourage sustainable living. Syntfarm hopes to be able to initiate a lively dialogue between visitors to the showroom and the artefacts displayed. All the commodified objects from *SYNTBOUTIQUE* are fabricated with the best quality materials found on market today and are the first step in establishing consumers' trust and support.

Syntfarm (syntfarm.org) is a media art collective founded by Andreas Schlegel and Vladimir Todorovic in April 2007 in Singapore. The group focuses on the preservation of expressions and structures that are found in various dynamic (eco)systems.

Annex B

Details of the 2012 Art/Science Residency Programme

Cabinet of Curiosities
Grit Ruhland (Germany)
Collaborated with: NUS Center for Quantum Technologies (Jenny Hogan)
Hosted by: NUS University Scholars Programme



Grit Ruhland studied sculpture and sculptural and special concepts at the University of Fine Arts of Hamburg, Germany, and continued her postgraduate studies with Professor Martin Honert. Currently based in Dresden, Germany, Ruhland has been teaching in art faculties at the University of Wuppertal and University of Dresden since 2007. Her fields of study include: working with new technologies, imparting artistic knowledge and participative working strategies, and constructing realities.

Ruhland joined the Arts/Science Residency Programme because she is interested in the artistic notion of relating abstract high-tech knowledge to more imaginable and tangible dimensions. Working on a *Cabinet of Curiosities* (https://quantumcabinet.wordpress.com/) during her stay, she engaged researchers and artists in constructive discussions on topics such as images, science and art, to introduce new cognitions for participants as well as herself.

Mapping Electromagnetism
Shintaro Miyazaki (Germany)
Collaborated with: Yong Siew Toh Conservatory of Music
Hosted by: NUS University Scholars Programme

Detektors for Singapore, 2012 Singapore

Shintaro Miyazaki studied media theory, musicology and philosophy at the University of Basle and conducted his PhD studies at Humboldt University Berlin. He specialises in critical thinking about information technology and its history. He is experienced in the field of software-based experimental music and sound/media art. His main interest lies in the relationships between sound and operations of information storage, transmission and processing. Miyazaki's post-

doctoral project investigates the history of a neuro-technological hearing aid, the cochlear implant, which helps adults and young children hear again or for the first time.

Miyazaki is curious about the rhythm of Singapore, along with its infrastructures and invisible technologies. He is exploring a rhythm-analysis of Singapore Listening to Singaporean Infospheres by building EM detectors with workshop participants and taking EM walking tours of the city.

Utopian Cuisine in the Anthropocene: Four Food Futures for Singapore
Catherine Kramer and Zackery Denfeld (Netherlands/India/USA)
Collaborated with: Asian Biopoleis (ARI STS Cluster)
Hosted by: Tembusu College

Cathrine Kramer and Zackery C. Denfeld founded the Center for Genomic Gastronomy in 2010. The center is an international, independent research organization that focuses on studying the genomes and biotechnologies that make up the human food system on Earth. Kramer and Denfeld specialize in applying a culinary lens to complex topics such as emerging biotechnology, agricultural biodiversity and food system redesign. They are currently working on the project "Edible Time Machine" in the Netherlands for the Designers and Artists for Genomics Award.

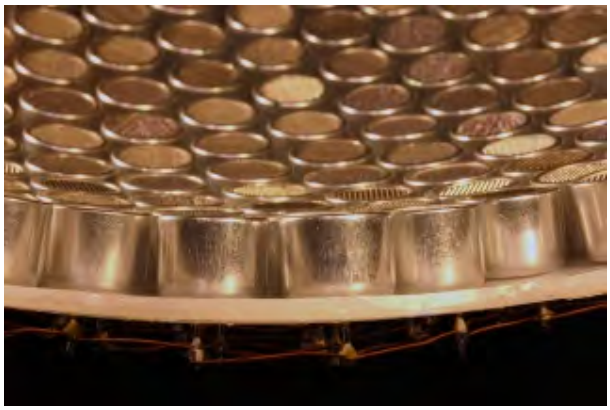
Kramer and Denfeld joined the Arts/Science Residency Programme to explore the cultural and culinary diversity of Singapore as well as the various geographic, economic and ecological constraints in the region's complex future. Kramer and Denfeld explored Singaporean food ways in order to create more nuanced discussions about the future of Singapore food systems. Through their project, *Utopian Cuisine in the Anthropocene: Four Food Futures for Singapore*, they established the connection between what is consumed, ways of cooking, and the larger ecological, economic and political systems. A book was published on their residency: Food Phreaking, published by The Center for Genomic Gastronomy.

Waterbar: Geoengineering for the public realm
Marc Böhlen (Netherlands/India/USA)
Collaborated with: Singapore-Delft Water Alliance
Hosted by: Tembusu College

Marc Böhlen is the director of graduate studies in the Department of Media Study at the University at Buffalo, New York, since 2010. He is also part of RealTechSupport. For the past 20 years, he has been designing and building information-processing systems that critically reflect on information as a cultural value. His areas of specialization are speculative robotics and public computational media. His other projects include Glass Bottom Float, a floating robot that assesses the

state of recreational waters via a three-tiered sensing system.
WaterBar is a public water-well designed for the post-sustainability age when clean water is simply not good enough. WaterBar geo-engineers mineralized water. It begins with a cleaning stage via an anthracite filter followed by a remineralization stage through a filter bank with select chemical properties. Water in contact with these filters receives measurable trace elements of magnesium, iron, calcium and other elements. But the filters also share, though origin and history, a connection to place. Water travels the world in endless cycles of evaporation and rainfall. A drop of water in Africa today may be a drop of water in Europe in the future. Waterbar accelerates the global flow of waters through many regions of the planet, and produces a drinkable water mix in the process. WaterBar includes quartz-rich granite from Inada, Fukushima, home of the latest devastating high-tech catastrophe; sandstone from La Verna, Italy, where St. Francis cared for the poor; marble from Thassos Greece, source of art and architecture and the beginning and possible end of democracy; limestone from Jerusalem/Hebron, Israel, a place of eternal conflict and shared hopes; and basalt from Mount Merapi, Indonesia, an unpredictable, active volcano. An internet-scanning, text-processing control system continuously circulates water through these filters, exposing the water to trace elements of the minerals and rocks. An algorithm mixes these re-mineralized waters in proportion to the intensity of related problems found in pertinent real-time online news to a daily mineralized water mix – the catch of the day. This mix is then offered for public consumption as an antidote to the bad news on water of the day, and available only as long as limited supplies last.

Ultrasonic Interactions
Miha Ciglar (Netherlands/India/USA)
Collaborated with: Arts and Creativity Lab / YST Conservatory of Music
Hosted by: Tembusu College



Miha Ciglar is an audio engineer and sound artist, working at the intersection of art and technology. In 2009 he obtained his MSc degree at the Institute for Electronic Music (IEM) – www.iem.at. Since 2001 he has performed his own compositions for various acoustic instruments, electro-acoustical performances, interactive dance performances, computer music and audio-visual installations at many international arts festivals.

This residency was about exploring different methods of sonic interaction involving high energy, focused ultrasound. The research is based mainly on two different acoustic phenomena, namely, directional sound and tactile sound, with the aim of establishing new interaction methods for live sound performance scenarios.

Annex C

Details of the 2013 Art/Science Residency Programme

Urban Food Growing Lab
Michael Doherty (United States)
Collaborated with: Future Cities Laboratory
Hosted by: Tembusu College
Blog: http://tembusugardens.tumblr.com/ and http://neufuture.com/2014/02/15/watercircle/

Michael's work is also interactive and draws students and communities in to participate in various ways. Workshops and design charrettes give the opportunity for students and researchers in a variety of fields to give input on ways of improving the efficiency, modularity and practicality of his systems.

The *Urban Food Growing Lab* at the Sunday Showcase was an exploration in creating sustainable and holistic food systems in urban environments by engaging the local community with these new techniques designed to grow fresh healthy food in our own home or workspace. It poses an alternative to commercial urban agriculture by introducing the idea of a distributed food production system.

Michael created an aquaponics system that captures the aesthetics and culture of Singapore through collaboration with local fabricators and artists such as the residence of the Thow Kwang pottery jungle. The primary goal of the project was to reconnect the community with the process of growing food by providing growing systems that can be implemented in virtually any public or private space. During the Showcase, Michael conducted workshops on the basics of hydroponics and how to put together one's own kit.

The Apocalypse Project
Catherine Young (Philippines)
Collaborated with: Future Cities Laboratory
Hosted by: Tembusu College
Blog: http://apocalypse.cc/

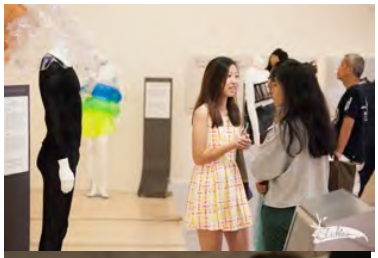
Catherine's work is extremely participative. She gets the public to feel like co-creators in the project by involving them in a variety of ways right from the beginning – even before her work "shows" in a public space. She creates a dialogue between the participants through workshops, symposia, and her blogs. During her public presentations, audiences are involved with design, creating feedback, and engaged in dialogue with each other, which are all critical aspects of the experience of her work.

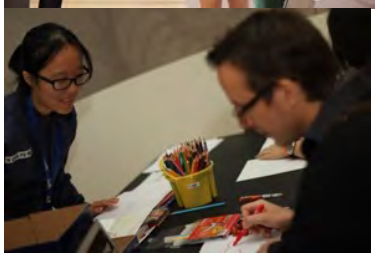
The Apocalypse Project at the Sunday Showcase was a speculative design research inquiry that explored our possible lifestyles as climate change continues to affect the planet. It comprised projects that ask specific questions on how we might live when the earth is not very liveable. Questions on senses, clothing, habitat, etc. in the form of objects and experiences were investigated and documented through writing, illustrations, photography, and video. By using primarily dystopian scenarios where our survival is at stake, we can ask more provocative questions and push creativity beyond known boundaries.

Three aspects of the projects were:
1. Climate Change Couture: Haute Fashion for a Hotter Planet
What do you wear to the end of the world? This project explored the future of fashion as climate change continues to impact our lifestyle. How can clothes work better? How do you get through a heat wave and a rainstorm in one day? What else can clothes do?

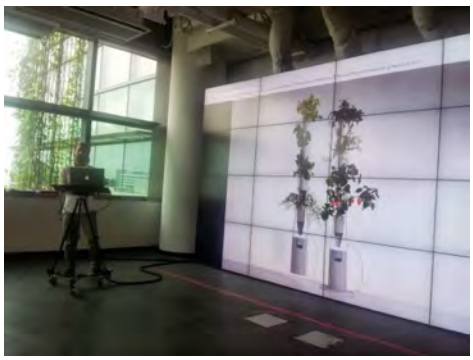
2. Planet Earth vs. Humanity: The Court Trial
What happens if Planet Earth sues its inhabitants for environmental misdemeanours? In this project, students will dramatize a court trial between the planet and its citizens. In this scenario, Earth has had enough with the environmental chaos brought about by humans. Carbon emissions, improper waste disposal, and a long list of harmful practices have made the planet snap and call for legal action. What penalties should the defendants receive, before they unleash the plaintiff's apocalyptic wrath?

3. The Apocalypse Workshop
The workshop asks individuals of different backgrounds (artists, scientists, laymen, and everyone in between) on their view of how climate change will affect us in the future (*My Apocalypse*), what abilities might we have to navigate through it (*Superpowers for the End of the World*), and what will they wear to it (*The Apocalypse Lookbook*).





1. **Events and activities involving both artists**
   a) Artist Talk at Future Cities Laboratory, 15 Aug 2013
   This talk was organised by FCL and pitched at scientists and researchers. There were between 20-30 people in the audience.




   b) Artist Talk at Tembusu College, Stephen Riady Centre LT50, 30 Sept 2013
   This talk was organised by Dr Margaret Tan for her Singapore as "Model" City? senior seminar. It was attended by approximately 100 students and 5 Fellows, including the Master of Tembusu College. Apart from the talk, the artists were also involved in the students' critique sessions and formed part of the judging panel of the students' projects.

c) 2013 Art/Science Residency Social Gathering, Tembusu College's Master's Common Lounge, 30 Oct 2013
This was a social gathering hosted by Tembusu College for the key stakeholders of the 2013 Art/Science Residency Programme to meet the artists and each other. This event was attended by the two artists, Prof Peter Edwards (Director, Singapore-ETH Centre), Dr Matthias Berger (FCL Researcher), Ms Lin Kuek (FCL Communications Officer), Ms Anna Salaman (Associate Director of Programming, ArtScience Museum), Ms Dawn Wang (Senior Manager in Communications, ArtScience Museum), Ms Amal Naquiah Binte Ahmad (Manager, Office of Corporate Relations, NUS), Prof Gregory Clancey (Master, Tembusu College), Dr Margaret Tan (Fellow and Director of Programmes, Tembusu College; ASR Co-director), Dr Adam Groves (Fellow, Tembusu College), Dr Jeremy Fernando (Fellow, Tembusu College) and Mr Luther Goh Lu Feng (Chief Connector at Hackerspace.sg and 12geeks.com).

d) Sunday Showcase, ArtScience Museum, 10 Nov 2013
Works from the two artists were shown in this one-day showcase, together with works from FCL, and projects by Tembusu College students. There were a total of 9 works on show and the Showcase was seen by over 100 visitors. See

e) ArtScience Conversations, Expression Gallery, ArtScience Musuem, 16 Nov 2013
This was a panel discussion on the theme *Negotiating Cities of the Future*. Five speakers, including the two artists, drew on cutting edge practices in the fields of art, science, technology and sustainability to address the topic of future cities. In particular, they highlighted creative ways local communities are engaged to reimagine and shape our future urban environment, in the midst of real concerns of climate change, sustainable food production, grassroots participation and innovations. The other speakers on the panel were:
Shannon Lim – Farmer, OnHand Agrarian
William Hooi – Educator and Curator
Luther Goh – Co-founder, Hackerspace Singapore

The session was organised by Dr Margaret Tan, Tembusu College, and moderated by Dr Denisa Kera, Assistant Professor, Department of Communications and New Media; Associate Fellow, Tembusu College, NUS.

There were about 20-30 people in the audience.

2. Workshops conducted by both artists

The artists were also involved in many workshops held within Tembusu College and outside. These events involved students, researchers, the arts community, and/or the public.

Workshops by Michael during residency:

What	When	Where	Participants
Archifest Urban Farm Corner	27/09/13 - 13/10/13	Dhoby Ghaut	200
Archifest Urban Picnic	12/10/13	Dhoby Ghaut	50
Farm Tour	21/11/13	Kranji	16
Forks Over Knives Screening	08/10/13	Tembusu	4
Garden Party	01/10/13	Tembusu	10
Ikea Hacking for urban ag	17/09/13	Ikea	10
DIVE! Screening	06/09/13	Tembusu	10
Vanishing of The Bees Screening	09/09/13	Tembusu	15
Hydroponics Workshop	03/09/13	Tembusu	15
Seed planting workshop	27/08/13	Tembusu	15



Workshops by Catherine during residency:

What	When	Where	Participants
Workshop	9/9/13	Tembusu	15
Workshop	12/9/13	Tembusu	7
Workshop	26/11/13	Nanyang Girls School	80


Annex D

Details of the 2015 Art/Science Residency Programme

Bioluminescent Drifter Swarms
Maurizio Martinucci aka TeZ (Italian based in Amsterdam)
Collaborated with: Art and Creativity Lab, IDMI
Hosted by: Tembusu College
Website: www.tez.it and www.optofonica.com

TeZ uses technology as a means to explore perceptual effects and the relationship between sound, light and space. He focuses primarily on generative compositions with spatialized sound for live performances and installations. In his works he adopts custom developed software and hardware, featuring original techniques of sonification and visualization to investigate and magnify subtle vibrational phenomena. In recent years his research has extended to the ideation and creation of specific architectural structures and unconventional sound and light propagation methods to enhance immersivity and multisensory perception.

For ASR, TeZ worked on creating underwater drifter drones that emit a neon glow to generate periodic spatial light and sound projections underwater and at water surface for

aesthetic viewing and for science data collections. The residency, however, was also aimed at creating connections between a manifold of Singaporean art, science and technology academic departments (including professors, researchers and students), organisations and individuals, in order to animate potential interdisciplinary discourses and to imagine real-life projects and applications together.

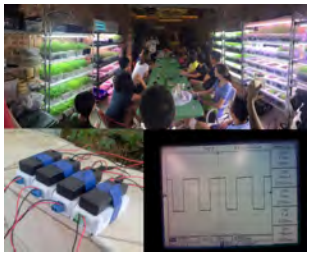
1. **Events and activities involving the artist**
   a) Master's Tea, Tembusu College's Master's Common Lounge, 12 Feb 2015
   This session was organised by Dr Margaret Tan and hosted by A/P Gregory Clancey. Apart from Tembusu College students, the session was also attended by Honor Harger, Executive Director of the ArtScience Museum, and A/P Lonce Wyse.

   b) Meeting with the Acoustic Research Lab at NUS and DHI, a NGO company with labs located at NTU, to look for synergies between TeZ's research and the lab's swarmbots and growing algae (plankton) culture, respectively.

   c) Series of workshops and talks at Hackerspace, NUS and NTU
   These include (clockwise starting from left): a workshop on Mozzy library for sound synthesis at the Makers' monthly appointment called HackLab, two "Spectral Sensorium" lectures at CUTE Center, NUS, and Art Design and Media department, NTU, a roundtable on "Artist-Curator Hybrids - Negotiating Curatorial Tactics and Artistic Knowledge in Contemporary Art

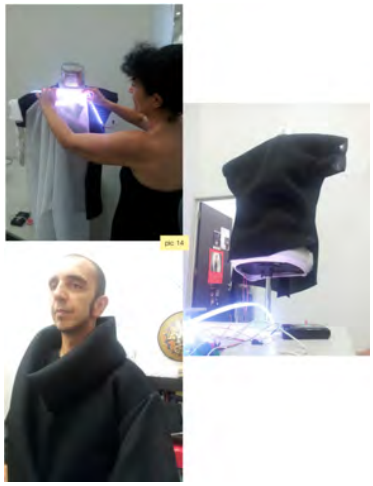
and Design", and working with CNM NUS students in designing and making some control switches and sensors for their custom BioReactor.

d) Experimental Electro-culture workshop for Tembusu College and Growell Popup/Edible Gardens group



e) An audiovisual performance at ArtScience Museum that explores the perceptual artefacts derived by specific sonic and light stimulation, using binaural beats and stroboscopic light at different frequencies and wavelengths,

while incorporating wearable techonlogy designed with the help of Galina Mihaleva from ADM, NTU.



Annex E

Media Coverage

ISEA2008 (consolidated):
http://isea2008singapore.org/news.html

2012 Art/Science Residency:
http://newshub.nus.edu.sg/headlines/0312/residency_30Mar12.php

2013 Art/Science Residency:
http://newshub.nus.edu.sg/pressrel/1308/220813.php
http://newshub.nus.edu.sg/headlines/1308/artists_29Aug13.php
https://tembusu.nus.edu.sg/news/2014/catherine-sarah-young-interviewed-in-fast-company
https://tembusu.nus.edu.sg/news/2014/sunday-showcase-at-the-artscience-museum-ft-tembusu-college
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http://unconsumption.tumblr.com/post/75598823371/climate-change-couture-the-trash-dress?utm_content=bufferfc8b3&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer
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2015 Art/Science Residency:

http://news.nus.edu.sg/highlights/where-art-and-science-meet
http://www.businesstimes.com.sg/lifestyle/arts-entertainment/the-art-of-sound
https://tembusu.nus.edu.sg/news/2015/our-artist-in-residence-tez-featured-on-both-the-business-times-and-nus-news