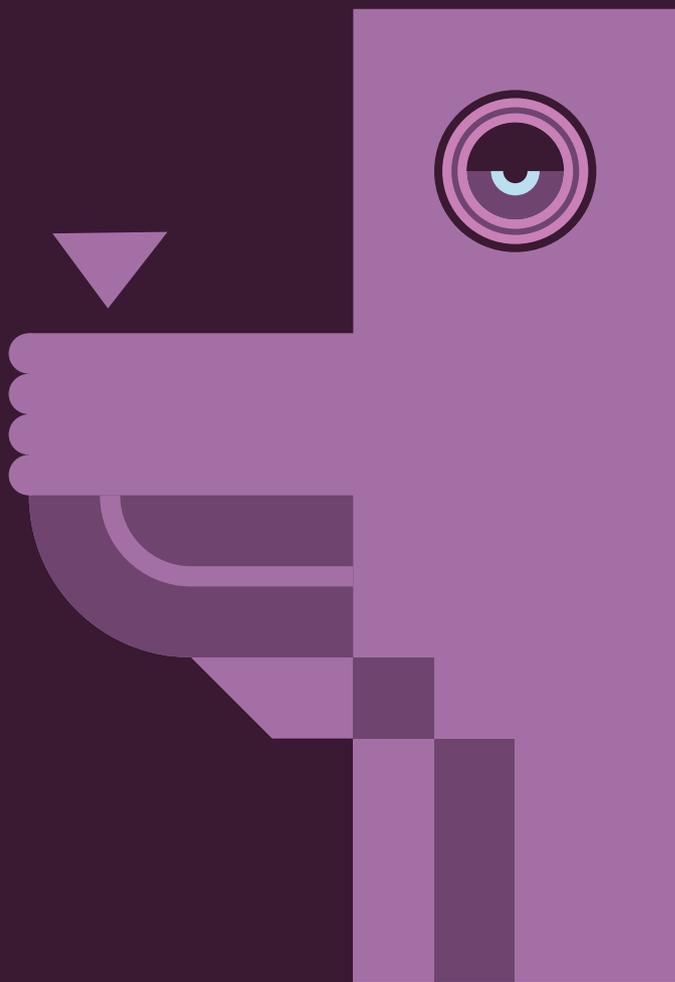


Network Ensemble Selected Network Studies



series of books

THE
strong
OF THE FUTURE

10



THE
strong
OF THE FUTURE



SF0010 eng

The book series entitled «The Strong of the Future» deals with accelerationist philosophy, in particular with the thought based on Nietzsche, Klossowski and Acéphale magazine, Deleuze and Guattari, Foucault and Lyotard.

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Selected Network Studies

Network Ensemble



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1 Introduction to Selected Network Studies

Title	Selected Network Studies
Artist	Network Ensemble
Label	Rizosfera
Catalogue #	NURKFM002
Format	SD card

The Network Ensemble

‘Selected Network Studies’ collects audio/visual experiments carried out by the Network Ensemble, a London-based electronic data-noise duo. Founded in 2015 by Oliver Smith and Francesco Tacchini, the Network Ensemble transforms wireless communications into sound in real time using a set of custom-made tools.

Originally conceived as a machine to amplify the activity of network landscapes, the Network Ensemble is a free-form and ever-changing set of tools and experiences for sonically uncovering and exploring the hidden operational layer at the very core of the network.

Selected Network Studies

Released through Rizosfera via limited edition SD cards, a digital download, a live performance and this eBook, ‘Selected Network Studies’ includes one hour of video material and 45 minutes of sound material. Accompanying this is visual and written documentation of both the hardware and software built for network exploration, as well as details of the data collection and performance sites.

TITLE	TOOL	LOCATION	TYPE	DATE
Network Study I	NE.app	Docklands, London	Data walk	12/11/15
Network Study IV	NE.app	Flight D82644	Data flight	10/07/16
Network Study V	NE.app	Fiumicino, Rome	Data walk	10/07/16
Network Study VI	NE.app	Garbatella, Rome	Data walk	11/07/16
Network Study VII	NE.app	Vatican City, Rome	Data walk	11/07/16
Network Study VIII	NE.app	US Embassy, Rome	Data walk	11/07/16
Network Study IX	NE.app	Piazza Navona, Rome	Data walk	11/07/16
Network Study X	NE.app	Flight FR4215	Data flight	16/07/16
Network Study XI	NE.app	Stansted, London	Data walk	16/07/16
Network Study XII	NE3	umlaut", London	Performance	02/02/17
Network Study XIII	NE3	NON, Berlin	Performance	10/02/17

Why Network

The invisible infrastructure of the networked communication systems surrounding and connecting us has become increasingly ubiquitous, immanent and multi-layered. The web of (de)centralised nodes and links that make up the Internet as we know it runs under our bodies, in the form of intercontinental submarine cables, through our bodies, in the form of cellular and wireless radio frequencies, and above our bodies, in the form of satellite frequencies and geo-location services.

Following Keller Easterling (2014), this multi-layered network can be seen as a consequential infrastructure space of its own, exerting control and shaping flows of power.

It is within this space that the Network Ensemble is established, setting out to explore the character of such a powerful and often impenetrable set of technological protocols. Specifically, the Network Ensemble explores the local (yet global) wireless network protocol known as WiFi.

Why Ensemble

Manifesting the (rich, constant, often furious) activity of the network often requires the use of complex, technical tools. The Network Ensemble builds away from the existing, advanced tools used for network analysis, and towards exploratory sensory experiences, approaching networks as a man-made natural force with their own essence and accompanying mystique.

To shed light on this closed-circuit system and render one of the many skins of the network (a black box, an impenetrable assemblage), a series of machines (both physical and virtual) have been built throughout the years to sonically perform the local wireless space, or WiFi. One of these machines, the NE3, was used to create 'Network Study XII' and 'Network Study XIII', included in this release.

The software running behind every machine is called NE.app and it has been re-adapted to fit each experiment of the Network Ensemble. The data collection flights and walks employed a version of the NE.app running on a laptop, allowing for covert WiFi data collection in locations with a higher level of security and scrutiny, such as airports, planes or embassies [see *Network Study IV*].

Release

'Selected Network Studies' is the second release of the Network Ensemble through the Italian label Rizosfera. Released in summer 2017, 'Selected Network Studies' directly follows from 'La Machine Informatique Dub', the debut EP of both the Network Ensemble and Obsolete Capitalism Sound System, launched under Rizosfera in summer 2016.

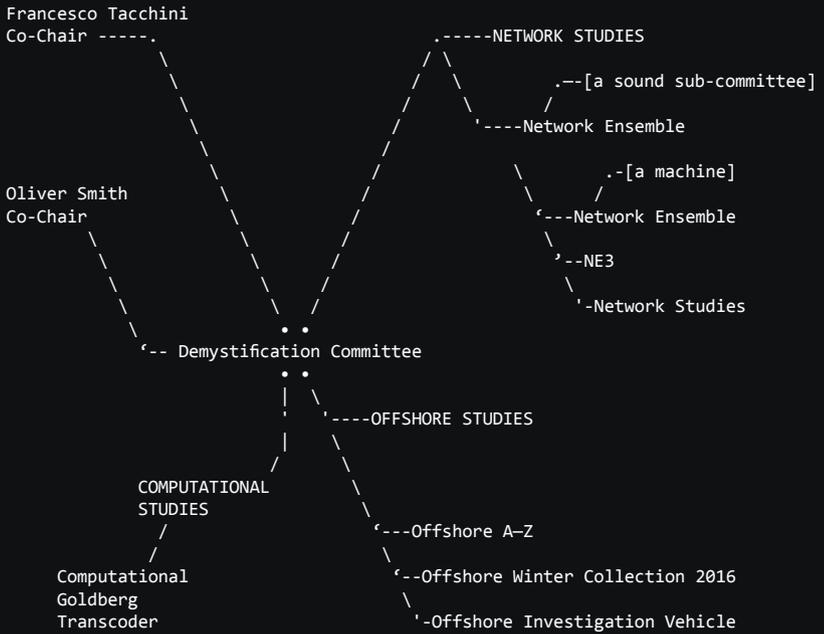
In 'La Machine Informatique', the Network Ensemble contributed a dub remix of a famous speech by French philosopher Felix Guattari, using exclusively sounds sampled from the original Network Ensemble machine. The machine can be seen on networkensemble.com and the track can be downloaded from [here](#).

With 'Selected Network Studies' the collaboration with Rizosfera continues, officially launching the first extended public body of audiovisual work by the Network Ensemble, with a focus on locations of network-infrastructure importance, as well as locations in which communications intersect with structures of power, or where one might not ordinarily consider the network to be present at all.

Demystification Committee

The Network Ensemble is a project by the [Demystification Committee](#), a collaborative framework set-up to investigate the globalised, extra-state, covert systems and large-scale networks, processes and technologies that shape our society. The Committee is chaired by [Oliver Smith](#) and [Francesco Tacchini](#).

Organigramme



2 Network Studies I—XI

Audiovisual Network Studies

Behind each audiovisual Network Study lies a walk, undertaken for the purposes of collecting network data with NE.app [see *Glossary*], as well as observing networked territories. The walk is replicated and recorded online through Google Earth, which offers a sampled, approximated 3D version of the region explored (transmitted, appropriately, across the network).

Reading the original transcript of collected network activity NE.app uses the WiFi data to control the audiovisual output three-ways.

The digitised Google Earth representation of the walk undertaken is haunted and visually warped by the collected data, bringing the networked record of space together with the spatial record of the network.

This warped imagery is then displayed alongside three data visualisations: a textual overview, a visual taxonomy and an aggregate of all the captured WiFi packets. The data is also sonified to give a sense of the weight and speed of the network. Through this, a fuller depiction of our online and offline worlds than is possible with our unmediated vision and experience is created.

In playback, NE.app autonomously decides when and how to cut in-between scenes, according to the amount of network activity. Content, structure and pacing of the audiovisual studies are controlled by the network data, a self-editing process that is itself a representation of the networks investigated.

Locations

The studies focus on locations of network-infrastructural importance as well as those in which communications intersect with structures of power, or where one might not ordinarily consider the network to be present.

Offering a snapshot of a particular time and duration allows for comparison between them, bringing structures, patterns and anomalies in these hidden territories to light.

MORE PACKETS

LESS PACKETS



DATA

UNKNOWN

BROKEN
GATEKEEPING

PACKET AGGREGATE

14:39:18

DOCKLANDS

Network Study I

Context

The area northeast of Canary Wharf is inhabited by large, anonymous buildings, their imposing grey exteriors surrounded by multiple layers of metal fencing and countless security cameras.

This especially militarised part of London houses the city's most important node of the internet: LINX, the London Internet Exchange. It is in this building that over 500 UK network operators and providers connect and exchange traffic, and where the network is connected to the rest of the world.

The Network Studies begin here, at the core of the Internet.

Title	Network Study I
Tool	NE.app
Location	Docklands, London
Date	12/11/15
Type	Data walk
Format	MP4
Length	12:10

Network Study I - Docklands

From Telehouse North, the home of LINX, Network Study I follows the path of the underground cables as they connect London, and the UK, to the global Internet. From this militarised sector of the Docklands the shining towers of Canary Wharf can be seen [see image on the left].

As one of the most important European financial hubs, housing the headquarters of banks such as HSBC, Barclays or CitiBank, this location is no coincidence: the financial services and fast-trading algorithms thrive on the speed, performance and scalability offered by proximity to the one of the most important node of the Internet, fed by the world's fastest telecommunication cables.

Moving across the bridge between the Docklands and Canary Wharf, under the watch tower, the walk enters this financial zone collecting the signals bouncing between the towers and traders.

Over 60,000 devices and 2,000 network channels were monitored as part of the walk around the Docklands and these are presented in real time in Network Study I.

Network Study IV—X

Context

In summer 2016 the Network Ensemble was invited to exhibit as part of the ‘Deleuze Studies 2016’ conference in Rome. In response to the invitation, Network Studies IV-IX were installed at the Roma Tre University as an autonomous audiovisual piece, presenting network data from six different locations in Rome.

The data collection walks for the studies were undertaken in areas of interest approaching or within the city on the days directly preceding their presentation.

This data was played back in real time at the conference using the NE.app [see *Glossary*], giving an up-to-date representation of recent network activity in the city.

‘Network Study X’ shows network activity collected from the return flight from the trip to Rome, so is included here due to its relevance and proximity to the other locations.

Title	Network Study IV
Tool	NE.app
Location	Flight D82644
Date	1/07/16
Type	Data flight
Format	MP4
Length	05:04

Network Study IV - Flight D82644

A WiFi-enabled plane travelling between London and Rome is the first subject of this set of studies. Although the Norwegian airlines flight provides for a limited space with very few inhabitants, an intense network activity is monitored throughout the flight.

A pocket of radio waves in the otherwise clear air, the collected data is represented live in Network Study IV: 352219 packets across 1894 network channels.

Title	Network Study V
Tool	NE.app
Location	Fiumicino, Rome
Date	10/07/16
Type	Data walk
Format	MP4
Length	04:08

Network Study V - Fiumicino

The major airport in Italy, Rome's Fiumicino Airport features a busy arrivals Terminal on the night of Sunday 11th July 2016. Tourists make their way in-and-out of the international zone, clearing customs and immigration control with Visas and Passports pronto in their hands.

At the other hand of the scale of standardised international freedom of movement are the failed asylum-seekers forcibly boarded on deportation flights. Unlike other flights, these do not appear on any of the airport's departure boards. Fiumicino is in fact the central node of the silent framework for deporting migrants established by the Italian government under EU regulations.

Police forces are aided by private and European agencies such as Frontex, Europol, Eurojust and Easo in identifying and detaining migrants throughout a series of 'hotspots' scattered in Sicily. These hotspots are borderline legal detention centres where migrants, often in the absence of a Magistrate, just in the presence of administrative police officers, are given a few minutes to make their case for seeking political asylum.

Often denied en-masse and without individual explanation, the migrants are held in the hotspot, unaware of their destiny. This is a tactic which delays the possibility to appeal against the denial until too late.

In some cases, migrants are notified of a failed application only when boarded on a bus to Fiumicino Airport, where the deportations are organised and financed by the European Union with the help of Italian police forces. In other cases, migrants are simply dumped on the streets, at the mercy of traffickers, criminals and the Mafia who see the perfect pray in such vulnerable people.

Hotspots and nodes are thus the unfortunate vocabulary shared by the State, deporting and denying rights to those most vulnerable, and by the wireless networks which thrive with activity in the arrivals terminal of Fiumicino Airport: roughly 200000 packets were sent by 30000 devices and these are represented in real time in Network Study V.

NETWORK

\$DS_US\$AS
fRCEwNDAN@wifi
Xperia 35 Compact_afb7
\$DS_US\$AS

hC Uffici

wifi00230
wifi00230
Tp_Wifi50

private/wm3111
fRCEwNDAN@wifi

private/wm3111

\$DS_US\$AS

\$DS_US\$AS
EASV260/149177

PACKET

Probe Response
Probe Request
Beacon frame
Beacon frame
Authentication
Request to Send



Block Acknowledgement
Data
Request to Send
Block Acknowledgement
Request to Send

CATEGORY

Structure

Structure

Structure

Structure

Gatekeeping



Communication

Data

Communication

Communication

Communication

SIGNAL STRENGTH



Title Network Study VI
Tool NE.app
Location Garbatella, Rome
Date 11/07/16
Type Data walk
Format MP4
Length 06:04

Network Study VI - Garbatella

The quiet backstreets of the Garbatella, a residential area in southern Rome, are the subject of the sixth network study. It's early morning and the many inhabitants of the area remain silent on a sunny Monday morning in the middle of summer, a time when schools are closed.

The network activity mirrors the calm offline world, with only a few hundred home networks and around 2000 devices monitored during the walk. Most of the packets are structural in nature, possibly coming from unused yet active devices and routers.

The only disruptions arise from a few unknown yet heavy packets, around minute 5 of the study, breaking the low morning hum of the network.

Title Network Study VII
Tool NE.app
Location Vatican City, Rome
Date 11/07/16
Type Data walk
Format MP4
Length 05:48

Network Study VII - Vatican City

The only officially recognised absolute theocracy in the world, Vatican City has its own nature and accompanying mystique. In a place where incredible amounts of power and secrecy, influence and lobbying, sovereignty and religion collide, the invisible forces of the network are easily forgotten.

Nonetheless, while walking through the columns of Saint Peter's Square in the Vatican City, an unusual amount of activity is monitored: the data is collected from both the large number of visitors and the administrative buildings of the Vatican City. Among these is the Telephone Service, which maintains a complex infrastructure of data networks for the telecommunications of the Holy See and the Vatican Radio, transmitting God's word at a speed roughly 1500 times slower than that at which WiFi packets travel.

The network is furious within the walls of the Vatican City, and it has been for many decades. It is here that in 1933 radio inventor Guglielmo Marconi built the first stable shortwave radio transmission system in the world. Crossing the Vatican in a timespan of 6 minutes allowed for the collection of over 200000 packets, ranging from pilgrims' phones to the telecommunications of the State, through the echoes of the Vatican Radio's waves.

Title	Network Study VIII
Tool	NE.app
Location	US Embassy, Rome
Date	11/07/16
Type	Data walk
Format	MP4
Length	06:34

Network Study VIII - US Embassy

In 2013, reports looking into covert collection systems operating from US Embassies across major world cities were published on a number of newspapers.

Using documents leaked by Edward Snowden, journalists revealed how the NSA's STATEROOM program (the same covert operation used, famously, to tap the phone of Angela Merkel) is targeting many capitals. As detailed in the leaks, the electronic collection of data happens on the roof of the often beautiful Embassy buildings located in the city centres of the world's capitals. The equipment and staff assigned by the US government to such secret operations hide behind "false architectural features" such as roof maintenance sheds.

Network Study VIII focuses on the US Embassy conveniently housed in the beautiful Palazzo Margherita in close proximity to many administrative buildings of the Italian government. Secured behind the white curtains of the fake roof maintenance shed and protected by diplomatic immunity, spying on the communication of the Italian leadership is achieved via a large antenna.

During the walk behind this study, NE.app monitored a lower frequency slice of the same air than the NSA's antenna does, collecting over 100000 packets from roughly 18000 devices.

Network Study IX - Piazza Navona

Title	Network Study IX
Tool	NE.app
Location	Piazza Navona, Rome
Date	11/07/16
Type	Data walk
Format	MP4
Length	06:18

Piazza Navona is one of Rome's busiest and most notorious squares. The piazza is adjacent to Palazzo Madama, the seat of the Senate of the Italian Republic.

Due to its proximity to such a key location for the administration of the State, many of the side-streets branching out from the Piazza house the restaurants where politicians discuss business: "I migliori affari si fanno a tavola" as the Italian saying goes ("The best business is done while dining").

The data collection undertaken returned network activity from over 30000 devices and over a 1000 network channels from the Piazza, the adjacent Senate of the Italian Republic and the surrounding restaurants, perhaps intercepting some of the Senators' WiFi communications.

Network Study X - Flight FR4215

Title	Network Study X
Tool	NE.app
Location	Flight FR4215
Date	16/07/16
Type	Data flight
Format	MP4
Length	04:54

A plane without WiFi offers a different feel to wrap up this set of studies. Minimal bursts of data come and go, mainly due to the machinic layer of the network rhythmically fed structural packets by the plane's built-in electronic equipment.

While no active users excite the network space of this flight, their machines never sleep, even when toggling AIRPLANE MODE: 200 devices, 25 networks and over 3000 packets were monitored as part of this data flight.

Network Study XI

Context

As the hub airport for budget carrier Ryanair, London Stansted Airport plays host to some of the cheapest flights in the country. Although this price point is achieved via some questionable employment practices and dubious customer service techniques, it makes it the largest European airline.

At the other end of the scale, for both price and frequency of flight, Stansted is the departure point for flights with an average fare around 125 times that of Ryanair: chartered deportation flights. At the behest of the UK government, and through an outsourced network of private companies, carrier Titan Airways operates flights forcibly removing people from the country. Often running under cover of night, these chartered flights take off amongst freight planes, from a relatively hidden part of the airport.

Taken by coach from detention centres, with their mobile phones confiscated, people may have to wait up to 12 hours before being boarded onto the flight. Before this moment they may not know the exact time or destination of the flight. Many will not fly at all: the Home Office often takes more people to the airport than will fit on a flight to ensure that, in the case of someone receiving a last-minute injunction to stay, these expensive flights remain full.

There is minimal opportunity to contest deportations such as these. Although government guidelines require 5 days notice for people to build a case, this is not always given, making it difficult if not impossible to raise funds or build a case. In response to contestations that suggest removing people (who have sometimes lived in the UK for most of their life, having come here as children) splits up families, the government has suggested that people could continue their relationship with their families and parents with their children via network technologies such as Skype.

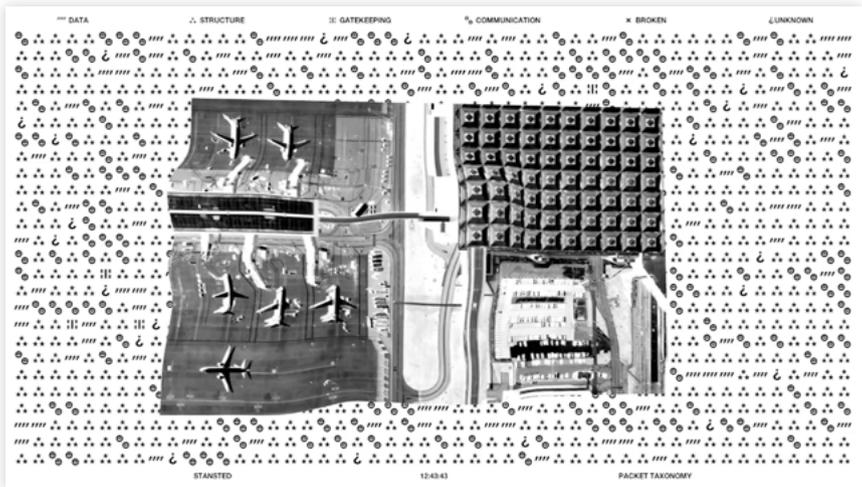
Title Network Study XI
Tool NE.app
Location Stansted, London
Date 16/07/16
Type Data walk
Format MP4
Length 04:54

Network Study XI - Stansted

Supporting Stansted Airport's roof canopy is a series of tree-like structures. Each of these serves a dual purpose, to support the roof and to deliver services such as electricity, air conditioning and telecommunications.

The airport's open structure allows a winding course to be taken amongst these network trees, the communications moving between them criss-crossing as the roof does.

Network Study XI used NE.app to explore Stansted's network space, detecting 183296 packets from 17688 separate devices. An airport terminal designed for simplicity, there is little in this network forest to suggest the state-sanctioned force that occurs elsewhere: the devices on the network are mostly those of tourists whose phones remain un-confiscated, and whose destinations are known to them.



3 Network Studies XII—XIII

Context

Network Studies XII and XIII are gallery-based sound performances which took place in London and Berlin in February 2017.

Utilising the NE3, the performances explored the volume, strength and variety of WiFi communications passing through their respective gallery spaces. The machine captured each packet of information transmitted on the WiFi frequencies and transformed them into sound in real-time.

To organise the experience of the data stream, a tailored version of the NE.app running on laptops concurrently received and analysed the network, filtering each packet into different categories: Infrastructure, Gatekeeping, Oversight, Content, Broken and Unknown [see *Glossary*].

Each category was used to create and control a different type of sound, with some controlling instruments or effects, while others manipulated the raw noise of the network as output by the NE3. The sounds of each category responded to the differing characteristics (for example the speed or intensity) of that particular sub-section of the network.

The two performance-studies traverse the infrastructural, human and mystical layers of the network, highlighting a world haunted by data, irrevocably but invisibly changed by its communications.

Moving through these three different layers of the network, the performances explored how each participant (be they machine, human or other) inhabits the physical and digital space.

Title	Network Study XII
Tool	NE3
Location	umlaut", London
Date	02/02/17
Type	Performance
Format	MP3
Length	18:14, 3 tracks

Network Study XII

Prelude for Machines

An invocation, presaging the coming machines, is consumed by their noise. The opening section of Network Study XII calls forth the packets from the machine layer of the network (the Infrastructural, Gatekeeping and Oversight packets). An undercurrent of pops, bass and mechanical sounds is interrupted by incessant chords as the machines communicate amongst themselves at network speed.

Humans

The low hum of human activity is the focus of the central act of Network Study XII. Data packets, carrying what users would consider the content of the network, are materialised in the form of human voices: encrypted messages, images, videos and text become a subtle conversation.

Ghosts

As the hum of conversation subsides, the performance enters the mystical slice of the wireless internet, where lost, corrupt, broken and unknown data packets sit. Trapped between worlds these indistinct packets are rendered as bells and, when strong enough, rich bass. Their intention and destination is unclear, and they fade out into the gallery space.



Title	Network Study XIII
Tool	NE3
Location	NON, Berlin
Date	10/02/17
Type	Performance
Format	MP3
Length	28:06, 4 tracks

Network Study XIII

Invocation

The network is man-made, the network is a natural force.

The network is invisible, physical infrastructure.

The network is rhythmic, the network is chaotic.

The network is sleepless, permanent, transient.

The network is instant, the network is infinite.

The network is inhaled and exhaled by machines.

The network is present, listen to the network.

Act I — Machines

Full submersion in the raw noise of wireless data gives way as Network Study XIII explores the mechanic aspects of the WiFi. Infrastructural, gatekeeping and oversight packets are transformed into pops, bass and mechanical sounds as rich chords burst into life over them.

Act II — Bodies

The low hum of human activity is the focus of the central act of Network Study XIII. Data packets, carrying what users would consider the content of the network, are materialised through the sounds of humanity, interrupting and interrupted by the machinic intensity of the network.

Act III — Mystique

The third and last act is a mystical journey across the noisiest slice of the wireless internet, where lost, corrupt, broken and unknown data packets live. As Act III comes to a close, this ephemeral data fades out, slowly, into the echoing gallery space.







4 Interview with the Network Ensemble

ON THE NETWORK

Let's start from the focus of your audiovisual project: the network as a concept and *dispositif*. What is the reason for focusing on the network as both an organizational process and a theoretical concept?

It was once possible to consider the network, its contents and contexts, separate from the physical world. The two were fairly distinct, with the network, contained in cables, intruding on the physical world only through fixed terminals. Of course the cables cut through or were submerged beneath the material of the physical world, but the network data was contained, and constrained, within them.

Wireless technology changes this, as do mobile or other, smaller, connected devices. An increasing amount of “things” able to talk the wireless language exist today, often perceived as magical and secure. While perhaps not technically in-secure, wireless things carry the promise of ease of use, the luxury of immediate set-up and the lure of affordability. They do not require a raising of technical skills, and the consequent awareness of how to shield from external ears. They multiply and through them the network is released.

The realities of the network become a part of the realities of the physical world. Instant and often free access to information and communication whenever, wherever are shadowed by the heightened possibility of surveillance and tracking. The positive and negative effects of wireless networks become inherent, somewhat functionally imperative, part of everyday life: “Free Wifi here”, a smart fridge, Siri & Alexa.

Throughout this, the network, the delivery medium of the internet, remains largely hidden. The stack of technologies on which web pages and emails rest precariously is deep and obscure, while that which is experienced as text, image or sound is constructed as it bubbles up through numerous technological layers. This complexity and prevalence, along with its global nature, puts the network on a similar level to the forces of nature, the wind and waves that surround us. There is something similar in its unpredictability, its constant change, its potential impact: beautiful or devastating.

The network, then, is a man-made natural force, a chaotic structure through which we pass and which, wirelessly, passes through us, but it is silent and for the most part invisible. To put it somewhat differently the network can be seen - following Keller Easterling - as a consequential infrastructure space of its own, exerting control and shaping flows of power. The project asks, what if we could experience the network, this infrastructure space? Not its results - the messages, videos, articles - but its actions: the transmissions and transformations that carry and assemble these results.

The WiFi, as well as being one of the key parts of the network also provides opportunities for investigation. It is in some respects the accessible crest of the larger infrastructure offering connection through personal devices or networks within buildings to the deeper layers, such as internet exchanges or submarine cables. That it offers this, with only a requirement of proximity, not physical connection, makes it a useful point of entrance and departure from which many paths can be taken.

ON EXPERIMENTAL TOOLS AND DIY MAKING

A unique aspect of the project is the custom-building and self-initiated production of data-collection tools and assembling software operating them. Why this choice?

We create tools as an initial research process. The necessary starting point is looking and listening. Donna Haraway puts it disarmingly simply: research is knowing a bit more in the evening than you did in the morning. We often align a number of readily available hardware and software tools and create assemblages through which we gather information in multiple ways.

Through this initial process we come to know a bit more about (network) data, the structures that produce it, the conditions which create it and which it creates in return. Once an assembled tool is completed or consistently usable (tools are never completed - only ever abandoned) there comes the process of operating it, exploring with it.

We create tools as a refining process. We suspend our disbelief, adopting an approach similar to dowsing: a type of divination employed in attempts to locate hidden materials without the use of a scientific apparatus, and without a full understanding. If we waited for a full and complete understanding, we would be paralysed in the face of complexity. Dowsing into the unknown, we gradually improve our divining rods in an iterative fashion. In this case, looking at and listening to the urban environment and the WiFi data found within it refine our tools and, in return, our understanding of those networks and their operations.

We create tools as a necessity, stemming from an inability to access existing tools, whether due to the structures of control around them, their complexity or the fact that a tool for a particular task does not exist. In this case, tools exist to read networks, and tools exist to make sound, but a tool for both has to be bespoke.

We create tools as a tactic. Different situations call for different approaches, particularly when collecting data in sensitive locations. In this case, software tools operating within a laptop allow for covert data collection, preventing scrutiny when on a plane, in an embassy or by a governmental building [*Network Study IV, VIII—X*].

We create tools as an open box, so that they be pulled apart and understood, visually if not physically. Enough with black boxes and impenetrable assemblages: our most successful machines should be structured to describe their machinations. In this case the NE3, a tool to turn WiFi packets into a source of data-noise [*Network Study XII—XIII*], is conceived as a compact board where all components are exposed and their connections visible, facilitating an initial understanding of how information flows within it. There are, of course, further levels of complexity within this - within a world of software and microprocessors it is not necessarily possible to fully expose the workings of an active object, but we hope that its presentation in this way encourages questioning and exploration.

We create tools in the attempt to produce unique, beautiful artefacts. Sometimes this presupposes the establishment of a visual system. In this case, a symbolic representation of network activity was conceived: a set of icons screen-printed on the original Network Ensemble machines visually describe six categories, or network slices, within which WiFi packets are found. The same icons become the vehicle of audiovisual experimentation during the Network Ensemble performances, establishing a different network aesthetic.

ON CARTOGRAPHIES AND PSYCHO-GEOGRAPHIES

In 20th Century historical avant-garde an increasing attention is given to the environment: the Situationists' theorisation of *détournement* and psycho-geography are an example of it. Your data walks remind us of living data archives. What is your relationship to urban geography?

To some extent the Network Ensemble has always been situationist. It experiences different network conditions, devices and frequencies; it travels to different geo-political contexts; it is surrounded by different infrastructure, with different material quality; it faces different audiences; it has different intents. Whether a performance, an exhibit, a data-collection assemblage or a musical act, the Network Ensemble embraces psychogeography in a playful and free-form exploration of urban spaces.

Some specific aspects of the project have less of a free-flow relationship to urban geography. The data walks lying behind each audiovisual network study are undertaken for both the purposes of collecting network data as well as observing networked territories. As a process of seeing and experiencing specific places of interest, the walks start, perhaps, as less of a psycho-geographic *dérive* and more of a focus on a specific territory, with a fixed location and a defined start and end.

Of course, within this there is flexibility: it is not possible or necessary to stick rigidly to this and the act of walking and looking surely has an impact on the parts of the network we pass through. These living data archives, as you define them, represent samples of an area, a snapshot of a time, place and network.

It is therefore necessary for us to study a specific area before visiting it. Its network-geographical features might be used to guide the journey. Is there infrastructure to follow, as in the case of the LINX Internet Exchange in London's Docklands [*Network Study I*]? What might be found in the networks that travel along and branch off of it?

Techno-political implications might otherwise guide us. Perhaps the network is brought to bear on those in its proximity, as in the case of the US Embassy in Rome [*Network Study VIII*], where the NSA hacks into networked communications travelling in the nearby air. What power is embedded there? What might be extracted, intercepted or injected through those airborne packets?

Finally, juridical and physical borders might define, or confine, the journey. The network intersects with State power in both Fiumicino and Stansted Airport [*Network Study V, XI*], two central nodes of the silent framework for deporting migrants established by the European governments under EU regulations. Often running under cover of night, chartered deportation flights take off amongst freight planes, from relatively hidden parts of the airports. Constrained by both material and legal walls, our relationship with these urban spaces is static: we can but sit in the Terminals where little suggests the state-sanctioned force that occurs elsewhere.

ON DE-COMPUTATION

Is your approach to contemporary technology one of de-computation or, in other words, of de-construction of the obscure side of technological power?

“Whether enthralled or enslaved by machines and algorithms, we want to understand them, either to bend them back to human will or push back against them!” announced John Fass introducing his De-computation class.

De-computation is a methodology, perhaps a mindset, we were introduced to as part of the Information Experience Design MA at the Royal College of Art in London. At its simplest, de-computation helps designers study the ways algorithms shape behaviour and mediate our experience of the world. It thus acts as a means to approach technology, and conversely to view design through a computational lens.

A de-computational approach aims to humanise technology, harnessing its speed and capacity for creative benefit, and showing ways of resisting its inexorable logic. As a two-way exchange between design and technology, it combines elements of design making with computational thinking. In other words, we find de-computation applies effectively to studying and making things, or even formulating a tactic.

With the Network Ensemble, we identify at least two approaches falling under the umbrella of de-computation. One is a process of demystification. We consider the network a black box, an impenetrable assemblage. We strive to understand its operations by travelling down the layers, protocols and structures that form it, de-constructing it as we go with both an analytical eye and a dowser’s hope and belief.

The other is an active process of de-construction. We strive to build machinery which expose some of its machinations and construct tools as an open box, so that they be de-constructed — as discussed in **ON EXPERIMENTAL TOOLS AND DIY MAKING**.

ON ACCELERATIONISM

Selected Network Studies is released through Rizosfera, a music label grown out of the Italian collective Obsolete Capitalism. Through its releases Obsolete Capitalism gives voice to “accelerationist” artists influenced by the work of Nietzsche, Foucault and Deleuze. What do you make of the accelerationist movement — a philosophical current born out of London, where you are based and where a wide range of (not only) musical influences co-exist?

“[...] an acceleration which is also navigational, an experimental process of discovery within a universal space of possibility”

—Alex Williams & Nick Srnicek, *Manifesto for an Accelerationist Politics*

We developed the Network Ensemble in London two years ago [see *The history of the Network Ensemble*], a period of time during which we also formalised our collaboration under the moniker Demystification Committee. The Network Ensemble is the sound unit of the Demystification Committee and it aligns to other projects we run, part of a greater effort in investigating the extra-state, large-scale networks and covert systems that shape our society.

The systems we investigate make themselves known, often unintentionally, through the production of an incredible amount of noise. The Network Ensemble especially focuses on this noise that we can read as data to identify its actions and intentions, track its machinations and influences, and foreground its accelerated processes.

The exploration of such fluctuating technology encompasses, but is not limited to, the study of platforms, machines, physical networks (of networks), virtual and artificial forces and legal and juridical frameworks. With a focus on these processes, the Demystification Committee attempts to understand and represent clashing technological and societal trajectories through artistic experimentation.

This necessitates a will “to become literate in these technical fields” [MAP 3, 9], and a direct involvement that moves beyond the use of specific techniques, tools or tactics.

Conceived as a vehicle to explore a “universe of possibility”, the Demystification Committee adapts to ever-changing scales and ever-accelerating speeds [MAP 2, 1—2]. Around us, perhaps not geographically but cognitively, we see others that operate across similar scales. Particularly relevant are Benjamin Bratton and Keller Easterling’s writings, their exposition of infrastructure space and its operating systems allows us to consider apparatus such as cities or states in the same frame as computational technologies such as WiFi networks.

Hidden in the crack of these systems, we see artists such as Goldin & Senneby operating at a level of deep engagement, magnifying their actions through the lever of geopolitical infrastructure; Shintaro Miyazaki and Martin Howe channeling infrastructure through custom tools, transforming large-scale technical systems as raw material for sound; Sam Conran, literally in the “universe of possibility”, synthesising signals from outer space to make music; Stine Deja exploring the techno-social matrix and the gap between virtual and real spaces; Maximo Recio glorifying quantitative data analysis and its potential to fabricate (financial) fictions; Hayden Anyasi using the algorithms of surveillance to fight biased representation of identity in media; Jelka Kretzschmar investigating global crisis of migration and the physical barriers put up by societies; Andrew Brash dissecting the symbiotic relationships between visual identity and the urban environment; Charlotte Maëva-Perret infiltrating subversive ways of making, publishing and consuming to unveil the machinery of global mass production.

Finally, collective such as yours and organisations such as Furtherfield in London, transmediale in Berlin, the Institute of Network Cultures in Amsterdam which offer the space, time, focus and stages for new experiments. Perhaps, paraphrasing Alex Williams and Nick Srnicek, rather than destroy the material platform of neoliberalism we should first repurpose it towards common ends.

“The existing infrastructure is not a capitalist stage to be smashed [...]” but a stage to perform from.



TR 802.11 Network Drum Machine

VOLUME 

TEMPO  

MODE

PLAY

REC

PLAY

Perc

HH

BD

SD

5 The history of the Network Ensemble

The Network Ensemble was born out of a pun.

In December 2014 we took part in ‘Possessed Objects’, a group show held at the Royal College of Art in London, where we were master students of the Information Experience Design programme. The show challenged the perception of technology as *supernatural* through four artworks which confronted technological (mis)beliefs. The work did not seek an awed, stunned worship of technology but rather a questioning of its immediate workings and the techno-political implications of its use.

Among the subjects investigated by the artists was that of network, intended as the infrastructure underlying the Internet. The increasingly ubiquitous, multi-layered, immanent (and almost definitely magical;) assemblage that we refer to as ‘the Internet’ felt like a worthy topic, and an infrastructure space of its own largely unknown to us.

Oliver’s contribution to ‘Possessed Objects’ specifically tackled this subject. *On/Off/In[line]* was an installation exploring the WiFi network, hunting for its inhabitants’ electronic equipment. The piece collected information and communications from devices in a close proximity and monitored them, calculating their distance from the exhibition space. The surveilled communications, too fast to be visualised, were sonified by transforming the bytes of WiFi packets directly into sound waves. The cacophonous amount of information played out was somewhat more representative of the realities of the activity than if it had been visually translated.

On/Off/In[line] was specifically targeting 802.11 technology, a set of standards dealing with wireless local area networks. In other words, 802.11 is the code-name for WiFi technologies. The sonification of the surveilled data in Oliver's piece was interesting enough to suggest that the exploiting device could be turned into a music-making instrument. Perhaps a new kind of electronic instrument with WiFi at its base, processing the incoming wireless signal by modulating one of its parameters to output electric voltage, thus sound.

The legendary Roland **TR 808**, an analog drum machine who allowed a new kind of freedom to music producers in the 80s (just play *Planet Rock* by Afrika Bambaataa & the Soulsonic Force), provided the pun: we were going to build **TR 802.11**.

A virtual prototype was ready by January 2015. TR 802.11 Network Drum Machine monitored devices connected to the wireless local area network and waveforms from WiFi packets through a graphical user interface. We threw a studio party at the Royal College of Art to test the drum machine.

Mirroring the naming of Wifi protocols we quickly developed TR 802.11a, TR 802.11b, TR 802.11g and TR 802.11n and imagined an ensemble of autonomous network machines that would create new melodic landscapes. Each machine would be portable and used to either perform with or autonomously playback network data, thus developing a rhythmic character independent of a single space or subject.



A physical device was ready by summer. Built into a flight-case to be easily carried, the machine was taken around London to explore the WiFi network territory. When shut, 2 ports accessible on the outside let the user tune into the network with an antenna and hear its raw sounds with headphones. When open, a set of peripherals (stored in the bottom half of the flight-case) can be connected to 6 ports built into an operational panel (located on the other half), letting the user perform the network space.

Building on the software developed for the early TR 802.11 virtual experiments, we developed NE.app, a software tool for the capture and analysis of network data. Sitting at the hearth of the operational panel, NE.app collects as much WiFi packets from the local networks as it can. Upon receipt it categorises them according to their intent and transforms them into an electrical pulse, which is transmitted to the ports on the operational panel. Each port corresponds to a slice of the network: structure, gatekeeping, communications, data, broken and unknown.

The peripherals sonify these network slices. When plugged into the ports, they translate the electrical pulse into a digital sound, a mechanical tap, and so on... The peripherals are various in shape, scope and configuration: an antenna, a set of speakers, a series of solenoids, to name a few. Together, they form an autonomous orchestra which plays the network data live onto its physical surroundings, allowing serendipitous and distorted soundscapes to be uncovered by a user, whether performing or exploring. It is this horizontal relationship between machine and human that we dubbed “Network Ensemble”.

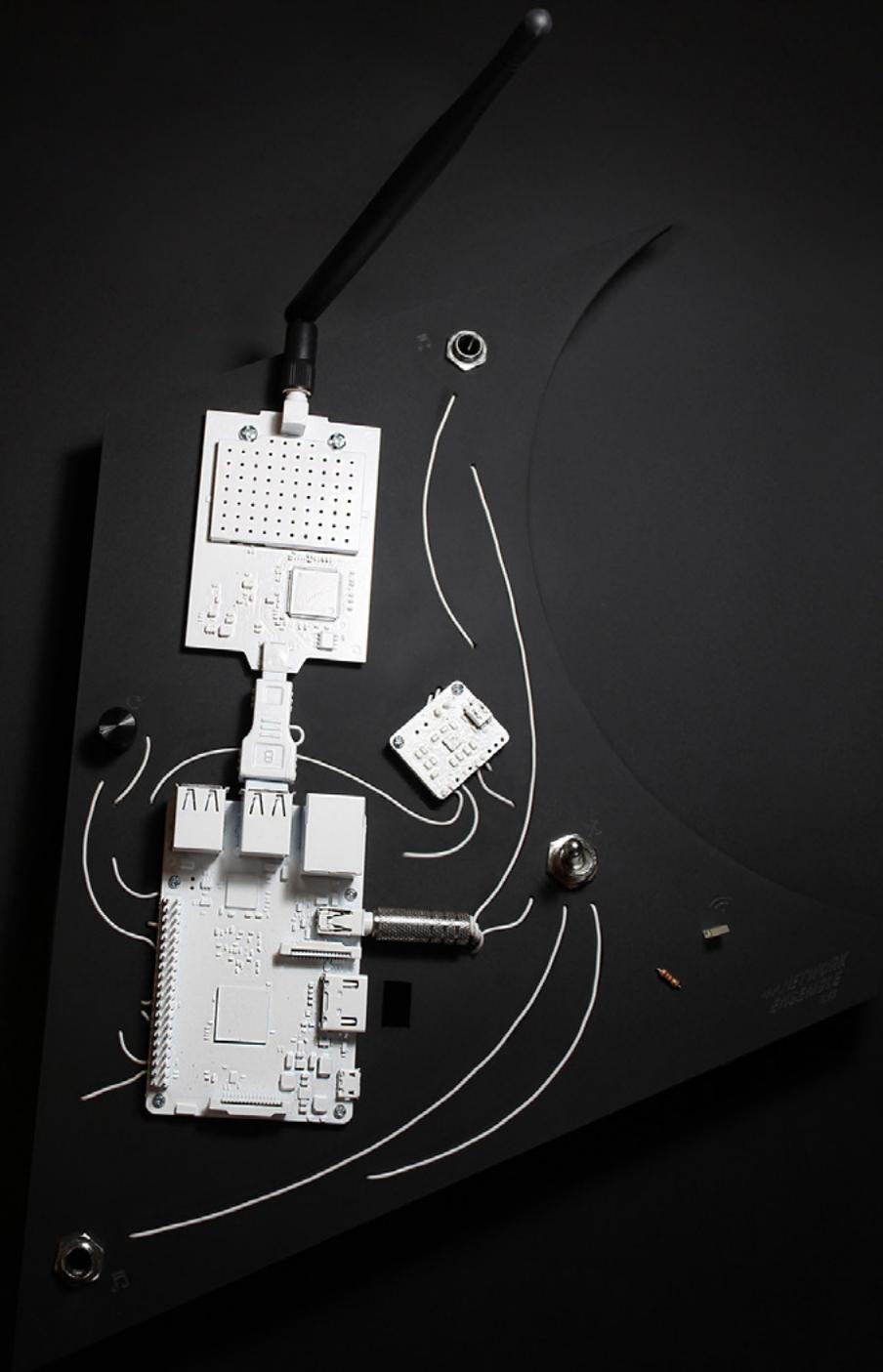


A second machine, made in part with steel, was exhibited at the Royal College of Art Show 2015. Intended as a stable rather than portable device, the peripherals sat around it — not needing to be stored in the flight-case, which now featured a panel with a built-in antenna. Two more peripherals were added: a MIDI keyboard, stuttering ambient noise and bursting into life as the network picked up pace; and a Super 8 projector, hacked to advance a frame of the Micky Mouse animation The Band Concert only when it received a network packet - the conductor of this ensemble.

A third machine, the NE3, was built in 2017. NE3 is a compact board which uses a stripped down version of the NE.app employed in previous Network Ensemble experiments to receive packets on all networks local to it and convert their content into sound as directly as possible. A single knob on the top-side of the board allows control of the speed at which the network data is transformed, ranging from high speeds, staying true to the intense nature of the WiFi, to low speeds, making it possible to identify patterns in the noise or investigate the sonic character of a particular slice of the network. Two jack ports allow for the connection of audio equipment for sonic manipulation and performance. As a base, the NE3 has a surface transducer which turns nearly any surface into a speaker.

Originally conceived as a drum machine to amplify the activity of network landscapes, the Network Ensemble is now a free-form and ever-changing set of tools and experiences for sonically uncovering the hidden operational layer at the very core of the network. Since 2015, we have performed as part of the ensemble, under this moniker, in a number of locations across three countries. We have also used the machinery to study wireless networks, exploring physical and network territories, creating audiovisual work from our findings.

Some of this sound and video work is released for the first time through *Selected Network Studies*.



6 Glossary

Network

A large system consisting of many similar elements that are connected together to allow communication between each part (often via one or more control nodes). For the purpose of this release, the Network refers to the infrastructure underlying the Internet, and specifically the wireless transmission of it.

It is viewed as a ubiquitous, multi-layered and immanent assemblage which can be read as a consequential infrastructure space of its own, exerting control and shaping flows of power

Ensemble

A group of things or people acting/taken together as a whole, often in a musical sense.

WiFi

A system and technological protocol for connecting electronic equipment to the Internet or allowing mutual communication without using wires and within a spatially limited area.

Device

For the purpose of this release, device is intended as electronic equipment exchanging packets with other equipment across a local wireless network (WiFi).

Packet

A unit of data transferred over a network. The network may be wireless or physical.

Packet sniffing

Software or hardware that can intercept and log traffic that passes over a network. All Network Studies included in this release were created with software and hardware performing packet sniffing, specifically NE.app and NE3.

Packet category

Networks make use of different types of packet to achieve all necessary communications. For the Network Studies, captured WiFi packets are categorised as follows

Infrastructure / Structure

The structural level of the wireless technology: packets that organise the network.

Gatekeeping

Management of network access: packets that aid data exchange between devices.

Oversight / Communications

Packets responsible for the meet and greet of devices.

Content / Data

Carried data: messages, images, videos. Packets transmitting the user's media.

Broken

Corrupted and null packets: packets that may not reach their destination.

Unknown

Everything else. The ghosts in the network: unusual, very rare or non-standard packets.

NE.app

A software tool for the capture and analysis of network data, NE.app uses the WiFi card in a laptop to collect as many packets from all local networks as it can (a practice known as packet sniffing). Upon receipt it categorises them according to their intent and to the layer of the network in which they sit.

The resulting transcript of network activity can then be either saved as a score for later playback, or used live to control audiovisual output when performing. Using the WiFi card embedded in a laptop also allows for covert data collection in locations with a higher level of security and scrutiny, such as airports, planes or embassies.

NE3

A network instrument, a compact board which captures and dissects the network, turning it into a source of data-noise. Using a stripped down version of the NE.app employed in previous Network Ensemble experiments, NE3 operates as a noise source for performance of the network space [see *Network Study XII—XIII*].

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STUDIES



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