# SENSING DOMESTICITY

Research Plan
2021-2022

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AR3A010 Research Plan
for Explore Lab

2.4 GHz

# TABLE
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# SENSING DOMESTICITY

"Our interaction with architecture is mediated through a vast universe of sensors and controlling devices."
Evangelos Kotsioris, "Sensing Architecture", Perspecta, The Yale Architectural Journal 51 (2018): pp. 227-243, 227.

*Sensing*

The photoelectric sensors of doors, the ambient light sensor of a computer, the ionization chamber of a smoke detector, the night-vision cameras and microphones of a home alarm system, the temperature sensor of a 'smart home' thermostat, all unconsciously compose our daily interactions with the built environment. These encounters are a continual negotiation with large networks of interconnected electronics that can detect human presence, 'tell' how heavy something is, 'smell' fire, 'see' in the dark, 'hear' sounds, and 'feel' the temperature of a space. All of these sensors continuously monitor and adjust our environment for us. The operation of our homes is no longer imaginable without them.[1] Sensing architecture is literally all around us, but there is a lack of an architectural understanding of it:

The architectural discipline lacks a media study approach and an understanding of the technical systems we are embedded in and know or 'see' the world with. These systems can turn out to have more agency on space than we realize: In the digital age, we are surrounded by both invisible systems of radio signals or microwaves, and their visible manifestations in cell towers, satellites, wireless access points, controlling devices and sensors. The latter are the material infrastructures we depend on to navigate in the new world, or as Marshall McLuhan famously described media - a "nervous system" that connects the different points of a territory and allows the circulation of information.[2] Further, he regarded this nervous system as extensions of our human senses that "work as environments". But in the era of "electric drama", he argued,

PROBLEM
STATEMENT

1 Evangelos Kotsioris, "Sensing Architecture," Perspecta 51, The Yale Architectural Journal, 2018, pp. 227-244, 227.

2 Marshall McLuhan cited in Francesco Casetti, "Mediascapes: A Decalogue," Pespecta 51 The Yale Architectural Journal, 2018, pp. 21-43, 27.

the "really total and saturating environments are invisible. The ones we notice are quite fragmentary and insignificant compared to the ones we don't see."[3]
Being prostheses and externalizations of the human sensing body, sensors perceive as 'living beings' their material environment in very distinct spectral ranges. Most of these spectral ranges lie exterior to the human ranges of perception and thus seem to us invisible. Nevertheless, sensors are capable of sensing these humanly imperceptible realities (signals) and every signal can, in turn, be translated into an image, which can produce a deeper understanding of our environment and the ecologies of human and machinic entanglements.[4]

*Domesticity*

The domestic space has progressively become a mediascape. This new networked reality, into which our domestic spheres advance, lies in stark contrast to the traditional concept of the home as an intimate, secluded and sheltered space. Especially in the recent period of isolation, the home has taken on a new meaning, challenging the physical frame of the dwelling as it expands the outline of the built space, constantly roaming through spatial temporalities. Thus, the domestic may no longer be captured sufficiently by conventional architectural means - the section, the floor plan or the elevation - but continuously changes both virtually and materially in scale, form and agenda. It is always *becoming*.

*Becoming*, on the one hand as a constant negotiation of boundaries that are reset by each connection to an invisible spectral territory and its visible planetary infrastructures:
The temporary occupation of a frequency when transmitting the command to buy a new pair of shoes online. A glass fibre cable, "thin as a hair, long as an ocean", that, for the fraction of a second, binds together our home with a friend's dwelling on another continent.[5]

*Becoming*, on the other hand in relation to a subject's perception of its environment and the state of 'feeling (at) home'. It has to be acknowledged that the home is not something that can be planned to be, but only to become. Thus 'home' never is a fixed state but a state of becoming: A house is first of all not a home, but a foreign place. Only by the means of configuration (with materialities and immaterialities), a relationship to one's environment can be established and a place can become home and felt like home. This feeling is not necessarily bound to any scale:

3 Marshall McLuhan, "The Invisible Environment: The Future of an Erosion," Perspecta 11 The Yale Architectural Journal, 1967, pp. 161-167, 164.

4 "Everything that exists as a signal can also exist as an image." Jussi Parikka, "On Seeing Where There's Nothing to See," in Photography Off the Scale: Technologies and Theories of the Mass Image. Technicities. , ed. Dvorak Tomas (Edinburgh: Edinburgh University Press, 2021).

5 World Brain, Arte, 2017, https://www.arte.tv/de/videos/050970-001-A/world-brain/. min. 04:40

One can feel 'at home' in a city, a neighbourhood, a street, an institution, a house and first and foremost in one's body. It is ultimately the body, that mediates between our environment and us. It senses change constantly and reacts accordingly - just as every other sensor that is implemented in our technological devices.

Therefore, it becomes important to critically examine the relation of the human body to its sensing environment to understand their mutual interaction that may contribute to 'automating' the state of feeling at home.

It becomes clear that a new way of reading, understanding and visualizing the contemporary domestic condition is required, superseding the home as a cultural construct and acknowledging it as part of a dynamic process of constant change. In this regard *Sensing Domesticity* raises the question: *What new spatial articulations of domesticity can be achieved when domestic sensors are instrumentalised as mapping tools, and thus liberated from their background role and integrated directly into the design process?*

RESEARCH QUESTION

Since "virtual environments - {defined by sensors and systems} - became the new site of architecture", a technological understanding within the architectural discourse must be manifested.[6]

This work feels the urge to explore, visualize and retool the interrelations of 'spectral topographies' - a term coined by designer and researcher Sophie Dyer - and the environments they compose. In her research, Dyer aims to shift the focus from familiar structures and bodies that populate space to their electromagnetic radiation and infrastructural traces: We are unable to experience the dense and codified electromagnetic milieu they create, yet they shape and are shaped by the material worlds we inhabit.[7]

THEORETICAL FRAMEWORK

In her book *Enduring Innocence*, architect Keller Easterling labels this vast occupation of the spectrum (mostly in the range of microwaves) as 'c-band urbanism'. With 'c-band', she refers to a set of frequencies that were formerly reserved for satellites but are now utilized by nearly every smart device. While Easterling's c-band urbanism is a way to grasp the spatial dimension of this media phenomenon on the urban scale, *Sensing Domesticity* will question its impact on the definition of the domestic.[8]

Doing so, the project will try to find a dialogue between Marshall McLuhan's approach of understanding media - as the extensions of the human sensing body - and Jussi Parrika's concept of media as extensions of earth.[9] [10]

6  Evangelos Kotsioris, "Sensing Architecture", Perspecta 51, The Yale Architectural Journal, 2018, pp. 227-244, 232.

7  Sophie Dyer and Eline Benjaminsen , "Spectral Topographies", Migrant Journal 2 (2018): pp. 34-47.

8  Keller Easterling, Enduring Innocence (Cambridge , MA: The MIT Press, 2005).

9  Marshall McLuhan and Louis H. Lapham, Understanding Media - the Extensions of Man (Cambridge , MA: MIT Press, 1994).

Media technologies should be considered in the context of geological processes, from the process of formation and transformation to the movement of natural elements from which media are built. Viewing media and technology as geological processes allows us to consider the profound depletion of the non-renewable resources needed to fuel the technologies of today's "home".[11]

10  Jussi Parikka, A Geology of Media, vol. 46 (Minneapolis: University of Minnesota Press, 2015).

11  Kate Crawford and Vladan Joler, "Anatomy of an AI System," Anatomy of an AI System, accessed October 14, 2021, https://anatomyof.ai/.
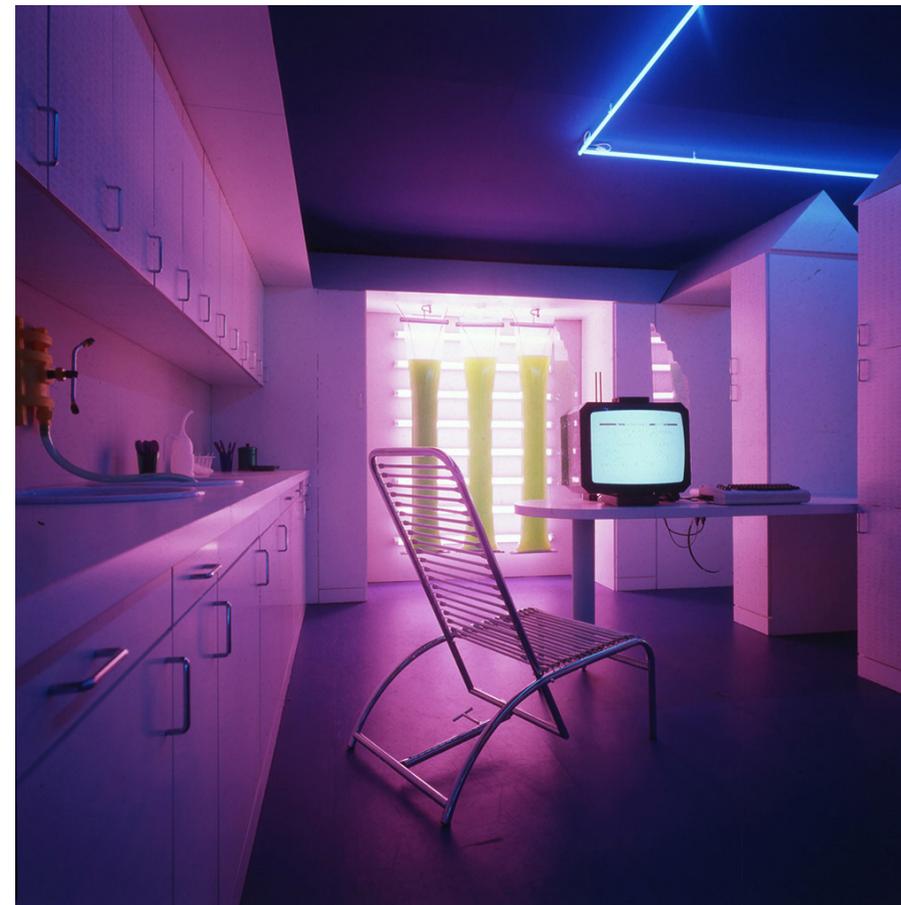


FIG 1 La Casa Telematica 1983, Ugo La Pietra

FIG. 2 FIG. 3 Home?
Radio towers photographed by
Eline Benjaminsen for the article
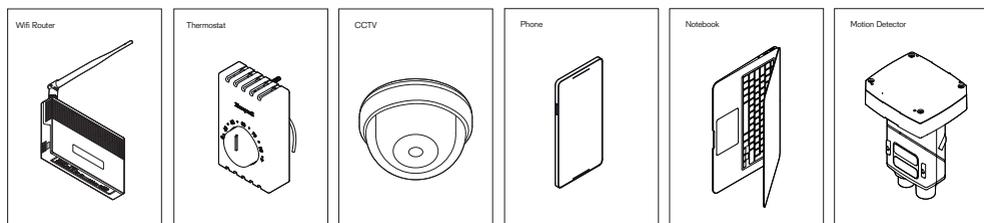*Spectral Topographies* for the
Migrant Journal

SENSING DOMESTICITY

*Investigatory Approach:*
*De-coding, Trans-coding, Re-coding*

To answer the research question, domestic sensors are to be transformed from agents of the 'problem' to tools of the research method, following three steps of *De-coding*, *Trans-coding* and *Re-coding*. While the main focus of *De-coding* is on investigating and understanding the posed problem, *Trans-coding* and *Re-coding* translate the research outcome into a design.

*De-coding*

Firstly, a selection of meaningful domestic sensing objects is made. Each object's configuration is to be understood at a technical level, by dissecting it into its rudimentary parts and analysing the stages of the sensors' process and feedback loop. Questions: *Which objects are relevant for redefining a contemporary domestic condition? Which sensors are integrated into the object? How are they interconnected and may incorporate domestic notions of security, comfort or connectivity?*



Secondly, each documented sensor is examined in relation to its material properties and the material system it connects to, looking at different scales. Questions: *What kind of material systems are the object's sensors embedded in? What are the extensive maps one can retrieve, from small to planetary scale? Finally, how can we rethink material properties and their effect on the scale of architectural elements?*

FIG. 3 Step 1 of De-coding: A selection of meaningful domestic objects equipped with sensors.

Thirdly, the sensor is instrumentalised: it is allowed to act as it 'naturally' would within a specific domestic case study, passively sensing the interior. All of the sensor's gathered data is then collected and scrutinised. Questions: *What does the object sense? On which spectral ranges does it communicate? How does it 'see' or 'speak'?*

Fourthly, the performance of the sensor is interpreted and translated into an intensive model. This act of interpretation detaches itself from technicalities, but instead, manifests itself as a subjective model that narrates the sensor's 'lens' of interpreting the 'interior'. Questions: *What kind of intensive models can one create? What kind of intensive cartographies can visualize the studied 'language'?*

This translation from the 'technical' to the 'humanly perceivable' (de-coding) requires the construction of a 'model' in its broadest sense (that can take form as a drawing, performance, representational object, etc). By freeing this model from preset parameters of what it should be, it adapts to each sensor accordingly, in which different materials and mediums will lead to tactically contextual and materially expressive interpretations.

*Trans-coding*

The steps of de-coding will be repeated for a number of objects and their identified sensors.
In an act of trans-coding, the afore-mentioned 'model' is now passed through a thought experiment that juxtaposes it with a respective domestic activity, or program - forming small design interventions and bridging the research to the design phase.
This research will result in a catalogue of domestic conditions, that will together with the use of literature contribute to a renewed notion of domesticity.

This exercise opens up a way to understand and locate machinic processes as different registers of knowing the world, and not as some opposite ends to a spectrum that responds to our human-centric understanding of intelligence. This is more an attempt to understand multi-sensorialities together in the ecologies they become.

*Re-coding*

Entering the design phase (*Re-coding*), the different domestic conditions will be related and integrated into a certain context to finally produce a new vision of contemporary dwelling. Doing so, we will embrace the idea of dwelling as a network, creating transitional spaces and positioning them between the house and the city, the private and the public, the physical and the virtual.
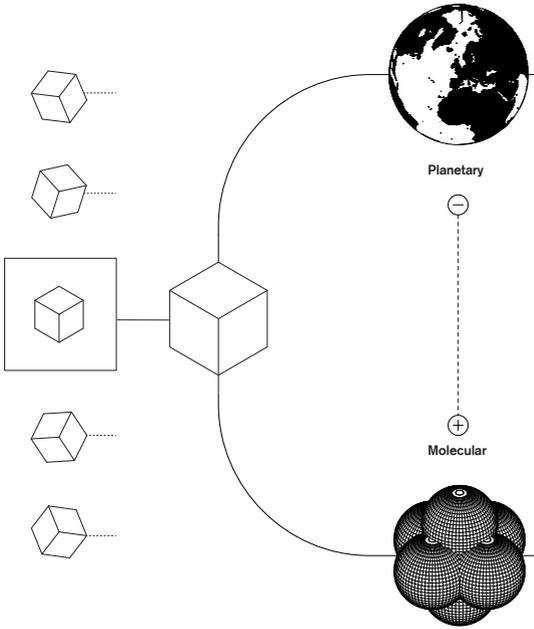
P1          P2          P3          P4   P5

## 0. Objects

Which objects are relevant for redefining a contemporary domestic condition? Which sensors are integrated into the object? How are they interconnected and may incorporate domestic notions of security, comfort or connectivity?

## I. Scale

What kind of material systems are the object's sensors embedded in? What are the extensive maps one can retrieve, from small to planetary scale? Finally, how can we rethink material properties and their effect on the scale of architectural elements?

## II. Language

What does the object sense? On which spectral ranges does it communicate? How does it 'see' or 'speak'?
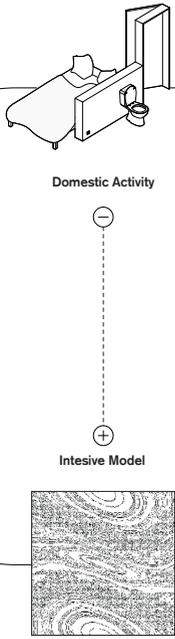
## III. Intensive Mapping

What kind of intensive models can one create? What kind of intensive cartographies can visualize the studied 'language'?
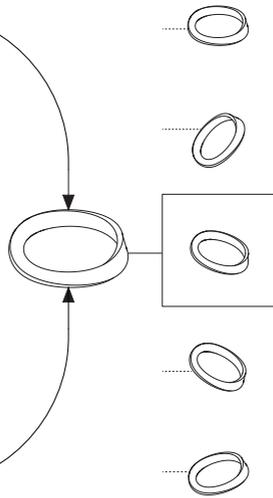
## IV. Design Interpretations

In an act of trans-coding, the afore-mentioned 'model' is now passed through a thought experiment that juxtaposes it with a respective domestic activity, or program - forming small design interventions and bridging the research to the design phase.

## V. Design

Entering the design phase (Re-coding), the different domestic conditions will be related and integrated into a certain context to finally produce a new vision of contemporary dwelling.
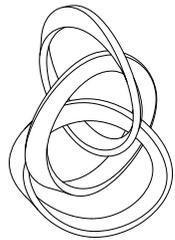
Hz

**Planetary**

⊖

**Molecular**

⊕

**Domestic Activity**

⊖

**Intesive Model**

⊕

Hz



FIG. 4 Diagram of Research Structure

Antenna Dipole
in Home Wifi Router

1 Coax cable
2 Copper cable
3 Aluminium tube
4 Plastic spacer

Each half of the dipole is a 1/4 wavelength,
with the length corrected based on the velocity
of the coax being used. Assuming a centre
frequency for 802.11b of 2.44 GHz, a 1/4
wavelength in free space is 30.7mm.
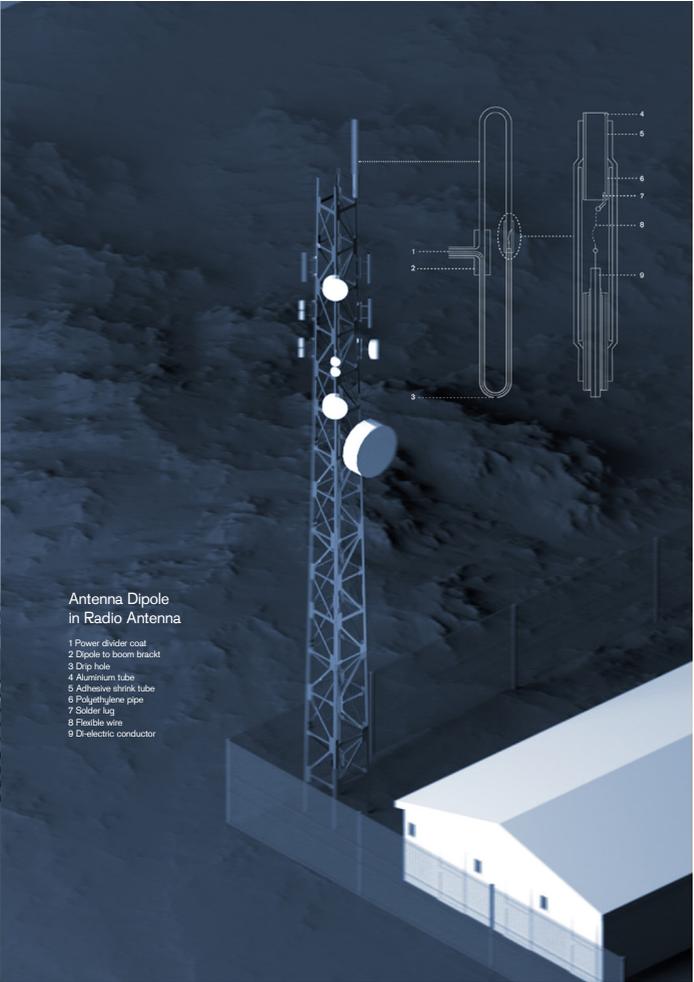
Antenna Dipole
in Radio Antenna

1 Power divider coat
2 Dipole to boom brackt
3 Drip hole
4 Aluminium tube
5 Adhesive shrink tube
6 Polyethylene pipe
7 Solder lug
8 Flexible wire
9 Di-electric conductor

FIG. 2 De-coding the Wifi Router:
Material comparison of the
small scale home wifi rooter
and its antenna to the big scale
radio antenna it connects to.

FIG. 5 The research outcome
in the form of a catalogue will
compile the traced "domestic
conditions". Here: De-coding of
the home wifi router.

*Pedagogical Approach:*
*Negotiating the three*

Teamwork is seen as the pedagogical method to not only increase the quantity but more importantly the quality of the work: as an enrichment of complexity in the thought and design process. We will leave the echo chamber of a self-reflective hermetic way of thinking and dive into a negotiation between the three of us, constantly challenging the research topic: by explaining and debating individual ideas as well as reformulating and agreeing on common ground.

In this sense, we depart for and eventually return to a collective field of investigation, that is constantly reviewed with three different lenses, claiming their own area of expertise: the technical (a.), theoretical (b.), and representational (c.) lens, that will together and in negotiation form a full picture. A dynamic glossary which can also be found in the appendix of this research plan will help to exchange, clarify and nuance key terminology.

a. technical lens

The technical lens applies a media archeological approach inspired by Jussi Parikka's concept of media as extensions of earth.[12] It traces the sensor's incredibly large planetary technology and addresses the concept of domesticity within different material scales and their affordances.

b. theoretical lens

The theoretical lens questions the impact of sensors on the human body following a media-ecological approach. As "the extension of any one sense alters the way we think and act—the way we perceive the world", this lens tries to debate the meaning of a sensing domestic environment for the human body, and the becoming of a 'feeling of being home'.[13]

c. representational lens

The representational lens tries to find appropriate interpretations of the data gathered by sensors to develop ways of representing intensive processes. It stresses the importance of representation as a reflective tool - a medium that needs thorough attention itself.

RESEARCH
METHOD II

12  Jussi Parikka, A Geology of Media, vol. 46 (Minneapolis: University of Minnesota Press, 2015).

13  Marshall McLuhan and Quentin Fiore, The Media Is the Massage (Berkeley, California: Gingko, 2001).



FIG. 6  "Three Lenses" investigating the new domestic condition;
La Casa Telematica 1983, Ugo La Pietra

"The limits of my language mean the limits of my world."
Ludwig Wittgenstein, Tractatus Logico-Philosophicus (1921),
trans. Charles K. Ogden and Frank P. Ramsey  (New York, NY:
Harcourt, Brace & Co., 1922), 149.

Sensing Domesticity will, within its (time) limitations, form a catalogue that will serve as a methodological example of how sensing devices can be understood in resonance with our domestic environment - to be able to incorporate them into the design process. The point is neither to glorify technology nor to demonize it. It is about looking at humanity and technology in an ever-existing co-evolution and understanding technicities in this regard. With the increasing atomization of technological objects and sensors, they continuously step out of our field of vision and language - interfaces become ubiquitous and thus unconscious. We need to distance ourselves from being mere users to be able to understand the systems we are embedded in and to eventually hack them.

Inspired by Stewart Brand's *Whole Earth Catalog*, which was conceived as a catalogue of tools, we seek operational means to achieve individual "independence" and to be able to better read and shape domesticity in a technological environment.[14] The electro-magnetic milieu and its territorial anchors are thus to be opened up as an architectural planning field. The steps of *De-coding*, *Trans-coding* and *Re-coding* are the method that help us to navigate through and demystify the encoded space of investigation, the "infosphere". The infosphere is also understood as an 'atmosphere' with different ambient layers, as light or temperature: If these are translated - transcoded - into our perceptual spectrum they can be actively included in the design of humanly perceptible, spatial atmospheres.

The attempt is made to overcome the limits of our language and to make ourselves related to another language -  to learn how to read and write it spatially.

OUTLOOK AND
REFLECTION ON
RELEVANCE

14  Stewart Brand, Whole
Earth Catalogue, 1968.

SENSING DOMESTICITY

SENSING DOMESTICITY

# GLOSSARY

A dynamic glossary is used to share and nuance terminology important to the project. It is continously extended during the research phase and is thus part of the pedagogical research method. Quotations aim to provide apt definitions.

## // becoming
In Manuel DeLanda's lecture on *Extensive and Topological Thinking,* we understand that everything is constantly becoming - at different speeds. The different speeds of becoming define a rate of change.[15] Different speeds of becoming further give apparent stability to the things around us, whereas their rate of change can be translated to our consciousness by representational means.
● see also **model**

## // c-band urbanism
We may not be aware of its pervasiveness, yet we live in the era of 'c-band urbanism'. In 2005, architect Keller Easterling invented the phrase to characterize the vast 'microwave' sphere that has invaded 21st-century landscapes. C-band is a set of frequencies that were formerly reserved for satellites but are now utilized by nearly every smart device.[16]

## // ecology
● see **media ecology**

## // electromagnetic spectrum
is the entire range of wavelengths or frequencies of electromagnetic radiation extending from gamma rays to the longest radio waves and including visible light. (via Merriam Webster)

## // extensive
● see **intensive**

## // hertz
In the SI (Système International d'Unités), Hertz is the unit of frequency equal to one cycle per second.

## // infosphere
is a term described by artist and designer Richard Vijgen as "an interdependent environment, like a biosphere, that is populated by informational entities. While an example of the sphere of information is cyberspace, infospheres are not limited to purely online environments."[17] The Infosphere is not only a technical issue but an immanent spatial and geopolitical issue, as Georg Vrachliotis discussed with Peter Weibel, director of the ZKM (Center for Art and Media in Karlsruhe) in an Interview for Arch+ Project Bauhaus in 2019.[18]

## // intensive
While extensive quantities (such as volume, area, length, amount of energy or entropy) are additive, intensive quantities are not. In Manuel DeLanda's text *Space: Extensive and Intensive, Actual and Virtual* he refers to intensive spaces as the site of processes which yield as products the great diversity of extensive spaces. "Indeed, it may be argued, wherever one finds an extensive frontier (e.g. the skin which defines the extensive boundary of our bodies) there is always a process driven by intensive differences which produced such a boundary (e.g. the embryological process which creates our bodies, driven by differences in chemical concentration, among other things.)"[19]

## // mediascape
Francesco Casetti writes in *Mediascape: A Decalogue*: "When a medium is intimately integrated into a space, or when it constitutes a prominent presence within it, we may consider this space to be a mediascape." He borrows the term from Arjun Appadurai, who defines it as a concentration of tools for communication and expression in a world dominated by flows.[20]

## // media archeology
"Media history conflates with earth history; the geological materials of metals and chemicals get deterritorialized from their strata and reterritorialized in machines that define our technical media culture.", writes Jussi Parikka in *Media Geology*.[21] Francesco Casetto adds in *Mediascape: A Decalogue*: "Media archeology is interested in retracing the long history of a technological device: it identifies borrowings and debts, ancestors and lost relatives, a possible lineage and the creation of new families."[22]

## // media ecology
In his article *Mediascape: A Decalogue*, Francesco Casetti describes media ecology as complementing media archeology. ● see media archeology
He further states that Media Ecology focuses on "media as components of an environment or as environments as such. Media are not defined on the basis of identities that are stable regardless of the space they occupy, but media are identified by the positions they occupy in a space, and by the articulation or re-articulation they produce within a space."[22]

## // milieu
The electromagnetic milieu can be understood as an ecology of different frequencies, and is thus different from the indexical spectral understanding.

## // micro wave
Microwave frequencies span from 300MHz to 300 GHz in the electromagnetic spectrum. Their wavelengths range from one meter to one milllimetre. The wifi router communicates with 2,4GHz and 5GHz bands that fall within the microwave range.

## // model
The 'model' is seen as a reflective tool within the whole graduation project: It helps to translate the 'technical' to the 'humanly perceivable'. It can take form of a drawing, performance, representational object, etc. By freeing this model from preset parameters of what it should be, it adapts to each 'sensor' accordingly, in which different materials and mediums will lead to tactically contextual and materially expressive interpretations.

## // negotiation
1. Negotiation as pedagogical method: We, as a team, depart for and eventually return to a collective field of investigation, that is constantly reviewed with three different lenses, claiming their own area of expertise: the material, theoretical, and representational lens, that will together and in negotiation form a full picture. This glossary serves as site of exchange to form a common set of vocabulary.
2. Negotiation in the radio spectrum according to Sophie Dyer: „In a new material politics of radio negotiation is understood as more-than-human: it cosmic, legal, economic and techno-scientific process. Each frequency makes different demands. To give an example, negotiation at 2.4 GHz takes place at the level of individual devices. According to the IEEE 802.11 collision avoidance protocol, a Wi-Fi router will not 'talk' if another device is 'talking'. If two routers begin 'talking' at the same time, they will both wait a random amount of time until 'talking' again."[23]

## // radio wave
Radio waves are defined as electromagnetic waves in the range of 30 hertz to 300 gigahertz corresponding to wavelengths of 1,000 kilometres and 1 millimetre.

## // representation
● see **model**

## // spectrum
The electromgnetic spectrum is distinct to the electromagnetic milieu. The spectrum codifies an ecology of frequencies.
● see also **milieu**

(...)

15  Manuel DeLanda, "European Graduate School Video Lectures," European Graduate School Video Lectures, (2011), https://www.youtube.com/watch?v=0wW2I-nBlDg.

16  Keller Easterling, Enduring Innocence (Cambridge , MA: The MIT Press, 2005).

17  Richard Vijgen, "Architecture of Radio," Architecture of Radio, 2016, http://www.architectureofradio.com.

18  Georg Vrachliotis and Peter Weibel, "Open Code 'We Will Experience an Uprising to Reclaim Our Data,'" Project Bauhaus: Can Design Change Society?, 2019, pp.146-151.

19  Manuel DeLanda, "Space: Extensive and Intensive, Actual and Virtual," in Deleuze and Space (Edinburgh, UK: Edinburgh University Press, 2005), https://edinburgh.universitypressscholarship.com/view/10.3366/

20  Francesco Casetti, "Mediascapes: A Decalogue," Pespecta 51 The Yale Architectural Journal, 2018, p. 26.

21  Jussi Parikka, A Geology of Media, vol. 46 (Minneapolis: University of Minnesota Press, 2015), p.34.

22  Francesco Casetti, "Mediascapes: A Decalogue," Pespecta 51 The Yale Architectural Journal, 2018, p. 42.

23  Sophie Dyer, "0 Hz – 300 GHz*", 2021, http://www.interference.space/Almanac.

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