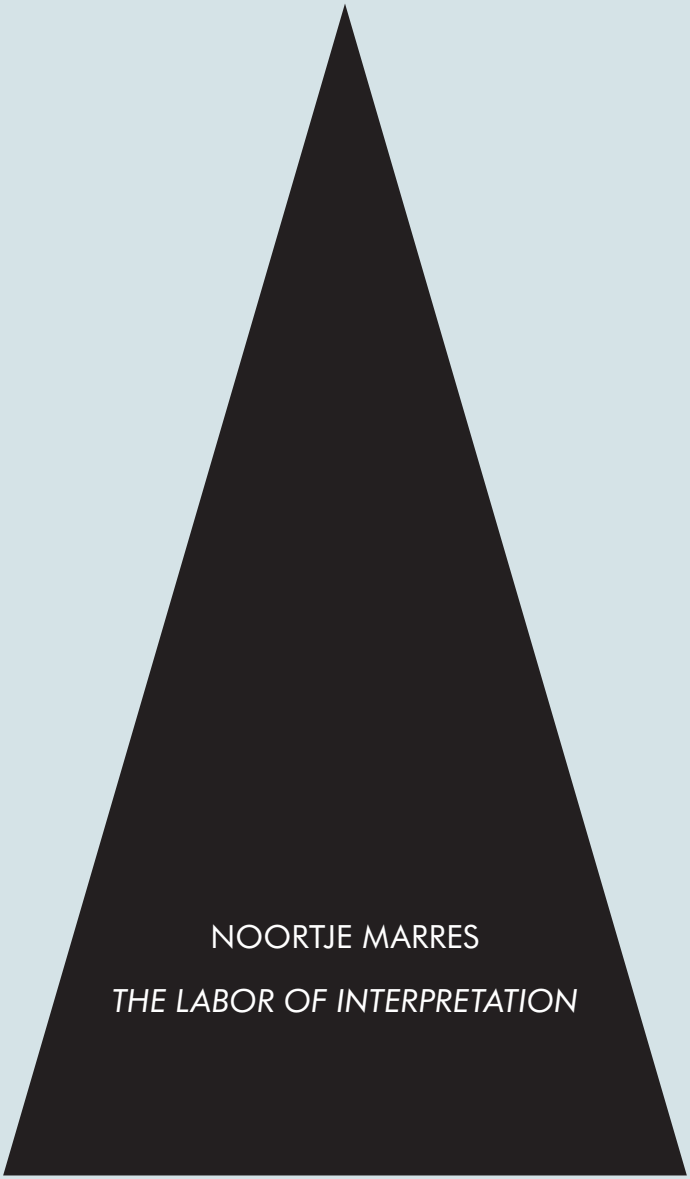

NOORTJE MARRES
THE LABOR OF INTERPRETATION

This contribution features three seemingly ordinary objects that support the technical, social, material, and personal work of digesting climate change through quantification. Each of the artifacts featured—teapot, seeds, car-engine circuit board, etc.—is in some respect mundane: we live in intimate proximity to them; they are part of the fabric of everyday life. But these objects also share an exceptional capacity: they contain traces of the vast, complex problem that is atmospheric pollution, and as such, they are able to provide insight into the "slow disaster" that is the degradation of the air, the environment, and the soil—and may help to problematize the part we all play in it.

It is often assumed that knowing climate change requires a vast machine, a complex techno-scientific system that includes Earth system simulation models, globally managed weather stations, integrated satellite networks, and large computational laboratories needed to process all the data, run the simulations, and then attempt to integrate the two. Few of us are immune to the fascination with this vast machine, but many recognize that something else is required too, if knowledge of climate change is to take hold—on a personal, institutional, and societal level. To really know climate change, we must become more intimately acquainted with it, we must grasp it as something that touches our lives, as something that is happening *inside* the air we breathe, the appliances and energy we use, and the plants growing everywhere. In other words, to achieve an interpretation of climate change, we must engage in "digestive work": the knowledge of climate change must somehow pass through our bodies. Each of the artifacts assembled here has the special, valuable capacity to support this "digestive" work.

The double quality of the artifacts—teapot, seeds, car part, etc.—the way they are both ordinary thing and archival datum (object), is critical to their ability to facilitate the labor of interpretation of climate change. As archival objects, they contain the traces of vastly distributed, problematic processes stretching across times and spaces, which are millions of times longer and bigger than they are themselves. As mundane objects, they remind us that everyday environments, habits, bodily movements are NOT removed from these processes, but are among the very settings in which they play out.

In this respect, it would be wrong to think that to understand climate change we must somehow "add" warm feeling to cold mathematic reasoning. Rather, as stated above, we must let knowledge pass through our bodies. These objects, then, do not merely support abstract knowledge of the changing atmosphere, soil, and climate; they also raise the social question: How do we live WITH global warming, with carcinogenic NO_x emissions, with digitally enhanced, "semiautonomous" cars and power plants that change their behavior without telling us? Crucially, moreover, they suggest that this social question is not the opposite of a technical question: the technical labor of data interpretation is at the very same time the intimate labor of letting the world—tea, NO_x, seeds, etc.—pass through our (collective) bodies.

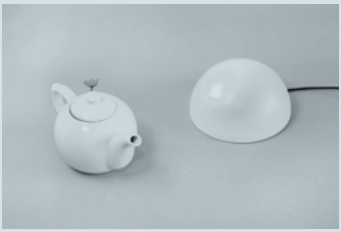
There is no routing around issues of measurement: we need to pass through technical matters to get to the social question. Equally, there is no routing around the intimate issue of how we digest knowledge as part of social life, that is, if we are to take on the scandal of the ongoing, routine, but life-threatening degradation of our environments.

THE ENVIRONMENTALLY AWARE TEAPOT

The Tea Light is an experimental prototype that presents a way to realize "intelligent" energy-use both at home and at work. It foregrounds an everyday practice ("making tea"), and shows how it is possible to take into account "the environment" as part of such everyday activity.

The teapot's interface tells its user about the constantly changing composition of the current energy supply: when dirty energy sources—such as coal-fired power plants—are switched on across the grid, the tea light turns red ("now is a bad time to make tea"). When the orb glows green, there is less carbon-intensive energy available.

Known as a technology for "responsive energy demand," this tea light is special insofar as it includes an environmental signal in the user interface. An early prototype of this tea light technology was developed in 2009 in a place called the Hub, a community center in London. Today, virtually all large energy companies in the UK support some form of dynamic demand management, but they have largely rejected the idea of using so-called "smart" electricity meters to communicate emission-related data to users. The only responsive social mechanism their smart grids acknowledge remains that of the price of energy (£), upholding an old, highly un-innovative, consumptive model of society.



▲ Chris Adams, The environmentally aware teapot, London 2009

PALEOBOTANICAL SEEDS AND FOSSIL LEAVES[1]

These seeds are small enough to hold in your hands, and indeed, you could almost step on them, but they are also millions of years old and, what's more, they contain intricate records of the changing climate.

Paleobotanists can deduce past climate states (weather patterns) from these fragments of plant matter. The Mastixia is a tree, the seeds from which were found in brown coal layers in East Germany, which means the region must have been warmer about ten or twenty million years ago as today Mastixia only grow in South East Asia.

And it is not just seeds that lead this double life as plant matter and geological record, so do other parts of plants, like leaves, such as these leaf fossils (*Credneria denticulate*) that were found in central Germany near the Harz Mountains. Large and round, these, too, suggest that the climate was warmer in this region about eighty million years ago than it is today.

Paleobotanists date these plant materials by analyzing the layer of the earth where they were found, looking in particular at the mineral and fossil content.

However, the seeds and leaves are not alone in leading a "second life" as historical records: so does the apparatus for the interpretation of Paleobotany. Drawers of index cards accompany these paleobotanical objects from the Museum für Naturkunde in Berlin, showing us layers of archival writing, reminding us that the apparatus for the interpretation of paleobotanical objects equally changes over time, offering a historical record of our knowledge cultures.

Indeed, plant fossils have not always been appreciated as instruments of climate science, and we may

1 With many thanks to Tahani Nadim for her invaluable suggestions, and to Barbara Mohr for sharing her knowledge.

measure changes in our knowledge cultures—our "epistemic climates"—by following the writing on these index cards from across the decades. They remind us that knowing is something we do with our hands, our bodies, and not just our brains.

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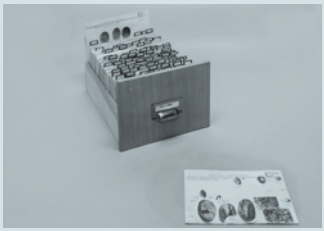

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▲ Ganitrocera persicoides – Miocene – Klettwitz, Germany; Mastixicarpum crassum – Miocene – Altenburg, Germany; Mastixicarpum cacaoides – Eocene/Oligocene – Haselbach, Germany; Mastixicarpum cacaoides – Miocene – Regis, Germany; Credneria denticulate – late Cretaceous – Quedlinburg, Germany

▲▲ Credneria denticulate – late Cretaceous – Quedlinburg, Germany

▲▲ Card index box A of the paleocarpological collection (Coll. D. Mai), Berlin

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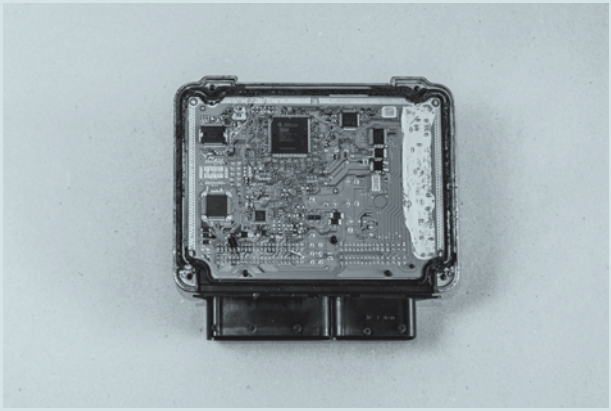
VOLKSWAGEN ENGINE CONTROL UNIT

An object sits at the heart of Dieselgate, the emissions violation scandal that engulfed car manufacturers in 2015: the Engine Control Unit (ECU). On it runs a piece of software publicly known now as a "defeat device."

Most cars are equipped with ECUs today, but this particular model is capable of cheating on emissions tests, and currently sits in an estimated eleven million cars. It is able to detect when the car in question is being driven under so-called "test conditions"—by monitoring things like speed and the position of the steering wheel—in which case the ECU adjusts the car's performance, dramatically reducing its emissions of CO_2 and carcinogenic NO_x. When these artificial test conditions no longer apply, emissions increase radically. This particular ECU model was purchased on eBay by two curious individuals, Felix Domke and Daniel Lange. To expose the workings of the defeat device, they used a method called "real-time logging": hooking up the ECU to his own car, Felix ran the firmware while driving around for many hours, first around his neighborhood, then on a so-called "dyno" in a garage.

On a more general level, the ECU offers an impressive demonstration of the complicated "work of interpretation" that is done in our economies and societies. The public exposure of the ECU's dodgy behavior required extensive work of interpretation by engineers, researchers, policy-makers, journalists, and media publics. Their societal labor was indispensable to producing the scandal. In fact, many experts were aware of the existence of defeat devices in diesel cars before the scandal. The "known" fact of emissions rigging could only be proven unacceptable—undigestible—on a societal level. If insights

into our individual and collective misbehavior are to really take hold, this knowledge must pass through social channels. It is not just NO_x and other carcinogenic particles that pass through the most intimate parts of life today—through our cars, our world (the air), and our bodies. So must our knowledge.



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▲ Defeat Device, Lüneburg 2011.