Times of Waste

The Leftover

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This exhibition is an extract from the *Times of Waste* project, which claims that we live in the time of refuse. We must settle in the waste, live with it, not against it. The times of repression are over.

The exhibited materials are an attempt in the form of assemblages, a fragmentarily composed archive of remnants and parts, through images, narratives and sounds, to associate up close to the matter and waste a smartphone leaves behind. The theme frays off in all directions, develops eons of time and spatial dimensions and sometimes just abruptly ends.

Times of Waste is both about movements and is in movement. It is *work in progress* that urgently points to *progress*, and is a thinking of progressing. It is about progress of another kind, in which

ecological, social and mental activities have equal place.

The projected maps show that there are simultaneities in which both giant and small-scale distances are covered, and that some paths remain open. Here, we received no information. Much of it seems to be fragmented, unclear, opaque and global – distributed in many ways across infrastructures and actors.

Yet in these manifold and interwoven characteristics there are opportunities. Ways of acting that reject the singular global solution. Actions which use the small-scale and small parts that grow, distribute, infect others.

According to the philosopher Isabelle Stengers, it is the posing of uncomfortable questions to those responsible (business leaders, managers, government officials, etc.) that is one of the first steps to be taken to raise the issue of whether everything is as often claimed in fact under control. In this sense we ask the following:

- Where do the leftovers go?
- Who pays for this?
- And do we want to endlessly consume through perfect recycling?

Despite promising innovations and reasonably good means there is still even today no real solution to the enormous volume of permanently accruing e-waste. There is no ultimate solution. Waste does not resolve itself. It always wastes anew – this too is work in progress.

With smartphones the greatest waste happens not after but rather before use. Neodymium oxide, which is taken here as exemplary, is an essential material in the production of the loudspeakers, microphones and vibrators in smartphones.

Neodymium magnets are also important components for modern wind turbines or in the batteries of electric cars.

This powder has generated waste in no way less harmful than what is displayed here.

Alternatives to Neodymium are already being studied. However, these “alternatives” will also generate their own waste and have unforeseen effects, too.

Times of Waste, the times of rubbish, are the times of the Anthropocene, an age in which the traces of humans are geological. The term was coined in 2000 and is controversial because in its uncritical application it gives man a wide-ranging role in the earth, spreads a crippling crisis, and suggests that our human-made problems can only be solved by technical means.

From the critical perspective of the materials gathered here – most of which will outlive us – the Anthropocene concept is also apt. It makes clear that "nature" supplies the raw material for technology. This means that a smartphone is an accumulation of rock, which after its use leaves a further accumulation of rock – and in between there will be the short interval of the techno-loving human, who had the temerity to attempt to master nature.

The waste sector is a growing and innovative sector in the green economy and industry. Through applying the resources of the capitalist market economy, it attempts to tame the excessive exploitation of raw materials and the abandonment of toxic waste: waste becomes raw material which can finally be turned into material of use, when a shortage of raw materials occurs, and thus its value increases.

In this respect, not only new recycling methods, but also new business models are being developed: circular economies, where producers are involved in recycling, and leasing models instead of ownership conditions, which allow for regulated disposal of obsolete equipment.

Switzerland has one of the best waste disposal systems in the world. However, after incineration a full refuse bag still leaves about a quarter of its contents. Of this, around 4% is highly toxic and is

stored in national or international underground dumps: the mercury-containing electrostatic dust generated by flue gas systems, and the filter cake that remains in the waste water filters of treatment plants.

The rest is **slag** (19%). It is not immediately dangerous, but contains poisonous heavy metals, especially lead, copper, and zinc, in considerable quantities. These can be activated by acid rain. Landfill sites are therefore protected with drainage pipes. These feed into sewage treatment plants; the heavy metals are fixed in the sewage sludge, after they remain in the burnt ash. This is then stored.

In landfills with state-of-the-art metal recovery plants, however, most of these metals are extracted: this amounts to about 10 % of the slag; of this, 2 % are non-ferrous metals, which may contain components of mobile phones that have been disposed of in household rubbish. Metal salts, though, remain in the stored slag.

With the latest processing equipment installed, as in DHZ Lufingen, non-ferrous metals such as aluminum and heavy metal mixtures (copper, zinc, lead, gold, silver) are refined and sold directly to smelters such as Umicore or Aurubis. Slag is business: since it has the same purity as copper ore from mines in the Democratic Republic of the Congo, such processing is considered “urban mining Eldorado”.

In Holland and Belgium the contaminated slag is used in the construction industry.

The Swiss produce 720 kg of **household refuse** annually per person (Federal Office for the Environment 2017) ranking second only to Denmark. In contrast to the EU, Swiss waste production is growing. In the

refuse incineration plant in Basel, around 8,000 tonnes of toxic waste are collected each year from ordinary household rubbish, which has to be stored in hazardous waste disposal sites.

Each year, around 22 kg of e-waste is generated per person in Switzerland. In 2016, this amounted to 184,000 tonnes, with tendency on the increase of number of items, also due to mobile devices (Swico 2017). In e-waste, the Swiss also ranked eighth worldwide (Global e-Waste Monitor 2017).

Listen to the soundscape to see what the processing of household and electronic waste sounds like, the wall projection brings you visually closer to these materials

Waste is what is mixed: the undifferentiated. Depreciation occurs through mixing: what is mixed is not specific, so tends to worthlessness. With waste, everything is similar. Grey-brown indifference. That's why shredding seems primitive. It just throws everything together. In Switzerland, it is too expensive to remove magnets and other materials manually. Automatic material sorting is done where possible.

Raw materials for high-performance equipment must be pure. This makes waste and its recycling unattractive. Most materials lose their quality, or any valuable materials exist in very small proportions. But it is the same situation with raw material mining. Recycling is downcycling. Even though some transformations are strategically called upcycling. For we live in the Times of Waste.

Raw material production is waste production. Seen in this way, a new smartphone is always already waste.

A mobile phone has about 0.4g neodymium onboard (loudspeaker, vibrator, microphone), the sources vary. How great the concentration is in the Chinese mines, where most of the mining is taking place, is not made available by the People's Republic of China. In the production of neodymium, it is not primarily the small quantity obtained from large quantities of rock that is the greatest problem (as in the case of gold), but the radioactivity and acidity. In China, some of the most elementary safety precautions for occupational health and safety are missing. Dust enters the lungs of the workers and pollutes the surrounding fields. A further problem is tailings, waste-sludge lakes that stretch for miles around the mines and settlements in Baotou. What is to be done with this radioactively charged material and whether the water discharge from these lakes is at least partially decontaminated is unclear.

The recycling rate of the metals in a smartphone ranges from 0 % to over 50 %. Certain rare metals such as indium could be recycled, but it is cheaper to extract and refine them under the most precarious environmental and social conditions from raw material. Indium is virtually "anyway" a by-product of zinc production. In the case of the rare earth metal neodymium, progress has not gone beyond laboratory tests, and industrial recycling is not worthwhile financially. This is why the magnet is not removed during disassembly. The average rate of gold recycling is 15 – 50 %. When modern recycling processes are applied, this can be carried out practically without loss.

- 1 cell phone contains 20 – 25 mg of gold, depending on the model and year, the equivalent extraction of which would require 8.75 kg of ore.
- 40 – 50 mobile phones produce 1g of gold.
- It would take around 40,000 – 50,000 old mobile phones to produce the 1kg Umicore gold ingot mounted on the metal plate.

Andreas Kappler's research team in Geomicrobiology at the University of Tübingen is working on metal extraction processes from slag which is left over in refuse incineration. They are experimenting with microorganisms from the Rio Tinto in Spain, which has suffered acid pollution through mining, and from a copper-bearing mine area in China. The microorganisms' abilities to dissolve or collect metals have been successfully replicated at the laboratory stage for the purification of slags. The same principle is to be used in future for the recycling of rare earths and other metals. Due to the low raw material prices, however, the process has not yet been industrially implemented on a larger scale, as the Tübingen-based company Novis GmbH had planned to do in cooperation with the university.

In the wall video projection microscope images of various microorganisms can be seen from the laboratory of the University of Tübingen

"*The* used mobile phone market *can be compared with the secondhand car market: once the market becomes saturated, the used market begins. This situation has occurred in the western countries. But the return in Switzerland is still low.*"
RS Switzerland

How does the used mobile phone market work in Switzerland?

In Switzerland, companies such as *verkaufen.ch*, *RS Switzerland* or *Revendo* are developing the used mobile phone market. *verkaufen.ch* works with among others Sunrise and Swiss Post; *RS Switzerland* with Swisscom, who also cooperate with M-Budget. *RS Switzerland* offers used mobile phones on the M-Budget website; *verkaufen.ch* via their own.

After purchase, the devices are checked, the data are deleted and overwritten. Equipment in good condition is sold in Switzerland; equipment in a lesser condition goes to repair shops or middlemen in Europe and Africa. Defective devices go to a Swico recycling partner such as Immark and are recycled as standard. Swico Recycling is a national collection system for scrapped electrical appliances, which allows the equipment to be recycled funded by the recycling fee paid on new equipment by end users at purchase.

verkaufen.ch checks the equipment in-house and can therefore also offer a repair service for defective smartphones. *RS Switzerland* works with *Réalise*, a socially engaged company. However, they do not carry out repairs in Switzerland; instead they transport the equipment to the parent company in France.

Trade outside Switzerland is carried out by all the different intermediaries with whom a relationship of trust has been established. Most traders come from the countries to which they export. An important point of sale in Africa are local markets. *Helvetrade SA*, a company whose proceeds largely go to *Terre des Hommes*, also works in this way. *Helvetrade SA* supplied equipment to Pakistan and Hong Kong 5 – 6 years ago, from there they went to the low-income regions of China. In the meantime, Hong Kong and Pakistan have been replaced by African countries. Thus, multiple and multiplying paths and economies develop.

The used mobile phone market is an emerging market. It attracts people who do not always want to own the latest thing or those who have to live on a small budget. It actually benefits from the growth ideology, since only a fast throughput guarantees equipment replenishment. “Large companies, such as

Samsung, use the secondhand market and they support it as much as possible. For this is how people become “tied” to their devices, and if later they earn more, they will perhaps buy a new device of the same brand. Small companies like us are the door-openers of the big companies”. verkaufen.ch

Companies like Samsung or Apple do not get into the second-hand business for ecological reasons, but rather to participate in a different market.

With the smartphone, alternatives are difficult. It is a sealed up minicomputer whose reparability and recyclability are problematic. Nevertheless, it is possible to repair about 15 smartphone components. The Fairphone is a cut above the others because its components are designed to be replaceable.

The life span of 5 – 6 years of a smartphone, compared to the average first usage of 12 – 24 months, is not bad, especially considering that the small size of the device means leaving little electronic waste.

Although the smartphone is designed as a short-use, throw-away product, you can actually use it individually “quite a bit” differently. There is a potentiality that, in spite of everything, makes the smartphone interesting, especially for the increasingly relevant collectively lived DIY cultures of repairing. In these DIY cultures, the common activities of “the patch” are understood as forms of a post-growth society which, in a playful and non-ascetic way, relativize life in excess.

In a Swiss high-security duty free warehouse near Zurich Airport, Schweizerische Metallhandels AG Germany stores strategic metals as asset investments. In (financial) crises, they are protected from expropriation by the German state. Metals such as indium, hafnium or gallium have comparatively low annual production. Their prices are determined on commodity exchanges; they increase with scarcity. Due to the often irretrievable implementation of these rare metals in high-tech products, investors expect an increase in the value of their investments. In turn, research laboratories are working intensively on the recovery of rare metals such as indium, in order to prevent possible future shortages, and in addition to reduce the degradation of these raw materials, which are mined and extracted under conditions damaging to both health and the environment.

Price explosion of rare earth metals

In 2010, prices for rare earth metals (REMs) increased dramatically. The reason for the price explosion: The People's Republic of China, then producer of 98% of world demand for REMs, imposed export restrictions. As a result, new mining projects started up around the world (California, Australia, Greenland, various African states) and millions were invested into the substitution of REMs (among others Fraunhofer Institute Germany), or in increased efficiency, e.g. in the field of magnet manufacture (Japan). These measures pushed prices down and Chinese market share fell to 90 % of world production.

The export restrictions were sparked off by the dispute between China and Japan over the Senkaku Islands northeast of Taiwan. To respond to the Japanese electronics industry that had invented FeNdB magnets, and hold valuable patents in this sector, China stopped exporting REMs. The subsequent price explosion affected practically every industrial nation and made the dependence of high-tech producers on China visible.

The **Basel Convention** on the Control of Transboundary Movements of Hazardous Wastes and their Disposal entered into force in 1989. It is an environmental agreement that regulates the export of hazardous waste.

According to the Basel Convention, waste, such as e-waste, can only be transported from countries of the "Global North" to countries of the "Global South" and vice versa, if these nations are parties to the agreement. It is only in this way that the rules of the convention apply, which means there must be "state of the art" recycling facilities in the destination country. The consignment of the waste requires the consent of the importing and exporting countries, as well as all transit countries. Such consent and settlement is subject to a thorough notification procedure.

In short, the Basel Convention prohibits the export of e-waste to countries of the "Global South".

Switzerland signed the agreement in 1990. Around 170 countries are members, including China. The US, which according to Wikipedia ship 80% of their dangerous waste abroad, has never ratified the agreement; so these rules do not apply to them.

What options do governments have?

The e-waste problem is increasingly becoming a political issue. Around the world it is addressed in different ways:

The Swiss **Business Responsibility Initiative** calls for Swiss-domiciled companies to respect internationally recognized human rights and environmental standards in their foreign operations; they are liable for the misconduct of their subsidiaries and the companies they control. This also applies to the production of raw materials for electronic products, e.g. the mining company Glencore based in Zug.

A statutory initiative on the part of Bündnis 90 / The Greens in Germany calls for legal measures against **planned obsolescence.** Obviously short-lived designs, built-in flaws or fail points, and construction methods that prevent or complicate the repair of equipment are to be prohibited by law.

The **EU-norm for chargers** has already been implemented: from now on, there is an end to the cable chaos for charging devices for smartphones, electric toothbrushes, shaving devices, etc.

In the USA, the **Dodd-Frank Act** was passed in 2010. It prohibits, among other things, the purchase of cobalt and other metals from the Congo. This is intended to prevent the US and other countries from unintentionally supporting civilian war militias in the Democratic Republic of the Congo that operate the extraction of tin, cobalt or tantalum exploiting child labour and without proper health and safety regulations. However, the law is problematic because it takes away jobs in the Congo when no raw materials at all are allowed to be exported.

The International Tin Supply Chain Initiative (ITSCI), which is supported by tin producers worldwide, has succeeded in making 95% of the tin production in Central Africa traceable, thus largely forcing the militias out of business. The initiative started with a mine in 2011, since then more than 1,500 companies in the Democratic Republic of the Congo, Burundi, Rwanda and Uganda are involved. ITSCI received the *edie sustainable award* 2017 in the "sustainable supply chains" category. However, should Donald Trump and the Republican Party, as announced in the run-up to the elections, overturn the Dodd-Frank Act, the further participation in the initiative for US firms – and these are smartphone producers like Apple – would no longer be binding.

What options do individuals have?

At www.buyaware.org you can see what environmental and social impact a smartphone has. The best thing to do is to use the Fairphone, which tries to use components that are as environmentally and socially compatible as possible. Apart from that Fairphone respects modularity: individual defective components should be replaced as easily as possible. This extends the life of the smartphone. The reality is that Fairphone, too, has its limits: even the committed Dutch makers were only able to trace the origin of the metals used completely in one case (tin). And working conditions at the production site of China despite Fairphone intervention (no more than 12 hours of work per day) are critical.

One of the most important initiatives against irresponsible raw material production facilities is STOP-Lynas. The activists in Malaysia do not accept that radioactive polluted rare earth metals mined in Australia are shipped to Malaysia in order to be further processed there, bypassing environmental and social standards.

Jim Puckett from the Basel Action Network BAN tracks illegal movements of e-waste both inside and outside the USA.

To this end, various technically innovative methods are used, such as the tracking of waste with transmitters, the photographing of e-waste containers and their numbers as well as publicly effective interventions on the spot. For example, how e-waste illegally crossed the Hong Kong-China border has been filmed.

Sustainability scale of material use and material production

The *Times of Waste* project has developed a comprehensive sustainability scale on the use of materials. The list also includes overarching considerations such as sufficiency, i.e. the self-constraint of one's own needs to an environmentally compatible measure– the most environmentally-friendly product / material is the one that does not have to be produced:

1. Sufficiency and sharing models
2. Longevity of products
3. Use of second-hand products
4. Repair of defective equipment
5. Re-use of individual parts / component recycling (e.g. magnets in smartphones)
6. Various levels of material utilization (e.g. smelting of metals)
7. Energy utilization (plastic, paper, etc.)
8. Regulated landfilling (traceable, retrievable for later recycling)
9. Illegal landfill

Remarkably, classical recycling, i.e. material recycling, is only ranked sixth.

Sources

The texts have emerged from observations and conversations that we have had with people during our research in the various institutions, as well as from studies they have made available to us:

- Office for Environment and Energy Basel-Stadt: Martin Lüchinger, Timo Weber
- Landfill Elbisgraben: Heinz Schaub, Pablo Schori
- DHZ Lufingen: Benjamin Blumer, and Marco Weber
- Empa St. Gallen: Heinz Böni, Patrick Wäger and Rolf Widmer
- Fairphone: Miquel Ballester
  Geomicrobiology, University of Tübingen: Andreas Kappler, Jing He
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- University of Applied Sciences, Rapperswil: Rainer Bunge
- Immark AG: Enrico Leoni
- Institute of Evolutionary Biology and Environmental Sciences, University of Zurich: Fabienne Barmettler, Carlotta Fabbri
- ITRI / ITSCI / PACT: Mickael Daudin, PACT reporting officer
- Refuse incineration plant Basel: Johannes Allesch, Hanspeter Geugelin, Daniel Baumberger, Max Duss, Markus Hediger, Kurt Kaspar, René Kress, Erik Rummer, Hans Stocker, Kurt Wenk
- Heinz Leuenberger, Chief Technical Advisor UNIDO
- Novis GmbH, Tübingen: Thomas Helle, Benjamin Gann
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Links

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- Fairphone www.fairphone.org
- Environmental and Social Impact Smartphones www.buyaware.org
- Law initiative planned obsolescence www.murks-nein-danke.de
- Group responsibility initiative www.konzern-initiative.ch
- Dodd-Frank Gesetz http://wirtschaftslexikon.gabler.de/Definition/dodd-frank-act.html
- ITRI / ITSCI Zinn Initiative www.itri.co.uk

Impressum

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