

5000times

exploitative mechanisms within the design of smart high-tech products

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ABSTRACT

Design within globalised capitalism runs the risk of generating harm. In this discourse, the production of high-tech devices (smartphones, tablets, notebooks) serves as key example of such harmful effects. The designer is located at a critical point between reinforcing discriminative and inhumane mechanisms while fuelling the very demand for this mechanism to exist: consumption. The author's study *5000times* acts as a foundation for the discussion by conducting empiric experiments around the topic of productive industries and the human body within these. By beginning to de-assemble a high-tech device, a quest began into where and how the human hand has participated in the production of the device. The result of *5000times* shows the amount of tasks, which are done manually along the assembly of high-tech products. Re-enacting these tasks as a designer originating from a privileged western context, represents the coherence, reliance and hence accountability of the designer towards the productive mechanism that is being used. The empirical and theoretical research into the topic of high-tech manufacturing unpacked the crucial amount of manual work and the devastating, discriminatory, and exploitative politics under which this work is happening. The study claims that product designers are responsible not only for the experience of the consumer but also for how those who make the designed product are affected by it.

TECHNOWOMB

How often do we realise – as we sit swiping – that somewhere, someone is, as an example, testing the image quality of smart high-tech devices by taking thousands of selfies each day? *5000times* investigates and reenacts the human labour at the backbone of productive industries. The paper argues that design objects such as smart-high tech devices withhold a political contradiction of modernity which manifests in the comfort provided to the consumer-end and its opposition to the exploitative body politics that the maker's end is subjected to. We see that smart high-tech devices supply opportunities, comfort, agency and work advantages to the consumer end. In the context of their production these designed objects imply, on the contrary, jobs or labour that lacks comfort and agency of the employee (Asia-Pacific Journal 2013). The material study *5000times* visualises a series of four stacks of separate manual tasks that we can find along the production of smartphones, tablets and laptops (*fig. 1*). These material visualisations are based on the scale of one person and function as tools for dialogue. They invite the interrogation of one's own position and accountabilities towards the topic of (re-)productive industries. Each stack indicates in quantity the amount of manual work that one person will create in a day's work within high-tech manufacture(f.l.t.r.):

These numbers have been calculated through an analysis of assembly line footage and multiplied for an average workday of 12 hours (Facing Finance 2015). The extensive, repetitive, and even absurd nature of the human work becomes obvious within the numbers and their materialisation.

The 18 suicide cases by Foxconn employees in 2010, during the production of the first iPad (Aditya Chakraborty 2013) and the more recent cases in August 2016 (Ben Sin, 2016) ask for a discussion on Apple's production politics and ethics. Depending on production times, assembly employees will have to work up to 18 hours a day and are granted a day off every two to three weeks. Questions arise with these figures:

- If so many hands are needed to produce high-tech machines, what are the manual tasks?
- What is the individual worker asked to do on a daily basis?



Fig. 1: 2160times Solder drops (solder pieces together) , 3927times Kapton tape (place onto inner component), 2541times Foils (screen protection), 3600times Selfies (image quality check).

While we can read much about the devastating conditions inside factories like Foxconn, the actual assembly line tasks are not published within articles or studies online. To come to grasp with these questions, a MacBook Pro was disassembled to search for inner traces. Reminiscent traces might suggest what happens inside the factory where the device was assembled. The first evidence was a Foxconn sticker (*fig.2*) behind the screen of the device. The tag transformed the device into a witness of the production doctrine and the manual work behind consumer high-tech products, as it proved a link to the facts and figures published in

articles on Foxconn's politics. Following the reveal of the sticker, a total of 54 pieces of Kapton tape were extracted from the laptop (*fig.4*).



Fig. 2: Foxconn sticker

Their irregular placing, length differentiation, and zig-zag cutting edge (*fig.3*) indicated they were placed manually by hand. Kapton tape is the thinnest electronic isolation layer. It is extremely heat resistant and as such, vital to the production of electronics. This tape appears like secret notes left behind by the person who manufactured the item: they imply the task that at least one person inside the factory will do on a daily basis – placing a tape inside high-tech products.

The disassembled laptop also uncovers each singular part, which might have been placed, screwed or soldered by hand into the device. To confirm further manual tasks, video footage from factory tours were gathered and analysed. These videos allowed me to find proof and extend the list of the manual assembly line tasks. The analysis of the videos captured manual tasks, which can be grouped into nine sections (*fig.5*).

Some of these tasks will be repeated several times along the assembly like for example placing a tape onto a component. The material used for the video analysis is second hand and not primarily recorded for this study. Subsequently there might be manual tasks missing in this analysis, which were not visible in the analysed footages. Within an animation, *5000times* captures these findings through a re-enactment of the

gathered tasks (fig.6). The video footage provided material to extract, count, and multiply the average length that each task takes to fulfil. The approximate lengths are gathered by counting how long it takes the employee to pick up the device, perform the task and place it back onto the assembly line. These numbers are then scaled up to an average workday of 12 hours to receive an estimate of how often the task will be performed by one employee in one day of work.

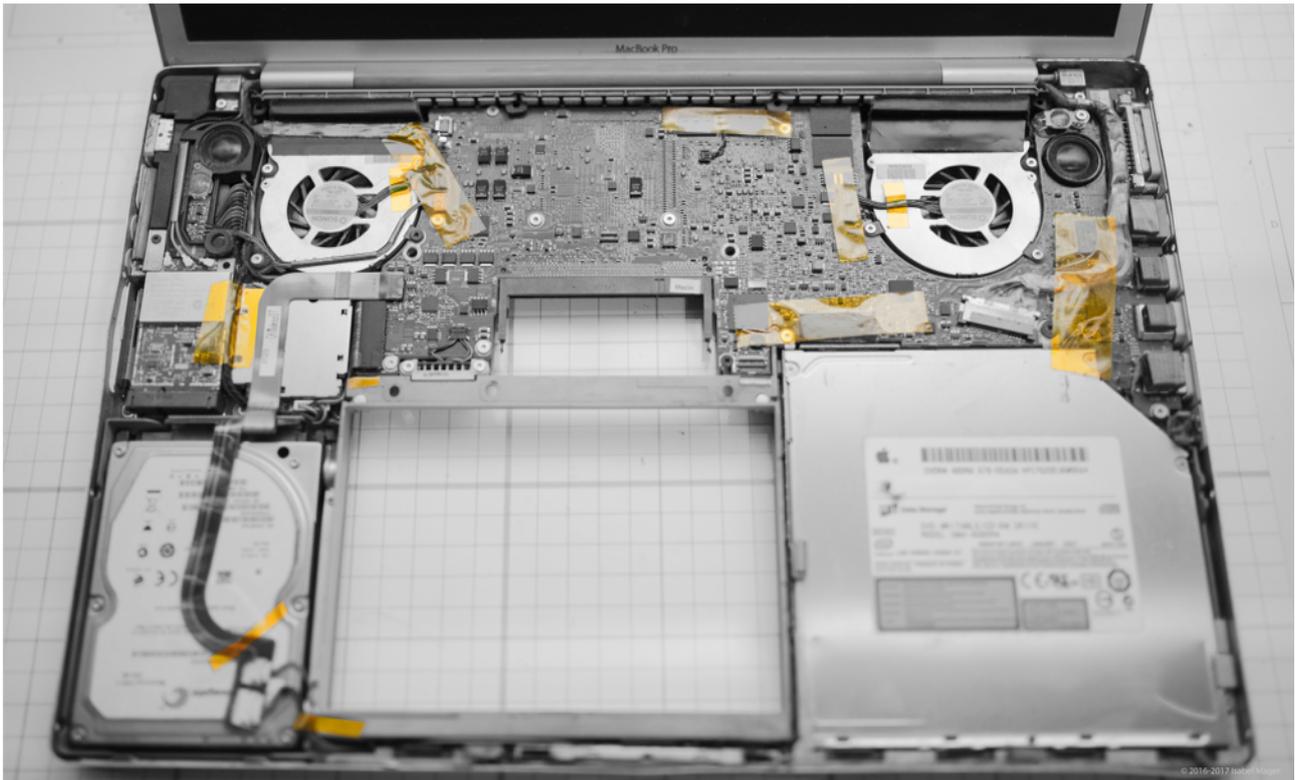


Fig. 3: The first view into a disassembled MacBook Pro shows pieces of Kapton tapes.

The analysis of assembly line tasks within video footage of factory tours inside high-tech manufacturing spaces underpins a continuation of the Fordist production setting. High-speed efficiency of a 24/7 production, division of tasks into small steps, and the level of accuracy in which these steps will be performed by the employee resonate with the Fordist setting. In regards to these findings and the numbers resulting of the analysis, *5000times* understands the situation of productive industries as neo-Fordist. Neo-Fordism (Edmund Heery and Mike Noon 2008) objects the post-Fordist concept, which claims a disappearance of low-skilled and low-agency occupations through new work organisations such as *just-in-time* or *lean-production*. Instead, neo-Fordism points at the dependency of *just-in-time* and *lean-production* on Fordist systems and their continuation in (not only) off-shored factories. Subsequently, the productive set-up is understood as a continuation of the Fordist setting with few updates through modern technologies and depending on the context of production. Expansion of markets and supply chains lead to a displacement of unlawful labour conditions outside of prosperity zones instead of their re-placement through political

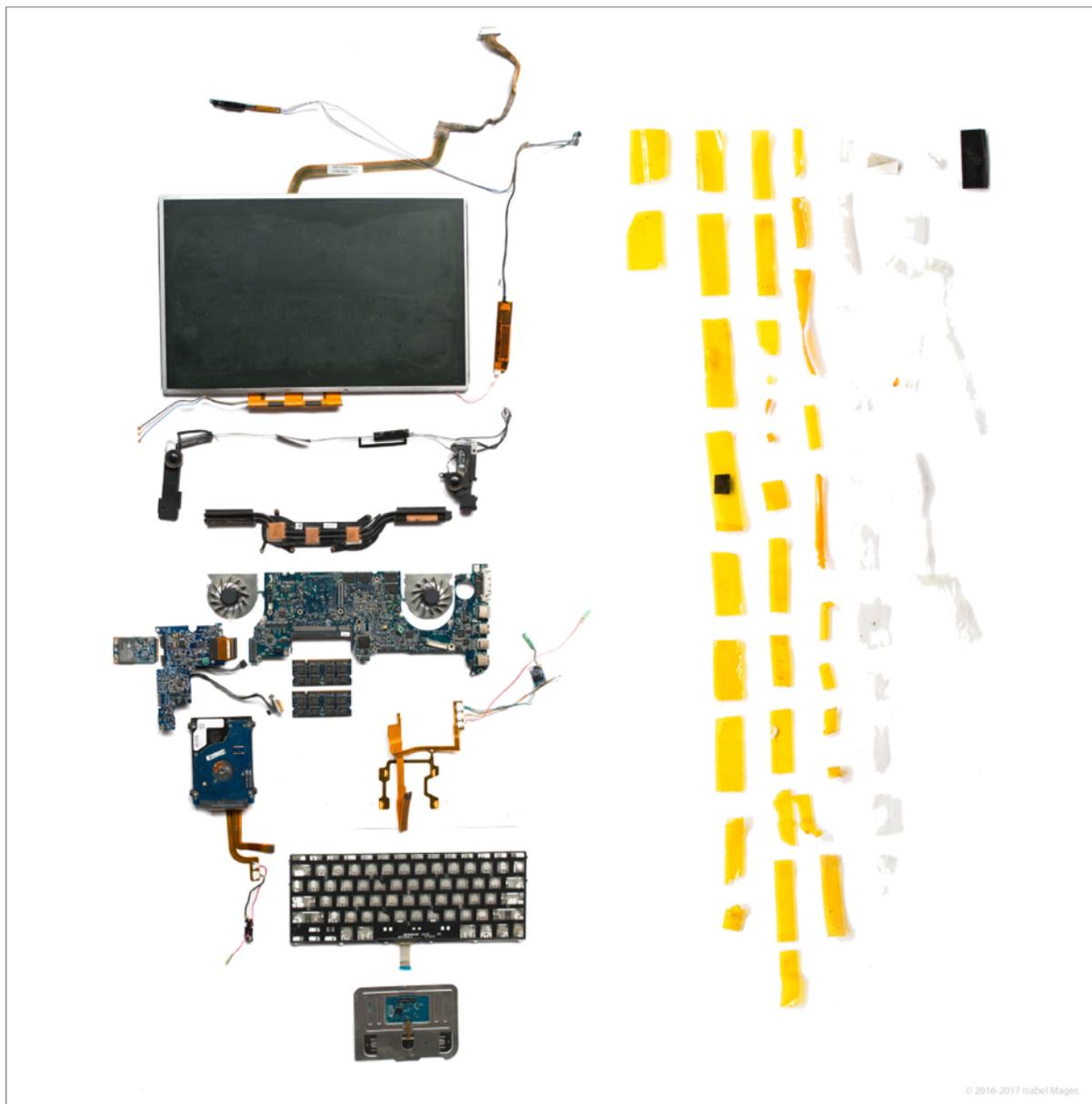


Fig. 4: The tape pieces and separate parts within the MacBook Pro.

inclusion, recognition and re-formulation of productive (body-)politics. It is the motivation of *5000times* to re-link the accountability of the user's and designer's end with the violence and harsh politics which the maker's end is objected to. It is through this geopolitical link that the study of *5000times* suggests the step towards a political inclusion of productive settings which supply and cooperate with separate contexts, yet are not protected by their legislation and rather exploited by these separated contexts (Keller Easterling 2014, 33).

ATTACH FRAME INTO SHELL OF DEVICE	2274x
MARK AREAS FOR ASSEMBLY	4800x
SCREW PARTS ONTO FRAME	1964x
PLACE KAPTON TAPE INTO THE SHELL	3927x
SOLDER PIECES TOGETHER	2160x
CLOSE THE SHELL OF THE DEVICE	6171x
CLEAN THE SCREEN AND ADD A FOIL	2541x
CHECK THE IMAGE QUALITY	3600x
WRAP THE DEVICE	2880x

Fig. 5: Screenshot of *5000times* animation showing the list of tasks along high-tech manufacturing.

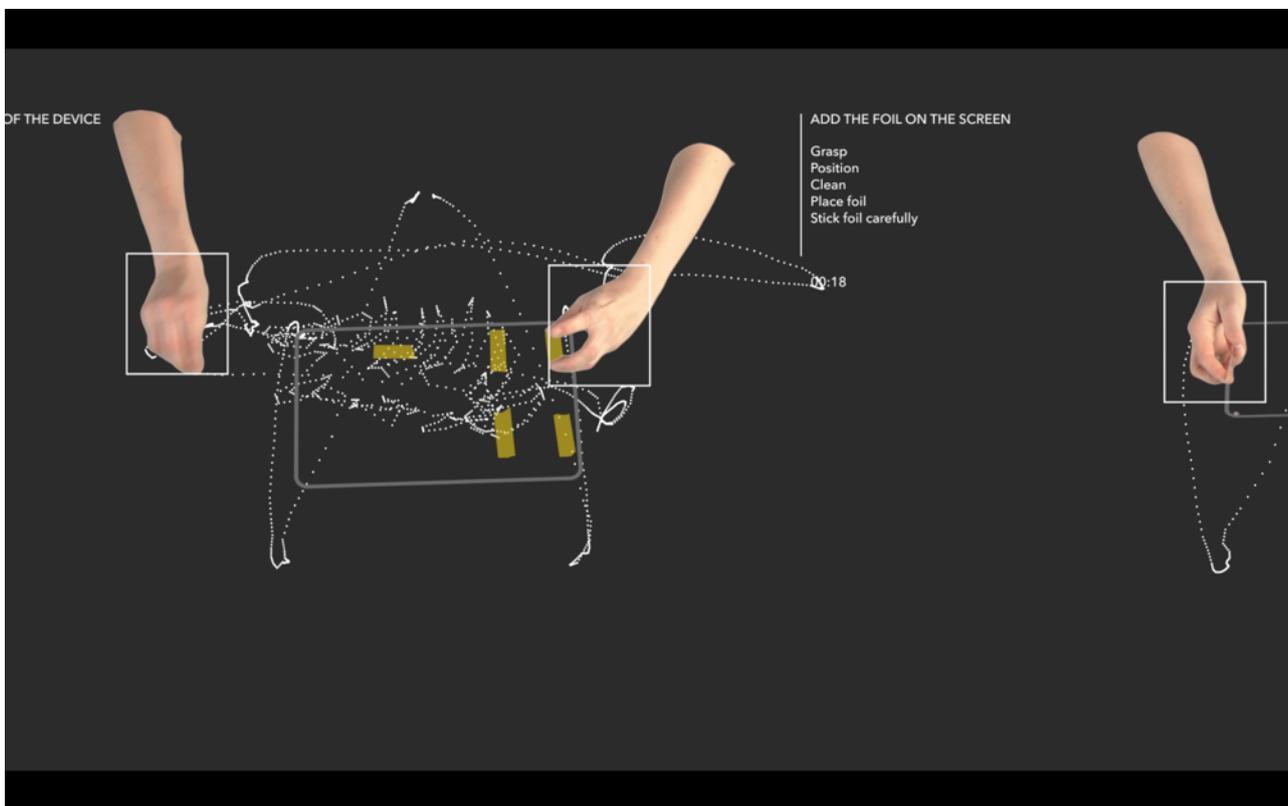


Fig. 6: Screenshot of *5000times* animation showing the re-enactment and tracking of assembly tasks.

SYSTEMATIC DISCONNECTION

Why am I so familiar with these devices, yet so unfamiliar with their making?

I am a consumer and designer, located in a white western context of privilege. This positioning lead me to acknowledge and reflect on the reliance that life and practice in a western context have on a globalised infrastructure of supply. It allows one to wonder to which extent western lifestyles are built upon the discomfort and human cost of lives which are systematically kept distant. *5000times* formulates an inquiry into such design related harm through the impacts of a designed artefact at the productive end. If we choose to enter the world of design, we choose to direct our attention towards material artefacts which are inextricable of their social and political implications. Furthermore, the act of design is intertwined with the maintenance of capitalism, the ideal of a free-market and the politics of exchange. To read design is to look beyond it as an individual object, multiplied into mass-production. In saying that “the design process is organized on an extremely co-operative basis. For this reason, no one person can be held responsible for a product anymore”, Vilém Flusser underlines the diverse mechanisms that a designed object will go through and support or reinforce (Vilém Flusser 2015, 67). In regards to the technological developments of the last decades and the reach that technologies of research, tracing and tracking provide, we can question Flusser, whether it is still not possible to hold a person responsible for the object being created.

Systems of production and supply, representation, promotion of objects, communication and sensation are mechanisms of exchange immanent to the multiplication of designed goods. Each of these mechanisms are governed with specific politics, norms, behaviours and values. As designers we participate in the choice for these mechanisms; be it to source, produce, manufacture, transport, promote, retail, maintain, recycle, waste the designed artefacts or to prescribe sensational and symbolic layers onto the creation. In this decisive practice we create hierarchies on the levels of race, class, gender, ethnicity and sex.

The motivation of *5000times* is to make the unethical body politics of manufacturing empirically tangible to the privileged consuming body, which is not subjected to the settings embedded in their daily devices.

Designers represent the core target group for *5000times*. The American company Apple and their Taiwanese manufacturer Foxconn, located in Shenzhen, China, were chosen as example for this case study. The California based tech-company holds a strong connection to design, propagating it as a key strategy of their business. The company also aims to be the role-model within the high-tech industry.

Foxconn Inc., known for its militarised production doctrine, produces for a wide range of high-tech and consumer electronic brands other than Apple. However, the 18 suicides from 2010 were linked solely to Foxconn factories, which assemble Apple devices (Jennie Rothenberg Gritz 2012).

A visual test shows a recording of a Foxconn factory producing Apple devices overlaid with an official Apple *Making Of* video for the iPhone 5 (fig. 7). In this overlay, we can see the contrast between promotional and investigative imagery.

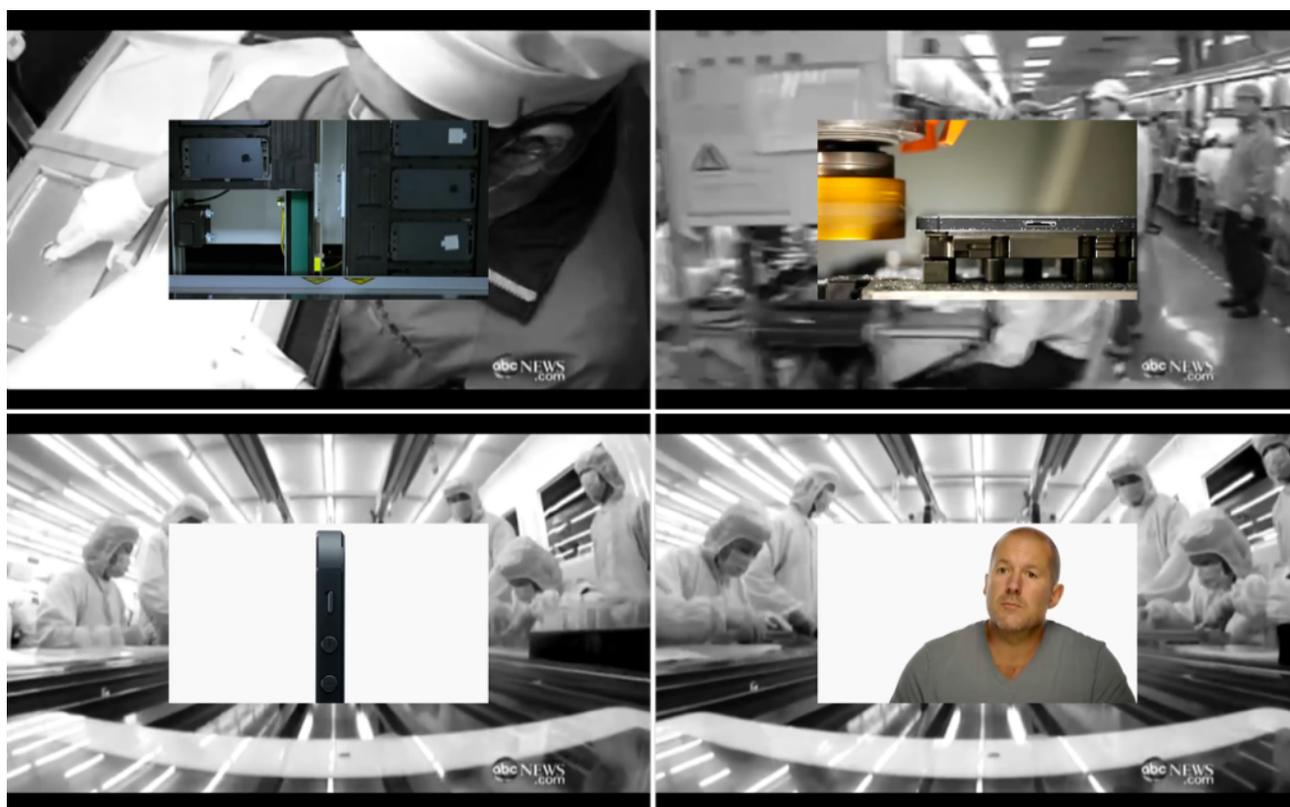


Fig. 7: Overlays of an ABC News documentation showing the inside of a Foxconn factory producing Apple devices with a *Making Of* video published by Apple.

The front-middle of the frame (fig. 7) is occupied with a sleek and individualised representation of the device, being touched purely by machinery along its *Making Of*. This is contrasted with the background video; it shows the vast quantity of hands that will interact with the device along its *Making Of*. The only person inside the Apple video is Jonathan Ive, Apple's Chief Design Officer. Not representing the assembly work in their *Making Of* video makes it seem as though Apple does not value the enduring work of assembly employees. The documentation of ABC News (ABC News 2012) states, that "one iPad will go through the hands of 325 people along its manufacture" and further notes that the company could not sell more iPhones (93 million) and iPads (40 million) in 2012 because their Foxconn assembly line could not produce them fast enough to keep up with the demand of consumers. This example states the direct link of Foxconn's manual

labour capacities to Apple's sales. If the factories in Shenzhen cannot run fast enough, then the American company cannot sale. We could see a dependency here of Apple's finances on the bodily activity of manufacturing. It is this labouring at Foxconn that ensures the base of Apple's value creation. The images that we perceive of both, Apple and Foxconn, are contrasting in their narratives. In the media we perceive images and narratives of harsh Foxconn facilities next to comforting promotional images of Apple. An image-gap is created by these contrasting narratives, that represent two closely collaborating entities in the media. This image-gap frames the geo- and socio-political gap between context of production and consumption.

In 2012, Chinese artist Li Liao applied for an assembly line position at Foxconn for his piece *Consumption* (2012). Liao wanted to work until the total amount of his wage would be enough to pay for one iPad (in 2012). Not spending money on rent and living costs, Li Liao worked for 40 days to purchase the iPad (Evan Osnos 2013). During an interview with the *New Yorker* in 2013, Liao mentions the disconnection between employees and the product: "Many of the products in this world actually have nothing to do with the workers who made them. To most of the workers there, Apple was just a name, a logo," he says.

SEMANTIC ROOTS

In her book *The Human Condition*, German philosopher Hannah Arendt describes how since ancient times a linguistic distinction has been made in European languages between the word of *labour* and *work*. *Labour* and *work* both represent an activity that provides the (financial) means to sustain ones life. Arendt describes a first problematic: we understand *labour* and *work* as the same activity, which they are not. *Labour* differs from what is commonly understood as *work* through its demand on a physical, bodily level. Health is a major concern within discussions around the topic of *labour* (Moana S. Simas et al. 2014). *Labour* and *work* have been linked to two different bodies, classes, professions since ancient Greece – namely the craftsmen and those who work with their body – labourers, "slaves and tame animals" (Arendt, 1998, p. 80).

If we look at this divide from a contemporary perspective, we could argue that the craftsmen is equivalent to the designer, who is operating from a position of agency (a western white-centric profession) (Ekene Ijeoma 2016). The labourer, in this sense, could be equivalent to the contemporary factory worker, because this remains a profession of lower classes on a global scale.

Secondly, there is a problematic in the disconnection of the word *labour* from any physical outcome. *Labour* is a verbal noun, which does not contain the outcome of its labouring. The word *labour* describes an act and not a thing or object while the word *work* names an activity and its physical outcome. Subsequently can

labour not be connected to the object it creates, as the product remains rooted in the word *work* – *work* is the product. *Labour* cannot – in terms of semantics – create economical value, but *work* does.

The semantical divide and understanding of *labour* and *work* seems to exist since long in European languages. It raises questions towards the influence that languages have on our perceptions and behaviours. If the construction of a language divides an activity, that we individuals perform for the same reason (to sustain life), into a binary, then this language-construct might effect our understanding of this divide and value differentiation as a given, a “norm”.

In a cost breakdown of an Apple iPhone 6 plus we can see the financial divide in how *labour* and *work* are valued. Dave Smith’s article for the *Business Insider* notes that the worker wages for assembly and manufacture make up \$11, which is 2 per cent of the final retail price. Apple, ranked as the fourth most powerful corporation by Foreign Policy, generates a quarterly revenue of \$42.4 billion (Parag Khanna and David Francis 2016). Figure 8, based on a diagram published by the *Business Insider*, shows that manufacturing and material costs are \$242.50, which is a third of the final retail price. \$11 are spend on Assembly & Test per iPhone 6 Plus, which is a rather small amount in relation to the total cost of \$649 per iPhone 6 Plus. If we added \$11 per phone, totalling \$660 per phone, we would double the wage of each assembly employee participating in the production of this device.

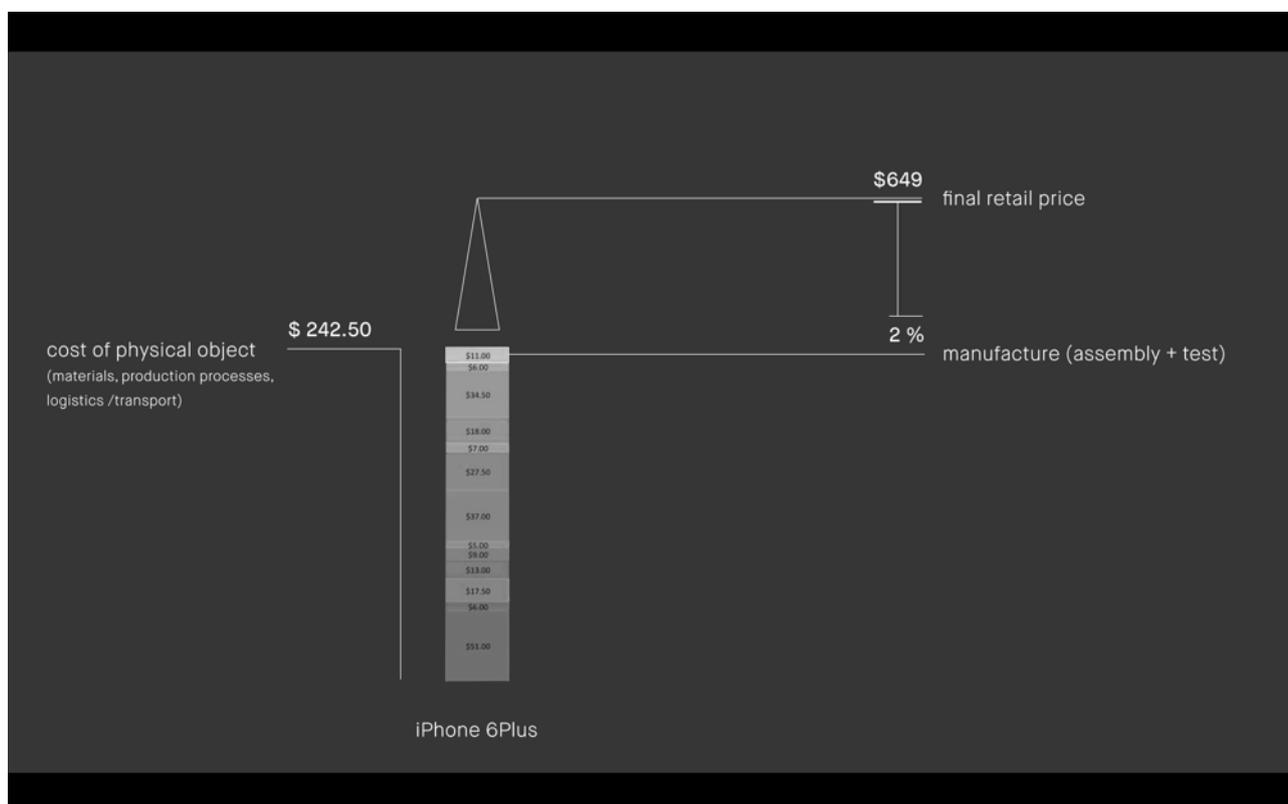


Fig. 8: Cost breakdown of an iPhone 6 Plus based on a diagram from the Business Insider.

BODY ACTS OBJECT

During the analysis of the video footage, the singular and repetitive movements of employees appeared like precarious choreography, directed by the object's design into a machine-like body of production. The animation of *5000times* compresses this appearance by focusing on the bodily movements of manufacturing, tracing these movements and connecting all sets of hands to mark their extensive cooperation (fig.9).

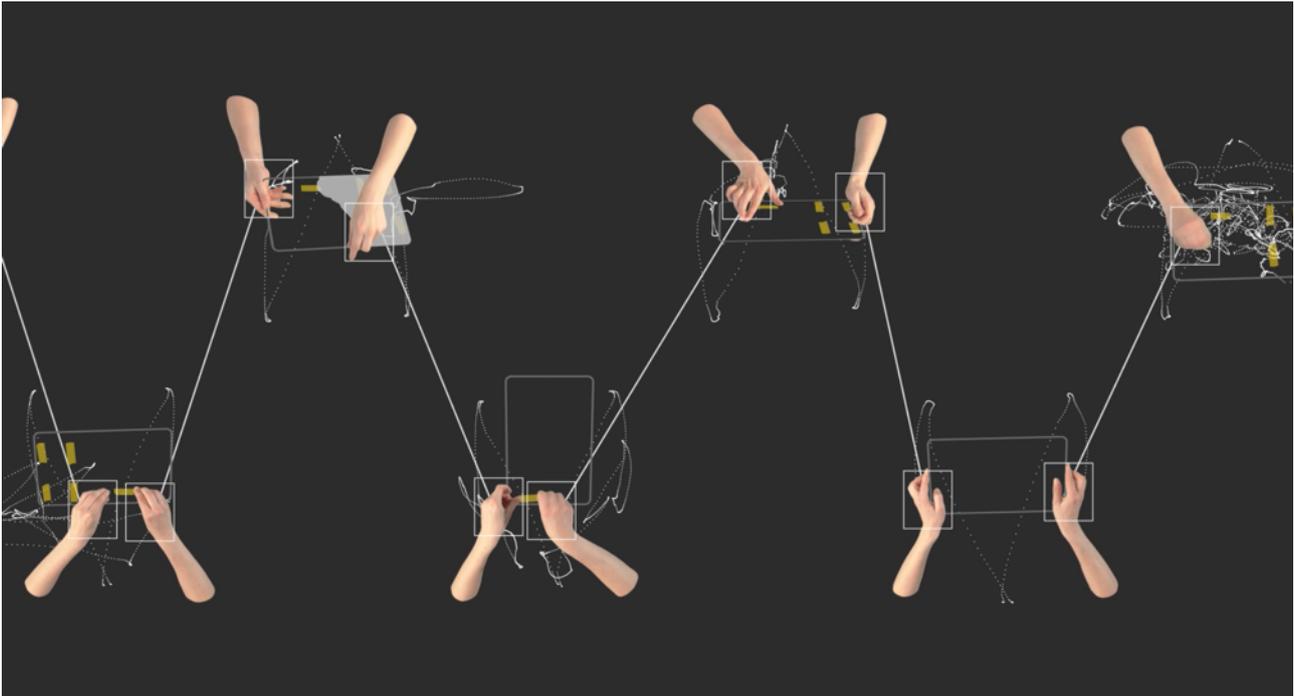


Fig. 9: Still from the 5000times animation re-creating the manual tasks along high-tech device manufacturing.

The work *75 Watt* by Revital Cohen and Tuur van Balen amplifies the division of labour and assembly movements in a choreographic manufacture. The set of *75 Watt* is a Chinese factory and the performers are assembly employees of this factory (Revital Cohen & Tuur van Balen 2013). The choreography shows the manufacturing of one object. The object was designed to direct the movements of the assembly employees into a choreography. It is an undefinable object with no specific usage except of being the directing medium of the choreography. *75 Watt* manifests the link between the designed artefact and the bodily movements that it will imply during its making. These designed movements remain unnoticed outside of its manufacturing facility. The text along *75 Watt* (Ibid.) wonders in which sense the object might be a directing subject along its manufacturing. Behind the manufactured object though stands the the designer and/or the engineer who planned the object. As designer, we indirectly govern the bodily movements of assembly employees through the designed objects.

In their final paragraph on the project, Cohen and van Balen embed the vision on the end of the “human labourer on the assembly line” (Ibid.) and the replacement of human labourers with robots. This belief of a totally automated production setting remains speculative and is not shared within *5000times*. The words of an American designer working in China, cited by the *Atlantic* remind us that “humans are the most adaptable machines”. With this sentiment, the designer underlines that the idea of a totally automated production process remains fictive, as maintenance and development of machinery are far more complex and expensive than human labour. A group of 100 employees can learn a new task and adapt to the updated technology in less than a week. If we imagine a group of 100 robots that need to adapt to new components and technologies of our design, then we would have to rewrite the software, update, and extend the hardware, test this and finally, multiply and install this adapted robot 100 times. This is too expensive, too time consuming and does not fit into the logic and speed of a high-tech consumer market. Hype as the titles of “Foxconn replaces 60,000 factory workers with robots” (Jane Wakefield 2016) simplify and augment the complexity of assembly work as mentioned by Motherboard (David Bixenspan 2016). Automation might occur for specific services and on a larger scale in factories for promotional or research purposes, however it will take several generations of assembly employees to work in harmful conditions until their occupation is replaced by AI robotics.

VISIBLE

One approach for present action might be to reconnect two systematically, culturally and geographically separated contexts which are economically interdependent: production and consumption, designer and maker. The question of representation is one challenge for this reconnection. How can we represent the topic of labour exploitation in a context which appears culturally and geographically distant to the exploitative situation?

There are three reasons why I chose to reduce the imagery and place my own body into the visualisations of *5000times*. The first is the concern with how the media frames the topic of labour exploitation visually. Articles are accompanied with images of manufacturing sites and employees. This direct imagery of manufacturing might, at a certain saturation, strengthen the distance, gap and disconnection between the consuming and the producing body. Manufacture is outsourced outside of the context of western lifestyles. Its literal pictures show signs and bodies which might appear distant to the consuming classes. Remarks like “But isn’t this a good job within their context?” and “They do have a choice for this work. For many who come from rural areas, a factory job means a step into modern life...” were common responses from visitors when I explored dialogues on the topic of labour exploitation during the *5000times* exhibition at the 2016 Dutch Design Week in Eindhoven. In its final iteration, *5000times* shows no images of the literal assembly context at Foxconn in Shenzhen to prevent preconceptions from entering the dialogue too early. Rather, the

reduced imagery provided space to the visitor to enter and observe the piece with an open mind. One hidden book of factory stills was shown during *Dutch Design Week* in case visitors questioned the research findings.

For the first analysis of *5000times*, I was not in contact with assembly employees, labour organisations, factories or journalists and as such, there has been no dialogue with the context I am talking about. All material of *5000times*, besides the disassembled laptop, is based on second hand material taken from texts, images and videos online. The lack of a direct conversation with the context of assembly work reminded me not to use imagery or visual connotations of this context. The next steps for the project *5000times* will include the approach and open dialogue with the context of high-tech manufacture in Shenzhen, China.

The visualisations of the tasks in four stacks allowed the visitor to place themselves in relation to the captured physical act (e.g. placing 3,921 pieces of tape). The visitor could create a direct relation to the physical work of the piece as these are based on the scale of one person. This realisation lead visitors to start a questioning of their own position of privilege in relation to the tasks and initiated a discussion on the topic of labour exploitation. The exhibited manual work of one person in one day provided an added insight into manufacture to visitors and end-users. The experience of the body and what certain movements might do to the body could appear to be a language understood in diverse contexts.

Lastly, the decision to use my own body within the imagery of *5000times* refers to the position I have as a white body within the European context and how I can use the image of this body to pull discussions on labour exploitation closer into the spheres of design and consumption. The reenactment of the observed tasks within animation and visualisations started as a research tool. It provided insights into the treatment of bodies within manufacturing settings in a simulated but non-comparable situation. This reenactment evolved into the tool to express the intention of *5000times*: putting one's own body into the simulated situation of Foxconn factory workers, performing their labour as the body of the designer and as the western body (*fig.10*).



Fig. 10: Performance of soldering task.

How can we revalue the body that makes our devices?

It is a critique of companies like Apple who profess that design is their method for success but abuse the human rights of their workers in off-shore factories. It is a question of race and class divisions within design processes, with the intention of decolonising design through democratic and ethical organisation of spaces that supply progressive (western) lifestyles.

The attention given to the product and its effect on potential users by the designer is not equal to the attention given to the potential manufacturers of that product. As designers of goods we share an accountability for reproduction and politics used to reproduce the goods we generate. Aesthetics, functionality, user-friendliness and further sensations are part of the design process, as is the choice of material sourcing and manufacturing processes. One could say that a product bridges between the manufacturing body and the consuming body – through the designing body.

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