Experimenting the Future:

the symbiosis of handcrafts and digital technologies in the Joris Laarman Lab.

Name: Anouk Reijmer

Student number: S1133659

Email: a.reijmer@umail.leidenuniv.nl

Supervisor: Prof. Dr. T. R. A. de Rijk

Second reader: Drs. M.A. de Ruiter

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LIST OF CONTENTS

INTRODUCTION

“Everything you see around you will change in form and possibilities.” And that is exactly what innovative Dutch designer Joris Laarman (Borculo, 1979) aims for with his experimental designs. During the opening of his MX3D test lab last year, this thirty-year old something designer already argued how digital fabrication techniques would become more and more important in our future.[1] Together with a team of engineers, craftsmen and software developers, Laarman is going produce the first fully functional 3D printed metal bridge somewhere around 2017 over a canal in Amsterdam. A revolutionary idea based on ground breaking robotic 3D print technology, in which ‘robots can print sustainable materials, such as metals and synthetics, in virtually any size or shape.’ It will be an on-going project, in which Laarman will continuously research, develop and improve technology together with the most innovative companies and institutes in hard- and software, as well as construction and welding, to create products with a whole new form language.[2] It was not because of this project Laarman became a renowned designer; already since his graduation project (*Heatwave,* 2003), Laarman has become well known for his innovative work, in which science, art and technology meet.[3] Furthermore, we can see how he combines traditional craft practices with new digital technologies. For example, computer-generated algorithms based on the structure of bones created the structure of his first *Bone Chair*, but the knowledge and skills of an experienced craftsman were needed as well to cast the actual object into one piece of metal (fig 1). In some of his other projects he made use of robots that could reprogram furniture over and over again. He also used them to produce tables in a Rococo formed language, as done with *Digital Matter* (fig. 2) Either way, in doing so, Laarman shows how digital fabrication will no longer be restricted to simple geometric forms dictated by industrial machinery and even more how it will enable designers, as well as craftsmen, in the future to create, imagine and produce new forms that would previously have been all but impossible.[4]

1 http://www.jorislaarman.com/work/mx3d-bridge/
2 http://mx3d.com/about/
3 http://www.jorislaarman.com/work/heatwave/
4 http://www.jorislaarman.com/work/digital-matter/

Thus, according to Laarman the production process of objects is tremendously changing, and will continue to do so in the future. He also refers to himself as *a child* of a time of transition, with 'one foot in the industrial era and the other in the digital era', and mentions how technology is developing faster than ever before, and how frightening, fascinating and inspiring this is at the same time.[5] Indeed, in our daily lives we are constantly confronted with the fact that automated machines, computers and robots take over parts, or even all of the work we previously had to do with our hands. One the one hand, this has had a positive effect on the economy, but on the other hand it symbolized the demise of the traditional craftsman. Already with the advent of industrialization, debates about the disappearance of traditional craftsmen set off, which resulted amongst others in the Arts and Crafts movement in the 19th century, as well as the shaping of Craft Councils and Contemporary Craft Journals only some decades ago. With the shaping of these movements, as well as councils and magazines, some people tried to retain traditional craft practices, for they represented authenticity, honesty, and pride, and reminded one of the good old times. Furthermore, they also represented skill, experience, and knowledge, which could only be learned through years of training and hard work, and thus could not be imitated by machines or robots. According to some, this will ultimately result into the disappearance of traditional craft.[6]

In *The Invention of Craft* (2013) Head of Research at the Victoria and Albert Museum Glenn Adamson disagrees that digitalization will lead to the disappearance of craft practices. Instead of marginalizing, he is convinced that the work of craftsmen is *changing* because of digital production processes.[7] Furthermore he argues that traditional craft is actually a modern invention.[8] This may sound contradictory, but Adamson has got a valid point. In his book he demonstrates how traditional craft must be seen as industry's other. When the Industrial Revolution took place, the shaping of traditional craft as a counterpart to industry, was occurring as

5 Ibid.,18.
6 http://heritagecrafts.org.uk/
7 Adamson, G., *The Invention of Craft*, Oxford: Berg Publishers, 2013, xix- xxiv.
8 Adamson, 2013, 184.

well.[9] This does not mean that craft as an activity didn't exist before that time; rather it got a name and filled the hole of industry's opposite. Thus, where industry was seen as something new and modern, traditional craft practices were seen as conservative and something that was related to the past. In his first book, *Thinking Through Craft (2009)*, Adamson deconstructed the narrative of craft by opposing it to modern art.[10] He set out three principles of craft. First, craft is *supplemental*: it is made to serve a functional purpose, as opposed to a modern artwork, which is autonomous in the first place. Secondly, craft is organized around *material* experience: it needs to be touched and used, whereas paintings only need to be looked at. The last principle is *skill*: for skill is the most complete embodiment of craft as an active, relational concept. The production of modern art does not necessarily need the artist to be skilled in something, whereas a good chair needs to be of a good quality.[11] However, Adamson makes very clear that his interpretation of craft is one of craft under the conditions of modernity, so it is not described in a pre-modern context (or a contemporary context for that matter), but particularly in relation to modern art.[12] Thus, according to Adamson, traditional craft derived its meaning of its relationship to modernity or industry. But craft is an ever-changing thing; and what we really need according to Adamson, is a brand-new conversation. He argues how ceramics and metalwork are still seen as traditional craft practices, but 'amateur'-crafting like scrapbooking and cake decorating on the one hand, and industrial skills like prototyping and welding on the other, need to be seen as craft practices as well. "We need to welcome all these different skills, and others too, and we need to see how they are embedded in many arenas of making."[13] Therefore, he argues how contemporary craft needs to be redefined and it needs a theory of its own, for times are changing and therefore the traditional notion of craft is changing as well. In his books he researched the notion of craft and craft's position in society under the conditions of industry and modernity. However, the notion of craft under the conditions of digitalization has not yet been researched.

9 Ibid., XIII-XV.
10 Adamson, G., Thinking Through Craft Oxford: Berg Publishers, 2009, 1-4.
11 Adamson, 2009, 4-5.
12 Adamson, 2013, xxiv.
13 https://www.craftcouncil.org/magazine/article/big-questions-glenn-adamson

Laarman also believes traditional craft practices will continue to play an important role in today's making process, for 'you cannot simply think physical objects up in your mind, even using the most advanced computers; making them still requires the actual skill.'[14] However, he also agrees with Adamson these practices are changing. He believes that craftsmanship ought to be seen as something that is always evolving, rather than something nostalgic, and that, with the help of high-tech tools, it should become central to society."[15] In his ideal world, there would be a symbiosis of handcrafts and technology: 'a democratic design world, in which digital and locally fabricated design is affordable for everyone'.[16] Indeed, in his projects we can see how he makes use of digital production techniques to produce his concepts, but still uses experienced craftsmen for the workmanship of his objects. It is this combination of traditional, as well as contemporary craft practices, and new digital production techniques that symbolize a new notion of craft, and he is convinced that new digital fabrication techniques will enable craftsmen in the near future to create and produce things that would have been all but impossible. However, he does question, regarding the rapid developments in digital fabrication and industrial production processes, if *traditional* craftsmanship and the love of the way things are made, will still play a crucial factor in our society. This is a relevant question, which I would also like to address with my thesis. In this regard, and because of the fact that the notion of craft in this digital age has not yet been researched thoroughly, and as Adamson argues we need 'a brand-new conversation', I would like to research how Laarman and his lab deal with new digital production methods in their work and how this still relates to the traditional notion of craft. Therefore, I have formulated the following question:

How does Dutch designer Joris Laarman deal with digital fabrication techniques in the production of his work and how does this relate to the traditional notion of craft?

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14 Star, A., *Joris Laarman Lab*, Groningen: Groninger Museum, 2015, 19.
15 Ibid.
16 Star, 2015, 180; 259.

In the first part of my master thesis I will give an overview of the work of Joris Laarman and the Joris Laarman Lab. Some of his works will be highlighted, for they help me visualize his underlying thoughts about the merge of craft practices and digital technologies to explore new territories. I have divided the chapter in three sub-chapters: Ornament versus Functionality, Technology versus Craft, and New Methods and Materials. Every sub-chapter includes several projects that can be connected to those three categories. Some of those projects can be divided into multiple categories, yet for a good overview, I decided to divide them like this. In doing so, I hope to get insight into how Joris Laarman deals with digital production methods in the production of his work, but also how this still relates to the traditional notion of craft. Times are changing, so the traditional notion of craft may have changed into a more contemporary one. Therefore, in the second part of my master thesis, I would first like to research the traditional notion of craft, by means of looking into its etymology and definition to help me answer my main question more correctly. Thereafter, I would like to research if there is a *contemporary* notion of craft, and if so, how it defers from the traditional notion of craft. In this part I will make use of contemporary debates about the notion of craft. I will also look into the amateur-craftsman, for it is becoming a trend for consumers to design and produce their own unique objects as well.

For the first part of my master thesis, I will make use of exhibition catalogues and interviews done with Laarman in the past. The book included to his first solo-exhibition at the Groninger Museum, as well as his websites www.jorislaarman.com and www.mx3d.com will serve as my primary research material. For the second part, I will make use of secondary literature about the notion of craft in past and present. Though Adamson has served as an introductory source, he is one of the most important sources on modern craft and is also one of the co-editors of *The Journal of Modern Craft* (2008), in which 'all aspects of craft as it exists within the condition of modernity are being addressed.[17] He investigates and re-envisions craft from a whole new position and therefore, besides the work of Joris

17 http://journalofmoderncraft.com/about-2

Laarman, he also serves as one of the main inspirations for my master thesis. Furthermore, I will also make use of a slightly older source of Prof. Herwin Schaefer (*The Methamorphosis of the Craftsman*, 1958), for it gives me insight into how the traditional craftsman is slowly 'changing' into a more contemporary one, and how this affects the notion of craft in general. Lastly, I will also make use of contemporary literature about the merging of traditional and digital production practices, such as Lucy Johnston's *Digital Handmade: Craftsmanship and the New Industrial Revolution* (2015), to analyze how designers and craftsmen deal with new possibilities and their (new) positions in this digital era.

By using Laarman and his innovative experimental work as subject for my master thesis, I hope to get insight into the notion of craft and how its traditional notion is changing (or has already changed) into a more contemporary one. In a bigger perspective, I hope to contribute to the on-going debate amongst scholars about the future of craftsmen and their role in this digital age. As a remark, I would like to note that this is not a case study, for the work of Joris Laarman cannot be seen as an example for the future of all craftsmen and their role in this digital age. With his designs, he does not address the future of a baker or a basket weaver for example. He does however demonstrate the possibilities of craftsmen working in the furniture and building industry, and as an artist raises the subject with his work to show that craftsmen need to work together with industry to come to new knowledge and skills, which in turn leads to new innovations. In this way, his work and thoughts serve as an example for me to show how the notion of craft is changing, and therefore could affect the role of the traditional craftsmen in this digital age.

1. JORIS LAARMAN LAB

From November 2015 till April 2016 one could visit the *Groninger Museum* in the Netherlands for an exhibition on the *Joris Laarman Lab*: a collaboration of artist, designer and innovator Joris Laarman, his partner Anita Star (1979), and a hand full of scientists, craftsmen and engineers. They describe their lab as “an experimental playground, set up to study and shape the future and discover the many new possibilities of upcoming technology and its consequential aesthetics.” Moreover, they have a very diverse portfolio: ‘it varies from sculptural experimental furniture and innovative production processes to museum installations, film, digital media and workshops given at universities around the world’.[18] Accompanied to Laarman’s first solo-exhibition is a book including photographs and short texts about some of his most experimental and innovative works done so far. Although this is not an actual exhibition catalogue, I will use it as my guideline for this chapter, for it gives information about the creative process and underlying thoughts as stated by Laarman himself. Furthermore, I will use his websites as reference points, as well as interviews done with the artist in the past.

1.1. Introduction

Born in a small town in the rural countryside of the Netherlands, Laarman wasn’t particularly stimulated by his surroundings. Above all, he was a daydreamer. Until he travelled to Amsterdam, where his creative mind was first stimulated, and his experimental designs are currently being conducted in his own lab. He specifically calls it a lab, for he likes to refer to himself as an inventor or an innovator, rather than a designer: “I don't just try to make beautiful things, I collaborate with craftsmen, scientists and engineers in order to study and fashion the materials things are made of".[19] With his graduation project *Reinventing Functionality* (2003) he distinguished

18 http://www.jorislaarman.com/about/
19 http://www.vogue.it/en/uomo-vogue/people-stars/2012/04/-joris-laarman

himself from the other students on the *Design Academy* in Eindhoven, by creating indeed something more than just a beautiful object. His teacher, and co-founder of *Droog Design*, Gijs Bakker (1942) set up countless meetings with companies in order to get the project realized.[20] In 2005, Laarman joined the 'Simply Droog 10+1' exhibition at the *Gemeentemuseum* in The Hague with his polyconcrete radiator. His design was accompanied by other designs from renowned Dutch designers like Marcel Wanders (1963), Hella Jongerius (1963) and Tejo Remy (1960). The purpose of the exhibition was to showcase conceptual designs, which were original, clear, practical and sometimes even produced with the newest technologies.[21]

In the same year, he and Anita Star founded the Joris Laarman Lab and moved their start-up company to a warehouse in the docks of Rotterdam. This was a very fruitful period, in which Laarman designed amongst others the *Crystal Garland* for the *Swarovski* exhibition 'Unbridaled' (2007), and an ideal house for the international furniture fair *IMM Cologne* in Germany (2006). The *Garland* was made out of 15.000 crystals, but oddly enough seemed to drape very flexible like a paper garland would do so (fig. 3).[22] For his *Ideal House*, Laarman envisioned a laboratory-like house, in which contemporary living would literally be experimented (fig. 4).[23] Furthermore, he was asked to create an installation for an exhibition in 2006 in Japan, which became his *Parasol Project* (fig. 5). By using the newest technologies, interactive parasols only opened up when the sun was shining, which was ideal for Japanese people who did not want to tan.[24] His *Nebula* (2007) was an outcome of the collaboration between Laarman and *Flos*, one of the first big companies that approached him after his graduation (fig. 6). A bundle of old lampshades from a flea market inspired Laarman to create a blown glass version for the Italian lightning brand ran by Piero Gandini, who said: "when turned on, it looked

20 Star, 2015, 35.
21 http://www.gemeentemuseum.nl/tentoonstellingen/simply-droog-10-1-jaar-avant-garde-design
22 Star, 2015, 66-67.
23 Ibid., 62-65.
24 Ibid., 68-69; http://www.jorislaarman.com/work/parasol/

like an explosion of light… like a star in the sky."[25] One of the bigger projects Laarman conducted in Rotterdam was his *Bone Furniture*: interior objects based on computer-generated algorithms that copied the structure of bones.[26] I will elaborate on this project in chapter 1.4.1.

In 2009, Joris Laarman and Anita Star decided to move their lab to the capital. They took all their belongings and employees with them to grow into the lab that it is today.[27] At that same time, Laarman was becoming one of the leading designers in the Netherlands, giving guest lectures on different design academies, still exhibiting his radiator on *Droog* exhibitions, and showcasing some of his newest projects in renowned museums like the *Victoria and Albert Museum* in London and the *Museum of Modern Art* in New York.[28] For the 50th birthday of the *Guggenheim Museum* in New York, Laarman designed a non-living swarm of individually flying paper planes resembling a swarm of starlings, which would transform the rotunda into a huge vivarium (fig. 7). When the *Paper Starlings* (2010) were low on battery, they would automatically recharge on a platform on the ground and joined the swarm again when fully charged. Laarman: "At that time, this project was too expensive, but given the current technological possibilities, it is starting to come within reach."[29]

This futuristic thinking is actually one of Laarman's 'trademarks'. He states that he and his lab are constantly searching for new production methods that will only be common in ten years, and by working together with scientists, they try to anticipate on what will be possible in the near future.[30] Though, with these projects, Laarman also anticipates on what is already possible and - maybe more important - on the effects of these new possibilities. Already in 2005, just after graduation, Laarman conceptualized the effects of the digital revolution into his *Credit Brooth*: a piece of jewelry that is not worth value in its material, but in its content (fig. 8). In this digital age, a SD-card is sometimes worth much more than a golden ring, that's why

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25 Star, 2015, 70-71; http://www.flos.com/consumer/en/products/pendant/Nebula; http://www.jorislaarman.com/work/nebula/
26 Star, 2015, 73.
27 Ibid., 109.
28 Ibid.,142-144.
29 Ibid., 146-149; http://www.jorislaarman.com/work/paper-starlings/
30 Dutch Profles: https://www.youtube.com/watch?v=EO1IPlGLKoE (5:21 min.)

Laarman created a brooch on which you can upload your money, “so you can wear virtual value like a piece of real jewelry again”.[31] Another example is his *Gigabyte Bookcase* (2010), in which Laarman addresses the disappearance of shape, volume and material in the digital world by creating a ‘monument’ for paper books. The bookcase can contain as many books as an e-reader of 1 GB (fig. 9).[32]

Most of his projects done so far were commissions from museums or private clients. Laarman admits how some of his projects need to stay limited editions to keep his company running. He states: “we earn the money we finance almost everything along with the sale of those editions.” Furthermore, he mentions how these products would need to change too much, to make it a cheaper version for the consumer industry, and he doesn’t like the restrictions that come along with it. In this way, Laarman can continue his experiments.[33] And that is exactly what he likes the most about his work: “working in an experimental way, you get much more unexpected results, and you can actually invent things.”[34] But not all his projects are limited editions for the sake of money. In 2003, Laarman addressed the fragility of the industrial mass-production process, by producing a series of vases called *Limited*, which all looked different as a result of the wear of the same mold used over and over again to create the vases with (fig. 13). In this way, Laarman shows how even industrial made products are not all identical and forever without the interference or help of the human hand.[35]

With most of his works we can see how Joris Laarman searches for the perfect balance between functionality and ornament, as well as the use of technologies and craft in the production process. Every project is another experiment to explore what could be done in the future and how it could become common one day. In the following part of this chapter, I will discuss some of his work more thoroughly to understand *why* and *how* Laarman produces his innovative and

31 Star, 2015, 54-55.
32 Ibid., 142.
33 Philip Smet: https://www.youtube.com/watch?v=4O8m4pSzYns (4:00 min.)
34 Fast Company: https://www.youtube.com/watch?v=NCgZ1-NqGbI (1:36 min.)
35 Star, 2015, 56-57; Wall text ‘Limited’ on the Joris Laarman Lab exhibition, Groningen: Groninger Museum (visited 01/03/2016).

influential designs. I will do this by using three 'categories' I've mentioned before: 'Ornament versus Functionality', 'Technology versus Craft', and 'New Methods and Materials'. Of course I am aware that most of his works can be classified into more than one category, though I feel like some of his works do address a specific category more than others.

1.2. Ornament versus Functionality

'Ever since the beginning of modern design, there has been a discourse on the use of ornament versus functionality.'[36] During the nineties, art historian and curator Renny Ramakers (The Hague, 1946) observed how Dutch product designers were moving into a different direction: a deliberate lack of style, the recycling of materials, and most important, creating new forms as a result of a concept, rather than its aesthetics.[37] A few years later, in 1993, Ramakers and Bakker founded *Droog Design* (now *Droog*). Its main goal was to give a different perspective on design as well as the promotion of the work of contemporary Dutch designers. They gave these young designers an international platform for their at-the-time radical designs. *Droog*, which means 'dry' in Dutch, was named after its Dutch characterizations: no-nonsense soberness, clear, and yet with a sense of humor ('Droge humor' is a typically Dutch humor with a sober, ironic twist). In this sense, *Droog* had always been associated with simplicity and a lack of style or decoration. When Laarman was still a student on the Design Academy, he and his classmates were very influenced by this conceptual thinking of *Droog*, especially with Gijs Bakker as their professor. Still, Laarman never quite understood why this ruling soberness needed to exclude decoration or ornamentation. Therefore, he graduated on this subject.[38]

1.2.1. Reinventing Functionality

36 http://www.jorislaarman.com/work/vortex/
37 Ramakers, R. *Less + More: Droog Design in Context*, Rotterdam: 010 Publishers, 2002, 6-10.
38 Star, 2015, 31; http://www.jorislaarman.com/work/heatwave/

His thesis project *Reinventing Functionality* questioned the on-going discourse on function versus ornament by searching for the most functional form for a radiator to diffuse heat (fig. 10, 11). Laarman stated how heat is radiated best by using a surface as large as possible. Ironically enough, he found out that by using the characteristic curls of the Rococo style, space was being used in a most efficient way. Thus, with his graduation project, Laarman demonstrated how functionality doesn't always need to exclude decoration or the other way around.[39] He explained on his website: "I wanted to demonstrate that functionalists are also style sinners, and that soberness is not always more functional than a highly decorative form."[40] Laarman actually likes the fact that his radiator looks like a piece of art or a wall sculpture at first sight, when instead it is a functional object that produces heat. The archetypical water faucet is the only characteristic that shows its actual function.

Besides the fact that Laarman questions the on-going discourse on function versus ornament, he demonstrates how traditional craftsmanship and industrial production processes are combined in his designs. Before the Dutch heating company *Jaga* took his *Heatwave* into actual production (2007), it had to be developed into a version for central heating. *Droog* also produced a version of the radiator, but this was an electric version made out of aluminum. The best way to realize the original concept and design of Laarman, according to his former product developer Tony Michiels, was to produce a metal hose in a polyester concrete shell, which was completely reconstructed from clay by hand. 'Later on, this hand-made model was 3D-scanned to adjust any imperfections with the computer. Then a mother-mold was machined from a computer model, which formed the basis for a seemingly infinite series of iterations that finally led to the definitive production version.'[41] This ultimately resulted in the start of the *Joris Laarman Lab*.

1.2.2. Vortex

Laarman argues how ornament has always been an important aspect in his work, and how this digital era allows many new perspectives on the discourse of ornament

39 Ibid.
40 Ibid.
41 Star, 2015, 36.

versus functionality. From the beginning of modernism, 'ornament' was seen as something outdated. Functionalism and minimalism replaced the styles of the previous centuries, and using the still rather basic industrial production processes, Laarman felt this combination led to uniformity and dullness. Because of the restrictions of industrial production processes at that time, it wasn't possible to create all kinds of forms yet. In this era, with its digital design technologies it is becoming possible to create almost everything you want. That is why Laarman believes ornament and personalization are becoming more and more important.[42]

In 2014, Laarman got inspired by the dissertation (2006) of Mark J. Stock, an artist, scientist, and programmer, who creates still and moving images and objects combining elements of nature, physics, chaos, computation, and algorithm. "His work explores the tension between the natural world and its simulated counterpart, between organic and inorganic, digital and analog, and structure and fluid."[43] Laarman was struck by the organic and decorative, yet fully virtually made vortexes that appeared on his screen. For his *Vortex* pieces (2014), he used the research of Stock to let the customers decide how much ornamentation they would like in their furniture. In doing so, he addressed the personalization of objects, as well as the discourse on ornamentation and functionality. To create these ornamentations, Laarman used algorithms based on Stock's research. By means of special software, Stock could mimic the processes of the rotational movement in gas or fluids (vortex). Using this special software, Stock made it possible to show these processes, which could not have been seen with the naked eye in this way. On the walls of the Groninger-exhibition, the curators placed several examples of computer simulations, on which variations of this simulation where shown. So every image had its own form, created by a certain moment in this simulation. In this way, every bookcase, designed after the image, could become unique and personal in a way that customers chose how much ornamentation they would like.[44] The *Vortex Bookcase* was engineered in such a way that it could take a new form every time it was taken

42 Wall text 'Vortex' on the Joris Laarman Lab exhibition, Groningen: Groninger Museum (visited 01/03/2016).
43 http://markjstock.com/bio/
44 Star, 2015, 192-204.

apart, because the multiple layers of perforated aluminum contours were assembled following a digital blueprint that could be adjusted every single time (fig. 12).[45] In this way, the customer could 'create' a new bookcase over and over again.

1.3. Technology versus Craft

Laarman mentions how 'over the past several decades, the transition from analogue to digital has revolutionized many fields, most notably computing and social media. But digital technology is also starting to define an evolution in the way we manufacture, distribute and recycle products. Inspired by emerging industrial manufacturing methods in the early twentieth century, modernist pioneers valued and changed the aesthetics of design. Now, the new realm of digital fabrication is shifting our current notion of design and pushing artists to explore the endless new possibilities of digital manufacturing.'[46] Laarman is such an artist who explores the endless new possibilities of digital manufacturing. Though he also values traditional craft practices and the artistic quality of the final product. He combines artistic and creative skills with technological knowledge, and in this way merges traditional craft practices with digital production methods. In the following projects, Laarman visualizes the merge of craft and technology, as well as the endless possibilities of digital production processes.

1.3.1. Forest tables

In 2010, Laarman designed a table that combined the craftsmanship of a blacksmith with high-tech digital manufacturing processes. The frame of this *Leaf Table* was based on algorithms. The legs were based on the arrangement of the various elements of a computer network, also known as the 'network topology' (the psychical layout of a network), whereas the table top was inspired by a Voronoi-diagram (a geometric model formed by the separation of multiple sections). The legs of the table resembled the trunks of a tree, whereas the table top appeared to be coming straight out of nature, 'like the structure of a leaf'. The frame was created with the help of

45 http://www.jorislaarman.com/work/vortex/
46 http://www.jorislaarman.com/work/digital-matter/

computer-controlled etching and laser-cutting tools.[47] Without these digital production methods, a table like this could probably not have been made in the first place. Though, it is with the help of a skilled blacksmith this table is assembled and finished. Precisely because of this merging of craft and technology, it is possible to create and produce an object like this. A year later, Laarman was asked to develop an installation of tables for the Korean Art Gallery *Kukje*. He took the *Leaf Table* as his starting point and developed another series of *Forest Tables* that fitted together like 'tree canopies in a forest'.[48] The tables could also be assembled in various compositions, which gave the customer the choice of how to arrange his own 'forest' (fig. 13).

1.3.2. Digital Matter

In the same year as the production of his *Forest Tables*, Laarman developed a kinetic installation for the *High Museum of Art* in Atlanta. It had to illustrate a direction of future design based on upcoming technology. Its outcome was *Digital Matter*. The first tables produced with his robot installation 'Abby' were named *Kilovoxel*, *Megavoxel* and *Gigavoxel* (fig. 14).[49] Three tables in a Rococo formed language, made with tiny volumetric pixels called 'voxels', all resembled each other but were different in their detailing. The *Kilovoxel* table was made with a 10 mm. voxel, whereas the *Megavoxel* and *Gigavoxel* were produced with respectively 5mm. and 3mm. voxels. In this way, the *Gigavoxel* table is more detailed, for the digital blueprint consists out of more voxels, and thus can be more accurately produced by the machine. Laarman compares it to the evolution of computer game heroes such as *Super Mario*, because the table becomes more realistic as the resolution of the material increases. In this way, the installation resembles the evolution of 'digital matter' (the three-dimensional realization of digital images through the use of voxels).[50]

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47 Star, 2015, 128.
48 http://www.jorislaarman.com/work/leaf-table/
49 High Museum of Art Atlanta: https://www.youtube.com/watch?v=50apIGRSLeM
50 Wall text 'Digital Matter' on the Joris Laarman Lab exhibition, Groningen: Groninger Museum (visited 01/03/2016).

For this project, Laarman was inspired by a research done by MIT and Cornell University about programmable matter. He was so fascinated about the future possibilities, that he and his lab developed a digital fabrication tool, on which you can upload a digital blueprint, which in turn will be produced by the robotic installation. In his ideal world, there would be robotic arms like these in every city, to produce objects made of digital material that could be reassembled over and over again. Laarman: “Recent developments in the field of nanotechnology show a future, in which materials are no longer static, but can be remodeled over and over again.” For his project, Laarman used the heavily decorated forms of the Rococo style, but in fact it could be any kind of form, as long as the voxels can create it. He continues by saying: “We believe a hybrid form of digital fabrication and local crafts is the future of a more democratic design world. With the help of new technologies we hope that in a few years everyone will be able to afford good design that is locally fabricated”.[51]

1.3.3. Makerchairs

With his *Digital Matter* Laarman shows how, in the near future, digital production methods can produce an object completely by itself by only using the digital blueprint one entered in the computer. It seems rather contradictive then when he argues that craft will always exist. Though, with his *Makerchairs*, he would like to show exactly how he sees this future merge of craft and digital technology (fig. 15). In his series, consisting out of at least ten different chairs, Laarman combines handicraft with digital technologies by using 3D printing as a new production method. He wants to make it possible for consumers one day to produce digitally fabricated parts by a 3D printer, so that they can literally *make* their own furniture at home. He already made it possible to download the digital blueprint of one of his *Makerchairs* via Open Source, which can be found on the website of the *Bits & Parts* project.[52]

With his *Makerchairs* he explores the possibilities of digital manufacturing methods and pure handicraft, because although the 3D printer produces the multiple parts of the chair, the actual finishing and assembling of these parts, has to be done by hand. Laarman: “We believe in the symbiosis of handcrafts and technology like parametric

51 Star, 2015, 179-180.

52 Groninger Museum: https://www.youtube.com/watch?v=fjapIVwbP5s

design tools and digital fabrication. The *makerchairs* fit right into that dream."[53] His first *Makerchair* was actually a three dimensional puzzle of a chair, which had to be assembled by putting together all the pieces. Its prototype consisted out of 202 parts. The following version consisted out of 85 parts that could be assembled within two weeks at reasonable cost. This chair was initially produced for the *Bits & Parts* project. But the first chair that could actually be manufactured with a 3D printer at a local fabrication laboratory (fablab or a so-called *maker space*) was the kids chair, made available on 3DHubs.com. This was a smaller version of the puzzle- or *Jigsaw Makerchair*, so it would not take a lot of time to print and assemble all the pieces. All his chairs were made with different techniques and different materials. So, besides the 3D printer, Laarman also used CNC (Computer Numerical Control) milling, which is the taking away of access material, instead of producing it. Furthermore, besides using different kinds of woods, Laarman also used resin, magnesium or plastic for example.

1.4. New Methods and Materials

As mentioned in the introduction of this chapter, I have chosen to divide some of Laarman's work into categories, for some of them address their category very well. Others could be classified into more than one category. For instance, *Heatwave* addressed the discourse on ornament and functionality in the first place. But secondary, it was also the result of the collaboration between the hand and the machine. Another example is *Digital Matter* that addressed the production of tables made completely by robots, instead of the hands of a craftsman. Though it also showed how machines are no longer restricted to geometric forms and can produce highly ornamental objects as well. *Digital Matter* was a commission for the *High Museum of Art* in Atlanta, but it was not the only installation Laarman designed for this commission. *Dynamic Bench* is one of his other installations that anticipated on future design processes (fig 16). It is an interactive reprogrammable bench, made out of three hundred motors that can turn into a new configuration by the computer. In this way, the bench can take new forms over and over again.[54] In doing so,

53 Star, 2015, 259.
54 Ibid., 176-177.

Laarman addressed the personalization of things, as well as the new possibilities of digital manufacturing processes. In this sub-chapter I will address projects like these, for they are (in the first place) renowned for their creative process, in which new materials and new digital production methods are being used in the production process of his designs.

1.4.1. Bone Furniture

The first big project Laarman carried out had to do with a documentary of a German professor named Claus Mattheck. The documentary was about the ability of trees to add material where strength is needed. Proffesor Mattheck used this knowledge to create his own computer program, in which the structure of the trees was mimicked. When there was a weak spot in the structure, it was marked with a red color. To remove this red section, 'material' had to be added to make it green again. In this way, the tension in the structure became equally divided and there were no weak spots any longer.[55] At the same time, German engineer Professor Lothar Harzheim developed a dynamic digital tool, together with the International Development Centre *Adam Opel GmbH*, that copied the way bones grow. In contrast to trees, bones have the ability to take away material where strength is *not* needed. For Laarman, this software mimicked quite precisely the way evolution constructs, and therefore it opened a whole new world of possibilities for him. For the 'Smart Deco' exhibition initiated by *Droog* and *Friedman Benda*, Laarman asked Professor Harzheim if he would like to collaborate with him. As a result, the *Bone Chair* was developed (fig. 17). The design of this chair was based on the algorithms of the structure of bones. Where strength was needed to sit, the computer added material, where strength was not needed, the material was taken away. In this way, the design resulted in a very organic, almost bone-like chair.[56] The *Bone Chair* has gained worldwide fame for its appearance, as well for its concept, and it set off a whole new way of producing furniture. The collaboration of artists and scientists, as well as nature and technology makes it a fascinating chair, which already has been marked as one of the classics

55 VPRO Noorderlicht: https://www.youtube.com/watch?v=G7DVI8wqP-Q
56 Star, 2015, 73-80.

in Dutch design.[57]

The actual production of the chair started off with a paper edition (fig. 18). The idea was to produce an aluminum variant with 3D printing techniques, but the limitations of computing at the time prevented this from happening. That is why Laarman looked into other materials, such as paper. Using the method of laminated object manufacturing, which is the laminating of sheets of paper that are laser-cut into a specific three dimensional form, the paper version of the *Bone Chair* was born. The first *Aluminum Bone Chair* was produced in a small workshop somewhere in a small town in the Netherlands. Phil Verdult was one of the few craftsman who did not back down for the difficult job of casting metal in a 3D printed mold.[58] After the first *Bone Chair* was produced, many versions followed. By adjusting the algorithms of the design, the form of the chair changed along. So, when Laarman designed his *Bone Chaise*, which is a chaise longue, it had to be made of a more soft material for lounging and the strength points in the structure had to be changed (fig. 19). The mold of this particular chair was the only one in the series that was made completely by hand, due to the complex forms it had. The material used was a new developed casting resin, which was UV resistant, so it did not 'aged' in means of its color. In this way, the chair had a plastic, ice-like transparency, which made it look softer then its aluminum brother.[59] Laarman expanded his *Bone Furniture* series with the *Armchair* (fig. 20). 3D printing was still in its infancy at that time, and not all materials could be used to 3D print. That is why he tried to 3D print the mold instead of the product, so he could still benefit from the 3D printer, as well as all kinds of material. By filling the mold with a mix of white Carara marble powder and casting resin, his *Arm Chair* could be produced in a single piece. The last piece made for the *Bone Furniture* series was the *Rocker* (fig. 1). This chair was made in such a way that it could rock. It seems rather easy to produce all kinds of variants of the *Bone Chair*, but one has to remember that every single chair needs a different structure. So, to function as a rocking chair for example, this chair needed a different set of algorithms, which had

57 www.groningermuseum.nl/nieuws-solotentoonstelling-joris-laarman
58 Star, 2015, 80.
59 Ibid., 90.

to be developed by software designers.[60]

1.4.2. Foam China

During his teaching at the Rietveld Academy in Amsterdam, Laarman met Marjan van Aubel, who was still a student back then. When she graduated on her 'Foam Froth' project, Laarman decided to team up with her. They started to experiment with the material, which could expand to about 300 percent of its original volume. *Foam China*, as they called it, can be compared with the dough of bread that needs to rise (fig. 21). Furthermore, it has the same strength as Bone China, which is a soft-paste porcelain made out of bone ash, and is known for its strength and chip resistance. To test the material, they went to the *European Ceramic Work Center*, were they made countless samples to find out how this process exactly worked. They even made a prototype that would demonstrate to what extend the material could expand into a mold. The result was a pink 'Barbapapa' look-a-like chair, but Van Aubel argues that it could basically be used for anything: "I think it has a lot of potential as a building material because you can shape it at will. That's why it has many possibilities."[61] *Foam China* is an ongoing project that is being further developed for architectural applications at the Dutch Ceramic Company *Royal Tichelaar*.

1.4.3. Micro Structures

For the execution of the production of his designs, Laarman mostly makes use of 3D printing techniques. In his *MX3D* lab, one can find a timeline of the history of 3D printing, which already began in 1920 with the first patent issued on making objects with arc welding by building them up in multiple layers. The actual technology has been around for only two decades and is still developing. 3D printing was previously used for the production of molds and prototypes, but nowadays it can actually be used to produce the final product.[62] Laarman argues how it is becoming possible to 3D print objects outside of the printer, for the developments in software are rapidly increasing: "software becomes smarter and smarter, and in this way you can make

60 Ibid., 101.
61 Ibid., 112; http://www.jorislaarman.com/work/foam-china/
62 Star, 2015, 216.

very smart machines of robots that were in the first place silly and old."[63] He began experimenting with different materials and different methods to 3D print. His aim was to develop 3D printed objects that addressed functional conditions through their variation, containing diverse programmatic changes. In this way, a chair would contain certain qualities like strength and stability, as well as soft sitting and flexibility; all 'decided' by computer algorithms, that were placed into the computer to come to a certain cell structure of the material used.[64]

His first experiment was the *Soft Gradient Chair*, which was made out of thermoplastic polyurethane, a material that can be both soft and hard, depending on its cell structure (fig. 22). As a result, this chair is soft and comfortable in some places, as well as hard and firm in others by using only one material and one printing technique.[65] Furthermore, this chair could never have been made by hand, for its structure is much too complex by the appliance of generative design tools. Hence the name of the series: *microstructure*, because they produce 'micro' structures with a 3D printer. His second and third chair made for this series are respectively named the *Aluminum Gradient Chair* and the *Adaption Chair* (fig. 23, 24). The *Aluminum Gradient Chair* was made out of aluminum because Laarman was interested how the production of design chairs, which are usually made out of aluminum for its low costs, could be alternated and/or improved. The chair was produced by a computer-controlled laser (Selective Laser Sintering), which melted a powder substance of aluminum layer by layer onto each other. By adapting the thickness of the layers in some places, it could be made thicker, and thus stronger.[66] The *Adaption Chair* was made out of polyamide and copper. This chair was also produced with a computer-controlled laser (SLS), which again melted a powder substance of polyamide particles onto each other. When the layers where done, a copper layer was applied to it, which gave it its strength. After that, the 3D printed version of polyamide could be melted away so the chair would only consist out of its strong copper layer.[67]

63 Kunstuur, http://web.avrotros.nl/kunstuur/player/AT_2050481/
64 Star, 2015, 216.
65 Ibid., 220.
66 Ibid., 234.
67 Ibid., 241.

1.4.4. MX3D

In his previous projects, Laarman already used 3D printing techniques to create molds and prototypes, as well as the final products. But there were always limitations in terms of the size of the object, because 3D printers and SLS-machines were not capable of producing products outside of their own boxes. As inventor, Laarman was interested if it was possible to 3D print material outside of the machine. With the rapidly improving technologies of today, he teamed up with the *Institute of Advanced Architecture of Catalonia* (IAAC) to develop a machine that could actually do all of this. The result was *MX3D Resin*: an old robot made into a highly innovative 3D printer, which could print a superfast curing resin that could neutralize the effect of gravity during the course of the printing process. It was the precursor of Laarman's metal printer named *MX3D Metal*, which was the combination of an industrial robot with an advanced welding machine. In both methods - the 3D printing of resin as well as metal - there was no need for additional supporting structures. In fact, there was no need for a working surface at all; hence why Laarman is determined to produce the first 3D printed metal bridge over a canal in the city center of Amsterdam. But how does it actually work? In terms of the metal printer, small amounts of molten metal are added onto each other following a certain design or print that was added into the machine, and in this way it can form a certain structure. With the resin printer, it actually works the same, only with a superfast curing resin. [68]

In this way, the possibilities of 3D printing objects outside of the machine are endless. The first experiment done with the *MX3D Metal* resulted in the sculptural *Dragon Bench* (fig. 25). After this piece, Laarman and his lab made some other pieces for the *Dragon* series, and recently he also produced a collection of sculptural screens in varying sizes, geometries and materials. The *Butterfly Screen* was one of the first screens (fig. 26). It is a 2 x 3 meter double curved bronze surface based on a hexagonal cell division. Laarman argues how 3d printing on this scale is unexplored territory, so they are still learning as they develop new sculptural work:

68 Star, 2015, 245-250; http://www.jorislaarman.com/work/mx3d-resin/

“For every new form language a specific strategy is developed resulting in large a library of strategies that will become self learning in the near future.”[69] Even multi-material gradients from bronze to steel are in the planning, yet they are determined this new method also had to produce functional and meaningful objects in the end as well. In collaboration with craftsmen, engineers and software experts, Laarman developed this technology further and even started his own business in it, called *MX3D*. The company refers to itself as ‘a company that researches and develops ground-breaking robotic 3D print technology’. Laarman: “our robots print sustainable materials such as metals and synthetics in virtually any size or shape […] it is the bringing together of digital technology, robotics and traditional industrial production.”[70] It is still an on-going process, in which industrial multi-axis robots are combined with 3D tools, and the developing of the software to control them needs to be improved every single time, but Laarman firmly believes this will become more important in the future, and he wants to be ahead of that. The 3D printed metal bridge is a collaboration of amongst others *MX3D*, software company *Autodesk*, building company *Heijmans* and the city of Amsterdam. In the MX3D shed on the *NDSM*-yard they will experiment and test how the bridge can be build best to function as an actual bridge to walk on. They expect the bridge to be finished already in 2017 (fig. 27).

2. CRAFT IN THE DIGITAL AGE

In the previous chapter, I described the work of Joris Laarman and his lab, which included the collaboration of designers, craftsmen, engineers and scientists, as well as the merge of traditional craft practices and cutting-edge digital production technologies. With his projects, Laarman showed us that merging these two ‘opponents’ could be very fruitful for the invention of new methods and materials, and

69 http://www.jorislaarman.com/work/butterfly-screen/
70 http://mx3d.com/; http://www.jorislaarman.com/work/mx3d-bridge/

that experimenting with these new methods and materials could lead to new opportunities for industry, as well as for craftsmen. Industry has always been seen as the opponent of traditional craft. When the Industrial Revolution took place, craft seemed to diminish due to new industrial production processes, which were quicker, cheaper and more efficient. New methods and materials arose. Around 1750, steam engines and the production process of casting iron set off the First Industrial Revolution. Around the end of the 19th century, steel and electricity were invented, which both benefited and accelerated the industrial production process in their own way. This period, lasting approximately till the First World War, was named the Second Industrial - or Technological - Revolution. The Third Industrial Revolution took off around the second half of the 20th century with the advent of new forms of communication, such as the computer, and digitalization and the Internet at the end of the 20th century. With the change from analog to digital, the Digital Revolution, which is still evolving, set off the shaping of an information-society, in which digital technologies became more and more important. Of course, this raised a lot of questions and concerns. One of those concerns was the loss of craft and traditional craft practices. This concern already set off with the First Industrial Revolution, when the hands of craftsmen where being replaced by the machine.

In this chapter, I will analyze the traditional notion of craft by means of its etymology and definition. Thereafter, I would like to research if there is a (new) contemporary notion of craft, and if so, how it defers from the traditional one. I will address current debates about contemporary or modern craft, as well as the amateur-craftsman of the 21st century. In doing so, I hope to analyze what craft still means and how it plays a part in our (future) society.

2.1. Traditional Notion of Craft

When Austrian Architect Adolf Loos (1870-1933) wrote his *Ornament und Verbrechen* (1908) he stated how ornament was to be considered something uncultivated. He continued by explaining how in modern times, cultivated people were not suppose to be interested in ornamentation; rather they should appreciate objects for their function and simplicity. He said: “The form of an object lasts, that is

to say remains tolerable, as long as the object lasts physically" […] A lady's ball gown, intended for only one night, will change its form more quickly than a desk."[71] To change objects of use, like the desk, every decade solely for their appearance was according to Loos a waste of material, capital and effort, and thus a crime against the economy and the social life.[72] His plea was indirectly an offset for the functionalist mindset of modernists in the 20th century. Though, he was not the only one. Louis Sullivan already wrote about ornaments' elimination for the sake of the buildings function in 1892 with his *Ornament in Architecture*.[73] And Le Corbusier, who rejected any type of decoration on objects of use, and pleaded for the aesthetics of the machine, wrote about it in his *L'Art Décoratif d'Aujourd'Hui (*1925).[74] These modernist pioneers responded to a new society, one in which new technologies revolutionized the way we lived. They were more interested in exploring new materials and the simplification of forms by reducing or completely abandoning ornament, rather than continue working in a 'style'.

At that same time, the Arts & Crafts Movement arose, and as the name suggested, it included the coming together of art and manual labor. At the end of the 19th century and in the beginning of the 20th century, William Morris became known as the spokesperson of this movement. He pleaded for a return to 'the aesthetic' at the core of production, which fell under the activities of craftsmen and designers.[75] Together with John Ruskin, Morris wrote about the revival of the (lower) decorative arts as a moral and political tool against the industrial revolution and social and economic problems of that time. Returning to crafts, 'the creative work', was about the power of the individualist workers and the political control of the work situation. Morris and Ruskin advocated for craft as a traditional and simple trade, in which one designed and produced a functional, as well as an aesthetic product, that resembled the highly executed craftsmanship of the Middle Ages. Machine-made objects were

71 Loos, A., *Ornament and Crime* (PDF), Innsbruck: reprint Vienna, 1930 (1908), 22.
72 Loos, 1930, 19-24.
73 Sullivan, L., 'Ornament in Architecture', *Engineering Magazine 3* (Aug. 1892), 633-44.
74Le Corbusier, *The Decorative Art of Today*, J. I. Dunnet (trans.) London: The Architectural Press, 1987 (1925), 90.
75 Lovell Triggs, O., *The Arts & Crafts Movement*, New York: Parkstone International, 2014, 7.

cheap, soulless, and impersonal, and did not belonged to the visual arts. Thus, this promotion of moral and social health through quality of architecture and design, executed by skilled creative workers, was in fact a revolt against the poor quality of industrialized mass production and the revival of good craftsmanship".[76]

The first half of the 20th century evolved around this industrialized mass production, in which standardized products were produced on a large scale. By automating the work of craftsmen and standardizing the products, machines could produce bigger amounts in less time, which led to a higher profit and lower prices for the consumer. With the advent of the Information and Communication Technology (ICT) in the second half of the 20th century, the western society changed into an information-society. With the growth of data and information, the growth of knowledge also occurred. Computer software increased along, thus making machines more suited for the production of more complex and unique objects. At the end of the 20th century, the Internet was invented, and with this global system of interconnected computer networks, it became very clear that it would very soon intergrade in every aspect of our lives. When prosperity increased after the Second World War, it became possible to develop oneself, and with that, individualization arose.[77] The demand for more personal, unique objects was one of the effects of this change in society. At the same time, the appreciation for traditional craftsmanship and handmade objects returned in some circles. Now, in the 21st century, it becomes possible to 3D print a digital blueprint at your local fablab. Even the evolution of robots is becoming reality with the birth of the first robot baby.[78] So, what does traditional craft still has to offer then, and what does it actually still mean?

2.1.1. Definition

For my research I consulted different books about craft and the meaning and position of craft in past and present. In doing so, I encountered that there is no set definition of the word craft. In the English *Online Cambridge Dictionary*, the noun refers to: 'a skill or an experience, especially in relation to making objects; or a job or

76 http://www.arts-and-crafts-style.com/arts-and-crafts-movement.html (12/02/16)
77 Felling, A., Peters, J., Scheppers, P., *Individualisering in Nederland aan het eind van de twintigste eeuw: empirisch onderzoek naar omstreden hypotheses*, Assen: Van Gorcum, 2000.
78 http://www.nu.nl/weekend/4268487/kunnen-robots-zichzelf-binnenkort-voortplanten.html

an activity that needs skill and experience; and lastly something produced using skill and experience'. The verb refers to: 'the making of objects, especially in a skilled way'.[79] It does not refer to craft as a traditional and/or specific skill performed by the hand; the noun *artisan* or the adjective *artisanal*, now replaced that old definition of craft, by referring to 'something made in a traditional way by someone who is skilled with their hands'.[80] Searching for the definition of a craftsman in the American English dictionary of *Merriam-Webster*, its first definition refers to 'a person (especially men) who makes beautiful objects by hand'.[81] Furthermore, some people use the words *decorative arts*, a*pplied arts* or *arts and crafts*. These definitions seem to be more linked to the artistic field, rather than handworkers in general. When translated into other languages, one finds how many different translations there are and how they all have a different definition. The Dutch noun *ambacht* for instance, is 'the profession of making something with the skillful hands'.[82] Though, this cannot be alternated in a verb. In this case, the verb *handwerken* refers to 'working with the hand', but rather in the context of knitting, sewing and stitching. In German, the translation *wirdschaft* refers to 'a job, a business or a trade'.[83] The French know two words to describe craft: *métier* and *artisanat*, which respectively refers to 'trade or profession', and 'the production of products or services through a particular know-how and out of industrial context'.[84] Thus, the word craft does not have a universal definition, which makes it difficult to research its overall meaning. Taking all definitions together though, craft refers to a trade or profession, and the making of objects by men, using skill and experience, sometimes done by hand, and with a functional and/or decorative purpose.

2.1.2. Etymology

As seen above, the present-day definition and meaning of the word craft is still rather vague. Although the act of 'crafting' is as old as human mankind, the origin of the actual word is not certain. When looking up its etymology on the Internet, one finds craft to be derived from the old English 'cræft', which refers to 'power, physical

79 http://dictionary.cambridge.org/dictionary/english/craft
80 http://dictionary.cambridge.org/dictionary/english/artisan
81 http://www.merriam-webster.com/dictionary/craftsman
82 http://www.vandale.nl/opzoeken?pattern=ambacht&lang=nn#
83 http://www.mijnwoordenboek.nl/vertaal/EN/DE/craft
84 http://www.mijnwoordenboek.nl/vertaal/EN/FR/craft

strength, courage, skill and ability', as well as the Proto-German 'Kraft', the Old Norse 'kraptr', and even the present Dutch 'kracht' do.[85] The first time the actual word was used in literature, was in 1729 by Nicolas Amhurst, an English poet and political writer. He published a newssheet under his pseudonym Caleb d' Anvers entitled *The Craftsman*. It was a weekly periodical, in which the overthrow of the government was a central topic. It had nothing to do with the present-day definition of craft, but more with the political connotation of power, strength and courage it used to mean in the first place. [86] About forty years later, in 1773, the *Dictionary of the English Language,* written by Samuel Johnson, defined craft for the very first time as 'manual art or trade'. Where this definition exactly came from is not clear, yet it was merely used a verb. According to Paul Greenhalgh, author of *The Culture of Craft: Status and future* (1997) it had no constituency and it could be applied to any form of practice within culture. He states it wasn't always clear what was meant by craft. It was not a thing in itself and did not imply specific methods, trades or object types.[87] The second definition in the *Dictionary of the English Language* was linked to the previous definition by Amhurst's magazine, which referred to 'fraud, full of artifices, sly and to play tricks'.[88] At the end of the nineteenth century, the word craft got its current meaning, and it became a powerful signifier in debates in the visual arts by the Arts and Crafts Movement. It is very likely, Morris and Ruskin used the word craft to refer to 'power and skill', for they had political means with the movement as well. As a result, craft's connotation was related to the fine arts, rather than something on its own.

2.2. Contemporary Notion of Craft

By looking into the etymology and definition of craft, I found out that craft is in the first place a cultural construction. It has no set definition, so the meaning of the word can change overtime and can differ by nation. In this way, it seems rather logic that craft, as we know it right now, does not have the exact same definition as craft had in

85 http://www.etymonline.com/index.php?term=craft

86 Chisholm, H., ed."Amhurst, Nicholas", *Encyclopædia Britannica* (11th ed.), Cambridge: Cambridge University Press, 1911, 853.

87 Dormer, P. (ed.) *The Culture of Craft: Status and future*, Manchester: Manchester University Press, 1997, 22.

88 Johnson, S., "Craft", *A Dictionary of the English Language*, (4th ed.), London, 1773, 499.; digital version: http://johnsonsdictionaryonline.com/?page_id=7070&i=499.

the 18th century. However, looking into its definition, we are still not certain about its actual meaning. We do know that traditionally, hand-made objects where made out of necessity. Functionality was its first purpose. Because nowadays industry has taken over this purpose, craft-made objects do not necessary have to be functional anymore. Furthermore, they do not need to be made completely by the skilled hands of an experienced craftsman. Machines and tools assist the hands of these craftsmen in executing their profession in a much more efficient way. Therefore, we can say that the purpose of crafted objects changed overtime, and with that, the definition of craft as well. We became to speak of the artisan, instead of the craftsman, for crafted objects became decorative instead of functional in the first place because producing solely functional objects did not seem to be profitable any longer. As a result, craft seemed to be more and more linked to the artistic field instead of the traditional trades and professions where one needed skill, knowledge and experience to produce a functional object with the hands.

Furthermore, when we refer to 'crafting' as an activity nowadays, we usually think of the amateur craftsmen or –women who hand make their own unique objects in order to sell them on websites like *Etsy*. With the advent of the Internet, three billion people got access to data, and with that access, people could learn on *Youtube* or do-it-yourself websites how to make something. Thus, these amateurs did not have had or needed a lifetime training in sewing or knitting for that matter. The revival of 'traditional' craft practices is also being used in another way: advertising. Local-made products like 'locally crafted' beers or 'traditional or artisanal' made breads for example, refer to (local) tradition and the skills needed for making such quality-like products. And lastly, we can see how 'hand-made' or 'manual' as a characterization of one of the first definitions of craft got eliminated from the definition we know right now. Is it legitimate to say then, that the notion of craft is currently under construction and that its traditional notion is completely changed or even lost?

2.2.1. Current Debates

Already in 1958, Professor of Decorative Art and History of Design, Herwin Schaefer wrote about *The Metamorphosis of the Craftsman*. He argued how today there is

once more much to-do about a revival of the crafts and how today's craftsmen face two problems: the lack of training and the lack of purpose. 'We no longer have a systematized training and we can't afford to spend time on a 'Victorian' self-training. Furthermore, the products once made by traditional craftsmen were made out of necessity. Today, we do not longer need functional products to be made by the hands of a skillful craftsman, for the machines do it quicker, cheaper and more efficient.' He concludes his introduction by saying that the amateurs of today solely produce useless objects of decoration and bric-a-brac.[89] That is why in his essay, Schaefer questions the aspirations of today's 'craftsmen'. Furthermore, he questions what a contemporary craftsman precisely includes, for he argues that traditional craftsmanship was destroyed with the advent of industrialization. He mentioned how the abolition of craft guilds in fact acknowledged the end of traditional craftsmanship, and with that the loss of traditional skills and training. Though, there had always been nostalgia towards hand-made objects, and there had always been individuals or groups that advocated for the revival of traditional crafts, this was according to Schaefer a delusion, for the world had changed due to technology and democracy, which made the return of old crafts impossible.[90]

Thus, according to Schaefer, a contemporary craftsman had two options: "he could aspire to be a craftsman in the sense of the pre-industrial age, in which case he would have to think of himself as a workman in the best sense of the word, his product would have to be of flawless workmanship, it would have to be useful, functional, unassuming, unassertive, it would have to serve, as he would have to serve." Or, the second and more obvious option: "he could aspire to be a craftsman in the tradition of the Victorian Arts and Crafts Movement, in which case his qualifications as a craftsman in the old sense would have to be taken for granted and over and above that he would have to be essentially an artist. His product would have to be of flawless workmanship as a matter of course, but it would derive its merit principally from its superior artistic conception and esthetic qualities, since it would have no other meaning or purpose." If one chose to be a craftsman in the

89 Schaefer, H., 'The Methamorphosis of the Craftsman', *College Art Journal*, 17 (3), 1958, pp. 266,276, 268.
90 Schaefer, 1958, 267.

sense of the pre-industrial age, he would have to face the technical and economic realities of our time, for he would have to compete with machines and their low-price productions to produce quality made and functional objects of use, not to mention the time he has to invest in a traditional training. [91] As a result, most 'craftsmen' chose the second option according to Schaefer, and unfortunately found themselves in a no man's land between craft, art and the knick-knacks.[92] These individuals, who called themselves a craftsman, actually performed the act of an artist-craftsman, which made them immune from the competition of industry.[93] 'Contemporary craftsmen, who chose to pursue a technical career however, had the satisfaction of meeting real needs and they had opened to them the creative challenge and the unlimited possibilities of the new methods and materials of technology.'[94]

Thus, Schaefer advocates that the craftsmen of today need to let go the nostalgia of exclusively hand-made objects, and instead need to embrace and appreciate the ability of machines to produce functional, esthetic objects as well. Their new job is to *help* industry, by 'giving more esthetic quality to the product of the machine'.[95] Designers, artists and engineers already concern themselves for some time now with the esthetics of the machine, and as Schaefer already argued in 1958, the true descendants of old craftsmen are actually the model-makers and technicians working in the furniture and building industries. They are the ones who give meaning and beauty to the functional industrial products, who still have the skills and knowledge needed for the production of functional objects. Yet these workers do not promote themselves as 'craftsmen', they do not concern themselves with being 'original' or 'creative', but merely with doing a good job. That is why, according to Schaefer, they are actually the ones who come closest to the real meaning of being a 'true' craftsman, not the artists-craftsman of today who calls himself a craftsman.[96]

In *Digital Handmade: Craftsmanship and the New Industrial Revolution* (2015) art and design journalist Lucy Johnston speaks of the *digital-artisan*. With the

91 Ibid., 269.
92 Ibid., 270.
93 Ibid., 271.
94 Ibid.
95 Ibid., 275.
96 Ibid., 276.

digital-artisan she refers to the practicing of combining traditional craftsmanship with digital technologies in the production process of art and design. She states: “While the industrial revolution of the nineteenth century diminished the role of the craftsman in the manufacturing process, the digital revolution has given rise to entirely new working methods and hybrid skill-sets, and has reinvented the way we approach and appreciate the output of the craftsman.[97] In this book, she gives an overview of eighty designers who mix artisan craftsmanship with technological production methods. Joris Laarman is one of them, and she mentions how he is a true pioneer in the exploration of digital-fabrication technologies.[98] She believes, just like Laarman, that the digital era we are currently living in, does not exclude craft, but rather gives craftsmen, designers and artist new possibilities to create: “no longer dictating or restricting the creativity of the making process, computer software, digital technologies and the tools of large-scale manufacturing are instead being applied in unconventional ways to enhance and assist it, enabling the crafting of extraordinary, artistic forms that would previously have been all but impossible.”[99]

However, by arguing that new digital techniques enable the artist and designer in the ‘crafting’ of artistic forms, Johnston indirectly argues that those new techniques enable the ‘artisan’. It does not enable all kinds of ‘handworkers’. Thus, you would say that the profession of a plumber, who is not necessarily enabled by new digital technologies, is more likely to face the consequences of this digital era. Though, as we did face the loss of some crafts in the past, we did gain some new crafts, like the software designer for example. And some crafts even benefited from industry, like the goldsmith, who works with new digital technologies to improve certain tasks. In this way, it seems rather logic that craft indeed needs to be redefined and indeed needs to adapt itself to the changes in society. And perhaps this is the way we have to look at contemporary craft nowadays: craftsmen who produce objects not with their own hands, but with the help of machines instead.

2.2.2. The Amateur-Craftsman

97 Johnston, L. *Digital Handmade: Craftsmanship and the New Industrial Revolution*, New York: Thames & Hudson Inc., 2015, 8.
98 Johnston, 2015, 132.
99 Ibid., 7.

Nowadays, school is not the only place to learn a craft or skill anymore. With the advent of the Internet, people can decide themselves what they want to learn, for the web is filled with data and knowledge. Nowadays, one can easily look up how to make an apple pie, how to change a tire, or even how to make jewelry for example. All those do-it-yourself (DIY) projects vary from a creative context, to a technical context as well, for it is also possible to repair your own computer for example. With so many people able to freely share ideas and spread information (as well as inspiration) across the web, amateur-makers are forming communities of their own, and more people around the world are becoming influenced to be a maker themselves. Take *Etsy* (2005) as an example. *Etsy* is a website established for people who want to sell their home made and/or second-hand products, as well as for people who want to buy unique and handmade objects. It is an online-platform that stimulates the authenticity of products and wants to 'reimagine commerce in ways that build a more fulfilling and lasting world'.[100] Authenticity, uniqueness, handmade and preservation are features that describe their mission. Yet these terms also describe a way of living that is becoming more and more popular in the 21st century.

A designer like Laarman is stimulating this way of living by opening up his designs to the online-world. By means of Open Source, he already made it possible to download a digital blueprint of one of his *Makerchairs*, which then can be printed on a 3D printer and needs to be fabricated by a local craftsman or the customers themselves. The need for making our own objects could originate from the fact that we live in a highly digital world, and we are losing our connection with the physical world day by day. Nowadays, young children are being educated with a tablet, text each other all day long, and go straight behind their computers after school to check their Social Media pages. They probably never learned how to work with wood or how to knit. Half a century ago it was a matter of course that craft was educated on school, but also by parents. Technical skills, like woodworking, were transferred from father to son, and creative skills, like knitting, were transferred from mother to daughter. Nowadays, children do not learn these skills anymore, which makes it very

100

likely they long for it. This assumption is strengthened by the fact that on *Pinterest*, one of those social media pages, 'DIY' is the most popular category, so there seems to be a rising desire towards working with the hands again. In a bigger picture, making our own objects could also be a counteraction towards the globalisation and mass-industry. With the rise of individualism, the need to make something unique by one self seems to be a rather logical reaction. Furthermore, modern technology has made it even easier than ever before, to create and distribute personal hand-made items that are customizable and unique without having middlemen like manufacturers between them and their customers. With start-up companies like *Kickstarter*, amateur-makers are stimulated to turn their creative ideas into real life products, without having the risks of starting their own company.

As a result, the nature of making things changed, and according to Mark Hatch, CEO of *Techshop* and author of *The Maker Movement Manifesto* (2013), this led to the beginning of the Maker Movement.[101] The Maker Movement or Maker Culture is in fact a (digital) platform, or an (online-) community for amateur-makers who are taking manufacturing back to its roots. And with the opening of so-called 'makerspaces', which are laboratories, studios and/or workshops in one's own neighbourhood, everybody could join this new movement. It stimulates the meeting of, working together with, and learning from other amateur-makers, who are also interested in science, technology and creative projects including digital and electronic technologies. In these labs or studios, one can find 3D printers and CNC-milling machines, but also 'traditional' equipment to work with wood or metals for example.[102] It is opening a whole new world for consumers to produce their own objects. According to Hatch, there are a number of trends that push the Maker Movement forward: "Cheap, powerful, and easy-to-use tools; easier access to knowledge, capital and markets; a renewed focus on community and local resources; a desire for more authentic and quality things; and a renewed interest in how to make things." Logically, this will have consequences for the craftsmen and designers of today, as well as for mass-industry. It is only opening up to us a whole

101 Hatch, M., The Maker Movement Manifesto: Rules for Innovation in the New World of Crafters, Hackers, and Tinkerers, New York: McGraw-Hill Education, 2013, 3.
102 Hatch, 2013, 4.

new world of ‘crafting’.

However, what do we actually mean when we use the word ‘craft’ or the act of ‘crafting’ nowadays? I already mentioned its definition and its etymology in previous chapters, yet there seems to be a change of its connotation in daily life. People nowadays use the verb ‘crafting’ in a hobby-sphere. The Craft Council mentions how the interest in crafts tends to be on the rise in the recent years but primarily as a hobby and an additional source of income.[103] Advertisements also use the word to address characteristics like tradition, uniqueness, handmade, local and personal to persuade buyers to buy their products. In this way, the word has been taken out of its context by society as well as industry. A good thing about this change in the use of the word craft or the adjective ‘crafted’ or the verb ‘crafting’, is that it is becoming popular again, and its connotation becomes a positive one. In the introduction, Adamson explained how craft was to be considered ‘the other’ and conservative and something that was related to the past. He mentioned how it got a negative connotation next to the positive effects of the rise of industry. Now that we are longing for the handmade and the personal again, the meaning of craft, its notion, has changed along.

103 http://www.craftcouncil.org.uk/crafting-hobby.html

CONCLUSION

For my master thesis I questioned how Dutch designer Joris Laarman deals with digital fabrication techniques in the production of his work and how this still relates to the traditional notion of craft, but to answer the first part of my question, I first needed to analyze what this traditional notion of craft exactly was.

Nowadays, designers and craftsman have more access to new possibilities in the field of production than ever before, but this also counts for the everyday consumer. Digital tools, materials, and production processes change the way objects are designed, manufactured and distributed. Furthermore, it enables the customer to make its very own unique and handmade product as well. This logically affects the position and role of the traditional craftsman and the traditional notion of craft in general. The unique, hand-made nature of crafted objects lies at the heart of its profession, reflecting core beliefs such as the importance of authenticity, skills learned trough a lifetime education, and the value, pride and satisfaction of workmanship in general. However, if digital production methods like 3D printing, and the countless possibilities for consumers to produce their own unique objects, is now becoming the standard, what does that have to say for the traditional notion of craft then? I have researched this traditional notion, by looking into its definition, as well as its etymology. I found out that the word actually derived its traditional meaning from multiple words that were related to either political means or strength in general. With the rise of the Arts & Crafts Movement, it became a signifier in debates in the visual arts, and in this way, got related to the artistic realm. How it got connected to the profession of making things by hand with skills and experience remains unknown, but it seems rather logical it had to do with the initial meaning of the word: strength. With the rise of industry, and later on digitalization, this notion seemed changed due to the fact that ‘craft’ was no longer needed (it lost its functional purpose to machines) and therefore found its purpose in the artistic realm again. Furthermore, people also started to make their own objects with the help of do-it-yourself websites and instructions on the Internet, because of their longing for

the past again. We can say then, that there has been a huge change in the notion of craft with the rise of industry, its relation to (modern) art, the need for people to make their own objects, and the countless possibilities made possible by digitalization.

When I encountered this new notion of craft, it was important for my main question, to understand that the traditional notion of craft had changed into a more contemporary one. By researching the work of Laarman, I found out that he sees opportunities (instead of consequences) for craftsmen in the future, precisely because of these new digital fabrication techniques that are merged with traditional, as well as contemporary craft practices. By means of some examples, I will show how he sees this future merge of craft and technology to create, imagine and produce things that would previously have been all but impossible:

One of the first big projects Laarman conducted, and gained international fame with, was his *Heatwave*. The actual production of his radiator included the hands of a model maker, who produced the first mold with his skilled hands and the experience needed to handle the material. Thereafter, a 3D scan could be made of the mold with the computer, handled by an ICT specialist, to adjust it to an even more perfect mold. And finally a 3D mold was machined from the computer model, which formed the basis of the final *Heatwave*. This model originated from the merge of traditional, as well as contemporary craft practices and new digital production technologies. Without this collaboration of the hand and machine, the mold would not have been so ‘perfect’. The same goes for his *Forest Tables*, and many other projects for that matter. The form and aesthetics of the *Forest Tables* are not inspired by nature, but by the various elements of a computer network. The frame of the table was produced with the help of computer-controlled etching and laser-cutting tools, which made it possible to produce something so complicated, that the hands of a human being probably could not have made it in the first place. However, the assembling of the table top with the legs had to be done by a skilled blacksmith, for this could only be done once in proper way. His renowned *Bone Chair* was also designed with the help of computer technologies. Computer designed algorithms, based on the structure of bones, modeled a chair for sitting in. The actual finished product had to be produced with the help of 3D printing techniques and a

skilled metal caster, for the metal needed to be casted with experience into the 3D produced mold. This project shows that it is so important that these traditional craftsmen still exist, for the chair was never produced otherwise. It also shows how these traditional craftsmen need to keep up with new methods and materials as well.

His *Digital Matter* project on the other hand, did not include the hands of a craftsman in the traditional sense of the word. No wood maker or blacksmith was needed for the production of these tables, for they were completely assembled by robots. However, the robots did need to be designed and handled by 'contemporary' craftsmen, like the electro technicians and software designers for example. In this way we see can this change in the notion of craft, for traditional craft practices are being replaced or altered into more contemporary craft practices. As a result, we see a change of the notion of craft as something functional made by the hands of a skilled craftsman, towards the notion of craft as something decorative or functional made by the hands or machines controlled by the hands of a skilled craftsman.

The *Makerchairs* are actually one of his newest projects, which include this making by the consumers themselves, instead of an experienced and skilled craftsman. Via Open Source, digital blueprints can be downloaded, so one could 3D print the design of his bought chair in a local makerspace. In this way, the help of a manufacturer is not necessarily needed. There seems to be a rise of these amateur-craftsmen, who consider themselves a craftsman because they can make something with their own hands. The desire of making something with our own hands, probably originates from the fact that digital technologies become more and more important in our everyday life and we tend to be nostalgic for the loss of traditional craft practices due to industry and mass-production. Furthermore, the need for personal and unique products also comes forth out of standardized mass-produced objects and the rise of individualism. With some of his projects, like the *Vortex* bookshelves and his kinetic installations, which can change of form over and over again, Laarman also addresses this personalization and decoration of things.

Thus, with his projects, Laarman explores the opportunities of digital fabrication by using cutting-edge production methods and techniques, like 3D

printing, robotics, and CNC Milling machines, to produce objects that would not have been possible to be made by hand. However, he always combines these new technologies with workmanship, for he believes making the actual objects still requires actual skill. Whether these are the skills of a blacksmith, who still employs traditional craft practices, or the skills of an ICT specialist, who does not use the hammer and chisel to produce an object, but a robot instead.

It is in this way, we can argue Laarman deals with these new digital fabrication techniques in the production of his work by using the skills and experience of new and *contemporary* craftsmen in handling those new techniques. In the near future Laarman believes digital fabrication will enable these craftsmen to create, imagine and produce new forms that would previously have been all but impossible. Though I would like to remark that not all craftsmen will be enabled in the future, for some crafts will eventually disappear. Yet, we simply need to reformulate craft then, for it remains a cultural construction, and with society changing in the future, the notion of craft will ever change along.

APPENDICES

Portfolio

2003: Final Thesis on ‘Reinventing Functionality’
2003: Heatwave prototype
2003: Limited
2003: Ivy
2005: Heatwave Aluminum
2005: Credit Brooch
2005: Heatwave Marble
2006: Heatwave Silver
2006: Parasol Project for exhibition by ‘Design Tide’
2006: Ideal House for International furniture fair IMM cologne
2006: Paper Bone Chair prototype
2006: Bone Chair (aluminum)
2006: Bone Chaise longue
2007: Arm chair
2007: Rocker
2007: Heatwave (Jaga)
2007: Nebula
2008: Crystal Garland – collaboration with ‘Demakersvan’ for exhibition ‘Unbridaled’
2009: Foam Porcelain Mould experiment (chair)
2010: Branch (Bone Furniture)
2010: Bridge (table)
2010: Leaf Table
2010: Paper Starlings
2010: Starlings Table
2010: Cumulus Table
2010: Half Life lamp
2010: Gigabyte Bookcase

2010: Asimov Installation
2010: Kinetic Sofa/Dynamic Bench
2010: Digital Matter
2011: Wall Street Journal Award
2011: Kilovoxel, Mega & Giga Voxel tables
2011: Forest Tables
2014: Vortex Bookcase
2014: Time Capsule
2014: Huble Table
2014: Soft Gradient Chair (Micro Structures)
2014: Aluminium Gradient Chair
2014: Long Cell Chair / Adaption Chair
2014: MX3D Resin
2014: MX3D Metal
2014: Dragon Bench
2014: Makerschair Hexagon prototype
2014: Makerschair Hexagon armrest prototype
2014: Makerschair Diamond
2014: Makerstable Diamond
2014: Makerschair Maze Maple
2014: Makerschair Jigsaw Wood
2014: Makerschair Diagonal Wood
2014: Makerschair Diagonal Resin
2014: Makerschair Polygon
2014: Makerschair Mesh
2014: Makerschair Pixel
2014: Makerschair Voronoi
2014: Makerschair Jigsaw Print
2014: Makerschair Bits & Parts
2017: MX3D Bridge

Illustrations

Fig. 1: Joris Laarman, *Bone Rocker*, 2007.

Fig. 2: Joris Laarman, *Digital Matter*: *Gigavoxel table*, 2011.

Fig. 3: Joris Laarman, Demakersvan, *Crystal Garland,* 2007.

Fig. 4: Joris Laarman, *Ideal House*, 2006.

Fig. 5: Joris Laarman, Demakersvan, *Parasol Project*, 2006.

Fig. 6: Joris Laarman, *Nebula*, 2007.

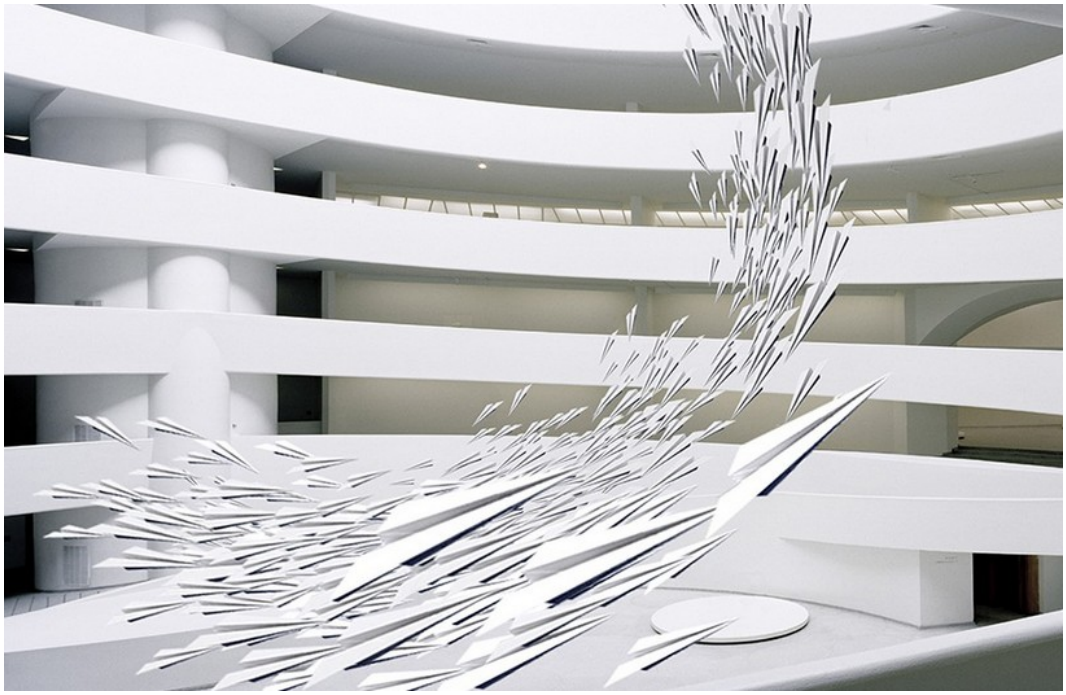

Fig. 7: Joris Laarman, *Paper Starlings*, 2010.

Fig. 8: Joris Laarman, *Credit Brooch*, 2005.

Fig. 9: Joris Laarman, *Gigabyte Bookcase*, 2010.

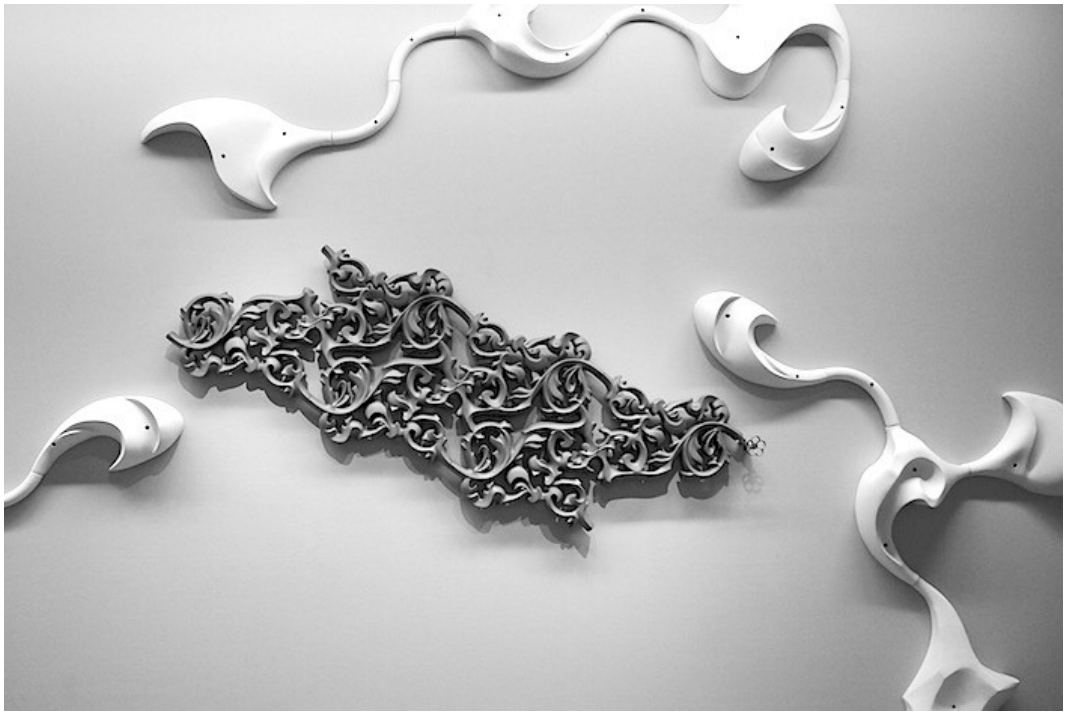

Fig. 10: Joris Laarman, *Heatwave & Ivy* (Exhibtion Groninger Museum), 2016.

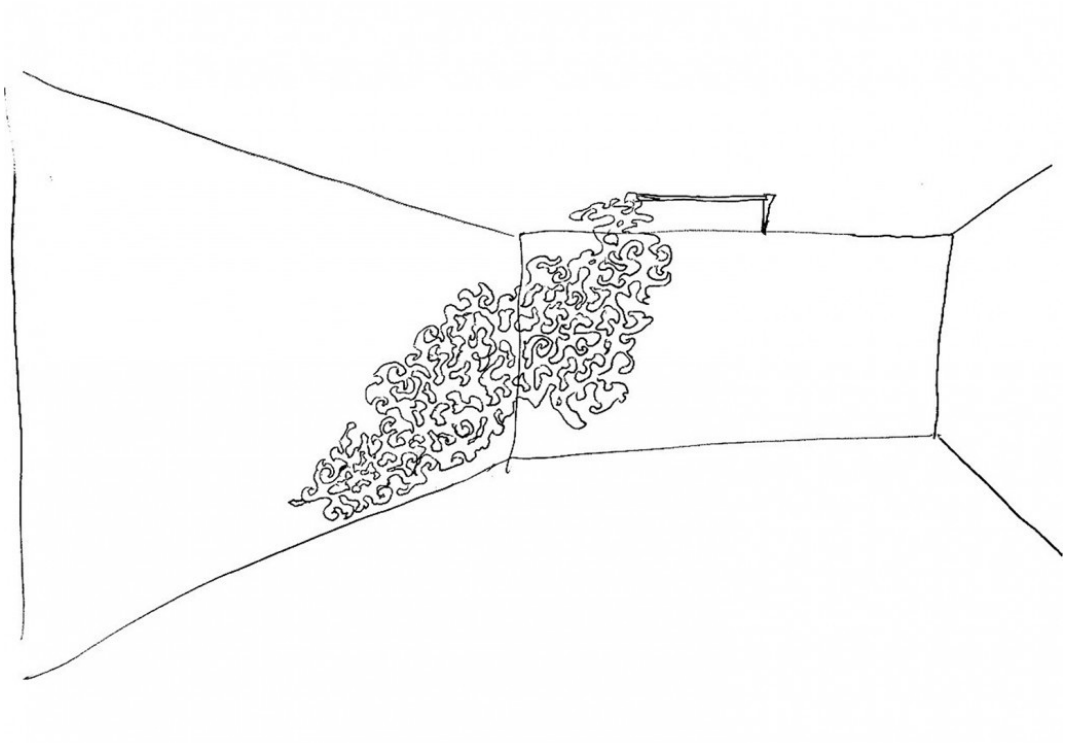

Fig. 11: Joris Laarman, first sketch of radiator, 2003.

Fig. 12: Joris Laarman, *Vortex Bookcase*, 2014.

Fig. 13: Joris Laarman, *Forest Tables*, 2011.

Fig. 14: Joris Laarman, *Digital Matter: Kilo-, Mega-, Gigavoxel tables*, 2011.

Fig. 15: Joris Laarman, Outlay of *Makerchairs*, 2014.

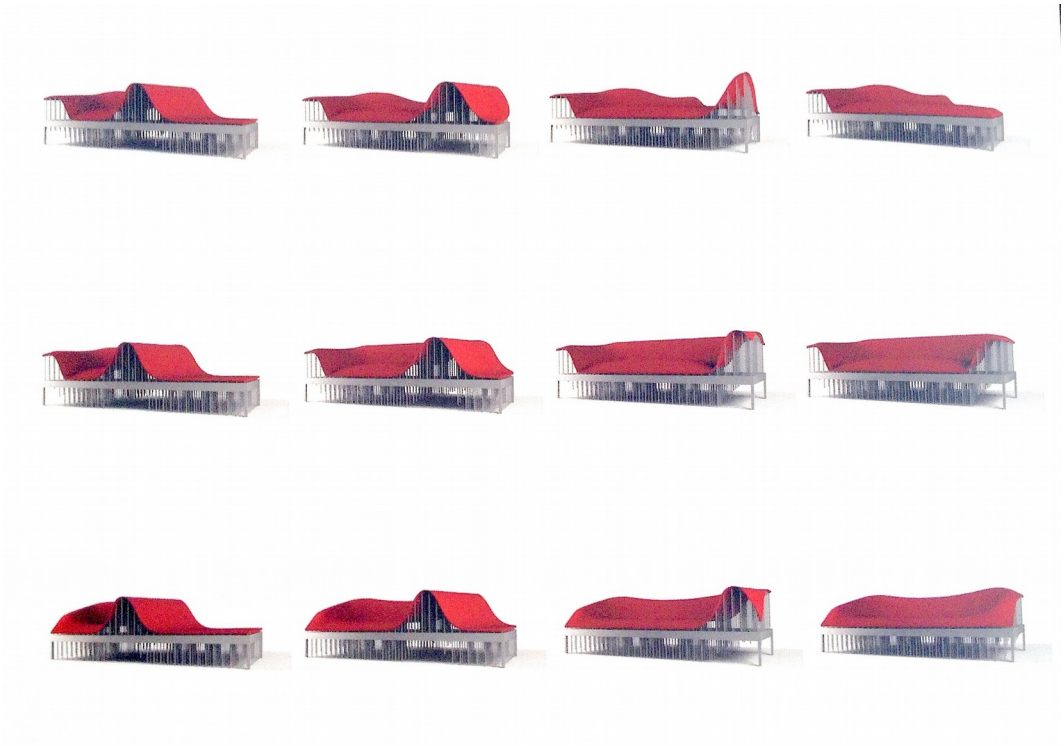

Fig: 16: Joris Laarman, *Dynanic Bench* (Kinetic Sofa), 2010.

Fig. 17: Joris Laarman, Phil Verdult, *Aluminum Bone Chair*, 2006.

Fig. 18: Joris Laarman, *Paper Bone Chair*, 2006.

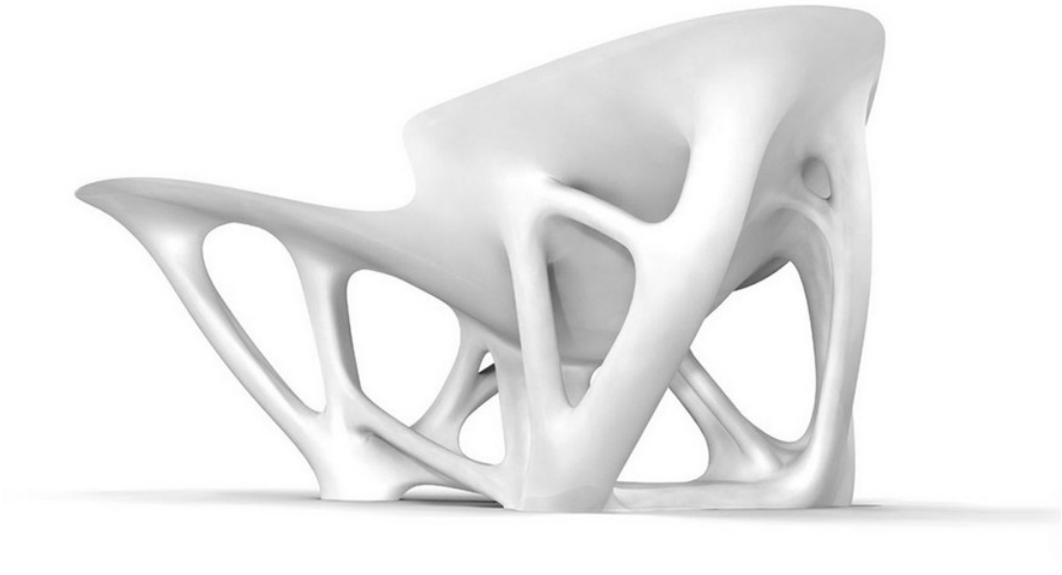

Fig. 19: Joris Laarman, *Bone Chaise Longue*, 2006.

Fig. 20: Joris Laarman, *Arm Chair*, 2007.

Fig. 21: Joris Laarman, Marjan van Aubel, Foam China, 2007.

Fig. 22: Joris Laarman, *Microstructures: Soft Gradient Chair*, 2014.

Fig.23: Joris Laarman, *Microstructures: Aluminum Gradient Chair*, 2014.

Fig. 24: Joris Laarman, *Microstructures: Adaption Chair*, 2014.

Fig. 25: Joris Laarman, *Dragon Bench*, 2014.

Fig. 26: Joris Laarman, Butterfly Screen, 2016.

Fig. 27: MX3D, Autodesk, Heijmans et. al., visualization of printed bridge, 2016.

LIST OF ILLUSTRATIONS

Fig. 4: Joris Laarman, *Ideal House*, 2006, commission for International furniture fair: IMM Cologne, Cologne, Germany.
http://www.domusweb.it/en/design/2006/03/06/ideal-houses-in-cologne-2006.html

Fig. 5: Joris Laarman, Demakersvan, *Parasol Project*, 2006, carbon Fibre / textile / lots of electronics, commission for Design Tide (design event), Tokyo, Japan.
http://www.jorislaarman.com/work/parasol/

Fig. 6: Joris Laarman, *Nebula*, 2007, hand blown glass / aluminum, 80 x 80 x 130 cm., Manufactured by FLOS (Italy), Metropolitan Museum of Art, New York, United States of America.
http://www.jorislaarman.com/work/nebula/

Fig. 7: Joris Laarman, *Paper Starlings*, 2010, mixed media, 'Re:Contemplating the Void', Solomon R. Guggenheim Museum, New York, United States of America.
http://www.jorislaarman.com/work/paper-starlings/
Fig. 8: Joris Laarman, *Credit Brooch*, 2005, gold plated chip, 8,5 x 5,5 x 0,1 cm., designed for collection "Chi ha paura...?", Stedelijk Museum 's-Hertogenbosch, Den Bosch, the Netherlands, no. s2005.014.
http://www.sm-s.nl/collections/exposition/17/130

Fig. 9: Joris Laarman, *Gigabyte Bookcase*, 2010, stainless steel / concrete / glass / wood, 560 x 200 x 200 cm., private collection.
http://www.jorislaarman.com/work/gigabyte-bookcase/
Fig. 10: Joris Laarman, *Heatwave,* 2003, polyconcrete / plumbing parts, 72 x 75 x 10 cm. & *Ivy*, 2003, polyconcrete / allen screws / seven modular elements, 'Joris Laarman Lab' exhibition, Groninger Museum, Groningen, the Netherlands.
Image made by author.

Fig. 11: Joris Laarman, first sketh of radiator, 2003.
http://www.jorislaarman.com/work/heatwave/

Fig. 12: Joris Laarman, *Vortex Bookcase*, 2014, aluminum, 280 x 250 x 40 cm., private collection.
http://www.jorislaarman.com/work/vortex/

Fig. 13: Joris Laarman, *Forest Tables*, 2011, resin / aluminum, installation of three coffee tables of various sizes with a height of 35 cm., Kukje Gallery, Seoul, South-Korea.
http://www.jorislaarman.com/work/leaf-table/

Fig. 14: Joris Laarman, *Digital Matter: Kilo-, Mega-, Gigavoxel tables*, 2011, neodymium voxels, 70 x 110 x 55 cm., Groninger Museum, Groningen, the Netherlands, no. 2013.0500.
http://www.jorislaarman.com/work/digital-matter/

Fig. 15: Joris Laarman, Outlay of *Makerchairs*, 2014.
Star, 2015, 261.
Fig: 16: Joris Laarman, *Dynanic Bench* (Kinetic Sofa), 2010, proposal for the High Museum of Art, Atlanta, United States of America.
Star, 2015, 176.

Fig. 17: Joris Laarman, Phil Verdult, *Aluminum Bone Chair*, 2006, Aluminum, 75 x 44 x 76 cm., Rijksmuseum, Amsterdam, the Netherlands, no. BK-2011-49.
http://www.nederlandsdesign.com/joris-laarman-bone-chair/

Fig. 18: Joris Laarman, *Paper Bone Chair*, 2006, Rijksmuseum, Amsterdam, the Netherlands, no. BK-2011-50.
http://www.droog.com/news/2011/08/paper-bone-chair-rijksmuseum/

Fig. 19: Joris Laarman, *Bone Chaise Longue*, 2006, polyurethane rubber, 147 x 77 x 56 cm., Groninger Museum, Groningen, the Netherlands.

http://www.jorislaarman.com/work/bone-chaise

Fig. 20: Joris Laarman, *Arm Chair*, 2007, marble / resin, 79 x 99 x 74 cm., High Museum of Art, Atlanta, United States of America. no. 2008.163.
https://www.high.org/Art/Permanent-Collection/CollectionDetails?deptName=Decorative%20Arts%20and%20Design&objNum=2008.163&pageNumber=0&search=true

Fig. 21: Joris Laarman, Marjan van Aubel, Foam China: Foam Porcelain large mold experiment, 2007.
http://www.jorislaarman.com/work/foam-china/

Fig. 22: Joris Laarman, *Microstructures: Soft Gradient Chair*, 2014, Thermoplastic Polyurethane, 72 x 70 x 77 cm., Museum of Modern Art, New York, United States of America, no. 1072.2015.
http://www.jorislaarman.com/work/soft-gradient/

Fig. 23: Joris Laarman, *Microstructures: Aluminum Gradient Chair*, 2014, laser sintered aluminum, 72 x 70 x 77 cm., National Gallery of Victoria, Melbourne, Australia.
http://www.jorislaarman.com/work/gradient-chair/

Fig. 24: Joris Laarman, *Microstructures: Adaption Chair*, 2014, copper / polyamide, 70 x 62 x 74 cm., Denver Art Museum, Denver, United States of America.
http://www.jorislaarman.com/work/adaptation-chair/

Fig. 25: Joris Laarman, *Dragon Bench*, 2014, metal, 217 x 364 x 105 cm., High Museum of Art, Atlanta, United States of America.
http://www.jorislaarman.com/work/groninger-museum/

Fig. 26: Joris Laarman, *Butterfly Screen*, 2016, bronze, 200 x 300 cm., *Design Bits & Craft expo*: Miami, United States of America / Basel, Germany.
http://www.jorislaarman.com/work/butterfly-screen/

Fig. 27: MX3D, Autodesk, Heijmans et. al., visualization of printed bridge, 2016, Oudezijds Achterbrugwal, Amsterdam, the Netherlands.
http://mx3d.com/projects/bridge/

BIBLIOGRAPHY

Books

Adamson, G., *Thinking Through Craft*, Oxford: Berg Publishers, 2007.

Adamson, G., *The Invention of Craft*, Oxford: Berg Publishers, 2013.

Bussemakers, J, *Ruim baan voor vakmanschap: een toekomstgericht mbo*, Kamerbrief over toekomstgericht middelbaar beroepsonderwijs, 02/06/2014.

Chisholm, H., ed."Amhurst, Nicholas", *Encyclopædia Britannica* (11th ed.), Cambridge: Cambridge University Press, 1911, 853.

Dormer, P. (ed.) *The Culture of Craft: Status and future*, Manchester: Manchester University Press, 1997.

Felling, A., Peters, J., Scheppers, P., *Individualisering in Nederland aan het eind van de twintigste eeuw: empirisch onderzoek naar omstreden hypotheses*, Assen: Van Gorcum, 2000.

Hatch, M., The Maker Movement Manifesto: Rules for Innovation in the New World of Crafters, Hackers, and Tinkerers, New York: McGraw-Hill Education, 2013.

Johnson, S., "Craft", *A Dictionary of the English Language*, (4th ed.), London, 1773, 499.

Johnston, L. *Digital Handmade: Craftsmanship and the New Industrial Revolution*, New York: Thames & Hudson Inc., 2015.

Le Corbusier, *The Decorative Art of Today*, J. I. Dunnet (trans.) London: The Architectural Press, 1987 (1925).
Loos, A., *Ornament and Crime*, *Ornament and Crime* (PDF), Innsbruck: reprint Vienna, 1930 (1908).

Lovell Triggs, O., *The Arts & Crafts Movement*, New York: Parkstone International, 2014.

Minister of Economic affairs and Minister of Education, Culture and Science on the WRR-report: 'naar een lerende economie', *27 406 De kenniseconomie in zicht*, (209), 27-02-2014.

Ramakers, R. *Less + More: Droog Design in Context*, Rotterdam: 010 Publishers, 2002.

Rissati, H., *A Theory of Craft: Function and Aesthetic Expression*, Chapel Hill: University of North Carolina Press, 2007.

Schaefer, H., 'The Methamorphosis of the Craftsman', *College Art Journal*, 17 (3), 1958, pp. 266-276.

SER (Sociaal Economische Raad), *Handmade in Holland: vakmanschap en ondernemerschap in de ambachtseconomie*, The Hague, 2013.

Star, A., *Joris Laarman Lab*, Exh. Cat., Groningen: Groninger Museum, 2015.

Sullivan, L., 'Ornament in Architecture', *Engineering Magazine, 3,* 1892, pp. 633-44.

Woolley, M., Sabiescu, A., *The Use of Craft Skills in New Contexts*, Riches Resources Project, 22-10-2015.

Zijpp, van der, S., Wilson, M., *wall texts,* 'Joris Laarman Lab' exhibition, Groningen: Groninger Museum, 22/11/2015 - 10/04/2016.

Websites

http://www.craftcouncil.org.uk/crafting-hobby.html

https://www.craftcouncil.org/magazine/article/big-questions-glenn-adamson

http://www.flos.com/consumer/en/products/pendant/Nebula

http://www.gemeentemuseum.nl/tentoonstellingen/simply-droog-10-1-jaar-avant-garde-desi

gn

www.groningermuseum.nl/nieuws-solotentoonstelling-joris-laarman

http://markjstock.com/bio/

http://johnsonsdictionaryonline.com/?page_id=7070&i=499.

http://www.jorislaarman.com/about/

http://www.jorislaarman.com/work/butterfly-screen/

http://www.jorislaarman.com/work/digital-matter/

http://www.jorislaarman.com/work/foam-china/

http://www.jorislaarman.com/work/heatwave/

http://www.jorislaarman.com/work/leaf-table/

http://www.jorislaarman.com/work/mx3d-resin/

http://www.jorislaarman.com/work/mx3d-bridge/

http://www.jorislaarman.com/work/nebula/

http://www.jorislaarman.com/work/paper-starlings/

http://www.jorislaarman.com/work/parasol/

http://www.jorislaarman.com/work/vortex/

http://mx3d.com/

http://mx3d.com/about/

http://www.vogue.it/en/uomo-vogue/people-stars/2012/04/-joris-laarman

http://web.avrotros.nl/kunstuur/player/AT_2050481/

https://www.youtube.com/watch?v=EO1lPlGLKoE/

https://www.youtube.com/watch?v=4O8m4pSzYns

https://www.youtube.com/watch?v=NCgZ1-NqGbI

https://www.youtube.com/watch?v=50apIGRSLeM

https://www.youtube.com/watch?v=fjapIVwbP5s

https://www.youtube.com/watch?v=G7DVI8wqP-Q