Deliverable 2.2

The Mingei collection of knowledge

ANNEXES

Table of Contents

Annex 1. Knowledge collection form 10

A1.1 Procedure 10

A1.2 Data 10

Annex 2. Literature 18

A2.1 Silk pilot 18

A2.1.1 Silk - the dream fabric (Divine Silk) / Seide, der Stoff aus dem die Träume sind - (Göttliche Seide) 18

A2.1.2 From a silkworm to a silk thread / Von der Seidenraupe zum Seidenfaden 24

A2.1.3 Craft Steps / HANDWERKLICHE SCHRITTE 25

A2.1.4 Krefeld from Its Origins to Town Like Silk and Velvet / KREFELD VON DEN URSPRÜNGEN BIS ZUR "STADT WIE SAMT UND SEIDE" 29

A2.1.5 HdS historical patterns 32

A2.1.6 Vocational Training in Krefeld / Berufsausbildung in Krefeld 56

A2.1.7 100 Years Hubert Gotzes 1905 – 2005 Craft Weaving Workshop and, Factory for Ecclesiastical Textiles, Krefeld / 100 JAHRE Hubert Gotzes 1905-2005 HUBERT GOTZES KUNSTWEBEREI UND PARAMENTENFABRIK KREFELD. 58

A2.1.8 Parament Weaving Hubert Gotzes – Products / Paramentweberei Hubert Gotzes – Produkte 76

A2.1.9 Origins of the "Crown Prince District" / Entstehung des Kronprinzenviertels 77

A2.1.10 Haus der Seidenkultur 89

A2.1.11 Family von der Leyen and the development of the silk industry 91

A2.1.12 History of Textile Dyes and Colouring / Zur Geschichte der Textilfarbstoffe und der Farbgebung 94

A2.2 Mastic pilot 99

A2.3 Glass pilot 137

Annex 3. Photographic documentation 159

A3.1 Silk pilot 159

A3.2 Mastic pilot 162

A3.3 Glass pilot 173

Annex 4. Filmography 176

A4.1 Silk pilot 176

Einrichten des Golwebstuhles (Setting up the Gold Loom), 2007-2010 and 2013-2017 176

Stadtspaziergang auf Seiden Pfaden (Hanging by a thread), 2018 176

City walk on Silk Paths, 2017 176

A4.2 Mastic pilot 176

The Tree we Hurt, 1987 176

The four seasons of law (I earini synaxis ton agrofylakon), 1999 177

Annex 5. Digitised documents and archives 178

A5.1 Silk Pilot 178

A5.2 Mastic Pilot 178

A5.3 Glass Pilot 180

Annex 6. Digitisation of Tangible Heritage 182

A6.1 Photographic documentation 182

A6.1.1 Two dimensional content: printed mater, manuscripts, visual depiction 182

A6.1.2 3D Artefact photography 183

A6.1.3 File formats and standards 185

A6.2 3D digitisation 186

A6.2.1 Active illumination 186

A6.2.2 Photogrammetry 191

A6.2.3 Post processing of 3D scans 194

A6.2.4 File formats 194

Annex 7. Digitisation of Human Motion 196

A7.1 Motion capture 196

A7.1.1 State of the art 196

A7.2.2 Technical guidelines 197

A5.2 Visual tracking 199

A7.2.1 State of the art 199

A7.2.2 Guidelines for the acquisition of the acquisition of videos 200

Annex 8. Vocabularies 202

8.1 Silk pilot 202

8.1.1 Basic weaving terms 202

8.1.2 Basic silk terms 204

8.1.3 Machines and tools 205

8.1.4 Ecclesiastical textiles 213

8.2 Mastic pilot 214

8.3 Glass Pilot 221

Annex 9 Digitised Socio Historical Context 232

9.1 Silk Pilot 232

9.1.1 Upper Rhine 232

9.1.2 Krefeld 235

9.1.3 Krefeld city infrastructures 237

9.1.4 History of Rhine and regions....239
9.1.5 The Krefeld textile industry....241
9.1.6 Colours of the Church Year....268
9.2 Mastic Pilot....270
9.2.1 Economy....270
9.2.2 Emic (inside) presentation....271
9.2.3 Festive events....272
9.2.4 Gender roles....272
9.2.5 History....273
9.2.6 Oral tradition....274
9.2.7 Religion....275
9.2.8 Art....276
9.2.9 Clothing....276
9.2.10 Customs....277
9.2.11 Media representation....277
9.2.12 Social organisation....278
9.3 Glass Pilot....280
9.3.1 Timeline of glassblowing and clear, colourless glass....281
9.3.2 Georges Bontemps (1799 -1883)....283
9.3.3 Choisy-le-Roi glass factory (1820 – 1847)....285
9.3.4 Conservatoire des arts et métiers (1819 – 1889)....286
9.4 Industrial Revolution and Global Events....288
References....301

List of figures

Figure 1. The Pomegranate Pattern. 33
Figure 2. The Ear of Corn Pattern. 34
Figure 3. The Elephant Pattern. 35
Figure 4. The Lion Pattern. 36
Figure 5. The Paradise Pattern. 37
Figure 6. The Crow Pattern. 38
Figure 7. The Pattern of St. Bernhard. 39
Figure 8. The Circle Pattern. 40
Figure 9. The Pimpernel pattern. 41
Figure 10. The Arabesque Pattern. 42
Figure 11. The Stag Pattern. 43
Figure 12. The Gondola Pattern. 44
Figure 13. Das Granatapfelmuster 45
Figure 14. Das Ährenmuster. 46
Figure 15. Das Elefantenmuster. 47
Figure 16. Das Löwenmuster. 48
Figure 17. Das Paradiesmuster. 49
Figure 18. Das Krähenmuster. 50
Figure 19. Das Muster des heiligen Bernhard. 51
Figure 20. Das Kreismuster. 52
Figure 21. Das Pimpernelmuster. 53
Figure 22. Das Arabesque Pattern. 54
Figure 23. Das Hirschmuster. 55

Figure 24. Das Gondelmuster. 56

Figure 25. Pattern designs and weaved fabric. [Qammaz, Zabulis, 2019] 159

Figure 26. Weaving instructions [Qammaz, Zabulis, 2019]. 159

Figure 27. Weaving instructions [Qammaz, Zabulis, 2019]. 160

Figure 28. Design and weaving of a fabric [Qammaz, Zabulis, 2019]. 160

Figure 29. Fabric designs and samples [Qammaz, Zabulis, 2019]. 161

Figure 30. Fabric samples and catalogue information [Qammaz, Zabulis, 2019]. 161

Figure 31. Historical figures of the Gotzes company [Qammaz, Zabulis, 2019]. 161

Figure 32. Pattern design and Jacquard encoding, in the past [Qammaz, Zabulis, 2019]. 162

Figure 33. Technical diagram of Jacquard attachment operation [Qammaz, Zabulis, 2019]. 162

Figure 34. Diagram illustrating the principles of laser triangulation based range devices (images from [9]). 188

Figure 35. Diagram of a typical structured light system (image from [204]) 189

Figure 36. Overlapping area of images captured at A and B are resolved within the 3D model space to enable the precise and accurate measurement of the model (image from [9]). 191

Figure 37. Structure from motion pipeline (image from [204]). 192

Figure 38. Structure from Motion. Left: Diagram illustrating the principles of structure from motion measurement from multiple overlapping images. Middle: Example of SFM methodology illustration the orientation and number of overlapping images utilised in the modelling of a building. Right: The resulting 3D point cloud data sets derived using SfM (images from [9]). 193

Figure 39. Visualisation of calibration postures [Zabulis, 2019]. 199

Figure 40. Loom parts mapping and terms (images from [143]). 208

Figure 41. Paraments (Image from [144]). 213

Figure 42. Clergy of various ranks in vestments celebrating Mass (image from [145]). 214

Figure 43. Representation of locations, in the Mingei Online Platform (image from [170]). 232

Figure 44. Maps of the upper Rhine region (images from [159]). 233

Figure 45. Rhine water pathways (images from [159]). 234

Figure 46. The area in the vicinity of the Roman Gelduba settlement (image from [147]). 234

Figure 47. Maps of central Europe in relevance to the Thirty Years War (images from [149]). 235

Figure 48. Krefeld map annotations for the Historical City Centre and the Crown Prince District (images from [159]). 236

Figure 49. Locations of Gotzes Company workshops (images from [159]). 236

Figure 50. Locations of HdS city tour (images from [159]). 239

Figure 51. The house of a weaver (Left: image still from Hds documentary [160] Right: image from [159]). 239

Figure 52. Krefeld population (1604-1895) [Zabulis, 2019]. 243

Figure 53. The visit (1758) of Frederic the Great at the von der Leyen palace (image from [152])..247

Figure 54. Von der Leyen company assets (Zabulis. 2019, data source: [84]). 248

Figure 55. The Krefeld crow pattern (image from [161]). 262

Figure 56. Versions of the elephant motif (images from [162] and [163]). 263

Figure 57. Historical illustrations of Abul Abass (image from [164]) 264

Figure 58. Historical depictions of war elephants in Europe and their relationship to chess (images from [165] [166] [167] [168] [169]). 266

Figure 59. Jumbo the elephant (images from [153] [154]). 267

List of tables

Table 1: Amounts of produced mastic, 1939-2000 [Tsouchlis 2007] 133

Table 2: Trade and industrial use of produced mastic, 1939-2000 [Tsouchlis 2007] 134

Table 3. Camera settings for artefact photography [Zabulis, 2019]. 184

Table 4. Photogrametric software solutions [Zabulis, 2019]. 193

Table 5. Basic weaving terms [Zabulis, Doulgeraki, Karuzaki, 2019]. 202

Table 6. Basik silk terms [Beisswenger, Zabulis, 2019] 204

Table 7. Textile looms [Zabulis, Doulgeraki, 2019]. 205

Table 8. Loom parts [Doulgeraki and Zabulis, 2019]. 208

Table 9. Loom tools / accessories [Zabulis, Doulgeraki, 2019]. 210

Table 10. Thread and yarn production devices [Zabulis, 2019]. 212

Table 11: Tools used in mastic cultivation [Kaplanidi, 2019] 214

Table 12: Machines used in the production of mastic products [Kaplanidi, 2019] 217

Table 13: Machines used in glassmaking [Dubois, 2019] 221

Table 14: Materials involved in glassmaking [Dubois, 2019] 222

Table 15: Objects used in glassmaking [Dubois, 2019] 225

Table 16: Processes of glassmaking [Dubois, 2019] 226

Table 17: Tools used in glassmaking [Dubois, 2019] 228

Table 18. Ownership of Luisenstrasse 15 [Beiswenger, 2019] 255

Table 19. Colours of the Church Year [Beisswenger, 2019]. 268

Annex 1. Knowledge collection form

This form aims to identify the information and content types that are important for representing craft instances, in accordance with the HCs representation. The collection of information will be accomplished concurrently with the digital assets acquisition process. The collected information has to be bound with historic, societal, economic, and traditional contexts, to produce fundamental text-based narratives for the pilot HCs. The major scope is to gather all the information related to the craft and to categorize them on a certain common typology. The structure of the report is based both on the structure of the project's DoA and the categorization followed by UNESCO, in the documentation of Elements of the Representative List of Intangible Cultural Heritage.

The basic hypothesis to begin the process of gathering information about a craft relates to the importance of this craft. It is summarized in the phrase **"What Makes Craft unique**?" As a continuation of this question, there are the following critical questions:

- What is the cultural significance of the craft?
- What are unique aspects of the craft that need to be preserved?
- How is knowledge being transferred?
- Who are the craftspeople?
- What is the future perspective of the craft?
- Why do these crafts take place in this territory?

The answers to the above questions will produce the backbone for collecting material concerning the intangible aspect of the craft.

A1.1 Procedure

1. Complete a form with information that can be collected based on the table (*Data*).
2. Scanned data will be collected in a tagged envelope like: "Mingei_craft_i.e.SD_ video"
3. All information should be accompanied by documentation such as sources, photos, videos etc.
4. Ethics forms should accompany verbal testimonials and videotaped interviews.

A1.2 Data

Brief Description of the Craft
Provide a summary description of the Craft that can introduce it to readers who have never seen or experienced it.

Images/ 3D	Video/audio	Text files

Geographical Location and Range of the Craft		
Provide information on the distribution of the craft within the territory or territories, indicating, if possible, the location on which it is centred. Indicate if the territory has a specific environmental/geographical or social/historical relation to the craft.		
Maps	Video/audio	Text files

Selected and Representative Communities, concerning the Craft		
Identify one or several communities, groups or, if applicable, individuals concerned with the craft.		
Images	Video/audio	Text files

Craft Workers / Skilled Workers / Handicrafts Education
Identify clearly, who are the craftspeople, the special characteristics of the workers who practice or are highly skilled in the craft, specific knowledge, manual skills, and education.

Images	Video/audio	Text files

Gender Roles		
Identify the processes related to the craft according to the gender of the craftsperson.		
Images	Video/audio	Text files

Equipment		
Identify every equipment, module, and accessories (such as e.g. tools, machines, utensils, uniforms etc.) that are used for the preparation and the performance of the Craft.		
Images	Video/audio	Text files

Products
Identify products or material objects in general (handicrafts, worship or secular vessels, goods, food, etc.) that are developed as an outcome of the performance or implementation of the Craft.

Images	Video/audio	Text files

Documents		
Identify the historical archives that are relative to the craft.		
Images	Video/audio	Text files

Craft Tradition		
Identify clearly the traditions, which are known for the uniqueness and the diversity in technique, use of the craft, and possibly are influenced by local topography, climate, and socio-religious factors.		
Images	Video/audio	Text files

Oral Tradition / Story Telling / Work Songs / Myths and Legends
Identify all the information that defines the cultural and historical tradition of the craft.

Images	Video/audio	Text files

Social Practices / Social Dimension		
Identify the habitual activities that structure the lives of the community/ group of people that has to do with the craft.		
Images	Video/audio	Text files

Design Dimension		
Identify patterns, motifs, shapes of craft products, and (a) investigate their relation (if any) to the historical development of craftsmanship, (b) indicate contemporary tendencies.		
Images/3D	Video/audio	Text files

Artistic Dimension
Identify contemporary artists or collectives that use the craft in their artmaking, either by practicing the craft themselves or by commissioning craftspeople to produce their artworks.

Images/3D	Video/audio	Text files

Economical Dimension		
Identify one or several communities, groups or, if applicable, individuals concerned with the nominated element.		
Images	Video/audio	Text files

Rituals		
Identify, if applicable, the rituals that help reinforce the sense of common identity and continuity between the people involved with the craft; e.g. worship rites; rites of passage; traditional games etc.		
Images	Video/audio	Text files

Festive Events
Identify, if applicable, the festive events such as seasonal ceremonies, special gestures and words, recitations, songs or dances, special clothing, processions, animal sacrifice, special food etc.

Images	Video/audio	Text files

Religious Dimension		
Identify, if applicable, the impact of religion on crafting.		
Images	Video/audio	Text files

Learning / Education / Transmission of Knowledge		
Research, scholarly, educational, artistic, and recreational activities. People or institutions are involved in the transmission of the craft.		
Images	Video/audio	Text files

Geography of Workshops
Identify and map the structure of laboratories, indoor or outdoor workshops, and/or other indoor or outdoor workspaces. Also, map the movement of primary material and craftsperson(s).

Images/3D	Video/audio	Text files

Emic (Inside) Representation		
Collect personal testimonies from craftspeople and/or their family and/or people closely related to the craft regarding their view on their relationship with the craft and why the craft is unique and significant to them.		
Images	Video/audio	Text files

Annex 2. Literature

All literature and images in this annex are provided by the respective Mingei partners (HdS, PIOP, and CNAM).

A2.1 Silk pilot

A2.1.1 Silk - the dream fabric (Divine Silk) / Seide, der Stoff aus dem die Träume sind - (Göttliche Seide)

Author: Christel Naber, HdS.

English translation: Cynthia Beisswenger, HdS.

A2.1.1.1 English

Introduction

Pure silk, one of the oldest known natural fibres, is still highly fashionable even after thousands of years. This beautiful and elegant fabric fascinates mankind with its precious radiance, gossamer touch and strength. As long ago as antiquity, the incomparable haptic inspired the powerful in this world to such a degree that they even weighed the fibres in gold. Kings, emperors and the clergy wore splendid silken garments, the wealthy ladies and gentlemen of society did not want to forego silk clothes.

The history of Krefeld, also referred to as the "Silk and Velvet Town", is closely linked to this magical material. Today there is a small museum, Haus der Seidenkultur, which shows how the history of silk has shaped the development of the town over the past three centuries.

Discovery

Numerous stories and legends surround the origin of silk thread.

It is undisputed that silk production originated in China around 5000 years ago. From there the exceptional thread spread to India, Persia and Japan, via Byzantium as far as Rome and Venice. It took the caravans six to eight years to transport the valuable freight 10,000 km along the legendary silk routes to Europe. For more than 3,000 years the Chinese were able to safeguard the secret of silk production. There was, however, all sorts of speculation. For example, travellers recounted that young girls reeled butterfly wool from the trees and that this was then used to weave the delicate fabric. Others reported that exotic birds built magnificent nests in the trees. The most well-known story in connection with the discovery of silk, however, is that of Empress Si Ling Chi. It is said that she used to sit under a mulberry tree in the imperial garden and drink tea. One day a gust of wind blew a small white object into the drink. When the empress tried to remove it, she found that she could unwind a gossamer thread. This gave her the idea to have a gown woven from it: silk thread had been discovered!

For almost three thousand years the Chinese emperors prohibited the export of the eggs of the silk moth and the seeds of the mulberry tree on the pain of the death penalty. The knowledge about silkworm breeding, the silk monopoly, remained behind the Chinese Wall for a long time. It was not until the 6th century after Christ that an imperial princess succeeded in smuggling the secret of silk production out of the country. She was to marry an Indian prince but did not want to have to forego her habitual silk clothes in her new homeland. Therefore she hid both the eggs of the silk moth and the seeds of the mulberry tree in her bouffant hairstyle. In this way, silk was able to cross the border as the guards did not dare to touch the hair of such a high-ranking person.

Origin of mulberry silk

The small white object which Si Ling Chi found in her teacup was the cocoon of the rather unimpressive, some 2-3 cm long common silk moth a nondescript moth (Bombix mori) which has a wing span of around 4 centimetres.

In the autumn, this moth lays between 300 and 400 pin-head-sized eggs on the leaves of a mulberry tree. When temperatures rise in the spring and the first tender green shoots appear, black-hairy caterpillars 2-3 mm long hatch from the eggs. The caterpillars spend the next four weeks eating the fresh, juicy mulberry leaves without a break. As the moth has been domestically bred for thousands of years, it is no longer able to exist in the wild. Breeders can determine the exact time when the eggs should hatch by subjecting them to the appropriate temperature and consequently it is possible to produce several generations of Bombix mori each year.

Initially, the tender leaves have to be cut into small pieces, then the caterpillars are fed on the delicate shoots and subsequently rough leaves and small branches. During this period the silkworm devours 40,000 times its body weight in leaves and increases its length by 25 times. Having shed its skin four times, it now measures 8-10 centimetres and has reached the end of the eating phase. After resting for two days, it begins to produce silk thread. Glands beneath the head secret a double thread, which solidifies in the air. The silkworm attaches it as a loose, disordered web in the straw swags, nets or lattices prepared by the breeder. Hanging in this so-called flock silk, the creature then starts to spin its cocoon. The endless double thread consists of fibroin, a protein, which the creature has produced from the mulberry leaf diet. Over a period of three days, the caterpillar winds an endless thread around itself in the form of figure eight, moving its head some 250,000times in order to do it. The silk threads are then cemented together to form an impenetrable shield with a glue-type substance serecin. Within this secure shield, the caterpillar pupates to emerge after 2 weeks as a hairy, whitish moth. In order to hatch, the moth produces an enzyme that softens the shield so that the moth can push the silk threads apart with its front feet. Its only task is to maintain the species because its life is so short it does not need any organs for food intake. Male and female moths from perfect cocoons are brought together to breed. After mating which can take up to 12 hours, the male moth dies immediately and the female once she has laid her eggs within three days.

Silk Production

When the caterpillar is defenseless during metamorphosis within its valuable shield designed to protect it against predators, mankind brings about its early demise.

The cocoon must remain intact in order to salvage the lucent endless thread. Therefore the breeder harvests the pupating creatures after around 10 days and kills them using steam or microwaves. In a tub of hot water, the silk glue is dissolved and rotating brushes find the start of the endless thread. Around 800 metres of double thread can be unreeled from the cocoon and these produce the valuable filament silk. The tangled ends from the outer layer are also after being untangled, combed, and spun. Long-fibres produce schappe silk, short-fibres coarse silk. The glue is removed from the filament silk by boiling it in soap water and the intensity of the process determines the lustre of the thread. The completely “degummed”, i.e. silk from which all the sericin has been removed, is the most valuable, lightest and best quality silk.

Silk produced by Bombyx mori is pure cultivated silk. Other types of moths produce wild silk based on the same principle. The Tussah moth, for example, is to be found predominantly in the woodlands of India. The cocoons are collected when the moths have hatched and therefore wild silk is always spun thread. It has a knobbly irregular dull thread structure.

Properties and use

Silk is very precious because a complicated process is required to obtain it and because it is not available in large quantities. It accounts for less than one percent of global fibre production nowadays. However, its excellent properties guarantee a constant demand for silk products.

Silk captivates initially because it has lustre and is light and supple. In addition to its elegance and hint of exclusivity, it has exceptional wearing properties. The structure of the silk thread is closely comparable to human skin structure. Therefore people feel at home in this material, the skin can breathe and people with allergies can tolerate it without problems. Ladies who can afford luxury wear silk underclothes because apart from being aesthetically pleasing they appreciate the pleasant feeling on the skin. Silk bedclothes also point to a superior lifestyle and are often linked to the erotic. In the “roaring 1920s”, shapely ladies’ legs in silk stocking visible under short skirts delighted the gentlemen. In this sector, synthetic fibres have in the meantime taken over.

Not just in the past but right up to the present day, garments made of silk emphasize the superior standing of the owner. In the home, silk wall coverings, cushions, curtains, canopies, and carpets are regarded as a status symbols. Even after death, the silk lining in an expensive precious wood coffin points to the important rank of the deceased.

A silk thread measuring 500 metres weighs only one gram but it is possible to suspend a weight of 80 grams from it. Consequently, a silken rope can carry more weight than a metal rope of the same thickness. Dschingis Khans’s warriors reportedly reinforced their armour with layers of silk to protect themselves from the enemy’s arrows.

Due to their elasticity, silk products have form stability, they do not crease easily. Any creases soon disappear. Silk can be dyed in brilliant colours, it warms in winter and cools in summer. Its capacity to insulate against the cold makes it an ideal material for high-quality bedclothes or as a lining for winter jackets. It is only in the technical sector that the importance of silk is decreasing due to advanced technology and the lower costs of synthetic fibres. As computers have now replaced the typewriter, silk ribbons are only required in one small niche market. Typewriters with silk ribbons are still needed for top-secret documents because when using silk ribbons the letters are typed in one another not next to one another and therefore it is not possible to reconstruct the text as would be the case with synthetic ribbons or computers.

In the 1930s and 1940s when there was a shortage of textile fibres, silkworms were once again bred in Germany on a small scale. In eastern Germany there were even silkworm breeding projects as recently as the 1970s. However, the silkworm is a very sensitive, highly bred creature, which requires a great deal of care and a warm climate and therefore breeding on a commercial scale could not be established in this region. That is why Frederick the Great's plans for silkworm breeding on a large-scale failed.

Silk cloth has always been and still is woven and processed in the area of Krefeld. Splendid ecclesiastical vestments which have lost nothing of their magnificence in some cases over hundreds of years bear witness to just one of the important niche markets for this remarkable material.

A.8.1.2 Deutsch

Seide, der Stoff aus dem die Träume sind - (Göttliche Seide)

Einleitung

Reine Seide, eine der ältesten bekannten Naturfasern, ist auch nach Jahrtausenden noch modisch hochaktuell. Dieses schöne und elegante Material fasziniert die Menschheit wegen des edlen Glanzes, der Leichtigkeit und Festigkeit. Die unvergleichliche Haptik begeisterte schon in der Antike die Mächtigen dieser Welt so sehr, dass sie die Faser sogar mit Gold aufwogen. Kaiser, Könige und der Klerus stellten sich in prunkvollen Seidengewändern dar, die vermögenden Damen und Herren der Gesellschaft wollten nicht auf Seidenroben verzichten.

Die Geschichte Krefelds, auch Stadt wie Samt und Seide genannt, ist eng mit diesem märchenhaften Material verbunden. Heute erinnert hier vor allem ein kleines Museum, das Haus der Seidenkultur, an die Geschichte der Seide, die über drei Jahrhunderte hinweg die Entwicklung der Stadt prägte.

Entdeckung

Um die Herkunft der Seidenfaser ranken sich unzählige Geschichten und Legenden.

Unbestritten ist, dass die Seidenherstellung vor ungefähr 5.000 Jahren in China ihren Ursprung hatte. Von hier aus verbreitete sich die außergewöhnliche Faser nach Indien, Persien und Japan, über Byzanz bis nach Venedig und Rom. Sechs bis acht Jahre brauchten die Karawanen, um die kostbare Fracht über 10.000 km entlang der legendären Seidenstraßen nach Europa zu bringen. Mehr als 3.000 Jahre lang konnten die Chinesen das Geheimnis der Gewinnung von Seide bewahren. Es gab diesbezüglich jedoch allerlei Mutmaßungen. So berichteten Reisende, dass junge Mädchen Schmetterlingswolle von den Bäumen wickeln und daraus die zarten Stoffe weben würden, andere erzählten, exotische Vögel bauten glänzende Nester in die Bäume.

Aber am bekanntesten ist die Geschichte der Kaiserin Si Ling Chi, die in Zusammenhang mit der Entdeckung der Seide genannt wird. Angeblich pflegte sie 2.700 Jahre v. Chr. in ihrem kaiserlichen Garten unter einem Maulbeerbaum Tee zu trinken. Eines Tages wehte ein Windstoß ein kleines, weißes Gebilde in das Getränk. Als sie versuchte, dieses zu entfernen, entdeckte sie, dass sich ein hauchdünner Faden abwickeln ließ. Dabei kam ihr die Idee, aus diesem Faden ein Gewand anfertigen zu lassen: die Seidenfaser war entdeckt!

Unter Androhung der Todesstrafe verboten die chinesischen Kaiser fast drei Jahrtausende lang die Ausfuhr der Eier des Seidenspinners und der Samen des Maulbeerbaumes. Das Wissen um die Seidenraupenzucht, das Seidenmonopol, blieb hinter der Chinesischen Mauer für lange Zeit erhalten. Erst im 6. Jahrhundert nach Christus gelang es einer kaiserlichen Prinzessin, das Geheimnis der Seidengewinnung außer Landes zu schmuggeln. Denn sie sollte einen indischen Prinzen heiraten, wollte in der neuen Heimat aber nicht auf die gewohnten Seidengewänder verzichten. So versteckte sie sowohl die Eier als auch die Maulbeerbaum-Samen in ihrer aufgetürmten Frisur. Auf diese Weise konnte Seide die Landesgrenze überwinden, denn die Zöllner wagten es nicht, die Haare einer hochrangigen Persönlichkeit zu berühren.

Entstehung der Maulbeerseide

Der kleine, weiße Gegenstand, den Si Ling Chi in ihrer Teetasse gefunden hatte, war ein Kokon des Maulbeerspinners, einem unscheinbaren, etwa 2 - 3 Zentimeter langen Falter (Bombix mori) mit einer Flügelspannweite von ca. 4 Zentimetern.

Der Nachtfalter legt im Herbst 300 bis 400 stecknadelkopfgroße Eier auf die Blätter des Maulbeerbaumes. Wenn im Frühling die Temperatur ansteigt und das erste zarte Grün erscheint, schlüpfen 2-3 mm lange, schwarz behaarte Raupen aus den Eiern. Nun beginnen diese, etwa 4 Wochen lang ununterbrochen frische, saftige Maulbeerblätter zu fressen. Da der Schmetterling seit Jahrtausenden vom Menschen gezüchtet wird, ist er nicht mehr in der Lage, in Freiheit zu leben. Der Züchter kann durch die Zufuhr von Wärme den Zeitpunkt des Schlüpfens festlegen, somit mehrere Generationen „Bombix mori“ in einem Jahr erzeugen.

Anfangs müssen die ersten Blättchen kleingeschnitten werden, danach verfüttert man die zarten Triebe, später auch derbe Blätter und kleine Äste. Die Raupe verzehrt während dieser Zeit das 40.000 fache ihres eigenen Körpergewichtes an Blättern und steigert dadurch ihre Länge um das 25 fache. Nach viermaligem Häuten misst sie 8-10 Zentimeter und beendet nun die Fressphase. Sie legt eine zweitägige Ruhephase ein, danach beginnt die Produktion des Seidenfadens. Aus Drüsen unterhalb des Kopfes wird ein Doppelfaden abgesondert, der an der Luft erstarrt. Die Raupe spannt ihn als lockeres, ungeordnetes Gespinst in die vom Züchter vorbereiteten Strohgirlanden, Netze oder Gitter. In dieser sogenannten Flockseide hängend kann das Tier sich nun sorgfältig in seinen Kokon einspinnen. Der endlose Doppelfaden besteht aus Fibroin, einer Eiweißsubstanz, die das Tier aus der Maulbeernahrung erzeugt hat. Drei Tage lang legt die Raupe den ca. 3.000 m langen Endlosfaden in Form einer Acht um sich herum, rund 250.000 Mal muss sie ihr Köpfchen dazu bewegen. Mit einer leimartigen Substanz, dem Serecin, werden die Seidenfäden zu einer undurchdringlichen Schutzhülle verklebt. In dieser sicheren Hülle verpuppt sich die Raupe, um nach 2 Wochen als behaarter, weißlicher Falter zu schlüpfen. Dazu sondert der fertige Schmetterling ein Enzym ab, das die Hülle an einer Stelle aufweicht, sodass er mit den Vorderfüßen den Kokonfaden auseinanderdrücken kann. Seine einzige Aufgabe ist die Arterhaltung, denn sein Leben ist so kurz, dass er keine Organe zur Nahrungsaufnahme mehr benötigt.

Für die Zucht werden männliche und weibliche Falter aus perfekten Kokons zusammengebracht. Nach der Paarung, die bis zu 12 Stunden dauern kann, stirbt das männliche Tier sofort, das weibliche nach der Eiablage innerhalb von drei Tagen.

Seidengewinnung

Dadurch, dass in einer Phase der Wehrlosigkeit während der Metamorphose die Raupe sich in einer wertvollen Umhüllung vor seinen natürlichen Feinden zu schützen sucht, bereitet ihr der Mensch ein vorzeitiges Ende.

Der Kokon muss intakt bleiben, will man die glänzende Endlosfaser gewinnen. Daher erntet der Züchter die verpuppten Tiere nach etwa 10 Tagen und tötet sie mit Wasserdampf oder Mikrowellen ab. Ein heißes Wasserbad löst den Seidenleim auf, rotierende Bürsten suchen den Anfang des Endlosfadens. Ungefähr 800 Meter Doppelfaden können gehaspelt, also vom Kokon abgewickelt werden, diese ergeben die wertvolle Grègeseide. Auch die wirren Anfänge in der äußeren Schicht, die Florettseide, wird genutzt, indem man sie auseinander zupft, kämmt und verspinnt. Langfaserige Seide ergibt die Schappeseide, kurzfaserige Bourette. Durch Kochen in Seifenwasser wird die Haspelseide vom Leim befreit, die Intensität dieses Prozesses bestimmt den Glanz des Endlosfadens. Die vollkommen „entbastete“, also vollständig vom Serecin befreite Seide stellt das teuerste, leichteste und edelste Material dar.

Die Seide des Bombix mori ist reine Zuchtseide. Andere Schmetterlingsarten erzeugen nach dem gleichen Prinzip Wildseide. Der Tussahspinner beispielsweise lebt vorwiegend in den Wäldern Indiens. Die Kokons werden eingesammelt, nachdem die Schmetterlinge geschlüpft sind. Wildseide ist immer gesponnenes Garn, sie weist eine noppige, unregelmäßige und matte Garnstruktur auf.

Eigenschaften und Verwendung

Der zur Seidengewinnung erforderliche Aufwand und die relative Seltenheit der Faser sind Gründe für ihre Kostbarkeit. Ihr Anteil an der weltweiten Faserproduktion liegt heute unter einem Prozent. Doch ihre herausragenden Eigenschaften garantieren auch heute noch eine stetige Nachfrage für Seidenprodukte.

Die Seidenfaser besticht in erster Linie durch ihren Glanz, ihre Leichtigkeit und ihre Geschmeidigkeit. Doch neben ihrer Eleganz und dem Hauch von Exklusivität verfügt sie auch über außerordentliche Trageeigenschaften. Der Aufbau der Seidenfaser gleicht der menschlichen Hautstruktur am ehesten. Deshalb fühlt sich der Körper in diesem Material so wohl, die Haut kann atmen, der Allergiker verträgt sie problemlos.

Damen, die sich Luxus leisten, tragen Seidenunterwäsche, da sie neben dem ästhetischen Aspekt auch das angenehme Hautgefühl schätzen. Auch Seidenbettwäsche weist auf einen gehobenen Lebensstil hin und wird gerne mit Erotik in Verbindung gebracht. In den „wilden Zwanzigern“ versetzten wohl geformte, unter kurzen Röcken sichtbare, Damenbeine in Seidenstrümpfen die Herrenwelt in Entzücken. In diesem Bereich haben synthetische Fasern inzwischen der Seide den Rang abgelaufen.

Nicht nur in der Vergangenheit, sondern auch heute betont Kleidung aus Seide die gehobene Stellung des Besitzers. Bei der Wohnungsausstattung gelten seidene Tapeten, Kissen, Vorhänge, Wandbespannungen, Baldachine und Teppiche als Statussymbol. Sogar über den Tod hinaus weist eine seidene Auskleidung in einem teuren Edelholzsarg auf die bedeutende Stellung des Verblichenen hin.

Ein Seidenfaden von 500 Metern Länge wiegt nur ein Gramm, dennoch könnte man ein Gewicht von 80 Gramm daran aufhängen. So vermag ein Seil aus Seide mehr Gewicht zu tragen als ein gleich dickes aus Metall. Es wird berichtet, dass die Krieger Dschingis Khans ihre Rüstungen mit Seidenschichten verstärkten, um vor den Pfeilen der Feinde geschützt zu sein.

Wegen ihrer Elastizität weisen Seidenprodukte Formstabilität auf, sie besitzen eine geringe Knitterneigung, Falten hängen sich rasch wieder aus. Seide lässt sich in brillanten Nuancen färben, sie wärmt im Winter und kühlt im Sommer. Ihre Fähigkeit, isolierend gegen Kälte zu wirken, macht sie zu einem idealen Material für hochwertige Bettdecken oder als Fütterung für Winterjacken. Lediglich im technischen Bereich nimmt die Bedeutung der Seide wegen fortschrittlicher Technologien und der geringeren Kosten synthetischer Fasern ab. Da der Computer heute die Schreibmaschine ersetzt, sind seidene Farbbänder nur noch in einem Nischenbereich nötig. Für hochgeheime Dokumente nämlich werden Schreibmaschinen mit seidenen Bändern benutzt, weil bei solchen Bändern die Buchstaben ineinander und nicht neben einander getippt werden. Man kann somit einen Text anhand der Bänder nicht mehr rekonstruieren, wie das bei Computertexten oder synthetischen Bändern der Fall wäre.

In den 1930igen und 1940igen Jahren, als Textilfasern knapp wurden, hat man in Deutschland Seidenraupen auf kleiner Ebene wieder gezüchtet. In Ostdeutschland gab es sogar bis in den 1970igen Jahren Projekte zur Seidenraupenzucht. Die Seidenraupe ist jedoch ein sehr sensibles, hochgezüchtetes Lebewesen, welches sorgfältigste Betreuung in einem milden Klima verlangt, daher konnte eine kommerzielle Züchtung in diesen Breiten nicht angesiedelt werden. Aus diesem Grunde sind auch bereits die Pläne von Friedrich dem Großen für eine Seidenraupenzucht im großen Stil gescheitert.

Seidenstoffe wurden immer und werden noch in der Gegend um Krefeld gewebt und weiter verarbeitet. Kostbare Paramente, die teilweise über hunderten von Jahren nichts von ihrer Schönheit eingebüßt haben, zeugen von nur einem der wichtigen Nischenmärkte für dieses bemerkenswerte Material.

A2.1.2 From a silkworm to a silk thread / Von der Seidenraupe zum Seidenfaden

Author: Christel Naber, HdS.

English translation: Cynthia Beisswenger, HdS.

<u>A2.1.2.1 English</u>

1. The female night moth “Bombix mori” lays 300 – 400 eggs.
2. Black-haired 2-3 mm long caterpillars hatch from these pinhead-sized eggs.
3. The breeder feeds the caterpillars exclusively with large quantities of mulberry leaves.

4. For approximately four weeks the caterpillar eats continuously until it is 8 – 10 cm long.
5. After shedding its skin four times it is fully grown and ready to transform itself into a night moth.
6. The moth spins itself into a stable cocoon over three days and remains there protected as a pupa for two to three weeks.
7. Following its metamorphosis, the night moth secrets an enzyme at one point of the cocoon destroying the approx. 3000 m long endless thread.
8. The silk moth frees itself from the cocoon and is now ready for mating.
9. Having mated the male moth dies immediately and the female lives for 2 or 3 days to lay eggs. The development of the next generation can begin. In a favourable climate, up to eight generations per year are produced.
10. Around 4000 years ago the Chinese discovered that an endless fibre can be reeled from the cocoon of the silk moth cocoon.
11. By dipping the cocoons into boiling water the pupae are killed. 800 m of thread can be reeled from the tangled threads. The remainder of the cocoon is processed for spinning.
12. The endless silk thread is wound onto bobbins and produces the valuable filament silk.

A2.1.2.2 Deutsch

Von der Seidenraupe zum Seidenfaden

1. Der weibliche Schmetterling „Bombix mori“ legt 300 – 400 Eier.
2. Aus den stecknadelkopfgroßen Eiern schlüpfen 2-3 mm lange, schwarz behaarte Raupen.
3. Die Raupen werden vom Züchter ausschließlich mit großen Mengen Maulbeerblättern gefüttert.
4. Ungefähr 4 Wochen lang frisst die Raupe ununterbrochen, bis sie 8 – 10 cm groß ist.
5. Nach vier Häutungen ist die Raupe ausgewachsen und bereit, sich in einen Schmetterling zu verwandeln.
6. Sie spinnt sich nun 3 Tage lang in einen stabilen Kokon ein, um sich innerhalb von 2 - 3 Wochen geschützt verpuppt in einen Schmetterling zu verwandeln.
7. Nach ihrer Metamorphose zum Schmetterling löst sie den Kokon an einer Stelle durch die Ausscheidung eines Sekretes auf und zerstört dabei den 3000m langen Endlosfaden.
8. Der Seidenspinner entschlüpft dem Kokon und ist jetzt bereit zur Paarung.
9. Nach der Paarung stirbt das männliche Tier sofort, dem Weibchen bleiben 2 – 3 Tage zur Eiablage. Die Entwicklung einer neuen Generation kann beginnen, bei günstigem Klima bis zu 8 Generationen pro Jahr.
10. Vor ca. 4000 Jahren entdeckten die Chinesen, dass sich aus dem Kokon des Seidenspinnerschmetterlings eine Endlosfaser abwickeln lässt.
11. Durch das heisse Wasser sterben die Puppen und rund 800 m Filamentfaden können gehaspelt werden. Der Rest des Kokons wird versponnen.
12. Die endlosen Seidenfäden werden auf Bobinen gespult und ergeben die wertvolle Grègeseide.

A2.1.3 Craft Steps / HANDWERKLICHE SCHRITTE

Author: Dipl. Ing. Dieter Blatt, HdS.

English translation: Cynthia Beisswenger, HdS.

A2.1.3.1 English

1. Pattern Designer

The pattern designer develops ideas for patterns, which are to be incorporated into the woven textiles. To do this he requires considerable graphic and artistic talent. Depending on the technical options available in the weaving workshop, the specifications set out by the studio, the fashion trend, and the designated use, he designs geometric or floral shapes, abstract or graphic representations. Sometimes he also provides various colour options.

2. Point Paper Designer

The task of the point paper designer is to convert the artistic design of the pattern designer into a technical drawing according to the patterning options provided by the weaving machine.

To do this he transfers the design to special paper, the so-called point paper. Each rectangle on the point paper symbolises a crossing of warp and weft threads. Depending on the pattern, colour is used to indicate in the appropriate rectangle which warp threads should be on top at the crossing point (weave). There are many different weaves and the point paper designer has to choose the most appropriate one so that the design in question appears as accurately as possible in the fabric.

3. Card Puncher

The card puncher transforms the technical drawing made by the point paper designer into a punched card.

With his fingers on the keyboard he enters the data into the card punching machine and with his foot he punches the card by activating the pedal. A hole in the card signalises to the Jacquard machine that a warp thread has to be raised. No hole in the card, then the warp thread remains where it is. The space between the lower warp threads and the raised warp threads is referred to as the shed into which the weft thread can be inserted. One card is needed for each weft thread. Once they have been punched, the cards for each pattern are numbered and threaded together and then suspended in the Jacquard machine as an endless card set.

4. Warper

A specific number of warp threads are reeled from spools parallel to one another onto the warp beam.

Depending on the number of spools available, the process is repeated until the required number of warp threads has been reached. Then all the warp threads are transferred from the warping beam to the warp beam at the same time. Sometimes the warp threads are coated with sizing to prevent abrasion.

5. Fitter

The fitter is responsible for setting up the loom. The looms are not set up just for one pattern but for as long a time as possible because the set up process can be extremely complicated and time-consuming. It is only necessary to re-set the loom when one warp has been completely woven and a different quality warp is required. This is seldom the case because every standstill means an economic loss.

There are two different methods to install a new warp.

If the warp has the same number of threads, then the individual threads can be directly knotted to or pieced to the ends of the warp threads of the completely woven warp. If the new warp has a different number of threads (= different quality) then the harness has to be changed.

When a new harness is used, each warp thread is drawn through the appropriate heald which is attached to the harness string.

Then the warp threads are drawn through the slits in the reed and this enables the number of warp threads per centimetre and the weaving width to be determined.

6. Weaver

The weaver is the person who produces the final product. The loom needed not to stand still therefore the weaver often had to work from daybreak to dusk. He needed good eyesight to find any flaws and dexterity to piece the torn threads together. From the weft brief, the weaver obtained information about the weft material and the weft density.

The weaver was a man who kept his entire family busy preparing the threads for weaving. For example, the children or the weaver's wife had to prepare the spools for the loom shuttles using a reeling wheel.

Manual weaving is extremely time-consuming. The amount of fabric produced depends on the fineness of the fabric and the warp and weft material used. In Krefeld, silk and gold threads were often used and these are both fine and delicate. The final product was therefore very expensive not only because of the materials used but also the necessary production time.

<u>A2.1.3.2 Deutsch</u>

HANDWERKLICHE SCHRITTE

1. Musterzeichner

Der Musterzeichner oder Dessinateur entwickelt Ideen, welche Muster die gewebten Textilien aufweisen sollen. Dazu benötigt er viel zeichnerisches und künstlerisches Talent.

Abhängig von den technischen Möglichkeiten in der Weberei oder den Vergaben des Ateliers sowie dem Modetrend und dem Verwendungszweck entwirft er geometrische oder florale Formen, abstrakte oder gegenständliche Darstellungen. Manchmal erstellt er dazu verschiedene Farbstellungen.

2. Patroneur

Der Patroneur muss den künstlerischen Entwurf des Musterzeichners/Dessinateurs nach der Musterungsmöglichkeiten der Webmaschine in eine technische Zeichnung umsetzen.

Dazu überträgt er den Entwurf auf ein Spezialpapier, das sogenannte Patronenpapier. Jedes Rechteck auf dem Patronenpapier symbolisiert eine Verkreuzung von Kett- und Schussfäden. Je nach Muster wird mit Farbe in den entsprechenden Rechtecken eingezeichnet, welcher Kettfaden bei der Verkreuzung oben liegen soll (Bindung).

Es gibt eine Vielzahl von Bindungen, die der Patroneur so einsetzen muss, dass der vorliegende Entwurf möglichst genau im Gewebe erscheint.

3. Kartenschläger

Der Kartenschläger setzt die technische Zeichnung des Patroneurs in eine Lochkarte um.

An der Kartenschlagmaschine gibt er mit den Fingern auf der Klaviatur die Daten ein und mit dem Fuß stanzt er über das Pedal die Karte. Ein Loch in der Karte signalisiert der Jacquardmaschine eine Kettfadenhebung. Kein Loch in der Karte, der Kettfaden bleibt unten. Der Zwischenraum zwischen den unten liegenden Kettfäden und den gehobenen Kettfäden ist das sogenannte Webfach, in das dann der Schussfaden eingetragen werden kann. Für jeden Schussfaden wird eine Karte benötigt. Die Karten für ein Muster werden, nachdem sie geschlagen sind, nummeriert, zusammengebunden und als endloses Kartenspiel in die Jacquardmaschine eingehangen.

4. Schärer

Die Kettfäden werden von Spulen in einer bestimmten Anzahl parallel auf den Schärbaum gewickelt.

Je nach Anzahl der Spulen wiederholt man den Vorgang, bis die gewünschte Anzahl der Kettfäden erreicht ist. Anschließend werden die Kettfäden gemeinsam vom Schärbaum auf den Kettbaum übertragen. Manchmal werden die Kettfäden zum Schutz gegen Scheuern mit einer Schlichte überzogen.

5. Vorrichter

Der Vorrichter ist für das Einrichten der Webmaschine zuständig.

Die Webstühle werden nicht für ein Muster sondern für möglichst lange Zeit eingerichtet, weil der Einrichtungsvorgang sehr aufwendig sein kann. Nur wenn eine Kette abgewebt ist und eine andere Qualität benötigt wird, ist eine Umstellung erforderlich. Dies ist nur selten der Fall, da jeder Stillstand einen wirtschaftlichen Verlust bedeutet.

Es gibt zwei verschiedene Vorgänge, um eine neue Kette einzuziehen.

Bei einer Kette mit gleicher Fadenzahl können die einzelnen Fäden direkt an die Restfäden der abgewebten Kette angeknotet oder angedreht werden. Hat die neue Kette eine andere Fadenzahl (= andere Qualität) muss der Harnisch verändert werden.

Bei einem neuen Harnisch wird jeder einzelne Kettfaden durch die entsprechende Litze eingezogen, die mit der Harnischkordel verbunden ist. Danach werden die Kettfäden durch die Lücken im Riet eingezogen, wodurch die Anzahl der Kettfäden auf 1cm und die Webbreite genau festgelegt werden kann.

6. Weber

Der Weber ist die Person, die das Endprodukt herstellt. Der Webstuhl sollte nicht still stehen, daher musste der Weber oft vom ersten Tageslicht bis zur Dämmerung arbeiten. Er benötigt gute Augen, um Fehler zu entdecken und Fingerfertigkeit, um gerissene Fäden anzuknoten.

Über den Schussbrief erhielt der Weber die Informationen zum Schussmaterial und zur Schussdichte.

Historisch ist der Weber ein Mann, der die ganze Familie mit der Vorbereitung der Fäden für das Weben beschäftigte. Zum Beispiel mussten die Kinder oder die Frau des Webers die Spulen für das Webschiffchen mit dem Spulrad herstellen.

Das Handweben ist sehr zeitaufwendig. Die produzierte Stoffmenge hängt von der Feinheit des Gewebes und dem verarbeiteten Kett- und Schussmaterial ab. In Krefeld wurden oft Seiden- und Goldfäden eingesetzt und diese sind sowohl fein wie auch empfindlich. Das Endprodukt war daher sehr teuer, nicht nur wegen der verarbeiteten Materialien sondern auch wegen der erforderlichen Produktionszeit.

A2.1.4 Krefeld from Its Origins to Town Like Silk and Velvet / KREFELD VON DEN URSPRÜNGEN BIS ZUR “STADT WIE SAMT UND SEIDE”

Author: Cynthia Beisswenger, HdS.

English translation: Cynthia Beisswenger, HdS.

A2.1.4.1 English

Krefeld is a town with a Roman past. Excavations in neighbouring Gellup bear witness to the existence of at least six Roman camps up until the fourth century A.D. Burial sites dating from the time of the Franks indicate that the area was settled continuously. Since the late Middle Ages Krefeld has belonged to the County of Moers. The Counts of Moers made every effort to establish the Reformation early in their territory and the first Reformist preacher took up his post in 1561. At the beginning of the 17th century, Krefeld came under the rule of the Netherlands. And the town became an island of religious tolerance. Consequently, in a period in which the denomination of the population was determined by the denomination of the ruler, Mennonites from near and far came to Krefeld and settled there. This immigration had far-reaching consequences which have shaped the profile of the town right up to the present day. The religious refugees brought with them linen processing skills and as they were also mostly successful businessmen they laid the foundation stone for economic growth and prosperity. The von der Leyen family, immigrants from Radevormwald, also contributed significantly to the development of the "Town like Silk and Velvet". Originally linen weavers, they increasingly changed the emphasis of their business to silk weaving.

In 1702 Krefeld became Prussian and silk weaving became the most important economic factor with sales to the Prussian court in Berlin flourishing. In this period the silk weavers were out workers who received orders to weaver fabrics from merchants and traders. The looms were set up in front of the light window in the typical small cottages, some of which still exist today. The head of the household was normally the weaver and other family members helped with tasks such as reeling the thread onto the bobbins for the shuttle. On one of the main avenues of the town, there is a monument to the weavers "Meister Ponzelaar". He wears a frock coat (his Sunday best) in local dialect "Laakesserock", a high-necked waistcoat, a small collar with a silk scarf and a "Jraduutkapp" (a black cap). At the end of the week, he takes the finished fabric on the beam to the merchant's office together with a bag containing any thread left over. There he was paid and received a new prepared warp beam and thread for the week ahead. Such weavers were a typical sight in the town until the beginning of the 19th century. Their craft required rapid comprehension and rhythmic movement of hand and foot.

In 1785 Edward Cartwright invented his first mechanical loom and continued to make improvements to it. The enhanced looms then went on sale in 1820. With the advent of mechanisation the silk entrepreneurs started to build factories where all the machines were powered by one source of energy and the workers were responsible for more than one loom.

This meant that the "Meister Ponzelars" were often made redundant. However, the large emerging factories required manpower and the growing population started moving from rural areas to the towns seeking work. As the rural population was largely Catholic this meant that the town of Krefeld which had initially been Protestant became increasingly Catholic.

Although Krefeld had already been extended several times to accommodate the newcomers, a completely new town plan was drawn up by Adolph von Vagedes. The former fortifications were removed and the town which was in the meantime one of the richest in Germany was given a neoclassical face. The centre was enclosed by four boulevard-type streets. Outside the central area other districts sprang up, such as the Crown Prince District near the station.

A2.1.4.2 Deutsch

KREFELD VON DEN URSPRÜNGEN BIS ZUR "STADT WIE SAMT UND SEIDE"

Krefeld ist eine Stadt mit römischer Vergangenheit. Ausgrabungen in Gellup zeugen von der Existenz von mindestens sechs römischen Lagern bis zum 4. Jahrhundert nach Christus. Grabungsstätten datierend aus der Zeit der Franken beweisen, dass die Gegend kontinuierlich besiedelt wurde.

Seit dem späten Mittelalter gehört Krefeld zur Grafschaft Moers. Die Grafen von Moers bemühten sich frühzeitig stark, die Reformation in ihrem Herrschaftsgebiet zu etablieren und der erste

Reformist-Prediger übernahm seinen Posten im Jahre 1561. Anfang des 17 Jahrhunderts kam Krefeld unter der Herrschaft der Niederlande und die Stadt wurde zu einer Insel religiöser Toleranz.

Zu einer Zeit in der die Konfession des Herrschers die Konfession des Volkes bestimmte, kamen verfolgte Mennoniten von nah und fern und ließen sich in der Stadt nieder. Diese Immigration hatte weitreichende Konsequenzen, die das Profil der Stadt bis zum heutigen Tage geprägt haben. Die religiösen Flüchtlinge brachten Kenntnisse der Leinenverarbeitung mit sich und waren noch dazu meistens erfolgreiche Geschäftsleute. Sie haben den Grundstein für wirtschaftliches Wachstum und Wohlstand gelegt. Die Familie von der Leyen, Immigranten aus Radevormwald, trugen ebenfalls erheblich zur Entwicklung der "Stadt wie Samt und Seide" bei. Ursprünglich Leinenweber veränderten sie zunehmend den Schwerpunkt ihres Geschäfts auf die Seidenweberei.

In 1702 wurde Krefeld preußisch und das Seidenweben wurde zum wichtigsten wirtschaftlichen Faktor, da Umsätze mit dem preußischen Hof in Berlin florierten. In dieser Zeit arbeiteten Seidenweber als Heimarbeiter, die Aufträge von Händlern und Geschäftsleuten bekamen. Die Webstühle wurden im Licht direkt am Fenster in kleinen typischen Weberhäuschen aufgestellt. Es existieren noch heute einige solche Häuschen. Das Familienoberhaupt war normalerweise der Weber und andere Familienmitglieder haben mit Aufgaben wie dem Aufwickeln des Garns auf die Spulen für das Schiffchen geholfen. In einer der Hauptstraßen der Stadt steht ein Denkmal für die Weber, die man „Meister Ponzelar" nennt. Er trägt einen Gehrock (seine Sonntagskleidung) in Krefelder Dialekt "Laakesserock", eine hochgeschlossene Weste, einem schmalen Umlegekragen mit seidenem Halstuch und eine "Jraduutkapp" (schwarze Mütze). Am Ende der Woche trug er den fertigen Stoff auf dem Kettbaum zum Büro des Händlers zusammen mit einer Tasche voll Restgarn. Dort wurde er bezahlt und er erhielt einen neuen vorbereiteten Kettbaum sowie Garn für die nächste Woche. Solche Weber waren ein typischer Anblick in der Stadt bis zum Beginn des 19. Jahrhunderts. Für ihr Handwerk benötigten sie schnelle Auffassungsgabe und rhythmische Bewegungen von Hand und Fuß.

In 1785 erfand Edward Cartwright seinen ersten mechanischen Webstuhl und arbeitete ständig an Veränderungen. Die verbesserten Webstühle kamen 1820 auf den Markt. Mit Beginn der Mechanisierung fingen die Seidenproduzenten an, Fabriken zu bauen, in denen alle Maschinen von einer einzigen Energiequelle angetrieben wurden und die einzelnen Arbeiter für mehr als einen Webstuhl zuständig waren. Dies bedeutete, dass die "Meister Ponzelars" oft arbeitslos wurden. Die neu entstehenden großen Fabriken benötigten Personal und die wachsende Bevölkerung auf dem Lande zogen um in die Städte, um Arbeit zu finden. Da die ländliche Bevölkerung meistens katholisch war, wurde Krefeld, das ursprünglich protestantisch war, zunehmend katholisch.

Obwohl Krefeld zur Aufnahme der Neuankömmlinge bereits mehrfach erweitert wurde, wurde ein komplett neuer Stadtplan vom Architekten Adolph von Vagades erstellt. Die ehemaligen Festungsbauten wurden entfernt und die Stadt, die inzwischen eine der reichsten Städte Deutschlands war, erhielt ein klassizistisches Gesicht. Das Zentrum wurde von vier Boulevards umgeben. Außerhalb des Zentrums sind andere Viertel entstanden, wie das Kronprinzenviertel in der Nähe des Bahnhofs.

A2.1.5 HdS historical patterns

Author: HdS.

This subsection provides content translated by Cynthia Beisswenger from German. The original texts (included in the Mingei digital dataset) are in German and are curated material of HdS.

The content regards historic patterns that were implemented by HdS practitioners. Below images of the Jacquard weaved patterns are provided. Associated are descriptions of the event, story, tale, or symbol depicted in the textile sample, in the form of stories. The corresponding stories are provided along with HdS products that bear the imaged patterns, in the photographic images below. The original content appears at https://seidenkultur.de/shop/seidenmuster

A2.1.5.1 English

A2.1.5.1.1 The Pomegranate Pattern

The ornament form in the design was developed from the pomegranate which served as a motif for textile design in antiquity. The pomegranate is the symbol of fertility, love, life and immortality due to the abundance of seeds and its brilliant red colour. In Eastern Europe, the pomegranate was a favoured motif amongst bobbin lace-makers. In the 15th century, the pomegranate design was incorporated in brocades and damasks in the velvet weaving manufactories in Venice and proved very popular. This product is made of pure filament silk. The design is based exclusively on traditional, historic patterns. A few years ago this pattern was still being manually woven on these premises on wooden Jacquard hand looms which were up to two hundred years old.

Figure 1. The Pomegranate Pattern.

A2.1.5.1.2 The Ear of Corn Pattern

Right up to the beginning of the 19th century, it was seldom that textiles were produced exclusively for the church. Robes were tailored from secular textiles but patterns were chosen which also had significance in the symbolic language of the Christian church. The ear of corn which we use is just such a symbol because it is a gift of nature and a present from God; it gives us our daily bread. The ear of corn reminds us of the transubstantiation (transforming) of bread into the body of Christ during Holy Mass (Catholic theology). The models for this pattern are the flower patterns popular in the 18th and 19th centuries.

Figure 2. The Ear of Corn Pattern.

A2.1.5.1.3 The Elephant Pattern

This pattern belongs to the historic Hubert Gotzes weaving company. The appropriate point paper design is kept in the archives. It goes back to the famous “Elephant Cloth” from the shrine of Charlemagne. The original material is regarded as being one of the most impressive examples of artistic silk weaving at the time. Produced in the Byzantine Empire – probably for the emperor’s court there, it is thought that the original cloth arrive in the Occident as a gift. An imperial gift because the elephant as one of the strongest animals on earth symbolises the ruler. When the German Emperor Otto III had Charlemagne’s tomb in Aix-la-Chapelle opened in the year 1000, he wrapped the mortal remains of his predecessor in the magnificent cloth. That is how the precious silk cloth has endured the centuries. When the shrine was opened again several times in the 19th and 20th centuries, the impressive pattern was recorded at first in a drawing and later photographed. That is also how it reached Krefeld. Whilst the original motif is some 80 cm in diameter, the variation produced at the beginning of the 20th century is just under 30 cm. The configuration of the motif with the elephant in a circle is also new. In the original, the elephants are standing opposite one another and in strict rows one above the other. Another 20th-century variant depicts the elephants in rows but the direction in which they face alternates, in one row the elephants look to the left and in the next to the right. The version which the Haus der Seidenkultur/the historic Hubert Gotzes weaving factory for ecclesiastical vestments brought out in 2004 shows a different possible motif configuration.

Figure 3. The Elephant Pattern.

A2.1.5.1.4 The Lion Pattern

The pattern repeat comprises two rows. In the first row there is a pair of male lions in a heart-shaped motif on the right-hand and left-hand side of a flower arrangement. The heads of the animals are turned away from each other. Between the motifs is a vase containing 5 pomegranates. In the second row there is a vase containing 3 carnation-type flowers above the pomegranates. On either side, there is a bird with the body of a goose, although the feather headdress is more reminiscent of a peacock. Large tendrils bear five heart-shaped leaves which surround the area containing the birds. The models for this pattern are to be found in 15th century Italy. As it was not until the 19th century that textiles were woven specifically for liturgical use, silk cloth intended for secular use was used to make ecclesiastical vestments. Preference was given to patterns whose symbolism also had a sacral significance. For example, the lion, king of the animals, became the symbol of the power and glory of God. The lion was also the heraldic animal of the House of Judah (Genesis 49:9-10) and consequently of the Jewish kings since David, the ancestors of Jesus Christ. (Matthew 1, 1-17).

Figure 4. The Lion Pattern.

A2.1.5.1.5 The Paradise Pattern

This is one of the designs produced by the Hubert Gotzes weaving factory for ecclesiastical textiles established in Krefeld in1905. It can still be seen on loom no. 6 in the weaving workshop today. Right up to the beginning of the 19th century, it was seldom that textiles were produced exclusively for the church. Robes were tailored from secular textiles but patterns were chosen which also had significance in the symbolic language of the Christian church. The paradise pattern is arranged symmetrically with pairs of birds of prey facing one another under a sun motif. The pairs of birds are each separated by an elaborately stylised palm tree, in whose fronds there is a nest. Therein grows a tree with a single flower in the centre and wide-spread branches under which there is a pair of swans facing one another. The pattern belongs to a group of textiles inspired by Chinese motifs which were produced in the 14th century in various centres for silk weaving in Italy such as Lucca, Venice and Florence. Despite the obvious heathen symbols, these patterns found their way into the symbolism of the church. The crescent moon was ignored and the bird was interpreted as an eagle. This, the most powerful bird in the sky, was equated with Christ, the sun regarded as the light of the enlightenment. The pair of swans represented constant faithfulness. Therefore it was possible to make ecclesiastical vestments and altar hangings from material bearing this pattern. In Krefeld, the pattern was produced exclusively as silk cloth based on the colour canon of the church, i.e. in the five colours red, white, black, green and purple, just as the historic model was. The pattern could also be woven tone in tone or two colours by also using gold thread.

Figure 5. The Paradise Pattern.

A2.1.5.1.6 The Crow Pattern

As the story goes, although it is not historically documented, the town of Krefeld was founded on a crow field. The name Crow Pattern is most probably attributable to a former designation of Krefeld, e.g. Krinfelde, Creinvelt, Crenevelt or Creyvelt. It was, logical to develop a crow as a symbol and advertising emblem for the town of Krefeld. We now reproduce this historic pattern on pure silk scarves and ties as a reminder of Krefeld of the past.

Figure 6. The Crow Pattern.

A2.1.5.1.7 The Pattern of St. Bernhard

The model for this pattern is to be found on Byzantine silk dating from the 11th century. A golden yellow cope from the Brauweiler monastery, the so-called St. Bernhard cope is decorated with this pattern. According to the legend, St. Bernard of Clairvaux wore this cope when he preached in the Brauweiler monastery in 1147 where he urged the believers to join the second crusade. The motif was, however, also familiar in the 11th century because it can be found on the cover of a manuscript dating from this period. A pair of eagles facing one another is to be seen in the circular areas arranged in rows on both sides of the tree of life. Stylised climbing plants surround the circular motifs. There are small circular disks where they meet. Round rosettes provide the motif in the corners.

Figure 7. The Pattern of St. Bernhard.

A2.1.5.1.8 The Circle Pattern

The circle is one of the oldest, if not the oldest symbol used by mankind. As early as the Neolithic period, ceremonial gathering places were arranged in a circular shape (Stonehenge in southern England). Round cup marks are made of rocks. The solar disc and the full moon are the most striking circular objects in nature and people worshipped them like gods. In the 3rd and 4th centuries A.D., the cloth woven by the Copts in Egypt was decorated with a circular pattern. Silk cloth was also woven with this pattern in Persia. These textiles could well have served as the pattern for the textiles with large circular patterns which were laboriously woven from precious silk in the Byzantine Empire at the end of the first millennium. The circle symbolises perfection. It is the symbol for an ideal order. Integrity and balance. It has no beginning and no end (eternity). It is therefore particularly appropriate as a symbol of the divine which is why the Christian church has taken over this symbol for their liturgical textiles.

Figure 8. The Circle Pattern.

A2.1.5.1.9 The Pimpernel pattern

The Pimpernel pattern depicts an ancient spice plant. This pattern was designed for a wall covering in 1876 by the English artist William Morris (1834 – 1896). The evergreen plant which gives it the name covers the background with thick tendrils. Tulip stems are woven in between and the large yellow and white flowers incline to the left and right. The pattern is built-up asymmetrically as is the case in mediaeval textiles on which William Morris liked to base his designs but it is reminiscent of Art Nouveau. The point pattern maker, Günter Göbels, did the necessary background work to enable this pattern to be woven on modern Jacquard looms.

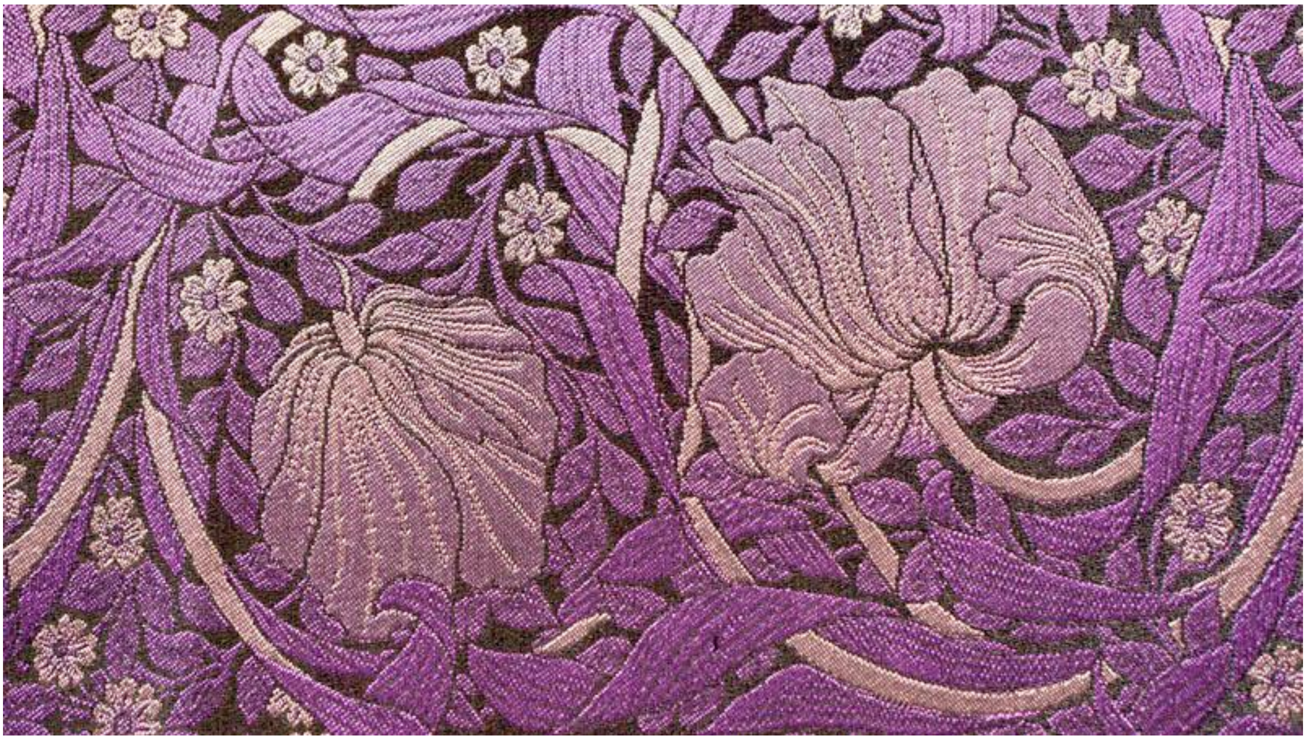

Figure 9. The Pimpernel pattern.

A2.1.5.1.10 The Arabesque Pattern

Arabian influences largely characterise the Arabesque pattern. Motifs from the plant world are artistically interwoven with stylised fantastic animals and in some cases intertwined to form an ornate design. The company Hubert Gotzes replaced the wave-like, parallel curved lines containing kufic characters between the individual pattern elements with floral garlands. Such patterns referred to as Arabesques were the speciality of Moslem master craftsmen and were for a long time also considered standard for their Christian successors. It is striking to note the analogies between the Arabesque patterns and the floor designs in the mosques and palaces built in southern Spain during the reign of the Moors and the painted ornaments in the Alhambra. During the reign of the Moors in Granada in the 13th century, silk weaving flourished at a high level and could compete with Italian silk production.

Figure 10. The Arabesque Pattern.

A2.1.5.1.11 The Stag Pattern

The motif arranged in a network of hexagonal sections shows two tethered stags standing opposite to one another on a floral background. Above them is a band of clouds with a corona and two birds of prey opposite to one another. The individual sections are surrounded by wide ornamental bands with a floral pattern. The stag is an ancient symbol well-known in the Christian Church depicting the God-loving soul or the soul of those who wishes for calm and peace (documented in the Bible in Psalm 42, verse 1: "As the stag pants for flowing streams, so pants my soul for you, O God". The stag already played an important role in the ecclesiastical robes of the 13th and 14th centuries. The oriental influence on pattern design at the time can be clearly seen in the fine imaginative design of the animal motifs and the type of ornaments chosen. In the Krefeld ecclesiastical textiles market of the 19th and early 20th centuries, the stag pattern was one of the most popular designs and was woven in every imaginable colour combination and weaving technique. The Hubert Gotzes silk weaving and ecclesiastical textiles factory produced splendid brocade, gold brocade and velvet cloth with this motif. Today the appropriate original point paper designs (design nos. 220, 170 and 320) and the Jacquard punch cards can be found in the museum's archives. Therefore in principle, it is still possible today to weave the stag pattern on one of our 100-year-old Jacquard handlooms.

Figure 11. The Stag Pattern.

A2.1.5.1.12 The Gondola Pattern

The gondola pattern essentially combines two recurrent characteristic elements offset against one another. In the foreground, it depicts a boat resembling a gondola being steered by a falcon with a bell. A passenger in the boat is a dog or a domesticated panther. This hunting scene is typical of Italian lampas fabric dating from the 14th and early 15th centuries. The gondola glides over spiral-like waves on which three ducks or swans are swimming. The background element is a pomegranate tree, the crown of which extends into a symmetric palmette. This pattern may refer to the legend of Torpes of Pisa who was an official in the service of Emperor Nero. During a ceremony in honour of the goddess Diana, Torpes declared that he believed in the one Christian God. Thereupon Emperor Nero had him tortured and beheaded. The corpse of the martyr and saint was placed in a rotten boat together with a dog and a cockerel and it drifted down the river Arno to the Tyrrhenian Sea. According to Provençal tradition, Torpes' corpse was washed up on the French coast near to the place which was later to become St. Tropez, taking its name from St. Torpes. Today the gondola pattern provides the logo for the German Textile Museum in Krefeld ("Deutsches Textilmuseum Krefeld"). The museum owns a fragment of the original pattern repeat which has the inventory number 01981.

Figure 12. The Gondola Pattern.

A2.1.5.2 Deutch

A2.1.5.2.1 Das Granatapfelmuster

as Muster zeigt eine aus dem antiken Granatapfel entwickelte Ornamentform, die als Motiv schon in der Textilkunst des Altertums erscheint. Wegen des Samenreichtums und der leuchtend roten Farbe ist der Granatapfel Symbol für Fruchtbarkeit, Liebe, Leben und Unsterblichkeit. In Osteuropa war der Granatapfel ein beliebtes Muster bei Klöppelspitzen. Im 15. Jahrhundert wurde das Granatapfelmuster in Venedig von den dortigen Samtwebereien in Brokaten und Damasten verwendet und war sehr beliebt.

Figure 13. Das Granatapfelmuster

A2.1.5.2.2 Das Ährenmuster

Die Ähre ist eine Gabe der Natur und ein Geschenk Gottes, sie gibt uns unser tägliches Brot. Die Ähre erinnert auch an die Transsubstantiation (Wandlung) von Brot in den Leib Christi in der heiligen Messe (Kath. Theologie). Die Vorbilder dieses Musters sind die im 18. und 19. Jahrhundert beliebten Blumenmuster. Dank der modernen Technik konnten wir dieses historische Muster für Sie nachweben lassen.

Figure 14. Das Ährenmuster.

A2.1.5.2.3 Das Elefantenmuster

Dieses Muster ist im Besitz der historischen Paramentenweberei Hubert Gotzes. Auch die dazugehörige Patrone ist im Archiv vorhanden. Es geht zurück auf den berühmten „Elefantenstoff" aus dem Schrein Karl des Großen. Der Originalstoff zählt zu den beeindruckenden Zeugnissen der damaligen Kunst der Seidenweberei. In Byzanz hergestellt - wahrscheinlich für den dortigen kaiserlichen Hof, gelangte der Originalstoffvermutlich als Geschenk in das Abendland. Ein kaiserliches Geschenk, denn der Elefant als eines der stärksten Tiere der Erde, symbolisiert den Herrscher. Als im Jahre 1000 der deutsche Kaiser Otto III das Grab Karl des Großen in Aachen öffnen ließ, umhüllte er mit dem prachtvollen Stoff die sterblichen Überreste seines Vorgängers. So überstand der kostbare Seidenstoff die Jahrhunderte. Als man im 19. und 20. Jahrhundert den Schrein zum wiederholte Male öffnete, wurde das beeindruckende Muster zeichnerisch und später fotografisch festgehalten. So gelangte es auch nach Krefeld. Während das Originalmotiv ca. 80 cm im Durchmesser aufweist, bringt es die Variation zu Beginn des 20. Jahrhunderts auf knappe 30 cm. Auch die Anordnung des Motivs, der Elefant im Kreis, ist neu. Im Original stehen sich die Elefanten gegenüber und streng in Reihung übereinander. Eine weitere Variante des 20. Jahrhunderts stellt die Elefanten in einer Reihe dar, jedoch wechselt hier in jeder Reihe die Ausrichtung, mal blicken die Elefanten nach links und in der nächsten Reihe nach rechts. Die Edition, die das Haus der Seidenkultur/Historische Paramentenweberei Hubert Gotzes in 2004 aufgelegt hat, zeigt eine andere Variationsmöglichkeit in der Motivanordnung und die Edition 2008 eine weitere.

Figure 15. Das Elefantenmuster.

A2.1.5.2.4 Das Löwenmuster

Der Rapport dieses Musters besteht aus zwei Reihen. In der ersten Reihe befindet sich in einem herzförmigen Motiv ein männliches Löwenpaar zur rechten und linken Seite eines Blumenstraußes. Die Köpfe der Tiere sind einander abgewandt. Zwischen den Motiven steht eine Vase mit 5 Granatäpfeln. In der zweiten Reihe erhebt sich über den Granatäpfeln eine Vase, gefüllt mit 3 nelkenartigen Blüten. Zu beiden Seiten steht ein Vogel, der den Körper einer Gans hat, obschon der Kopfschmuck mehr an einen Pfau erinnert. Große Ranken tragen 5 herzförmige Blätter, welche die Felder mit den Vögeln umgeben. Die Vorbilder für unser Muster sind im Italien des 15. Jahrhunderts zu suchen. Da erst im 19. Jahrhundert Stoffe speziell für den kirchlichen Gebrauch gewebt wurden, verwendete man für die Anfertigung von Paramenten Seidenstoffe aus dem profanen Bereich. Man wählte mit Vorliebe Muster, deren Symbolik auch eine sakrale Bedeutung hatte. So wurde der Löwe, der König der Tiere, Sinnbild für die Macht und Herrlichkeit Gottes. Der Löwe war auch das Wappentier des Stammes Judäa (Genesis 49:9-10) und so der jüdischen Könige seit David, der Vorfahre von Jesus Christus. (Matthäus 1, 1-17).

Figure 16. Das Löwenmuster.

A2.1.5.2.5 Das Paradiesmuster

Die Paramentenweberei Hubert Gotzes, Krefeld, gegründet 1905, webte, unter vielen anderen, dieses Muster. Noch heute ist es auf dem Seidenwebstuhl Nr. 6 im Websaal zu sehen. Hier wurden aus den kostbaren Seidenstoffen Paramente, also Priestergewänder und andere Textilien für den kirchlichen Gebrauch gefertigt. Noch bis Anfang des 19. Jahrhunderts webte man nur selten Stoffe ausschließlich für die Kirche. Man schneiderte Gewänder aus weltlichen Kleiderstoffen, wählte aber dazu solche, deren Musterung auch in der Symbolsprache der christlichen Kirche Bedeutung hatten. Das Paradiesmuster ist symmetrisch aufgebaut mit einander zugewandten Raubvogelpaaren unter einem Sonnenmotiv. Die Vogelpaare sind jeweils getrennt durch eine stark stilisierte Palme, auf deren ausgebreiteten Wedeln ein Nest angebracht ist. Daraus wächst ein Baum mit einer einzelnen mittleren Blüte und weit ausladenden Zweigen, unter diesem sitzt ein einander zugewandtes Schwanenpaar. Das Muster gehört zur Gruppe der chinesisch inspirierten Gewebe, die im Italien des 14. Jahrhunderts von verschiedenen Seidenwebzentren wie Lucca, Venedig und Florenz hergestellt wurden. Trotz der offensichtlich „heidnischen“ Symbole fand dieses Muster Eingang in die Symbolik der Kirche. Man übersah die Halbmonde und deutete den Vogel als Adler. Dieser, als stärkstes Tier der Lüfte, wurde mit Christus gleichgesetzt, die Sonne als das Licht der Erleuchtung gesehen. Das Schwanenpaar stand für die immer während Treue. Somit war es möglich, Messgewänder und Altarbehänge aus diesem Stoff herzustellen. In Krefeld wurde das Muster ausschließlich wie das historische Vorbild, als Seidengewebe im Farbkanon der Kirche, in den fünf Farben Rot, Weiß, Schwarz, Grün und Violett hergestellt. Dabei konnte das Muster Ton in Ton oder zweifarbig durch das Hinzunehmen von Gold erscheinen.

Figure 17. Das Paradiesmuster.

A2.1.5.2.6 Das Krähenmuster

Überliefert, jedoch nicht historisch bestätigt, gab es ein Krähenfeld, auf dem sich die Stadt Krefeld gründete. Der Name des Krähenmusters geht höchstwahrscheinlich auf eine der alten Bezeichnungen Krefelds zurück, z.B. Krinfelde, Creinvelt, Crenevelt oder Creyvelt. So lag es nahe, dass man eine Krähe als Symbol- und Werbefigur für die Stadt Krefeld entwickelte. Dieses geschichtsträchtige Muster präsentieren wir nun auf reinseidenen Schals und Krawatten als Erinnerung an das alte Krefeld.

Figure 18. Das Krähenmuster.

A2.1.5.2.7 Das Muster des heiligen Bernhard

Das Vorbild für dieses Muster ist auf einer byzantinischen Seide des 11. Jahrhunderts zu finden. Eine goldgelbe seidene Kasel aus dem Kloster Brauweiler, die sogenannte St. Bernhard Kasel, trägt dieses Muster. Der Legende nach trug St. Bernard von Clairvaux diese Kasel, als er im Kloster Brauweiler 1147 eine Predigt hielt, welche die Gläubigen zum 2. Kreuzzug aufrief. Das Motiv ist aber schon seit dem 11. Jahrhundert bekannt, da es auf dem Einband eines Manuskriptes aus dieser Zeit zu finden ist. In den in Reihen angeordneten Kreismedaillons ist zu beiden Seiten eines Lebensbaums ein sich gegenüberstehendes Adlerpaar zu sehen. Stilisierte Blütenranken umgeben die Kreismotive. An deren Berührungspunkten stehen kleine Kreisscheiben. Die Zwickelmotive bestehen ebenfalls aus Kreisrosetten.

Figure 19. Das Muster des heiligen Bernhard.

A2.1.5.2.8 Das Kreismuster

Der Kreis ist eines der ältesten, wenn nicht das älteste Symbol der Menschheit. Schon im Neolithikum werden Kultstätten kreisförmig angelegt (Stonehenge in Süd-England). Felsen werden mit runden Vertiefungen (Cupmarks) bestückt. Die Sonnenscheibe und der Vollmond sind die auffälligsten kreisförmigen Objekte in der Natur und wurden von den Menschen als Gottheiten verehrt. Schon seit dem 3. bis 4. nachchristlichen Jahrhundert werden in Ägypten die koptischen Wirkereien mit Kreismotiven geschmückt. Auch in Persien webte man Seidenstoffe mit diesem Muster. Dies sind wohl die Vorbilder für die großformatigen Kreismusterstoffe, die in Byzanz Ende des ersten Jahrtausends in kostbarer Seide in mühsamer Handarbeit gewebt wurden. Der Kreis symbolisiert das Vollkommene. Er ist Sinnbild für eine ideale Ordnung, Ganzheit und Gleichgewicht. Er hat keinen Anfang und kein Ende (Ewigkeit). So ist er als Symbol für das Göttliche besonders geeignet, die christliche Kirche hat gerne dieses Symbol für ihre liturgischen Textilien übernommen.

Figure 20. Das Kreismuster.

A2.1.5.2.9 Das Pimpernelmuster

Bei der Pimpernelle, auch bekannt als „kleiner Wiesenknopf", handelt es sich um eine alte Gewürzpflanze. Dieses Muster wurde 1876 von dem englischen Künstler William Morris (1834 – 1896) als Tapetendessin entworfen. Die namengebende, immergrüne Pflanze überzieht den Fond mit dichten Ranken. Dazwischen sind Tulpenstängel eingeflochten, deren große, gelbweisse Blüten sich nach rechts und links neigen. Das Muster ist asymmetrisch aufgebaut wie bei den mittelalterlichen Geweben, an denen sich William Morris gern orientierte, erinnert aber auch an die Ornamente des Jugendstils. Der Patroneur Günter Göbels hat die Voraussetzungen geschaffen, dass dieses Muster auf modernen Jacquard–Webmaschinen hergestellt werden konnte. Zum Anlass des 100-jährigen Bestehens der Paramentenweberei Hubert Gotzes, stiftete die HauserGruppe, Krefeld, Krawatten mit diesem Muster..

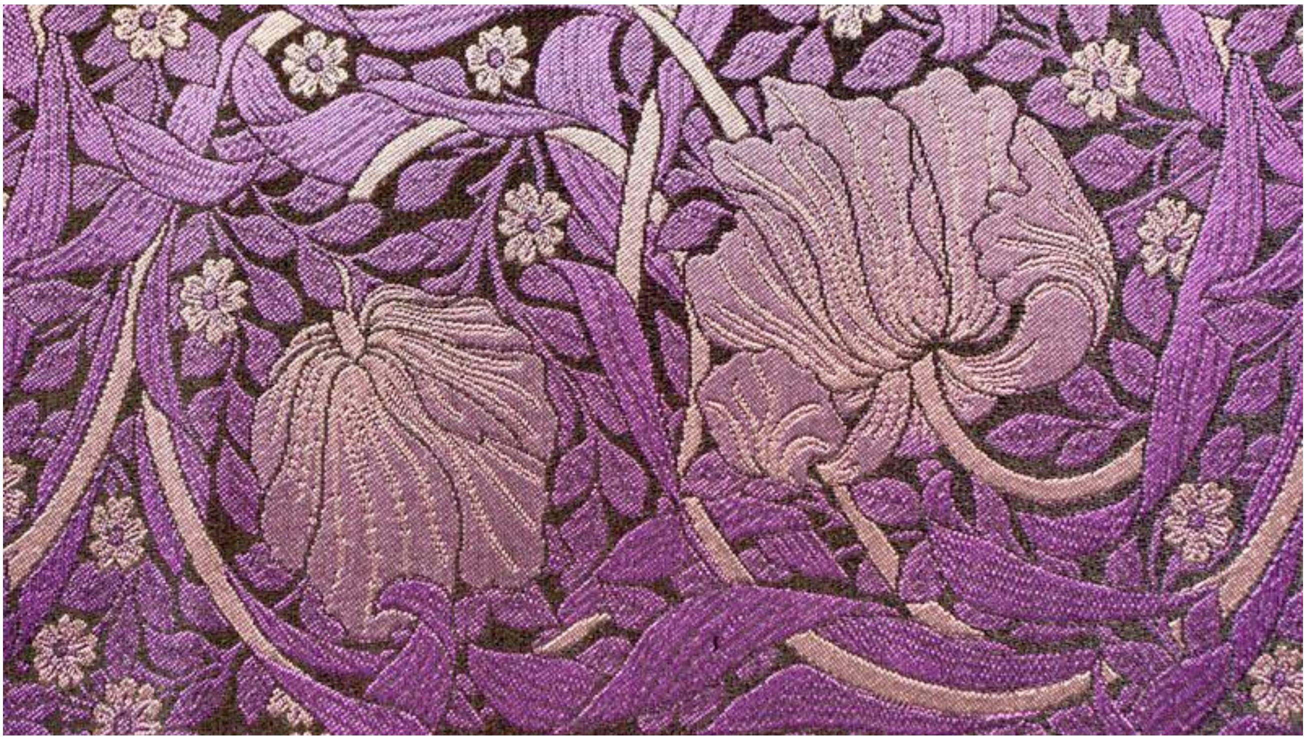

Figure 21. Das Pimpernelmuster.

A2.1.5.2.10 Das Arabesque Pattern

Das Arabeskenmuster ist stark von arabischen Einflüssen geprägt. Motive aus der Pflanzenwelt sind kunstvoll mit stilisierten phantastischen Tieren verwebt und teils zu Ornamenten verflochten. Zwischen einzelnen Musterelementen sind wellenförmige, sich parallel fortsetzende Bogenlinien mit gewebten kufischen Schriftzeichen von der Firma Hubert Gotzes durch Blütenranken ersetzt.

Derartige als Arabesken bezeichnete Musterungen wurden in besonderer Weise von muslimischen Meistern beherrscht und waren auch für die christlichen Nachfolger lange Zeit hindurch maßgebend. Auffallend sind frappante Analogien der Arabesken mit den Mustern von Fußböden in maurischen Moscheen und Palästen im südlichen, früher maurischen Spanien, sowie mit den Ornamentmalereien in der Alhambra. Im maurischen Königreich Granada des 13.Jahrhunderts kam die Seidenweberei zu einer gewissen Blüte und war durchaus konkurrenzfähig mit italienischen Seidenmanufakturen.

Figure 22. Das Arabesque Pattern.

A2.1.5.2.11 Das Hirschmuster

Das in einem Netz von Sechseckfeldern angeordnete Motiv zeigt zwei gegenständige, angekettete Hirsche auf blumigem Untergrund. Darüber befindet sich ein Wolkenband mit Strahlenkranz und zwei gegenständigen Greifvögeln. Die einzelnen Waben sind von breiten, mit Blümchen gemusterten Ornamentbändern umgeben. Der Hirsch ist ein altes, in der christlichen Kirche sehr bekanntes Symbol und bedeutet die Gott liebende Seele oder die Seele des Menschen, die sich nach Ruhe und Frieden sehnt (biblisch belegt in Psalm 42, Vers 2: „Wie der Hirsch lechzt nach frischem Wasser, so lechzt meine Seele, Gott, nach dir.“). Bereits in kirchlichen Gewändern des 13. und 14. Jahrhunderts spielt der Hirsch eine bedeutende Rolle. Doch werden in der feinen, phantasievollen Gestaltung der Tiermotive und in der Art der Ornamente die orientalischen Einflüsse auf die Mustergestaltung jener Epoche deutlich. In der Krefelder Paramentenbranche des 19. und beginnenden 20. Jahrhunderts gehörte das Hirschmuster zu den populärsten Dessins und wurde in jeder beliebigen Farbzusammenstellung und Technik gewebt. Die Seidenweberei und Paramentenmanufaktur Hubert Gotzes stellte prachtvolle Brokat-, Goldbrokat- und Samtstoffe mit diesem Motiv her. Heute befinden sich die zugehörigen Originalpatronen (Dessin-Nr. 220, 170 und 320) und Kartenspiele in unserem Museumsarchiv. Somit könnte das Hirschmuster grundsätzlich auch heute noch auf einem unserer über 100 Jahre alten Jacquard-Handwebstühle gewebt werden.

Figure 23. Das Hirschmuster.

A2.1.5.2.12 Das Gondelmuster

Das Muster Gondel vereint im Wesentlichen zwei wiederkehrende charakteristische Elemente, die jeweils in Reihen versetzt angeordnet sind. Zum einen zeigt es ein Boot, das einer Gondel ähnelt, die von einem Jagdfalken mit Glöckchen gerudert wird und dessen Passagier ein Hund oder domestizierter Panther ist. Diese Jagdszene ist als typisch für das italienische Lampas-Gewebe des 14. und frühen 15. Jahrhunderts zu bezeichnen. Die Gondel gleitet über spiralförmige Wellen, auf denen drei Enten bzw. Schwäne schwimmen. Zum anderen befindet sich im Hintergrund ein Granatapfelbaum, dessen Krone sich zu einer symmetrischen Palmette erweitert. Dieses Muster weist eventuell auf die Legende von Torpes von Pisa, der als Beamter des Kaisers Nero tätig war. Bei einer Zeremonie zur Ehrung der Göttin Diana hat Torpes sein Glauben an den christlichen Gott erklärt. Daraufhin ließ ihn Kaiser Nero foltern und enthaupten. Der Leichnam des Märtyrers und Heiligen soll dann mit einem Hund und einem Hahn auf einer morschen Barke ausgesetzt worden sein, die den Arno hinab in das Tyrrhenische Meer trieb. Die provenzalische Tradition geht davon aus, dass Torpes beim späteren Saint-Tropez angespült worden sei und die Stadt ihren Namen verliehen hat. Heute ist das Muster Gondel der Motivgeber für das Logo des Deutschen Textilmuseums Krefeld. Ein Fragment des originalen Rapports befindet sich im Besitz des Museums mit der Inventar-Nr.01981.

Figure 24. Das Gondelmuster.

A2.1.6 Vocational Training in Krefeld / Berufsausbildung in Krefeld

Author: Cynthia Beisswenger, HdS.

English translation: Cynthia Beisswenger, HdS.

A2.1.6.1 English

In the mid-1800 there were some 90 companies in the silk industry in Krefeld which required increasing numbers of skilled workers. Both industry and craftsmen called for a weaving school to be set up to teach the whole range of crafts involved in silk cloth production. Subsequently, the “Crefeld Höhere Webschule” (College for Weaving) was established based on that in Lyons. It was opened in October 1855. It was the only college specifically teaching the skills needed in the silk sector. In 1913 courses were also offered on Sundays to meet demand. The college continued to grow and moved into new premises which led to its renaming as “Königliche Webe-, Färberei- und Appreturschule” (Royal College of Weaving, Dyeing and Dressing). By 1901 the college had expanded to such an extent that it was divided into two sections, one concentrating on weaving and one on dyeing and dressing. During the Second World War, the college was damaged although teaching was sustained on a lower level than normal. It was re-opened in November 1945 as a textile engineering college. In 1971 it was amalgamated with several other colleges in the region to form the “Fachhochschule Niederrhein” with campuses in Krefeld and Mönchengladbach.

As part of a semester project 2018/2019, a group of 8 students from the Hochschule Niederrhein, Faculty for Textile/Clothing Production Techniques, took on the assignment to develop a trendy collection of silk products for Haus der Seidenkultur which will appeal also to the younger generation. In view of the Bauhaus centenary, it was decided to produce various accessories in silk based on a design which the students linked to Bauhaus – straight lines, geometrical shapes and distinct colours. This is a good example of co-operation between the college and the museum.

Personal memories: Annette Pöllmann was a student in the faculty "Textilkunst" (Textile Art) at the textile engineering college in the course "Print- and Weaving Design" taught by Elisabeth Kadow from 1948 to 1950. She remembers how they managed to be creative despite shortages of materials. And "all students from the Technical Engineering College" trudged to the steelworks at noon for the "Mennonites' Meal" where everyone was given a spoonful of oat soup with or without raisins". Ms. Pöllmann went on to become a professor herself and now at the age of 93 has just designed a "Bauhaus" scarf to coincide with the temporary exhibition celebrating the Bauhaus centenary at HdS where she is an active volunteer.

A2.1.6.2 Deutsch

Berufsausbildung in Krefeld

Mitte des 19. Jahrhunderts gab es um 90 Firmen in der Seidenindustrie in Krefeld, die eine zunehmende Zahl an Fachkräfte benötigten. Sowohl die Industrie wie auch das Handwerk drängte auf die Gründung einer Webschule zur Unterrichtung sämtlicher mit der Produktion von Seidenstoffen zusammenhängenden Handwerke. Daraufhin wurde die Crefelder Höhere Webschule gegründet, basierend auf dem Vorbild in Lyon. Die Schule wurde im Oktober 1855 eröffnet und war die einzige Schule, die das im Bereich Seidenproduktion erforderliche Fachkönnen unterrichtete. In 1913 wurden Kursen auch sonntags angeboten, um die Nachfrage gerecht zu werden. Die Schule wuchs weiter und zog in neue Räumlichkeiten um, was zu der Namensänderung in Königliche Webe-, Färberei- und Appreturschule führte. Bis 1901 ist die Schule so gewachsen, dass sie in zwei Bereiche aufgeteilt wurde; ein Bereich konzentrierte sich auf das Weben und der andere auf Färben und Schlichten. Während des Zweiten Weltkrieges wurde das Gebäude beschädigt, der Unterricht ging jedoch auf niedrigerer Flamme weiter. Im November 1945 wurde die Schule als Textilingenieurschule offiziell wieder eröffnet. In 1971 erfolgte ein Zusammenschluss mit verschiedenen anderen Fachschulen aus der Region zur „Fachhochschule Niederrhein" mit Campus in Krefeld und Mönchengladbach. Haus der Seidenkultur und die Studenten von der Fachhochschule unternehmen auch heute gemeinsam Projekte.

Als Teil eines Semesterprojektes 2018/2019 der übernahm eine Gruppe von 8 Studentinnen von der Fachhochschule Niederrhein, Fakultät Textilien/Kleidung Fertigungstechniken, die Aufgabe, für HdS eine Serie von Seidenprodukten, die die junge Generation anspricht, zu gestalten. Im Hinblick auf das „Bauhausjahr" wurde entschieden, verschiedene Accessoires basierend auf Designs, die die Studentinnen mit „Bauhaus" verbinden, zu entwickeln.

Persönliche Erinnerungen: Annette Pöllmann studierte Druckgestaltung an der Textilingenieurschule von 1948 bis 1950 unter der Dozentin Elisabeth Kadow und erinnerte sich, wie man es schaffte, trotz des Materialmangels kreativ zu bleiben. Und „Alle Studierenden der Städtischen Textilingenieurschule „pilgerten" mittags zum Edelstahlwerk zur „Mennonitenspeisung", wo jedem eine Kelle voller Haferflockensuppe (mal mit, mal ohne Rosinen) ins Essgeschirr gefüllt wurde. Frau Pöllmann studierte weiter und wurde selbst Professorin für Druckgestaltung. Sie ist mit 93 Jahre immer noch als Ehrenamtlerin bei HdS aktiv und hat für die HdS-Bauhaus-Ausstellung eine passende Schal kreiert.

A2.1.7 100 Years Hubert Gotzes 1905 – 2005 Craft Weaving Workshop and, Factory for Ecclesiastical Textiles, Krefeld / 100 JAHRE Hubert Gotzes 1905-2005 HUBERT GOTZES KUNSTWEBEREI UND PARAMENTENFABRIK KREFELD.

Issued by the "Association of Friends Haus der Seidenkultur Paramentenweberei Hubert Gotzes e.V.Paramentenweberei Hubert Gotzes e.V"
For the Centenary Exhibition
Krefeld 2005

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English translation: Cynthia Beisswenger, HdS.

Note: A PDF version of the original (Deutsch) is available, in the Mingei dataset. The PDF version includes illustrations and photographs with legends, not transcribed. The Deutsch version has been transcribed using OCR from the PDF and may include transcription errors. The Deutsch version includes inline bibliographical citations.

A2.1.7.1 English

Hubert Gotzes, Craft Weaving Workshop and, Factory for Ecclesiastical Textiles, Krefeld.

Introduction

In 2005 Haus der Seidenkultur in Krefeld celebrated a centenary. The site of the former craft weaving workshop and parament manufactory looked back over 100 years of company history. The company itself closed in 1992 but thanks to the Krefeld archivist Paul Günter Schulte and the first Chairman of the Association of Friends of the Hubert Gotzes weaving workshop, Josef Stangenberg, it was possible to save the building with its contents and transform it into a museum. In one of the last original Jacquard manual weaving workshops in Europe, the historic looms are operated to demonstrate to visitors the sophisticated art of weaving ecclesiastical textiles.

Ecclesiastical textiles

"That is to say all textile accouterments customary in churches and required for whatever purpose during the divine service."

That was the prosaic definition given in a textbook dating from 1924 relating to the study of ecclesiastical textiles. Yet anyone who has held an intricately work priest's vestment with woven pictures, finest embroidery and sumptuously decorated braids can only marvel at the craftsmanship of those who produced it.

Weavers, embroiderers and needlewomen spent hundreds of hours to finish such a garment.

The liturgical vestment in its traditional form was developed in the 13th century. The priests' vestments were, however, subjected to the artistic tastes of their respective period as far type and design was concerned and varied greatly in cut and decoration. In the 19th century, standard designs were determined for the liturgical vestments by the Roman Rites Congregation. Nowadays, the regional bishops' conferences can adapt the regulation to local requirements.

The quality of the ecclesiastical fabrics is of significant importance. Silk, linen and wool still formed the basis of the fabrics before the Second World War. These were used for liturgical vestments, altar cloths as well as church banners and baldachins. The quality of the fabrics did not depend on the chosen fabrics alone. The more compact the fabric is, that is the more threads there are per square metre horizontally and vertically, the stronger the fabric is. The yarn must be colourfast and the colours and patterns properly harmonised. The patterns frequently relate to religious symbols.

Gold brocades are particularly precious fabrics, originally heavy, richly patterned velvet fabrics. It is the gold metal threads carefully worked into them which give them their unusual radiance. In the 20th century Japanese gold thread was used for this. A great deal of time and effort was needed to produce such thread which involved wrapping gold leaf attached to wafer-thin rice paper around a silk thread. The Krefeld weavers procured such thread from Japan. The Krefeld textile industry and trading companies provided all the other services and materials required to manufacture ecclesiastical fabrics: colour-fast yarns as well equipment, design drawings workshops, point paper designs and punched cards to weave patterns.

Ecclesiastical Fabric Weaving in Krefeld

Krefeld began to develop into one of the most important silk metropoles in the German-speaking territories in the 17th century. One reason for this was the fact that many religious refugees settled in and around the town which formed part of the territory ruled by the House of Orange under which the town received the status of a "religious asylum".

Many of the Mennonite families, which moved to the town were linen weavers, spinners, merchants and employers of outworkers. At the beginning of the 18th century, linen weaving was increasingly being replaced by silk production, a development, which was also supported by the government. Silk fabrics being luxury articles were in greater and greater demand and due to the influx of specialists, in particular from France, the quality of the fabrics continuously improved. The silk industry in Krefeld experienced its biggest boom in the mid-19th century. Krefeld became Germany's silk town. Some companies specialised in certain products, for example, velvet weaving, heavy-weight and light-weight, patterned and plain silk fabrics. One special field was ecclesiastical textiles.

In Krefeld, one of the first producers of textiles for the church was F.J. Casaretto, a descendant of an Italian silk weaving family who moved to Krefeld in the 18th century. Casaretto was a Catholic entrepreneur in the silk weaving sector which was dominated by Protestants and Mennonites and it was the chaplain of the main church, St. Dionysius, Franz Bock, who persuaded him to venture into this unfamiliar metier and what is more to concentrate on historic patterns. The company set up in 1842 presented its new "mediaeval fabrics" to a wide public in an exhibition of religious art organised by Bock in 1852. The company situated on the "Sudwall" subsequently set up a tailor's workshop in order to offer clients the finished liturgical vestments. Casaretto even exported his products to the Netherlands, Belgium, Switzerland and Austria.

For a long time, Casaretto's ecclesiastical fabric company remained the only such company in Krefeld. This, however, was to change in the 1880s when the mechanical silk loom conquered the workshops in the town putting many manual weavers into dire straits. In addition to setting up private benefit funds and introducing state and communal measures, the industry called to mind the significant skills of these manual weavers. Weaving ecclesiastical textiles at least provided possible employment for some of them. In 1887 an "Exhibition of Religious Fine-Art, Weaving and Embroidery from the Past" took place at the "Königliche Webschule" (Royal School of Weaving) under the patronage of the Archbishop of Cologne at which Krefeld weaving workshops for ecclesiastical textiles were also represented. The purpose of the exhibition was to "Encourage to Acquire New" and to provide hope that "the production of religious textiles would gain impetus from the exhibition".

The hopes of the initiators seemed to be fulfilled and in the following decades more and more weaving workshops for ecclesiastical textiles were founded in Krefeld. Around 1900 there were already 12 companies and others were founded up to 1914 which also produced fabric for banners. One of these was the Hubert Gotzes company.

Hubert Gotzes Weaving Workshop for Fine-Art and Ecclesiastical Textiles, The Family Enterprise, The early years

Hubert Gotzes was born on 5th September 1860 in Amern. According to the population register for the town of Krefeld Gottfried Hubert Gotzes together with his wife Gertrud Karoline, née Vollekeir, aged 42 years and their seven children moved from Amern, St. Anton, district Kempen, to Krefeld. Initially, the family lived at Rossstrasse 130 but probably only temporarily because the town address book for 1901-1902 states Prinz-Ferdinand-Strasse 23 as the address of the skilled weaver Hubert Gotzes at this time and two years later Hubertusstrasse 53. It is not known whether Hubert Gotzes was employed in the weaving workshop for ecclesiastical textiles belonging to Theodor Gotzes in the Dionysiusstrasse from 1900 to 1905 but this was definitely feasible because he was obviously well acquainted with picture weaving.

On 21st October 1905, Hubert Gotzes became self-employed and his company was entered in the Commercial Register as "Hubert Gotzes Paramentenfabrik". He now referred to himself as a producer of liturgical vestments, ecclesiastical fabrics and banners. The registered business address of the company was Klosterstrasse 43 and Westwall. In the town address book for 1907-1908 and a certain Wilhelm Gommersbach from Blumenstrasse 148 was named as a further owner of the company. He was not, however, mentioned in subsequent years.

The many changes of address and the setting up of the company suggest that the family had become increasingly economically better off since their arrival in Krefeld. Hubert Gotzes was, it seems, a proficient craftsman and obviously also a good business man who as a "foreigner" in the unbelievably competitive silk town of Krefeld could risk setting up his own company. In addition, he was able to count on the support of his eldest sons, Jakob Theodor and Karl Matthias who were already 22 and 21 years old when the company was set up.

Luisenstrasse 15 in the years prior to the First World War

1908 Hubert Gotzes purchased the property Luisenstrasse 15, probably together with the entire workshop equipment and set up his business premises there. The house had been built in 1867/68 by the silk producer Gottfried Diepers.

Luisenstrasse had been developed in the mid-nineteenth century. Around 1900 the district had a typical mixture of residential and business properties. 23% of the population were employed in the textile industry. Self-employed people, craftsmen, civil servants and employees as well as workers lived in the district. The areas to the rear of the properties served either as gardens or were developed with small workshops.

It is evident from the building Luisenstrasse 15 that it had been constructed to use it commercially: the entrances for the suppliers and the customers are directly adjacent to one another. The customer entrance leads into the business and office areas, the suppliers' entrance into the courtyard towards the side wing with the workshops and the private rooms on the upper floors. Behind the house, there was also a courtyard and a garden. In the Luisenstrasse the company, at last, owned the facilities necessary for the business. The description given by contemporary witnesses shortly prior to the Second World War of how the various rooms were used probably corresponded more or less to the situation when the production of ecclesiastical fabrics first started:

Looking at the property from the street, the reception room and the office were located at the front on the right. The side wing at the rear accommodated the so-called "workshop" for embroidery and needlework and on the upper floor the weaving room. On the upper floor on the street side there was a large showroom and to the rear of the building the private rooms. Over time the family also acquired the appropriate adjacent premises in the Mariannenstrasse in order to construct a shed-roofed building. The velvet brocade weaving workshop was located there. This building was destroyed in the Second World War.

The Business up to 1992

It is not known exactly when the adult sons (and possibly also daughters) of Hubert Gotzes became involved in the production of ecclesiastical textiles. Apart from Hermann born in 1888, all sons completed a commercial apprenticeship. However, it must have been involved in the entire production process occasionally. The eldest son Jakob (1883-?) may have been employed as a business administrator in the family business from the start, similar to Josef (1886-1959) who travelled around as a sales representative. From 1910 on, the second eldest son Matthias (1884-1935) was registered in the address books as a grocer in Hülserstrasse 118, from 1913 in Mariannenstrasse 94. Hubert junior, the youngest son (1893-?) attended the Institute St. Leon in Bruges (Belgium) in 1910 to complete a business apprenticeship when he was just 17 years old. He returned to Krefeld in 1912. Two years later his father sent him to Chicago in the USA. There Hubert junior set up a trading company for the family business. Over the years this was to prove a fortunate step because the business in America became an important pillar of the company even during the unstable period prior to the Second World War. The ecclesiastical fabrics were very popular with the Americans for their excellent quality and colour fastness. The two daughters, Pauline (1890-?) and Gertrud (1896-?) are not mentioned in the documents.

Hubert Gotzes died on 28th December 1916 following a long illness. Initially, Jakob and Josef Gotzes took over the management of the business as executors of his will. In the address book of 1920, Jakob, Josef, Matthias and Hubert (junior) were named as joint owners of the company. His widow, Karoline, had not had any significant impact on the business. She died in 1921.

The period during which the Gotzes brothers managed the company jointly does not seem to have been easy. On the one hand, the overall economic situation was not very positive and on the other, it was difficult to reconcile four different opinions. The documents of the Chamber of Industry and Commerce reveal that Hubert Gotzes junior who was managing the business in Chicago left the joint business in 1928. In the mid-1920s Josef set up an ecclesiastical fabrics workshop in the new Linner Strasse 80 and in the meantime, Jakob had opened his own ecclesiastical fabrics workshop in the adjacent house (Luisenstrasse 17) and he left the joint family business on 5th December 1930.

Between 1931 and 1934 Matthias Gotzes was the sole owner of the business in Luisenstrasse 15 because in a questionnaire from the Krefeld Chamber of Industry and Commerce dating from the year 1934 he is named as the sole company manager. At this time 14 persons were employed, twelve workers (5 female and 7 male) including two apprentices, one male and one female, as well as the owner and his wife Henriette both of whom took care of the office work and the company management.

However, fate soon struck again. In 1935 Matthias Gotzes was killed in a car accident. His widow took over the business and was a resolute head of the company until she died in 1969. The business continued to retain the name of the company founder, Hubert Gotzes. Henriette steered the production through the particularly difficult times of the Second World War and through the crisis in ecclesiastical fabric business following the Vatican Council in 1962-65 when new regulations stipulated plainer liturgical vestments and many workshops producing ecclesiastical fabrics in Krefeld had to close down. Erwin Maus, Henriette Gotzes' nephew, was great support for the business. From January 1962, the company was registered as a partnership in the Commercial Register as Erwin Maus became a partner. He had learned the weaving trade from scratch and subsequently worked in the office and as a sales representative.

Following the death of his aunt in 1969, he took over the management of the company. When the last weaver died in 1989 it was no longer possible to continue production and the company was finally entered in the Commercial Register as defunct on 16th September 1992.

Production and Products

At the beginning of the twentieth century, liturgical vestments and fabrics were still produced as was usual in the manufactories of the 19th century. The inventory comprised various manual looms with Jacquard attachments on which patterned velvet, silk and brocade fabrics, as well as braids, could be produced. There was also an embroidery workshop and a needlework workshop which survived until the company closed.

In the Chamber of Industry and Commerce register the number of looms at the Hubert Gotzes company was listed as 20 prior to the Second World War and "8 usable" hand looms in 1946. These 8 looms still exist today. During the bombing raids, it was mainly the velvet looms in the shed-roofed annex, which were destroyed.

The company produced patterned fabrics, in particular velvet and silk cloth, braids and ribbons with woven or embroidered picture designs, altar cloths, baldachins and other church textiles including a complete range of liturgical vestments required for important church services such as copes, stoles, chasubles etc. They were produced according to the wishes and measurements of the client. In addition, Gotzes also produced banners for various organisations as well as fabric for neckties both during and after the Second World War.

The Krefeld producers of ecclesiastical textiles had a good reputation for their very high-quality products and the colour fastness of the fabrics.

This also applied to the Gotzes company. The production of patterned velvet brocades was very complicated. On average one hand, weaver only produced 0.4m per day of this precious fabric from so-called non-weighted silk, i.e. from material that had not been dyed with stannates and was therefore much more durable. Another speciality was the gold brocades, fabrics into which gold threads had been woven. Gotzes procured these threads directly from Japan. These stood out as there were no traces of metal discolouration even after longer periods. The gold brocades were an export hit especially in the USA where richly patterned priests' vestments remained popular significantly longer than in Europe. When weaving picture designs only one weaver needed to work on any one length of cloth as each weaver has a slightly different stroke and the change would have been noticeable in the cloth immediately.

Pattern designers, point paper designers and card punchers worked on the development of new designs for a collection. The pattern designer first develops a single motif. Then he adds decorative surrounds and from this creates a repeating pattern. Then he checks the effect of the repeating pattern on a larger surface. Studio Rentmeister in Krefeld produced the pattern designs for Gotzes. These drawings were then processed by the point paper designer. He transferred the picture broken down into small squares to the appropriate point paper. Each square corresponding to the intersection of warp and weft threads. The point paper design was the precise template for the finished fabric. The card puncher produced the cardboard punched cards on the so-called "piano" based on the point paper design. The punched cards were then sewn together to form an endless strip and it ran through the Jacquard attachment fixed to the loom. The cards controlled the lifting of the individual warp threads and thus produced the pattern. The card punching work for Gotzes was also outsourced. The motifs for embroidered pictures were, however, developed or adapted at the company.

At the end of the 19th century, the Krefeld ecclesiastical fabric workshops started to concentrate on the patterns of old historic patterns. Hubert Gotzes followed suit and used motifs such as the stag pattern, pomegranate, birds and symbols such as the cross or floral ornaments. Not only the fabrics themselves demonstrate the large variety of motifs used but above all the richly embroidered so-called "Kölner Borten" (Cologne braids). One specialty was the "Kölner Stäbe", 5 to 7 cm wide strips of fabric which were woven according to the medieval "Kölner Borten". They often display motifs, which were already usual in the 16th century: rosette, a tree with many branches, or the names of Mary and Joseph. If required several motifs could be combined with one another, embroidered on as individual items, or sewn on as woven pictures (applications). The embroidered applications, so-called "needlework paintings" frequently displayed representations of Christ or saints. These were sewn onto the section of the vestments requested by the client. Each client could therefore compile their individual vestments from illustrations in a catalogue or select what they like from a series of finished vestments.

The orders were completed relatively quickly despite the very complicate handicraft involved. Depending on the pattern, a weaver could weave the fabric for a priest’s vestment in two to five days on average. The velvet brocade took more than 10 days. The fabric was then cut out, sewn together and embroidered so that the order was completed within two to three weeks.

Clientele and Marketing

Naturally, the Gotzes company had a specific client base: primarily religious institutions represented by priests and bishops. The main customer was the Catholic Church which still ordered richly decorated vestments prior to the Second World War. However, also the Orthodox church bought textiles from Gotzes. In addition, associations ordered banners and emblems.

Customer service was provided in two ways: The Gotzes company had a reception room or showroom where the various textile patterns and finished vestments could be displayed. This served in particular the customers from the surrounding area. Some regular customers frequently visited the showroom. A significant proportion of orders were, however, acquired by travelling salesmen. In the early days of the company history, this was carried out by bicycle or by train, later by company car. Sometimes it was the company owners who travelled as in the case of Matthias Gotzes. Furnished with a large case of samples he travelled on average 8 to 14 days per month throughout the region. Afterwards, the samples had to be cleaned and ironed which required time and effort. An idea of Erwin Maus brought about an innovative breakthrough in customer service following the Second World War. He constructed a sales vehicle by attaching a camping trailer to a Mercedes vehicle with a driver’s cab. The trailer was fitted with cupboards to hang the vestments and also mirrors so that the vestments could be tried on straightaway. After the Second World War, two other sales representatives were employed by Gotzes apart from Erwin Maus and therefore they could cover the entire Federal Republic. Sales were also made in neighbouring countries, for example, the Benelux countries. Up to the Second World War, the American business with the trading company in Chicago was an important pillar. These contacts ended after the war.

Employees and Working Conditions

Nothing is known to date about the number of employees in the first decades following the establishment of the company. The first precise figures are found in documents from the Krefeld Chamber of Industry and Commerce dating from 1934. A company survey states 12 persons. In addition, there was the company owner Matthias Gotzes and his wife Henriette who worked in the production. A total of 19 employees was stated for 1938, 3 male workers – probably the weavers – and 6 female workers – embroiderers and needlewomen. In addition, there were the apprentices, the employees who worked in the office and the sales representatives. Immediately after the war in September 1945, Gotzes employed only 7 persons but by 1951 the total had reached 16 employees and workers and by 1957 as many as 23. The Second Vatican Council which decreed that the clergy wear plainer vestments caused sales to drop drastically and probably led to the workforce being reduced.

Interviews with the former weavers Wendelinus Breuer and Paul Amend give a closer insight into everyday life at the company. Amend learned the weaver's craft from scratch at the company. In the first year of his apprenticeship, 1952, his main tasks were to reel the weft yarn for the then 5 weavers in the workshop, to keep the workshop clean, to fetch coffee and to run errands for Mrs. Gotzes. It wasn't until the second year that he was able to sit at the loom and overtime was given more and more complicated weaving tasks. In 1955 the journeyman's wages amounted to 90 Pfennig per hour. The weavers had to perform almost all tasks necessary in the weaving workshop themselves. Prior to the Second World War female warpers and piecers came from outside into the workshop to complete and install the warp beam. Later the manual weavers had to do everything themselves.

In the 1950s the working day began at 7 o'clock in the morning. At 9 o'clock there was a coffee break lasting at most a quarter of an hour. Henriette Gotzes, the strict "ruler" in the production department, could hear exactly which looms were being used at any time and went to inquire what was wrong if there was a standstill. The working week was on average 48 hours. On Saturdays, the apprentices had to thoroughly clean the workshop and occasionally work in the garden of the company owner.

If large orders had to be made ready for dispatch, it often happened that the female apprentices stayed overnight at the company following the extra-long shift. Nowadays unthinkable but at the time quite normal were also the sanitary facilities. The only toilet in the building was located under the stairs leading to the upper floor. It was not until later that an additional WC was installed on the upper floor.

Overall the two weavers remember that the working atmosphere was good. Normally there was either a company outing or a company party once a year held locally or somewhere in the region (for example even as far away as Unkel am Rhein). The fiftieth anniversary of the company in 1955 was celebrated in Krefeld with a good meal, nine-pin bowling and dancing.

From the 1970s it became increasingly difficult to find trainees for the company. Compared to other branches of industry wages were only moderate and it was difficult to find workers highly skilled in embroidery and manual weaving. The last weaver left in 1989 and that meant the end of production. Even if it had been possible to find a manual weaver capable of producing such fabrics it would not have be possible to pay an appropriate wage.

The Museum

Hubert Gotzes officially ended the production of ecclesiastical fabrics on 16th September 1992. The company was entered as defunct in the Commercial Register. In the meantime, however, committed Krefeld citizens had become aware of the industrial treasure in Luisenstrasse. The Förderverein Haus der Seidenkultur Paramentweberei Hubert Gotzes e.V. (Association of Friends) was founded in 1993 and took on the task of preserving the historical workshop as a museum for the public. The Association of Friends has owned the historical workshop since the year 2000.

As an important part of Krefeld's history, Haus der Seidenkultur as the former company Gotzes in Luisenstrasse is now officially known, keeps the former handicraft from being forgotten and presents the middle-class aspect of industrialisation. Temporary exhibitions also give an insight into the extensive history of Krefeld's textile production. Educational programmes for children and young persons as well as adults introduce them to the exciting topic of silk thread.

"The museum flyer for 2005 rightly states "one hundred years old and not at all boring!"

A2.1.7.2 Deutsch

100 JAHRE Hubert Gotzes 1905-2005 HUBERT GOTZES KUNSTWEBEREI UND PARAMENTENFABRIK KREFELD

Autorin GABRIELE HARZHEIM

100 JAHRE

Hubert Gotzes

KUNSTWEBEREI UND PARAMENTENFABRIK

HERAUSGEGEBEN VOM "FÖRDERVEREIN HAUS DER SEIDENKULTUR PARAMENTENWEBEREI HUBERT GOTZES E.V." ZUR JUBILÄUMSAUSSTELLUNG

KREFELD 2005

EINFÜHRUNG

Im Jahre 2005 feiert das "Haus der Seidenkultur" in Krefeld ein Jubiläum: Der Standort der ehemaligen Kunstweberei und Paramentenfabrik Hubert Gotzes blickt auf 100 Jahre Firmengeschichte. Zwar ist der eigentliche Betrieb bereits 1992 eingestellt worden, aber Dank des Krefelder Stadtarchivars Paul Günter Schulte und des ersten Vorsitzenden des Förder-vereins Paramentenweberei Gotzes e.V., Josef Stangenberg, konnte das Firmengebäude mit Inventar gerettet und zum Museum umgestaltet werden.

So werden noch heute in einem der letzten originalen Jacquard-Handwebsäle Europas - allerdings jetzt nur für Besucher - die historischen Webstühle betätigt und die sehr aufwendige Kunst der Paramentenweberei vorgeführt.

PARAMENTE

"Unter Paramenten versteht man alle im Gotteshause gebräuchlichen und den Zwecken des Gottesdienstes irgendwie dienenden stofflichen Ausstattungsgegenstände" [Braun, Josef: Praktische Paramentenkunde, ib 1924, S. 1].

So nüchtern definiert 1924 ein Lehrbuch für Paramentenkunde den Gegenstand seiner Darstellung. Doch wer schon einmal ein aufwendig gearbeitetes Priestergewand mit gewebten Bildmustern, feinsten Stickereien und üppig ausgestatteten Borten in Händen hatte, kann nur über die Kunstfertigkeit der Produzenten staunen. Hunderte Stunden Handarbeit von Webern, Stickerinnen und Näherinnen sind nötig, bis ein solches Kleidungsstück fertig gestellt ist.

Das liturgische Gewand hat sich in seiner überlieferten Art bereits im 13. Jahrhundert entwickelt. Allerdings unterlagen die Priestergewänder in Form und Gestaltung der jeweiligen künstlerischen Auffassung ihrer Zeit und variierten in Schnitt und Dekoration deutlich [Neubert. Ingeborg: Die Krefelder Paramentenproduktion (1852-1914), Diss. masch. geschrieb Manuskript. Krefeld 1990, S. 21]. Im 19. Jahrhundert wurden einheitliche Formen für die Gestaltung der Paramente durch die römische Ritenkongregation festgelegt, heute können regionale Bischofskonferenzen die Vorschriften an die örtlichen Erfordernisse anpassen.

Bereits die Qualität der Paramentenstoffe ist von entscheidender Bedeutung. Seide, Leinen und Wolle bildeten noch vor dem Zweiten Weltkrieg die Grundlage der Gewebe. Aus ihnen wurden Priestergewänder, Stoffe für die Altarausstattung sowie Kirchenfahnen und Baldachine hergestellt. Die Qualität der Gewebe hing nicht nur von ausgesuchten Rohstoffen ab.

Je dichter das Gewebe ist, das heißt je mehr Fäden in der Höhe und in der Breite sich auf einem Quadratzentimeter finden, umso solider ist es. Auch die Farbechtheit des Garns und die harmonische Farben- und Musterwirkung mussten stimmen. Häufig lehnte sich die Musterung an die religiöse Symbolik an.

Besonders wertvolle Stoffe sind Goldbrokate, ursprünglich schwere, reich gemusterte Samtgewebe. Ihren ungewöhnlichen Glanz erhalten sie durch die eingearbeiteten Goldmetallfäden. Im 20. Jahrhundert verwendete man dazu japanische Goldfäden. Dieses Garn, das in sehr aufwendiger Weise hergestellt wurde, indem feinstes, auf hauchdünnes Reispapier aufgebrachtes Goldmetall um einen Seidenfaden gewickelt wurde, bezogen die Krefelder Paramentenweber aus Japan. Ansonsten bot die Krefelder Textilindustrie und die Handelshäuser alle Dienstleistungen und Rohstoffe für die Paramentenproduktion: farbechte Garne sowie sonstiges Zubehör, Ateliers für die Entwurfszeichnungen oder Produzenten der Patronen und Lochkarten für die Musterweberei.

DIE PARAMENTENWEBEREI IN KREFELD

Krefelds wirtschaftliche Entwicklung zu einer der wichtigsten Seidenmetropolen im deutschsprachigen Raum begann im 17. Jahrhundert. Hintergrund war die Ansiedlung vieler Religionsflüchtlinge. Krefeld hatte als Besitz des Hauses Oranien den Status einer "religiösen Freistatt" [Neubert. Ingeborg. Die Krefelder Paramentenproduktion (1852-1914), Diss.. masch. geschrieb Manuskript. Krefeld 1990, S. 37].

Viele der in die Stadt zugezogenen mennonitischen Familien waren Leinenweber, Spinner, Händler und Verleger. Zu Beginn des 18. Jahrhunderts wurde die Leinenproduktion zunehmend von der Seidenfabrikation abgelöst, ein Vorgang, der zusätzlich von Regierungsseite unterstützt wurde. Seidenstoffe als Luxusartikel wurden immer begehrter, und durch die Einwanderung von Fachkräften, insbesondere aus Frankreich, erhöhte sich die Qualität der Gewebe zunehmend. Mitte des 19. Jahrhundert erlebte die Seidenindustrie in Krefeld ihren größten Aufschwung. Krefeld wurde zur Seidenstadt Deutschlands. Manche Firmen spezialisierten sich auf bestimmte Produkte, z. B. auf die Samtweberei, auf schwere und leichte, gemusterte und ungemusterte Seidenstoffe. Ein Spezialbereich war auch die Paramentenweberei.

Einer der ersten Produzenten kirchlicher Textilien in Krefeld war F. J. Casaretto, Nachfahre einer im 18. Jahrhundert nach Krefeld eingewanderten italienischen Seidenweberfamilie [Neubert. Ingeborg:

Die Krefel&r (1852-1914), Diss.. masch. geschrieb Manuskript. Krefeld S. 45]. Als katholischer Fabrikant in der sonst von Protestanten und Mennoniten beherrschten Branche der Seidenweberei wurde er von Franz Bock, dem Kaplan der Hauptpfarrkirche St. Dionysius, dazu überredet, in das unbekannte Metier einzusteigen und sich vor allem an historischen Mustern zu orientieren. Die seit 1842 bestehende Firma stellte sich 1852 in einer von Bock organisierten Ausstellung kirchlicher Kunst einem breiten Publikum mit seinen neuen "mittelalterlichen Stoffen" vor. Später richtete die am Südwall ansässige Firma eine Schneiderei ein, so dass fertige liturgische Gewänder der Kundschaft angeboten werden konnten. Casaretto exportierte sogar ins Ausland in die Niederlande, nach Belgien, in die Schweiz und nach Österreich.

Casarettos Paramentenfabrikation blieb lange Zeit das einzige Unternehmen dieser Art in Krefeld. Dies sollte sich allerdings in den 1880-er Jahren ändern, als der mechanische Seidenwebstuhl die Fabriken der Stadt eroberte und viele Handweber in eine Notsituation gerieten. Neben der Gründung privater Unterstützungsfonds und staatlicher sowie kommunaler Maßnahmen besann sich die Branche der großen Fertigkeit dieser Handwerker. Die Paramentenweberei bot zumindest für einige von ihnen die Möglichkeit einer Anstellung. 1887 fand in der Königlichen Webschule, unter der Schirmherrschaft des Erzbischofs von Köln, eine "Ausstellung kirchlicher Kunstwebereien und Stickereien der Vergangenheit" [Siehe Catalog der Ausstellung kirchlicher Kunstwebereien und Stickereien der Vergangenheit, Crefeid 1887] statt, bei der sich auch Krefelder Paramentenwebereien präsentierten. Die Ausstellung sollte "Anregung zum neuen Schaffen" geben und der Hoffnung Ausdruck verleihen, dass "die kirchliche Textil-Fabrikation durch diese Ausstellung neuen Schwung nehmen wird… [Stadtarchiv Krefeld. Best. 4 - 1448 Ausstellung kirchlicher Kunstwebereien und Stickereien Neubert, Krefelder Paramentenproduktion, S. 47].

Die Hoffnung der Initiatoren schien sich zu erfüllen, denn in den folgenden Jahrzehnten wurden immer mehr Paramentenwebereien in Krefeld gegründet. Um 1900 gab es hier schon 12 Unternehmen, bis 1914 folgen noch weitere, die auch Fahnenstoffe herstellten. Zu ihnen gehörte auch die Firma Hubert Gotzes.

DIE KUNSTWEBEREI UND PARAMENTENFABRIK HUBERT GOTZES DER FAMILIENBETRIEB DIE GRÜNDUNGSJAHRE

Hubert Gotzes wurde am 5. September 1860 in Amern geboren. Wie das Melderegister der Stadt Krefeld am 23. Mai 1900 berichtet, kam Gottfried Hubert Gotzes [Rufnamen sind unterstrichen], 39 Jahre alt, zusammen mit seiner Ehefrau Gertrud Karoline geb. Vollekier, 42 Jahre alt, und ihren sieben Kindern aus Amern, St. Anton, Kreis Kempen nach Krefeld. Zunächst wohnte die Familie in der Roßstraße 130, wahrscheinlich aber nur vorübergehend, denn das Adressbuch für 1901-1902 [Stadtarchiv Krefeld, Adressbuch 1901-1902 (23)] nennt als Adresse des gelernten Webers Hubert Gotzes für diesen Zeitraum die Prinz-Ferdinand-Straße 23 und zwei Jahre später [Ebenda, Adressbuch 1903/04 (23)] die Hubertusstraße 53. Ob Hubert Gotzes in der Zeit von 1900 bis 1905 in der Paramentenweberei von Theodor Gotzes in der Dionysiusstraße tätig war, ist nicht bekannt, aber durchaus möglich, denn er kannte sich mit der Bildweberei offenbar gut aus.

Am 21. Oktober 1905 machte sich Hubert Gotzes selbständig und ließ sich ins Handelsregister mit der Firma "Hubert Gotzes Paramentenfabrik" eintragen [Haus der Seidenkultur. Materialsammlung: Kopie des Handelsregisterauszugs des Amtsgerichts Krefeld HR A 227]. Er selbst nannte sich nun Paramenten-, Paramentenstoff-und Fahnenfabfrikant. Das Adressbuch von 1907-1908 nennt als

Firmensitz die Klosterstraße 43 sowie Westwall 184, außerdem als weiteren Firmeninhaber Wilhelm Gommersbach aus der Blumenstr. 148, der aber in den Folgejahren nicht mehr in Erscheinung tritt.

Die häufigen Umzüge und die Firmengründung sprechen dafür, dass es den Gotzes seit ihrer Ankunft in Krefeld wirtschaftlich immer besser ging. Hubert Gotzes war wohl ein tüchtiger Handwerker und offensichtlich auch ein guter Geschäftsmann, der es als "Fremder" in der unglaublichen Konkurrenzsituation der Seidenstadt Krefeld wagen konnte, sich selbständig zu machen.

Hinzu kam, dass er wohl auf die Mithilfe seiner ältesten Söhne Jakob Theodor und Karl Matthias, die um die Zeit der Firmengründung bereits 22 bzw. 21 Jahre alt waren, rechnen konnte.

DIE LUISENSTRAßE 15 IN DEN JAHREN VOR DEM ERSTEN WELTKRIEG

1908 kaufte Hubert Gotzes das Haus Luisenstraße 15 - wahrscheinlich mit kompletter Werkstatteinrichtung - und richtete dort seine Geschäftsräume ein. Das Haus war 1867/68 vom Seidenfabrikanten Gottfried Diepers erbaut worden.

Die Bebauung an der Luisenstraße war Mitte des 19. Jahrhunderts entstanden. Um 1900 handelte es sich um ein Quartier mit typischer Mischnutzung von Wohnen und Gewerbe. 23 % der Bewohner waren in der Textilbranche tätig. Selbständige, Handwerker, Beamte und Angestellte sowie Arbeiter wohnten hier. Die von der Straße abgewandten Bereiche der Häuser dienten entweder als Gartenfläche oder waren mit handwerklichen Betrieben erschlossen [Dautermann Christoph: Die Luisenstraße in Krefeld - eine Straße des 19. Jahrhunderts. In: Die Heimat 74, 2003, S. 94ff].

Das Haus Luisenstraße 15 zeigt, dass es bereits im Hinblick auf eine gewerbliche Nutzung gebaut worden war: Lieferanten-und Kundeneingang liegen direkt nebeneinander. Der Kundeneingang führte in die Geschäfts- und Büroräume, der Lieferanteneingang in den zum Hof hin liegenden Flügelbau mit den Werkstätten sowie in die oberen Privaträume. Außerdem gab es hinter dem Haus noch einen Hof sowie Gartenflächen.

In der Luisenstraße besaß die Firma wohl endlich die Räumlichkeiten, die den Anforderungen des Betriebs gerecht wurden. Vermutlich hatte die Raumnutzung, wie sie sich nach Zeugenaussagen kurz vor dem Zweiten Weltkrieg darstellte, im Wesentlichen bereits zu Beginn der Paramentenproduktion bestanden:

Von der Straße aus gesehen vorne rechts lag das Empfangszimmer und das Büro, in dem hinteren Flügelbau das so genannte "Atelier" mit der Stickerei und Näherei, darüber im Obergeschoss die Weberei. Im Obergeschoss zur Straße hin war ein großer Ausstellungsraum eingerichtet, nach hinten schlossen sich Privaträume an [Interview mit Frau Maus am 5. August 2005]. Außerdem erwarb die Familie im Laufe der Zeit auch das entsprechende Anschlussgrundstück in der Mariannenstraße, um dort einen Shedbau zu errichten. Hier war die Samtbrokatweberei eingerichtet. Allerdings wurde dieser Anbau im Zweiten Weltkrieg zerstört.

DER BETRIEB BIS 1992

Seit wann die erwachsenen Söhne (und möglicherweise auch Töchter) von Hubert Gotzes mit in die Paramentenproduktion einbezogen wurden, ist nicht bekannt. Außer dem 1888 geborenen Hermann absolvierten wohl alle Söhne von Hubert eine kaufmännische Lehre. Möglicherweise wurden sie aber zwischendurch immer wieder in den gesamten Produktionsablauf einbezogen [Vgl. Thönnissen. Karin: Das Haus der Seidenkultur - Historische Pararnentenweberei Hubert Gotzes. In: Museen im Rheinland 1/05, S. 14 ff]. Vielleicht war Jakob (1883- ?), der älteste Sohn, von Anfang an als Kaufmann im Familienbetrieb tätig, ähnlich wie Josef (1886-1959), der wohl als Firmenvertreter unterwegs war.

Ab 1910 wird der zweitälteste Sohn Matthias (1884-1935) als Kolonialwarenhändler in der Hülserstr. 118, ab 1913 in der Mariannenstr. 94 in den Adressbüchern geführt [Stadtarchiv Krefeld. Adressbuch 1910 (27) und 1913 (28)]. Hubert junior, der jüngste Gotzes-Sohn (1893- ?), ging 1910, damals 17-jährig, als Handelslehrling ans Institut St. Leon in Bruges (Belgien) und kehrte 1912 wieder nach Krefeld zurück [Haus der Seidenkultur, Materialsammlung: Kopie Personenstandskartei der Krefeld]. Bereits zwei Jahre später schickte ihn sein Vater in die USA nach Chicago. Dort baute Hubert junior ein Handelsgeschäft der Firma auf. Dies sollte sich über die Jahre hinweg als glücklicher Umstand erweisen, denn das Amerikageschäft war selbst in den unbeständigen Zeiten vor dem Zweiten Weltkrieg wichtiges Standbein der Firma. Die Paramente waren wegen ihrer ausgezeichneten Qualität und Farbechtheit bei den Amerikanern sehr beliebt. Ohne Erwähnung in den Akten bleiben die beiden Töchter Pauline (1890-?) sowie Gertrud (1896-?).

Hubert Gotzes starb am 28. Dezember 1916 nach längerer Krankheit. Zunächst übernahmen Jakob und Josef Gotzes als Hubert Testamentvollstrecker die Geschäftsführung [Stadtarchiv Krefeld: Krefelder Zeitung vom 5.2.1917]. Spätestens 1920 werden im Adressbuch als Inhaber der Firma Jakob, Josef, Matthias und Hubert (junior, in Chicago) genannt. Die Witwe Karoline hat nicht maßgeblich in den Betrieb eingewirkt. Sie starb 1921.

Die Zeit der gemeinsamen Betriebsführung der Firma durch die Gotzes-Brüder in den 1920-er Jahren scheint nicht einfach gewesen zu sein. Zum einen sah die gesamtwirtschaftliche Lage nicht sehr gut aus, zum anderen war es schwer, vier Meinungen unter einen Hut zu bringen. Aus den Unterlagen der

Industrie- und Handelskammer [Haus der Seidenkultur. Materialsammlung: mit der und Handelskammer. 1932-1957] geht hervor, dass Hubert Gotzes junior, der das Handelsgeschäft in Chicago leitete, 1928 aus der gemeinsamen Firma ausschied. Josef gründete Mitte der 1920-er Jahre eine Paramentenfabrikation in der neuen Linner-Str. 80, und auch Jakob eröffnete zwischenzeitlich eine eigene "Paramentenfabrik" im Nachbarhaus (Luisenstr. 17) und trat am 5. Dezember 1930 aus dem gemeinsamen Geschäft aus. Zwischen 1931 und 1934 wurde Matthias Gotzes alleiniger Inhaber der Firma in der Luisenstr. 15, denn in einem Fragebogen der Industrie- und Handelskammer Krefeld aus dem Jahr 1934 wird nur er als Betriebsführer genannt [ebenda]. Zu dieser Zeit waren 14 Personen in der Firma beschäftigt, davon 12 Arbeiterinnen und Arbeiter (5 Frauen, 7 Männer, darunter ein Lehrling und ein Lehrmädchen) sowie der Inhaber selbst und seine Ehefrau Henriette, die sich beide um das Büro bzw. die Betriebsführung kümmerten.

Schon bald kam der nächste Schicksalsschlag. 1935 starb Matthias Gotzes bei einem Verkehrsunfall. Seine Witwe Henriette übernahm die Firmengeschäfte und sollte die Geschicke des Betriebs als resolute Chefin bis zu ihrem Tod 1969 leiten. Der Betrieb behielt weiterhin den Namen des

Firmengründers Hubert Gotzes. Henriette brachte die Produktion durch die besonders schwierigen Zeiten des Zweiten Weltkriegs sowie durch die Krise der Paramentenweberei nach dem Vatikanischen Konzil 1962-65, als die neuen Bestimmungen schlichtere liturgische Gewänder forderten, und es in Krefeld zu einem "Sterben" der Paramentenwebereien kam. Große Unterstützung erhielt die Firma durch die Mitarbeit von Erwin Maus, einem Neffen von Henriette Gotzes. Ab Januar 1962 wurde die Firma als offene Handelsgesellschaft im Handelsregister geführt [Haus der Seidenkultur, Materialsammlung: Kopie des Amtsgerichts Krefeld HR A 227], da Erwin Maus als Gesellschafter in das Unternehmen eintrat. Er hatte das Weberhandwerk im Betrieb von Grund auf gelernt und arbeitete später im Büro und als Kundenvertreter. Nach dem Tod seiner Tante 1969 übernahm er die Geschäftsführung. Als nach dem Ausscheiden des letzten Webers 1989 die Produktion nicht mehr fortgeführt werden konnte, dauerte es nicht mehr lange, bis der Betrieb endgültig am 16. September 1992 als erloschen im Handelsregister eingetragen wurde [ebenda].

PRODUKTION UND PRODUKTE

Liturgische Textilien und Gewänder wurden noch zu Beginn des 20. Jahrhunderts so produziert, wie es bereits in den Manufakturen des 19. Jahrhunderts üblich gewesen war. Das Inventar bestand aus verschieden eingerichteten Handwebstühlen mit Jacquard-Aufsätzen, auf denen gemusterte Samt-, Seiden- und Brokatstoffe sowie Bänder gewebt werden konnten, aus einer Stickerei sowie einer Näherei. Diese Abteilungen haben sich bis zum Schluss in der Firma Gotzes gehalten.

In einer Auflistung der Industrie- und Handelskammer wird die Zahl der Webstühle der Firma Hubert Gotzes mit 20 Handwebstühlen vor dem Krieg und 8 "gebrauchsfertigen" Handstühlen 1946 genannt [Haus der Seidenkuitur, Materialsammlung Korrespondenz mit der Industrieund Handelskammer. 1932-1957]. Diese 8 Handstühle sind bis heute erhalten geblieben. Während der Bombenangriffe waren vor allem Samtstühle im Shedanbau zerstört worden.

Gefertigt wurden in der Firma zum einen gemusterte Stoffe, insbesondere Samt- und Seidenstoffe, Bänder und Borten, deren Bildmuster gewebt oder gestickt waren, Altardecken, Baldachine und andere kirchliche Textilien, sowie komplette Kapellen, d.h. die gesamte Ausstattung für festliche Gottesdienste, wie Chormäntel, Stolen, Messgewänder usw. Sie wurden nach Wunsch und Maß der Besteller hergestellt. Daneben produzierte Gotzes auch Fahnen, z. B. für Vereine, während und nach dem Krieg auch Krawattenstoffe [Interview mit Frau Helga Maus am 5. August 2005].

Die Krefelder Paramentenproduzenten waren für ihre qualitativ sehr hochwertigen Produkte sowie die Farbechtheit der Stoffe bekannt. Dies traf auch für die Firma Gotzes zu. Sehr aufwendig in der Produktion waren die gemusterten Samtbrokate. Ein Handweber fertigte im Schnitt am Tag nur etwa 0,4 m dieser wertvollen Stoffe, die aus so genannter unbeschwerter Seide hergestellt wurden, also aus einem Material, das nicht mit Zinnsalzen gefärbt war und somit eine längere Haltbarkeit aufwies. Eine andere Spezialität waren die Goldbrokate, Stoffe, in die Goldfäden eingewebt waren. Die Firma Gotzes bezog diese Fäden direkt aus Japan. Sie zeichneten sich dadurch aus, dass die Stoffe selbst nach längerer Zeit keine Metallverfärbungen aufwiesen. Die Goldbrokate waren ein Exportschlager insbesondere in die USA, wo reich verzierte und gemusterte Priestergewänder wesentlich länger beliebt blieben als in Europa. Wichtig beim Abweben von Bildmustern war, dass jeweils nur ein Weber am selben Stück Stoff arbeitete, da jeder Weber einen etwas anderen Anschlag hatte und man den Wechsel sofort am Produkt erkannt hätte.

An der Entwicklung eines neuen Musters einer Kollektion waren Musterzeichner, Patroneure und Kartenschläger beteiligt. Der Musterzeichner entwarf zunächst ein einzelnes Motiv. Diesem fügte er schmückendes Beiwerk zu und gestaltete daraus den Rapport, den sich auf dem Stoff ständig wiederholenden Mustersatz. Anschließend überprüfte er die Wirkung des Rapports auf einer größeren Fläche. Die Firma Gotzes ließ ihre Muster im Atelier Rentmeister in Krefeld entwickeln. Die Zeichnung wurde anschließend vom Patroneur bearbeitet. Er übertrug das Bild aufgelöst in kleine Karos auf entsprechendes Papier. Jedes Karo entsprach einem Schnittpunkt von Kett- und Schussfaden. Die Patrone war die genaue Vorlage für den fertigen Stoff. An Hand der Patrone fertigte der Kartenschläger auf dem sog. "Klavier" Lochkarten aus Pappe. Diese wurden zu einem Endlosband zusammengenäht und liefen durch die auf dem Webstuhl befestigte Jacquardmaschine. Sie ermöglichten das Heben unterschiedlicher Kettfäden und damit das Entstehen des Musters. Auch die Arbeit des Kartenschlagens vergab die Firma Gotzes nach außen. Im Hause selbst wurden dagegen Motive für die Bildstickerei entwickelt bzw. verändert.

Bereits Ende des 19. Jahrhunderts waren Krefelder Paramentenwebereien dazu übergegangen, sich verstärkt an Mustern alter historischer Paramente zu orientieren. Auch Hubert Gotzes griff diese Motive auf, z. B. das Hirschmuster, Granatapfel, Vögel sowie Symbole wie das Kreuz oder florale Ornamente. Nicht nur entsprechende Stoffe, sondern vor allem die reich mit Stickereien verzierten Kölner Borten zeugen von der großen Vielfalt verwendeter Motive. Eine Besonderheit waren die "Kölner Stäbe," schmale, zwischen 5 und 7 cm breite Stoffstreifen, die nach dem mittelalterlichen Vorbild der "Kölner Borte" gewebt wurden. Sie zeigen häufig Motive, die bereits im 13. bis 16. Jahrhundert üblich waren: die Rosette, ein verzweigter Baum oder die Namen Maria und Joseph. Auf Bestellung konnten mehrere Motive miteinander kombiniert werden oder auch als Einzelstücke aufgestickt oder als gewebte Bilder (Applikationen) aufgenäht werden. Die gestickten Applikationen, die so genannten "Nadelmalereien," zeigten häufig bildliche Darstellungen -von Christus oder von Heiligen. Diese wurden an die vom Kunden gewünschten Stellen des Gewandes aufgenäht. Aus einem Bildkatalog mit Mustern und Stickereimotiven konnten die sich Kunden so ihr individuelles Gewand zusammenstellen oder aus einer Reihe bereits fertiger Gewänder das ihnen zusagende aussuchen. Trotz der sehr aufwendigen Handarbeit erfolgte die Abwicklung des Auftrags relativ zügig. Ein Weber konnte je nach Muster und Gewebe den Stoff für ein Priestergewand im Schnitt in zwei bis fünf Tagen abweben. Samtbrokate dauerten mehr als 10 Tage. Anschließend kam das Zuschneiden, Nähen und Sticken, so dass nach spätestens zwei bis drei Wochen der Auftrag fertiggestellt war.

KUNDSCHAFT UND VERTRIEB

Naturgemäß besaß die Paramentenmanufaktur Gotzes einen speziellen Kundenstamm: In erster Linie waren es kirchliche Institutionen, vertreten durch Pfarrer und Bischöfe. Hauptabnehmer war die katholische Kirche, die noch vor dem Zweiten Weltkrieg reich verzierte Gewänder bestellte. Aber auch die orthodoxe Kirche bezog von Gotzes Textilien [Interview mit Frau Helga Maus am 5. August 2005]. Daneben bestellten Vereine Fahnen und Vereinsabzeichen.

Die Betreuung der Kundschaft erfolgte auf zwei Weisen. Zum einen besaß die Firma Gotzes ein Empfangszimmer bzw. einen Ausstellungsraum, in dem die verschiedenen Textilmuster und fertigen Gewänder vorgeführt werden konnten. Dies diente insbesondere der Betreuung der Kundschaft aus der näheren Region. Es gab auch Stammkunden, die häufiger das Haus besuchten. Ein ganz wesentlicher Teil der Auftragsakquise erfolgte über Vertreterreisen. In der frühen Phase der Firmengeschichte geschah dies mit dem Fahrrad oder dem Zug, später auch mit dem firmeneigenen Pkw. Teilweise reisten die Firmeninhaber selbst, wie im Falle von Matthias Gotzes. Ausgestattet mit einem großen Musterkoffer war er im Schnitt 8-14 Tage in der Region unterwegs [ebenda]. Anschließend musste die Ausstellungsware gereinigt und gebügelt werden, was immer viel Aufwand bedeutete. Einen innovativen Durchbruch in der Kundenbetreuung brachte nach dem Zweiten Weltkrieg die Idee von Erwin Maus, einen Verkaufswagen zu bauen, indem er auf einen Mercedes mit Fahrerkabine einen Campinganhänger setzte. Dieser war mit Schränken zum Hängen der Gewänder sowie einem Spiegel ausgestattet, so dass dort direkt die Anprobe erfolgen konnte. Neben Herrn Maus waren nach dem Krieg noch zwei weitere Verteter für Gotzes tätig, so dass die ganze Bundesrepublik abgedeckt werden konnte. Auch ins benachbarte Ausland, z. B. in die Benelux-Länder, wurde verkauft. Bis zum zweiten Weltkrieg war ein wichtiges Standbein das Amerika-Geschäft mit dem Handelshaus in Chicago. Diese Kontakte rissen allerdings nach dem Krieg ab.

MITARBEITER UND ARBEITSBEDINGUNGEN

Über die Zahl der Mitarbeiter in den ersten Jahrzehnten seit der Firmengründung ist bisher nichts bekannt. Die ersten exakten Zahlen liefern die Unterlagen der Industrie- und Handelskammer Krefeld aus dem Jahr 1934 [Haus der Seidenkultur, Materialsammlung: Korrespondenz mit der Industrie- und Handelskammer, 1932-1957]. Eine Betriebserhebung nennt an Beschäftigten 12 Personen. Dazu kamen der Firmeninhaber Matthias Gotzes und die im Betrieb mitarbeitende Ehefrau Henriette. Für 1938 werden insgesamt 19 Mitarbeiter genannt, davon 3 männliche Arbeiter - wahrscheinlich die damaligen Weber, und 6 Arbeiterinnen, also Stickerinnen und Näherinnen. Dazu kamen Lehrlinge sowie Angestellte, die im Büro und als Vertreter beschäftigt waren. Unmittelbar nach dem Krieg im September 1945 waren nur 7 Personen bei Gotzes beschäftigt, für 1951 werden wieder 16 Angestellte, Arbeiterinnen und Arbeiter genannt, 1957 sogar 23. Einen schweren Einbruch brachte das 2. Vatikanische Konzil mit sich, dessen neue Bestimmungen für schlichtere Gewänder Auftragseinbußen verursachten und wahrscheinlich auch die Zahl der Mitarbeiter minderten.

Einen näheren Einblick in den Alltag der Firma geben die Interviews mit den ehemaligen Webern Wendelinus Breuer und Paul Amend [Interview mit Wendelinus Breuer am 19.08.2005 und Interview mit Paul Arnend am 01.09.2005]. Amend lernte in der Firma das Weberhandwerk von Grund auf. In seinem ersten Lehrjahr 1952 musste er in erster Linie für die damaligen 5 Weber der Werkstatt das Schussgarn spulen, die Werkstatt sauber halten, Kaffee holen und Botengänge für Frau Gotzes erledigen. Erst im zweiten Lehrjahr wurde er an einen Webstuhl gesetzt und erhielt im Laufe der Zeit immer kompliziertere Webaufträge. Der Gesellenlohn belief sich 1955 auf 90 Pfennig in der Stunde. In der Weberei wurden fast alle anfallenden

Arbeiten selbst verrichtet. Waren noch vor dem Zweiten Weltkrieg Schererinnen und Andreherinnen zum Fertigen und Aufbäumen der Kette von auswärts in den Betrieb gekommen, so mussten die Handweber nun alles selbst erledigen.

Der Arbeitstag in den 1950-er Jahren begann am 7 Uhr morgens. Um 9 Uhr wurde eine Kaffeepause eingelegt, die aber nicht länger als eine Viertelstunde dauern durfte. Henriette Gotzes als damalige strenge "Regentin" des Betriebs konnte genau hören, ob und welche Webstühle gerade in Betrieb waren und fragte sofort nach, wenn Stillstand entstand. Die Arbeitswoche betrug im Schnitt 48

Stunden. Am Samstag mussten die Lehrlinge und Lehrmädchen die Werkstatt gründlich reinigen und gelegentlich auch im Garten der Firmenchefin arbeiten. Waren größere Aufträge versandfertig zu machen, so kam es auch vor, dass die Lehrmädchen nach einer langen Extraschicht im Betrieb übernachteten. Für die heutige Zeit undenkbar, aber damals durch-aus selbstverständlich waren die sanitären Verhältnisse. Die einzige Toilette des Betriebs befand sich unter dem Treppenaufgang zum Obergeschoss. Erst später wurde ein zusätzliches WC im Obergeschoss eingebaut.

Insgesamt erinnern sich die beiden Weber an ein gutes Betriebsklima. Einmal im Jahr fand in der Regel ein Betriebsausflug oder ein Betriebsfest statt, wobei man meist in die nähere oder weitere Region (z. B. bis nach Unkel am Rhein) fuhr. Das 50-jährige Betriebsjubiläum 1955 feierte die Belegschaft in Krefeld mit einem guten Essen, Kegeln und Tanz. Seit den 1970-er Jahren wurde es immer schwerer, Nachwuchskräfte für den Betrieb zu finden. Im Vergleich zu anderen Branchen waren die Löhne nur mäßig und gute Arbeiterinnen und Arbeiter mit viel handwerklichem Geschick in der Stickerei und Handweberei schwer zu finden. Das Ausscheiden des letzten aktiven Webers 1989 deutete das nahe Ende der Produktion an. Selbst wenn sich jemand gefunden hätte, der noch als Handweber die entsprechenden Stoffe hätte produzieren können, so wäre dies letztlich unbezahlbar geworden.

DAS MUSEUM

Am 16. September 1992 war das offizielle Ende der Paramentenfabrikation Hubert Gotzes gekommen. Die Firma wurde als "erloschen" im Handelsregister eingetragen [Haus der Seidenkultur. Materialsammlung: Kopie des Handelsregisterauszugs des Amtsgerichts Kr&ld HR A 227]. Doch inzwischen war das industrielle Kleinod in der Luisenstraße ins Bewusstsein engagierter Krefelder Bürger gedrungen. 1993 gründete sich der "Förderverein Haus der Seidenkultur Paramentenweberei Hubert Gotzes e.V." und macht es sich seither zur Aufgabe, die historische Werkstatt, die im Jahr 2000 in Vereinsbesitz überging, als Museum für die Öffentlichkeit weiter zu erhalten.

Als wichtiger Teil der Krefelder Geschichte bewahrt das " Haus der Seidenkultur," wie die ehemalige Firma Gotzes in der Luisenstraße 15 jetzt offiziell heißt, das alte Handwerk der Seidenhandweberei vor dem Vergessen und zeigt den bürgerlichen Teil der Industrialisierung. Wechselnde Ausstellungen geben außerdem einen Einblick in die große Geschichte der Krefelder Textilproduktion. Museumspädagogische Aktionen führen Kinder, Jugendliche sowie Erwachsene an das spannende Thema rund um den seidenen Faden heran. Deshalb kann 2005, wie schon der Museumsflyer schreibt, von der Paramentenweberei Gotzes mit Recht gesagt werden... *100 Jahre alt und kein bisschen langweilig!*

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Gabriele Harzheim: S. 9, 14

Foto Haus: S. 19

A2.1.8 Parament Weaving Hubert Gotzes – Products / Paramentweberei Hubert Gotzes – Produkte

Author: HdS.

English translation: Cynthia Beisswenger, HdS.

A2.1.8.1 English

In 1868 Gottfried Diepers built a house with a weaving workshop equipped with Jacquard handlooms to supply a niche market - ecclesiastical textiles, banners and flags. He was not the only person to do so and over the next decades many such workshops sprang up in the surrounding streets

It was not economical to use the mechanised looms to produce the small quantities of very high-quality fabrics interwoven with gold and silver threads. The influx of Catholic workers from the surrounding region meant that many new churches were constructed in the new districts on the outskirts of the town towards the end of the 19th century and beginning of the 20th century and consequently the demand for ecclesiastical textiles was high.

Hubert Gotzes was one of the craftsmen who moved from the countryside, Amern, to Krefeld in order to practice his craft. Initially, he worked at several locations in the town before purchasing the building and workshop together with the existing looms in Luisenstrasse 15 in 1908. The building which backed on to it in Mariannenstrasse also belonged to it.

The company then proceeded to produce robes, pluviales, chasubles and stoles for priests, antependiums (altar cloths) as well as canopies and banners for processions. The banners normally portrayed the Virgin Mary and the patron saints of the respective churches and were richly decorated. The processions through the streets took place on religious holidays, one of the most important for Krefeld being the Corpus Christi procession which was one of the largest in the region (depicted in the museum). The first customer was St. Stephan’s church in Luisenstrasse.

A2.1.8.2 Deutsch

In 1868 errichtete Gottfried Diepers ein Wohngebäude mit angeschlossener Weberei, in der Jacquard Handwebstühle aufgestellt waren, um einen Nischen-Markt – Paramente und Fahnen – zu beliefern. Und er war nicht die einzige Person mit diesem Vorhaben. Über die nächsten Jahrzehnte sind viele solche Werkstätten in den umliegenden Straßen entstanden.

Um kleine Mengen an hochwertigen, mit Gold- und Silberfaden durchwirkten Stoffen zu produzieren, war es nicht wirtschaftlich, die neuen mechanisierten Webstühle einzusetzen. Ende des 19. und Anfang des 20. Jahrhunderts führte der Zustrom katholischer Arbeiter aus der umliegenden Gegend dazu, dass in den neuen Vierteln in den Außenbezirken der Städte viele neue Kirchen gebaut wurden. Daher war die Nachfrage nach Paramenten hoch.

Hubert Gotzes war einer der Handwerker, der vom Lande (Amern) in die Stadt (Krefeld) gezogen ist, um sein Handwerk auszuüben. Zunächst arbeitete er an verschiedenen Standorten in der Stadt, bevor er 1908 das Gebäude mit Werkstatt samt Webstühlen in Luisenstraße 15 von Gottfried Diepers kaufte. Das dahinter liegende Gebäude in der parallelen Mariannenstraße gehörte auch dazu.

Die Firma stellte Gewänder wie Pluviale, Kasel und Stola für die Priester sowie Antependiums, Baldachine und Fahnen für Umzüge her. Die Fahnen wurden meist mit Darstellungen der Madonna und der jeweiligen Kirchenheiligen reich geschmückt. Die Umzüge fanden an religiösen Feiertagen statt, einer der größten in der Gegend war der Fronleichnamsumzug in Krefeld (dargestellt im Museum). Der erste Kunde war die Stephanskirche in der Luisenstraße.

A2.1.9 Origins of the "Crown Prince District" / Entstehung des Kronprinzenviertels

Author: Dr. Ulrike Denter, HdS.

English translation: Cynthia Beisswenger, HdS.

8.9.1 English

It was not until 1819 that the inner area of the town of Krefeld was completed with four boundary streets called "Wälle" based on the plans of master builder Adolph von Vagedes.

Just sixteen years later design work had already started for a seventh expansion of the rapidly growing town. In the year 1843, the Prussian government in Berlin approved a revised version of the plans which the Düsseldorf government building officer Franz Anton Umpfenbach had drawn up. These plans set out the town expansion in an easterly direction covering what is now known as the "Crown Prince District".

This district extends in a north/south direction from the Rheinstrasse to the then Canalstrasse, now Hansastraße, and in the west/east direction from Ostwall to the then Kronprinzenstrasse, now Philadelphiastrasse. The strict geometric road network in the district was to a large extent also stipulated in the planning and was only interrupted by the diagonally traversing Alte Linner Strasse which was retained as the historical route to Linn. The Luisenplatz and Albrechtplatz were developed as new public squares.

The names of important personalities from the Prussian royal family were given to the streets running north to south. The former "Crown Prince Street" was a reference to the then Crown Prince Friedrich Wilhelm IV who visited Krefeld in 1833. Still today the Luisenstrasse, Mariannenstrasse und Elisabethstrasse commemorate Louise of Prussia, Marianne of Oranien-Nassau and Elisabeth of Bavaria.

Further plans included the building of new public buildings. 1864 the secondary school was opened on Luisenplatz; from 1882 onwards this was run as a grammar school (focussing on science and mathematics). This municipal school emerged from the Latin school endowed by the Mennonite businessman, Adam Wilhelm Scheuten. The Protestant Friedenskirche church was built diagonally opposite the school between 1872 and 1874. The Catholic church, Stephanskirche, already dated from the 1850s and was located at the end of the extended Stephansstrasse. An orphanage was opened on the eastern side of Kronprinzenstrasse in the 1850s sponsored by Protestants and the

Krefeld women's association founded in 1827 purchased a house with a garden in 1868, Elisabethstraße 90. In the year 1854, the Puricelli brothers who were already operating an ironworks in Hunsrück built the first gasworks in Mariannenstrasse.

Surrounding area and infrastructure

Krefeld is located on broken stone terraces formed by the river Rhine over time. The “Crown Prince district” grew up immediately on the edge of the upper terrace and therefore it directly borders the surrounding fault terrain of the Sprödental (valley). Ditches were built to drain the area enough to create gardens there. As the streets were not yet tarmacked, the surface water seeped into the ground or was conducted into the damp low-lying land via the drainage ditches. The Kronprinzenstrasse located at the eastern edge of the new urban district was therefore not very popular with prospective Krefeld land developers. In contrast building development in Luisenstrasse was already more or less complete by the 1870s.

One fact was very noticeable and that was that numerous silk weaving workshops had been set up at the southern end of Luisenstrasse. This is possibly attributable to the close proximity of the station because thanks to the access to the German railway network, mail and freight transport from Krefeld was gradually being transferred from road to rail. From 1849 onwards there was a rail link between Homberg – Uerdingen – Krefeld – Viersen, which was extended to Aachen and Oberhausen in 1853. The Cologne – Krefeld route opened in 1856. Equally important for the Krefeld-based silk business was the establishment of the “Crefelder Eisenbahngesellschaft” (Krefeld Railway Company) in the year 1868, which undertook the building of the routes to Hüls, Moers and St. Tönis. This was also very important for passenger traffic because many workers often had to cover long distances to reach their workplace, in the past on foot.

Beginning of silk weaving in Luisenstraße 15

The property situated in the present-day Luisenstraße 15 appeared for the first time in the municipal address book for the year 1868, at the time designated as Louisenstraße 1e with the owner Gottfried Diepers. The merchant and silk producer born in Krefeld in 1833 had designed the building as both residential and business premises with production facilities at the rear. Some years later the business premises extended from Luisenstrasse straight through the block to Mariannenstraße 4. In the address book dating from 1879, the company Diepers & Reeve is listed under this address. With his business premises, Gottfried Diepers was at the time one of the some 300 Krefeld entrepreneurs involved in the silk and velvet industry responsible for operating some 33,000 manual looms.

The company was established at a time of general political and significant economic uncertainty. The labour market was subject to a constant fluctuation between full employment and mass redundancies. In the small weaver and merchant town of Krefeld with a population of around 55,000, the existence of the manual weavers was particularly threatened by the fluctuating economic situation. The workers benefited from fewer restrictions following the introduction of freedom of trade by the French and the breakdown of patriarchal company structures but when there was a lack of orders they had nothing to fall back on.

Working life was hard. In the year 1848, the officially reduced number of working hours was still 14 hours on six days a week. Children over the age of nine years and up to 16 years could work for 10 hours six days a week. The first factory inspectors were appointed from 1853 as the first step on the way to trade supervision and occupational safety.

Architecture and Infrastructure of the „Four-window House"

The two-storey residential and business premises in Luisenstraße 15 have the typical basic layout of a front and rear house in the second half of the 19th century. The street facade of the front house is designed with four windows and the rear house is attached to the front house as a side wing. There is a basement covering the entire area of the front house building. The annex at the rear did not lend itself to a basement. Slotted foundations were the cheapest and only sensible solution on the boggy gravel and sand ground. As discovered during the subsequent refurbishment, low arches formed the foundation for the room floors and ensured that the building itself remained dry.

A particular feature of the house is the two adjacent entrances and two separate stairways. The entrance on the left originally led to the private rooms on the first and second floors of the front house. The salesrooms on the ground floor and the ground floor rooms in the rear building were accessed through the business entrance on the right. From the rooms at the rear, there was a stairway to the upper floor of the side wing where the weaving room was situated. Here it was possible to position the looms at right angles to the windows which had been designed as large as possible.

Prior to the general proliferation of artificial lighting, the weavers at their workplaces depended on the optimum use of daylight and after sunset on the light from petroleum lamps, candles and/or pinewood spills. Although the Puricelli Brothers operated their gasworks in the adjacent Mariannenstrasse, there is no indication that the house was connected to the gas network or that gaslight was available. The weaving workshop was heated by a stove.

Public wells equipped with manual beam pumps ensured the water supply. An appropriate water tap was located in front of the building Luisenstrasse 18. Effluent and sewage were collected in a pit which was regularly emptied. In a terraced street, this procedure was either carried out through a so-called Schürgweg between the houses or the contents of the pit had to be carried through the house hallway in buckets to the cart with the collection tank waiting in the street. In the historical maps, there is no indication of a Schürgweg for the block of houses to which Luisenstrasse 15 belongs.

Sale of the property to Hubert Gotzes

In 1908 Gottfried Diepers, who in the meantime was 75 years old, sold the properties Luisenstrasse 15 and Mariannenstrasse 4 to the entrepreneur Hubert Gotzes who was born in Amern in 1850. The latter had been working as an independent weaver of altar coverings, ecclesiastical fabrics and banners at various locations in Krefeld since 1905. Now Gotzes transferred his rapidly expanding business to the new production facilities and gradually took his sons Jacob, Matthias, Josef and Hubert into the business.

In the meantime, mechanical weaving had also become firmly established to a large extent in the silk industry and Krefeld had since 1887 become a large town having reached a population of 100,000. Besides some 10,000 mechanical looms operating in the town, only around 2,700 manual looms were being used and consequently many weavers were in dire straits. The manufacture of ecclesiastical fabrics gave at least some of them the opportunity of employment. In this sector, weaving was still carried on manual looms because only short lengths of cloth were required as each item was individually designed. Gold and silver threads that were difficult to weave were also used in addition to silk threads.

The Health and Safety Act came into effect in 1891 and this provided for a state business inspectorate. The act also set out revised conditions for the employment of minors. From then onwards children could only be employed once they had reached the age of 13. The maximum working time per day for 13-year-olds was six hours and for 14- to 16-year-olds ten hours. Work on Sundays and night work were strictly forbidden for children and youngsters. In the year 1900, the ten-hour day and 6-day week were introduced for adults.

Infrastructure at the beginning of the 20th century

In 1899 the municipal electricity station in Canalstrasse started operation and initially supplied customers with direct current. Presumably, Hubert Gotzes pressed ahead in his efforts to obtain a branch connection soon after acquiring the property. During a later refurbishment of the building, an antiquated electrical system was unearthed. This had been equipped with a protective earth conductor at a later date. As this protective measure was standard from 1930 onwards, the original electrical installation must already have been in place by then. During the refurbishment process, the early installation of a central heating system could be retraced based on the course of the old heating pipes. The dimensions of the heating pipes and other originally preserved parts indicate that it was initially a low-pressure system with a coke-fired boiler. Later that was replaced with gravity heating.

In 1893 two waterworks started supplying high-quality drinking water from deep wells which had been installed in the water protection areas on the western side of the town. The central sewage canal which had run along Canalstrasse via Bockum to Uerdingen and to the Rhine since 1875 was renewed in 1908 and provided with an initial purification stage. The inner urban canal system having been restructured at the same time, it was now possible to dispose of sewage directly via the canalisation.

Due to the significant increase in the amount of mail being sent at the beginning of the 20th century, the Reichspost set up post offices in the individual districts of the town in addition to the head post office. A new post office building was erected in Luisenstrasse in 1907 and therefore the “Crown Prince district” had its own post office.

Shortly after the opening of the municipal electricity station, the first electrically powered trams drove through the town. The long-distance line to Düsseldorf which still runs today exists since 1898. The first trains arrived at the newly built railway station in 1907. Prior to that, the state railway company had had the track superstructure moved on to embankments. In 1906 the town of Krefeld constructed a port on the river Rhine and this increasingly attracted companies to the town which were not directly related to the textile industry. The time when the fate of the town had hung solely on a silk thread was now coming to an end.

Hubert Gotzes and the Heirs

There is evidence that Hubert Gotzes made several alterations to his new business location. He probably instigated the initial extension of the rear building with the weaving room on the upper floor. The layout of the rooms on the ground floor, where the needlework and embroidery workshops were accommodated, was changed and larger windows were installed. It is not possible to date these building measures precisely because all the Krefeld building authority files were destroyed in the Second World War.

When Hubert Gotzes died in 1916 aged just 66 years, his sons initially took over the management of the company jointly but later went their ways. The eldest son Jakob had already rented the adjacent building Luisenstrasse 17 and was registered there as a silk producer from 1927 to 1933. During the subsequent refurbishment work, it was found that the wing annexes of the houses Luisenstrasse 15 and 17 were connected via a joint heating circuit. Obviously, the weaving business extended over both buildings. Josef Gotzes was first recorded as having his own weaving workshop for ecclesiastical textiles on the Neuen Linner Strasse in the municipal address book of 1928. Hubert Gotzes junior, who had already managed a branch of the company in Chicago since 1914, finally settled in the USA in 1928 and resigned from the jointly managed company in Krefeld.

Matthias Gotzes finally became the sole owner of the company in Luisenstrasse 15 in 1933, retaining the company name Hubert Gotzes. At the time 14 persons were working at the company: in addition to the owner and his wife, there were six male workers, six female workers, a male apprentice and a female apprentice. Just three years later Matthias Gotzes was killed in a road accident and his wife Henriette took over the management of the business. As the couple had no children, Henriette adopted her nephew Erwin Maus and trained him to succeed her. At the same time, she had to overcome the difficulties facing the company following the outbreak of the Second World War.

Second World War and Reconstruction

Following a devastating aerial bombardment on 22nd June 1943 and the subsequent major fire, the “Crown Prince district” was virtually destroyed. The building in Mariannenstrasse 4 also fell victim to the firebombs, and the side wing in the Luisenstrasse 15 was severely damaged. In particular the eastern end wall and part of the wall facing the courtyard were destroyed. The eight looms located on the upper floor of the side wing were, however, still completely intact but at first could not be used because of the damage to the building. As the front house had more or less been spared the employees closed ranks and continued to work as far as possible. The needlework and embroidery workshop were moved into the private rooms of the building.

Shortly after the end of the war, the wing section in Luisenstrasse was repaired, whereas the building in the courtyard was not renovated. The house in the Mariannenstrasse 4 was rebuilt in 1954/55 and was from then onwards used mainly as residential premises. Only the so-called “Mausmobil” was parked there, a vehicle equipped like a complete salesroom which Erwin Maus used when visiting his customers.

In the post-war years, further reconstruction work was carried out to the property in Luisenstrasse. Dormer windows were installed in the attic to create additional living space. The stairway was also redesigned to separate the residential areas from the business areas. In the 1960s health and safety regulations stipulated that sanitary facilities had to be installed at the front of the weaving workshop. That meant that one loom had to be removed. This measure was reversed during a subsequent refurbishment of the building and the original weaving workshop reconstructed.

The last Managing Director Erwin Maus

Whilst on one of his business trips Erwin Maus became acquainted with Helga Meyer a designer from Koblenz. In 1954 the couple married and Helga Maus became responsible for the Hubert Gotzes design workshop. When the company celebrated its 50th anniversary in 1955, it was already working at full capacity again. In the mid-1950s the company employed up to 23 persons at any one time.

Following Henriette Gotzes death in 1969 Erwin Maus took over the manufacture of ecclesiastical fabrics and continued to manage the company together with his wife Helga. Despite the severe losses suffered by the ecclesiastical fabric business as a result of the Second Vatican Council (1962 – 1965) requiring that the clergy wear plainer robes, the Hubert Gotzes company was able to hold out for a long time at its original location. Over time, however, the number of skilled manual weavers gradually decreased until in the 1980s only one, Andreas Friedenberg, was still employed in the Luisenstrasse 15. After his sudden death in 1989, Erwin Maus closed the weaving workshop and just maintained sales. On 16th September 1992, the company was recorded as defunct in the Commercial Register.

It was, however, important to the entrepreneur that the last Krefeld silk weaving workshop with its Jacquard looms in its authentic place should be preserved for posterity. He, therefore, contacted th the town of Krefeld and initiated a process which finally led to the Kulturstiftung NRW together with the Sparkassenstiftung Krefeld (cultural trusts) acquiring the property and handing it over to the Association of Friends in 2000. Since then the Association of Friends has run the former weaving workshop for ecclesiastical textiles as a museum supported by a team consisting mainly of volunteers. Erwin Maus had achieved his final aim in life. He died in 2004.

Museum "Haus der Seidenkultur"

Apart from restoring and re-commissioning the Jacquard looms which in the meantime were of considerable age, the Association of Friends was soon faced with a mammoth task. The historic weaving workshop did not meet the fire protection standards for a publicly used building and it was closed down in September 2011 on the order of the town of Krefeld. With unrivalled effort and many donations from local citizens, associations and industry it was possible to stem the refurbishment work and to give the former weaving workshop a modern concept without giving up the old structures.

Time and again the refurbishment process resulted in surprising discoveries, including detecting structural inadequacies. For example, when the side wing was extended into the garden it was not underpinned with a foundation. The walls were merely built on top of the terrace flagstones. The side wing building also did not have adequate rigidity because the cross walls had disturbed the production process and had been removed.

Structurally stable, with state-of-the-art media technology and with increased floor space on the first floor, the Museum “Haus der Seidenkultur” was officially re-opened on 4th April 2014. The temporary exhibition which opened simultaneously “Time Leaps made by Precious Silk” presented current fashion made of fabrics with historic patterns, thus clearly demonstrating the transition from tradition to the present day. Some two years later the house façade was restored with neo-classic ashlar masonry and given the present bright red colour.

8.9.2 Deutsch

Entstehung des Kronprinzenviertels

Erst im Jahr 1819 war der innere Bereich der Stadt Krefeld nach den Planungen des Baumeisters Adolph von Vagedes mit den vier Wällen abgeschlossen worden. Schon wurde 16 Jahre später mit dem Konzept einer siebten Erweiterung der rapide wachsenden Stadt begonnen. Im Jahr 1843 genehmigte schließlich die preußische Regierung in Berlin eine überarbeitete Fassung des Plans, den der Düsseldorfer Regierungs- und Baurat Franz Anton Umpfenbach erstellt hatte. Hierauf basierend entstand als Erweiterung des Stadtgebiets in östlicher Richtung das heute so genannte Kronprinzenviertel.

Dieses Stadtviertel erstreckt sich in Nord-Süd-Richtung von der Rheinstraße bis zur Canalstraße, heute Hansastraße, sowie in West-Ost-Richtung vom Ostwall bis zur Kronprinzenstraße, heute Philadelphiastraße. Schon in der Planung war das streng geometrische Straßennetz des Quartiers weitgehend festgelegt und nur durch die schräg durchlaufende Alte Linner Straße, die als historischer Weg nach Linn erhalten blieb, unterbrochen. Als neue Plätze wurden der Luisenplatz und der Albrechtplatz geschaffen.

Bei der Namensgebung der Nord-Süd-Straßen wurde auf bedeutende Persönlichkeiten des preußischen Königshauses zurückgegriffen. So nahm die ehemalige Kronprinzenstraße Bezug auf den derzeitigen Kronprinzen Friedrich Wilhelm IV., der Krefeld im Jahr 1833 besucht hatte. Noch heute erinnern Luisenstraße, Mariannenstraße und Elisabethstraße an Luise von Preußen, Marianne von Oranien-Nassau und Elisabeth von Bayern.

Weitere Planungen umfassten den Bau neuer öffentlicher Gebäude. 1864 nahm am Luisenplatz die Realschule 1. Ordnung, die ab 1882 als Realgymnasium geführt wurde, ihren Betrieb auf. Diese städtische Schule war aus der von dem mennonitischen Kaufmann Adam Wilhelm Scheuten gestifteten Lateinschule hervorgegangen. Diagonal gegenüber der Schule wurde zwischen 1872 und 1874 die evangelische Friedenskirche errichtet. Als Abschluss der verlängerten Stephanstraße entstand in den 1850er Jahren die katholische Stephanskirche. Auf der Ostseite der Kronprinzenstraße eröffnete in den 1850er Jahren ein Waisenhaus unter evangelischer Trägerschaft, und der 1827 gegründete Krefelder Frauenverein kaufte 1868 ein Haus mit Garten in der Elisabethstraße 90. Im Jahr 1854 bauten die Gebrüder Puricelli, die im Hunsrück bereits ein Eisenwerk betrieben, an der Mariannenstraße ein erstes Gaswerk.

Umgebung und Infrastruktur

Krefeld liegt auf den Schotterterrassen, die der Rhein im Lauf der Zeit gestaltet hat. Das Kronprinzenviertel entstand unmittelbar an der Kante der Oberterrasse und grenzte somit direkt an das umgebende Bruchgelände des Sprödentals. Dieses wurde mit Wassergräben nur soweit entwässert, dass dort Gärten angelegt werden konnten. Da die Straßen noch nicht asphaltiert waren, versickerte das Oberflächenwasser in den Boden oder wurde über Entwässerungsgräben in die feuchte Niederung abgeleitet. Die am östlichen Rand des neuen Stadtviertels gelegene Kronprinzenstraße war deshalb bei den bauwilligen Krefeldern eher unbeliebt. Dagegen wies die Luisenstraße schon Ende der 1870er Jahre eine weitgehend geschlossene Bebauung auf.

Auffallend ist, dass sich insbesondere am südlichen Ende der Luisenstraße zahlreiche Seidenwebereien angesiedelt hatten. Möglicherweise ist dies auf die unmittelbare Nähe des Bahnhofs zurückzuführen, denn mit dem Anschluss an das deutsche Eisenbahnnetz verlagerte sich der Krefelder Post- und Güterverkehr nach und nach von der Straße auf die Schiene. Ab 1849 gab es die Verbindung Homberg – Uerdingen – Krefeld – Viersen, die 1853 bis Aachen und Oberhausen erweitert wurde. 1856 kam die Linie Köln – Krefeld dazu. Ebenso wichtig für das Krefelder Seidengewerbe war die Gründung der „Crefelder Eisenbahngesellschaft“ im Jahr 1868, die dafür sorgte, dass Strecken nach Hüls, Moers und St. Tönis gebaut wurden. Dies war auch für den Personenverkehr von großer Bedeutung, denn viele Arbeiter hatten die oft weiten Wege zu ihren Arbeitsplätzen bisher zu Fuß zurückgelegt.

Beginn der Seidenweberei an der Luisenstraße 15

Im Adressbuch für das Jahr 1868 erscheint die Immobilie an der heutigen Luisenstraße 15 zum ersten Mal, derzeit noch unter Louisenstraße 1e, mit dem Besitzer Gottfried Diepers. Der 1833 in Krefeld geborene Kaufmann und Seidenfabrikant hatte das Gebäude bereits als Wohn-/Geschäftshaus mit Produktion im Hintergebäude konzipiert. Einige Jahre später erstreckte sich der Gewerbebetrieb von der Luisenstraße quer durch den Block bis zur Mariannenstraße 4. Unter dieser Adresse ist im Adressbuch von 1879 die Firma Diepers & Reeve aufgeführt. Mit seinem Geschäftslokal reihte sich Gottfried Diepers in die derzeit rund 300 Krefelder Unternehmen der Seiden- und Samtindustrie ein, die insgesamt für den Betrieb von etwa 33.000 Handwebstühlen verantwortlich waren.

Die Firmengründung erfolgte in einer Zeit allgemeiner politischer und großer wirtschaftlicher Verunsicherung. Der Arbeitsmarkt war einem ständigen Wechsel zwischen Vollbeschäftigung und Massenerwerbslosigkeit unterworfen. In der kleinen Weber- und Kaufmannstadt Krefeld mit ihren ca. 55.000 Einwohnern war insbesondere die Existenz der Handweber von der schwankenden Konjunktur bedroht. Nach der Einführung der Gewerbefreiheit durch die Franzosen und dem Aufbrechen der patriarchalischen Firmenstrukturen erfreuten sich die Arbeiter zwar größerer Freizügigkeit, fielen aber bei schlechter Auftragslage ins Bodenlose.

Das Arbeitsleben war hart. So betrug die im Jahr 1848 offiziell reduzierte Arbeitszeit immer noch 14 Stunden an sechs Tagen in der Woche. Kinder über neun Jahre bis zum 16. Lebensjahr durften 10 Stunden an sechs Tagen in der Woche arbeiten. Seit 1853 gab es die ersten Fabrikinspektoren als erste Stufe auf dem Weg zu Gewerbeaufsicht und Arbeitsschutz.

Architektur und Infrastruktur des Vierfensterhauses

Das zweigeschossige Wohn- und Geschäftshaus Luisenstraße 15 zeigt die für die zweite Hälfte des 19. Jahrhunderts typische Grundaufteilung in Vorder- und Hinterhaus. Das Vorderhaus ist in der Straßenfassade vierachsig ausgebildet und das Hinterhaus als Seitenflügel an das Vorderhaus angefügt. Das Vordergebäude ist voll unterkellert. Für den hinteren Anbau bot sich eine Unterkellerung nicht an. Eine Gründung auf Schlitzfundamenten war die preiswerteste und einzig sinnvolle Lösung in dem sumpfigen Kies- und Sandboden. Wie sich bei der späteren Sanierung herausstellte, bildeten niedrige Gewölbe den Untergrund für die Zimmerböden und stellten sicher, dass das Gebäude selbst trocken blieb.

Als besonderes Merkmal verfügt das Haus über zwei nebeneinander gelegene Eingänge und zwei getrennte Treppenhäuser. Der linke Eingang leitete ursprünglich in die Privaträume im ersten und zweiten Geschoss des Vorderhauses. Über den Geschäftseingang auf der rechten Seite waren die Verkaufsräume im Erdgeschoss und die unteren Räume des Hintergebäudes erreichbar. Von dort führte eine Treppe in das Obergeschoss des Seitenflügels mit dem Websaal, in dem die Webstühle quer zu den so groß wie möglich dimensionierten Fenstern aufgestellt waren.

Vor der allgemeinen Verbreitung künstlicher Beleuchtung waren die Weber an ihren Arbeitsplätzen auf die optimale Nutzung des Tageslichts und nach Sonnenuntergang auf Petroleumlampen, Kerzen und/oder Kienspäne angewiesen. Obwohl die Gebrüder Puricelli ihr Gaswerk in der benachbarten Mariannenstraße betrieben, gibt es keinen Hinweis, dass das Haus über einen Gasanschluss und damit über Gaslicht verfügte. Geheizt wurde der Websaal mit Öfen.

Die Wasserversorgung wurde über öffentliche Brunnen mit Handschwengel-Pumpen sichergestellt. Bei dem Gebäude an der Luisenstraße 18 befand sich eine entsprechende Wasser-Zapfstelle. Abwässer und Fäkalien wurden in einer Grube gesammelt, die regelmäßig zu leeren war. Dieser Vorgang wurde bei einer geschlossenen Bebauung entweder über einen zwischen den Häusern befindlichen sogenannten Schürgweg abgewickelt, oder der Grubeninhalt musste in Kübeln durch den Hausflur zu dem vor der Tür wartenden Fuhrwerk mit Sammeltank getragen werden. Für den Häuserblock, der auch das Gebäude Luisenstraße 15 umfasst, ist in historischen Karten kein Schürgweg nachweisbar.

Verkauf der Immobilie an Hubert Gotzes

1908 veräußerte der inzwischen 75-jährige Gottfried Diepers die Immobilien Luisenstraße 15 und Mariannenstraße 4 an den 1850 in Amern geborenen Unternehmer Hubert Gotzes. Dieser war seit 1905 als selbständiger Paramenten-, Paramentenstoff- und Fahnenfabrikant an wechselnden Standorten in Krefeld tätig gewesen. Nun verlagerte Gotzes sein rasch expandiertes Unternehmen an die neue Produktionsstätte und bezog seine Söhne Jakob, Matthias, Josef und Hubert nach und nach in die Geschäfte ein.

Mittlerweile hatte sich die mechanische Weberei auch in der Seidenindustrie in großem Umfang etabliert, und Krefeld war seit dem Jahr 1887 - mit Erreichen einer Einwohnerzahl von 100.000 - Großstadt. Neben den etwa 10.000 mechanischen Webstühlen arbeiteten in der Stadt nur noch ca. 2.700 Handstühle, sodass viele Handweber in eine Notsituation gerieten. Die Paramenten-Manufakturen boten zumindest für einige von ihnen die Möglichkeit einer Anstellung. Hier wurde nach wie vor auf Handstühlen gewebt, da aufgrund der individuellen Fertigung der Paramente nur jeweils kurze Stoffstücke benötigt wurden und darüber hinaus neben Seidenfäden auch schwierig zu verarbeitende Gold- und Silberfäden eingesetzt wurden.

Seit 1891 war das Arbeiterschutzgesetz in Kraft, in dem eine staatliche Gewerbeaufsicht verankert wurde. Auch wurden in dem Gesetz die Bedingungen bei der Beschäftigung von Minderjährigen neu geregelt. Von nun an durfte erst ab dem 13. Lebensjahr gearbeitet werden. Die maximale Arbeitszeit pro Tag betrug für 13-Jährige sechs Stunden und für 14- bis 16-Jährige zehn Stunden. Sonntags- und Nachtarbeit war für Kinder und Jugendliche grundsätzlich verboten. Im Jahr 1900 wurde der Zehn-Stunden-Tag bei sechs Arbeitstagen in der Woche für Erwachsene eingeführt.

Infrastruktur zu Beginn des 20. Jahrhunderts

Im Jahr 1899 nahm das städtische Elektrizitätswerk an der Canalstraße den Betrieb auf und belieferte seine Kunden zunächst mit Gleichstrom. Mutmaßlich trieb Hubert Gotzes schon bald nach dem Erwerb der Immobilie den Anschluss an die Elektrizität voran. Bei der späteren Sanierung des Hauses wurde eine altertümliche Elektroanlage freigelegt, die nachträglich mit einem Schutzleiter ausgestattet worden war. Da diese Schutzmaßnahme ab 1930 Standard war, muss die ursprüngliche Elektroinstallation bereits vorher abgeschlossen gewesen sein. Auch der frühzeitige Einbau einer Zentralheizung ließ sich im Sanierungsprozess anhand des Verlaufs der alten Heizungsrohre nachvollziehen. Die Dimensionierung der Heizungsrohre und weitere im Original erhaltene Teile deuten darauf hin, dass zunächst eine Niederdruckheizung mit einem Koksheizkessel betrieben und später durch eine Schwerkraftheizung ersetzt wurde.

Seit 1893 förderten zwei Wasserwerke Trinkwasser hoher Qualität aus Tiefbrunnen, die in Wasserschutzgebieten auf der Westseite der Stadt angelegt worden waren. Der zentrale Abwasserkanal, der bereits seit 1875 entlang der Canalstraße über Bockum nach Uerdingen zum Rhein führte, wurde im Jahr 1908 erneuert und mit einer ersten Reinigungsstufe versehen. Nach der parallel erfolgten Neuregulierung des innerstädtischen Kanalsystems bestand grundsätzlich die Möglichkeit, Fäkalien direkt über die Kanalisation zu entsorgen.

Aufgrund des stark ansteigenden Postaufkommens zu Beginn des 20. Jahrhunderts richtete die Reichspost neben dem Hauptpostamt weitere Postämter in einzelnen Stadtbezirken ein. So erhielt auch das Kronprinzenviertel im Jahr 1907 ein eigenes, an der Luisenstraße neu erbautes Postgebäude.

Kurz nach der Eröffnung des städtischen Elektrizitätswerkes fuhren die ersten elektrischen Straßenbahnen durch die Stadt. Seit 1898 gibt es die heute noch existierende Fernlinie nach Düsseldorf. Im Jahr 1907 kamen die ersten Züge im neu gebauten Hauptbahnhof an. Vorab hatte die Staatsbahn den Gleiskörper auf Dämme verlegen lassen. Nach der Anlage eines Rheinhafens im Jahr 1906 durch die Stadt Krefeld siedelten sich zunehmend auch textilferne Betriebe an. Die Zeit, in der die Geschicke der Stadt allein am seidenen Faden gehangen hatten, ging somit dem Ende entgegen.

Hubert Gotzes und die Erben

Es gibt Hinweise, dass Hubert Gotzes einige Umbauten an seinem neuen Firmensitz vornehmen ließ. So erfolgte wahrscheinlich auf seine Veranlassung die erste Verlängerung des Hinterhauses mit dem Websaal im Obergeschoss. Auch die Räume im Erdgeschoss, die die Näherei und die Stickerei beherbergten, wurden in ihrem Zuschnitt verändert und erhielten größere Fenster. Eine genaue Datierung der einzelnen Baumaßnahmen ist nicht möglich, da die gesamten Bauakten der Stadt Krefeld im Zweiten Weltkrieg vernichtet wurden.

Als Hubert Gotzes 1916 im Alter von nur 66 Jahren starb, führten seine Söhne den Betrieb zunächst gemeinsam weiter, gingen dann aber nach und nach eigene Wege. Der älteste Sohn Jakob hatte sich in dem Nachbargebäude Luisenstraße 17 eingemietet und war dort von 1927 bis 1933 als Seidenfabrikant gemeldet. Bei den späteren Sanierungsarbeiten stellte sich heraus, dass die Flügelanbauten der Häuser Luisenstraße 15 und 17 in einem gemeinsamen Heizkreislauf verbunden waren. Offensichtlich erstreckte sich der Webereibetrieb über beide Gebäude. Josef Gotzes wird im Adressbuch von 1928 erstmals mit einer eigenen Paramentenweberei auf der Neuen Linner Straße geführt. Hubert Gotzes junior, der bereits seit 1914 eine Zweigstelle in Chicago betreute, ließ sich 1928 endgültig in den USA nieder und schied aus der gemeinsamen Krefelder Firma aus.

Im Jahr 1933 übernahm Matthias Gotzes schließlich die Firma an der Luisenstraße 15 als alleiniger Inhaber, unter Beibehaltung des Firmennamens Hubert Gotzes. Derzeit waren 14 Personen in der Fabrik tätig, neben dem Inhaber und seiner Ehefrau sechs Arbeiter, vier Arbeiterinnen, ein Lehrling und ein Lehrmädchen. Nur drei Jahre später kam Matthias Gotzes bei einem Verkehrsunfall ums Leben, und seine Ehefrau Henriette führte die Geschäfte weiter. Da die Ehe kinderlos geblieben war, adoptierte Henriette ihren Neffen Erwin Maus und baute ihn als ihren Nachfolger auf. Gleichzeitig musste sie mit den Schwierigkeiten kämpfen, die durch den Ausbruch des Zweiten Weltkrieges auf die Firma zukamen.

Zweiter Weltkrieg und Wiederaufbau

Bei dem verheerenden Luftangriff am 22. Juni 1943 und dem darauf folgenden Großbrand wurde das Kronprinzenviertel weitgehend zerstört. Auch das Gebäude Mariannenstraße 4 fiel den Brandbomben zum Opfer, und der Flügelanbau an der Luisenstraße 15 wurde schwer beschädigt. Insbesondere waren die östliche Flügelgiebelwand und ein Teil der Hofvorderfrontwand zerstört. Die im Obergeschoss des Flügelanbaus aufgestellten acht Webmaschinen waren zwar noch vollständig erhalten, konnten aber wegen der baulichen Schäden vorerst nicht betrieben werden. Da das Vorderhaus im Wesentlichen verschont worden war, rückte die Belegschaft zusammen und arbeitete so gut wie möglich weiter. Näherei und Stickerei wurden in die Privaträume des Hauses verlegt.

Bereits kurz nach Kriegsende wurde zunächst der Flügelanbau an der Luisenstraße instandgesetzt, während das Hofgebäude nicht mehr erneuert wurde. 1954/55 folgte der Wiederaufbau des Gebäudes an der Mariannenstraße 4, das von nun an in erster Linie als Wohnhaus diente. Lediglich das sogenannte „Mausmobil“ war dort stationiert, ein als vollständiger Verkaufsraum ausgestattetes Fahrzeug, mit dem Erwin Maus seine Kundenbesuche absolvierte.

In der Nachkriegszeit erfolgten weitere Umbauten der Immobilie an der Luisenstraße. So wurde das Dachgeschoss des Vorderhauses mit Dachgauben erweitert, um zusätzliche Wohnfläche zu schaffen. Auch wurde zur Trennung von Wohn- und Gewerbebereich das Treppenhaus umgestaltet. In den 1960er Jahren führten Arbeitsschutzauflagen zum Einbau eines Toilettenraumes mit Waschgelegenheit im vorderen Bereich des Websaals. Dabei fiel der Platz für einen Webstuhl fort.

Diese Maßnahme wurde bei der späteren Sanierung des Hauses rückgängig gemacht und der ursprüngliche Websaal rekonstruiert.

Der letzte Geschäftsführer Erwin Maus

Bei einer seiner Geschäftsreisen lernte Erwin Maus die Koblenzer Designerin Helga Meyer kennen. Im Jahr 1954 heiratete das Paar, und Helga Maus übernahm fortan Arbeiten im Atelier der Firma Hubert Gotzes. Zum 50-jährigen Bestehen im Jahr 1955 lief das Unternehmen wieder im Vollbetrieb. Die Belegschaft zählte Mitte der 1950er Jahre zeitweise bis zu 23 Personen.

Als Henriette Gotzes im Jahr 1969 starb, übernahm Erwin Maus die Paramenten-Manufaktur und führte das Unternehmen zusammen mit seiner Ehefrau Helga weiter. Trotz der empfindlichen Einbußen für das Paramenten-Geschäft, die das Zweite Vatikanische Konzil (1962 – 1965) mit der Forderung nach schlichteren liturgischen Gewändern mit sich brachte, konnte sich die Firma Hubert Gotzes noch lange an ihrem angestammten Ort halten. Doch mit der Zeit nahm die Zahl der gelernten Handweber immer mehr ab, bis in den 1980er Jahren nur noch einer, Andreas Friedenberg, an der Luisenstraße 15 tätig war. Als dieser 1989 überraschend starb, stellte Erwin Maus die Weberei ein und hielt lediglich den Verkaufsbetrieb aufrecht. Am 16. September 1992 wurde die Firma als erloschen in das Handelsregister eingetragen.

Dem Unternehmer war jedoch wichtig, dass die letzte Krefelder Seidenweberei mit ihren hölzernen Jacquard-Handwebstühlen an authentischer Stelle für die Nachwelt erhalten bliebe. So suchte er den Kontakt zu der Stadt Krefeld und initiierte eine Entwicklung, die schließlich dazu führte, dass die Kulturstiftung NRW zusammen mit der Sparkassenstiftung Krefeld die Immobilie erwarb und im Jahr 2000 einem Förderverein übergab. Seitdem betreiben der Förderverein und die fast ausschließlich ehrenamtlich agierenden Mitarbeiter die ehemalige Paramenten-Manufaktur als Museum. Erwin Maus hatte sein letztes Lebensziel erreicht. Er starb im Jahr 2004.

Museum „Haus der Seidenkultur“

Neben der Instandsetzung und Wiederinbetriebnahme der inzwischen in die Jahre gekommenen Jacquard-Webstühle, kam auf den Förderverein bald eine Mammutaufgabe zu. Die historische Weberei entsprach nicht den Anforderungen des Brandschutzes an ein öffentlich genutztes Gebäude und wurde im September 2011 per Ordnungsverfügung der Stadt Krefeld geschlossen. Mit einer einzigartigen Kraftanstrengung und vielen Spenden aus Bürgerschaft, Vereinen und Industrie gelang es, die Sanierung zu stemmen und der ehemaligen Weberei ein modernes Nutzungskonzept zu geben, ohne die alten Strukturen aufzugeben.

Dabei hatte der Verlauf des Sanierungsprozesses immer wieder für Überraschungen gesorgt, bis hin zu der Entdeckung von statischen Unzulänglichkeiten. So war der Flügelanbau im Zuge der letzten Hauserweiterung, ohne Unterfangung mit einem Fundament, in den Garten hinein verlängert worden. Die Mauern waren schlicht auf den Platten der Terrasse hochgezogen worden. Auch war die Steifigkeit des Anbaus nicht gegeben, da Querwände, die den Produktionsablauf störten, entfernt worden waren.

Bautechnisch stabil, medientechnisch auf dem neuesten Stand und mit erweiterter Nutzfläche im ersten Obergeschoss wurde das Museum „Haus der Seidenkultur“ am 04. April 2014 feierlich wiedereröffnet. Die gleichzeitig beginnende Sonderausstellung „Zeitsprünge edler Seiden“ präsentierte aktuelle Mode aus Stoffen mit historischen Mustern und stellte somit anschaulich den Übergang von der Tradition zur Moderne her. Etwa zwei Jahre später wurde auch die Fassade des Hauses mit ihren neoklassizistischen Putzquadern restauriert und bekam abschließend den heutigen, leuchtend roten Anstrich.

A2.1.10 Haus der Seidenkultur

KREFELD

TOUR OF THE MUSEUM

Haus der Seidenkultur, an industrial monument in the centre of Krefeld.

- a living museum.
- an important part of Krefeld’s history.
- a central place for manual silk weaving.
- a middle-class part of industrialization.
- a place where former craftsmanship is preserved.

Experience Silk in Krefeld!

As you pass through the building you will experience the history of the Hubert Gotzes weaving factory for ecclesiastical textiles. Our treasure has been refurbished true to detail and with great care.

Entrance for owners and important visitors

The imposing corridor and staircase indicate just how wealthy the family Gotzes was.

Bistro/Shop

Why not enjoy a cup of coffee and let yourself become inspired by our high-quality silk products and handicraft items “Made in Krefeld”. These unique products can only be purchased from our museum.

Entrance for Suppliers

Here you reach the suppliers’ entrance where you can read about the history of silk in Krefeld.

Suppliers’ Staircase

Via a spiral staircase, you reach the first floor where 12 photos depict the transition from a silkworm to a silk thread.

Weaving Room

In the weaving room, such thread is used to weave silk brocade and other products on Jacquard manual looms made of wood.

Tailoring Corridor

You can feel the silk fabrics and trace how they are made into neckties.

Room displaying ecclesiastical vestments

This room displaying ecclesiastical vestments reflects the history of the Gotzes company and its range of products.

Technical Workshop

Here can be seen the workplaces of the point paper designer and the card puncher as well as the demonstration model of a Jacquard attachment.

Our collection of books comprising more than 2000 volumes is available to anyone with a special interest.

Temporary Exhibitions

Temporary exhibitions on specific topics are presented in two rooms on the ground floor.

Media Room

Lectures, films, workshops and social get-togethers take place here.

Dyer's Garden

The plants used for dyeing textiles in the workshops and mulberry bushes to breed silkworms can be found in this courtyard.

Way Out for Important Visitors

Just purchase a few gifts made of silk and velvet and then

- "See You Again Soon" –

at an interesting lecture or for the next temporary exhibition at

HAUS DER SEIDENKULTUR

KREFELD

Opening hours: Wed.-Fri. 15.00-18.00 hours Sun. 13.00-17.00 hours ++Luisenstr. 15.47799 Krefeld 02151/936960 info@seidenkultur.de www.seidenkultur.de

A2.1.11 Family von der Leyen and the development of the silk industry

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English translation: Cynthia Beisswenger, HdS.

A2.1.11.1 English

With the arrival of the Mennonites in the 17th century, the centre of linen production and linen trading moved from the region around Mönchengladbach/Rhedyt to Krefeld. Adolf von der Leyen also brought expertise in the processing of silk from the area known as "Bergisches Land" and had good contacts with the raw silk sector. Therefore he had silk woven into braids and ribbons. His son Wilhelm and also his four sons after him entered the silk business.

Whilst Peter von der Leyen traded with raw silk as an independent merchant and also operated a doubling mill, Johann and Friedrich von der Leyen set up a company, which produced various silk wares. Later the youngest brother, Heinrich, also entered the company. Once the von der Leyen brothers had opened dyeing works in 1724, the Krefeld silk business was well established and replaced their linen business to a large extent by 1730.

In 1731 Friedrich and Heinrich von der Leyen left the family business and set up their own silk company. In the middle of the 18th century this company was producing on some 600 looms and employed virtually half of the Krefeld population. The sales markets of the global company were to be found in Europe, the Orient and America. Possible competitors were quashed through the intervention of the authorities and initially had little chance to assert themselves. As Friedrich and Heinrich von der Leyen had no children, they took their nephews Conrad, Friedrich and Johann – sons of their brother Peter – into the company.

In the year 1702 Krefeld became Prussian. The Prussian king Friedrich II visited Krefeld twice, 1751 and 1763. He was very interested in the silk manufactories which were trading worldwide and maintained good contacts with the von der Leyen family whom he often asked for advice on economic matters.

Whilst travelling through in 1751, Friedrich II. spent just a few hours with the von der Leyens. They took the opportunity to draw his attention to the unsatisfactory situation regarding the postal system and succeeded in ensuring that from 1755 onwards the stagecoach carrying the post from Cologne to Kleve made a detour to stop in the centre of Krefeld. In 1763 the king stayed in the town for two days and the von der Leyen family accommodated him in "Haus in den Kette" on the corner of Rheinstraße/Friedrichstraße. Friedrich II. was very impressed by the silk producers and granted them exclusive rights for silk production in 1766.

In addition, in 1781 Friedrich II, prohibited the recruitment of soldiers in Krefeld and the surrounding area to ensure that the flourishing silk industry had adequate numbers of workers available. As justification, the Prussian king is supposed to have said: *"There are those and those* *and people from Krefeld…!"* Between 1787 and 1789 the king granted Conrad, Friedrich and Johann von der Leyen a peerage.

Other Mennonite Silk Producers

Contrary to his three brothers Peter, Friedrich and Heinrich, Johann von der Leyen did not take any measures against competitive companies in his field of business, that of the production of velvet wares and silk braids. He entered into co-operations with members of the extended family whereby his business partners changed several times. Eventually, Johann von der Leyen took his nephews by marriage Cornelius and Johann Floh into his company as partners. This connection remained in place until the death of Johann von der Leyen in the year 1764. After that Cornelius and Johann Floh continued to manage the company alone initially. Despite every effort they did not succeed in expanding their silk ware production against the will of the brothers and so they withdrew to their core business velvet and silk braids. The succession was secured when in 1777 Cornelius Floh's son Gottschalk entered the company and also 1786 Isaak de Greiff, who was married to Cornelius' daughter Anna.

Around 1750 the linen merchant Gerhard Lingen and Peter Orts, a former clerk working for Johann von der Leyen, set up the company Gerhard Lingen & Co., which initially produced velvets and velvet braids and later started to produce silk fabrics. As Gerhard Lingen had no male heirs he took his step-grandsons Jakob, Gerhard and Heinrich von Beckerath into the company. It was extremely difficult for Lingen & Co. to compete against the overpowering competition and therefore in 1807, two years after the death of Gerhard von Beckerath, it was decided to close the company. The children of the company owner-operated separately from then onwards.

Heinrich von Beckerath's sons, Heinrich and Gerhard, grew up in Schloss Cracau (Cracau Castle). In 1811 the brothers set up a company that emerged from the dye works which already existed in Cracau to become a strong and stable business. In addition, they operated an outworking network. Heinrich von Beckerath gained possession of Schloss Cracau through his marriage to Margarethe Rahr, daughter of Johannes and Elisabeth Rahr. Johannes Rahr's father had already been a tenant in Cracau where he ran a vinegar factory. Following the death of his father.-in-law, Heinrich von Beckerath gave his support to his mother-in-law enabling her to purchase the castle estate. The contract was sealed with the signature of King Friedrich II in 1779.

A2.1.11.2 Deutch

Mit dem Zustrom der Mennoniten im 17. Jahrhundert verlagerte sich das Zentrum des Leinengewerbes und des Leinenhandels aus dem Raum Mönchengladbach/Rheydt nach Krefeld. Adolf von der Leyen brachte aus dem bergischen Land zudem Fachkenntnisse in der Verarbeitung von Seide mit und hatte gute Kontakte zur Rohseidenbranche. So ließ er Seide zu Borten und Bändern weben. Auch sein Sohn Wilhelm und dessen vier Söhne stiegen nach und nach in das Seidengewerbe ein.

Während Peter von der Leyen als Einzelkaufmann mit Rohseide handelte und eine Zwirnerei betrieb, gründeten Johann und Friedrich von der Leyen eine Firma, welche diverse Seidenwaren herstellte. Später trat auch der jüngste Bruder Heinrich in die Kompanie ein. Nachdem die Brüder von der Leyen 1724 eine Färberei eröffnet hatten, stand das Krefelder Seidengewerbe auf eigenen Füßen und löste bis 1730 das Leinengewerbe weitgehend ab.

1731 verließen Friedrich und Heinrich von der Leyen das Familienunternehmen und gründeten eine eigene Seidenfirma. Mitte des 18. Jahrhunderts produzierte diese auf ca. 600 Webstühlen und beschäftigte nahezu die Hälfte der Krefelder Einwohnerschaft. Die Absatzmärkte der Weltfirma lagen in Europa, im Orient und in Amerika. Mögliche Konkurrenten wurden unter Einschaltung der Behörden unterdrückt und hatten zunächst kaum eine Chance sich zu behaupten. Da Friedrich und Heinrich von der Leyen kinderlos waren, nahmen sie ihre Neffen Conrad, Friedrich und Johann – Söhne ihres Bruders Peter – in das Unternehmen auf.

Im Jahr 1702 war Krefeld preußisch geworden. Der preußische König Friedrich II. besuchte Krefeld zweimal, 1751 und 1763. Er war sehr an den weltweit agierenden Seidenmanufakturen interessiert und war in gutem Kontakt mit der Familie von der Leyen, die er in wirtschaftlichen Angelegenheiten um Rat zu fragen pflegte.

Auf seiner Durchreise 1751 weilte Friedrich II. nur wenige Stunden bei den von der Leyen. Dennoch nutzten diese die Gelegenheit, auf die unbefriedigende Situation im Postverkehr hinzuweisen und erreichten damit, dass die Postkutsche Köln – Kleve ab 1755 einen Umweg mit Zwischenstation in der Krefelder Innenstadt machte. 1763 blieb der König zwei Tage in der Stadt und wurde im „Haus in den Ketten" Ecke Rheinstraße/Friedrichstraße von der Familie von der Leyen beherbergt. Friedrich II. war sehr von den Seidenfabrikanten eingenommen und verlieh ihnen im Jahr 1766 Monopolrechte für die Seidenproduktion.

Zudem verbot Friedrich II. im Jahr 1781 die Anwerbung von Soldaten in Krefeld und den umliegenden Landkreisen, damit der blühenden Seidenindustrie genügend Arbeitskräfte zur Verfügung standen. Als Begründung soll der Preußen-König seinerzeit gesagt haben: „Es gibt Solche und Solche und Krefelder...!" Zwischen 1787 und 1789 wurden schließlich Conrad, Friedrich und Johann von der Leyen vom König in den Adelsstand erhoben.

Weitere mennonitische Seidenfabrikanten

Anders als seine Brüder Peter, Friedrich und Heinrich verzichtete Johann von der Leyen darauf, in seinem Geschäftsbereich, der Herstellung von Samtwaren und Seidenbändern, Maßnahmen gegen Konkurrenzfirmen zu ergreifen. Er ging Kooperationen mit Angehörigen aus dem weiteren verwandtschaftlichen Umfeld ein, wobei seine Geschäftspartner mehrfach wechselten. Schließlich holte Johann von der Leyen seine angeheirateten Neffen Cornelius und Johann Floh als Teilhaber in seine Kompanie. Diese Verbindung hielt bis zu Johann von der Leyens Tod im Jahr 1764. Danach führten Cornelius und Johann Floh die Firma zunächst allein weiter. Trotz aller Bemühungen schafften sie es nicht, gegen den Willen der Brüder von der Leyen ihre Seidenwarenfabrikation auszudehnen und zogen sich auf ihr Kerngeschäft zurück. Die Nachfolge war gesichert, als 1777 Cornelius Flohs Sohn Gottschalk in die Kompanie eintrat und 1786 Isaak de Greiff, der mit Cornelius' Tochter Anna verheiratet war.

Um 1750 gründeten der Leinenhändler Gerhard Lingen und Peter Orts, ein ehemaliger Kontorist Johann von der Leyens, die Firma Gerhard Lingen & Co., die zunächst Samte und Samtbänder herstellte und später die Fabrikation von seidenen Tüchern aufnahm. Da Gerhard Lingen keine männlichen Erben hatte, holte er seine Stiefenkel Jakob, Gerhard und Heinrich von Beckerath in die Kompanie. Lingen & Co. hatte einen sehr schweren Stand gegen die übermächtige Konkurrenz, und so wurde im Jahr 1807, zwei Jahre nach dem Tod Gerhard von Beckeraths, beschlossen, die Firma aufzulösen. Die Kinder der Firmeninhaber agierten von nun an getrennt.

Die Söhne Heinrich von Beckeraths, Heinrich und Gerhard, wuchsen auf Schloss Cracau auf. 1811 gründeten die Brüder eine Firma, die sie ausgehend von einer auf Cracau bestehenden Seidenfärberei zu einem soliden, dauerhaften Unternehmen ausbauten. Daneben betrieben sie einen Seidenverlag. Heinrich von Beckerath war durch die Heirat mit Margarethe Rahr, Tochter von Johannes und Elisabeth Rahr, in den Besitz von Cracau gelangt. Schon der Vater von Johannes Rahr trat als Pächter von Cracau auf und betrieb dort eine Essigfabrik. Nach dem Tod seines Schwiegervaters setzte sich Heinrich von Beckerath dafür ein, dass seine Schwiegermutter das Schlossgelände käuflich erwerben konnte. 1779 wurde der Vertrag mit der Unterschrift von König Friedrich II. besiegelt.

A2.1.12 History of Textile Dyes and Colouring / Zur Geschichte der Textilfarbstoffe und der Farbgebung

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English translation: Cynthia Beisswenger, HdS.

<u>A2.1.12.1 English</u>

Fragments of fabrics found during excavations indicate that as long as 8000 years ago textiles were being dyed with natural dyes. The use of dyes such a madder and indigo could definitely be proved in textiles dating back around 3000 years. The limited amount of knowledge about dyeing methods used in ancient times is based primarily on grave finds and chronicles kept by Greek and Roman writers and their technological descriptions.

In the Mediterranean, region madder was the most important red dye in antiquity and an important trading item between Asia and Europe. In the Orient extremely complicated procedures for madder dyeing using special oils were well established (Turkey red oil), with these it was possible to achieve a very vivid intensive red. Amongst other things the traditional Turkish headwear, the “Fes” was dyed in this way. In the Middle Ages madder found its way over the Alps, probably brought by Benedictine monks. Madder was then grown in larger areas in the Netherlands and in France, especially in Alsace (Hagenauer madder). The particular red tones in Alsatian traditional costumes could only be produced using madder. Also in Speyer the locally extracted madder dye “Speyer Red" was well-known. Madder retained its significance until 1869 when the structure and synthesis of alizarin, the main component of madder was determined

One of the most intensive red colorants produced by nature is crimson. The original inhabitants of South America obtained this from female cochineal coccids which were bred on prickly pear cactuses on a large scale. In the 16th century, the Spanish colonialists took over the production and exported the valuable dye to Europe. Their genuine cochineal was still unknown until then. In Europe a different type of coccid, the Kermes coccid had served as the source for a chemically similar dye to crimson since antiquity. This was replaced by cochineal over time due to its inferior colour intensity. Until 1952 the scarlet red cloth for the British officers' uniforms was coloured with cochineal.

Safflower occupies a very special position. The plant contains both a red and a yellow pigment. The ancient Egyptians already used Safflower red to dye the linen bindings in which they wrapped their mummies.

Amongst the ancient pigments for shades of yellow there are two which were also very popular as spices, saffron and curcuma. The first evidence for the use of dyer's rocket was found in Roman times. Prior to the discovery of America, dyer's rocket was one of the most important sources of yellow pigment in Europe. Dyer's rocket was cultivated primarily in England, France and Germany, in particular in Thuringia and the region around Halle. At the beginning of the 20th century, dyer's rocket was only used to dye silk.

In antiquity plants, which contained the colourless pre-products for the pigment indigo were virtually the only pigment source for shades of blue. The indigo bush, a tropical butterfly bush belonging to the legume family, originated from India and Eastern Asia but was already cultivated in Egypt 2500 years before Christ. In Europe indigo was very rare until the 12th century and was imported from India via Syria and Alexandria. It was not until the 16th century that it was imported in large quantities by the Dutch from the East Indies and replaced the indigo which had been extracted from woad up to then.

Important European centres for the cultivation of woad were in France and Thuringia. The process needed to extract the pigment from woad was very arduous and time-consuming. The foliar rosettes of the dug-up woad plants were washed and spread out in the meadows to wither and subsequently crushed to a pulp in a woad mill. This pulp was then formed into fist-sized balls of woad, dried and subsequently sold to merchants at the woad market. The merchants then had this pre-product processed further. The balls of woad were broken up and moistened with water and urine. During the fermentation process which then started, the colourless indigo pre-stage was converted into a soluble product. Indigo was obtained as a result of oxidation with the oxygen from the air.

Once Baeyer had succeeded in synthesing indigo in 1870 and Heumann had developed a viable technical process for industrial manufacture in 1897, natural indigo gradually disappeared from the market.

The most expensive pigment and consequently the status symbol of "high society" in antiquity was the genuine purpure. This was already used as a dye by the Phoenicians. Purpure was extracted from the gland secretion of a specific sea snail. To do this the gland corpus was removed from the breathing cavity of the snails, crushed, placed in salt for three days, then boiled for ten days. The fabric to be dyed was dipped into the fluid which was still colourless and then spread out outside to dry. The colour was achieved through the influence of sunlight.

Thousands of purpure snails had to sacrifice their lives in order to be able to dye 1 kilogramme of wool. In 1910, the chemist Paul Friedländer proved that purpure is in fact the chemical compound Di-brom-indigo.

Following the discovery of the New World, dyewood that is to say those types of wood, which contain the pigments used for dyeing, gained significance in Europe. These include logwood, redwood and yellowwood (dyer's mulberry tree). To obtain the pigments the wood was grated or ground in a pigment mill and stored in the dark, frequently sprinkled with water and sporadically rearranged for a period of several weeks. The dyewoods which had been fermented in this way were decocted and the dyes isolated from the extracts.

The history of synthetic production of dyes begins in the year 1834 when Runge isolated the substance aniline as a by-product when coking hard coal. In 1856 Perkin produced the violet pigment mauveine randomly from aniline whilst he was trying to find a substance to fight malaria. In 1856 Kekulé succeeded in clarifying the structure of benzene as a basis for understanding the production of tar-based dyes. Dyes made from tar constituted the original line of business for subsequent large companies in the chemical industry.

The discovery of the first azo dyes by Grieß in the 1860s led to a turbulent development. What later became Bayer AG emerged from the trading company founded by Bayer and Weskott in 1863. In the same year the company Farbwerke Hoechst was founded and in 1865 the company Badische Anilin- und Soda-Fabrik (BASF). In Krefeld, too dye production started. Edmund ter Meer, son of the Krefeld-based silk producer Hermann ter Meer, founded a tar-based dye factory in Uerdingen in 1877 which operated under the name Uerdinger Bayer-Werk.

In the early days, the dye syntheses were more or fewer chance discoveries. It was not until later that the connections between the structure of an organic compound, the chromaticity and the reciprocal effects with certain fibres became obvious. For example, since the discovery of mauevine some 500,000 individual dyes have been synthesised but only 1% of these have come onto the market.

Nowadays the range of dyes, which have been "tailored" for certain fields of application dominate the market and have virtually replaced the natural dyes. Dyers' plants no longer play a role as far as quantity and value are concerned. They are only used in traditional cultures or very small niche sectors.

A2.1.12.2 Deutch

Bei Ausgrabungen gefundene Gewebefragmente deuten darauf hin, dass bereits vor mindestens 8000 Jahren Textilien mit Naturfarbstoffen gefärbt wurden. Auf etwa 3000 Jahre alten Textilien konnte dann konkret die Verwendung von Färbemitteln wie Krapp und Indigo nachgewiesen werden. Die wenigen Kenntnisse über Färbemethoden des Altertums stützen sich hauptsächlich auf Gräberfunde und Aufzeichnungen griechischer und römischer Schriftsteller und deren technologische Beschreibungen.

Krapp war im Mittelmeerraum der bedeutendste antike Rotfarbstoff und ein wichtiges Handelsgut zwischen Asien und Europa. Im Orient waren extrem komplizierte Verfahrens-weisen für Krapp-Färbungen unter Verwendung spezieller Öle (Türkischrotöl) bekannt, mit denen ein sehr farbintensives Rot erzielt werden konnte. Auf diese Weise wurde unter anderem die traditionelle türkische Kopfbedeckung, der „Fes", gefärbt. Im Mittelalter gelangte Krapp, wahrscheinlich durch die Benediktiner, über die Alpen. Seitdem gab es größere Anbaugebiete in den Niederlanden und in

Frankreich, insbesondere im Elsass („Hagenauer Röte“). Die speziellen Rottöne in Elsässer Trachten konnten nur mit Krapp erzeugt werden. Aber auch Speyer war für das aus heimischem Krapp gewonnene „Speyerer Rot“ bekannt. Krapp behielt seine Bedeutung, bis 1869 die Strukturaufklärung und Synthese von Alizarin, der Hauptkomponente von Krapp, gelang.

Eines der intensivsten roten Färbemittel, das die Natur hervorgebracht hat, ist das Karminrot. Dieses wurde von den Ureinwohnern Südamerikas aus den weiblichen Cochenille-Schildläusen gewonnen, die in großem Umfang auf Feigenkakteen gezüchtet wurden. Im 16. Jahrhundert vereinnahmten die spanischen Kolonialherren die Produktion und exportierten den wertvollen Farbstoff nach Europa. Dort war die echte Cochenille bis dahin unbekannt. In Europa diente bereits seit der Antike eine andere Schildlausart, die Kermes-Schildlaus, als Quelle für einen dem Karminrot chemisch ähnlichen Farbstoff. Dieser wurde aufgrund der geringeren Farbintensität mit der Zeit durch Cochenille verdrängt. Noch bis 1952 wurde das scharlachrote Tuch für die britischen Offiziersuniformen mit Cochenille gefärbt.

Eine Sonderstellung nimmt die Färberdistel, auch Saflor genannt, ein. Die Pflanze enthält sowohl einen roten, als auch einen gelben Farbstoff. Bereits die alten Ägypter verwendeten Saflor-Rot zum Färben von Leinenbändern, mit denen sie ihre Mumien umwickelten.

Unter den antiken Färbemitteln für Gelbtöne finden sich zwei, die auch als Gewürz sehr beliebt waren, Safran und Curcuma. Die Verwendung von Färberwau ist erst für die Römerzeit bewiesen. Vor der Entdeckung Amerikas war der Färberwau in Europa einer der wichtigsten Lieferanten für gelben Farbstoff. Wau wurde vor allem in England, Frankreich und Deutschland, hier insbesondere in Thüringen und in der Region um Halle, angebaut. Zu Beginn des 20. Jahrhunderts wurde Färberwau nur noch zum Färben von Seide verwendet.

Für den Blaubereich waren in der Antike Pflanzen, die farblose Vorprodukte für den Farbstoff Indigo enthalten, die nahezu einzige Farbstoffquelle. Der Indigostrauch, ein tropischer Schmetterlingsblütler, stammt ursprünglich aus Indien und Ostasien, wurde aber bereits 2500 v. Chr. auch in Ägypten kultiviert. In Europa war Indigo bis zum 12. Jahrhundert selten und wurde über Syrien und Alexandria aus Indien importiert. Erst ab dem 16. Jahrhundert wurde er in großen Mengen von den Niederländern aus Ostindien eingeführt und verdrängte den bis dahin aus der Waidpflanze gewonnenen Indigo.

Bedeutende europäische Zentren für den Waidanbau lagen in Frankreich und in Thüringen. Die Farbstoffgewinnung aus Waid war ein mühsamer, aufwendiger Prozess. Die Blattrosetten der gestochenen Waidpflanzen wurden gewaschen, zum Welken auf Wiesen ausgebreitet und anschließend in der Waidmühle zu Mus zerquetscht. Hieraus wurden faustgroße Waidballen geformt und nach dem Trocknen auf dem Waidmarkt an Händler veräußert. Diese ließen das Halbprodukt weiterverarbeiten. Die Bällchen wurden auf den Waidböden zerschlagen und mit Wasser sowie Urin angefeuchtet. Während der sodann einsetzenden Gärung erfolgte die Überführung der farblosen Indigo-Vorstufe in ein lösliches Produkt. Durch Oxidation mit Luftsauerstoff wurde hieraus der Indigo gewonnen.

Nachdem Baeyer 1870 eine Synthese für Indigo gelungen war und Heumann 1897 hieraus ein wirtschaftliches technisches Verfahren für die industrielle Darstellung entwickelt hatte, verschwand der natürliche Indigo allmählich vom Markt.

Der teuerste Farbstoff und damit das Statussymbol der antiken „high society“ war der echte Purpur. Dieser wurde bereits von den Phöniziern zum Färben eingesetzt. Purpur wurde aus dem Sekret einer Drüse bestimmter Meeresschnecken gewonnen. Hierfür wurden die Drüsenkörper aus den Atemhöhlen der Schnecken entfernt, zerquetscht, drei Tage in Salz eingelegt und zehn Tage gekocht. Der zu färbende Stoff wurde in die noch farblose Flüssigkeit eingetaucht und zum Trocknen im Freien ausgelegt. Durch Einwirkung von Sonnenlicht bildete sich die Farbe.

Tausende Purpurschnecken mussten ihr Leben lassen, um 1 kg Wolle färben zu können. Im Jahr 1910 wies der Chemiker Paul Friedländer nach, dass es sich bei Purpur um die chemische Verbindung Di-brom-indigo handelt.

Mit der Entdeckung der Neuen Welt gewannen Farbhölzer, d. h. Holzarten, die zum Färben verwendbare Farbstoffe enthalten, auch in Europa an Bedeutung. Dazu gehören Blauholz (Blauholz- oder Blutholzbaum), Rotholz und Gelbholz („Färbermaulbeerbaum“). Zur Gewinnung der Farbstoffe wurden die Hölzer auf Farbholzmühlen geraspelt oder gemahlen und im Dunklen unter häufigem Benetzen mit Wasser und zeitweiligem Umschichten über mehrere Wochen gelagert. Die so fermentierten Farbhölzer wurden ausgekocht und die Farbstoffe aus den Extrakten isoliert.

Die Geschichte der synthetischen Herstellung von Farbstoffen beginnt, nachdem Runge im Jahr 1834 aus Steinkohlenteer, der bei der Verkokung von Steinkohle als Nebenprodukt anfällt, die Substanz Anilin isoliert hatte. 1856 stellte Perkin den violetten Farbstoff Mauvein als Zufallsprodukt aus Anilin her, als er auf der Suche für ein Mittel gegen Malaria war. Im Jahr 1865 gelang Kekulé die Strukturaufklärung des Benzols als Grundlage für das Verständnis der Teerfarbenproduktion. Farbstoffe aus Teer waren der ursprüngliche Geschäftszweig für spätere Großunternehmen der Chemiebranche.

Nach der Entdeckung der ersten Azofarbstoffe durch Grieß in den 1860er Jahren setzte eine stürmische Entwicklung ein. Aus der im Jahr 1863 von Bayer und Weskott gegründeten Handelsgesellschaft für Farbstoffe ging die spätere Bayer AG hervor. Im gleichen Jahr wurden die Farbwerke Hoechst gegründet und 1865 die Badische Anilin- und Soda-Fabrik (BASF). Auch in Krefeld wurde mit der Herstellung von Farbstoffen begonnen. Edmund ter Meer, Sohn des Krefelder Seidenfabrikanten Hermann ter Meer, gründete 1877 in Uerdingen eine Teerfarbenfabrik, die später als Uerdinger Bayer-Werk firmierte.

In der Anfangszeit waren die Farbstoffsynthesen mehr oder weniger Zufallsentdeckungen. Erst nach und nach wurden die Zusammenhänge zwischen der Struktur einer organischen Verbindung, der Farbigkeit und den Wechselwirkungen mit bestimmten Fasern deutlich. So wurden seit der Entdeckung des Mauveins etwa 500.000 Farbstoffindividuen synthetisiert, von denen nur 1 % in den Handel kam.

Heute beherrschen Farbstoffsortimente, die für bestimmte Anwendungsgebiete „nach Maß geschneidert“ wurden, den Markt und haben die Naturfarbstoffe weitgehend verdrängt.

Färberpflanzen spielen mengen- und wertmäßig keine Rolle mehr und werden lediglich in traditionellen Kulturen oder in sehr kleinen Nischen angewandt.

A2.2 Mastic pilot

The **catalogue of the Chios Mastic Museum** was developed by Anna Kallinikidou for PIOP:

This Guide is based on the contents of the research programme that was undertaken for the creation of the museum, the proceedings of the three-day Working Group on mastic, which was organised by the Piraeus Bank Group Cultural Foundation, as well as on the academic literature.

Introduction

In our days, the cultivation of mastic is fully thriving on Chios, a fact that strikes even the most unsuspecting visitor. As one approaches the Mastichochoria region, where the land gets more and more rugged, stone terraces become more prominent, and gradually trees with a white film around their roots begin to dot the landscape. They are the skinos trees that produce gum mastic.

The Chios Mastic Museum is located in the Mastichochoria region in the south of Chios. It is only in this part of the Mediterranean region that the skinos plant (Pistacia lentiscus Chia) is cultivated, and from the ”tears” of its resin comes the gum mastic that is consumed all over the world!

Gum mastic production is based on an arduous cultivation practice; the skinos “tears” are the bearers of the toils of the cultivators. The tree that sheds tears has an age-long history and resilience, just as the people who care for it.

At the same time, gum mastic is an invaluable natural product around which a significant economic activity has been developing for centuries. The benefits from the exploitation of gum mastic and the regulations that govern it have shaped the cultural landscape of southern Chios.

The Chios Mastic Museum belongs to the Network of thematic Museums of technology created by the Piraeus Bank Group Cultural Foundation that is also responsible for its operation. The Museum is housed in a building that was designed exclusively for this purpose on land that was ceded by the Chios Gum Mastic Growers Association near the village of Pyrgi, at Rachi site (Tepeki). The founding and operation of the Museum was also supported by the Ministries of Economy, Development and Tourism, Culture and Sports, as well as the Municipality of Chios. The project of the Museum was funded by the Operational Programme “Competitiveness and Entrepreneurship” (NSRF 2007-2013, co-funded by ERDF), the Operational programme” Competitiveness, Entrepreneurship and Innovation 2014-2020” and Piraeus Bank.

The museum complex is harmoniously embedded in the surrounding landscape. The spaces that are necessary for the operation of the museum are distributed in two wings. The upper wing houses all the introductory and auxiliary functions, such as the ticket booth, the multi-purpose hall (“Skinos” hall), the hall of educational programmes (“Kentitiri” hall), the Mastiha café, the Museum Shop, as well as the other ancillary spaces.

The lower wing houses the permanent exhibition. According to needs dictated by the exhibition content, spaces acquire various configurations (field, settlement, offices, factory), there are points,offering a panoramic view of the scenery and open access to the natural landscape outside. Finally, visitors are led to the open-air exhibition, which has been also developed, with the use of pathways and proper audio-visual material, as an itinerary through the mastic field; thus, they become acquainted with the special characteristics of mastic cultivation and the agricultural landscape of southern Chios.

The permanent exhibition

The permanent exhibition centres on the Chios gum mastic as a unique natural product that is produced exclusively in southern Chios, in the Mastichochoria region. Visitors learn about the skinos plant and gum mastic, the resin that was acknowledged as a natural medicine in 2015, and discover the traditional know-how of mastic cultivation, which was inscribed in the Representative List of the Intangible Cultural Heritage of Humanity by UNESCO in 2014. Visitors also trace the management of mastic throughout history and understand how it shaped cultural heritage in the agricultural and inhabited landscape of southern Chios. They are informed about the function of the cooperatives and the processing of mastic in modern times, which constitutes a significant chapter in the production history of Chios, as well as the uses of mastic today throughout the world. Finally, they come into contact with the plant itself and the natural landscape in which it thrives.

The timelessness and sustainability of mastic cultivation are emphasized through the juxtaposition of contemporary images with archival photographic material, sharply differing in size as well. The arduous journey of mastic is reflected in the toil of mastic growers and workers who are the main protagonists in the audio-visual productions. Their testimonies as well as all the objects in the permanent collection (traditional clothing, tools, and equipment) safeguard the memories of the past. Multimedia applications highlight the landscape of mastic and built spaces as they developed in time, while models provide the necessary information to understand the uses of space. Original machines from the old factories are set in operation in order to revive an important cog in the machine of Greek production history.

Sculptures in the form of human figures stand in various spots at the terraced grounds of the open-air exhibition and discreetly comment on the long-lasting relationship between man and nature in the Mastichochoria region. They all symbolize a world that is hard, measured and dynamic, but above all human-centred, just as the world of mastic.

Unit A. Introduction

The introduction emphasizes the paradox surrounding mastic. Despite the fact that the skinos plant is a characteristic feature of the maquis vegetation in countries of the Mediterranean, only in the south of Chios is the plant cultivated systematically in order to produce mastic, thanks to methodical eugenics, standardised commercial exploitation and the particular climatic conditions.

A song about the skinos plant is heard in the room. At the open exhibition case, we can touch the sweepings (skinos leaves, soil and mastic), which is the form in which mastic is gathered at the field. The mastic grower’s toil is reflected in the verses sung by Mrs. Marianthi Almyroudi, recorded in

2015 at Mesta village. The smell of mastic becomes stronger. A map shows the 24 villages in the south of Chios where gum mastic is produced; accordingly, they are known as the Mastichochoria (the mastic villages). Written sources serve as proof that mastic is produced only in Southern Chios.

The Mastichochoria in southern Chios

These villages were created in the Middle Ages, in order to organise systematically the production and exploitation of natural gum mastic. They were built on sites that were not visible from the sea, and they were enclosed by outside walls in order to ensure protection from invaders as well as to confine and control the population. From the very beginning, the administrative and social unit that each settlement constituted had acquired a special significance. Thus, every village configured and maintained its particular characteristics thanks to which it was distinguished from the others: dialect, customs, clothing, even the various subspecies of the skinos plant.

Today there are 24 mastic villages in southern Chios: Agios Georgios Sykousis, Armolia, Vavyloi, Vessa, Vouno, Elata, Exo Didyma, Tholopotami, Thymiana, Kalamoti, Kallimasia, Katarraktis, Koini, Lithi, Mesa Didyma, Mesta, Myrmigi, Nenita, Neochori, Olympoi, Pagida, Patrika, Pyrgi and Flatsia. The villages that were not destroyed during the earthquake of 1881 retain most of their original features.

The paradox of mastic

The Chios mastic had been a recognizable product even from the time of Antiquity when it already had acknowledged uses and specific qualities. Oribasius, a physician who lived in the 4th century A.D., reported: Resin is produced from skinos, also called skinini, and becomes mastic; the best and most plentiful is to be found on Chios Island. Around 600 references to gum mastic and its byproducts can be located in the works of at least 50 Greek and Latin authors in ancient times.

In our times, the unique qualities of this resin are attributed to the following factors: a. methodical application of eugenics; b. systematized commercial exploitation; c. the climate of southern Chios. The tall wooded mountains in the northern part of the island contain humidity and weaken the northern winds, thus granting the hilly part of southern Chios a very special climate with mild winters and very dry summers. Often it rains throughout the island, except in the region of Mastichochoria; dry and hot summers at Mastichochoria allow gum mastic to dry. If the mastic gets wet before “maturing”, it is ruined.

Skinos growers on Chios used to distinguish the trees that gave the most and better quality resin. They would cultivate those and propagate them in order to create new plantations with skinos trees that retained the qualities of their ancestors. As centuries passed, methodical application of eugenics created a new kind of skinos tree that was much more productive in terms of the amount of mastic that could be acquired from it, and this variety became known as Pistacia lentiscus var. Chia (mastic tree). Today, though, scientists gradually understand that this variety was the product of systematic cultivation (Pistacia lentiscus cul. Chia).

Through a trade network that was quite extended, gum mastic moved to the centre of a systematized framework of commercial exploitation and was considered an expensive and valuable product that dominated the market thanks to the variety of its uses and applications. The commercial significance of gum mastic is also reflected in the Price Edict promulgated in 301 by Emperor Diocletian, in order to determine a price cap for goods and services. The Edict was posted in marketplaces of various cities and listed the goods and services chosen by each city according to its particular commercial needs. The Chios mastic is mentioned in excerpts from the Edict that were found in southwestern Anatolia (Aphrodisias of Karia) and in the Peloponnese (Tegea and Troizina). The trading of mastic as a commercial product on both sides of the Aegean confirms that this was a product that circulated in short-distance as well as long-distance trade. In addition, records taken from these excerpts reveal that the Chios mastic maintained its high price per libra: one libra of mastic (327.45 grams) costs 175 dinars, when the same amount of incense, for example, costs 150 dinars, while a libra of pork meat or beef costs 12 and 8 dinars, respectively.

Unit B. Skinos and gum mastic

The exhibition unit "Skinos and gum mastic" presents the characteristics of the plant (skinos) and the qualities of its resin (mastic). The unit develops in visual dialogue with the skinos plantation outside, so as to highlight the form of the plant and its relation to the rest of the plantation. The lightbox showcases the scientific information about the physiology of the plant and the chemical properties of the resin, thanks to which gum mastic was acknowledged as natural medicine.

<u>What is skinos?</u>

The skinos plant, also known as the mastic tree, is an evergreen shrub. It is a resilient plant, which thrives, in the arid, stony, dry and poor soil of southern Chios, where the male plants are cultivated. A strong variety of the plant is propagated, as new plants are created when the growers plant branches or grafts.

The mastic tree has a lifespan of more than a hundred years. It grows slowly and starts to produce resin five to seven years after planting. From the age of fifteen and until its fiftieth year, the plant gives its peak production of mastic, which decreases considerably after the seventieth year. The average yearly production per tree is 150-180 grams of mastic. Rarely, a single tree produces up to 2 kilograms.

Because the mastic tree needs adequate air circulation, the skinos trees are planted in lines at a distance of 3 to 5 metres from each other, and in rows at a distance of 2 to 3 metres from each other. Because mastic also needs shade, the foliage of the tree becomes shaped like an umbrella providing ample shade for branches and the area around the trunk of the tree. The tree is pruned in such a way that the branches start out from a low point and develop parallel to the ground, if possible, so that the resin tear may flow on shady and clean soil.

<u>Family and genus</u>

The oldest surviving testimony that confirms the existence of the skinos plant (Pistacia lentiscus) has been found at the site of the volcano on Santorini Island, where fossilized leaves of the plant dating from 50,000 to 60,000 years ago have been found enclosed within the walls of the caldera.

The plant Pistacia Lentiscus var. Chia belongs to the Anacardaceae family. It is related to species such as the pistachio tree (Pistacia vera) and terebinth (Pistacia terebinthus).

Today the mastic trees are characterized by a variety of subspecies that often differ from village to village. The differentiation is more prominent in the foliage and the height of the shrub, while the amount of resin produced may also vary.

What is gum mastic?

The natural gum mastic of Chios is a resin. More than 70 of its ingredients have been identified. It consists of 3% essential oil, 25% natural polymer, and 72% total extract. Subcomponents of this resin have antimicrobial, anti-inflammatory, and anti-oxidant properties as well as beneficial activities against diabetes.

Over time, gum mastic has been used in the following ways: a) as an ingredient of chrism, as incense and as a colour stabilizer in a religious painting of icons; b) as a chemical component of varnish for musical instruments and furniture, benzol, linseed oil, in the mix used as stabilizer and glue for glass and precious stones; c) as an aromatic substance in the production of wine and raki, as a condiment in the preparation of sweets and pastries; d) as an ingredient of soaps, creams, sunscreen; e) as an ingredient in products for the cleaning of teeth, for the protection from dental diseases, for clean breath, for periodontal perfusion, to stop toothache, as a stabilizer for teeth, in toothpicks; f) in medicinal uses for the digestive tract, the strengthening of cardiac function, to combat coughing, to regulate hair growth, to combat skin diseases and infections, to disinfect and to ensure asepsis.

Natural medicine

Pedanius Dioscorides, from Anazarbus, Cilicia, in Asia Minor, in his five-volume pharmacological manual titled Περὶ ὕλης ἰατρικῆς, also known as De Materia Medica (About Medical Material), dating from 77 A.D., records the basic information about mastic, apparently adopted by later medical writers as well.

In our days, scientific research gradually confirms the beneficial properties and uses of mastic in medicine. In 2015, the European Medicines Agency (E.M.A.) classified mastic as a traditional herbal medicinal product in two therapeutic indications: mild dyspeptic disorders, and treatment of minor inflammations of the skin and as an aid in the healing of a minor wound.

The ingredients of mastic that have proven therapeutic action are the following: moronic acid (antimicrobial activity), oleanonic acid (anti-inflammatory activity, against diabetes) as well as the isomasticadeniolic acid and masticadenionic acid (anti-oxidant properties, active against diabetes).

Unit C. Cultivation

The exhibition unit titled “Cultivation” describes the various stages in the cultivation of the skinos plant and the production of mastic. Mastic farming is an arduous toil. The expertise of cultivation techniques is transmitted from generation to generation, further developing the know-how from the past. Local society centres on the production cycle of mastic, as the role of the mastic grower, continues to carry the full weight until our times.

Mastic growers care for the tree, prepare the soil (arrange the so-called “table”, i.e. the ground around the trunk, and add sifted white soil), they make incisions on the trunk and the branches of the tree (i.e. they embroider it, to get the tears). A few days later, the mastic resin has started to flow, and then growers begin to collect the mastic drops. When the weather gets colder, the women start working on the mastic in the village. They sift it, they soak it, they clean it and they deliver it to the Chios Gum Mastic Growers Association. Today this traditional process has been inscribed by UNESCO on the Representative List of the Intangible Cultural Heritage of Humanity.

This exhibition unit is divided into three sub-units: a) work in the field, b) work in the village, and c) mastic: intangible cultural heritage. Various objects (tools, clothing, equipment, and furniture), texts and oral history, audio-visual productions and photographic material add to the contents of this exhibition unit.

<u>Mastic cultivation in the annual cycle of agriculture</u>

Despite its uniqueness and commercial value, mastic cultivation and production is unable to provide adequate financial resources for the subsistence of the local population. For this purpose, the traditional family unit on Chios Island continues to cultivate olives, grains, figs, vine, vegetables and legumes, and also develops bee-keeping, cattle breeding and fishing.

Nevertheless, mastic cultivation is the most arduous and tiring of them all. The skinos plant demands continuous care throughout the year. Indeed, during the harvesting and the cleaning of mastic, everyone works, man and women, children, adults and the elderly, as well. Yet, because agricultural work, in general, is plenty, mainly the female population is employed in the cultivation of mastic.

Care for mastic trees starts in winter and ends in spring. Resin is produced in summer and during the first months of autumn. From October until early spring, the mastic drops are cleaned in the households. During this long period, mastic cultivation is the dominant element of daily life.

<u>The Skinos Plantation</u>

In the past, the skinos plant used to be cultivated at a distance from the villages, at the edges of hills and generally in the aridest and most hilly terrain. Vegetables, grains, and legumes were cultivated in the areas nearest to the villages, while the olives, the carob trees, and the various fruit trees were located further afar.

The skinos plantations, or mastic fields, have a particular morphology. The soil is arranged in terraces divided by dry-stone walls built with stones that are revealed during the clearing of land. Often, a small stone cabin is built in the field, as temporary housing for the family during mastic cultivation. There are also auxiliary buildings such as warehouses, stables, and water tanks for animals.

The Chios Mastic Museum is located in an original skinos plantation with its auxiliary buildings, the stable, and the water tank.

<u>Work in the field</u>

Planting and care for skinos:

In winter the young skinos plants are planted, after being generated out of the branches of old trees (grafts) that are the best mastic trees in the possession of a grower. Old plantations are renewed through stolons or suckers. According to tradition, the best timespan for planting starts on the next day of Saint John’s feast (8 January) and lasts until mid-February. Usually, the new plants are not watered, but they are covered with a wide stone at the point where the graft is planted, so that it will be kept cool and protected from sunlight.

During the same period, from January to February, the skinos tree is pruned and cleaned from all the dry branches, so that it may strengthen. Thus, the field is aerated and resin dries quicker on the tree trunk. In March and April, growers till the field around the skinos trees, to revitalise the soil and remove any pests. In autumn, some growers sow beans as natural fertilisers, which they cover with soil during the flowering period.

Preparing the soil under the skinos tree:

In early summer, the ground around the trunk of the skinos plant is levelled with the use of a tool called amia and cleaned thoroughly with makeshift brooms, so that the “table” is formed, the circular space around the trunk on the ground where the mastic drops are about to fall.

White soil, incisions:

This smoothened ground is then covered with white soil, so that the mastic drops that fall will be solidified, polished, and easily collected. Along with the application of white soil comes the first stage of embroidering, called riniasma. The growers make a few incisions at a low point on the trunk, “so that the tree remembers to give mastic”, as the locals say.

Embroidering:

In August and September, the growers “embroider”. This is the process of scratching the bark of skinos on the trunk and the thick branches, which is made with care and dexterity, so as not to hurt the trunk of the tree in great depth. The incisions are shallow, no deeper than 5 millimetres, and no longer than 15 millimetres.

Usually the embroidering is done in two cycles two and three times a week on the same skinos tree, around a hundred incisions depending on the age and size of the tree, starting from a high point and proceeding lower, with more and thicker incisions around the trunk. After each embroidering session, the tears are left to dry.

Collecting mastic:

From mid-August till after mid-September growers collect the mastic drops. They are gathered very early in the morning dew because gum mastic tends to soften with heat. If it rains in August or early September, mastic production is destroyed.

The first stage of harvesting takes place in the last days of August, around two weeks after the first incisions, with mastic having dried for at least two weeks. Then the growers collect only the thick pieces of resin, which they call “pita”. Yet harvesting essentially begins on the feast of the (14 September), and continues throughout the month. In the end, the growers clean the “table” in order to gather even the tiniest drop of mastic and they sift in order to leave out the white soil. Mastic is gathered unsifted and uncleaned in the basement of the house in wooden chests, which growers cover with white soil, so that it may not clot.

“Kokoloi”:

“Mastic doesn’t disappoint anyone, “people say because the skinos plant produces even small amounts of resin throughout the year, and there’s always some mastic left, even after the most thorough harvesting. From October to March, it is time for the kokoloi, the collection of the few tiny grains of mastic left on the trees. It is said that in the past this was a task for the poorer cultivators in the area.

Work in the village

Sifting:

During the collection of mastic and until November, it is stored in households, spread out so that it may stay cool and thus solidify. The sifting with the use of sieves called “dromonia” serves to remove the leaves, stones, and twigs. Mastic pieces are sieved according to their sizes, with the use of sieves in four degrees of thickness, like the ones used for grains. Thus, repeating three to five times, the growers initially separate the mastic pieces according to qualities. The “tahtarisma”, the sifting that separates the fine pieces and the mastic in powder form from any impurities, is usually carried out by women and requires a special knack and experience.

Washing:

The traditional practices that are used for the cleaning of mastic are identical in all the villages of Chios. When the weather gets cold, the women clean the mastic pieces in front of the houses, in courtyards or in the street. They wash mastic in water with white soil, leave it to soak for a day, and then drain it. In this way, dust and remains of stones are removed, and yellow resin is separated from the white one. Then they clean the mastic pieces with soap and rinse them. Wet mastic pieces are spread out on white sheets, on the floor, on rooftops, even in the street, so that they may dry and remain clean.

Perhaps the only difference is the washing of mastic in the sea, which is practiced during the last decades by those who live close distance to the seashore and those who have the means to transport the sacks filled with mastic.

Cleaning:

From autumn till early spring growers clean their mastic. Women, working in groups, “pinch “it in order to remove any impurities that might remain stuck on granules of mastic.

Mastic for sale:

Even though life for the people in southern Chios is inextricably linked to skinos cultivation and the collection of mastic, they were not used to consuming their product. For them, it was just something for sale.

Mastic: intangible cultural heritage

In 2014, the know-how of mastic growing in Chios was inscribed by UNESCO on the Representative List of the Intangible Cultural Heritage of Humanity. Accordingly, the simple tools of labour, constructed based on local knowledge, are gathered from the ground in order to document the intangible cultural heritage of humanity.

Intangible Cultural Heritage is defined as the sum of practices, representations, expressions, knowledge and techniques, as well as the tools, objects, artefacts and the cultural places related to them, which are acknowledged as part of their cultural heritage by communities, groups and at some cases individuals themselves.

Unit D. Management

The exhibition unit titled "Management" presents the way in which the exploitation and management of mastic for centuries shaped the landscape of southern Chios. From the troubled times during which Chios was part of the Byzantine Empire until the island became part of the Modern Greek State, first the Genoese and then the Ottoman rulers systematized the management and exploitation of gum mastic. Based on this order, the agricultural landscape evolved, the various settlements were created, the houses were built to a specific architecture, and the social life of mastic growers was adapted to it as well. Mastic growers represented a special category of serfs for the Genoese, bound by the duty to produce mastic. Until 1400, provisions for organised mastic cultivation had led to the fortification of the settlements. In the time of Ottoman rule, gum mastic production ensured various privileges to mastic cultivators. The affluence of local communities was reflected in the dense web of settlements and the development of housing architecture.

This exhibition unit is divided into five sub-units: a) the cultural heritage of mastic, b) the architecture of the settlements, c) troubled times, d) Chios under Genoese rule, e) Chios under Ottoman rule. First, the agricultural landscape is presented, and then the inhabited one. The contents of this exhibition unit are based on photographic and archival material, models, multimedia applications, and a few objects.

Locate the various sites on Chios that are related to the management of mastic throughout history, and look for them while touring the island!

The cultural heritage of mastic

Gum mastic was systematically cultivated and commercially exploited throughout the Middle Ages. It was a significant export product enriching the economy of the island and a major source of wealth for local rulers, since mastic was famous for its medicinal effects and numerous other beneficial qualities are already known from Antiquity.

The organised management of mastic production influenced the agricultural landscape of southern Chios. It determined the locations of the skinos plantations and of the remaining cultivations. It traced the paths and roads that connected the villages and the fields. Mainly, though, it shaped the creation of villages, dictating a model of constructing settlements according to the needs and restrictions of the monopoly of mastic. Finally, mastic was also related to monuments of cultural heritage on Chios.

Today we often refer to the “culture of mastic”, meaning that dense network of historical, economic, social and cultural relations that developed around the cultivation and management of mastic. This is the main theme around which Unit D unfolds.

Patron saint of mastic trees

According to tradition, the skinos trees on Chios shed tears owing to the miracle of Saint Isidore. He was born around 230 A.D. in Alexandreia. While serving as an officer at the Roman navy in Chios he confessed his faith before admiral Numerius. He was jailed, tortured, and finally beheaded. His martyrdom during transport from Chora to Nechori, the beheading, and the tearing to pieces of his body remained indelibly in the collective memory of local society, and his memory is honoured with great glory on 14 May, as he is considered the patron saint of mastic trees. Churches and chapels dedicated to Saint Isidore can be found at the villages Neochori, Nenita, Kallimasia, Armolia, Pyrgi, Mesta, Lithi, Elata, Komi, Koini, Agios Georgios Sykousis and elsewhere on Chios.

About mastic in the Middle Ages

While Byzantine authors often wrote about various products originating from Chios, especially emphasising the extraordinary quality of the local wine, information about mastic are essentially confined to a few lexical references. One of the first medieval texts referring to the production of gum mastic is by Russian Abbott Daniel, not a figure of major significance, who stopped by Chios in the early 12th century (1106-1107) on his journey to the Holy Land: From Mytilini to Chios, where Saint Isidore is buried, it’s a distance of 100 versts [1,047 metres]. This island produces mastic, good wine, and all kinds of vegetables.

Mastic is presented as a highly esteemed product in both the Christian and the Muslim realm, as a commodity as valuable as pepper and indigo. Some travellers emphasize that, although the skinos tree grew elsewhere as well, gum mastic was produced only on Chios Island. Similarly, Arab chroniclers called Chios “the island of mastic”. The various testimonies of travellers on the issue of the centre of mastic production concur. According to them, the mastic-bearing skinos tree grew exclusively in the southern part of the island. As to the characteristics of the plant from a botanical point of view, in most cases, the travellers agreed that it was a variation of the Pistacia Lentiscus species.

The architecture of villages

Despite the fact that Chios was surely inhabited during Antiquity and the Byzantine era, there are no known architectural remains that testify to the cultivation and commerce of gum mastic during those times. For that, we have to rely only on the numerous references to mastic throughout the written sources. On the contrary, mastic cultivation is clearly reflected in the landscape during the following periods of foreign rule on the island.

The creation of settlements came about because of the policies by the Genoese company Maona for the civil reinforcing of rural areas in order to promote the organised management of mastic. Settlements were meant to house the mastic cultivators, a special category of serfs bound by the duty of mastic production. In order to reach its goals, the Maona company had created a web of commitments and duties, rigorous control and punishments. In parallel, under threat of piracy and Ottoman invasion, the villages were fortified and walled within the framework of a special programme imposed by the Giustiniani.

Under Ottoman rule, the mastic villages developed but retained their character as walled fortified settlements. Even though special privileges were accorded to the islanders in lieu of a motive to continue mastic cultivation, stifling restrictions were imposed especially during mastic harvesting, in order to contain and combat smuggling. At least during the 17th and 18th centuries, and until 1840, the possession of skinos trees and housing was tantamount to tax obligation paid in the form of gum mastic.

The organization and inhabitation of rural areas

During this long-lasting period, the skinos trees were the dominant feature of the landscape. The villages, the pathways and the rural constructions, the farm fields and the pasture grounds were all used uninterruptedly.

Every Mastichochori (mastic village) organised the agricultural space around it differently, according to the site where the village was located and the natural resources in the environs. Villages were constructed in flat lowland areas with access to water sources, located far from the sea. Usually, they were built in small valleys suitable for systematic cultivation.

Until 1400 most of the Mastichochoria had been already shaped. The gates of the walls surrounding them opened and closed at predetermined times. Villagers left in groups early in the morning and returned in groups at dusk. The tower built for defense purposes was at the centre of the village. It was the largest and tallest building, the final refuge in case of a raid by pirates. The streets linking the central square of the tower with the gates of the walled village were few and narrow. From them branched out other streets, even narrower and leading to cul-de-sacs with small houses.

In the time of Ottoman rule, thanks to the privileges given to the inhabitants of Chios, the villages became densely populated. Residences grew in size and were enriched with decorative elements. Yet, houses located in villages always functioned as units of production and processing of agricultural produce and subsistence needs. The public spaces and the workshops functioned in order to serve the needs of the community.

The creation of settlements

First, the castra were created, the square towers in the centre of fortified rectangular courtyards. The basic road network in the settlements most probably developed on the pre-existing footpaths leading to the castra. As housing gradually was built around the castra, loosely shaped settlements started to form, and their population kept growing.

Later, probably within the framework of a wider defensive plan, it was decided that settlements would be fortified with a surrounding wall equipped with round towers in the corners and with gates at the points where the wall met the basic roads. The new walls usually enclosed an area in polygonal shape, in accordance with the natural terrain and the size of the settlement at the time. Most probably the walls also enclosed undeveloped land which was built later.

The fortified settlements of the Genoese era can be divided into three main categories, according to the type of the core dwellings and the process by which they developed. The first category includes villages that developed around a tower with a fortified yard, and a wall built in the perimeter after the expansion of the settlement. The second category, quite similar to the first one, includes villages that were formed around a single tower and were walled much later. The third category includes villages that were created with a surrounding wall and a central tower from the start, also shaped based on urban planning.

During the same period, the possibility of a grave attack on fortified settlements seemed highly unlikely, since pirates were mainly interested in capturing ships and their cargo, not in storming the coastal areas. New buildings were constructed right next to the surrounding walls, transferring their loads on them and opening small windows as well.

It was in the early 19th century that people started to build houses outside the village walls. In villages such as Mesta, Pyrgi and Olympoi the phenomenon started much later, while in villages such Kalamoti, Vessa, and Elata, where the area already enclosed was too small, dwellings were already being built outside the walls much earlier.

In the time of Genoese rule, the so-called castra were created in southern Chios. The film focuses on Pyrgi and presents the rectangular tower and the rectangular walled yard with the round towers and the central gate. Inside, there are warehouses for the storage of produce. Around the tower with the walled yard the village develops, where building blocks are arranged along the natural routes. In these early days, the area is not densely populated. The film centres on the Olympoi village, with the houses being built around the central tower. The roads branch out radially in relation to the central rectangle. Then we move to the Mesta village. When habitations around the tower grow denser, a polygonal wall is built, and parts of the land are left undeveloped.

In the Ottoman era, the empty spaces between the village and the perimeter walls are filled with buildings constructed in contact with the wall, which is utilized as a house wall, and even windows are opened there. Some buildings also acquire multiple storeys, at times extending over the street.

<u>The village of Olympoi</u>

The village is located in a lowland zone. Just outside the village, limits there are orchards, and the skinos plantations are located on higher ground.

The village is walled. There are turrets at the corners of the wall. Two gates open to the two central roads of the village leading to its centre, the tower, where they converge. Houses have been built along the wall, and so there are windows on it.

The village roads are narrow and labyrinthine. The houses have two storeys by now, and often rooms extend outwards over the street. The dominant colours are those of the local rocks.

Houses at the Mastichochoria

The houses were built from stone and a binding agent. In order to construct a storey, stone or wooden beams were essential. Balance was ensured with the use of carved beams, made out of wood or metal, free-standing or embedded in walls. Even though buildings support each other, as in most cases they share sidewalls in terraced buildings, it is possible to see joint between houses, as proof of non-concurrent construction.

The buildings were usually crooked and complex in shape, as the building blocks intruded in each other. Quite often, a storey extended over the rooftop of the building next door, through an arch that created a passageway.

The interior of the house, although restricted in size, was by no means Spartan. Wooden cupboards and shelves adorned the walls, while a wooden elevation was used as a bed in the room where the whole family slept. The floor was usually covered with “astrakia”, a kind of hydraulic lime with a smooth texture, also used to cover rooftops. In a few cases, floors were covered with stone tiles, while in houses that are more recent the bedrooms have wooden floors. Sometimes we also see decorated pillars. Window frames were especially decorated, and sometimes-characteristic seats were created in front of the windows, matching the thickness of the wall.

Turbulent times

From 330 A.D., when the Eastern Roman Empire was founded, Chios became part of the trade route connecting Constantinople with Egypt and Syria.

From the 7th century, Arab pirates marauding the coasts of the island destroyed its ports. In the early 11th century, after control of the Aegean was regained, powerful Byzantine families settled in Chios. The island’s economy developed and its port attracted merchants from the West.

In the late 11th century, Latin merchants traded in Byzantine ports with the privilege of lower tariffs. Trade on Chios was controlled by the Venetians in exchange for naval protection.

Later, emperor Michail VIII Palaiologos regained control of Chios and transferred the privileges of the Venetians to the Genoese.

The Genoese gradually consolidated their dominance, and after a period of guardianship rule by the Zaccaria family, they conquered the island in 1346.

Mastic exploitation in the Byzantine era

We have nearly no knowledge regarding the organization of production and the trade of mastic on Chios during the Byzantine era. The Nea Moni (New Monastery) of Chios must have had a significant role and a central position in the production of the invaluable resin in the mid-11th century, as according to the Golden Bull of 1259 by Emperor Michail VIII Palaiologos this monastery owned agricultural land with skinos plantations in the mastic-producing region of the island.

The inclusion of Chios in those areas of the Byzantine Empire where the Venetians enjoyed privileges of tax exemption from 1082 is indicative of their early interest in the island and mastic in particular.

The financial gains to be had from the trade of gum mastic naturally interested the main rivals of the Venetians, the Genoese, as well. Another indication of the profit derived by the Byzantine state from the export of mastic is the Golden Bull of 1304 by Andronikos II Palaiologos, which exempted the Genoese from the payment of tariffs on all products except salt and mastic. Ensuring the monopoly of mastic was a great motive for the Zaccaria who sought control of the island and consolidated their primacy in its exploitation.

The Zaccaria family in Chios (1304-1329)

The Zaccaria were one of the richest and most powerful families in Genoa. Fulcone Zaccaria was a friend of Emperor Michail VIII Palaiologos, who granted Phocaea to Manuele Zaccaria, son of Fulcone, in 1267.

In 1275 his other son, Benedetto, who had been already involved in the trade of mastic since 1282, married the sister of Emperor Michail VIII Palaiologos and acquired the region of Damalas, along with the monopoly of alum, as part of the dowry. In addition, in 1288 he succeeded his brother Manuele as lord of Phocaea.

In 1304, Benedetto Zaccaria conquered Chios, Samos, Ikaria and Kos, which were marauded by pirates. Andronikos II Palaiologos granted him the island of Chios for a period of ten years, provided that the flag with the double-headed eagle would wave as until then on the island. This grant was renewed in 1314, 1319, and 1324.

Throughout his rule, Benedetto Zaccaria settled in Chios, strengthened the naval defence of the island, built the Neokastro (New Castle), respected the rights and the property of Nea Moni, organized the production and trade of mastic. Most important, though, was the fact that they liberated the serfs and established the system of apotritoi. As apotritoi, villagers could farm the land they already worked as serfs, but could also have the ownership of one third of the land. They could own half the fruit produced in the two thirds of the ruler's lands. In this way, the ruler got rich and the cultivator as well.

After Benedetto died, his son Benedict II Palaiologos succeeded him. The last of the Zaccaria family, the sons of Benedict II, Martin and Benedict III, succeeded him in 1314. In 1320, Martin exiled his brother to Damala and later solicited the support of Western rulers who acknowledged him as a monarch in 1325. As a king he imposed grave taxation and angareies (compulsory service) on the inhabitants of Chios, constantly violated the terms of the initial agreement and derived enormous profit from mastic and other resources of the island. Byzantine Emperor Andronikos III marched against him, and Chios came under Byzantine rule again in 1329.

The exploitation of mastic by the Zaccaria

The annual revenue of Chios during the time of the Zaccaria rule amounted to 120,000 gold coins. A large part of this amount is derived from the trade of gum mastic. The monopoly of this product was in the hands of the family, and they used mastic repeatedly as collateral in order to contract loans. In 1319 Martin Zaccaria acquired permission from Pope John XII to export mastic to Alexandreia, despite the fact that all Frankish trading activities in Egypt had been already banned.

Chios under Genoese rule

In 1346 the Genoese attacked Chios. They conquered the whole island quickly, except for the town of Chios, also conquered after a three-month siege. Then they attacked Phocaea, on the coast of Asia Minor, and established full control over that area as well.

The new land holdings were given to Maona, a private shipping company, for twenty years. The exploitation agreement included the monopoly of mastic, alum, salt, and tar.

Authorities in Genoa, because of constant financial constraints, never managed to buy out Chios from the Maona company. On the contrary, they were forced to renew the lease agreement eight times. In 1566, the Ottomans conquered the island and seized the possessions of Maona.

Maona

Maona was founded in 1346 as a joint-stock company to exploit areas or monopoly privileges, by 29 creditors of Genoa.

The members of the company provided the funds for a navy of 29 galleys, providing the future revenues from the areas to be conquered as collateral for the debt incurred with the government of Genoa.

Despite the success of the naval campaign, they could not repay the debt.

Thus, they began another military campaign, in Asia Minor, in order to strengthen the position of Genoa, and they conquered Chios. The treaty of 1347 granted the Maona company the rights to Chios and Phocaea for twenty years until the loan would be repaid. Genoa kept the sovereignty, judicial power and the right to buy back the shares of the creditor members.

With a new treaty in 1362, the government of Genoa accepted that the Maona company had the right to rent Chios and Phocaea for twelve years to twelve leaseholders, provided each would acquire one of twelve equal shares.

The leaseholders were organized into a new corporation called the New Maona. After 1364, they all adopted the surname Giustiniani, from the name of a famous Genoan family.

The members of the New Maona had equal participation in the liabilities, profits, and losses of the company.

The share capital comprised 1,200 shares with a nominal value of 120,000 liras, 100 of them to each member of the company. The members had the right to transfer their shares to persons outside the company.

Soon each share was divided into three parts, which were also subdivided into twenty-four parts. Thus, at the time of the Ottoman conquest of Chios, the Maona company had acquired more than 600 members.

Administrative control from Genoa

The contract of 1346 also provided for the administrative organization of Chios.

A podestà taking orders directly from the government of Genoa was appointed head of the administrative hierarchy on the island. He was appointed by the Doge among four candidates selected by the Maona company from a list compiled by the Genoese authorities. Initially, he served for one year, but after 1558, he served for a four-year term. The podestà had the right to mint coins, provided that they were in accordance with the ones already in circulation in Genoa. He had limited powers as far as fiscal management was concerned, since duties and revenues were transferred to the Maona company.

The same was held as far as public expenditure was concerned since all decisions were taken by councillors elected from among members of Maona, who also undertook the defence of the island. This Council was the central governing body of the Maona company. The number of councillors varied between 6 and 10. Among them were also two treasurers or governors of Maona. The Council also had the initiative for diplomatic contacts.

A subordinate of the podestà was the castellan of Chios, also appointed by authorities in Genoa. As second in governmental hierarchy, he was head of the castle – Genoa had retained the rights to the castle as well – and the armed forces on the island.

Finally, Genoa also selected a secretary (notarius) who was in charge of keeping ledgers and registers of the chancellery where public and private contracts were recorded. From 1408 onwards, the notarius also had an assistant.

Administrative structure by Maona

Besides the appointment of the two highest officials and their entourage, the selection of the other government officials was an affair conducted by Maona, as the company had its administrative procedures and mechanisms.

The representative body was the general assembly of shareholders. After 1350, shareholders gradually replaced the 29 initial partners, and in 1373 Genoa sold them the exploitation rights for the island of Chios. The general assembly of shareholders also determined who would hold office.

Each shareholder was selected by the drawing of lots and could serve in the governing council of the island or sell the right to the office or appoint someone else in his place. The offices were divided into 13 groups of two and were held for six months. Accordingly, each shareholder was called to hold office for a year throughout a cycle of 13 years.

The island was divided into twelve administrative districts. The northern part, Apano Merea, comprised 8 districts, while the southern part, Kato Merea, comprised 4 districts. A castellan was in charge of each district and responsible for policing and resolving the disputes between villagers, who also had the right to appeal to the judicial powers of the podestà.

Reinforcing the countryside

After the island's conquest by the Genoese, the population of Chios was less than 25,000 according to calculations. The Maona company divided the island into districts, with their centres were located in castles or villages, referred to as castra. The main settlement and administrative centre of the island was Chios town, known as Kastro, where the seat of Maona and the podestà were located as well.

The countless small villages scattered all over the countryside did not allow efficient protection of mastic production and the farmers themselves, and also hampered efficient governance on the island. Aiming to attract farmers to the countryside and to organize production in the most profitable way, the new overlords of the island applied a policy of systematic reinforcing of the countryside.

The main tool of this policy was fortification. The Genoese initially founded isolated castles at new locations or near pre-existing settlements. The central towers might have been built during the Zaccaria period, who had already fortified the island before its conquest and organization by the Giustiniani. A network of 24 watchtowers served warnings in case of any threat or attack from the sea.

Control of production

The Maona company appointed officials responsible for organizing the production, harvesting and distribution of mastic. They were free from the control of the podestà and the other officials, and they also had the right to force farmers and mastic workers to perform their duties, without any intervention by the authorities. The Maona company appointed a Secretary of mastic affairs in charge of weighing and one in charge of sales. In Chios, there was even a special neighbourhood known as Contrata Mastica, with all the offices housing the services related to mastic.

In the southern part of the island, cultivators rented a predetermined number of skinos trees from the Maona company. Even though liberated, the farmers were under the obligation to serve the Genoese overlords of the island. People who married women from mastic-producing areas were also under the same obligation. The whole workforce was registered in special books.

The farmers who cultivated skinos trees were obliged to deliver a minimum predetermined amount of mastic every year, which was weighed with the use of the pendarium as a measurement unit. If they delivered less they would pay, a fine to the administration of the island, while surplus mastic was purchased for a predetermined price.

The cultivators were also responsible for taking care of the plants and cleaning the area under and around each one of them from wild vegetation and dirt so that the collection of mastic could be conducted under the best possible circumstances. The whole production process of gum mastic essentially was the same as the one that is followed even today. The cultivators, using a pointed tool made of iron, made multiple incisions on the bark of the tree. From these, the mastic resin flowed in the shape of tears, which they gathered. Opinions differ as to the time of harvest. It is said that harvesting began during July and August, ending in September. Yet, there are testimonies that the first harvesting of the mastic resin took place in the spring months, from the successive incisions that had been done in the previous year.

According to harvest time and the processing that had taken place, there were different qualities of mastic: there was fresh gum mastic, from the current harvest, and old gum mastic, from the harvest of the previous year; there was unprocessed gum mastic, as it was gathered from the tree, and processed gum mastic, considered higher quality, as it had been cleaned from leaves, soil and dirt residue. Mastic processing included the cleaning of the resin from any impurities and smaller, inferior quality pieces, through sifting.

All the stages of the production process were controlled by specially appointed officials. The produce was then delivered to representatives of the Maona company, most probably in order to be stored in a central warehouse. After harvesting and processing, the product was packaged and sold in baskets tightly wrapped with canvas sheets. The Maona company owned vessels for the transport of gum mastic, with a capacity of 15 to 30 baskets.

Measures to defend the monopoly

In order to defend the monopoly, the Maona company took strict measures fighting theft, illegal possession and smuggling of mastic. The product was sold wholesale. Mastic officials were not allowed to sell the product to third persons, regardless of their social status. Anyone outside the acknowledged network had no right to trade the product.

Yet, illegal sales and theft were rife. In 1392, the podestà of Chios issued a new decree ordering the most rigorous punishment for transgressors. The punishment for stealing mastic varied from the payment of a fine – raised according to the amount stolen – to death by hanging.

The lightest penalty was a fine per ounce of mastic and public flogging, if the fine had not been paid within ten days, for stealing an amount of mastic less than one pound. For larger amounts, the fine was also higher, while corporal punishment was enforced when the fines were not paid within the prescribed period. Corporal punishment included public flogging, stigmatization, and even mutilation of the offenders.

In detail, fines were determined as follows: for 1 to 10 pounds of mastic stolen, mutilation of an ear; for 10 to 25 pounds of mastic stolen, stigmatization on the forehead and the cheek; for 25 to 40 pounds of mastic stolen, mutilation of the nose; for 40 to 50 pounds of mastic stolen, mutilation of nose and ear; for 50 to 80 pounds of mastic stolen, stigmatization on forehead, mutilation of the nose and one ear; for 80 to 100 pounds of mastic stolen, stigmatization on forehead, mutilation of the nose and both ears; for 100 to 200 pounds of mastic stolen, mutilation of the nose and one arm or limb or removal of one eye; in case of more than 200 pounds of mastic stolen the punishment was beheading, a non-redeemable penalty. At the same time, though, the podestà also ordered that whoever was in illegal possession of mastic, whether Westerner or Greek, member of the clergy or not, would be spared from punishment provided the product would be handed in during the following 15 days at the church of Saint Michail or any other predetermined spot.

Organized exploitation of gum mastic

The policy adopted by the Maona company concerning gum mastic aimed at increasing demand for the product and maintaining stable pricing. It also imposed restrictions on the amount of mastic that would be harvested yearly; in case of overproduction, the company ensured that the surplus would be either destroyed or stored in warehouses in order to be marketed the following year.

The constant need for liquidity led the Maona company to pre-sales of the product through auctions. According to this process, the highest bidders acquired the exclusive right to sell the product in one or more of the following three geographical zones: a) the Muslim East; b) Romany and the Turkish lands; c) the West. A predetermined amount of mastic per year at predetermined prices corresponded to each of these areas. Conceding the right to sell mastic through auctioning ensured significant revenues to the Maona company. These profits were distributed to the members according to their shares in the company, after having first deducted the management fees and the costs for the defence of Chios Island.

The largest amounts of mastic were sent to the East, where the largest markets were located in the Pera district of Constantinople, in Famagusta, in Beyrut and mostly in Damascus and Alexandreia. In the West, Genoa was the largest commercial hub for the trade of gum mastic. From there, the produce was transported to Ceuta in North Africa, to Sicily, and over the Alps to Paris, Bruges, and London. In the Italian peninsula, significant amounts of mastic were exported to Calabria, Apulia, Marche, Tuscany, and Lombardy, besides Sicily.

In the 15th century, income from the trade of mastic represented half the income of the island. The 43,750 liras brought in from the auction that took place in 1401 were more than amply sufficient to meet the administrative and defence needs of the island. In the end of that century, according to calculations by Christopher Columbus, the island's profit from the exploitation of this aromatic resin amounted to 50,000 ducats.

Yet this image of prosperity did not always correspond to the actual situation. Just as the Zaccaria had done in the past, the Maona company also had to contract loans repeatedly using the revenue from the sale of mastic as collateral, in order to meet its financial obligations towards other parties. This was especially the case after the mid-15th century, as the cash needs, under pressure from the Ottomans, became more and more acute.

During the last century of Genoese rule on Chios island, the demand for gum mastic fell, perhaps because of a change in the dietary habits, or maybe because the fad for chewing mastic gum receded over time. The decline in mastic trade cannot be attributed solely to the expansion of the Ottomans in the Aegean. Yet, it is certain that because of the dramatic decrease of revenue from the exploitation of gum mastic, the only source of income for the Maona company, Chios became easy prey for the Ottomans.

Chios under Ottoman rule

Chios became part of the Ottoman Empire in 1566. The conquest by the Ottomans was not an unexpected event, as a long preparation had already taken place since from 1512 the Maona company had imposed a tax on the Sublime Porte equalling the one paid by the Chios residents after the conquest of the island.

Aiming to continue the cultivation of mastic, Ottoman authorities imposed a new system of administration and taxation according to which significant privileges and exemptions from duties were granted to the Aga of Mastic (Emin) in return for delivering a predetermined amount of pure mastic on a regular basis. The villagers of the Mastichochoria region were exempted from compulsory services and other kinds of taxation, and they enjoyed religious freedom and self-administration.

The Massacre of 1822 destroyed the Mastichochoria region as far as the population, society and economy is concerned. The Turks were enraged at the attempted revolt on Chios Island. During four months, thousands of people were killed and arrested, as a warning to others, and some managed to escape to the West, to Thessaloniki or the Cyclades (mainly to Syros, Andros, and Naxos islands). This disaster devastated the production of mastic, which had been the pillar of the economy of the island along with other sectors of primary production. Yet, mastic cultivation revived after the inhabitants returned to the island. After 1830, favourable legislation encouraged mastic-producers to return from migration.

Reforms in the Ottoman Empire brought about through the Tanzimat led to deregulation of mastic trade and changes in the taxation of people in the Mastichochoria region. The mastic-producing villages became organized as a single administrative region (nahiye = municipality), and mastic production was taxed in monetary terms, while the compulsive sale of mastic produce to the Aga of Mastic was abolished. Gradually, though at a low pace, began the processing of gum mastic in Chios town and the trade of skinos products intensified.

In 1850, very low temperatures in winter (in the local dialect, the “kaftria”), destroyed a very large number of mastic trees. This disaster ravaged around 80% of the cultivations, and accordingly prices rocketed. In 1881 the “Chalasmos”, an earthquake with a magnitude of 6.5 degrees on the Richter scale destroyed the town of Chios and the eastern Mastichochoria region, leaving behind 3,500 dead and homeless. This catastrophe changed the structure and morphology of the settlements.

When Chios became part of the Modern Greek state in 1912, the island was decoupled from the Asia Minor mainland. Changes in taxation and the wars that followed had a grave effect on the production and revenues of mastic. The male population of the area decreased significantly because of mass recruitment during the First World War.

The short-lived occupation of Smyrna by the Greek army was the last vestige of the single economic area comprising the coast of Asia Minor and the islands.

Thus, the end of the Ottoman era in the history of mastic can be pinpointed to 1923, when the Turkish side accepted from a legal point of view the incorporation of the islands to the Greek State. The creation of nation states and economic borders between the islands and the coast disrupted mastic exports to traditional markets at the Anatolian territories of the former Ottoman Empire.

The Sublime Porte and mastic cultivators

The Porte decreed a special form of administration for the Mastichochoria region. As it had the absolute control of production, the residents of these villages were directly accountable to the Porte, thus differing in terms of administration from the other areas of the island.

The residents of the Mastichochoria region were exempt from all the taxes imposed on all the other islanders, except for the poll tax, paid only by the head of each family, and the tax in kind, mastic ”margarokokos” (first-class). This tax, imposed on the whole of the Mastichochoria region according to the production capacity of each village, was divided among the members of each community.

Residents of the Mastichochoria region had the right to appeal to the Porte when they believed that their fiscal rights and community autonomy were being violated. They also had the right to defy authorities at the community administration whenever their privileges were under threat.

Finally, the Mastichochoria villagers were exempt from additional burdens such as compulsory services, but they were under the obligation to provide beasts of burden for the transport of mastic and to ensure the protection and fortification of the southern part of the island.

The Emin of Mastic

The Lord of Mastic, or Sakız Emini, was charged with the administration of the villages and the collection of mastic tax.

Every spring, the Emin would arrive at the Mastichochoria, along with the custody in charge of counting, weighing, and sifting, in order to determine exactly the amount of mastic to be given by each village. Local officials were in charge of determining and distributing the tax to be paid among the villagers.

The office of the Emin remained until 1839. A remnant (or parody) of this ritual is to be found in the current tradition of the Aga on Clean Monday in Mesta and Olympoi.

Central powers and self-administration

Chios became a pashalik. The Ottoman governor (pasha) had under him a kahya, a kadi, a voyvoda and a customs officer. Yet villages were governed by the elected Council of Elders. At each village, power was in the hands of one or more elders, according to the size of the population. In performing their duties, these elders were assisted by commissars, abbots, guards (viglatores) and dragates (jandarmerie).

All of them were elected during a general assembly.

The vekils or commissars were inspectors or mayors at the Mastichochoria region. Usually, they were elected by the elders for one year. They served as judges in case of grievances among villagers or between villagers and strangers. They elected the appropriate "mnemonic" or notaries, to ensure that justice would be served and recorded. They were also responsible for education matters, and exams took place in their presence. They ensured that roads were in good order and that hygiene regulations were obeyed.

The elders were elected by an assembly of elders, the head priest, and the elite, in order to act as "aga" for a year. The elders were remunerated for their expenses and services from the village fund. They had the right to arrest whomever they wanted and to deliver him to be jailed.

They were elected to serve for a year and they were put in charge of all the affairs of the village, the management in general.

The commissars or re-commissars were elected to serve for a year and they were put in charge of all the affairs of the village, the management in general. The viglatores were responsible for the surveillance of the sea around Chios as well as the mainland.

Their main duty was to contain smuggling, especially that of mastic.

<u>Privileges granted</u>

The privileges granted to the residents of the Mastichochoria comprised religious freedom and the building of churches without limitations, ban on the building of mosques outside Kastro, ban on recruitment of children or violent islamisation, free choice of garments, protection of property rights, exemptions from the payment of the tithe, no taxation on housing, on orchards and vineyards, no duties on Chios products traded in ports of the Black Sea, and many more.

Until 1820, many of those privileges had begun to fade or were ignored by agents of the Ottoman Empire. The Porte would frequently "intervene" to redress grievances.

Until 1820, many of those privileges had begun to fade or were ignored by agents of the Ottoman Empire. The massacre in 1822 obliterated the privileges of Chios In 1824 the governor of Chios formally invited the islanders to return. A few years later, in parallel with the re-founding of the Council of Elders, he returned their powers and privileges, thus dividing Chios into two administrative entities: the Municipality of Chios and the Municipality of Mastichochoria. A fireman of 1832 ordered that property confiscated from Chiots be returned, exempt from the tithe, as before. With the introduction of the Tanzimat in 1840, on the basis of the principle of equality among all the subjects of the Empire, the payment of the tithe was imposed on mastic growers as well, and the system of direct taxation took effect, according to data from the property. This brought about the end to the monopoly of mastic and deregulated the market.

<u>Dress in the Mastichochoria region</u>

Thanks to these privileges, residents in the Mastichochoria region were not obliged to comply with the standards of Ottoman dress. On the contrary, they were able to safeguard the local dress that had been developed under the strong influence of the Genoese and their clothing. The short white draped foustania of Mastichochoria, the pristida of Pyrgi, the foustani me gagioma (draped dress) of Kalamoti and the foustani or konto or camisori worn at the rest of the Mastichochoria region were based on dress models from the 16th century strongly influenced by the Italian Renaissance.

Local women manufactured their dress modelled on the dress of the Chios noblewomen, yet making significant changes to the initial patterns. These changes were due to the needs of work in the field and the material used for dress, manufactured by the women themselves in the household loom: the chiotiko (cotton twill fabric). Accordingly, the long draped robes with a vertical aperture in the upper part allowed free movement of the female body during agricultural work.

In Pyrgi, the dress with podies or rasozipouna echoes the medieval male attire in rural areas. On the rest of the island, men wore the familiar island costume with breeches.

Control of the production process

When Evliya Çelebi passed through Chios in 1671, he described the skinos trees as “low trees where farmers make an incision in July; when it [mastic] dries on the soil, they gather it with care”. Later, travellers also recounted and illustrated the tools that were used and are almost the same as the ones that are still used today.

Mastic-producers who were responsible for caring for the skinos trees were not allowed to neglect their obligations. They were also obliged to deliver a certain amount of gum mastic (303 crates, according to 18th-century sources) to state authorities in lieu of tax.

The remaining amounts of gum mastic were sold inevitably to the tax collector at a trivial price. Producers could purchase mastic for their use, if they wanted, at double the price and only from the tax collector, in sealed packaging so that it would not be considered stolen goods. During harvest time, the gates of the villages were shut and guards were put on watch in order to control “all passers-by”. Whoever was arrested “bearing mastic “was punished by confiscation of property, life imprisonment or death. To combat smuggling, villagers were made to spy on each other.

Through a taxation programme, the ownership of skinos trees and a house was linked with the obligation to pay the mastic tax. At least during the last quarter of the 17th century, every owner of a house in the Mastichochoria region was required to deliver an amount of gum mastic in order to cover the tax obligations of the village. This obligation was borne by the property and was transferred or divided between parents and children or between spouses.

The obligation to pay tax in kind was determined according to a pattern identical for all the producers of wealth in the Ottoman Empire. Yet, in the case of mastic, producers were under extreme pressure, because the monopoly of the product in the hands of the Emin of Mastic, the compulsory sale of the product to the capital city of the empire and the ban on smuggling hindered the creation of surplus for the payment of taxes.

The mastic tax was essentially enforced upon the whole village as a unit under the obligation for the payment, accordingly divided among the residents. In particular, the tax collector maintained a register with the number of all the skinos trees in possession of every mastic-producer in every village. In case harvest was insufficient for one year, the producer had to contract a loan in order to pay for the taxes, very often burdened with a high-interest rate and having to mortgage even his harvest. If he were unable to meet obligations during the following year as well, he would often proceed to eradicate his trees, preferring to lose his wealth rather than work without remuneration.

Uses and trade of gum mastic

For the Ottomans, mastic was the most important product of Chios, and they controlled its monopoly. Gum mastic provided direct revenue for the Sublime Porte and was the object of taxation profit for the customs offices in Istanbul. The state determined the price and sold the product as well. In order to receive pre-payment of the value of mastic in cash, the state also auctioned off the right to receive payments in kind (mastic) of the annual land tax (mukata'a), based on the minimum annual values as they were determined by the State Treasury. Sometimes the state granted successful tenderers the right to receive payments for more than a year. Potential contractors submitted their tenders having calculated profit and expenses, as well as the annual tax. The successful tenderer (mültezim) paid the said amount to the state and kept the rest of the income from tax as personal profit.

The best quality mastic would be received by the Sublime Porte. In a market register dating from 1640, we find the Chios mastic, among other aromatic substances, in three grades: highest grade (for the Sultan), tear and low-grade mastic. Translucent gum mastic, also called "sultan's mastic", was worth more than gold. Its production and trade were controlled by the Sultan himself. If any amounts of gum mastic were found in anybody else besides the lawful contractors (mültezim), it was confiscated, since the mastic trade was exclusively associated with the Sultan's Treasury.

Gum mastic was traded in East and West. The largest commercial hubs were located in Istanbul and later in Smyrna, as well as in the ports of the Italian peninsula. And large stations in the trade of mastic were located in all the large markets for products of the East in Western Europe. A prominent trading post reflecting the inroads at the Black Sea region was Kaffa in Crimea, which had been a Genoese port and a hub where Latin merchants exiled from Chios were active until the early 18th-century. In the trade of gum mastic, Crimea was an entry point to the markets of Eastern Europe and even the Baltics.

Gum mastic and the products of skinos were used in their natural forms, like chewing gum and mastic wood for toothpicks, in naturally processed form (grated, shredded, dissolved in water), as a condiment for kitchen use, as an ingredient in the production of pharmaceutics and cosmetics, in painting and in the form of distillate (mainly mastic oil) in perfumery, the beverage industry and pharmaceutics.

The third group developed mainly during the 19th century, in relation to the development of the free trade of mastic and the specialization of some merchants and manufacturers mostly in Smyrna and Istanbul as well as on Chios. It was then that the consumption of mastic spread to wider sections of the population and diversified throughout the Balkans and the Near East through the developments in the beverage industry and confectionery. Mastic, though, always retained its high symbolic value because it was used in the kitchens of the Sultan and in the preparation of chrism in the Orthodox Church.

The prime of Chiot society

Developments in the 17th century were especially significant since they favoured the so-called "communities" of the Mastichochoria. As the right to reside in the villages of the area was bound with the obligation to pay tax, foreigners were excluded from the production of mastic. The residents of the Mastichochoria enjoyed the freedom that enabled them to negotiate directly with the Sublime Porte since they were autonomous from the elites of the country.

The bourgeoisie of the island was at its prime during the 18th century, when numerous merchant houses were founded in Britain, France, and the Netherlands. During that time, many Chiot merchants also operated in Smyrna and settled in Istanbul. Special emphasis was given to education and culture. In 1792 the School of Chios was founded, an institution renowned throughout Greece, with 12 professors, its own printing house, and a library comprising 30,000 books.

In the mid-19th century, Chios had a population of 60,000 inhabitants, of whom 57,000 were Greeks, 2,000 were Muslims and 400 were Roman Catholics. Mastic was the main export, followed by oranges, lemons, almonds, silk, grains, dried vegetables, olive oil, wine, cotton and fruit. The products of Chios were exported to Istanbul, the Danube region and Russia.

In the end of the 19th century, the Mastichochoria villages were incorporated in the municipality of Kalamoti; they were 22 villages with 13,945 inhabitants in total. The cultivators of skinos trees were all Christians. Mastic was at the top of the list of exported products. Around 200,000 pounds of it were exported mainly to Istanbul and Western Europe, in addition to alcoholic mastic beverages, wine, citrus fruit and olive oil.

Following a single line in time, from the 1st century A.D. to the 21st century, we discover the uses of mastic. On the map of the Mediterranean, the Byzantines, the Genoese and the Ottomans state their positions and their territories. They establish administrative structures for the management of mastic through monopolies and to combat the smuggling of the product. The fully loaded galleon travels, but the mastic cultivator always remains at the same geographical location, away from the sea and the ports of mastic, committed to his own role, confined by the walls of the village. Despite cross-sections and discontinuities, gum mastic brings privileges and freedoms, improving the lives of the islanders. Today, mastic is an inextricable feature of the landscape of southern Chios.

Unit E. Production

The unit titled "Production" presents the production history of gum mastic and all its byproducts. As the obligation to pay tax in kind was abolished in 1840, a transitional period of free trade and the initial processing of mastic began. Yet, the mastic cultivators were led to a standstill because of historical circumstances. The compulsory founding of a cooperative was inevitable in order to ensure the protection of mastic producers. Thus began the story of Chios Gum Mastic Growers Association, which holds the fate of mastic since 1938. In the early years, the Association traded gum mastic and managed the network of commercial representatives, packaging of the products and adaptation to international developments. In the 1960s, the Association undertook the processing of gum mastic and produced natural mastic, chewing gum, and mastic oil. Today gum mastic is used in medicine and the pharmaceutical industry, in cooking and confectionery, in the beverage industry, in dyes, perfumes, and cosmetics. Thanks to its constantly increasing uses and applications, gum mastic travels throughout the world.

This exhibition unit comprises the following subunits: a) the foundation of cooperatives; b) the Chios Gum Mastic Growers Association; c) the factory of the Association; d) the uses of mastic. As the unit develops at different levels, visitors acquire a wider perspective on the trajectory of mastic. Photographic and archival material from the archives of the Chios Gum Mastic Growers Association, restored machinery from the old factory of the Association – functioning for demonstration purposes – original objects related to the administrative and commercial activities of the Association, as well as audio-visual productions and multimedia databases, accompany the presentation of the trajectory of mastic throughout the cycles of production.

The founding of cooperatives

Deregulation of the mastic trade

Throughout the various stages of the monopolistic exploitation of the mastic trade, growers themselves were in charge of its management only during 1840-1938.

Freedom in management of mastic trade began when the residents of Mastichochoria became equal with the rest of the population for taxation purposes and ended with the founding of the Chios Gum Mastic Growers Association.

Throughout this time, control of production was transferred from the producer and the primary production process to the control of market mechanisms and the development of processing in relation to the sales networks. This strengthened the retailers and the tradesmen who purchased mastic directly from the growers, having unofficially distributed among themselves whole villages or even families.

In an attempt to maximise profits from mastic trade, until the end of the 19th century, systematic planting and intensive farming were adopted in stages, as well as the clearing of land to ensure exemption from land tax in the early 20th century.

Commercial pressure, price fluctuations, and the need for money led to overexpansion of mastic cultivations outside villages and to the creation of production surplus. Thus, the price given by the producer was lower than the cost of cultivating mastic. Producers of mastic were in crisis.

In the early 20th century, the “Mastic Regulation” drafted in the village of Kalamoti stipulated a decrease in cultivation time (three months), a ban on the collection of kokkoloi, and the destruction of low-quality product. The Regulation was signed by all the producers and approved by the Ottoman authorities. A committee appointed for four years would inspect the application of the Regulation. Violators would be punished by fine or imprisonment. As a result of this Regulation, production decreased and prices doubled.

The liberation of the island in 1912 created a vacuum as far as measures to promote the management and production control of mastic were concerned, as these had been agreed upon in assemblies of growers who had signed the promissory notes. The fact that they were taxed like the rest of the Greek population dealt a blow to mastic growers, and compulsory recruitment in wartime decreased the production capacity in the area of the Mastichochoria.

Early attempts by individuals to process gum mastic

The deregulation of the mastic trade resulted in the expanded usage and consumption of the product. Traditional uses in vogue during the Ottoman period continued: beverage industry, incense production, various kinds of sweets, medicine and varnish industry. In parallel, new uses were developed and presented in guidebooks to commercial fairs of the time.

In the fair of 1870, the following were presented for the first time: mastic alcohol produced by two companies (one in Nafplion, the other in Constantinople), mastic raki produced in Piraeus, mastic water, and mastic raki produced by Kyriakos Fountoudis in Chios, mastic locums made in Constantinople and mastic jam prepared by Marietto Bezeri in Chios.

In 1875 in Athens, mastic-secreting skinos trees were sold in pots, as well as mastic alcohol in Piraeus, dried figs with mastic and mastic raki in Corfu. References to activities of this kind continued during the following years, with an emphasis on products mixing mastic with alcohol.

In Athens, in the mid-19th century, mastic coffee shops selling alcoholic mastic beverage opened one after another. This mastic beverage was drunk in the morning, between 11.00 and 13.00, during the employees’ break at work, as an aperitif at lunchtime, after the end of work and before returning to the office after the lunch break, but also in the afternoon, after the usual visit to a coffee shop or pastry shop in the city centre. In addition, the streets of the marketplace were filled with itinerant sellers who peddled gum mastic along with nutmeg, frankincense, various rings and trinkets, socks and underwear. Some of the “mastic girls” used the sale of mastic as a façade in order to peddle sorcery remedies.

In 1913-1914, merchants did not purchase mastic from the growers. Greece was at war, and in 1914 the incorporation of the so-called “new countries”, as well as Chios, to the tax regime of “old” Greece caused grave discontent.

In 1915, growers began to organize assemblies asking for protective measures regarding mastic. In Kalamoti, in the summer of 1915, the first general assembly took place, and its conclusions became a decree by law titled “Concerning extraordinary measures to aid Agriculture. Measures in favour of mastic, No. 23”.

In order to ensure protection for gum mastic, in 1929 the Greek state promoted law 4381 that imposed restrictions on the “incisions” of the skinos trees and the collection of gum mastic in a timespan of three months (15 July-15 October), and through controlled planting of new trees there was an attempt to stabilize production at 200,000 okas (around 550,000 pounds) annually. In parallel, according to this law, distribution and management of the product would be undertaken by third parties: landowners, brokers, politicians, lawyers and members of leading or powerful social groups in general.

Meanwhile, since the mid-1920s various cottage industries processing gum mastic were founded, known as ”masticharia”, by former fruit growers and merchants of dried fruit and mastic. It was there that mastic transported from villages was cleaned and sorted by women workers who had migrated from Asia Minor. Cleaned gum mastic in various grades was delivered to local processing facilities and sometimes exported directly to Europe (France, United Kingdom, Cyprus, Germany, Romania, Greece), Asia (Turkey, Lebanon, Syria, India, Iraq), or Africa (Egypt, Morocco, Tunisia, Algeria).

Restrictions to the amounts of produce and the very low prices in the marketplace provoked the ire of mastic producers, especially in 1930-1936. In January 1932, a committee to save the product was set up; the committee studied the problem and presented its conclusions at an assembly in Kalamoti. It comprised the local elite, social, financial, and political. Yet G. Choremis, president of the committee, did not believe in cooperatives. Financial cooperatives had been already been founded since 1915, but they had failed. Nevertheless, the founding of the Agricultural Bank of Greece in 1929 and the agricultural reforms during the 1920s provided loan guarantees for the financing of such initiatives as well as systematic encouragement for the creation of cooperatives by producers.

In 1934, the issue of compulsory founding of cooperatives by mastic growers was again on the table. The assembly came out in favour of the cooperative, without the exact description of the purpose of the cooperative. Until 1937, the prefect of Chios kept assuring that the Association would concentrate solely on the gathering of mastic, while the cleaning and trade of the product would remain in the hands of merchants.

Compulsory Law 1390/1938, voted in November 1938 by the Metaxas government, officially imposed the cooperatives in every mastic-producing area and their affiliation with the Chios Gum Mastic Growers Association, with compulsory participation by all mastic producers. The statutory texts of the cooperatives and the Chios Mastic Growers Association were approved in early February 1939.

Chios Gum Mastic Growers Association

The Association is governed by the nine-member Governing Council, elected by the General Assembly. Its Mission Statement is the following: The protection of the Chios mastic through the systematisation of production, collection and processing, and through mass marketing, as well as the raising of the living standards of mastic growers by offering them a variety of services and by ensuring their cooperation as members of this cooperative promoting the growth of their economy.

The results from the first fiscal year confirmed the expectations of the Association and vindicated the commitment of the mastic producers, who got 50% more than the price they received until then.

In 1939, the Association comprised the following Departments: management office,

Accounting Department, Financial Services Department, Trade Department, treasury, technical department, and human resources. In 1951, the administrative structure was further reinforced, including the Propaganda and Logistics Department, promoting the management, collection, and sale of the product through the local cooperatives, the Warehouse and Retail Department etc. Regional offices included the agencies, retail outlets, warehouses, and industrial buildings.

In order to fulfill its duties: a) The Association raises loans and grants them to its members. b) It acquires possession of warehouses or sheds for the storage of mastic. c) It packages and sells on behalf of the cooperatives the mastic delivered by them, paying up to 3/4 of its value in advance. d) It acquires possession of buildings for industrial processing of mastic, for own profit or on behalf of the members, and sells the products or by-products resulting from the processing. e) It provides for the balancing of demand and supply of mastic and undertakes its advertisements, also actively searches for new markets and ways to increase consumption of mastic. f) It acts on behalf of the members and after their consent in order to acquire goods necessary for cultivation.

The social role of the Association

During the Second World War, the Chios Gum Mastic Growers Association did not stop purchasing gum mastic from the producers, as part of its social policy. Thus, in the early 1950s, when the adverse effects of the war period were more than obvious, the Association was in no position to pay for mastic, whose trade was undergoing a grave crisis. Nevertheless, the Association distributed the humanitarian aid by the Allies and provided various household goods and agricultural supplies to mastic growers. Thus, it became a prime agent providing support to farmers in southern Chios.

After the mid-1950s, the finances of the Association were much improved and payments for mastic purchased in years past were gradually settled. The Association also managed other agricultural products, gathering surplus production, negotiating prices and trading on behalf of the producers. In parallel, it began to provide loans funded by own capital; they were short-term loans, covering needs related to cultivation or emergencies. The amount was proportional to the amount of mastic delivered by the grower, in return for future deliveries.

During the 1960s, the Chios Gum Mastic Growers Association was powerful. It provided financial services; it gathered up agricultural products; it owned industrial complexes for the processing of agricultural products; it sold tools, seeds, fertilisers, household goods and animal feed. It was able to contribute financially to the construction or completion of infrastructure works, to sponsor public institutions, churches, associations, and schools, to establish scholarships for agricultural studies for young people from southern Chios.

The organization of cooperatives

Promoting and enhancing the concept of the cooperatives was a significant priority for the Association since the relevant sensibility would also ensure that growers conformed to the compulsory law of 1938 and would also increase their active participation in the policy-making procedures. Within this framework, the Association created the Cooperatives Department, organised the cooperative unions and strengthened their local structures.

As local cooperatives neglected their institutional and financial obligations, in order to ensure compliance the Association hired itinerant bookkeepers who undertook the task of keeping records for the various cooperatives. In August 1941, the Association founded three regional accounting offices: one in Nenita, in charge of cooperatives in Nenita, Vouno, Koini, Kataraktis, Neochori and Kallimasia; another one in Exo Didyma, in charge of cooperatives in Agios Georgios, Mesa Didyma, Exo Didyma, Myrmigi, Tholopotami, Lithi, Vesa and Elata; and a third one in Kalamoti, in charge of cooperatives in Mesta, Olympoi, Pyrgi, Armolia, Kalamoti and Patrika. Yet, the war did not allow them to operate normally, and during the first years after 1945, there was a dire need for the accounting issues of the cooperatives to be put in order.

According to directives of the Association, it was decided that technical personnel would be hired to receive mastic deliveries. They would be in charge of applying the best and less expensive system for the cleaning of mastic. They received mastic deliveries and were in charge of quality control and sorting according to the guidelines of the Association, while they also instructed growers how to clean mastic.

The Association took draconian measures to ensure compliance in mastic deliveries, especially until the end of 1940. Very often, the craftsmen were fined as well. Whoever did not comply with instructions was fired summarily. These practices, though not common in the Association, emphasized the importance of growers' compliance with the quality standards set by the administration.

Primary cooperatives

According to the statute, 21 cooperatives were founded in 21 villages of the Mastichochoria region. These cooperatives acted as mediators between mastic growers and the Association. They undertook mastic deliveries on behalf of growers and carried out the payments by the Association; they administered loans given by the Agricultural Bank via the Association; they supplied growers with fertilisers, animal feed and other goods, and they traded on their behalf other agricultural products beside mastic.

The General Assembly would convene whenever an exceptionally important decision had to be taken, as well as to provide information to growers. It also elected two representatives and an alternate for the Association. The Governing Council, with five members, decided on matters concerning the everyday operations of the cooperative. The third-member Supervisory Council, as the controlling mechanism of the cooperative, checked the decisions and activities.

According to the statute, enrolment in a cooperative was determined as follows: Throughout the region of one or many Communities at Mastichochoria of Chios, there is in each one a Cooperative of limited liability, with obligatory membership for any adult mastic producing landowners or growers, or usufructuaries, or tenants, or sharecroppers farming skinos plantations. Those underage are represented by persons acting as their guardians, while those who are deprived of the freedom of managing their property are represented by their legal representatives who register as members themselves. Owners of skinos plantations in the environs of multiple communities are not obliged to register in all the cooperatives of the region, but only one, either where they reside or according to the area where their production is located, as they choose.

The grower delivered the mastic he collected to the cooperative, where it was weighed, and the amount was recorded in the file of the grower. Mastic was stored in the cooperative warehouse and then delivered to the Association. During the delivery of the product to warehouses, the ownership of mastic was transferred from the grower to the cooperative. Thus, the amount of mastic in storage was considered property of the cooperative.

The Association sent the cooperative an amount of money as advance payment, which the cooperative transferred to the grower in accordance with the weight of the product delivered by him and the predetermined prices. If the mastic trade went well, he would also receive complementary payments for the amounts of mastic he delivered.

Combating smuggling

Cracking down on smuggling was very important for the Association. Its main tools employed for this purpose was the prosecution of smugglers and the punishment of growers. In parallel, though, the Association administration acknowledged that the best way to minimise illegal channelling of mastic to smugglers was by propagating the collective gains to be had by law-abiding practices. During the following decades, illegal mastic trade was indeed reduced, yet smuggling has never been fully eradicated.

Due to systematic recording of the amount of mastic delivered, as well as the informal network of information, the Association controlled to a large extent the illegal sales of mastic and the growers themselves. The Association's control mechanism also provided for merchants who bought any amount of mastic directly from growers, as well as anyone mediating between growers and other persons, to be prosecuted after “accusation by the Association” and punished by a jail term of up to six months and a penalty payment up to five times the value of the mastic smuggled. This amount of mastic is confiscated and delivered to the Association.

As was to be expected, the Association reserved a different treatment for growers who were arrested while trading illegally, and a different one for the merchants. Typically, Article 11 of the statute states: All members of the Cooperatives are obliged to deliver the whole of their mastic production to the Cooperative to which they belong and via that to the Association. In extraordinary circumstances, each grower is allowed to retain at most two okas of the mastic he has produced, provided it will be reserved for household use. The way, in which the delivery is carried out will be determined by the Statute of the Association or, as authorised, by its regulation regarding operations. Any member of the Cooperative who does not comply with the above will be liable to a fine equal to the value of the mastic not delivered, imposed by decision of the Governing Council.

Processing at the Association’s factory

After the German Occupation, the Association had reserves of more than 600 tons of mastic. The Association also had to service loans taken by the Agricultural Bank of Greece, but was faced with closed markets and is obliged to make the most of its reserves. So it diversified into processing, by standardising the production of various forms of mastic, such as mastic oil, rosin, resin wax, varnish and frankincense.

In the early 1950s, the Association produced the “BEM” chewing gum, yet its production was terminated after the failure of the recipe, and in 1956 the Association marketed the chewing gum under the brand name ELMA, meaning Greek Mastic.

Chios town was the centre of production at the time. The building of the Association was extended, since new operations demanded new equipment, some of which were so rare that they had to be manufactured by local workshops. Parallel activities also developed there: chemical control, manufacturing of wooden boxes, and printing of packaging material.

As chewing gum sales continually increased, in 1981 the Association decided to build a new chewing gum factory, completed in 1988, at Kambochora in the Kardamada region, where it still operates today.

As time passed, production processes remained almost unchanged. Today, natural gum mastic, chewing gum and mastic oil are the most important products of the Association. These three production lines are presented in the exhibition, with the use of original mechanical equipment. The restored machinery can be operated by visitors for demonstration purposes.

Production line of natural mastic

Weighing and storage:

The grower delivers mastic to the Association, having cleaned and roughly sorted it.

During delivery, mastic is weighed, sorted according to quality (soft or hard) and size (pita, large, small), and stored.

Sifting:

Mastic is sifted in stages. In this way, it is graded according to the size of the pellets. Each size category has its subcategories. Then, mastic is stored in fridge-rooms.

Washing:

When an order is to be prepared, the prescribed quality and amount of mastic are transferred to the washing area. The washing process is carried out in two stages: first, in saltwater. Clean mastic floats, while pieces containing other elements sink to the bottom. Then mastic is washed with green soap. In this way, it is cleaned of impurities and acquires a sheen. Then it is air-dried.

Cleaning:

Mastic pieces that sunk during the washing process are then spread on large tables and classified according to quality, they are cleaned from impurities with the help of a sharp knife. This is a task carried out exclusively by women workers.

Production line of gum

Producing chicle:

Chicle is made out of natural mastic, sugar, butter, and cornflour. In the prescribed quantities, the above ingredients are placed inside the blending machine, where the meal is blended for 15 minutes in a heated vat, with the addition of hot water. Then it is spread on a marble counter. Icing sugar is added, and the meal is kneaded by hand to form “pies” 2.5-3 cm wide. They are placed in rows of shelves and cooled with the flow of air that lowers their temperature from 50 to 35°C.

Forming gum dragees:

The “pies” are transferred to the machines for cutting. The cylinders in adjustable distances and sizes gradually form thin sheets of the meal and cut it into rectangles like lozenges, also called gum dragees. Then they are placed on the appropriate shelves and left to dry. The ones that are not well-shaped are kneaded and cut again.

Coating:

Gum dragees that are whole and well-shaped are transferred to the candy machines.

Each of the machines has a capacity of 40 to 60 kilograms and rotation at about 24 times per minute. Their vat is heated by glass flame underneath, while fresh air is channelled through a nozzle. The aim is to control moisture and completely dry the dragees. This process lasts around 24 hours, depending on the humidity in the environment. Then the chewing gum dragees are unloaded on thin palettes and left to dry on the shelves.

Polishing:

Having cooled, the dragees are loaded on the revolving cylinder, where they are polished with stearin and talc for about 15 minutes. Now the dragees are ready to be packaged.

Production of mastic oil:

Mastic oil is produced by distilling natural mastic that is unsuitable for other uses, because it is not sufficiently pure. Mastic is placed in a closed vat. Underneath, steam at a temperature of 120oC heats and melts the pieces of mastic. The essential oil turns into vapours that are gradually carried towards the tube at the upper end of the vat. What remains below is solid resin, known as rosin. Via the tube, vapours are led to a condenser that is made up of a tube in the shape of a helix immersed in a vat where water keeps circulating. The vapours of water and essential oil liquefy while cooling and are collected in a tank with overflow. Essential oil, which is lighter, overflows to the oil reservoir while water is separated via the tap at the lower end of the tank.

Packed with special care:

Recently in Athens kiosks, patisseries, and the baskets of street vendors selling sweets a green-red box with the brand ELMA figures more and more often. It contains Chios mastic, in a form and packaging identical to the famous American brand of chewing gum, while it is tastier and more pure. Every day more and more Athenians or residents of other areas taste this delicious Greek product and are amazed at its perfection and value. And of course, its price is much lower than that of the American gum. It is produced by the “Chios Mastic Growers Association”, a huge and very powerful corporation, itself a source of pride for Greece.

This was written in Chiakos Laos (People of Chios) newspaper in 1960.

As the market for chewing gum showed promising growth, the Association undertook the packaging of chewing gum and other products as well. Until today, the marketing pitch for chewing gum has *remained constant in its basic argument: the mastic chewing gum from Chios is natural, original, flavours the mouth, cleans the teeth, strengthens the gums, and helps digestion. Most of all, though, it is an exclusive product of Chios.*

Uses of mastic: an epilogue

Thus began the story of the Chios Gum Mastic Growers Association, the institution that systematised the cultivation, production and processing of gum mastic. The Chios Gum Mastic Growers Association, based on the structure of a cooperative and operating with democratic procedures, supported cultivations and farmers, and the local economy in general. Its main achievement, though, was that Chios Island became identified with this invaluable natural product, thus opening a significant chapter in the production history of Greece.

Today, gum mastic that is produced on Chios Island travels throughout the world. The Chios Gum Mastic Growers Association, its subsidiary company Mediterra, as well as other merchants and producers, make full use of this natural product and create related manufactured goods for uses that had been known for centuries.

Mastic is a rare material, produced from a rare plant under special conditions thanks to the labour and intelligence of the people. The management of mastic was important, as can be seen from the structures created since the Middle Ages for control of the production process and its trade.

The mastic of Chios Island is valuable today, as it had always been. Yet, in our days, its symbolic value is formally certified: it is recognised as a Protected Designation of Origin product, natural medicine and a part of the Intangible Cultural Heritage of southern Chios.

The agricultural landscape of the Mastichochoria

Here summer is long, dry and hot, with the average highest temperature at 30°C (in July). Winter is mild, without frost, with the average lowest temperature at 6°C (in January). The average annual rainfall is half a metre. Sunshine is ample, cloudiness is limited. The predominant winds come from the north, with stronger intensity during the winter months.

In the Mastichochoria region, intensive farming is not practiced. Thus, the semi-natural features of the ecosystem are preserved. The skinos plantations are permanent. In addition, they occupy only one section of the field. The agricultural landscape resembles a mosaic, as it is comprised of small estates with mixed farming.

The land is developed for cultivation with the creation of “scales”, that is terraced ground through the use of dry stone walls, which restricts drainage of water, keeps soil erosion in check and retains nutrients in the soil. These “scales” are built with stones that are found in the fields, and they are maintained by the farmers themselves. Caring for the terraced ground is as important as owning the land.

In order to ensure autonomy as far as subsistence needs were concerned, the residents of the Mastichochoria region cultivated olives for their oil and their edible fruit, fig-trees to have dried figs and vine in order to produce wine. In parallel, they made full use of wild trees such as carob, in order to produce flour and fodder, as well as the turpentine tree (tsikoudia) in order to have its oil.

In the same fields where mastic or olive was cultivated, in the free spaces on the terraced ground, farmers would also plant legumes (broad beans, lentils, and chickpeas), vegetables (tomatoes, onions, potatoes, green beans) and grains (wheat, barley, and vetch). They also utilized wild brushwood and herbs, such as aniseed, to produce spices.

Donkeys, mules, horses, and oxen are the main helpers used by men in daily work. The mastic fields were significant grazing areas for the small animals of the village, such as goats and sheep, because herbs flourished in them.

In the cultivations that were at a distance from the settlements, farmers used to build makeshift shelters, sheds (votes or cabins) where they would be protected from the midday sun, they would store their equipment or even stay the night on the field when the cultivation needs were especially acute. These sheds were used mainly when other cultivations were combined with that of the skinos tree. The sheds were also built with the use of dry stone, without mortar, in rectangular or cyclical shape, and they were covered with wood or tiles that would then be pasted with soil.

The research of Tsouchlis [60] [61] on the archive of the Chios Mastic Growers Association regarding its foundation and history, offers the following tables regarding (a) **amounts of produced mastic**, and (b) **trade and industrial use**, from 1939 to 2000:

Table 1: Amounts of produced mastic, 1939-2000 [Tsouchlis 2007]

Crop	Clean Mastic	Dust	Attached Pieces	Black Mastic / Subproduct	Neropinada (of lower quality)	Total
1939	211.230,72					211.230,72
1942-45	451.882,98	19.076,95		29.113,60		500.073,41
1946	183.190,53	4.793,60		10.989,76		198.973,89
1947						85.162,62
1948	188.024,00	6.057,28		17.103,04		211.184,32
1949	135.920,00	4.978,39		18.478,72		197.434,71
1950	173.977,60			26.939,97		229.266,94
1951	211.243,20			28.792,32		240.035,52
1952	230.159,04	5.865,60		11.957,76		247.982,34
1953	203.546,88	5.814,40		8.386,56	-10% weather	217.747,84
1954	189.932,48	5.137,77		16.781,44	Weather	211.851,69
1955	182.799,81			28.106,49		210.941,63
1956	208.354,56			17.844,48		226.199,04
1957	155.383,04			13.036,80	Drought	168.419,84
1958	146.969,60	3.779,85		9.283,01		160.032,91
1959	188.818,10	4.561,60		10.756,20		204.135,90.
1960	207.491,55	4.829,50		11.800,50		224.121,55
1961	194.192,00					211.124,70
1962	213.646,00					213.646,00
1963	242.871,50	7.149,00		12.828,40		242.848,90
1964	237.360,00	7.345,30		13.361,50		258.066,80
1965	242.871,00	6.396,75		12.493,60	Weather	235.245,45
1966	207.038,30	6.835,30		16.626,20	Rain	230.499,80
1967	238.922,00	7.275,30		13.028,20		259.225,20
1968	210.945,40	6.547,40		19.054,40	Rain	236.547,20

1969	233.976,00	6.864,70		17.327,90		258.168,60
1970	303.527,10	8.212,60	890,60	22.481,30		334.221,00 Π
1971	169.032,00	2.255,10	1.492,40	10.590,70	118.804,30	302.174,50 31/12
1972	181.103,60	6.288,70		24.315,30	41.969,40	253.677,00
1973	201.762,10	6.829,60		28.506,40	1.390,40	238.488,50
1974	219.959,40	8.722,50		34.974,70		263.656,60
1975	204.891,05	7.904,95		28.747,40		241.543,40
1976	180.923,95	6.678,70		26.533,90	119,80	214.256,35
1977	214.690,10	8.055,70		25.551,20	3,00	248.300,00
1978	155.122,95	5.098,25		18.810,70	15.689,10	194.721,00
1979	181.412,80	4.275,50		18.477,50		204.165,80
1980	144.281,10	2.768,00		15.537,90		162.586,50
1981	178.149,60	3.036,35		17.732,10		198.918,05
1982	163.437,70	2.674,50		16.575,30		182.687,50
1983	135.399,20	2.300,30		9.771,00	691,60	153.962,10
1984	164.004,40	2.571,90		12.964,80	636,80	180.177,90
1985	180.659,50	2.220,60		11.380,70	648,20	194.909,00
1986	203.777.90	2.226,90		10.389,60	177,70	216.572,10
1987	123.006,70	1.163,20		5.926,20	115,50	130.211,60
1988	155.203,60	1.394,70		6.924,60	52,30	163.575,20
1989	131.105,30	1.271,10	766,20	6.740,20	1.704,60	141.587,40
1990	68.516,90	781,30	418,10	4.344,60	550,90	74.611,80
1991	64.395,00	969,80	460,30	4.082,80	549,20	70.457,10
1992						97.939,20
1993						103.826,50
1994						103.796,61
1995						108.690,53
1996						110.923,73
1997						116.765,26
1998						138.665,39
1999						150.574,17
2000						97.328,40

Table 2: Trade and industrial use of produced mastic, 1939-2000 [Tsouchlis 2007]

Crop	Internal	External	Total int/ext	Distillation	Industrialization	Total kilos
				Mastic oil	Chewing gum, incence, rosebud oil	
1939						
1944-45	6.420,10	19.671,00	**25.091,10**			**32.166,79**
1946	6.122,05	84.216,22	**90.338,27**	2.605,00		**119.153,27**
1947	4.006,30	75.265,70	**79.272,00**	15.417,00		**121.391,29**
1948	18.236,80 χιλ					**121.400,62**
1949	26.987,88	191.790,00	**218.777,88**	3.153,85		**221.931,73**
1950	19.365,55	71.107,20	**90.472,75**	4.988,85		**95.461,60**
1951	18.314,30	175.666,40	**193.980,70**	2.576,80		**196.557,50**
1952	16.193,16	153.652,25	**169.846,17**	3.076,93		**172.922,34**
1953	17.163,92	99.778,65	**116.795,20**	2.076,92		**119.019,49**
1954	18.185,86	164.366,24	**182.552,10**	3.384,62		**185.936,72**
1955	17.016,55	128.772,96	**145.789,51**	7.633,33		**153.442,84**
1956	21.806,40	142.192,10	**163.998,50**	6.115,00	1.008,00	**171.121,10**
1957	29.817,45	143.735,00	**175.192,43**	8.666,65	1.852,00	**184.071,10**
1958	24.057,51	129.471,03	**153.528,54**	7.512,83	7.282,50	**168.323,87**
1959	22.973,18	197.472,09	**220.445,27**	6.013,20	9.442,50	**235.900,94**

1960	27.712,65	182.894,12	**219.982,25**	8.537,00	11.501,00	**230.644,77**
1961	27.622,19	171.004,07	**198.626,26**	6.430,00	10.479,00	**215.535,26**
1962	27.282,66	188.879,51	**216.162,17**	10.980,00	14.421,00	**241.563,17**
1963	30.912,00	269.239,00	**300.151,00**	12.908,00	10.514,00	**323.573,00**
1964	31.300,00	256.652,00	**287.952,00**	15.085,00	8.068,00	**311.105,00**
1965	37.291,00	283.902,00	**321.193,00**	11.839,00	10.357,00	**343.389,00**
1966	27.997,00	297.200,00	**325.197,00**	14.935,00	10.208,00	**350.340,00**
1967	25.319,00	266.298,00	**291.617,00**	22.380,00	8.937,00	**322.934,00**
1968	26.202,00	271.075,00	**297.277,00**	12.566,00	9.675,00	**319.518,00**
1969	28.640,84	300.696,35	**329.337,19**	18.450,00	9.375,00	**357.162,19**
1970	31.433,00	299.655,00	**331.088,00**	16.176,00	11.058,00	**358.322,00**
1971	34.313,00	260.156,00	**294.469,00**	26.408,00	14.171,00	**335.048,00**
1972	26.866,00	200.929,00	**227.795,00**	39.188,00	16.765,00	**283.748,00**
1973	23.483,00	229.361,00	**252.844,00**	6.310,00	15.813,00	**274.967,00**
1974	22.202,71	221.203,88	**243.406,59**		13.992,75	**257.399,34**
1975	28.486,15	72.981,74	**101.467,89**	20.115,00	13.945,00	**135.527,89**
1976	29.221,88	92.800,60	**122.022,48**	15.740,00	26.720,00	**164.482,48**
1977	26.659,38	108.305,27	**134.964,65**	2.835,00	25.676,00	**173.475,65**
1978	31.670,55	125.279,73	**156.950,28**	8.365,80	35.908,00	**201.224,08**
1979	27.351,51	76.544,76	**103.896,27**	12.426,00	50.964,00	**167.286,27**
1980	34.897,02	92.577,46	**127.474,48**	11.904,00	24.577,00	**163.955,48**
1981	35.667,37	78.339,76	**114.007,13**	1.960,00	33.578,00	**156.090,13**
1982	50.289,00	74.716,00	**125.005,00**	8.304,00	33.565,00	**166.874,00**
1983	39.431,66	84.426,95	**123.858,61**	4.855,50	62.500,00	**191.214,11**
1984	33.766,72	109.007,00	**142.773,72**	6.312,50	38.775,00	**187.861,22**
1985	19.344,78	82.604,72	**101.949,50**	8.071,50	25.765,00	**135.786,00**
1986	14.591,24	84.668,00	**99.259,24**	9.510,00	35.975,00	**144.744,24**
1987	14.993,89	106.526,68	**198.626,26**	5.091,50	18.765,00	**145.377,07**
1988	19.105,02	91.426,35	**110.531,37**	7.841,60	11.071,70	**129.444,67**
1989	21.010,39	78.259,20	**99.269,59**	6.513,90	31.853,20	**137.636,69**
1990	25.831,60	86.598,20	**112.429,80**	6.507,00	32.586,60	**151.523,26**
1991	35.140,44	102.273,80	**137.414,24**	4.200,00	35.394,00	**177.008,24**
1992	29.135,17	69.772,13	**98.907,30**	5.550,00	29.871,72	**136.850,35**
1993						
1994			**106.863,39**			
1995			**119.939,28**			
1996			**112.114,91**			
1997			**120.808,21**			
1998			**115.155,12**			
1999			**113.617,22**			
2000			**140.169,30**			

The **Chios Gum Mastic Growers Association** mentions on the website (https://gummastic.gr/en/company/vision) their vision as follows:

Chios Mastiha Growers Association’s vision and the target is to introduce mastiha to all consumers through modern and healthy products, to demonstrate that unique and special spice gifted with a distinctive flavour & aroma, but also with considerable & certified therapeutic qualities.

It aims to make mastiha an indispensable ingredient for a number of functional products of everyday use, in order to be able to actively respond to its purpose and its commitment towards its thousands of growers-associates. Respecting their labour and their efforts, the Association seeks to stand by them as an assistant, by contributing to the upgrade of mastiha cultivation, to the improvement of its producing procedure and of course to guarantee the highest possible profits for them.

Mastic has been apparent also in representational arts such as **film and photography**. The following segments are offered in [62] . The original text is in Greek. Below is a translation in English by the creators of the deliverable:

Film creations of a high level include the work of Dimos Avdeliotis. "The tree we hurt" and "The four seasons of law" are rich in autobiographical moments and personal experiences of the director that consist of a highly shrewd aspect of the Mastichochoria society during the 1960s and beginning of the 1970s. The inclusion of many historical facts, pictures, and personalities offers the opportunity to present a combination of artistic creation and historical documentation through photographs, landscapes, and objects of the Mastichochoria and mastic's culture.

The photographic material of the villages is created after the earthquakes of 1881 and they are followed by the publication of Pernot at the beginning of the 20th century. They are mainly photographs of ethnographic and reporting interest and many like them continue to be produced during the whole 20th century. Great collections, such as those of Periklis Papachatzidakis and Elli Papadimitriou at the Benaki Museum, preserve an image of the villages before and after the war.

From the interwar period and mostly the first years after the war, it is important the appearance of local photographers. A significant case is that of the Maistros family from Kalamoti, which comprises a vast visual record in film and photographs. The journey of a refugee – Kostas Maistros – to his village inherited us amateur pictures of Chios in 1948. The same individual provides photographic cameras to George Maistros who becomes the main photographer of mastic villages, capturing everyday life scenes and many of the eldest inhabitants of today's municipality of mastic villages. Recruitment to the army and immigration created the base in which private photography developed and spread to all social stratifications of the agricultural communities of northern Chios.

During the 1st year of the tree, it is best to irrigate 2, 3 or 4 times per day depending also on the weather conditions. The summer of 2nd or 3rd year of the tree is crucial in order to have a successful production. The older trees though are resistant to drought. It is important to note that persistent humidity can make the tree suffer until the point of drying. Thus, the quality of the mastic is reduced and there is the danger for infections.

Classification types of mastic as performed by the producers [59] :

Pitta: flattened round pieces of 3-7 cm, they are created when many mastic drops fall on top of one another

Fliskari or kandilera: smaller than pitta, more translucent, they hang from the incision

Dachtilopetra: smaller than fliskari, their name means "rock of a finger ring"

Tear: smaller than dachtilopetra, it takes its name because it is hanging from the tree like a "tear"

Kiliasto or psilo: very small pieces in round shape that dry fast, they fall and roll on the ground

Anapinada or neropinada: of lower quality because while drying it has absorbed water or dirt and therefore its economic value is lost

Volarida or apovoliariki: mastic gum has gathered together and became a lump. What happens when the mastic is gathered before getting dry. Its economic value is diminished

Dust: residues of processing

Clothing style and social meaning [97] :

- uncovered head + uncovered feet: a girl
- pristida + saritsi (dyed with saffron, 4 meters long, 5 centimetres wide): a girl is ready to marry (according to Pyrgi village)
- orange coloured saritsi: unmarried, or married and aged up to 30 years old
- white coloured saritsi decorated with stripes on the edges: older than 50 years old
- bolia without much decoration on the edges: married (according to Kalamoti village)
- blue weaved, sleeveless dress + white weaved breast cloth: elder (according to Mesta village)
- white or geranium colours kamizori + geranium coloured dress: young (according to Kalamoti village)
- geranium coloured kamizori + geranium coloured dress: elder (according to Kalamoti village)

The tradition of ‘Agha’ [58] :

‘Agha’ is a tradition of the mastic villages. It takes place during the seasonal change from winter to spring on 'clean Monday' in the Orthodox religious calendar. It is a satirical impression of the Agha when he was a ruler of the villages during the Ottoman Empire and of the fact that every time that a Greek would be judged, there was no chance that he would be found innocent. Agha brings forth only the external characteristics of the Turkish officer. Through this tradition ‘Agha’ represents justice and the relation of the ruler with the peasants: if the peasants feel there is justice, they will cultivate better, thus production will be better as well.

A2.3 Glass pilot

The glassmaker’s technical gestures **inscription** on the UNESCO Intangible Cultural Heritage List, produced by the French Institute of Arts and Craft:

I. IDENTIFICATION DE L'ÉLÉMENT

I.1. Nom

Les gestes des métiers d’art verriers

I.2. Domaine(s) de classification

Savoir-faire liés à l’artisanat traditionnel

I.3. Communauté(s), groupe(s) associé(s)

En France, la liste officielle des Métiers d'art est fixée par l'arrêté du 24 décembre 2015. Cette liste regroupe 198 métiers et 83 spécialités, répartis en 16 domaines. Le domaine du verre et du cristal comporte quatre principaux métiers. Le périmètre de la présente fiche est circonscrit aux gestes du verrier à la main, du verrier au chalumeau et du verrier décorateur, trois métiers qui relèvent depuis 2017 de la même convention collective nationale des "professions regroupées du cristal, du verre et du vitrail".

Aujourd'hui, la majeure partie de la production d'objets en verre est industrialisée. Cependant, les gestes des métiers d'art verriers sont toujours perpétués en France, au sein de plusieurs entreprises qui présentent des caractéristiques distinctes. Leur activité repose en effet sur des fondements différents, qu'il est important de mentionner, car ils ont une incidence sur les conditions d'exercice et le type de production. Trois catégories peuvent être schématiquement distinguées en fonction du modèle économique, du réseau de diffusion de la production et de la place de la création dans le processus de fabrication:

— La part la plus importante de la production artisanale d'objets en verre en France est assurée par quelques entreprises, de taille moyenne si l'on considère les effectifs (entre 50 et 500 salariés environ). Elles proposent un cadre industriel, avec des moyens techniques et de recherche importants, mais s'appuient sur un savoir-faire traditionnel, une prééminence du geste manuel dans le processus de fabrication et une main d'œuvre d'artisans qualifiés et spécialisés. Ces entreprises sont implantées dans les territoires historiquement marqués par l'essor de l'industrie verrière. Elles appartiennent au secteur du luxe, se concentrent sur une production très spécialisée et possèdent un réseau de distribution développé et international. Dans le domaine du cristal, quelques manufactures se partagent le marché parmi lesquelles les cristalleries Saint-Louis, la cristallerie de Baccarat, Daum et Lalique qui jouissent d'une importante notoriété. Chacune possède son propre catalogue de pièces récurrentes et emblématiques et une direction artistique qui fixe les tendances des nouvelles créations. Leur nom est une marque ; il est un gage de qualité et d'une certaine esthétique.
— Des ateliers de taille plus modeste sont davantage tournés vers une activité à caractère pédagogique et remplissent un rôle de sensibilisation du public aux métiers du verre et à leur histoire. Leur modèle économique repose en partie sur l'accueil de public. Les démonstrations de savoir-faire permettent de réaliser des pièces qui sont ensuite proposées à la vente, directement sur le lieu de production. Ces ateliers sont souvent implantés dans des territoires liés à l'histoire du verre et entrent dans une logique de tourisme de découverte économique.
— Enfin, des ateliers de petite taille sont répartis sur l'ensemble du territoire avec une capacité de production plus restreinte. Ces ateliers se consacrent plutôt à la recherche technique et esthétique et/ou collaborent avec des designers et des plasticiens.

La verrerie scientifique et technique est un cas à part. La production s'adresse à un réseau de laboratoires et d'entreprises spécialisés. L'entreprise Pignat est très présente sur le marché

I.4. Localisation physique

Lieu(x) de la pratique en France

En France, les deux principaux pôles où les gestes des métiers d'art verriers sont perpétués se situent au sein de territoires historiquement liés à l'industrie du verre et à son essor:

— Bas-Rhin, Meurthe-et-Moselle, Moselle (région Grand-Est)
— Vallée de la Bresle (région Normandie)

Cependant, des ateliers verriers sont implantés sur l'ensemble du territoire français du fait de la mobilité des praticiens et d'un accès désormais facilité aux matières premières.

Pratique similaire en France et/ou à l'étranger

La pratique se perpétue aujourd'hui encore, en Europe, au sein des foyers historiques de l'essor du verre: l'Allemagne, l'Autriche, l'Irlande, l'Italie, la République tchèque, la Slovénie et les Pays scandinaves.

I.5. Description détaillée

La fabrication d'objets utilitaires en volume par la mise en forme du verre est un savoir-faire très ancien, qui s'est épanoui dans différentes régions du monde et s'exprime aujourd'hui, en France, au sein de plusieurs territoires, sous des formes diverses, issues d'une longue tradition. Elle requiert la maîtrise de techniques et de procédés ancestraux.

Les pièces réalisées peuvent être de différentes tailles, remplissent une fonction et font souvent l'objet d'une importante recherche esthétique. Elles sont recherchées pour l'usage et pour leur valeur décorative. À l'origine, ces objets appartenaient principalement à la catégorie des arts de la table, mais les verreries diversifient aujourd'hui leurs productions dans les domaines de la décoration d'intérieur, du luminaire, de la bijouterie et de l'édition d'art. Les articles produits peuvent également avoir une vocation purement utilitaire, notamment dans le cas de la verrerie scientifique et technique.

Les gestes des métiers d'art verriers concernent:

— La fabrication de la matière première, employée par l'homme pour la fabrication d'objets. Celle-ci n'existe pas à l'état naturel et doit donc être préalablement fabriquée avant sa mise en forme, à partir de plusieurs matériaux. La composition du verre peut varier en fonction des propriétés que l'on souhaite lui donner et du type de production envisagé ;
— La mise en forme de la matière à l'état visqueux, c'est-à-dire à chaud, selon différentes techniques et à l'aide de divers outils ;
— Le travail de la matière à l'état solide, c'est-à-dire à froid, une fois les opérations à chaud terminées, par retrait de matière (taille et gravure) ou par ajout de matière (dorure).

Les gestes des métiers d'art verriers sont caractérisés par leur formidable permanence. Les conditions d'exercice, les outils et les types de production ont beaucoup évolué au fil du temps mais les gestes se sont adaptés sans subir de modifications substantielles. Si le savoir- faire se perpétue dans une forme relativement stable, la manière dont les verriers se considèrent eux-mêmes et sont perçus dans la société a, en revanche, beaucoup évolué depuis le XVe siècle. Sous l'Ancien Régime, les maîtres verriers étaient reconnus pour la maîtrise d'un savoir-faire dont les secrets se transmettaient de père en fils. Ils bénéficiaient du titre de « gentilhommes verriers” qui leur conférait droits et noblesse. Cependant, au XIXe siècle, l’industrialisation, la mécanisation de certains procédés et la disparition des privilèges du « gentilhomme verrier” modifièrent profondément le statut et les conditions de travail des verriers. Cadences élevées et pénibilité définissaient alors la vie des ouvriers du verre qui s’engagèrent dans une lutte sociale, à la fin du XIXe siècle, pour améliorer leur condition. À partir des années 1960, l’automatisation des productions supprima de nombreux emplois. Plusieurs verreries fermèrent leurs portes, avec d’importantes conséquences sur les territoires impactés. Aujourd’hui, le geste artisanal est revalorisé avec un intérêt croissant de la société pour le fait-main, les métiers d’art et une attention nouvelle portée sur la provenance des matériaux et les conditions de fabrication. Les verriers revendiquent davantage leur geste, leur métier d’artisan et la valeur ajoutée sans équivalent qu’apportent leur savoir et leur technicité.

Les métiers du verre requièrent d’abord une grande dextérité. Celle-ci se développe grâce à la pratique et la répétition, tous les verriers en conviennent. La parfaite maîtrise des gestes verriers s’effectue sur un temps long. Plus encore, l’art du verre demande des réflexes et une capacité d’analyse et d’adaptation qui relèvent autant de la perception que de la technique au sens strict. Tout verrier constitue, au fil du temps, sa propre archive mentale et sensorielle et l’étoffe à chaque nouvelle expérience, chaque nouvel objet ou difficulté rencontrée. Plusieurs années d’expérience sont ainsi nécessaires pour former un verrier accompli, capable d’anticiper les réactions de la matière, de travailler sans gabarit ou de réaliser à main levée des pièces rigoureusement identiques ou d’une grande complexité. Les praticiens peuvent chacun développer leur propre manière et des gestes différents sont susceptibles d’aboutir au même résultat. De la même façon, chaque verrerie peut développer des gestes propres à son catalogue et à ses références.

1. La fabrication du verre

L’homme privilégie le verre dans la fabrication de certains objets pour sa transparence, sa brillance, sa dureté, sa résistance et sa mauvaise conduction de la chaleur.

Le verre est un matériau composite dont on modifie l’état en agissant sur sa température. Liquide lorsqu’il est en fusion, il devient visqueux à mesure que sa température s’abaisse, puis durcit en refroidissant. Malléable à l’état visqueux, le verre est remarquablement dur et stable à l’état solide.

La fabrication de la matière fait partie intégrante de l’art verrier. Cette première étape est fondamentale, elle impacte l’ensemble des gestes qui lui succède.

Le verre s’obtient par le mélange et la fusion de plusieurs éléments: des vitrifiants, des fondants et des stabilisants. Il n’existe pas qu’une seule recette pour faire du verre. Les propriétés de la matière évoluent en fonction de la composition et des proportions de chaque ingrédient. La composition conditionne la température de fusion du matériau, sa résistance, sa transparence, son coefficient de dilatation et sa malléabilité. Elle varie en fonction du type de production envisagé et du résultat attendu. Chaque atelier possède ses propres secrets de fabrication, souvent garants de la qualité de la production. Les principaux composants qui peuvent être utilisés dans la fabrication du verre sont les suivants:

- Les vitrifiants: le verre est toujours composé avec de la silice, généralement apportée sous forme de sable. La silice est présente en proportion de 50 à 82 %. Un fort pourcentage de silice améliore la résistance chimique et thermique du verre et réduit son coefficient de dilatation. Le bore (ou anhydride borique) est présent dans la famille des verres borosilicatés qui sont privilégiés dans la verrerie scientifique. Son utilisation améliore significativement la résistance du verre et abaisse son coefficient de dilatation. Le borosilicate, plus connu sous sa dénomination commerciale “Pyrex” (dont le brevet a été déposé en 1915), doit être amené à une température particulièrement élevée pour être travaillé.
- Des fondants sont ajoutés pour abaisser le point de fusion du mélange vitrifiable (le point de fusion de la silice est de 1730°C). Ils permettent d’allonger la durée de malléabilité du verre. La soude (ou oxyde de sodium) était autrefois extraite des cendres de plantes marines. On pouvait aussi l’obtenir, selon les régions, avec des cendres de hêtre, de genêt et de ronce ou des sarments de vigne. La potasse (oxyde de potassium) abaisse non seulement le point de fusion du verre, mais facilite aussi son travail à froid, et accroît l’intervalle de température pendant lequel on peut le travailler. Elle était initialement extraite des cendres de fougères.
- Il existe plusieurs stabilisants, parmi lesquels le carbonate de calcium, sous forme de chaux et de craie ; l’oxyde de zinc ; l’oxyde de fer (souvent présent naturellement dans les roches ou dans les sables) ; l’oxyde de plomb.

Le cristal est une catégorie de verre très particulière qui se distingue par sa sonorité, sa brillance (son indice de réfraction), son poids, un point de fusion abaissé et une souplesse qui permet de travailler la matière plus longtemps à chaud et plus facilement à froid.

D’autres ingrédients peuvent être ajoutés pour modifier les propriétés du mélange vitrifiable. Le bioxyde de manganèse est utilisé dès la fin du IIe siècle pour ses propriétés épuratives ; il permet d’obtenir un verre plus pur et plus transparent. Le groisil ou calcin peut aussi être présent dans la composition du verre, parfois en forte proportion ; il est constitué de rebut refondu et agit comme fondant ; son utilisation permet d’économiser énergie et matière première.

Les petits ateliers utilisent bien souvent une composition déjà préparée ou du verre pré- fondu, adapté à leur production, qu’ils se procurent auprès de fournisseurs spécialisés.

2. Le travail du verre à chaud

L’action de la chaleur est essentielle pour fabriquer du verre comme pour le travailler et le mettre en forme. L’art verrier appartient ainsi à la catégorie des arts du feu. Lorsqu’il est en fusion, le verre devient malléable et liquide. Il est alors possible de lui donner une forme. Les gestes doivent être accomplis avec rapidité, avant que la matière ne refroidisse. Le verrier à chaud doit maîtriser le court instant pendant lequel la matière en fusion peut être travaillée. Le palier de travail désigne l’intervalle au cours duquel le verre est à la bonne température: il n’est ni trop fluide ni trop visqueux. Différentes techniques peuvent être utilisées pour travailler le verre en fusion.

2.1. La technique du verre soufflé à la canne

La technique du verre soufflé à la canne permet d’obtenir des objets en verre creux. Elle peut s’effectuer à la main ou à l’aide d’un moule. Le verrier travaille rarement seul. Le verre chaud repose sur une extrême coordination entre les différents membres de l’équipe. Les verreries sont organisées en “places”, c’est-à-dire en secteurs de travail. Un nombre variable de verriers est attaché à chaque place, en fonction du type de production. Une place peut par exemple comprendre un cueilleur, un souffleur, un poseur d’anse (de jambes ou de pieds…), un chef de place et un porteur à l’arche. Les principales étapes de la technique du verre soufflé à la canne peuvent être synthétiquement présentées comme suit.

— *Le cueillage*. Le cueilleur prélève, dans le pot ou le bassin où le mélange vitrifiable est préparé, une quantité de matière en fusion, qu’il détermine en fonction de l’objet à réaliser. Cette opération s’effectue à l’aide d’une canne creuse dont l’extrémité, le “mors”, a préalablement été chauffée et à laquelle le cueilleur imprime un mouvement de rotation. Le verre ainsi extrait du four est très fluide. Afin de centrer le verre sur la canne et d’éviter une perte de matière, le mouvement de rotation doit être sans cesse maintenu.
— *Le marbrage.* Le verrier répartit uniformément la matière au bout de la canne en roulant le verre chaud sur une table en acier que l’on nomme le “marbre”. Cette étape permet de centrer le verre, de ramener la matière vers l’extrémité de la canne, de diminuer l’épaisseur autour du mors, mais aussi de refroidir la surface du verre pour lui permettre de supporter une seconde cueillette, si nécessaire.

Cueillage et marbrage peuvent être répétés plusieurs fois afin de former des couches successives et d’obtenir la quantité de matière désirée. Dès que le verre est suffisamment refroidi pour supporter une autre couche de verre en fusion, la canne est à nouveau plongée dans le four. Une nouvelle couche vient recouvrir entièrement la cueillette précédente. Le nombre de cueillettes est décidé en fonction de la taille de la pièce à réaliser.

— *Le maillochage*. Avant sa mise en forme, la matière doit être préparée et optimisée. Le verrier s’installe en position assise au banc du verrier. La canne est placée à l’horizontale devant lui, posée sur les bras du banc, les “bardelles”. De la main gauche le verrier fait rouler la canne d’avant en arrière, sur les bardelles ; de la main droite, il tient une mailloche, mouillée au préalable dans un récipient d’eau. La paraison roule dans la mailloche. Le but de l’opération est de bien centrer la masse de verre ou de la répartir convenablement autour de la précédente paraison.
— *La première bulle d’air*. Le verrier souffle dans la canne pour introduire de l’air dans la paraison. La première bulle d’air est soufflée en tenant la canne à l’horizontale ou légèrement inclinée vers le sol. L’embout de la canne est bouché avec le pouce. L’air se retrouve comprimé dans la canne ; il se dilate dans la paraison sous l’effet de la chaleur. Selon la taille de la pièce souhaitée, le verrier peut procéder à plusieurs cueillettes et souffler entre chacune d’elles.
— *Le soufflage.* Une fois les étapes de préparation achevées, le verre est prêt à être mis en forme. Il peut être soufflé à l’aide d’un moule ou à main levée.
◊ *<u>Au moule</u>.* La paraison est enfermée dans un moule ; le verrier souffle alors dans la canne jusqu’à ce que le verre épouse parfaitement la forme du moule. L’ouverture du moule peut être effectuée à la main, par un aide, ou mécaniquement, en appuyant sur une pédale, si le verrier dispose d’un gamin mécanique.
◊ *<u>À main levée.</u>* Le verrier utilise la gravité et la force centrifuge et modifie l’inclinaison de sa canne pour mettre en forme la matière. La canne est élevée vers le haut pour obtenir une forme arrondie ou dirigée avec le sol pour obtenir une forme allongée. Le verrier peut également s’aider de différents outils: “mouillette”, ciseaux, palette, fers…

Entre chaque étape, et tout au long de la mise en forme de l'objet, la pièce est réchauffée dans le four de travail afin que le verre conserve sa malléabilité.

Une fois que la pièce a atteint la forme et la taille désirées, le fond peut être aplati à l'aide d'une palette. Puis, le col est marqué à l'aide de fers plats qui creusent un sillon à l'endroit où la canne et l'objet seront séparés.

— *Mise au pontil ou empontillage*. Cette étape consiste à souder la pièce au pontil par le fond. Le pontil peut être préalablement préparé (en fonction des méthodes propres à chaque atelier) en couvrant son extrémité d'une petite quantité de verre en fusion qui est ensuite collée au centre du fond de la pièce. Pour une bonne adhérence, les deux verres doivent être d'une température proche. La pièce est ensuite être séparée de la canne. À l'aide d'une lime, la démarcation créée au niveau du col est renforcée. Un choc thermique est créé avec une petite quantité d'eau. Un coup sec porté sur la canne est alors suffisant pour décrocher la pièce de la canne. La pièce est désormais fixée par le fond au pontil. Le haut de la pièce et le col peuvent ainsi être travaillés.

La pièce peut maintenant être finalisée. Un mouvement de rotation est toujours imprimé, d'avant en arrière, au pontil qui repose sur les bardelles pendant l'opération. De la main droite, le verrier peut façonner le corps de la pièce à l'aide de différents outils: les fers pour élargir le col, les ciseaux à rogner pour donner une régularité aux bords, la palette de bois mouillé pour finir l'évasement…

— *Les ajouts.* Des ajouts peuvent être posés sur la pièce: pied, jambes, anse, bec… Le cueilleur apporte du verre en fusion avec un ferret. Le verrier coupe la quantité de matière qu'il juge nécessaire pour former un ajout et le souder au corps de la pièce.

La pièce achevée est ensuite détachée du pontil. Le pontil est susceptible de laisser une marque ronde. Cette marque est conservée ou enlevée, à froid, par meulage et polissage.

La pièce est ensuite amenée à l'arche de recuisson ou four à recuire, une étape indispensable. Au cours du travail à chaud, le verre subit des différences de températures importantes qui créent dans sa masse des tension internes susceptibles de le briser rapidement, à moyen ou même à long terme. La recuisson permet un refroidissement progressif qui élimine toutes les tensions internes de la matière. Un refroidissement trop brutal ferait éclater le verre.

— *La décoration*. Certains effets ou techniques de décoration à chaud peuvent être utilisés, dont voici quelques exemples:
◇ *<u>Le décor filigrané</u>*. De fines baguettes colorées sont étirées et disposées à l'intérieur d'un moule. Lorsque la paraison épouse la forme du moule, elle incorpore les baguettes. De la même manière, des motifs colorés peuvent être mis en contact avec la paraison, entre le dernier cueillage et le dernier soufflage.
◇ *<u>Le verre bullé.</u>* Le verre bullé, spécialité de la Verrerie de Biot, est un verre épais dans lequel sont emprisonnées des petites bulles d'air irrégulières. Le verre bullé est obtenu en saupoudrant du bicarbonate de soude sur le verre en fusion avant le second cueillage. Au contact du verre chaud, le bicarbonate de soude se décompose et produit du gaz carbonique.
— *La coloration*. Les effets de couleur peuvent être obtenus de diverses manières.
◇ *<u>La coloration dans la masse</u>*. La coloration de la matière en fusion est obtenue en ajoutant au mélange vitrifiable des oxydes métalliques en très petite quantité, de 2 à 4 %. À chaque couleur

sa composition et toutes les compositions ne sont pas nécessairement compatibles entre elles. Le verrier doit identifier les caractéristiques de chaque verre coloré afin de déterminer s'il peut les associer entre eux.

- ◊ <u>*La coloration avec de la poudre de verre coloré*</u>. De la couleur peut être appliquée en surface de la paraison sous forme de poudre d'émail (du verre pilé). La paraison est roulée sur le marbre où la poudre d'émail est étalée. La poudre fusionne alors dans le four de travail et on obtient une masse de verre monochrome.
- ◊ <u>*La couleur doublée.*</u> À chaud, le verrier recouvre le verre clair d'une couche de verre de couleur en cueillant de la matière dans plusieurs pots contenant des verres de couleurs différentes. La doublure peut s'effectuer à l'extérieur ou à l'intérieur de la pièce et plusieurs couches de couleur peuvent être superposées.

— *Le verre soufflé au chalumeau*. Il est possible de fabriquer des contenants en verre de toutes les formes et de toutes les tailles à partir de tubes en verre. Le verrier détermine le diamètre du tube en fonction de la pièce qu'il souhaite réaliser. La partie du tube à dilater est d'abord chauffée, étirée, puis soufflée afin d'éviter que le tube s'aplatisse. La forme creuse est modelée par le mouvement que lui impriment les mains du verrier, mais aussi à l'aide de différents outils, pinces et ciseaux. Cette technique permet de réaliser des formes très complexes. Plusieurs parties peuvent être façonnées indépendamment les unes des autres puis assemblées dans un second temps. Il est également possible d'ajouter des ponts éphémères en verre aux objets en cours de fabrication afin de les saisir et de les faire tourner plus aisément.

2.2. La technique du verre au chalumeau

Le travail du verre au chalumeau est réalisé à la table, c'est-à-dire à un poste de travail assis. Il s'effectue à partir d'un matériau préalablement transformé. Le verre utilisé se présente en effet sous forme de tubes creux ou de baguettes pleines qui peuvent être de différents diamètres, compositions et couleurs.

Une source de chaleur est nécessaire. Elle est produite par un chalumeau dont la flamme est alimentée par une arrivée d'oxygène, parfois enrichie d'hydrogène. Le tube ou la baguette de verre est rapproché de la flamme (entre 600 et 1200°C). Le verre est chauffé ; sa température augmente jusqu'à ce qu'il ramollisse et devienne malléable. La température et la viscosité de la matière doivent être contrôlées et maintenues tout au long de la mise en forme de l'objet. Les mains du verrier tiennent les extrémités du tube (ou de la baguette) auquel il imprime un mouvement de rotation régulier et continu pour créer diverses formes, pleines ou creuses. Le verre peut être filé ou soufflé.

— *Le verre filé au chalumeau*. La technique du verre filé au chalumeau est employée pour créer des pièces décoratives ou artistiques. Des figurines colorées de petite taille peuvent par exemple être réalisées à partir de baguettes pleines de différentes couleurs. Le verrier tient les extrémités de la baguette. Il en modèle la partie chauffée à la flamme par des mouvements de rotation et d'inclinaison. Il s'aide de la gravité et parfois de petites pinces ou autres outils.

L'application la plus connue du verre au chalumeau est la verrerie scientifique et technique. Les laboratoires scientifiques intègrent le verre dans leurs installations car il réunit plusieurs propriétés. Le verre est d'abord pédagogique, car transparent, mais aussi mauvais conducteur de chaleur. Il présente surtout une forte résistance chimique, mécanique et thermique. Une catégorie bien spécifique de verre est généralement utilisée dans la verrerie scientifique: le borosilicate.

Les progrès de la chimie et les demandes toujours plus sophistiquées des laboratoires ont conduit les verriers à s'investir dans la recherche et l'innovation. De nombreux procédés ont été développés qui font aujourd'hui partie du savoir-faire inhérent à la verrerie scientifique, parmi lesquels:

- La soudure verre-métal, que l'on réalise grâce à une couche d'oxyde qui fait lien entre les deux matières ;
- L'irisation, dont l'objectif est de rendre la surface du verre conductrice d'électricité par un dépôt métallique ;
- L'argenture, qui favorise l'isolation par réflexion.

3. Le travail à froid

Le travail du verre à chaud couvre deux métiers d'art verriers: celui du verrier à la main et celui du verrier au chalumeau. Il peut être complété par un travail à froid, avec une intervention directe sur la matière durcie par le verrier décorateur. Il est en effet possible d'agrémenter les pièces refroidies d'éléments décoratifs par l'ajout de dorure ou la création de motifs qui sont creusés dans la matière, plus ou moins profondément, grâce à la technique de la taille ou de la gravure.

3.1. La taille

Plus profonde que la gravure, la taille permet de réaliser des décors géométriques par retrait de matière. Le cristal, par sa composition et ses propriétés, est davantage adapté à la taille. Recherché pour son éclat, il est en plus tendre à usiner.

Le tailleur utilise des meules de divers gabarits et de différentes sortes selon les étapes. Il les choisit dans des matériaux de moins en moins dur à mesure que la taille progresse. Les meules peuvent être en carborundum, en liège, en diamant, en grès, en bois… Elles sont fixées verticalement sur un axe actionné par un moteur. De l'eau s'écoule en continu sur leur surface pour éviter l'échauffement de la matière travaillée. Le tailleur se positionne debout ou assis, devant la meule, le poids du corps légèrement en avant, en appui sur les coudes, les mains de part et d'autre de la meule. Il tient entre ses mains l'objet qu'il incline et manipule pour le faire entrer en contact avec la meule aux endroits voulus. Le tailleur travaille sans guide et sans gabarit, il ne peut se fier qu'à son œil et à la précision de ses mains guidées par le compassage. La complexité des motifs est variable et le poids des grandes pièces constitue souvent une difficulté supplémentaire pour le tailleur.

La taille comporte plusieurs étapes.

- *Le compassage*. La première étape est celle du compassage. Elle consiste à marquer avec des lignes et des points, directement sur la pièce et à partir d'un modèle ou d'un plan, les divisions de la pièce, les hauteurs et largeurs des décors et les repères qui définissent l'emplacement des motifs. Plus le tailleur est expérimenté, moins il a besoin de repères, plus l'étape du compassage est écourtée.
- *L'ébauche.* L'ébauche est l'étape pendant laquelle le tailleur enlève le plus de matière. Elle s'effectue à l'aide d'une meule de carborundum. Le grain de la meule est choisi en fonction de

la profondeur de taille que l'on souhaite obtenir. La taille est un travail progressif, avec un choix d'angle plus ou moins aigu à mesure que le motif progresse.

- *La taille.* La taille permet d'affiner les décors avec des profondeurs de tailles différentes. Il existe de nombreux motifs, parmi lesquels les pointes de diamant, les côtes plates, les côtes de bambou, les filets, les côtes torses, les draperies, les perles et les olives. Au XIXe siècle, la taille à la meule devient de plus en plus complexe et prend l'appellation de "taille riche".
- *La technique du doublé ou de l'overlay.* Lorsque la pièce est composée de deux couches superposées (ou plus) de cristal, l'une claire et l'autre de couleur, le travail du tailleur est d'entrer dans la matière pour révéler la couche intérieure (en général, la couche claire). Cette technique permet de créer des motifs avec des contrastes de couleur.
- *Le polissage*. Les opérations de taille rendent la pièce mat. Une fois la taille achevée, il faut donc polir l'objet pour lui redonner son éclat et sa transparence. Le polissage peut s'effectuer manuellement avec une meule en liège, de la pâte à polir (pierre ponce), puis une meule de laine avec de l'oxyde de cérium. On peut aussi utiliser de l'acide pour réaliser cette tâche. Les pièces sont alors trempées dans un bain d'acide et mises en mouvement, puis rincées une fois qu'elles sont redevenues lisses.

3.2. La gravure

La gravure permet d'obtenir des motifs plus fins que la taille. Plusieurs procédés existent.

- *La gravure à la roue.* La gravure à la roue permet des tracés fins et précis mais requiert une grande habileté. La roue est un disque de cuivre placé sur un tour motorisé. Associée à une poudre abrasive, la roue, mise en mouvement, entaille la surface du verre par rotation.
- *La gravure à la pointe de diamant*. L'instrument employé est un stylet de métal à l'extrémité duquel est placé un éclat de diamant. Son utilisation s'apparente à celle de la gravure à la pointe sèche. La gravure est opérée en réalisant des traits parallèles qui permettent d'obtenir différentes nuances de blanc ou des pointillés dont le rendu est plus délicat.
- *La gravure à l'acide.* Un décor est d'abord appliqué sur le verre sous la forme d'une sorte de masque constitué de vernis au bitume. Le verre est ensuite plongé dans un mélange d'acides fluorhydrique et sulfurique. L'acide attaque les parties non protégées par le vernis et crée ainsi un décor. Les parties protégées, elles, ne sont pas détériorées et demeurent transparentes.

I.6. Langue(s) utilisée(s) dans la pratique

Essentiellement le français.

Dans certaines verreries et cristalleries de la région Grand-Est, le francique lorrain (aussi nommé platt) est encore très utilisé par les artisans.

I.7. Éléments matériels liés à la pratique

Patrimoine bâti

Le travail du verre à chaud s'effectue généralement dans un lieu vaste, haut de plafond, aéré et lumineux, que l'on nomme "halle". Des grands sites verriers des XVIIIe et XIXe siècles, il reste parfois des bâtiments préservés, voire réhabilités. L'ancienne halle du site verrier de Meisenthal a, par exemple, été réaménagée et transformée en un lieu dédié aux arts vivants et aux arts plastiques. Certains éléments du patrimoine architectural verrier sont également protégés au titre des Monuments historiques:

— ancienne verrerie de Trinquetaille
— verrerie de la Gare ou verrerie Denin
— ancienne verrerie de Charles-Fontaine
— ancienne verrerie de Lettenbach
— ancienne cristallerie ou manufacture des Cristaux de la Reine
— ancienne verrerie du Hochberg

Objets, outils, matériaux supports

Les fours

— *Arche:* four de recuisson, qui permet de refroidir progressivement les pièces une fois le travail à chaud achevé.
— *Four de fusion*: four, à pots ou à bassin, dans lequel sont effectués la préparation et la fusion du verre.
— *Four à pots*: enceinte réfractaire chauffée au bois, au gaz ou au fioul, dans laquelle sont placés des pots qui contiennent différentes compositions de verre. Il existe aussi des fours à pot unique, plus petits.
— *Four à bassin:* type de four inventé à la fin du XIXe siècle, qui a progressivement remplacé le four à pots. Il fonctionne au gaz, au fioul ou à l’électricité et comprend une grande cuve en matériau réfractaire.
— *Four de travail ou de réchauffe*: souvent placé à proximité du banc du verrier, il permet de réchauffer une pièce en cour de façonnage, mais aussi de chauffer l’extrémité des cannes, ferrets et pontils.
— *Ouvreau*: ouverture pratiquée dans les parois du four à fusion pour permettre le cueillage du verre.

Les outils du verrier

— *Banc du verrier*: banc, en fer ou en bois, munis de bras en fer appelés “bardelles”, sur lesquels la canne ou le pontil sont placés à l’horizontale pour pouvoir être roulés d’avant en arrière pendant le travail à chaud.
— *Canne à souffler*: canne creuse en fer ou en acier inox ; à l’une de ses extrémités est fixé un cône en acier réfractaire appelé “mors”, partie qui cueille le verre.
— *Chalumeau:* à partir d’une source de gaz sous pression, le chalumeau produit et dirige une flamme à la température élevée. Il est fixé à la table de travail afin de libérer les mains du verrier.
— *Ciseaux:* de différentes tailles et différentes formes, ils sont utilisés pour couper ou rogner le verre pendant le travail à chaud.
— *Ferret:* tige pleine en métal qui permet de cueillir du verre en vue d’apports de verre pour façonner des éléments tels que jambes, anses, pieds…
— *Fers*: pinces en métal de différentes formes (à jambe ronde, à jambe coupante, plats), qui servent à trancher le verre, ouvrir la paraison…

— *Gamin mécanique*: il permet au verrier de contrôler l'ouverture et la fermeture du moule avec une pédale.

II. APPRENTISSAGE ET TRANSMISSION DE L'ÉLÉMENT

II.1. Modes d'apprentissage et de transmission

Autrefois, la transmission des gestes des métiers d'art verriers s'effectuait presque exclusivement de père en fils. Lorsque la taille et la structure des ateliers changèrent, le mode d'apprentissage évolua également, débutant dès le plus jeune âge au sein même des verreries. L'organisation du travail et la répartition des tâches entre les différents postes facilitaient la transmission du savoir-faire en contexte de production.

Aujourd'hui, il existe plusieurs écoles en France qui dispensent un enseignement spécialisé dans le domaine du verre (à chaud et à froid), structuré en plusieurs diplômes reconnus par l'Éducation nationale. Cependant, il est tout à fait admis que l'apprentissage des métiers du verre est principalement fondé sur l'expérience et ne peut s'effectuer que sur un temps long. Les écoles enseignent néanmoins des bases théoriques et techniques essentielles. Elles permettent aussi de repérer et de sélectionner ceux qui possèdent les aptitudes indispensables aux métiers du verre mais aussi le goût et la motivation pour rejoindre un environnement de travail parfois difficile.

La structure des équipes au sein des ateliers est, aujourd'hui encore, propice à l'échange et à la transmission. Les grandes verreries, notamment, ont compris que le temps d'apprentissage pour former un verrier accompli était incompressible et que la transmission en entreprise était fondamentale pour éviter une rupture des savoir-faire ou des gestes propres à la production de l'entreprise. Les chefs de place et les chefs de compagnie sont ainsi chargés de guider et de former les nouvelles recrues. Des actions sont également mises en œuvre, dans certains ateliers, qui encouragent les verriers à parfaire leur technique, qu'il s'agisse de concours ou de sessions de fo Le concours "Un des Meilleurs Ouvriers de France" joue aussi un rôle important dans la transmission des gestes. Le titre de Meilleur Ouvrier de France (MOF) est presque unanimement perçu par la communauté des verriers comme la plus haute distinction qu'un verrier puisse obtenir en reconnaissance de son expérience et de sa maîtrise. Depuis 2001, le titre de MOF est reconnu comme diplôme d'État de niveau III, mais il bénéficie surtout d'une aura particulière. Les MOF sont souvent perçus par les jeunes praticiens comme des références auprès desquelles trouver un conseil. Les détenteurs du titre MOF constituent un réseau qui favorise l'échange et encourage la transmission.rmation interne.

II.2. Personnes/organisations impliquées dans la transmission

- **Lycée Jean-Monnet, Yzeure (Auvergne-Rhône-Alpes)**

Le lycée Jean-Monnet accueille, dans ses murs, l'École nationale du Verre, fondée en 1963 à proximité d'une cristallerie, celle de Souvigny, avec le soutien de la Fédération des Cristalleries et Verreries à la main et mixtes. Auparavant, le cursus de formation était structuré autour de plusieurs diplômes: le CAP Arts du verre et du cristal et le CAP Décorateur du verre (cursus en 2 ans, diplôme de niveau V), le BMA Souffleur de verre et le BMA Verrier décorateur (cursus en 2 ans, diplôme de niveau IV) et le DMA Arts du verre et du cristal (cursus en 2 ans, diplôme de niveau III). Cependant, la réforme DN MADE, qui concerne l'enseignement du design, des arts appliqués et des métiers d'art, est entrée en vigueur au lycée Jean-Monnet à la rentrée de septembre 2018 et a entièrement modifié la structuration des formations. L'École nationale du Verre propose désormais un cursus DN MADE, mention Matériaux, spécialité Créateur verrier, pouvant aboutir à un diplôme de niveau II.

- **Lycée professionnel Dominique-Labroise, Sarrebourg (Grand-Est)**

Le lycée professionnel Dominique-Labroise forme aux métiers du verre à chaud et à froid. Il propose un CAP Arts du verre et du cristal avec trois spécialités (verrier, taille-gravure et décorateur) et un BMA Souffleur de verre.

- **Lycée scientifique et technologique Dorian, Paris (Île-de-France)**

Le lycée scientifique et technologique Dorian est particulièrement réputé dans le domaine de la verrerie scientifique. Une section d'enseignement en formation initiale est dédiée depuis 1931 au métier de souffleur de verre en verrerie scientifique.

- **Centre européen de Recherches et de Formation aux arts verriers (CERFAV), Vannes-le-Châtel (Grand-Est)**

Fondé en 1991 avec le soutien des collectivités locales et de l'université de Lorraine, le CERFAV est implanté dans une commune historiquement liée à l'industrie verrière. L'association est à la fois un lieu de formation et de recherche. Elle forme par apprentissage au CAP Arts et techniques du verre, option Décorateur sur verre, au CAP Arts du verre et du cristal (souffleur de verre) et au CAP Soufflage (verrerie scientifique). Le CERFAV anime la formation "Créateur verrier", une formation de 2 ans, qui donne accès à une certification de niveau III inscrite au Répertoire national des certifications professionnelles (RNCP). Le CERFAV propose également une formation "Concepteur Créateur" et des formations en ligne ouvertes à tous: les MOOC (Massive Open Online Course) VITRA 1 et VITRA 2.

- **Université régionale des Métiers d'art, Sorrèze (Occitanie)**

Ce lieu de formation a la particularité de proposer, parmi ses cursus, un enseignement spécialisé dans la verrerie scientifique.

II.3. Évolution/adaptation/emprunts de la pratique

Un souci accru de la santé au travail

Issus d'un savoir-faire artisanal, les gestes des métiers d'art verriers impliquent, par définition, une forte présence de la main, mais pas seulement. Les métiers du verre se distinguent par l'implication du corps qui est requise dans la pratique. Dans le travail du verre à chaud comme dans la taille, l'ensemble du corps est mobilisé et sert d'outil de travail. Les charges peuvent être lourdes et la répétition du geste difficile. Les risques sont d'ailleurs multiples, qu'il s'agisse de l'exposition continue à la chaleur, du contact avec les produits utilisés sous forme de poudre pour la fabrication du verre ou de l'exposition aux émanations du verre en fusion. La vue peut être affectée par l'observation permanente du verre en fusion et provoquer la cataracte des verriers, alors que la tendinite est connue pour être la "maladie du tailleur". Les ateliers sont bien entendu équipés de dispositifs de filtration et d'aération mais, depuis quelques années, la vie des verreries est nouvellement impactée par un souci accru de la santé au travail.

La FCVMM est notamment très investie dans l'analyse et la prévention des troubles musculosquelettiques et des risques chimiques, auxquels les salariés des verreries sont exposés. En 2018, des prestataires extérieurs ont été sollicités afin de mener, dans les verreries membres de l'organisation professionnelle, des actions visant à améliorer les conditions d'exercice des verriers sans entraver leurs gestes. Sont par exemple à l'étude: des équipements d'aide à la manutention du verrier à chaud, des dispositifs ergonomiques pour la population des trieurs-choisisseurs, des analyses de l'exposition des salariés aux risques chimiques.

L'évolution des types de production et des réseaux de distribution des cristalleries

Ces dernières années, la transformation des modes de consommation a considérablement impacté les types de production et les réseaux de distribution des cristalleries. À l'origine, l'industrie du cristal était presque exclusivement dédiée à la fabrication de services de table. Aujourd'hui, la demande évolue. Selon la FCVMM, la part des listes de mariage dans le chiffre d'affaire des cristalleries, qui pouvait atteindre 25 % il y a 25 ans, est aujourd'hui de moins de 3 %.

Aussi les cristalleries ont-elles dû rechercher de nouveaux débouchés et modifier leurs productions. Désormais, les grandes maisons du cristal collaborent avec des designers, fabriquent des luminaires et investissent l'univers de la décoration d'intérieur, de la bijouterie et de l'édition d'art. De plus, elles s'ouvrent davantage aux marchés étrangers, avec l'ouverture de points de vente en Asie et au Moyen-Orient. Selon la FCVMM, l'export représentait, en 2017, près de 70 % du chiffre d'affaires des principales maisons.

L'adaptation aux normes environnementales

Les préoccupations grandissantes liées à l'écologie ont aussi des conséquences sur la manière dont les savoir-faire verriers sont pratiqués aujourd'hui. Les manufactures verrières doivent en effet s'adapter à des normes environnementales de plus en plus exigeantes, ce qui peut représenter de lourds investissements. Les cristalleries sont, par exemple, tenues de se conformer aux diverses réglementations liées à l'usage d'oxyde de plomb dans la fabrication de cristal. Dans ce domaine, la législation européenne est régulièrement actualisée et comprend plusieurs textes, parmi lesquels le règlement REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals), la directive ROHS (Restriction of Hazardous Substances) et la réglementation sur le contact alimentaire.

III. HISTORIQUE

III.1. Repères historiques

Pline l'Ancien attribue aux Phéniciens la découverte du verre et de sa fabrication. Dans son *Histoire naturelle*, il raconte comment des marchands de nitre (nitrate de potassium, aussi connu sous le nom de salpêtre) accostèrent sur les rives du fleuve Bélus et firent la découverte fortuite du verre au moment du repas. D'après le naturaliste, les marchands utilisèrent des pains de nitre qu'ils transportaient dans leur cargaison pour surélever leur marmite. Le sable du rivage, mélangé au nitre, se transforma alors en verre sous l'action du feu. Ce récit, bien connu des verriers, constitue davantage une légende qu'un fait historique. Il est cependant avéré que l'histoire du verre et de son appréhension par l'homme est très ancienne.

Les premiers objets utilitaires en verre datent de 1500 ans avant Jésus-Christ. Ils ont été retrouvés au Proche-Orient, en Egypte et en Syrie. En revanche, la présence de verre transparent manufacturé n'est attestée qu'à partir du Ve siècle avant Jésus-Christ. La technique du soufflage, quant à elle, semble avoir été introduite par les Égyptiens et les Phéniciens au Ier siècle avant Jésus-Christ. Ce nouveau procédé de mise en forme du verre, plus rapide, permet le développement d'une production à grande échelle et favorise la diffusion des objets comme du savoir-faire. L'art du verre se propage grâce aux échanges commerciaux et aux migrations de population. Il atteint Rome, puis Byzance et enfin Venise. Le savoir-faire voyage, la technique évolue, se perfectionne et fait l'objet de nouvelles découvertes. La chimie des couleurs, par exemple, se développe à proximité des grandes métropoles comme Rome et Alexandrie.

Au XIIIe siècle, alors que les artisans français se consacrent au verre plat et s'illustrent dans l'art du vitrail, Venise s'octroie le monopole de l'industrie verrière. Sur l'île de Murano, les premiers fours sont installés en 1291. L'invention, en 1453, du cristallo, un verre d'une grande transparence et d'une grande finesse nommé ainsi en référence au cristal de roche, contribue à la renommée des productions vénitiennes. Jusqu'au XVIe siècle, la Sérénissime reste difficile à concurrencer.

Des verreries commencent à s'installer dans différentes régions de l'Europe au XVe siècle, notamment en France, en Angleterre et en Europe centrale, où les verreries de Bohême se forgent rapidement une solide réputation pour la qualité de leurs productions. En France, l'industrie verrière se développe au cœur des régions qui réunissent en abondance les ressources et matières premières nécessaires à la fabrication du verre: le bois (alors seul combustible employé), le sable contenu dans le sol et la potasse extraite des cendres de fougères. La région de Bitche, en Lorraine, et la vallée de la Bresle, à la frontière de la Normandie et de la Picardie, sont deux des foyers de l'industrie verrière parmi les plus connus en France.

Les verriers, d'abord itinérants — initialement, les verriers se déplaçaient lorsque les ressources en bois à proximité de leur atelier éphémère étaient épuisées —, se fixent et s'implantent durablement en divers lieux grâce aux droits et privilèges que leur accordent les seigneurs. Une charte est ainsi signée en faveur des verriers lorrains en 1448, puis confirmée en 1469, par Jean de Calabre. Le privilège d'affouage est également accordé à certaines familles de verriers, en Normandie, pour l'exploitation de la forêt d'Eu. Enfin, dans le Languedoc, Charles VII concède certains privilèges aux verriers dès 1445. Les verriers, en vertu de leur savoir-faire et des secrets qu'ils se transmettent de père en fils, obtiennent certes de nouveaux droits, mais ils rejoignent surtout les rangs de la noblesse. Ainsi naît la caste des"gentilshommes verriers".

En France, l'industrie verrière bénéficie aussi de l'impulsion donnée par le roi Louis XIV, qui rachète la Compagnie des Glaces et fonde plusieurs manufactures royales comme les Verreries de Saint-Gobain. L'ambition du roi est alors de concurrencer Venise ; il va jusqu'à débaucher des verriers de Murano pour tenter de percer les secrets jalousement conservés sur l'île vénitienne.

À mesure que la production d'objets en verre s'intensifie, la consommation de bois par les verriers augmente et entraîne un important déboisement. En Angleterre, l'édit du roi Jacques Ier interdit aux verriers l'utilisation du bois comme combustible. Le charbon remplace le bois dès 1615, mais le nouveau combustible dégage une fumée qui colore le verre.

Les verriers anglais doivent alors s'adapter et leurs réflexions les amènent à faire une découverte extraordinaire: celle du cristal. La fusion en "pot couvert", creuset surmonté d'un chapiteau qui empêche le contenu du creuset d'être atteint par les fumées du combustible, est d'abord adoptée. Puis, les fondants habituels sont remplacés par du plomb pour accélérer la fonte du verre. C'est ainsi que le cristal est découvert par Georges Ravenscroft en 1674. Apprécié pour sa sonorité et son éclat incomparable, le cristal est aussi réputé pour son adaptation à la taille profonde, une propriété qui ouvre bien des possibilités décoratives. Le secret de fabrication de ce nouveau type de verre ne sera percé, en France, qu'un siècle plus tard.

Le XVIIIe siècle est un siècle de concurrence. Chaque nation tient à protéger la confidentialité de ses procédés et à défendre les spécificités de sa production: Murano préserve le secret du cristallo, les verreries de Bohême se distinguent avec leur verre coloré, en particulier leur verre rouge rubis et l'Angleterre détient le monopole du cristal au plomb.

Le roi Louis XV, l'arrière-petit-fils du roi Louis XIV, influence à son tour l'histoire de l'industrie verrière. Il encourage l'initiative privée et accorde divers privilèges aux entrepreneurs français par lettres patentes et arrêts royaux. C'est dans ce contexte que la Lorraine est rattachée à la France. Dans les années 1760, le roi, qui souhaite repeupler la région de Bitche et tirer profit de ses forêts, autorise l'évêque de Metz à construire une verrerie dans le village de Baccarat et deux avocats de Nancy (René-François Jolly et Pierre- Étienne Ollivier) à agir de même à Müntzthal (aujourd'hui Saint-Louis-lès-Bitche). La nouvelle verrerie de Müntzthal obtient le titre de "Verrerie royale de Saint-Louis" en hommage au roi Louis IX. Quelques années plus tard, en 1781, les verriers de Saint-Louis découvrent la formule du cristal au plomb. La fin du siècle est marquée par un progressif changement d'échelle qui va s'accentuer au siècle suivant.

Le XIXe siècle bouleverse les traditions verrières. L'emploi du charbon, moins coûteux que le bois, se développe dans toute l'Europe et les ateliers se transforment en manufactures. Le verre devient d'un usage plus courant ; la production d'objets utilitaires s'intensifie et s'industrialise. Certaines inventions favorisent cette dynamique et modifient les procédés traditionnels avec d'importantes répercussions sur les conditions de travail des verriers. Le four à bassin, par exemple, permet une économie de combustible, mais fonctionne en continue et nécessite une rotation des équipes toutes les 8 à 12 heures. Les moules métalliques, quant à eux, simplifient le travail du souffleur en même temps qu'ils affaiblissent ses prérogatives. Le privilège de gentilhomme verrier était en partie lié aux secrets de fabrication que seules détenaient les familles de verriers. Avec la mécanisation des procédés, les artisans perdent l'apanage du secret et la qualité de gentilhomme verrier disparaît. La condition des verriers est profondément impactée. Leur travail est déqualifié et les cadences qui leur sont imposées s'accentuent. Héritiers d'un savoir-faire artisanal ils sont de plus en plus perçus comme une main d'œuvre ouvrière. À la fin du XIXe siècle, les ouvriers des grandes verreries s'organisent en syndicats et fédérations afin de porter leurs revendications sociales.

Le XIXe siècle est aussi une période clef pour la verrerie scientifique et technique qui trouve ses origines dans l'Italie de la Renaissance et occupe une place à part dans l'histoire du verre. L'invention des premiers chalumeaux et l'arrivée du gaz (en 1850 à Paris) révolutionnent la technique dite “à la lampe” et permettent aux verriers de répondre aux besoins croissants des chercheurs en sciences.

Au début du XXe siècle, l'art Nouveau et l'art Déco trouvent dans le verre un moyen d'expression privilégié à travers les créations d'Émile Gallé, René Lalique, Daum ou encore Maurice Marinot. Les verreries françaises se distinguent aussi dans leurs collaborations avec les parfumeurs et la haute-couture. Dans les années 1960, la production de verre utilitaire s'automatise. Les verreries qui ne sont pas en capacité d'adapter leurs processus de fabrication ferment leurs portes et de nombreux ouvriers perdent leur emploi. La Lorraine, notamment, est particulièrement touchée. Aujourd'hui, le geste artisanal est revalorisé et redécouvert par le public. Des structures économiques très diverses construisent leur identité autour du maintien et du respect des gestes verriers, qu'il s'agisse des grandes cristalleries de l'est de la France ou de structures plus familiales, dédiées à l'accueil du public et dont la vocation est davantage orientée vers la pédagogie. Enfin, influencés par le mouvement Studio Glass qui s'est développé dans les années 1950 aux États-Unis, de petits ateliers s'implantent en France ; ils orientent leur activité vers la recherche esthétique et technique et s'ouvrent à des collaborations avec des designers et des plasticiens. La création du Centre européen de Recherches et de Formation aux arts verriers (CERFAV), dans les années 1990, participe pleinement à cette dynamique.

III.2. Récits liés à la pratique et à la tradition

- **Extraits d'entretiens**

Plusieurs entretiens ont été menés avec des praticiens pour constituer la présente fiche d'inventaire. Quelques extraits des retranscriptions faites d'après des notes écrites sont ici proposés.

— “Sept jeunes sont arrivés dans les trois ou quatre derniers mois. Parmi les sept, il y a ceux qui ont déjà un bagage verrier et ceux qui sont sans bagage, mais qu'on a pu tester pendant plusieurs jours. Le première tâche qu'on leur apprend est le cueillage. Il faut qu'ils soient en contact avec la matière et apprennent d'abord à se déplacer avec une canne. Ensuite, c'est le chef de place qui observe et analyse les progrès. Il donne des orientations et dirige la progression en fonction des mouvements qu'il observe mais aussi en fonction des opportunités. C'est la même chose dans le verre à froid. Au début, on apprend à effacer les marques de pontil, puis on s'exerce sur du rebut avant de travailler sur de véritables pièces.” [Loïc Garnier, directeur industriel des Cristalleries Saint-Louis, juin 2018]

— “J'ai passé mon CAP art et techniques du verre à Izeure. Je suis tombé dans le métier par hasard. Je voulais plutôt être tailleur sur cristal. J'ai découvert le verre à chaud à l'école. J'ai été attiré par le climat, les odeurs, les sensations dans l'atelier. J'ai été embauché à Saint-Louis en tant que cueilleur juste après avoir passé mon CAP, J'avais 19 ans. Le geste artisanal, le geste ancestral est préservé à Saint-Louis, c'est ce qui m'a attiré. J'ai fait 10 mois de cueillage, puis j'ai été souffleur pendant 6 ans, un peu sur toutes les places, et chef de place. Aujourd'hui, je suis chef d'atelier. […] Une fois qu'on a fait le tour du métier, le nouveau challenge c'est la transmission. L'apprentissage se fait par l'observation." [Nicolas Seychal, responsable verre chaud (MOF 2007) aux Cristalleries Saint-Louis, juin 2018]

— "Ma spécialité, c'est le fait-main, poser les jambes, les pieds … Si on sait faire du fait- main, on sait faire de la presse, ça ne va que dans un seul sens. Ce qui m'intéresse dans mon travail, c'est le niveau de précision, à l'œil, qu'on acquiert à force de répétition. Le matériel reste approximatif alors que la maîtrise de la main doit être totale. En tant que chef de place, je suis là pour corriger les gestes qui ne sont pas bons, pour enlever les gestes parasites. On se retrouve parfois dans les jeunes qui arrivent. Le plus important, c'est de gommer les erreurs dès le début." [Tony Carramusa, chef de place aux Cristalleries Saint- Louis, juin 2018]

— "La Verrerie de Soisy-sur-École a été créée par ma grand-mère. En 1978, face à la baisse du verre à la main, elle avait l'intuition qu'il fallait créer de petits ateliers pour montrer et faire perdurer le savoir-faire. […] Ici, on accueille environ 60 000 visiteurs par an. Il y a du monde toute l'année. Les particuliers viennent en famille. On accueille des groupes, notamment scolaires ou de troisième âge, parmi lesquels se trouvent beaucoup de groupes issus de CCAS [Centre communal d'action sociale] de toute la banlieue sud. […] Nous sommes cinq à travailler dans la verrerie: deux personnes travaillent le verre à chaud, une à froid, et deux vendeuses s'occupent de la boutique et de monter les bijoux et les luminaires […] Le gros de la production est destiné à la vente sur place mais l'atelier répond aussi à des commandes. On fabrique des petites séries pour des professionnels et de plus en plus de sur-mesure pour les particuliers." [Frédéric Alary, souffleur de verre à la Verrerie d'art de Soisy- sur-École, mai 2018]

— "L'entreprise Pignat fabrique des installations entières, pour des laboratoires et des industriels, dans lesquelles le verre est omniprésent. […] Dans l'atelier du verre, les grandes séries sont sous-traitées, car on ne veut pas faire de grandes séries ici. On fabrique des pièces variées et compliquées. C'est comme ça qu'on peut retenir les bons ouvriers. […] On ne fabrique pas directement le verre. On travaille à partir de tubes de différents diamètres, de 2 mm à 485 cm. […] Il a fallu inventer le tour pour pouvoir fabriquer de grosses pièces. Le tour remplace le mouvement de rotation de la main. Bien sûr, on ne peut travailler au tour que ce qui se trouve sur un axe. Et puis, il faut d'abord savoir travailler à la main. Le geste reste artisanal même si l'entreprise s'est beaucoup développée. Il y a eu une mécanisation progressive, mais toujours au service du geste initial. On produit aussi des pièces artistiques et on travaille avec des designers. On travaille notamment avec l'école de designers de Saint-Étienne. […] La transmission en entreprise est importante. Il faut jouer le jeu pour que l'école subsiste en accueillant des apprentis. L'école donne des bases, mais il faut leur apprendre le métier de zéro. C'est important de rencontrer d'autres verriers aussi, de voir d'autres ateliers. Mon père était MOF, alors j'ai eu la chance de rencontrer de grands souffleurs. Il y a de l'entraide dans le monde du verre. Le concours MOF permet de sensibiliser les jeunes. […] Un tempérament d'artisan, c'est être bricoleur, touche à tout, avoir le goût de la compétition, aimer le contact humain, être disponible pour réfléchir aux idées des clients. On est là pour rendre service. "[Pierre Pignat, souffleur de verre au chalumeau (MOF 1990) et fondateur de l'entreprise Pignat, juin 2018]

- **Mémoires et témoignages**

— Yves Blaquière, Le Souffle du verre: notes d'un amateur, Sorèze, Y. Blaquière, 1995

— Pierre Pignat, Pignat, un nom dans le verre, chez l'auteur, s.d.

— Michel Dumont, en collaboration avec Yves Borrel, Soufflage du verre et verrerie scientifique, Gif-sur-Yvette, M. Dumont, Paimpol et Y. Borrel, 2014

IV. VIABILITÉ DE L'ÉLÉMENT ET MESURES DE SAUVEGARDE

IV.1. Menaces sur la viabilité

La principale menace qui pèse aujourd'hui sur la pérennité des gestes des métiers d'art verriers concerne la transmission des savoir-faire. Si, en France, l'enseignement des bases techniques et théoriques, dans le domaine du verre, est assuré par plusieurs organismes reconnus, la formation d'un verrier accompli requiert du temps et s'effectue principalement en entreprise, sous la responsabilité des verriers les plus expérimentés.

Selon la FCVMM, la France compte aujourd'hui 1200 professionnels dans le domaine des métiers d'art verriers dont la majorité est âgée de plus de 44 ans. L'activité des ateliers verriers et des cristalleries est dépendante du degré de savoir-faire détenu par ses artisans. Pour survivre, les ateliers doivent relever le défi du renouvellement des générations, assurer la formation des jeunes artisans par les plus anciens et stabiliser leurs effectifs afin d'éviter une rupture des savoir-faire. Or, la transmission des gestes des métiers d'art verriers est difficile à transcrire et impossible à standardiser. Elle repose essentiellement sur la volonté et la pédagogie des professionnels en mesure de transmettre.

IV.2. Mise en valeur et mesure(s) de sauvegarde existante(s)

Modes de sauvegarde et de valorisation

- **Manifestations**

— Biennale internationale du Verre: organisée depuis 2009 par l'European Studio Glass Art Association qui présente l'événement comme le rendez-vous européen, pour le médium verre, des amateurs et collectionneurs d'art contemporain. La dernière édition s'est déroulée en 2015.
— Estivales du verre: organisées annuellement par le CERFAV, elles proposent des stages, d'une durée de 1 à 5 jours, des conférences, des démonstrations et des expositions thématiques sur le verre.
— Festival international des Arts du verre: organisé chaque année à Palau-del-Vidre (Occitanie) par l'Association pour le Patrimoine des Arts et de la Culture autour du Verre (APAC). La prochaine édition aura lieu du 8 au 11 août 2019.
— Festival international du Verre au chalumeau: organisé par l'association Flame'Off France, rassemblement d'artistes et d'artisans verriers spécialisés dans le travail du verre au chalumeau. La dernière édition s'est tenue au palais des Congrès de Remiremont (Grand-Est) du 27 au 30 juillet 2018.
— Journées européennes des Métiers d'art (JEMA): organisées chaque année par l'Institut national des Métiers d'art. De nombreux ateliers verriers ouvrent leurs portes à l'occasion de cet événement. La dernière édition s'est déroulée du 6 au 8 avril 2018.

- **Vecteurs de communication**

La plupart des ateliers verriers possèdent leur propre site internet qui valorise leur savoir- faire, mais aussi un point de vente ou un show-room ouvert au public implanté sur le lieu de production:

— Baccarat: https://www.baccarat.fr
— Daum: https://www.daum.fr
— Lalique: https://www.lalique.com/fr
— Meisenthal: http://ciav-meisenthal.fr

— Saint-Louis: https://www.saint-louis.com
— Verrerie de Soisy-sur-École: https://www.verrerie-soisy.fr
— Verrerie Biot: http://www.verreriebiot.com/fr

Certains proposent aussi des vidéos de présentation de leurs savoir-faire:

— "CIAV TV" : afin de garder trace de ses travaux, le Centre international d'Art verrier produit ou coproduit de courtes vidéos accessibles en ligne:
— https://vimeo.com/ciav/videos
— "Les savoir-faire de 10 maisons d'exception" : vidéo qui présente les savoir-faire des adhérents de la FCVMM:
— https://www.youtube.com/watch?v=so6ebAMDhqU
— "Baccarat, à l'origine de la légende"présente la cristallerie de Baccarat: https://www.baccarat.fr/fr/la-legende-de-baccarat/eblouissant-savoir-faire/

Actions de valorisation à signaler

En France, plusieurs musées possèdent et valorisent des collections d'objets en verre, anciens ou contemporains, retracent l'histoire des techniques verrières et proposent des démonstrations de savoir-faire. Généralement implantés à proximité d'anciens sites verriers, ces musées portent souvent le témoignage d'une mémoire verrière locale.

— Atelier-Musée du verre, Trélon (Nord): le musée du Verre de Trélon retrace l'histoire du verre dans l'Avesnois, de l'époque gallo-romaine à nos jours. Il est installé dans l'ancienne verrerie Parant, fondée en 1823. Le site a été restauré et conservé dans sa quasi intégralité. http://villesetvillagesdelavesnois.org/musees/museetrelon/museeverretrelon.htm
— Galerie-atelier du CERFAV, Vannes-le-Châtel (Meurthe-et-Moselle): le CERFAV possède un espace d'exposition ouvert au public. Il propose des expositions thématiques, mais aussi des démonstrations, avec des verriers nationaux et internationaux, autour des techniques de soufflage à la canne, verre au chalumeau et taille.
— La Halle du Verre/Musée du Verre et centre verrier du Grand Pic Saint-Loup (Hérault): https://www.cc-grandpicsaintloup.fr/-Halle-du-verre-.html
— Musée du Verre, Conches-en-Ouche (Eure): le musée du Verre de Conches présente des collections d'art verrier dans les domaines des arts décoratifs, du vitrail et de la sculpture contemporaine. https://museeduverre.fr/fr/presentation-du-musee
— MusVerre, Sars-Porteries (Nord): MusVerre présente une collection d'œuvres contemporaines en verre et de nombreux objets créés par les verriers de Sars-Poteries entre 1802 et 1937. https://musverre.lenord.fr/fr/Accueil.aspx
— Musée du Verre et de ses métiers, Dordives (Loiret): le musée du Verre et de ses métiers est dédié à l'évolution des techniques verrières, du soufflage à la canne et au chalumeau aux techniques industrielles. http://musees.regioncentre.fr/les-musees/musee-du-verre-et-de-ses-metiers
— Musée du Verre, Meisenthal (Moselle): http://site-verrier-meisenthal.fr/page/presentation
— Musée-Centre d'art du verre, Carmaux (Tarn): composé d'un musée, d'un centre d'art et d'un Centre de conservation et d'études archéologiques (CCE), le Musée-Centre d'art du verre de Carmaux est dédié au verre: son patrimoine comme ses usages dans l'art contemporain. Il

rassemble des collections d’objets en verre du grand Sud-Ouest et des documents et objets témoignant de l’histoire locale. http://www.museeverre-tarn.com/?lang=fr
— Musée du Verre, Sorrèze (Tarn): le musée du Verre de Sorrèze a été créé en 1995 par un enseignant, Yves Blaquière. Actuellement, le musée abrite plus de 2600 pièces de verre ancien, la plupart antérieures au XXe siècle. http://musee-du-verre.fr/

Pour faire connaître leur activité, les grandes cristalleries ont également ciblé le tourisme culturel et patrimonial, en créant des musées qui valorisent leurs archives et leur activité.

— Grande Place-Musée du Cristal Saint-Louis, Saint-Louis-lès-Bitche (Moselle): la cristallerie de Saint-Louis possède un département dédié à la préservation et à la valorisation de son patrimoine et de ses archives. La Grande Place-Musée du Cristal Saint-Louis donne à voir 2500 pièces et propose un parcours de visite de l’intégralité de la manufacture. https://www.saint-louis.com/fr/musee/la-grande-place.html
— Musée Lalique, Wingen-sur-Moder (Bas-Rhin): http://www.musee-lalique.com/
— Cristallerie Baccarat (Meurthe-et-Moselle): la cristallerie Baccarat possède un service patrimoine qui veille à la préservation et à la valorisation de ses archives, qu’il s’agisse de documents écrits ou d’objets en cristal. Le service patrimoine organise ainsi des expositions au sein de deux espaces: une galerie-musée au sein de la Maison Baccarat à Paris et le musée du Cristal implanté sur le site de la manufacture, à Baccarat.

Modes de reconnaissance publique

- **Label(s)**
  — Le label Entreprise du Patrimoine Vivant (EPV) est une marque de reconnaissance de l’État qui distingue des entreprises françaises aux savoir-faire artisanaux et industriels d’excellence. http://www.patrimoine-vivant.com/
  — Le label Pôle National d’Innovation pour l’Artisanat (PNIA) est octroyé par la direction générale des Entreprises (DGE) aux structures qui développent des synergies et des coopérations autour de l’innovation dans l’artisanat. Le CERFAV est ainsi reconnu comme PNIA des métiers du verre depuis 1993. https://www.entreprises.gouv.fr/secteurs-professionnels/poles-d-innovation-pour-artisanat
- **Réseaux**
  — Souffleurs de la science: association française des souffleurs de verre du CNRS, des universités et de la fonction publique. http://www.les-souffleurs-de-la-science.fr/accueil.html
  — Fédération des Cristalleries Verreries à la main et mixtes (FCVMM): syndicat professionnel, héritier de la Chambre syndicale des Fabricants de cristaux et de Verreries de France, créée en 1873. http://fedecristal.fr/
  — Fédération des Routes du verre: elle réunit les sites du sud-ouest de la France qui valorisent le patrimoine verrier du Languedoc et l'actualité de la création en verre. http://fede-routesduverre.overblog.com/
  — Route touristique des Arts du feu: de Mettlach en Sarre au Pays de Bitche, en passant par Völklingen, Sarrebruck, le Bassin houiller lorrain, la région de Sarreguemines et l’Alsace, la route touristique des Arts du feu crée un lien autour du thème du feu, reprenant l'ensemble des spécificités du secteur: la céramique et la faïence, le verre et le cristal, le fer et l'acier, le

charbon. https://www.mosl-tourisme.fr/programmes/la-route-touristique-des-arts-du-feu.html

— Route du feu SaarMoselle: initiative de l'Eurodistrict SaarMoselle concrétisée en 2015 pour développer le tourisme industriel, elle fédère dix sites dédiés au patrimoine industriel, parmi lesquels la Grande Place-Musée du Cristal Saint-Louis, le site verrier de Meisenthal et le musée Lalique. http://www.saarmoselle.org/page1536-la-route-du-feu.html#top

— Étoiles terrestres: le réseau fait la promotion de trois sites touristiques verriers (musée Lalique, site verrier de Meisenthal, Grande Place-Musée du Cristal Saint-Louis). http://www.etoiles-terrestres.fr/#pet

- **Distinctions professionnelles**

  — Le titre de Maître d'art est décerné à vie par le ministère de la Culture. Il distingue des professionnels des métiers d'art détenteurs d'un savoir-faire rare qu'ils s'engagent à transmettre. Plusieurs artisans du verre ont déjà été nommés Maître d'art: Jean-Pierre Baquère, verrier au chalumeau indépendant (2010) ; Serge Vaneson, tailleur et graveur sur cristal chez Baccarat (2006) ; Jean-Marc Schilt, souffleur de verre au Centre international d'art verrier de Meisenthal (2015). https://www.maitredart.fr/titre-maitre-d-art

  — Le concours "Un des Meilleurs Ouvriers de France" est organisé sous l'égide des ministères de l'Éducation nationale et de l'Enseignement supérieur et de la Recherche. Le diplôme associé est, depuis 2001, un diplôme d'État de niveau III, délivré par le ministère de l'Éducation nationale. https://www.meilleursouvriersdefrance.org/

Annex 3. Photographic documentation

A3.1 Silk pilot

Samples of photographic documentation acquired at HdS can be found below, regarding:

- Pattern design and instructions, Figure 26, Figure 27 and Figure 33.
- Stages of fabric design and creation Figure 28.
- Catalogues Figure 29 and Figure 30.
- Historical photographs Figure 31 and Figure 32.

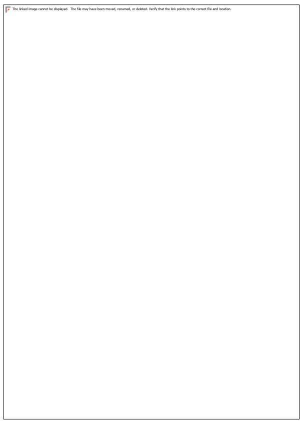
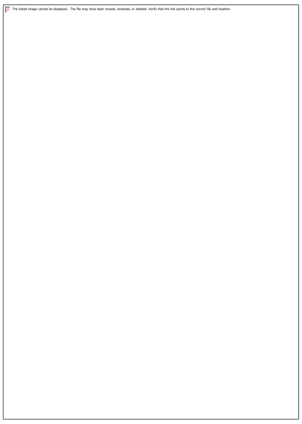
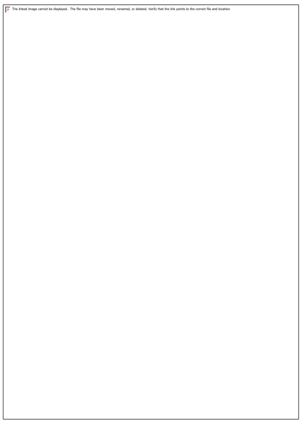




Figure 25. Pattern designs and woven fabric. [Qammaz, Zabulis, 2019]


Figure 26. Weaving instructions [Qammaz, Zabulis, 2019].

Figure 27. Weaving instructions [Qammaz, Zabulis, 2019].

Figure 28. Design and weaving of a fabric [Qammaz, Zabulis, 2019].

Figure 29. Fabric designs and samples [Qammaz, Zabulis, 2019].

Figure 30. Fabric samples and catalogue information [Qammaz, Zabulis, 2019].

Figure 31. Historical figures of the Gotzes company [Qammaz, Zabulis, 2019].

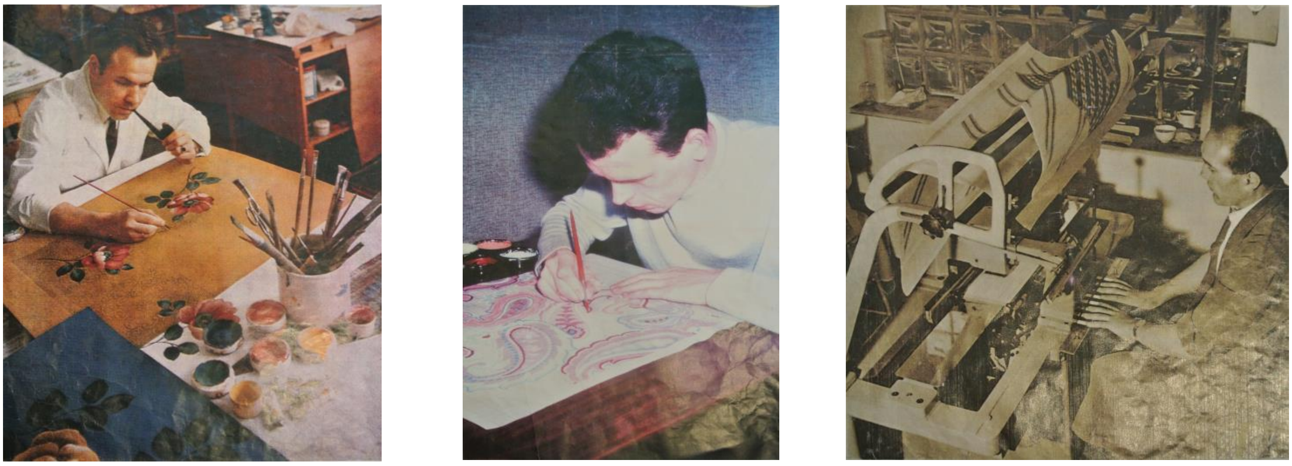


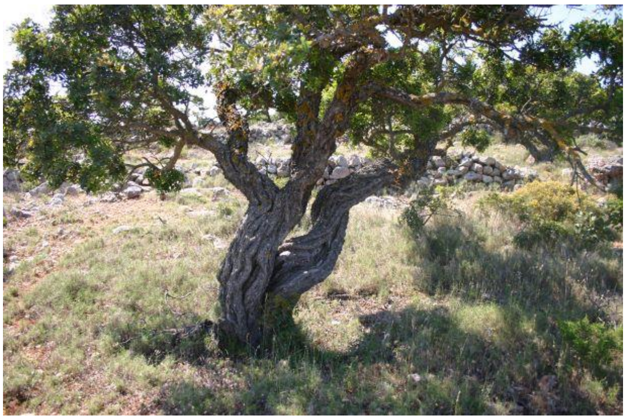
Figure 32. Pattern design and Jacquard encoding, in the past [Qammaz, Zabulis, 2019].

The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and location.

Figure 33. Technical diagram of Jacquard attachment operation [Qammaz, Zabulis, 2019].

A3.2 Mastic pilot

<u>The mastic tree</u>



	Etching by Jacob Enderlin. In *Archipelagus Turbatus…*, 1686.

<u>Chios Gum Mastic Growers Association</u>

	Chios Gum Mastic Growers Association badge

	The building of the Association in 1950-1960

Historical depictions

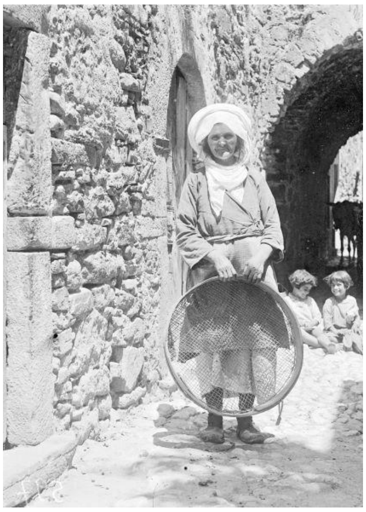
	Escutcheon of the Republic of Genoa (1005–1797).
	Chios, 16th century

Mastichochoria

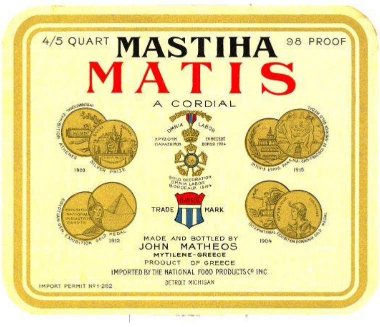
	Kalamoti village during the 1930s.
(a)  (b) 	Pyrgi village: (a) Agioi Apostoloi, (b) Xista are decorative patterns on the outside walls of the houses in Pyrgi.
 	Tower and road at Mesta.
 	At Olimpoi village.

Mastic field

Mastic processes

	Collecting mastic. By Edouard Charton. In *Le Tour de Monde*. Paris, 1878.
	Woman with sieve at Kalamoti, 1920 Photo by P. Papachatzidakis. Photography Archive of the Benaki Museum.
	Cleaning with water by the sea

Products

<table>
<tr><td>
</td><td>Label of “Matis” mastic liquor by John Matheos, Mytilene, imported by the National Food Products co. Inc. to Detroit, Michigan, USA.</td></tr>
<tr><td>
</td><td>Macedonian mastic liquor, 2000.</td></tr>
<tr><td>
</td><td>Label for mastic liquor by Tetteris Bros., Chios.</td></tr>
<tr><td>
</td><td>Label for mastic oil by the Chios Gum Mastic Growers Association.</td></tr>
</table>

<u>Machines</u>

 	Old and new blending machine for the production of the mastic gum mixture.
 	Old and new candy machine for the production of mastic gum dragees.
 	Packaging machine
 	Old new cutting machine
	Revolving cylinder

Mastic resin

<u>Objects</u>

	Baskets used while collecting the dried mastic resin
	Traditional mastic jars (bourboulakia) to transfer the mastic gum
	Homeware to store mastic gum

	Sini: Metal pan used to separate mastic gum and dirt
	Crate to transfer and store mastic gum

Tools

 	Amia: old agricultural tool for the preparation of the soil before kendima (embroidering)
	Axe

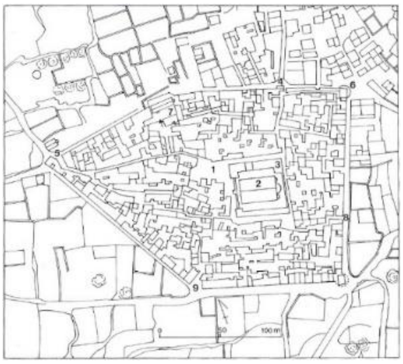
	Kenditiri: used for kendima (embroidering)
	Pickax
	Pruning hook
	Sieve

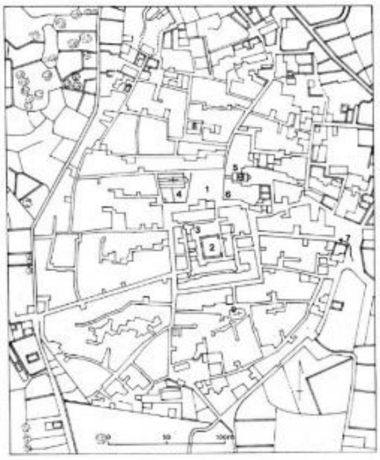
	Timitiri or xistiri: used for collecting the dried mastic gum

Religious depictions

 Saint Isidore.	Saint Isidore

Settlements

	Plan of Pyrgi

	Plan of Mesta

Customs

	On funeral wreaths in Istanbul they still use the phrase “seker ve sakiz” (sakiz=mastic) which underscores the importance of mastic in the Turkish cuisine and culture

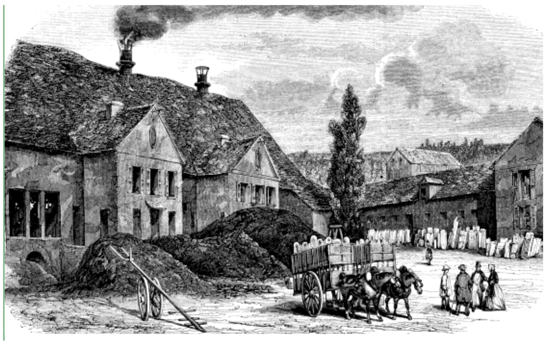
Traditions

	The tradition of Agha

A3.3 Glass pilot

Several objects gave by Bontemps as exhibited today at the Musée des arts et métiers, Paris

	The Crystal Jar, one of the items given by Bontemps in 1842 to CNAM.

	Drawing by Ebelmen of the glassmaker’s tools given by Bontemps in 1842. *Archives de la Manufacture de Sèvres, U17, liasse 52, document 4*.
	The glassmaker’s tools given by Bontemps in 1842 (Inv. 2788)
	The glass factory of Choisy-le-Roi in 1845

Annex 4. Filmography

A4.1 Silk pilot

***Einrichten des Golwebstuhles* (Setting up the Gold Loom), 2007-2010 and 2013-2017**

Created by Manfred Weisters, Günter Oehms, Wolfgang Volker. Haus der Seidenkultur, Film Project.

Explanations on the discussion between Günter Oehms and Manfred Weisters and on the films recorded on 3 DVDs.

Durations 36 min, 27min, and 52 mins.

Transcription

The transcription can be found on MOP and online at Zenodo:

https://zenodo.org/record/3876690#.XtkYgFUzbmE

***Stadtspaziergang auf Seiden Pfaden* (Hanging by a thread), 2018**

Created by Günter Oehms, Manfred Weisters, Rosemarie Viehweg-Weber, and Wolfgang Volker. Haus der Seidenkultur, Film Project.

Duration 16 mins.

***City walk on Silk Paths*, 2017**

Haus der Seidenkultur, Film Project.

Duration 16 mins.

Transcription

The transcription can be found on MOP and online at Zenodo:

https://zenodo.org/record/3876776#.XtkYf1UzbmE

A4.2 Mastic pilot

***The Tree we Hurt*, 1987**

IMDb summary: The friendship between two young boys during the summertime in 60's Chios Island.

Director: Dimos Avdeliodis

Screenplay: Dimos Avdeliodis

Music composed by: Dimitris Papadimitriou

Producer: Aristodimos Avdeliodis

Available in the archive and online at https://www.youtube.com/watch?v=4F3wmhM4kx8

The four seasons of law **(I earini synaxis ton agrofylakon), 1999**

IMDb summary: This film takes place at a small village at the Greek island of Chios, sometime around 1960. When the local field watchman dies, the agronomist must assign a new field watchman to be responsible for this village. We watch as four different people take this job and fail one after the other.

Director: Dimos Avdeliodis

Screenplay: Dimos Avdeliodis

Available in the archive and online at https://www.youtube.com/watch?v=gv9GJWO3MXA

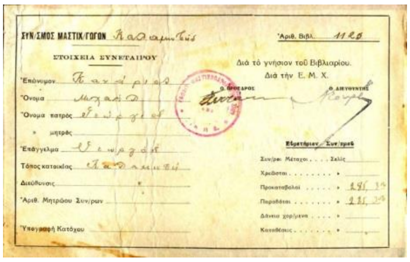
Annex 5. Digitised documents and archives

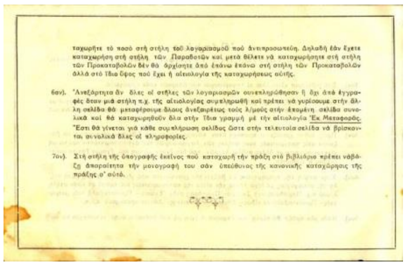
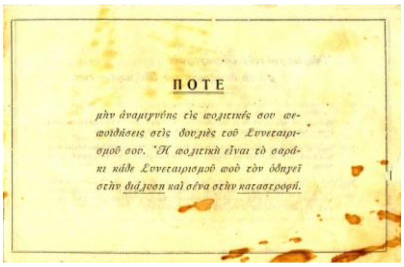
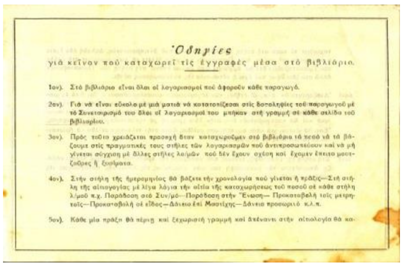
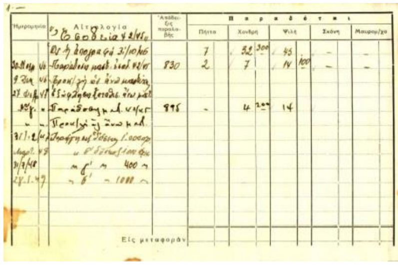
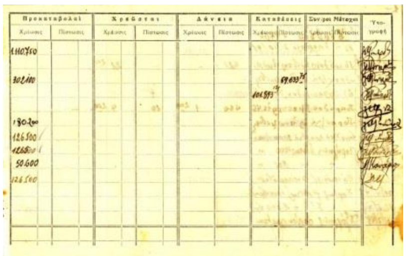
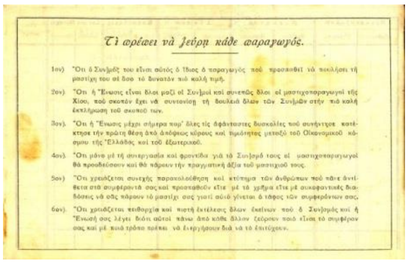
A5.1 Silk Pilot

- Sample catalogues
- Book

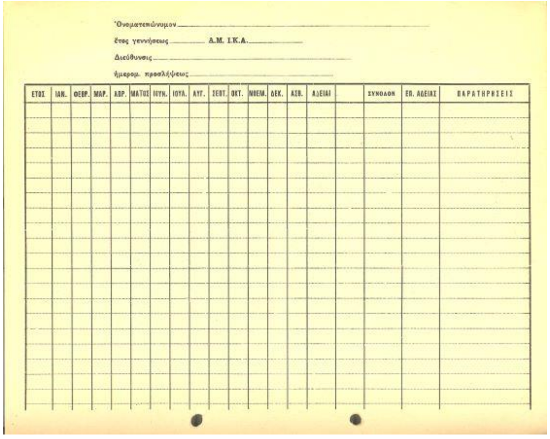
A5.2 Mastic Pilot

Indicative images shown from the digitised documents of the PIOP historical archive.

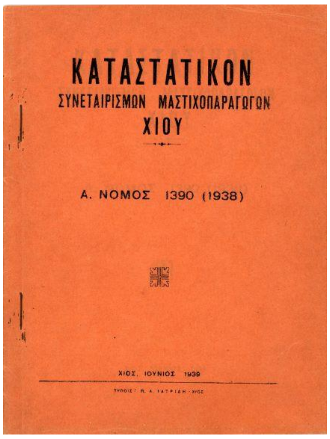



Booklet of the Chios Mastic Growers Association that every member of the Association should have and carry with him when he visited or conducted business with the Association. It contains records of transactions, rules that the member has to follow, and rules that the employee of the Association should follow in order to fill out the information correctly.



Health insurance record tab



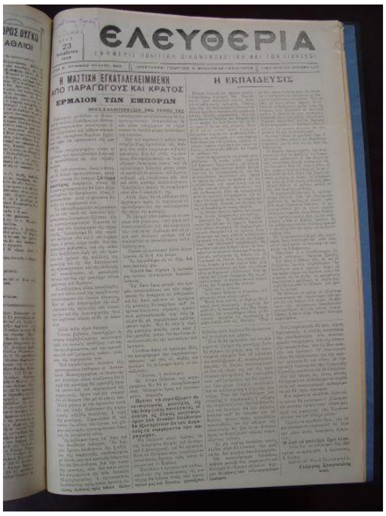
Articles of the Association published with the foundation of the Association in 1938

ΠΟΡΕΙΑ ΣΥΓΚΕΝΤΡΩΣΕΩΣ ΜΑΣΤΙΧΗΣ ΕΣΟΔΕΙΑΣ 1946

Μέχρι τῆς 15ης 'Απριλίου 1946 εἶχον συγκεντρωθεῖ στὶς ἀποθῆκες μας αἱ κάτωθι ποσότητες Μαστίχης ἐσοδείας 1946 κατὰ Συνεταιρισμοὺς καὶ ποιότητας.

Συνεταιρισμοί	Πήττα	Χονδρή	Ψιλή	Σκόνη	Μαυρομάστιχο	ΣΥΝΟΛΟΝ
"Αγιος Γεώργιος	322 300	756 300	1 545 300	87 200	176 —	2 888 300
'Αρμόλια	408 —	1 279 300	3 525 300	75 200	669 300	5 958 300
Βέσσα	18 200	67 100	106 100	2 200	20 300	215 100
Βουνὸ	824 300	2 220 100	3 713 200	106 300	87 100	6 952 200
'Ελάτα	9 200	463 —	1 733 050	9 200	120 200	2 335 250
"Εξω Διδύμα . .	129 100	285 200	827 100	29 200	50 300	1 322 100
Θολοποτάμι . . .	114 100	416 —	1 233 050	28 —	150 300	1 942 050
Καλαμωτὴ . . .	625 200	1 614 200	4 240 100	66 —	227 100	6 773 200
Καταρράκτης . .	438 300	1 559 —	3 832 200	79 —	49 —	5 958 100
Καλλιμασιὰ . . .	449 —	2 607 —	9 346 200	291 200	428 —	13 122 —
Κοινὴ	725 200	1 634 200	2 916 100	109 —	165 100	5 550 200
Λιθί	65 300	129 300	205 100	— —	13 —	413 300
Μέσα Διδύμα . .	312 100	1 016 200	1 839 350	79 300	176 —	3 424 150
Μεστὰ	150 200	490 200	720 300	23 —	178 300	1 563 200
Μυρμήγκι	68 100	255 —	807 100	20 200	155 300	1 306 300
Νένητα	2 001 300	4 299 300	10 259 300	666 —	916 300	18 144 —
Νεχωρι	191 200	931 100	2 409 300	83 100	179 300	3 795 200
'Ολύμποι	307 100	838 —	1 749 —	95 100	235 —	3 224 200
Πατρικὰ	577 300	847 —	1 325 300	118 200	140 —	3 009
Πυργὶ	1 275 200	4 752 200	13 748 300	341 200	1 299 200	21 417 300
	9 016 100	26 463 300	66 086 150	2 312 200	5 439 300	109 318 250

Analytical table of mastic crop arranged per mastic type and the sum, 1946

 ΧΙΑΚΑΙ ΗΜΕΡΑΙ Η ΚΡΙΣΙΣ ΤΗΣ ΜΑΣΤΙΧΗΣ ΤΙ ΕΠΙΒΑΛΛΕΤΑΙ ΝΑ ΓΙΝΗ ΕΠΙΤΟΠΙΑ ΝΕΩΤΕΡΑ	Newspaper 'Pagchiaki', 1915
 ΕΛΕΥΘΕΡΙΑ Η ΕΚΠΑΙΔΕΥΣΙΣ	Newspaper 'Eleutheria', 1929
 ΝΕΑ ΧΙΟΣ ΑΝΑΚΟΙΝΩΣΙΣ ΜΑΚΡΑ	Newspaper 'Nea Chios', 1941

A5.3 Glass Pilot

Captured images

Annex 6. Digitisation of Tangible Heritage

A6.1 Photographic documentation

A6.1.1 Two dimensional content: printed matter, manuscripts, visual depiction

A scanner or rectified photography is the recommended scanning modality for:

- Documents of text, visual art, and elements of printed matter
  - Two-Dimensional Manuscripts or Artefacts: original documents or artefacts, requiring faithful reproduction of the colour and/or texture of the material and the information it contains. Examples: older manuscripts with traces of signs of aging and/or deterioration; annotated document; map; scale drawing; work on paper; birthday card/postcard; weaving patterns, musical scores, scripts, Jacquard cards.
  - Black-and-White Printed Materials: relatively recent documents, black on white, without annotations, without images, with clear print, with a sharp contrast between the ink and the paper, and on paper that is neither yellowed nor stained. Examples: book; document printed on a laser or inkjet printer.
  - Printed Materials with Photographs and/or Annotations: similar to described previously, but have distinctive markings that may be useful to see in colour. Examples: book whose aging you want to show; book with colour or lead pencil annotations.
  - Onionskin, Rice Paper, Tracing Paper: All documents with notable transparency and/or a glossy finish. Example: duplicate copy of the correspondence.
  - Newspapers (Ink-Dot Printing): Examples: newspaper; magazine; stamp
- Photographic Documents
  - Photographs: Includes all photographic prints: black-and-white, monochromatic, or colour. Examples: black-and-white print; colour print; sepia print; ferrotype; ambrotype; daguerreotype; other.
  - Multiple Photographs: Prints with more than one image. Examples: stereograph; photograph on cardboard (more than one photo), Black-and-White Negatives, Black-and-White Negatives with Multiple Images, Glass Negatives, Colour Negatives, Slides (35mm), Colour Transparencies, Lantern Slides.

<u>A6.1.1.a Equipment</u>

The most important digitisation modalities are glance (adapted from [171]):

Digitization modality	Description, advantages	Disadvantages
Document scanner	- Scanning of individual, unbound pages - Extremely rapid processing with a high-efficiency level (up to approximately 50 pages/minute), automatic feeder - Software enables further processing steps (e.g. conversion into PDF) - Simple to operate	- Cutting-up of the documents - Not suitable for documents that are challenging from a conservational perspective - Errors possible in the form of a double-page feed

Reflected light scanners (also: book scanner)	- Scanning of bound documents - Style sheets up to A0 (depending on the type of scanner) - Book cradle to help position the book optimally - Special attachments enable gentle scanning at an opening angle of up to (min.) 90 degrees - Simple to operate - Simultaneous creation of different derivatives (e.g. JPEG) besides the master file (TIFF)	- Limited throughput due to manual operation - When working without an attachment, the document needs to be open 180 degrees
Scanning robots	- Very high throughput - Gentle processing (small opening angle)	- Only suitable for certain books. Limiting criteria include format or nature of the paper - Book covers and fold-outs cannot be scanned with a scanning robot; these need to be processed separately on a reflected light scanner - High cost
Special scanners	- Special constructions such as the Grazer Book Table or the Wolfenbuettel Book Reflector enable gentle, non-contact digitization of fragile documents (e.g. manuscripts, early printed books, codices)	- Complicated individual settings and manual handling result in a low throughput
High-quality digital cameras for image digitization	- For image documents: photographs, postcards, slides, negatives - Suitable for high-quality demands - Suitable for mass digitization	- Technical or photographic knowledge necessary
Film scanners	- For negatives in a 35mm or medium format and slides - Suitable for mass digitization, batch-based processing - Simple to operate	- Sometimes limited scanning quality

A4.1.1.b Guidelines

A6.1.2 3D Artefact photography

Adapted instructions from [172] and [173] .

Images of objects and artefacts cannot be created using a scanner and must be created via digital photography.

- Planar artefacts: textile, paper.
- Normal-Sized Artefacts: Examples: plate; tool; other
- Reflective Artefacts: Examples: glass object; mirror; ceramic; silver; other.
- Small Artefacts: Examples: artefact from archaeological digs; glass bead; coin; other.
- Round Artefacts: Examples: vase; goblet; marble; other
- Artefacts with a Trademark, Seal, Signature or Hallmark: Examples: bottle; plate; other
- Long Artefacts in Supple Materials: Examples: carpet; cloth; other.
- Large Artefacts: Examples: painting; poster; furniture; other
- Artefacts, Clothing Samples: Examples: costume; clothing; other.
- Artefacts with Multiple Components: Examples: toy; board game; other.

The digitization process for such content essentially "flattens" three-dimensional physical objects into two-dimensional digital representations; therefore, additional issues arise when considering how best to create, display, and describe the digital surrogate.

A4.1.2.a Equipment

A camera is only one component of a successful 3-D digitization project; also needed is an environment suitable for photographing objects, including lighting, background, and materials to properly position the objects for capture:

- Professional-quality digital SLR camera with 50mm lens and shutter release cable
- Tripod or copy stand
- Lighting
    - 2-3 mountable photo lights with stands
    - Photo tent/cube for tabletop photography
- Black, neutral grey, or white background (paper or cloth can be used)
- Colour and/or grayscale separation guide (preferably with scale in inches or cm)
- Cradles, paperweights, tape, tweezers, and other items as needed to position objects
- Image editing software (such as Adobe Photoshop)

A4.1.2.b Guidelines

Camera settings will vary depending on the setup being used and the object being photographed, but these settings can be used as a general starting point. Consult the camera manual to find out how to adjust these settings.

Table 3. Camera settings for artefact photography [Zabulis, 2019].

Setting	Recommendation	Comments
ISO	100-200	A lower ISO produces a smoother image with less digital noise.
Shutter Speed	1/25	This may require some experimentation depending on the setup being used. If the photos are too dark, a longer shutter speed may be needed. However, a longer shutter speed can cause blurring in the image, especially if a tripod

		is not being used.
Aperture	f8-f11	A smaller aperture gives a better depth of field in the image (objects both near and far are in focus).
White Balance	Auto	If saving images in RAW format, the white balance can be adjusted later.
File settings	10 to 16 megapixels; 48-bit RGB	The initial images should be captured at the highest size/quality possible for the camera.
File Type	RAW (Alternate: TIFF)	RAW files save the image exactly the way the camera's sensor "sees" it, and allow colour and white balance to be adjusted later.

Photographic techniques will vary depending on the setup and the item being photographed, but some general guidelines are listed below.

Basic technique:

- Mount the camera on a tripod and use a shutter release cable when taking photographs to avoid blurring.
- Avoid shadows in the images by using multiple lighting sources in various positions around the object.
- Position the object on or in front of a neutral background.
- Position the object as straight and/or level as possible.
- Include the colour or grayscale separation guide and scale in the image.
- Make sure the complete object is in the frame (except in the case of capturing specific details).
- Photograph the object from multiple angles (front, back, left, right, above, below, etc.) if there are details that cannot be viewed from a single angle.
- When shooting multiple angles, keep the object and the camera at the same distance/position.
- In general, avoid using the camera's digital "zoom" functionality, as this will lead to lower quality images. Physical zoom functions that physically move the lens are also acceptable.
- Capture any specific areas of interest, such as trademarks, signatures, seals, hallmarks, etc.

Other Recommendations:

- For smaller objects, a macro lens may be required.
- For clothing, place the objects on a mannequin if possible. If a mannequin is not available, lay the objects flat and photograph from above.
- If the item has multiple components or moving parts, photograph the object(s) multiple times in various states.
- For reflective objects, take care to ensure that the photographer and/or camera are not visible on the reflective surface of the object.

A6.1.3 File formats and standards

Extension	Name	Variants	Characteristics
.tiff	Tagged image	A very large	Adobe-owned format but specification stable

	fixed format	number of image representation options	since 1992 and with a wide variety of supporting applications. Can support lossless compression and professional quality images. The best option for long-term preservation.
.jpeg	Joint photographers' expert group	JPEG 2000 is the latest variant	Lossy Compression format is produced by most handheld digital cameras. Not suitable for long-term use, but sometimes for Web and mobile presentations.
.png	Portable network graphics	ISO 15948: 2003	Lossless compression format with large image representation options.

A6.2 3D digitisation

The capabilities of the different technologies vary in terms of several criteria, which must be considered and balanced when formulating appropriate campaign strategies. These include:

- Resolution - the minimum quantitative distance between two consecutive measurements.
- Accuracy - maximum level of recorded accuracy
- Range – the distance range that the device records
- Sampling rate - the time between two consecutive measurements
- Cost - the cost of the equipment and software to purchase or to lease
- Operational environmental conditions - in what conditions will this method work, (level of illumination, weather conditions, etc.)
- Skill requirements – the training required to operate out the scan
- Use – of the data
- Material – the substance(s) and state that the object is fabricated from

There are significant variations between the capabilities of different approaches. For example, triangulation techniques produce greater accuracy than time-of-flight. However, they can only be used at a relatively short range. Where great accuracy is a requirement, this can normally only be achieved with close access to the heritage object to be digitized (< 1m). If physical access to the artefact is difficult or requires the construction of special scaffolding, other constraints need consideration (e.g. using alternative non-invasive techniques). Alternatively, if physical access is impractical without unacceptable levels of invasive methods, then sensing from a greater distance may be required utilising direct distance measurement techniques (TOF, Phase Deviation) leading to less accurate results. When selecting the appropriate methodology, consideration must also be given to the length of time available to carry out the data collection process and the relative speed of data capture of each technology.

These criteria are to be taken into account in the selection of the appropriate digitisation modality, with respect to the anticipated conditions of operation, type of environment, as well as time and budget resources.

A6.2.1 Active illumination

In this section, we describe 3D scanning technologies, based on active illumination (e.g. laser, LED).

A4.2.1.a Time-of-flight

Time-of-flight (ToF) cameras are sensors that can measure the depths of scene points, by illuminating the scene with a controlled laser or LED source and then analysing the reflected light. According to, ToF technologies correspond to either direct or indirect measurement of time. A summary of these technologies is presented below.

Pulse-light technology. Pulse-light depth sensors are composed of a light emitter, which sends out pulses of either laser or laser diode (LD) and light receivers (photodiodes). The photodiodes detect the light as reflected onto an object and convert it into useful information with the help of time-to-digital or time-to-amplitude devices. In this case, the time taken for light to travel from the device to the object and back is directly measured. The laser emitter operates only on a small part of the scene or an object; two different technologies address this issue. LIDAR technology uses rotating mirrors while Flash LIDAR technology utilizes a diffuser, such that the laser spreads to the entire scene. Pulse-light sensors can operate outdoors and under adverse conditions, while they can take long-distance measurements (a few meters to several kilometres) **[190]** .

Continuous-wave technology. Similar to pulse-light technology, depth sensors based on continuous waves consist of an emitting device (commonly LED) and photodiodes. In this case, the light is sinusoidally modulated, while the received signal is phase-shifted. Time-of-flight is measured as phase difference of the emitted and backscattered signal. These sensors typically operate indoors, and are capable of short-distance measurements only (a few centimetres to several meters) **[190]** .

In **[192]** advantages of time-of-flight technology are summarized as follows. ToF is independent of target colour and reflectivity, supports high data rates, cancels ambient light and is unaffected by humidity, air pressure and temperature. Moreover, small sensor sizes permit miniaturization of the devices, therefore they are applicable to mobile scenarios. According to **[191]** , ToF technology can be applied in a wide range of applications, each having different requirements in terms of detection range, detection rate, power and field-of-view. Nevertheless, there is no “holy grail”, thus one must compromise some of the above factors.

A4.2.1.b Laser triangulation

Triangulation-based systems comprise of two components; a laser and a digital camera. The laser projects a line over the object, which is captured by the camera. Distance between laser and camera is a priori known, therefore distance to object can be calculated by trigonometry. Both laser and camera are typically placed on independently motorized rigs with known stepping. The motors control the rotation and possibly translation of the devices with respect to the object, such that different parts are scanned at a time. Figure 34 illustrates subsequent placements of the laser and the camera with respect to the object of the laser triangulation-based scanning system proposed in. Other systems, e.g. **[196] [197]** extend the basic setup by utilizing multiple cameras and mirrors.

A widely known project which utilized laser triangulation for 3D scanning was the Digital Michelangelo Project **[198]** .

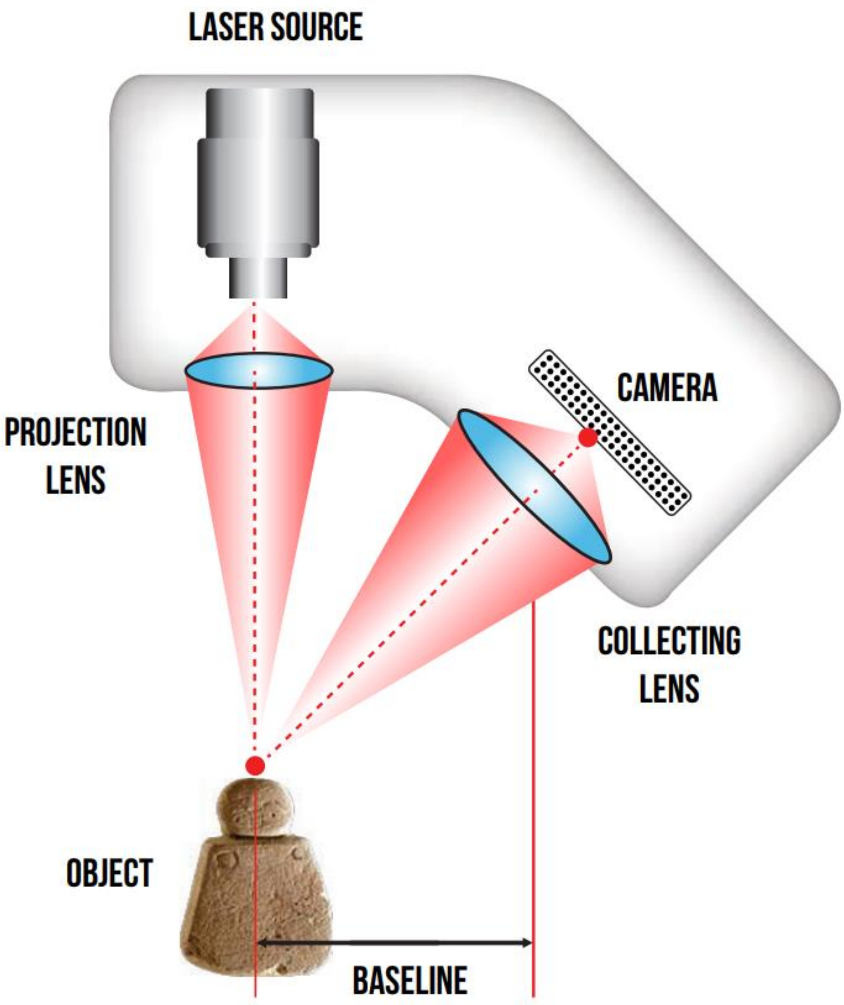


Figure 34. Diagram illustrating the principles of laser triangulation based range devices (images from [9]).

A4.2.1.c Structured light

Structured light sensors utilize a projection device and a camera. The projector shines structured patterns onto the object whose geometry distorts those patterns, while the camera captures distorted structured images from another perspective. Then, correspondence is established by analysing the distortion of captured structured images using techniques similar to stereo vision, e.g. triangulation **[200]** , as illustrated in Figure 35. Various techniques have been developed so far for the structured patterns. According to **[200]** they are classified into five categories, as follows.

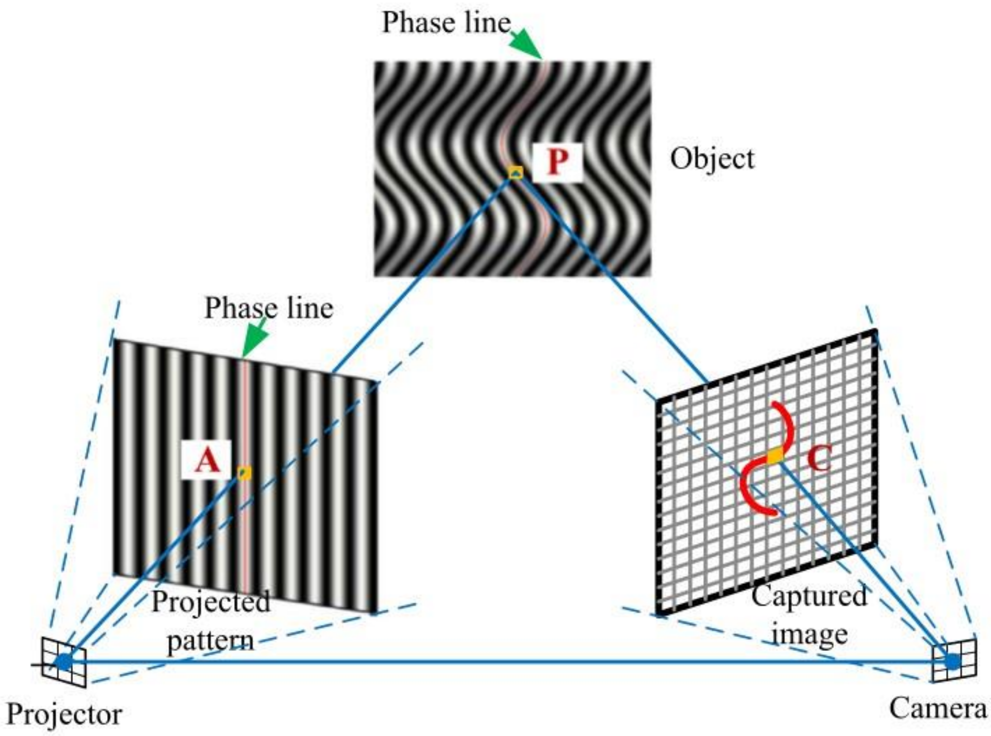


Figure 35. Diagram of a typical structured light system (image from [204] **)**

Statistical pattern. In this basic technique, a statistically random pattern is projected. The pattern encodes locally unique features; therefore, they can be easily identified by the camera. This technique was implemented in consumer-level sensors like Kinect v1, Intel RealSense R200, and iPhone X. Advantages of the method, derived out of its simplicity are that it is easy to understand, easy to implement even with commodity video projectors and most importantly easy to miniaturize. On the other hand, compared to other techniques, spatial resolution and measurement accuracy are low and sensitivity to noise (e.g. due to other light sources) is high.

Binary coding. The idea behind binary coding is based on constraints of the epipolar geometry. More specifically, to determine 3D coordinates, a unique structure of the pattern is required across only one direction of the image plane. An example is a pattern containing vertical stripes. In binary coding, different patterns are projected periodically, while the amount of patterns required for 3D measurements affects the data acquisition speed. In **[201]** the binary coding scheme is utilized in a setup with multiple cameras and potentially real-time 3D reconstruction, at the cost of the smaller capture volume. Advantages of binary coding include simplicity and computational efficiency as compared to more advanced techniques. Structured patterns are continuous in one dimension; therefore, measurement resolution can be as high as the camera resolution. In contrast, resolution is lower across the binary stripes and is limited according to both projector and camera pixel sizes.

Sinusoidal phase encoding. Both previous methods offered a limited resolution to at least one dimension. Phase encoding methods encounter this problem by establishing correspondences in the phase domain rather than the intensity domain of the image, through Fourier analysis. Pertinent methods typically analyse sinusoidal patterns, also called fringe patterns. This family of techniques for 3D shape measurements is also called Fourier transform profilometry (FTP). In general, FTP methods require object surfaces to have smooth geometry and without strong texture. Under this assumption, they achieve higher measurement quality than binary coding methods. Recent FTP algorithms leverage modern projection hardware (DLP) and/or processing power (GPUs), achieving real-time 3D shape acquisition **[201]** **[202]** .

Binary defocusing. In an effort to increase resolution across binary stripes, a method called “binary defocusing” was developed. This technique consists of projecting normal square binary patterns and properly defocusing the projector. This results in pseudo sinusoidal patterns. The method also exploits the ability of DLP projectors for displaying binary images at a much higher rate (kHz) than 8-bit grayscale (few hundred Hz). Projected patterns are processed as in typical fringe analysis. Binary defocusing is advantageous in that it enables speed breakthroughs and relaxes perfect time synchronization of projector and camera. Moreover, higher depth resolution is achieved. A few disadvantages are that careful adjustment of projector’s lens is required and that they operate only within limited spectrum light range and certain level light power. To overcome such issues, techniques other than conventional DLP projections have been developed **[203]** **[204]** **[206]** .

Other coding methods. Other methods, which do not directly relate to one of the previous techniques include arbitrary shape patterns (e.g. triangular, trapezoidal) but also colour coded structured patterns. The later are sensitive to object surface colour. Finally, there are hybrid solutions, e.g. phase-shifted patterns with additional markers and others. The challenges that are stressed by **[200]** for further advances specifically for the structured light methods are sensor miniaturization and tough object measurement.

A4.2.1.d Active stereo

Active stereo is a technology based on the classic stereo vision setup, having two sensors with small baseline plus an IR projector. Instead of detection of arbitrary interesting points on the images (keypoints), those are projected on the scene and subsequently captured by the camera pair. This technology was recently adopted by Occipital into Structure Core depth sensor **[207]** and by Intel into its recent RealSense D4xx depth cameras **[210]** . More specifically, a projector of D4xx sensors illuminates an arbitrary pattern. Depth is derived by solving the correspondence problem between the simultaneously captured left and right video images; i.e.,a depth map is calculated from disparity and triangulation. As it is emphasized, the pattern has nothing to do with conventional structure light techniques, i.e., it is not required that the pattern is a priori known nor strictly stable over time. Other advantages over conventional structured light sensors that are mentioned include robustness to the presence of multiple sensors and relaxation of requirements on temperature stability **[211]** .

A4.2.1.e Reflectance Transformation Imaging

Reflectance Transformation Imaging (RTI) is a computational method for the reconstruction of the surface of an object and its colour [244] .

RTI scans are obtained from multiple views of the object from a camera. In each photograph, light is projected from a different direction. Information from the corresponding images is used to estimate a model of the object's surface.

Each RTI resembles a single, two-dimensional (2D) photographic image. Unlike a typical photograph, reflectance information is derived from the three-dimensional (3D) shape of the image subject and encoded in the image per pixel.

A6.2.2 Photogrammetry

A core definition of photogrammetry was given by the American Society for Photogrammetry and Remote Sensing. They described it as the art, science and technology of obtaining reliable information about physical objects and the environment through processes of recording measuring and interpreting images and patterns of electromagnetic radiant energy and other phenomena. Photogrammetry is classified by **[212]** as (a) metric or (b) interpretative. Metric photogrammetry consists of measurements of high precision in order to find distances, angles, areas, volumes, elevations, and sizes and shapes of objects, while interpretative photogrammetry deals with the interpretation of the observed scene, i.e. object recognition **[198]** . In the context of this report we are interested in the former, and more specifically to digital metric photogrammetry. This relates to making measurements from multiple digital photos, in the purpose of extracting the three-dimensional structures from two-dimensional image sequences of observed objects. Towards this direction, notable techniques include structure from motion and stereophotogrammetry. An illustration of the photogrammetric principle of operation is provided in Figure 36.

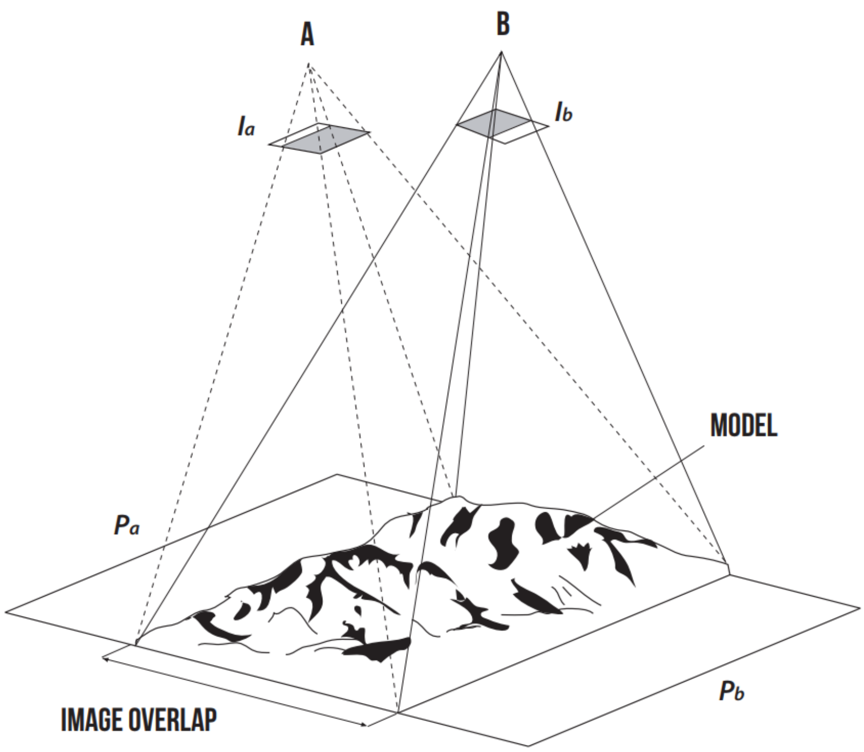


Figure 36. The overlapping area of images captured at A and B are resolved within the 3D model space to enable the precise and accurate measurement of the model (image from [9]).

At the minimum, photogrammetry-based 3D scanning depends on simple hardware for image acquisition. It typically requires a single colour camera, nevertheless, there exist custom solutions, comprising of specialized hardware. This method can be applied to both outdoor and indoor environments while depending on the application, image acquisition may be terrestrial or aerial. The required 3D scan is typically constructed offline; pertinent images are processed by special software. These and other aspects of photogrammetry are discussed in subsequent sections.

A4.2.2.a Terrestrial vs aerial photogrammetry

Common classification of photogrammetry with respect to photography is whether imagery is obtained from the ground (terrestrial imagery) or a plane or drone carrying a camera (aerial imagery). Depending on the scope of 3D scanning, but also to the flexibility and automation for image acquisition, both methods can be applied either alone or combined. For example, capturing the landscape, building complexes or large buildings, aerial photography is the only option. On the other hand, terrestrial photogrammetry is targeted to either scan large structures in outdoor scenarios, or rooms and smaller objects.

From a more technical point of view, aerial photography is further categorized as vertical (nadir) or oblique, depending on the angle of the camera axis with respect to the ground. Fig. 4 shows the abstract limits of what is considered oblique versus vertical imagery. Especially for 3D scanning, oblique imagery is more advantageous due to better capture of large vertical structures, e.g. high buildings. In terrestrial photogrammetry, imagery is captured by cameras, which are either hand-held or mounted on other gear (tripods, special mounts, etc.). If the distance of the camera to the object is less than about 300m., it is usually referred to as close-range photogrammetry **[212]** .

A4.2.2.b Algorithms and relevant software

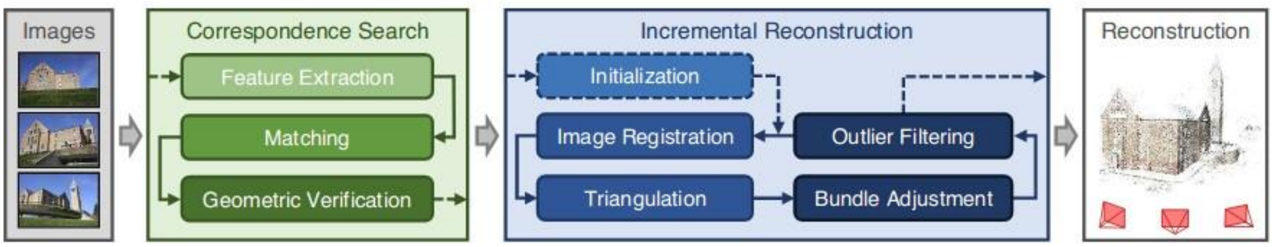


Figure 37. Structure from motion pipeline (image from [204] **).**

As already mentioned, photogrammetry relies on only RGB imagery data, while 3D reconstruction is accomplished offline using some piece of software. The most adopted algorithm for such reconstruction is a structure from motion (SfM). In **[204]** , SfM is referred to as the process of reconstructing 3D structure from its projections into a series of images taken from different viewpoints. Variations of SfM include incremental SfM **[204]** , global SfM **[206]** and out-of-core SfM **[207]** . Global SfM considers all views at once, while incremental SfM adds on one image at a time to grow the reconstruction. Out-of-core SfM is a family of approaches, which aim to reduce large memory demands, especially for large reconstruction problems. Figure 37 depicts the pipeline of iterative SfM. SfM algorithms are implemented in several software packages, including Leica Cyclone, Photomodeler Scanner, Agisoft Metashape, Visual SFM, Autodesk ReCap, to name a few. A comprehensive review of photogrammetry software is included in **[210]** . An illustration of the SfM principle, intermediate, and final results are provided in Figure 38.

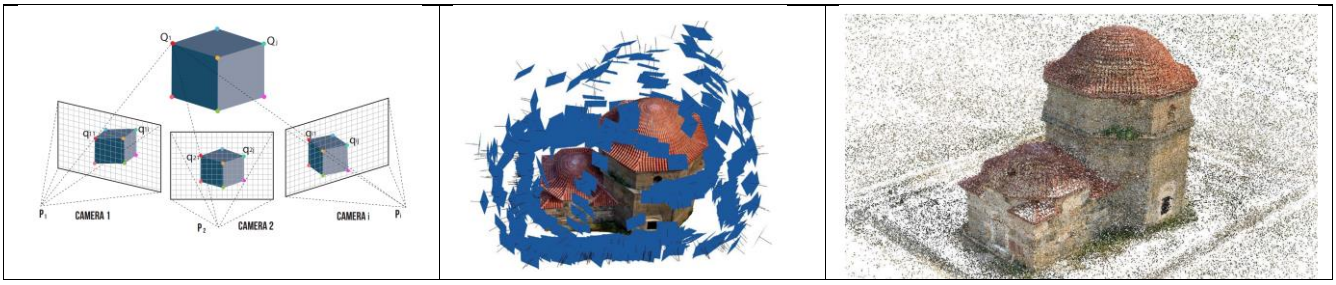


Figure 38. Structure from Motion. Left: Diagram illustrating the principles of structure from motion measurement from multiple overlapping images. Middle: Example of SFM methodology illustration the orientation and number of overlapping images utilised in the modelling of a building. Right: The resulting 3D point cloud data sets are derived using SfM (images from [9]).

State of the art and representative software solutions are briefly discussed in Table 4.

Table 4. Photogrametric software solutions [Zabulis, 2019].

Automatic Reconstruction Conduit ARC 3D www.arc3d.be	Web-service, where the user uploads an image collection and the system returns a dense 3D reconstruction of the scene.
Meshroom (Alice vision) https://alicevision.org/	Meshroom allows provides a complete photogrammetric pipeline. Given a set of images and it will generate a textured mesh automatically.
PhotoModeler Scanner (Eos Systems) www.photomodeler.com	Reconstructs the content of an image collection as a 3D dense point cloud. Requires placement of photogrammetric targets in the scene.
Insight3D insight3d.sourceforge.net	Open-source solution. The software facilitates the manual creation of low complexity 3D meshes that can be textured automatically.
PhotoScan (Agisoft) www.agisoft.ru	Stand-alone software product for photogrammetric processing of images and generates 3D spatial data to be used in GIS applications, as well as for 3D measurements. The software solution can merge the independent depth maps of all images and then produce a single vertex painted point cloud that can be converted to a triangulated 3D mesh of different densities.
Pix4DMapper www.pix4d.com	Software to create 3D and digital elevation models from image collections, including support for aerial photography captured by UAVs. The software is being offered as a standalone application or as a cloud-service. The software solution can merge the independent depth maps of all images and then produce a single vertex painted point cloud that can be converted to a triangulated 3D mesh of different densities. Provides support for BIM, GIS, as well as RGB, thermal and multispectral images. In addition, it provides support for automatic drone flight.
AutoDesk Recap	Software to perform photogrammetric reconstruction similar to

https://www.autodesk.com/products/recap/	PhotoScan and Pix4DMapper.

A6.2.3 Post processing of 3D scans

3D post-processing is a procedure consisting of a sequence of processing steps that result in the direct improvement of acquired 3D data, and its transformation into visually enriched geometric representations.

- **Geometric reconstruction.** Geometric reconstruction is the essential processing step for the elaboration of a 3D representation of an artefact or monument following the capture of 3D digitisation. It includes the creation of a mesh for the scanned data the processing of this mesh, mesh cleaning, mesh simplification, and mesh retopologisation.
- **Visual enrichment of 3D models.** Several computer graphics techniques can be utilised for the visual enhancement of the 3D models produced from the geometric reconstruction processes. Visual enrichment techniques
- **Hypothetical reconstruction.** The hypothetical reconstruction of an architectural object or archaeological site to a previous state is a process primarily related to field of historical studies. Nevertheless, some specific technical and methodological issues with 3D graphical representation of missing (or partially destroyed) heritage buildings are often integrated in 3D reconstruction approaches.

Important resources for 3D digitisation of CH are publicly availed by the non-profit organisation “Cultural Heritage Imaging”, http://culturalheritageimaging.org/ Its website provides tools, technology, and training, for several digitisation methods used in the preservation of Tangible CH.

A6.2.4 File formats

A 3D file format is used for storing information about 3D models. The basic purpose of a 3D file format is to store information about 3D models and in particular the geometry of a model, which describes its shape, and its appearance. The basic contents of a 3D file format are:

- The **geometry** of the 3D model
- The **appearance** of the 3D model
- **Scene information**

There are three ways of encoding **surface geometry**:

- **Approximate mesh.** The surface of a 3D model is first covered with a mesh of polygons. This represents the surface geometry of the target model. Triangles approximate the smooth geometry of the surface. Hence, this is an approximate format. The approximation gets better as the triangles get smaller. However, the smaller the triangles, the larger the number of triangles you need to tile the surface, increasing the required computational resources.
- **Precise mesh.** When an approximate encoding of the 3D model is not enough precise file formats can be used. These formats use parametric surfaces called Non-Uniform Rational B-Spline patches (or NURBS). These surfaces look smooth in any scale and can replicate the surface geometry of a small part of a 3D model in exact detail. While the precise mesh is exact

at any resolution, its rendering is slower and is avoided in applications where fast rendering is important.
- **Constructive solid geometry.** In this format, 3D shapes are built by performing Boolean operations (addition or subtraction) of primitive shapes like cubes, spheres etc. This file format is not relevant to scanned objects, for objects digitally created.

The second feature of the 3D file formats the **appearance** of the model. Colour and specularity are examples of related properties. Appearance describes surface properties such as material type, texture, and colour and determines the way that the model is rendered. Information about appearance can be encoded in two ways:

- **Texture mapping.** In texture mapping, every point in the 3D model's surface is mapped to a 2D image. Every surface point corresponds to a coordinate in this 2D image. The 2D image containing texture information needs to be stored within the same file or separately in a different file.
- **Face attributes.** Another way of storing texture information is to assign each face of the mesh a set of attributes. Common attributes include colour, texture and material type. A surface can have a specular component indicating the colour and intensity of true mirror reflections of light sources and other nearby surfaces. This approach is less relevant to scanning approaches and more relevant to the computer-aided design of objects.

Encoding **scene information** is a feature of a few 3D file formats. The scene describes the layout of the 3D model in terms of cameras, light sources, and other nearby 3D models. Some 3D encode information about lights.

The two most widely used formats for 3D digitisations are STL and OBJ. Comprehensive reviews of the numerous types of 3D file formats can be found in the EduTechWiki of the University of Geneva on [3D file formats] and on Wikipedia on [3D graphics file formats].

STL. STL (STereoLithography) is important in the domains of 3D printing, rapid prototyping, and computer-aided manufacturing. The corresponding file extension is.STL. STL encodes the surface geometry of a 3D model approximately using a triangular mesh. STL ignores appearance and scene information. It is one of the simplest and leanest 3D file formats.

OBJ. The OBJ file format is widely used in 3D graphics and is associated with the file extension OBJ. The OBJ file format supports both approximate and precise encoding of surface geometry. For approximate encoding, the surface mesh is not restricted to triangular facets, but polygons can be used. For precise encoding, it uses smooth curves and surfaces such as NURBS. The OBJ format can encode colour and texture information. This information is stored in a separate file with the extension.MTL (Material Template Library).

In Mingei a wide range of conventional formats are treated depending on the modality. The public data tat wil be available all reconstructions will be provided in open formats, including the aforementioned two.

Annex 7. Digitisation of Human Motion

A7.1 Motion capture

A7.1.1 State of the art

Marker-based systems have multiple cameras that encircle a specific volume. Retroreflective (i.e. has minimum scattering reflection) spherical markers are placed on the subject at a set pattern. The cameras emit IR light that is being reflected directly back to its source with virtually no scattering by the markers. A variant of that approach is the use of active LED markers that emit IR light instead of reflecting it. Each camera generates 2D images where the markers appear as white dots and everything else is black. Those images are triangulated and a complete volume is generated that shows the motion in three dimensions. The marker-based system provides a complete 3D area where only the marked objects are tracked while ignoring the rest of the scenery. With enough cameras and an appropriate setup, it is possible to have an unobstructed view of a large area. Another benefit is that the system records only the markers, therefore background items are not included in the final recording, making the output efficient. However, marker-based systems require more post-processing to extract joint angles from the cluster of markers, and they are not portable by their nature. Though they can be used for many different purposes, they need a structured environment. In general, optical-based systems are affected by their environment. Sources of IR light (sun, heating bodies, even a lot of people in a small room) can cause the sensors to record incorrect data, space limitations can limit the field of view, and equipment that needs to be in contact with the user (tools, instruments etc.) can create obstructions.

IMU systems are different in the sense that they do not measure displacement but acceleration. Each IMU is comprised of an accelerometer, a magnetometer, and gyroscope [213] [214] that provide measurements in three dimensions with respect to the earth’s magnetic field. The output of one IMU is relative to a global coordinate frame. The biggest benefit of this method is that there is no need to generate a reference signal, such as the IR light in the optical-based systems. However, this is of limited use when there is interest in the relative position between two body segments. To identify relative position and orientation, the person needs to wear several IMUs (either by using straps or embedded in specialized clothing) on different segments of the body. Since more than one IMUs are used, the measurements can be transformed to show the relative acceleration between each unit and therefore the relative position of each sensor can be found by integration. In general, IMU systems are very accurate with little noise. However, they are sensitive to magnetic noise. Sources of magnetic noise can be electrical appliances, metal furniture, and metallic structures within a building [213] . There are commercially available suits that have embedded several IMUs to be worn by the subjects and their output is very streamlined without the need for significant post-processing of the data. However, the drawback is that IMU suits can be used to record only the motions of people who can wear them, unlike marker-based systems, which can track the motions of drones, robots, individuals with amputation etc.

To sum up, IMU based suits are portable but have high specificity. However, electromagnetic disturbances can cause a high error in the azimuth angle (Perpendicular to the north-south pole of the earth’s magnetic field), for as long as the magnetic distortion is present [213] . Assuming the magnetic interference has some consistency (static magnetic field or distortion with a known frequency), it is possible to create filters to correct the signal to a reasonable amount [213] , [215] .

Regardless of the technology used to acquire those recordings, the resulting data are always a chain of coordinate frames and the difference in position and orientation between them. In the context of this project, MoCap recordings can be used to preserve and recreate the motions of the craft.

A7.2.2 Technical guidelines

The proposed protocol for IMU motion captures is provided below. Indicative visualisation of calibration (Range of Motion) tasks is provided in Figure 39.

Motion Capture Protocol Recording Protocol

Preparation setup

Calibration

A) Initialize the suit
B) Calibrate the suit with the participant. Have the person perform:
    a. I-Pose (Stand with the hands to their sides)
    b. T-Pose (Stand with the arms fully abducted)
    c. Walk a couple of meters

Range of Motion (ROM) Tasks

A) Record basic postures to identify the ROM of each person.
B) The postures will be:

Shoulder:

Shoulder flexion/extension

a. Starting from the neutral position (standing up straight with the hands naturally falling to the sides) the person will extend the arms as far as they can without bending the torso. Keep the arms fully extended for 1 second.
b. From the fully extended position, flex the arms until they are at a 180o angle (above the head) and hold them for 1 second. Return to neutral.
c. Repeat the recording three times.

Shoulder Abduction/Adduction

d. Starting from the neutral position, abduct the arms until they are above the head and hold them for 1 second.
e. From the fully abducted position, adduct the hands until the cross in front of the pelvis and hold them for 1 second. Return to neutral.
f. Repeat the recording three times.

Shoulder External/Internal Rotation

g. Starting from a position where the arms are parallel to the ground and the elbows are bent at 90o, rotate the shoulders until the fingers point towards the floor and hold for 1 second.

h. From the previous posture (full internal rotation of the shoulder), rotate the shoulder until the fingers point towards the ceiling. Return to the initial position.
i. Repeat the recording three times.

Forearm:

Forearm Flexion

a. Starting from the neutral position, flex the forearms until they reach the end of their RON hold for 1 seconds. Return to neutral.
b. Repeat the recording three times.

Forearm Rotation

j. Starting from a position where the elbows are flexed parallel to the ground, rotate the left forearm counter-clockwise and the right forearm clockwise (in order to be symmetrical) until they reach the end of their ROM and hold them for 1 second.
k. From the previous posture, rotate the forearms in the opposite direction until they reach the end of their ROM. Return to the initial position.
l. Repeat the recording three times.

Torso

m. Starting from the neutral position, bend the torso forwards as far as possible without moving the hips and hold the posture for 1 second.
n. From the previous position, bend the torso backwards as far as possible without moving the hips and hold the posture for 1 second. Repeat the recording three times.
o. Starting from the neutral position, bend the torso laterally to the right as far as possible without moving the hips and hold the posture for 1 second.
p. From the position of the preview, bend the torso laterally to the left as far as possible without moving the hips and hold the posture for 1 second. Repeat the recording three times.
q. Starting from the neutral position, rotate the torso to the right as far as possible without moving the hips and hold the posture for 1 second.
r. From the previous position, rotate the torso to the left as far as possible without moving the hips and hold the posture for 1 second. Repeat the recording three times.

Instructions:

a. Allow the expert to complete the process on his own. No instructions should be given unless there is some technical issue.
b. One recording will be done unless the experts say it is not time consuming to remove the setup and do the task again.

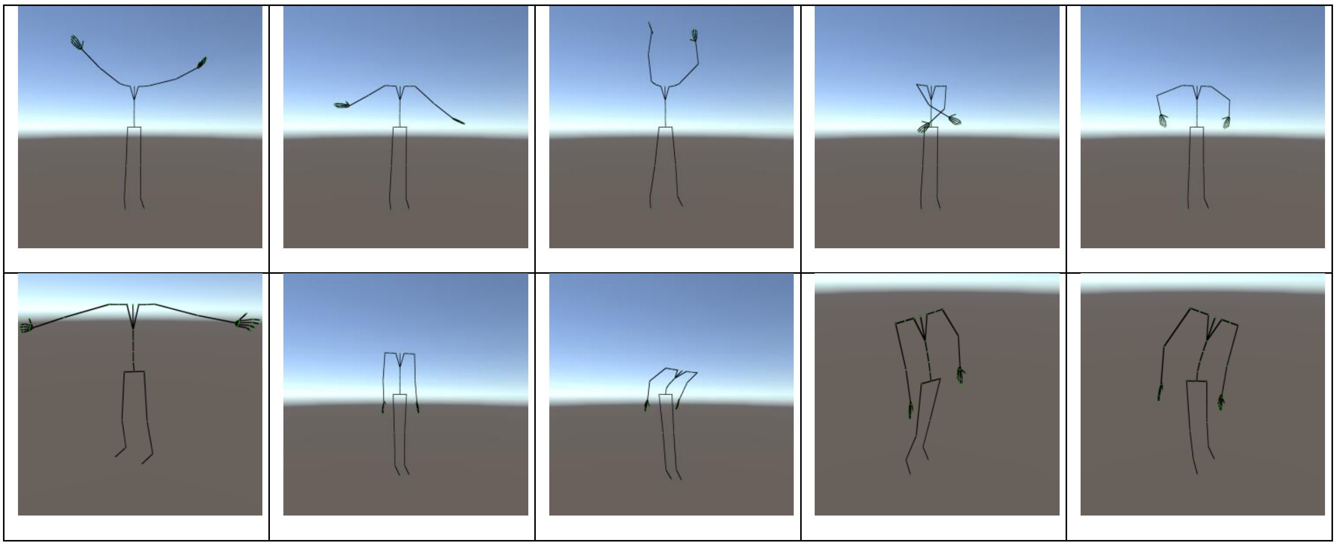


Figure 39. Visualisation of calibration postures [Zabulis, 2019].

A5.2 Visual tracking

The human body, pose estimation techniques are classified into three broad classes. The bottom-up discriminative methods, the top-down generative methods, and the hybrid ones. Generative methods can be very accurate, provide physically plausible solutions and do not require training. However, typically, they are computationally demanding, require initialization and can suffer from drift and track loss. Discriminative methods perform single frame pose estimation and do not require initialization. On the other hand, they rely on big collections of annotated training data and their solution is not always physically plausible. Hybrid methods integrate elements from both worlds in an effort to combine their merits.

A7.2.1 State of the art

Most recent human pose estimation methods rely on 2D keypoints extracted from RGB data **[216]** . The accuracy of these methods is high, mainly due to the availability of large annotated datasets **[218] [219]** . By building on the 2D keypoints and relying on RGB information only, many recent approaches perform either 2D pose estimation **[216]** or 3D pose estimation **[220] [221] [222] [223] [224]** . To tackle the difficulties of lifting 2D keypoints to 3D, some methods directly regress 3D keypoints or volumetric representations **[225]** . Recent approaches proceed further to estimate both the pose and the shape of the human body **[226] [227] [228] [229]** . In **[230]** , they establish dense correspondences between images and the 3D human body model. The approaches that rely on RGB information only, either produce a scale-normalized output or rely on prior assumptions to determine the models' scale. In both cases, their applicability in a number of domains (e.g., robotics) is limited.

To recover the full 3D human body pose in a real-world coordinate frame, most approaches rely on RGBD sensors. The work in **[231]** that relies on random forest regression defined the baseline for these approaches. In **[232] [233]** a generative approach is presented that relies on a single RGBD sensor and provides the full or partial body pose in real time. In **[234]** , a deep learning approach using the depth map is presented. Instead of the depth map, the work in **[235]** uses a volumetric representation and a 3D CNN to obtain the hand or human pose in real-time. In **[236]** they embed local regions into a viewpoint invariant feature space to handle noise and occlusion. In **[237]** they propose a CNN approach that uses both colour and depth information.

Recent pose estimation methods use several strategies to take into account the geometric structure of the human body. Several methods describe the pose by a set of key points so that its structure is learned implicitly during training **[226] [236] [237] [238]** . Other approaches extract the pose as a linear combination of prototype poses **[234] [239]** . To enforce the accurate geometric structure several approaches employ 3D human body models. The pose parameters of these models are either inferred using bottom-up regression only **[227] [240]** or estimated using a combination of bottom-up regression of body landmarks (e.g. 2D joint locations) and top-down optimization **[221] [230] [241]** .

Several human pose estimation approaches focus specifically on handling occlusions. One direction is to treat visibility as a binary mask and exploit scene context to estimate it **[241]** . Other methods use templates for occluded versions of each body part **[242]** or introduce occlusion priors **[243]** .

A7.2.2 Guidelines for the acquisition of the acquisition of videos

Types of cameras: Digitization using visual sensors typically employs RGB and depth cameras. As a rule, RGB cameras are able to capture images of higher resolution than depth cameras. However, depth cameras provide, additionally, a 3D reconstruction of the scene. The subtler the motion of a human, the higher the resolution of the camera that is used should be. The faster the motion of a human, the higher the frame rate of the camera should be. Cameras with a wide lens allow more of the scene to be included in the photograph, which can be useful when capturing small 3D environments where the photographer may not be able to move farther from the scene to photograph it.

Placement of cameras: Cameras should be placed close to the human of interest in order to capture as many details of the human's appearance and geometry as possible. RGB cameras can be placed arbitrarily close to the human, while depth cameras should be placed approximately 40cm - 5m away from the object to maximize the quality of the reconstructed 3D geometry. In the 3D reconstruction and motion tracking applications, having a whole view of the human is advised. However, in crowded environments with multiple objects and/or multiple people, only parts of the objects and people are typically visible. In this case, capturing the scene from various viewing angles using one or more cameras is necessary. More specifically, as far as capturing humans is concerned, frontal views of the human are preferred. State-of-art 3D human pose estimation algorithms from visual data are typically trained using frontal full views of human bodies where major identifying features of the body (face, arms, fingers) are visible and self-occlusions are limited. In addition, more than one frontal view of the body lead to a more effective 3D reconstruction of the shape and motion of the human. The cameras can either be static or moving, for instance, a GoPro camera or a smartphone camera. In any case, the photographer needs to make sure that the motion of the camera does not distort the appearance of the object or human in the captured images (motion blur, ghosting etc.). Tripods and gimbals help stabilize the cameras and ensure that crisp images of the scene are recorded.

Lighting: Care should be taken to ensure that there is enough light in the scene while avoiding strong mirror-like reflections of light and shadows. For instance, in dark rooms, additional light sources may need to be used. Data capture should be performed from a proper viewing angle so that shadows on the captured images are eliminated. In the case of capturing data outdoors, current depth cameras that typically rely on emitting infrared light do not reconstruct the environment effectively and one or more RGB cameras should be used instead.

The appearance of objects in the scene: The more distinct the appearance of the background objects compared to the human, the easier it will be for computer vision algorithms to detect the human in the scene.

Recorded motions: The type of human motions to be recorded depends on the application of interest. Having the expert perform multiple repetitions of the same motion allows for capturing the personal variability in motion execution and generally leads to more robust motion reconstruction.

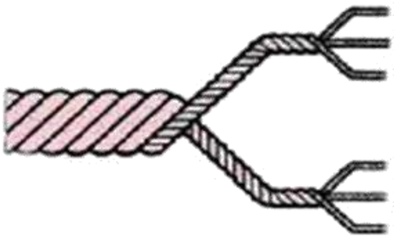
Annex 8. Vocabularies

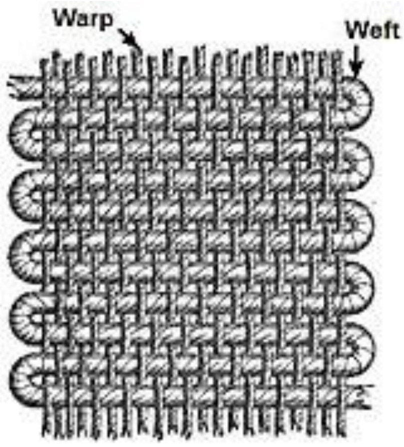
Images found online for this glossary are under the Creative Common license (mainly from WikiCommons) and each one bears its download URL.

8.1 Silk pilot

8.1.1 Basic weaving terms

Table 5. Basic weaving terms [Zabulis, Doulgeraki, Karuzaki, 2019].

Thread Image from [106]	Thread is a type of yarn but is similarly used for sewing. It can be made out of many different materials including cotton, linen, nylon, and silk.	
Yarn Image from [107]	Yarn is a long continuous length of interlocked fibres, suitable for use in the production of textiles, sewing, crocheting, knitting, weaving, embroidery, or rope making. Yarn is produced by spinning raw fibres of wool, flax, cotton, hemp, or other materials to produce long strands.	
Strands Image from [108]	Multiple yarns plied together to produce a long, thin strand used in sewing or weaving.	
Textile Image from [109]	A textile is a flexible material consisting of a network of natural or artificial fibres (yarn or thread). Textiles are formed by weaving, knitting, crocheting, knotting or tatting, felting, or braiding.	

Fabric Image from [110]	Fabric is a material made through weaving, knitting, spreading, crocheting, or bonding that may be used in the production of further goods (garments, etc.).	
Cloth Image from [111]	A piece of fabric that has been processed.	
Warp and Weft Image from [112]	Warp and weft are the two basic components used in weaving to turn thread or yarn into fabric. The lengthwise or longitudinal warp yarns are held stationary in tension on a frame or loom while the transverse weft (sometimes woof) is drawn through and inserted over and under the warp. A single thread of the weft crossing the warp is called a pick.	
Selvage Image from [113]	A selvage, or selvedge, is a "self-finished" edge of fabric, keeping it from unravelling and fraying. The term "self-finished" means that the edge does not require additional finishing work, such as hem or bias tape, to prevent fraying.	

Shed Image from [114]	The shed is the temporary separation between upper and lower warp yarns through which the weft is woven. The shed is created to make it easy to interlace the weft into the warp and thus create woven fabric.	

8.1.2 Basic silk terms

Table 6. Basik silk terms [Beisswenger, Zabulis, 2019]

***Bombyx mori* (Silkworm) and Cocoon** Image from [115]	*Bombyx mori*, the domestic silkmoth, is an insect from the moth family Bombycidae. This insect feeds on mulberry (*morus alba*) leaves. Its cocoon is the source of fine, white silk. Several species of silkworm are used in commercial silk production. *Bombyx mori* is the most common. Its cocoon is a casing spun of silk.	
Brocade Image from [116]	A rich fabric is woven with a raised pattern, typically made of silk and velvet and enhanced with gold or silver thread. Vestments often used brocade fabric. Gold brocades are particularly precious fabrics, originally heavy, richly patterned velvet fabrics.	
Damask Image from [117]	A heavy jacquard fabric is woven in silk, linen, cotton, worsted wool and manufactured fibres. Traditionally woven with an 8 and 8 satin weave. The reversible pattern is distinguished from the background by contrasting lustre.	

***Morus* (mulberry tree)** Image from [118]	*Morus*, a genus of flowering plants in the family *Moraceae*, comprises 10–16 species of deciduous trees commonly known as mulberries, growing wild and under cultivation in many temperate world regions. Mulberry leaves, particularly those of the white mulberry, are the sole food source of the silkworm.	

8.1.3 Machines and tools

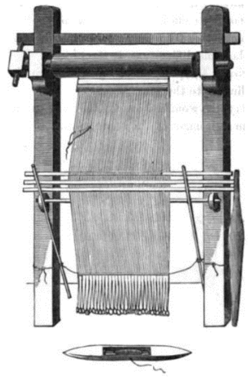
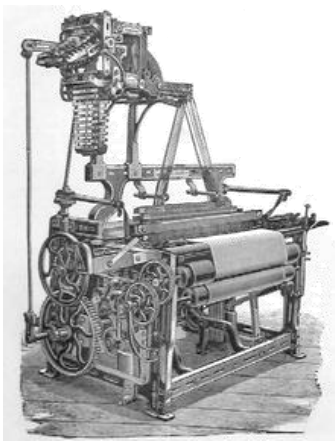
Central to the production of textiles are weaving machines, or otherwise, looms. Most looms can be described as a shedding device.

Shedding device: The type of device that is used to raise and lower the shed differs in the type of loom. With a tablet loom, the sheds are raised and lowered by rotating the tablets, or cards. In a floor loom, the shed is created by harnesses. Inkle looms have one of the more primitive shedding devices where there is one set of heddles and the shed is created by hand. The term shedding refers to the action of creating a shed. A shedding device is a device used to raise or open the shed. Creating the separation is referred to as raising or opening the shed, while the reverse is known as lowering or closing the shed.

A loom is a device used to weave cloth and tapestry. The basic purpose of any loom is to hold the warp threads under tension to facilitate the interweaving of the weft threads. The precise shape of the loom and its mechanics may vary, but the basic function is the same.

Table 7. Textile looms [Zabulis, Doulgeraki, 2019].

Hand loom Image from [119]	A handloom is a simple machine used for weaving. In a wooden vertical-shaft loom, the heddles are fixed in place in the shaft. The warp threads pass alternately through a heddle and a space between the shed, so that raising the shaft raises half the threads, and lowering the shaft lowers the same threads.	

Backstrap loom Image from [120]	The backstrap loom is a simple loom that has its roots in ancient civilizations. It consists of two sticks or bars between which the warps are stretched.	
Draw loom Image from [121]	A drawloom is a handloom for weaving figured cloth. A “figure harness” is used to control each warp thread separately. A drawloom has pattern healds, which make it possible to weave damask patterns. The pattern healds are located at a distance behind the usual heddles.	
Warp weighted loom Image from [122]	The warp-weighted loom is a simple and ancient form of loom in which the warp yarns hang freely from a bar supported by upright poles, which can be placed at a convenient slant against a wall. Bundles of warp threads are tied to hanging weights called loom weights, which keep the threads taut.	
Dobby loom Image from [123]	A dobby loom is a type of floor loom that controls all the warp threads using a device called a dobby. The word dobby is a corruption of “draw boy” which refers to the weaver's helpers who used to control the warp thread by pulling on draw threads.	

Frame loom Image from [124]	Frame looms almost have a similar mechanism that ground looms hold. The loom was made of rods and panels fastened at the right angles to construct a form similar to a box to make it more handy and manageable. Frame loom is being utilized even until now because of its portability and economy.	
Jacquard loom Image from [125]	The Jacquard machine is a device fitted to a power loom that simplifies the process of manufacturing textiles with complex patterns. Otherwise: a loom with a Jacquard attachment.	
Power loom Image from [126]	A power loom is a mechanized loom.	
Inkle Loom Image from [127]	Inkle weaving is a type of warp-faced weaving where the shed is created by manually raising or lowering the warp yarns, some of which are held in place by fixed heddles on a loom known as an inkle loom.	

Mechanical looms are assembled by several components, outlined in the Figure 40 and Table 8.

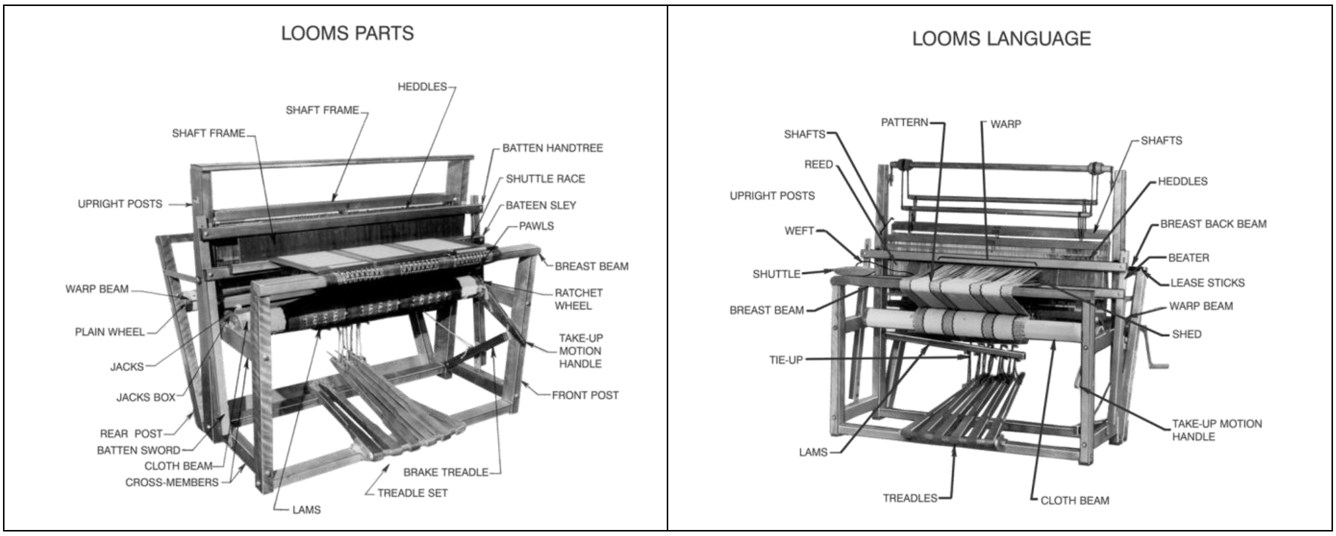
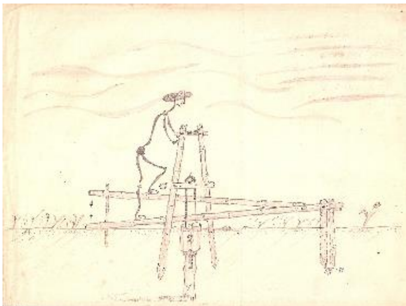


Figure 40. Loom parts mapping and terms (images from [143]).

Table 8. Loom parts [Doulgeraki and Zabulis, 2019].

Bobbin Image from [128]	A cylinder or cone holding thread, yarn, or wire, used especially in weaving and machine sewing.	
Treadle Image from [129]	A lever worked by the foot and imparting motion to a machine.	
Loom with treadle Image from [130]	A loom with a treadle that controls the harnesses.	

Warp-beam Image from [131]	Warp beam is also known as the weaver's beam. It is fixed at the back of the loom. The warp sheet is wounded onto the warp beam. The length of the warp in the beam may be more than a thousand meters.	
Heddle [Qammaz, 2019]	A heddle is a wire with a hole or eye in its centre through which a warp yarn is threaded. There are as many heddles as there are warp yarns in the cloth, and the heddles are held in two or more harness.	
Reed Image from [132]	A wood or metal frame that holds the healds/heddles in position in the loom during weaving. Reed is a metallic comb, which is fixed to the slay by a reed cap.	
Picking stick	A lever that transmits the crank action of a loom motion into the thrust, which drives the shuttle across the loom.	**See Figure 40. Loom parts mapping and terms** (images from [143]).
Over pick	A picking cam attached to the bottom shaft displaces the cone twisting the upright picking shaft carrying it. This causes the picking stick at the uppermost end to swing in a horizontal plane over the loom and transmits the motion to shuttle through lug-strap and picker guided by a spindle.	
Under pick	A picking cam attached to the bottom shaft displaces the cone twisting the picking shaft located horizontally below the upright picking stick connecting it through the lug strap.	
Cams	A cam mechanism usually consists of two moving elements, the cam, and the follower, mounted on a fixed frame.	

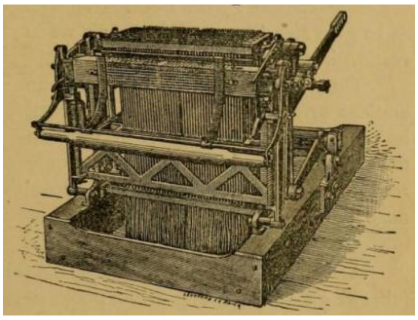
Beams	A cylindrical body with end flanges on which multiple warp ends is wound in a way to permit the removal of these yarns as a warp sheet.	
Beater	A beater, or batten, is a weaving tool designed to push the weft yarn securely into place. In small hand-weaving such as Inkle weaving and tablet weaving, the beater may be combined with the shuttle into a single tool. In rigid heddle looms, the beater is combined with the heddles. Beaters appear both in a hand-held form and as an integral part of a loom.	
Jacquard attachment Image from [142]	The Jacquard attachment is an automatic selective shedding device that is mounted on top of the loom and operated by a treadle controlled by the weaver.	

Table 9. Loom tools/accessories [Zabulis, Doulgeraki, 2019].

Pirn Image from [133]	A pirn is a rod onto which weft thread is wound for use in weaving. The pirn is installed within the shuttle. It leaves a single trace of yarn within the shed as it flies across its opening. This trace of yarn is transformed to a single weft when fastened to the woven fabric by the strike(s) of the beater.	

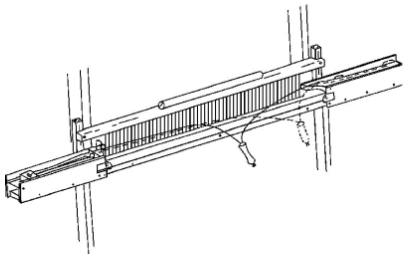
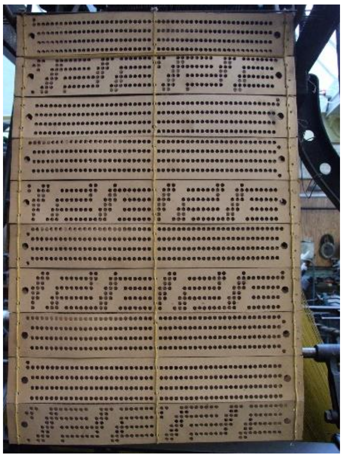
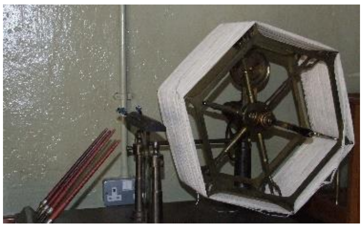
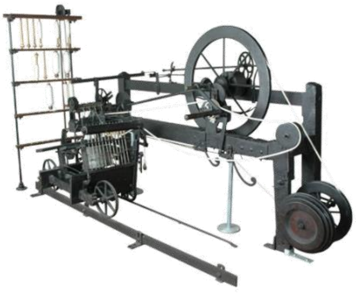
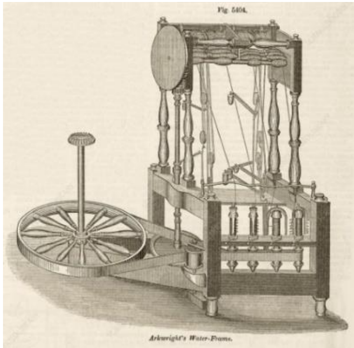
Shuttle Image from [134]	A shuttle is a tool designed to contain the yarn while weaving with a loom. Shuttles are thrown or passed back and forth through the shed between the yarn threads of the warp in order to weave in the weft. The simplest shuttles, known as "stick shuttles", are made from a flat, narrow piece of wood with notches on the ends to hold the weft yarn. Shuttles that are more complicated incorporate bobbins or pirns.	
Flying shuttle Image from [135]	This is an advancement of a loom part (shuttle). Shuttles were originally passed back and forth by hand. The flying shuttle used a rail that (a) allows a single weaver to weave much wider fabrics and (b) mechanised the process allowing for automatic looms.	
Shuttle box Image from [135]	It is the housing for the shuttle and is made of wood. It has a spindle and a picker. It may also accommodate the picker without spindle. The top and side of the box towards the slay race are open. The shuttle dwells inside the box for the intermediate period between two successive picks.	
Punched card Image from [136]	A punched card or punch card is a piece of stiff paper that can be used to contain digital data represented by the presence or absence of holes in predefined positions. (For Jacquard looms)	

Table 10. Thread and yarn production devices [Zabulis, 2019].

Warping mill Image from [146]	A machine for warping yarn.	
Spinning wheel Image from [137]	A spinning wheel is a device for spinning thread or yarn from fibres.	
Spinning jenny Image from [138]	The spinning jenny is a multi-spindle spinning frame.	
Spinning mule Image from [139]	The spinning mule is a machine used to spin cotton and other fibres.	

Spinning frame Image from [140]	The spinning frame is an invention for spinning thread or yarn from fibres such as wool or cotton in a mechanized way.	
Machine for punching cards Image from [141]	A device is used to pierce the cards that encode the motif to be woven. This device is commonly called a “piano”. Seated on a stool, the card puncher actuates the pedals located at the bottom of the machine. Like a pianist, his or her hands actuate the metal keyboard, while reading the numeric scale held on a lectern.	

8.1.4 Ecclesiastical textiles

Textiles are used in the production of garments. A **garment** is an article of clothing. **Ecclesiastical textiles** are textile accoutrements customary in churches and required for whatever purpose during the divine service. **Paraments** (see Figure 41) are the hangings or ornaments of a room of state. Paraments include the liturgical hangings on and around the altar, as well as the cloths hanging from the pulpit and lectern, as well as the ecclesiastical vestments and mitres, and altar cloths.

Figure 41. Paraments (Image from [144]).

Vestments (see Figure 42) are liturgical garments and articles associated primarily with the Christian religion, especially among the Eastern Orthodox, Catholics, Anglicans, and Lutherans. **Liturgy** is the customary public worship performed by a religious group. **Liturgical garments** are the clothes worn by the **clergy** wear during liturgies. **Clergy** are formal leaders within established religions.

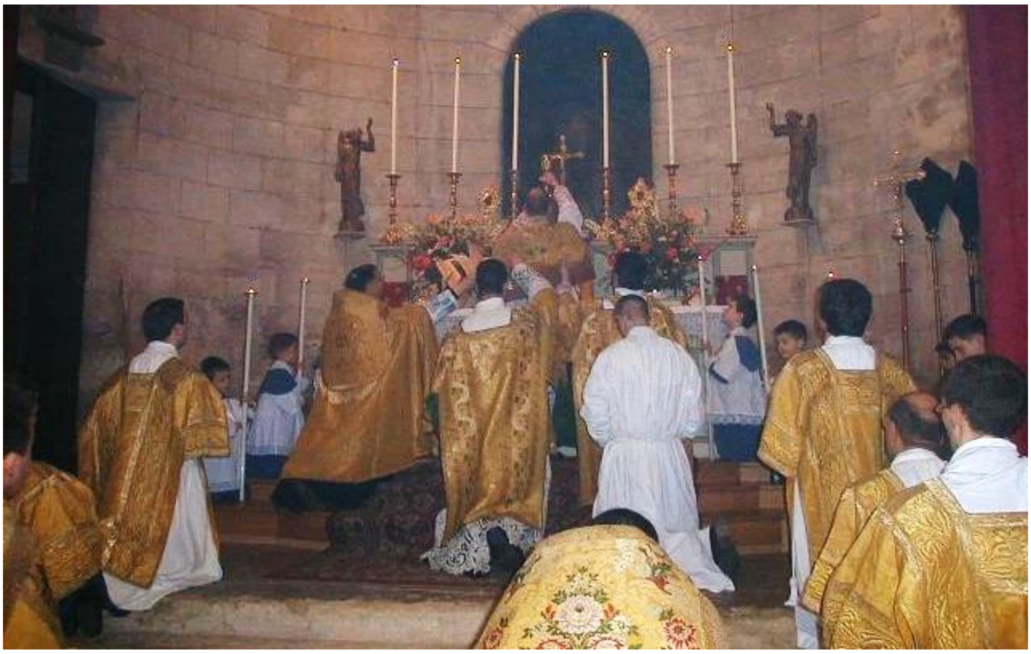
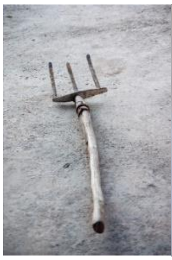


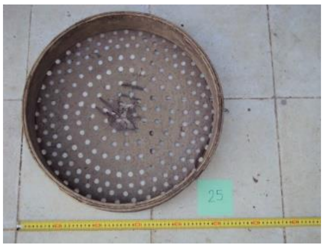
Figure 42. Clergy of various ranks in vestments celebrating Mass (image from [145]).

8.2 Mastic pilot

Table 11: Tools used in mastic cultivation [Kaplanidi, 2019]

Amia* Image from PIOP archive	An old agricultural tool with metal head and wooden handle used for the preparation of the soil before kendima (embroidering)	
Axe Image from PIOP archive	An agricultural tool with metal head and wooden handle	
Kenditiri* Image from PIOP archive	A metal agricultural tool with metal or wooden handle to make incisions on the mastic tree	

Baltadaki* Image from PIOP archive	A variation of kenditiri	
Korakomiti Image from PIOP archive	A variation of kenditiri	
Pickax Image from PIOP archive	An agricultural tool with metal head and wooden handle	
Pruning hook Image from PIOP archive	An agricultural tool for pruning with wooden handle and metal hooked blade	 
Rake Image from PIOP archive	An agricultural tool with metal head and wooden handle	 
Saw Image from PIOP archive	An agricultural tool with metal head and wooden handle used to cut the branches of the tree	

Shovel Image from PIOP archive	An agricultural tool with metal head and wooden handle used to clean and prepare the ground around the tree before kendima (embroidering)	
Sieve Image from PIOP archive	A roundshaped tool of variable sizes with wooden wall and metal mesh used to sieve the mastic gum	
Image from PIOP archive	A round-shaped tool of variable sizes with wooden wall and mesh made out of animal intestine used to sieve the mastic gum	
Dramoni Image from PIOP archive	A variation of sieve with metal mesh	
Timitiri or Xistiri* Image from PIOP archive	An agricultural tool with metal head and wooden handle used to collect the mastic gum	   

		  
Tsatali or Dikeli* Image from PIOP archive	An agricultural tool with metal head and wooden handle	

Available assets for tools include photographs and visual material. Tools that are digitised are marked with *.

New content includes visual material for digitisation purposes.

<u>Machines</u>

Table 12: Machines used in the production of mastic products [Kaplanidi, 2019]

Desiccator* Image from PIOP archive	It produces air and is placed in the room with the selves where the mastic gum dragees are placed to dry	

Blending machine (older)* Image from PIOP archive	Used for the production of the chewing gum mixture	
Blending machine (modern) Image from PIOP archive		
Boiler (older) Image from PIOP archive	Used to produce steam at a temperature of 120°C for the distillation process of mastic and production of mastic oil	
Candy machine (older)* Image from PIOP archive	Used in the production process of the chewing gum to dry the mastic gum dragees	 PIOP archive
Candy machine (modern) Image from PIOP archive		
Packaging machine (older) Image from PIOP archive	Used to pack mastic gum	

		
Packaging machine (modern) Image from PIOP archive		  
Press and engraving machine (older)* Image from PIOP archive	Used during the chewing gum process to press the chewing gum mixture, make it thin and formulate the shape of the gum dragees	 
Press and engraving machine (modern)* Image from PIOP archive		   

Printing machine (older) Image from PIOP archive	Used to print the packages of the products; made in Heidelberg	
Revolving cylinder (older) Image from PIOP archive	The gum dragees, after becoming cool, are loaded in the revolving cylinder where they are polished with stearin and talc for about 15 minutes	  
Scale (older) Image from PIOP archive	Used to weigh the mastic gum	
Separation machine (modern) Image from PIOP archive	Used to separate the mastic according to the gum's size	(Not available)
Sieve machine (older* + modern) Image from PIOP archive	Electrically driven sieve	(Not available)

Streamer (older) Image from PIOP archive	Part of the water and oil condenser for distillation	
Syrup maker (older) Image from PIOP archive	Used to produce the syrup for the mastic gum dragees	
Tank (older) Image from PIOP archive	Part of the distillation machine where vapours of water and essential oil gather to liquify while cooling	(Not available)
Vat (older) Image from PIOP archive	Part of the distillation machine, where mastic gum is placed and heated	

Available assets on machines include photographs, video, and photographic material. Machines that are digitised are marked with *.

New content includes photographic and visual material for digitisation.

8.3 Glass Pilot

Agents

Gaffer (corruption for ‘grandfather’)	The master craftsman in charge of a chair, or team, of hot-glass workers.

Machines

Table 13: Machines used in glassmaking [Dubois, 2019]

Lehr Photograph by Dubois, 2019.	The oven is used for annealing glassware. Early lehrs were connected to the furnace by flues, but the difficulty of controlling heat and smoke made this arrangement impracticable. Later lehrs were long, bricklined, separately heated tunnels through which the glass objects were slowly pushed. The glass remained in the lehr for several hours, while it was gradually reheated and then uniformly cooled. Today, lehrs work on a conveyor belt system.	
Furnace Photograph by Dubois (CNAM), 2019.	An enclosed structure for the production and application of heat. In glassmaking, furnaces are used for melting the batch, maintaining pots of glass in a molten state, and reheating partly formed objects at the glory hole.	
Garage Photograph by Dubois (CNAM), 2019.	A heating chamber is used to hold parts of objects that are assembled on the blowpipe, while other parts are being made.	

Available assets on machines include photographic and text material.

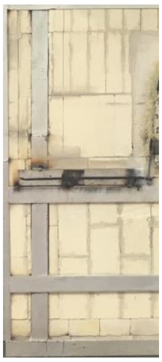
New content to be acquired includes video and visual material for digitisation.

<u>Materials</u>

Table 14: Materials involved in glassmaking [Dubois, 2019]

Alkali Photograph from [156]	In glassmaking, a soluble salt consists mainly of potassium carbonate or sodium carbonate. It is one of the essential ingredients of glass, generally accounting for about 15-20 percent of the batch. The alkali is a flux, which reduces the melting point of the major constituent of glass, silica.	
Batch Photograph by Dubois (CNAM), 2019.	The mixture of raw materials (often silica, soda or potash, and lime) is melted in a pot or tank to make glass. Cullet, as well as minor ingredients such as colorants, can be added to the batch to help the melting process.	
Bit Photograph by Dubois (CNAM), 2019.	A mass of molten glass, usually small and freshly gathered from the furnace. In a team of glassworkers, the bit gatherer removes bits from the furnace, using a bit iron. Bits are also known as gobs.	
Flux	A substance that lowers the melting temperature of another substance. For example, a flux is added to the batch in order to facilitate the fusing of the silica. Fluxes are also added to enamels in order to lower their fusion point to below that of the glass body to which they are to be applied. Potash and soda are fluxes.	(not available)
Gather Photograph by Dubois (CNAM), 2019.	A mass of molten glass (sometimes called a gob) collected on the end of a blowpipe, pontil, or gathering iron.	
Glass	A homogeneous material with a random, liquid like (noncrystalline) molecular structure. The manufacturing process requires that the raw materials be heated to a temperature sufficient to produce a	(not available)

	completely fused melt, which, when cooled rapidly, becomes rigid without crystallizing.	
Hot-formed Photograph by Dubois (CNAM), 2019.	The generic term for glass, which is manipulated while it is hot.	
Lime	Calcined limestone, which, added to the batch in small quantities, gives stability. Before the 17th century, when its beneficial effects became known, lime was introduced fortuitously as an impurity in the raw materials. The addition of insufficient lime can cause crizzling.	(not available)
Melt	The fluid glass produced by melting batch.	(not available)
Moil	The unwanted top of a blown object. When the last stage in the forming process is the removal of the object from the blowpipe, the result is a narrow opening that almost certainly is not what the glassblower desires. After annealing, therefore, the top of the object is removed, usually by cracking off. The moil from a mold-blown object is often called “overblow”.	(not available)
Post Photograph by Dubois (CNAM), 2019.	The glass is used to attach a second pontil to glass that is about to be pulled into a cane.	
Potash	Potassium carbonate. It is an alternative to soda as a source of alkali in the manufacture of glass.	(not available)

Refractory Photograph by Dubois (CNAM), 2019.	A substance, usually clay with a high silica content, capable of resisting high temperatures. Furnaces and pots are made from refractory materials.	
Sand	The most common form of silica is used in making glass. It is collected from the seashore or, preferably, from deposits that have fewer impurities. For most present-day glassmaking, sand must have low iron content. Before being used in a batch, it is thoroughly washed, heated to remove carbonaceous matter, and screened to obtain uniformly small grains.	(not available)
Silica	Silicon dioxide, a mineral that is the main ingredient of glass. The most common form of silica used in glassmaking has always been sand.	(not available)
Soda	Sodium carbonate. Soda (or alternatively potash) is commonly used as the alkali ingredient of glass. It serves as a flux to reduce the fusion point of the silica when the batch is melted.	(not available)

Available assets on materials include photographs and text material.

New content to be acquired includes visual material.

<u>Objects</u>

Table 15: Objects used in glassmaking [Dubois, 2019]

Marver (from French 'marbre', English 'marble') Photograph by Dubois (CNAM), 2019.	A smooth, flat surface on which softened glass is rolled, when attached to a blowpipe or pontil, in order to smooth it or to consolidate applied decoration.	
Pot	A fire-clay container in which batch is fused and kept molten. The glassworker gathers glass directly from the pot.	(not available)
Tank	A large receptacle constructed in a furnace for melting batch. Tanks, which were first used in antiquity, replaced pots in larger glass factories in the 19th century.	(not available)
Waster	A defective object discarded during manufacture. Wasters are routinely recycled as cullet.	(not available)

Available assets on objects used in glassmaking include photographs and text material.

New content to be acquired includes visual material.

<u>Processes</u>

Table 16: Processes of glassmaking [Dubois, 2019]

Annealing Photograph by Dubois (CNAM), 2019.	The process of slowly cooling a completed object in an auxiliary part of the glass furnace, or a separate furnace. This is an integral part of glassmaking because if a hot glass object is allowed to cool too quickly, it will be highly strained by the time it reaches room temperature; indeed, it may break, either as it cools or at some later date. Highly strained glasses break easily if subjected to mechanical or thermal shock.	

At-the-fire Photograph by Dubois (CNAM), 2019.	The process of reheating a blown glass object at the glory hole during manufacture, to permit further inflation, manipulation with tools, or fire polishing.	
Blowing Photograph by Dubois (CNAM), 2019.	The technique of forming an object by inflating a gather or gob of molten glass on the end of a blowpipe. Traditionally and in modern furnace working, the gaffer blows through the tube, slightly inflating the gob, which is then manipulated into the required form by swinging it, rolling it on a marver, or shaping it with tools or in a mold. It is then inflated to the desired size. In flameworking, one end of the glass tube is heated and closed immediately, after which the worker blows into the other end and manipulates the hot glass.	
Finishing Photograph by Dubois (CNAM), 2019.	The process of completing the forming or decoration of an object. Finishing can take the form of manipulating the object into its final shape while it is hot, of cracking off before annealing, or of cutting, enameling, grinding, or polishing.	
Fire polishing Photograph by Dubois (CNAM), 2019.	(1) In the hot shop: the reintroduction of a vessel into the glory hole to melt the surface and eliminate superficial irregularities. (2) In kiln working: exposing the object to significant heat so that it assumes a smooth surface.	
Firing	The process of (1) heating the batch in order to fuse it into glass by exposing it to the required temperature in a crucible or pot, (2) reheating unfinished glassware	(Not available)

	while it is being worked, or (3) reheating glassware in a muffle to fuse enamel or gilding. The melting of the batch may require a temperature of about 2400°-2750°F (1300°-1500°C), whereas the muffle kiln may require a temperature of only about 950°- 1300°F (500°-700°C).	
Founding	The initial phase of melting batch. For many modern glasses, the materials must be heated to a temperature of about 2450°F (1400°C). This is followed by a maturing period, during which the molten glass cools to a working temperature of about 2000°F (1100°C).	(not available)
Gather Photograph by Dubois (CNAM), 2019.	To collect molten glass on the end of a tool.	
Grozing	The process of breaking away the edge of a glass object with a grozing iron or pliers in order to shape it.	(not available)
Marver Photograph by Dubois (CNAM), 2019.	To roll softened glass on a marver.	

Available assets on processes include photographs and text material.

New content to be acquired includes photographs, video and visual material for digitisation.

<u>Tools</u>

Table 17: Tools used in glassmaking [Dubois, 2019]

Battledore Photograph by Dubois (CNAM), 2019.	A glassworker's tool in the form of a square wooden paddle with a handle. Battledores are used to smooth the bottoms of vessels and other objects.	
Block Photograph by Dubois (CNAM), 2019.	A tool made from a block of wood hollowed out to form a hemispherical recess. After it has been dipped in water to reduce charring and to create a "cushion" of steam, the block is used to form the gather into a sphere before it is inflated.	
Blowpipe Photograph by Dubois (CNAM), 2019.	An iron or steel tube, usually four to five feet long, for blowing glass. Blowpipes have a mouthpiece at one end. They are usually fitted at the other end with a metal ring that helps to retain the gather.	
Chair Photograph by Dubois (CNAM), 2019.	The bench used by the gaffer while forming a glass object. Traditionally, this is a wide bench with arms, on which the gaffer rests the blowpipe with its parison of molten glass and rolls it backward and forward so that the parison retains its symmetrical shape during the forming process.	
Clapper Photograph from [156]	A tool consisting of two rectangular pieces of wood joined at one end by a leather hinge. There is an aperture in one of the pieces of wood, and this holds the stem of a goblet or wineglass while it is being made. The clapper is used to squeeze a blob of glass in order to form the foot.	

Gathering iron Photograph by Dubois (CNAM), 2019.	A long, thin rod is used to gather molten glass.	
Glory hole	(1) A hole in the side of a glass furnace, used to reheat glass that is being fashioned or decorated. (2) A separate appliance for reheating glass.	(not available)
Jacks Photograph by Dubois (CNAM), 2019.	A tool with two metal arms joined at one end by a spring. The distance between the arms is controlled by the glassworker, who uses jacks for a variety of purposes while shaping the parison (for example, to form the mouths of open vessels). This tool is also known as a borsella or pucellas.	
Lipper	A glassworker's tool is made of wood in the shape of a cone and with a handle. It is used to form the lip at the mouth of a vessel.	(not available)
Pallet Photograph by Dubois (CNAM), 2019.	A glassworker's tool consisting of a square piece of wood or metal and a handle. It is used to flatten the bases of vessels.	
Parcioffi	Jacks with blades made of wood.	(not available)
Parison	A gather, on the end of a blowpipe, which is already partly inflated.	(not available)
Shears	A tool used to trim excess hot glass from an object in the course of production.	(not available)

	Many modern shears are embedded with chips of industrial diamonds.	
Pincers Photograph by Dubois (CNAM), 2019.	A glassworker's tool is used for decorating objects by pinching the glass while it is hot.	

Available assets on tools include photographs and text material.

New content to be acquired includes photographs and visual material for digitisation.

Annex 9 Digitised Socio Historical Context

9.1 Silk Pilot

Geographical information has been collected for the location of interest to the silk pilot. These locations have been recorded in the following ways.

For cities and villages and, in general, landmark locations found in a conventional map, we have referred to the GeoNames resource. In this way, we obtain an association with the GPS coordinate for the (centre of) the landmark location.

In other cases, we have entered the GPS coordinates using a GIS/mapping system and associated these locations with the name that is required for the pilot. For example, the location of a Gotzes workshop was found using its street address and then its GPS coordinates were retrieved. There are several online systems, which can facilitate this process, such as OpenMaps and Google Maps.

The locations presented in this subsection, are provided in XML format, in the Mingei dataset, containing both names and GPS coordinates. In Figure 43, this form of knowledge input is demonstrated, for the Mingei Online Platform. On the left, the location of Krefeld as a city is used and retrieved from the GeoNames online database, as shown in the centre. On the right, a location is set using the address and GPS coordinates; this location is to be later on linked, as the address of the Gotzes workshop, now location of HdS.

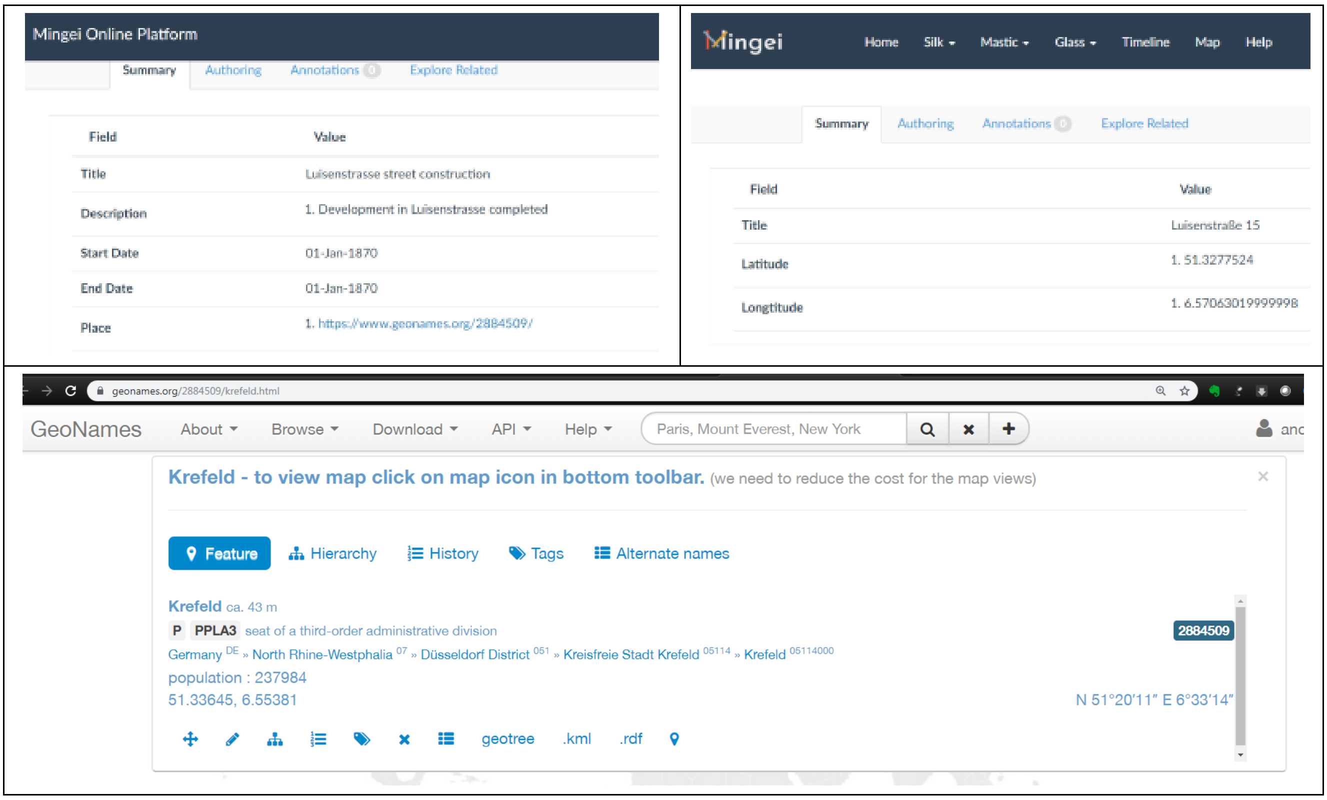


Figure 43. Representation of locations, in the Mingei Online Platform (image from [170]).

9.1.1 Upper Rhine

The broader vicinity of Krefeld, including Düsseldorf, Cologne, and the upper Rhine region, provides a better understanding of historic and contextual knowledge on the craft instance studied in the Silk pilot. In particular, the Rhine has been a vital and navigable waterway carrying trade and goods deep inland. Its importance as a waterway in the Roman Empire is supported by the many castles and fortifications built along with it. In the modern era, it has become a symbol of German nationalism.

Krefeld, also known as Crefeld until 1929, is a city in North Rhine-Westphalia, Germany. It is located northwest of Düsseldorf and Cologne, its centre lying just a few kilometres to the west of the river Rhine. The region around Krefeld is an industrial area for over two centuries. Krefeld is also called the "Velvet and Silk City". Figure 44 shows a map of the Krefeld region, pinpointing the locations of Krefeld, Cologne, and Düsseldorf.

Figure 44. Maps of the upper Rhine region (images from [159]).

In Figure 45, the geographical context is shown and focuses on the water pathways due to the Rhine. On the left, shown is a tracing of Rhine river locations at the vicinity of Krefeld (light blue lines, superimposed on map). Pinpointed locations in light blue are the cities of Krefeld, Cologne, and Düsseldorf and, in dark blue, the locations of Roman settlements of Xanten, Neuss, and Gelduba. On the right, show is a tracing of Rhine river and connected rivers (i.e., Moselle, Sieg, Ruhr, Lippe), pinpointing of locations visit of Rhine river cruises, operated by several companies in the area.

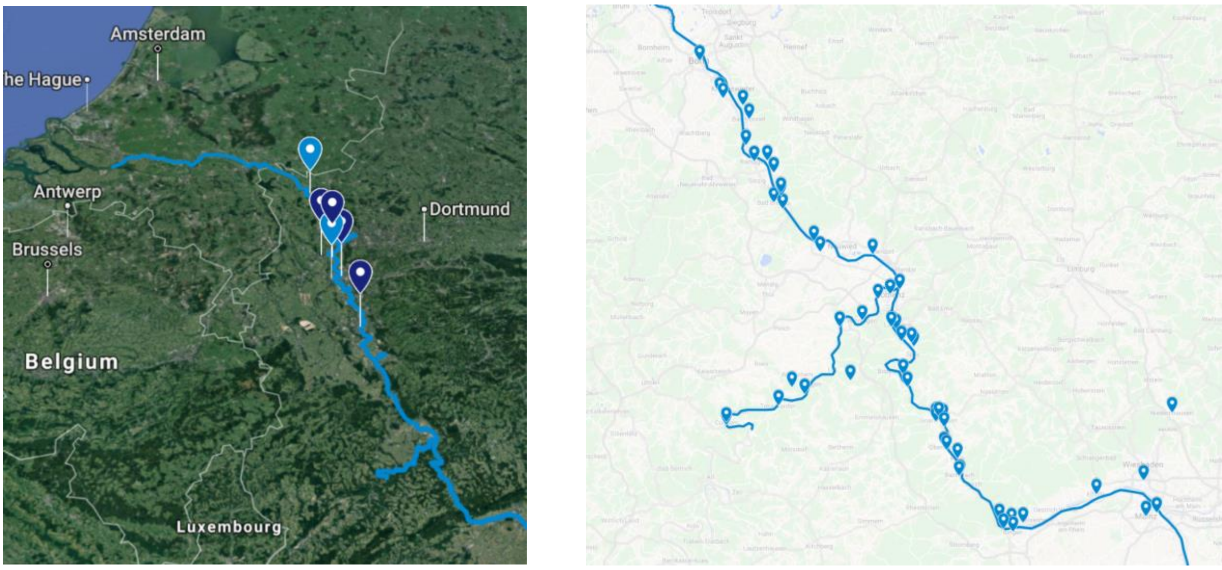


Figure 45. Rhine water pathways (images from [159]).

In Figure 46 and Figure 47, shown are historical maps of the region.

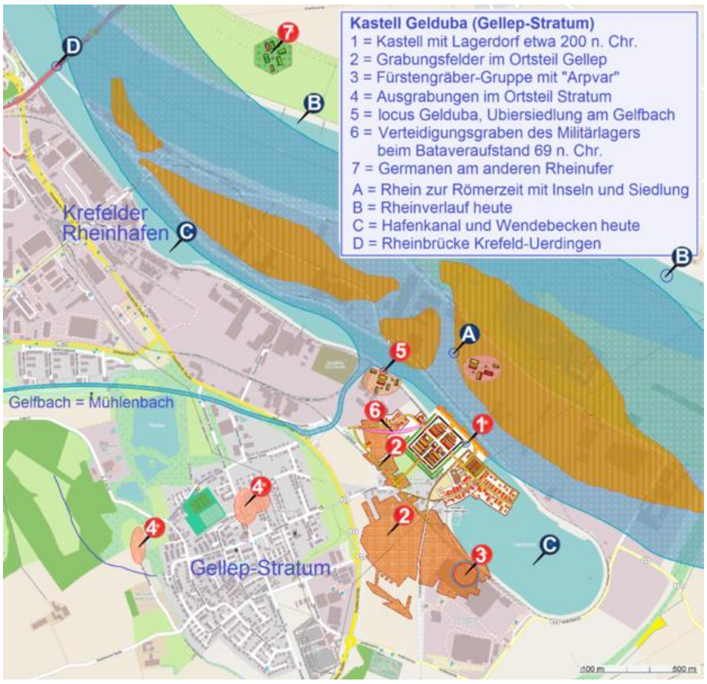
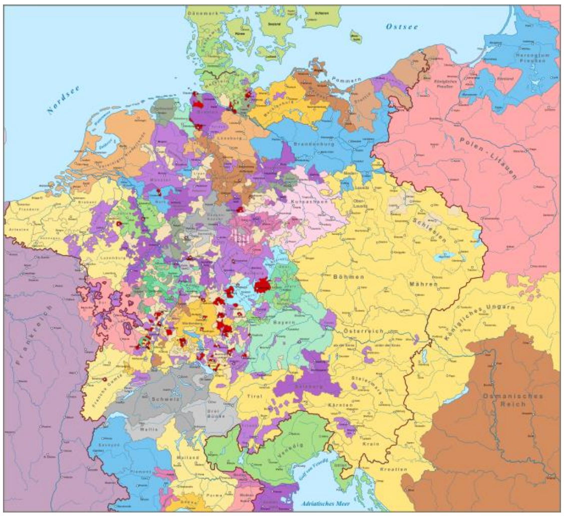
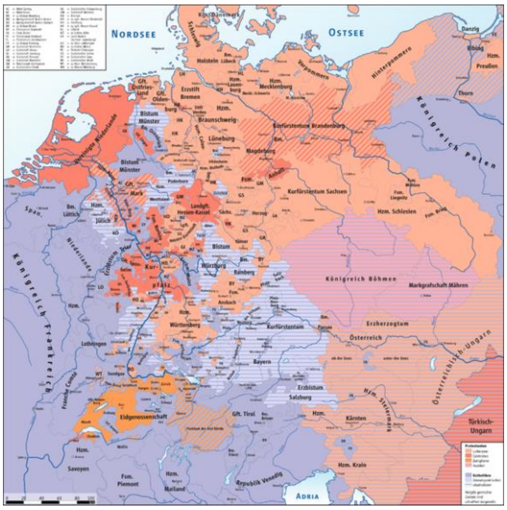


Figure 46. The area in the vicinity of the Roman Gelduba settlement (image from [147]).

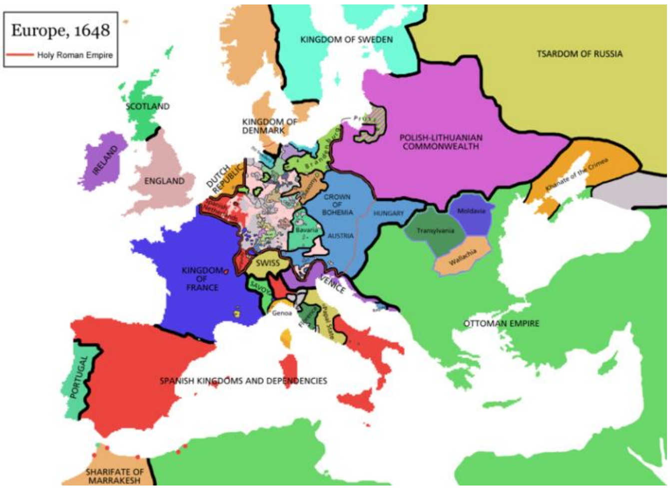


Holy Roman Empire at Central Europe, 1618.



Religious fragmentation in Central Europe, 1618.

The Holy Roman Empire, 1648.



Europe after the Peace of Westphalia, 1648.

Figure 47. Maps of central Europe in relevance to the Thirty Years War (images from [149]).

9.1.2 Krefeld

Krefeld is located northwest of Düsseldorf.

- Krefeld is located on broken stone terraces formed by the river Rhine over time.
- The district grew up on the edge of the upper terrace.
- The district becomes neighbouring to the surrounding Sprödental (valley).
- Ditches were built to drain the area enough to create gardens there.
- Surface water is collected via the drainage ditches.

Figure 48 shows maps Krefeld today, superimposing in black the Historical City Centre within the city walls (1819) and in purple the 7th expansion of Krefeld, or Crown Prince District: in 3D (left) and conventional map view (right). Pinpointed are city infrastructures (in yellow) and parks (in green) build in the Crown Prince District, which started in 1835.

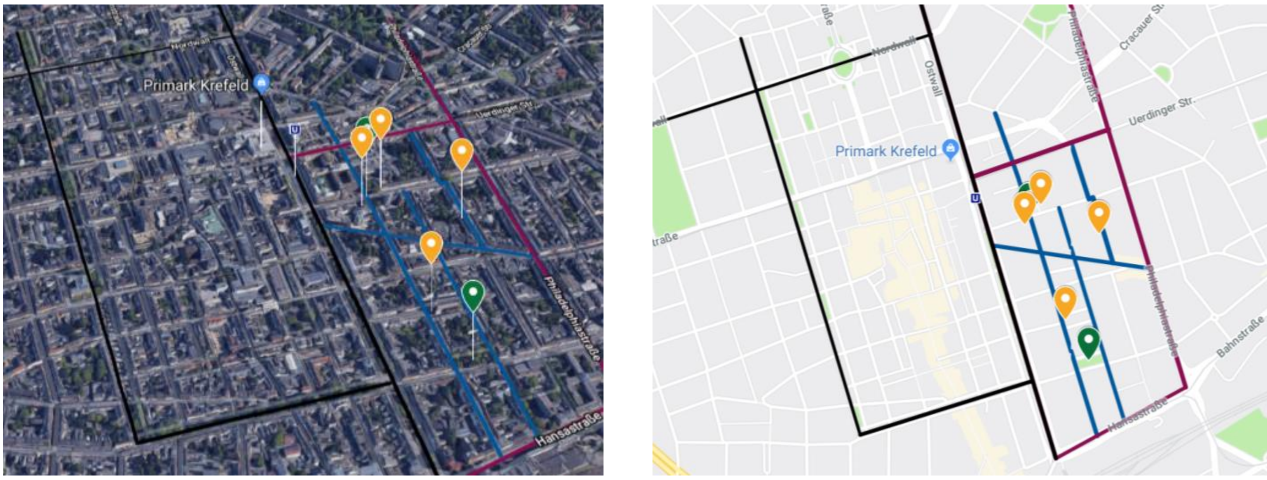


Figure 48. Krefeld map annotations for the Historical City Centre and the Crown Prince District (images from [159]).

- The Kronprinzenstrasse (eastern edge) was not very popular with prospective Krefeld land developers.
- 1819 inner area of Krefeld was completed with four boundary streets called “Wälle” based on the plans of master builder Adolph von Vagedes.
- 1835 Design work starts for a 7th expansion of the rapidly growing Krefeld.
- 1843 Prussian government (in Berlin) approved the plans of the (Düsseldorf government building officer) Franz Anton Umpfenbach. These plans set out the expansion in an easterly direction covering what is now known as the “Crown Prince District”.
- 1870s Development in Luisenstrasse completed.

The figure below shows Gotzes company workshop locations (light green) within the Crown Prince District (purple) and streets named after the Royal Family (blue). Pinpointed are city infrastructures (in yellow).

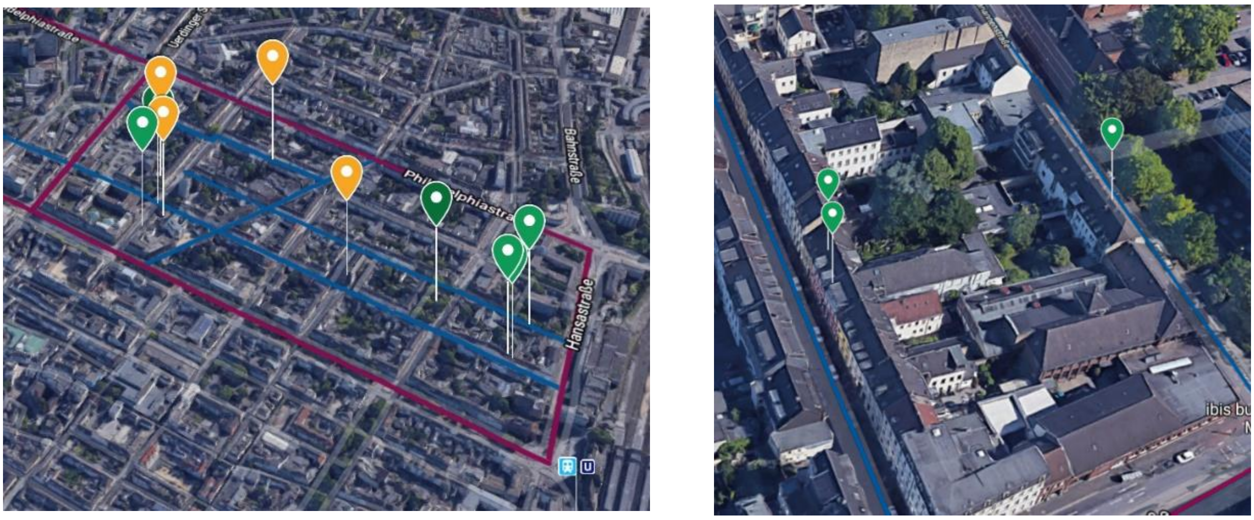


Figure 49. Locations of Gotzes Company workshops (images from [159]).

- 1900 the district had a typical mixture of residential and business properties. The areas to the rear of the properties either served as gardens or were developed with small workshops.
- Self-employed people, craftsmen, civil servants and employees, as well as workers lived in the district.
- 23% of the population were employed in the textile industry.

9.1.3 Krefeld city infrastructures

9.1.3.1 Power

- 1899 Municipal electricity station in Canalstrasse starts operation

9.1.3.2 Water, Health

- 1893 High-quality drinking water, by two waterworks from deep wells. Where: water protection areas on the western side of the town.
- 1875 Central sewage along Canalstrasse via Bockum to Uerdingen and to the Rhine.
- 1908 Central sewage renewed provided with an initial purification stage.
- 1908 Inner urban canal system, now possible to dispose of sewage directly via the canalisation.

9.1.3.3 Post

Beginning of the 1900s, there was a significant increase in the amount of mail.

- Reichspost sets post offices in individual town districts of the town (in addition to the head post office).

9.1.3.4 Transportation

Most silk weaving workshops, at the southern end of Luisenstrasse. Attributable to the close proximity of the train station, mail and freight transport.

- 1849 rail link to Homberg – Uerdingen – Krefeld – Viersen.
- 1853 extended to Aachen and Oberhausen.
- 1856 Cologne – Krefeld route opens.
- 1868 Establishment of the “Crefelder Eisenbahngesellschaft” (Krefeld Railway Company), new routes to Hüls, Moers, and St. Tönis.
- 1898 Long-distance train to Düsseldorf connected with Krefeld.
- 1900 Electrically powered trams for the town.
- 1906 Creation of a port on the river Rhine. This attracted companies to the town, which were not directly related to the textile industry.
- 1907 New train station.

9.1.4 Crown Prince District

Extends in a north/south direction from the Rheinstrasse to the then Canalstrasse (now Hansastraße), and in the west/east direction from Ostwall to the then Kronprinzenstrasse (now Philadelphiastrasse).

9.1.4.1 Structure

- A strict geometric road network has been planned.
- Diagonally traversing Alte Linner Strasse was retained as the historical route to Linn.
- Luisenplatz and Albrechtplatz were developed as new public squares.

9.1.44.2 Street and district names

The names of Prussian royal family members were given to streets running north to south.

- Crown Prince Street was a reference to the then Crown Prince Friedrich Wilhelm IV who visited Krefeld in 1833.
- Luisenstrasse - Louise of Prussia.
- Mariannenstrasse - Marianne of Oranien-Nassau.
- Elisabethstrasse - Elisabeth of Bavaria.

9.1.4.3 Social infrastructure

- 1850s The Catholic Church, Stephanskirche, is located at the end of Stephansstrasse.
- 1864 Secondary school on Luisenplatz opens. In 1882, it run as a grammar school (focussing on science and mathematics). This municipal school emerged from the Latin school endowed by the Mennonite businessman, Adam Wilhelm Scheuten.
- 1868 orphanage opens (on the eastern side of Kronprinzenstrasse), a house with a garden at Elisabethstraße 90. Sponsored by:
    - Protestants and
    - Krefeld women’s association (founded in 1827).
- 1872-1874 Protestant Friedenskirche church is built diagonally opposite to the school.

9.1.5 Krefeld walkthrough

In Figure 50, shown are the locations featured in HdS documentary (noted with purple markers). The locations are the following: HdS - earlier parament weaving H. Gotzes, Krefeld Hauptbahnhof (central train station), Ponzelar statue, Puppenbrunnen, Weaver's house, Alte Kirche, Et Bröckske, Ev. Freikirchen Mennoniten-Gemeinde, Konningstasse, Anson's Herrenhaus KG, Friedrichstraße 27, Stadtverwaltung Krefeld, St. Dionysius Church, Walking route.

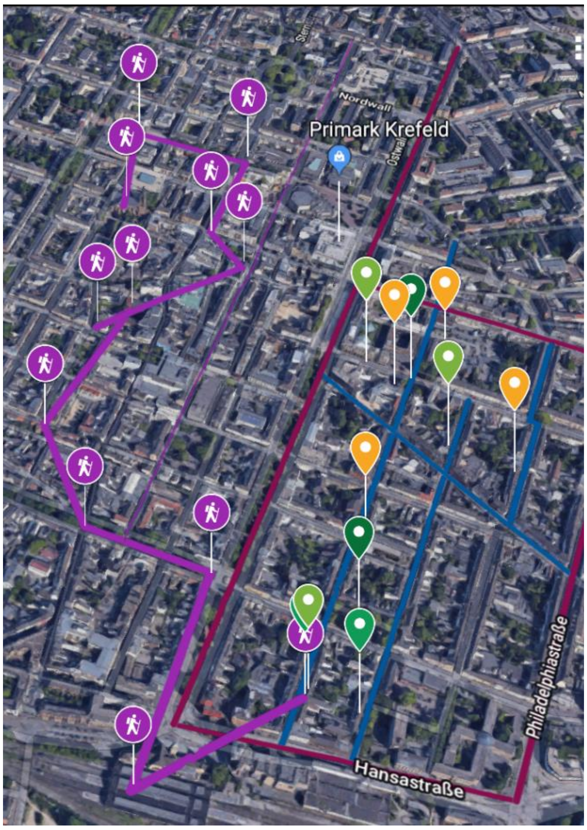


Figure 50. Locations of HdS city tour (images from [159]).

The figure below shows a video still (left) from the HdS documentary presenting the exterior of a weaver's house and (right) a 3D visualization of the featured location. Interest is focused on the fact that weaving requires light and thereby many windows on more than one side of the building, to extend hours of work.

Figure 51. The house of a weaver (Left: image still from Hds documentary [160] Right: image from [159]).

9.1.4 History of Rhine and regions

9.1.4.1 Key events

- 51AD - 5th century: The Roman military camp of Gelduba.
- 1105: First mention of Krefeld. The foundations were on the remains of the Roman military camp of Gelduba.
- 1618-1648: Thirty Years' War: a war fought primarily in Central Europe. Initially a war between various Protestant and Catholic states in the fragmented Holy Roman Empire, it gradually developed into a more general conflict involving most of the European great powers. Caused: Religious unrest, persecutions.
    - 23 June 1758: The Battle of Krefeld was a battle fought between a Prussian-Hanoverian army and a French army during the Seven Years' War.
- 1600s: Growth of Krefeld. The growth of the town began in that century, partially because Krefeld was one of the few towns spared the horrors of the Thirty Years' War. Many religious refugees settled in and around the town, which formed part of the territory ruled by the House of Orange, under which the town received the status of a "religious asylum".
- 1683: A group of 13 Mennonite families left Krefeld. To re-settle in Pennsylvania in order to enjoy religious freedom. They crossed the Atlantic on the ship Concord, and founded the settlement of Germantown (now incorporated in Philadelphia), thus beginning the Pennsylvania Dutch ethnic identity.
- 1715: Marienborn congregation forced to leave. Members moved to Krefeld on the lower Rhine, They continued proselytizing. This brought them into conflict with the authorities and several were sentenced to long prison terms.
    - 1719: Twenty families move from Krefeld to Pennsylvania, due to internal disagreements.
- 1765-1783: American Revolution. Relevant to the imagined ethnic community [86] , state, and constitution.
- 5 May 1789 - 9 November 1799: French Revolution. Relevant to the imagined ethnic community [86] , state, and constitution.
- 1939-1945: WWII.
    - 21 June 1943: Krefeld bombing. British bombs destroyed large parts of the east of the city; a firestorm consumed most of the city centre apart from the central train station, which remained intact apart from minor damage.

9.1.4.2 Political power

- February 1598: Walburga, wife of Adolf van Nieuwenaar, and last Countess of Limburg and Moers, gave the County of Moers, which included Krefeld, to Maurice, Prince of Orange.
- 1600-1601: John William of Cleves took possession of these lands.
- 1601: Maurice, Prince of Orange successfully defended his heritage.
- Feudal society started to decline in the 16th century, and political power began to be centralized in a state government.
- Circa 1650: Krefeld and Moers would remain under the jurisdiction of the House of Orange and the Dutch Republic during the Dutch Golden Age.

9.1.4.3 Business and trade

During the 1600s, Krefeld silk industry was built almost exclusively by private entrepreneurship. Textile merchants became some of the most important early entrepreneurs of this emerging economy. Fibre artists (workers in these industries) became proletariat. Mercantile economy rose, attempting to control centrally the economy, in the interest of strengthening the state.

9.1.4.4 German State

Key figure due to state reformations: Frederick the Great (1712-1786) ruled the Kingdom of Prussia during 1740-1786.

- 1772: Achieved sovereignty over most historically Prussian lands.
- Prussia greatly increased its territories and became a leading military power in Europe, under his rule.
- Nickname: Der Alte Fritz (“The Old Fritz“).
- Military theorist whose analysis emerged from his extensive personal battlefield experience and covered issues of strategy, tactics, mobility, and logistics.
- Modernized the Prussian bureaucracy and civil service and pursued religious policies throughout his realm that ranged from tolerance to segregation.
- Reformed the judicial system and made it possible for men not of noble status to become judges and senior bureaucrats.
- Encouraged immigrants of various nationalities and faiths to come to Prussia.
- Supported arts and philosophers, allowing complete freedom of the press and literature.

9.1.5 The Krefeld textile industry

This part of knowledge collection regards the Krefeld textile industry, and its pioneers, (e.g. the silk barons of Krefeld), as the textile industry flourished in Krefeld and, in particular, at its Crown Prince District. The latter became the epicentre of ecclesiastical textile production in the early 1800s, whose activity gave to Krefeld the name of the “Town of Silk and Velvet”.

The history of Krefeld, its people, and society, as the context, which the Krefeld textile industry flourished, aligned with European and World events from the late 1600s, such as religious unrest and persecutions, proto-industrialisation, the job market, the formation of social classes, the transition from feudalism to mercantilism, the transition from the putting-out system to the factory system, the impact on family and work relationships, the working conditions of apprentices, the Industrial Revolution, and WWII.

During the 1700s, the economic situation was dire, particularly for peasants. Textile production brought an influx of foreign funds and gave jobs. Frederick attempted to promote textile and later on silk production in Berlin. A comparison of entrepreneurship to state-controlled showed that Krefeld's specialization to silk, led by entrepreneurs like Gotzes, led to the business prosperity of Krefeld in comparison to other cases. Silk producers had decent income and working conditions. The industrial revolution though was harsh to linen weavers. The poor working conditions and low income influenced Engels and Marx.

Reasons of growth:

- Foreign exchange of the nation: Cloth was exported giving a positive balance of trade. Foreign trade is recognised as the “engine of growth”, for the emerging mercantile economy.
- The impoverishment of rural populations: There was an increasing pattern of dependence on the public or charity and linen manufacturing could provide jobs.

Proto-industrialization is the regional development, alongside commercial agriculture, of rural handicraft production for external markets. In the case of the silk pilot, the effects of the **development of Krefeld silk workshops results** in:

- Growth of foreign trade.
- The concentration of capital by merchant capitalists.
- Transition from the putting out system to workshops (to become later the factory system).
- Spread of rural domestic production of textiles dependent upon merchant capitalists.

9.1.5.1 Population influx in the 1700s

- Many religious refugees settled in and around the town, which formed part of the territory ruled by the House of Orange, under which the town received the status of a “religious asylum”.
- Protestant minorities, such as the Mennonites, were excluded from political office and land ownership.
- Through family connections, they created a network or transfer system for commodities, money, and information, which endowed them with considerable economic advantages that were collaboratively exploited (as in an association).
- The Rhenish political environment and system provided tolerance and protection and was (relatively) open socially. The system allowed the economic success of minorities.
- Workers were adept in learning novel tasks and manipulations for the silk industry from foreign experts. The von der Leyens brought experts from the Netherlands.
- The workers, transferring from linen to silk, carried over a tradition of industrial discipline and habits of work ingrained in them by generations of service in a well-developed and exacting domestic industry.
- The areas of Krefeld, Monchengladbach, Rheydt, and Viersen, experienced secularity due to the regional economy.

A favourable social environment to the course of economic activity is particularly striking in this instance, for the rise of the Krefeld, silk industry coincides both with the decline of the same trade in guild-dominated Cologne and with the lack of success of Frederick the Great to establish silk manufacture in Berlin.

9.1.5.2 Religion

- Catholic and Protestant churches encouraged the virtuous exercises of spinning, weaving, carding, and needlework at home.
- Catholic clerics and Luther disapproved of women’s independence.
- Some religious orders and communities for women were engaged in textile making.
- Many women gathered to work together (spinnstube translation: spinning bees).

- Encouraged by the textile industry for knowledge transfer and efficiency.
- Attracted unattached men and courtship play resulted.
- The unsupervised contact of unmarried women and men was not approved by clerics.
- Sometimes advocating that women should be able to live together for this purpose was enough to get one into trouble with religious authorities.

9.1.5.3 Population

In Figure 52, a plot of the population of Krefeld, Germany is shown, for the period 1604 to 1895. The plot is very coarsely annotated with historic periods and eras referenced in the silk pilot. While the population graph is based on the collection of knowledge, the annotations are only indicative, commentary, and for illustration purposes only.

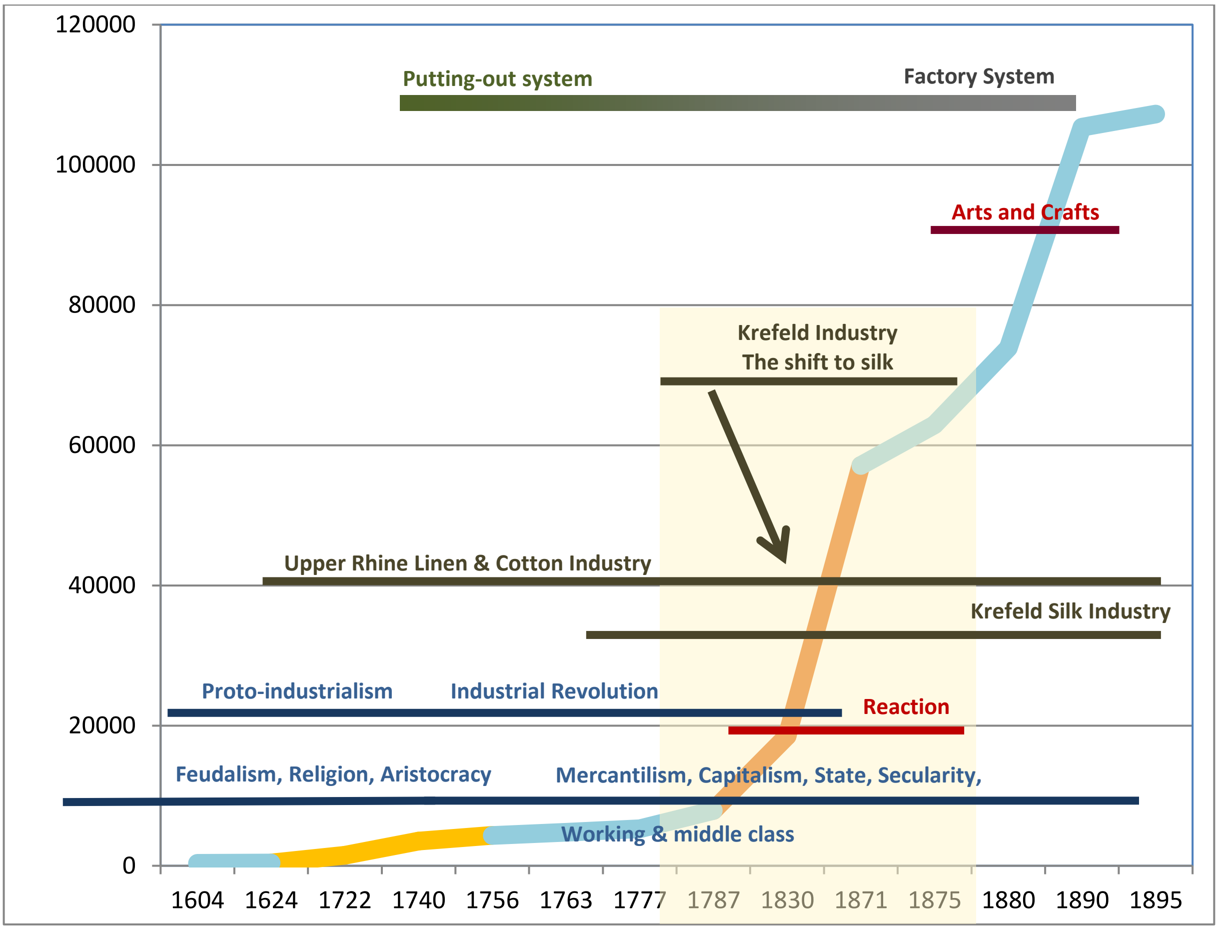


Figure 52. Krefeld population (1604-1895) [Zabulis, 2019].

9.1.5.4 Workforce

Like Krefeld's population, workforce comprised of city/regional citizens (majority) as well as members of the recently arrived Mennonite community as well as other immigrants and refugees from the religious persecutions.

- Majority of Krefeld's silk weavers were natives, children of local craftsmen, and peasants with smallholdings.

- Traditionally: women and children of rural vicinity performed unskilled tasks of preparing (cleaning, winding, etc.).
- Mennonite weavers or immigrants from more distant areas generally remained an exception within the new trade.

9.1.5.5 Communities

- 1743: Prussian authorities in Geldern raid the von der Leyens for employing foreign labour and advised that these ”foreigners” be made to migrate into town or at least into Prussian territory.
    - Prussian officials view industrial expansion with considerable misgivings (mercantilist beliefs at the time were prevailing royal doctrine).
    - Some Mennonite entrepreneurs try to imitate the innovation activities of the von der Leyens became the proximate cause of dissension between the two parties. Growing Mennonite wealth and influence, in turn, eroded those bonds. On achieving success, the Mennonites forsook the traditions of group loyalty to assume the arrogant stance of ruling potentates.
- 1759: these intragroup recriminations erupted into the open; at the time, the Seven Years' War was at its height and the fortunes of battle had brought the counties of Cleve and Moers, including Krefeld, under Austrian administration.
- 1780s: the Prussian part of Geldern claimed 200 to 300 silk looms in operation, working for Krefeld merchants. Most concentrated in Grefrath and Viersen where the existence of a Mennonite community facilitated the absorption of the weavers' colony into the Krefeld orbit.

9.1.5.6 The urbanisation of Krefeld

The influx of population: See above 4.3.5.1 Population influx in the 1700s.

Industrialisation brought the need for more workers and prosperity brought regional growth of workforce and urbanisation:

- Moers town and county, adjacent villages of Fischeln, Anrath, St. Tonis, and Huls (Kurkoln territory).
- Extended search for additional lands: areas of Cleve, Julich, and Geldern.
- 1763: Krefeld silk penetrated several Julich localities: Stchteln, Dilken, Kempen, and even Rheydt.
- 1788: Almost every former linen village near Krefeld had partially participated in the velvet and silk economy.
- Population influx young men attracted to Krefeld by the higher earnings and ample employment opportunities resulting from industrial growth.
- Textile operatives recruited among the local population. Locals succeeded in staving off the influx of outsiders into this realm, which they considered their exclusive preserve.
- Newcomers were pressed into the “residentiary” and tertiary sectors.

9.1.5.7 Working conditions in Krefeld and Germany

- 1848: the number of working hours was still 14 hours on 6 days a week. Children over the age of 9 years and up to 16 years could work for 10 hours on 6 days a week.

- 1853: the first factory inspectors were appointed, as the first step on the way to trade supervision and occupational safety.
- 1900: the ten-hour day and 6-day week were introduced for adults.
- 1981: The Health and Safety Act which provided for (a) state business inspectorate, (b) conditions for the employment of minors: children could only be employed over the age of 13, (c) maximum working time per day for 13-year-olds was six hours and for 14- to 16-year-olds ten hours (d) Work on Sundays and night work were strictly forbidden for children and youngsters.

9.1.5.8 The shift of the Krefeld industry to silk

During 1800-1820, Krefeld's textile industry started to abandon linen production and shifted to silk textile production. Ecclesiastical textiles were until then mainly weaved in linen and wool. The use of silk and velvet started to be initiated and the gold, silver threads were added.

Changes in the international economy due to the industrial revolution were among the main factors prompting Krefeld's industry to shift from linen to silk.

- The old linen industry provided a solid basis from which to launch this change (*Displacing thus the linen trades*, writes Gerhard von Beckerath *"they [i.e., the von der Leyens] struck roots with their silk industry on ground prepared by the Julich linen merchant-manufacturers"*).

The strategic importance of an existing industrial framework in creating "external economics" (external economies of scale) for the newly developing trade is well established. Here it became most apparent in the sphere of early labour recruitment. Krefeld confirmed, unmistakably, Adam Smith's contention on how minor the differences between working on linen and the silken product is.

9.1.5.9 Krefeld industry marketing events

	Event	**Significance**	**Impact**
1852	Exhibition of religious art organised by Bock.	Cassareto company presented its new "mediaeval fabrics "to a wide public.	Starting defining **trend** that gave Krefeld its fame and industrial survival.
1880	The mechanical silk loom conquered the workshops in the town putting many manual weavers into dire straits.	The industry needed the significant skills of manual weavers, for ecclesiastical textiles, as they were not mass-produced. It was not economical to use the mechanised looms to produce the small quantities of very high-quality fabrics interwoven with gold and silver threads. Weaving ecclesiastical textiles still provided employment.	**Political**. Private benefit funds, state and communal measures to cope with employment crisis.

1887	"Exhibition of Religious Fine-Art, Weaving and Embroidery from the Past". Location: Königliche Webschule" (Royal School of Weaving). Patronage: Archbishop of Cologne.	The purpose of the exhibition was to promote *"the production of religious textiles would gain impetus from the exhibition"*. Krefeld weaving workshops for ecclesiastical textiles were represented.	**Economic**. The hopes of the initiators seemed to be fulfilled, and in the following decades, more and more weaving workshops for ecclesiastical textiles were founded in Krefeld.

9.1.5.10 The Silk Barons and key historical figures

In the late 1680s, the industry's success could be attributed to the Mennonite families who thus far had been instrumental in promoting the town's progress. These same families later proved strategic in Krefeld's rise to prominence as one of the world's leading silk manufacturing centres. The names of these particular families bring to mind the emergence of a manufactocracy that was to play a leading role in the urban and regional economy. They were the van Aakens, Flohs, Preyers, Scheutens, op den Graeffs, ter Meers, von Lingens, von Beckeraths, Eltens, Jentgens, and last but not least, the von der Leyens. From the late 17th century until well into the 19th, Krefeld's material fate was to be inextricably intertwined with the capitalist fortunes of the von der Leyen family.

As linen merchants and prospering commission dealers of long-standing, the von der Leyens and the other Mennonites had accumulated relatively sizable funds. These impressive resources gave them the chance to finance, apart from export sales, the purchase of raw silk and of looms and other pieces of equipment, which they had to provide for their domestic workers. That the wealth gained in a preceding era was a prerequisite for entry into Krefeld's 18th-century silk business is a commonplace among local historians. These capital requirements also help explain why, at the time, the entrepreneurial function within this industry was confined to a handful of Mennonite merchant princes. The von der Leyens and their co-religionists not only possessed the will but also, as suggested earlier, the means to effect this transformation.

9.1.5.10.1 The von der Leyens

Von der Leyen is a German noble family, which made its fortune as silk merchants and silk weaving industrialists. They established a major textile business in Krefeld in the 18th century. In its heyday, the business delivered silk to most European courts and aristocratic dynasties. The family was ennobled in 1786 and one branch was raised to Baronial rank by Napoleon in 1813 and by the King of Prussia in 1816. The family tree runs until today, Heiko Echter von der Leyen (born 2 June 1955) is a German physician, professor of medicine and the husband of politician Ursula von der Leyen. Among other buildings in Krefeld, which bear many and wide windows to facilitate weaving, the castle of the family in Krefeld is now a government building and landmark of Krefeld.

- 1759: Peter von der Leyen mentioned in Radevormwald.
- 1656: Catholic ruler, Philip William, Elector Palatine, of Radevormwald introduces high penalty taxes for Anabaptists and Mennonites, which made the Mennonite Adolf von der Leyen (c. 1624-1698) seek refuge in the city of Krefeld, at the time ruled by the more tolerant House of Orange-Nassau.

- 1668: Heinrich von der Leyen secures citizenship. Establishes wholesale business and continues the family silk business.
- 1702: Krefeld is under the rule of the King of Prussia.
  - Frederick William I & Frederick the Great protect domestic silk production and help the von der Leyen business to expand further.
  - 1758: Frederick the Great stays in the family's Krefeld house, after winning the Battle of Krefeld (see Figure 53). During this visit of Frederick the Great at Krefeld; the von der Leyens negotiated upgrades in the Crown District infrastructure and privileges for the Krefeld industry.
- 1720: Peter von der Leyen founds a factory for sewing silk.
- 1724: Brothers Johann, Friedrich and Heinrich found a silk dyeing factory.
- 1749: Franz Heinrich Heydweiller inherits the part of the business.
- 1760: The von der Leyen creates a foundation for the support of local Mennonites.
- 1763: Half of Krefeld's population (of 6082 people) works for the von der Leyen factories.
- 1768: Von der Leyen supports Krefeld Mennonite Church.
- 1794: The Von der Leyen monopoly of the silk industry was finally ended during the French occupation.

Figure 53. The visit (1758) of Frederic the Great at the von der Leyen palace (image from [152]).

Key events in the von der Leyen enterprise are the following:

- The von der Leyen business flourished between 1720 and 1794.
- The success of the family's silk business has been attributed to the way they operated free from government control.
- Competition: The von der Leyens were incensed by the endeavours of the firm G. von Lingen. This firm was owned and managed by the brothers von Beckcerath, and attempted to intrude into the manufacture of silk ribbons. The von der Leyens petitioned the imperial authorities to

grant them the exclusive privilege of producing silk fabrics and silk ribbons in 1758 on the visit of Frederich the Great.

The company assets indicate an ever-rising status of the von der Leyen business (see Figure 54).

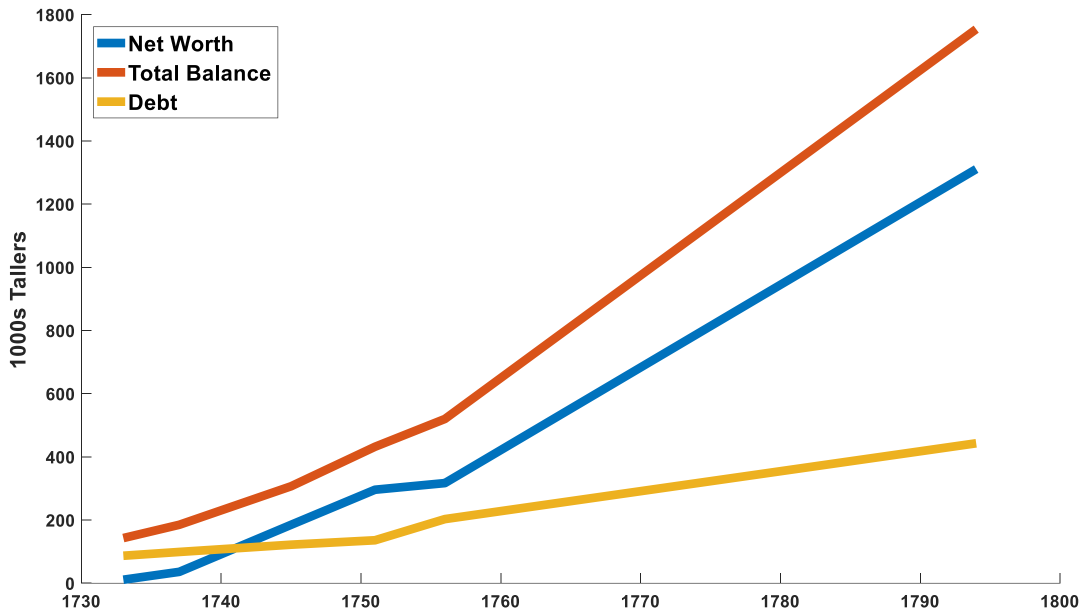


Figure 54. Von der Leyen company assets (Zabulis. 2019, data source: [84]).

9.1.5.10.2 Key historical figures of the Krefeld industry

Name	F.J. Casaretto
Nationality	
Birth	
Death	
Education	Descendant of an Italian silk weaving family
Occupation	Catholic entrepreneur in textile production
Activity	
Events	Moved to Krefeld in the 18th century.

Name	Franz Bock
Nationality	German
Birth	
Death	

Education	
Occupation	Chaplain of the main church, St. Dionysius, Krefeld.
Activity	
Events	Franz Bock persuaded F.J. Casaretto to venture into the ecclesiastical textile business and what is more to concentrate on historic patterns.

Name	Gottfried Diepers
Nationality	German
Birth	1833, Krefeld
Death	
Education	
Occupation	Silk producer
Activity	Maintained silk workshop in building. Gottfried Diepers opened the way for a new working structure by setting up this type of weaving workshop. Until the mid-19th century, weavers worked predominantly on looms at home. The new factories enabled the production of splendid textiles on the technically advanced Jacquard handlooms. Until almost the end of the 20th century, cloth interwoven with gold and silver threads for precious liturgical vestments was woven on such looms.
Events	• 1867/68: built Luisenstrasse 15 building and created the Diaper silk workshop. • 1906: Sold building and workshop.

9.1.5.11 Assessments on the growth of the Krefeld industry

The Krefeld silk industry solved the mounting labour shortage due to the growth of industry, resorting to putting-out systems: that is, they distributed an increasingly larger share of their work among the underemployed cotter weavers of the wider region.

A favourable social environment to the course of economic activity is particularly striking in this instance. The rise of the Krefeld silk industry coincides, both with the decline of the same trade in guild-dominated Cologne and with the lack of success of Frederick the Great to establish silk manufacture in Berlin.

Against the background of West German developments, Krefeld's industrial dynamism stood in marked contrast to the helplessness of many languishing linen centres unable to cope with the prospective loss of their main outlet, the English market.

In the course of the 18th century, this export market virtually dried up, supplanted by the meteoric rise of a resilient North Irish linen trade. Bolstered by governmental subsidies and a protective tariff, the Ulster linen industry not only established its ascendency within Great Britain but soon became a formidable competitor in the world at-large.

During the 1700s, elsewhere in the Rhineland or Westphalia the linen merchants were not equally aware of the difficulties to arrive due to competition from other markets. Possibly, because they lacked the intimate knowledge of and contact with foreign customers which would have enabled them to evaluate what was to come.

Krefeld profited from Cologne's decline. Krefeld was sufficiently close to Cologne to claim the role as regional silk centre, which the medieval metropolis was being forced to abdicate.

During the 1750s, sophisticated capitalist arrangements and sustained protoindustrial growth became the order of the day. This development is as true for Krefeld as it is for the Wupper valley cities. By the end of the 18th century, the story to be told is one of rapid urbanization and sizable accumulation of wealth in the wake of impressive successes registered by the Rhenish textile wares throughout world markets. The focus is on the achievements of these enclaves of prospering proto-industrialization and the historical significance of expanding domestic manufacture.

Comparative historical investigations emphasize the peculiarities of German development in order to explain why that development deviated so clearly from the path taken by the first industrial nation - Britain (whose development is more or less implicitly taken as the normal path of modernization). Such studies have attributed great importance to the weakness of the German bourgeoisie, which is judged responsible for a lack of capital of entrepreneurial talent, and of markets for which only conscious state action could adequately compensate. Mercantilism, bureaucracy, and enlightened absolutism are thus seen as substitutes for the spontaneous capitalism and a broad middle stratum of society that allegedly propelled British development.

The true carriers of industrial development in these textile regions were individual capitalist entrepreneurs. These began at the end of the medieval period as well-to-do peasants engaged in trade as a sideline, evolving later into specialized traders and "putter-owners", and finally as merchants and factory owners with hundreds of dependent workers. The successful Krefeld silk industry was built almost exclusively by private entrepreneurship. In contrast, the less successful Berlin industry was heavily dependent upon the assistance of the Prussian state.

Kisch's analysis of Rhenish development [84] fits well into the prolonged historical debate initiated by Weber's viewpoint on the relationship between Protestantism and capitalism [85] .

9.1.5.12 The Gotzes family and company

The collection of knowledge envelopes the story of the Gotzes family company, as a characteristic instance of a member of the ecclesiastical textile production industry. The collected knowledge is based on the material provided in D1.3, Section 7 and its Annexes 6 and 8.

4.3.6.1 The Gotzes family members and employees

Name	Hubert Gotzes
Nationality	German
Birth	5th September 1860, Amern
Death	28th December 1916, Krefeld
Education	

Occupation	
Activity	• Marries Gertrud Karoline, née Vollekeir • 1900: Moved from Amern, to Krefeld to practice his craft. • Initially, he worked at several locations in the town
Events	• 1908: purchases the property Luisenstrasse 15, together with the entire workshop equipment and set up his Gotzes Company there. • Circa 1908: acquired adjacent premises in Mariannenstrasse

Name	Gertrud Karoline, born Vollekeir
Nationality	German
Birth	
Death	
Education	
Occupation	
Activity	• (unknown date) Marries Hubert Gotzes at Amern • 1900: Moved from Amern, to Krefeld with husband.
Events	

Name	Hermann Gotzes
Nationality	German
Birth	1888
Death	
Education	
Occupation	
Activity	
Events	

Name	Jakob Theodor Gotzes
Nationality	German
Birth	1883
Death	
Education	Commercial apprenticeship
Occupation	Business administrator in the family business from the start

Relevance	
Events	• Opened own ecclesiastical fabrics workshop in the adjacent house at Luisenstrasse 17. • 5th December 1930: Left the joint family business. • 1927-1933: already rented the adjacent building Luisenstrasse 17 and was registered there as a silk producer. (Relevance in building information: the two buildings have the same heating system.)

Name	Josef Gotzes
Nationality	German
Birth	1886
Death	1959
Education	Commercial apprenticeship.
Occupation	Travelled around as a sales representative from the start
Relevance	
Events	• 1928: own weaving workshop for ecclesiastical textiles & fabrics on Neuen Linner Strasse 80.

Name	Hubert Gotzes Jr
Nationality	German
Birth	1893
Death	
Education	Business apprenticeship, at Institute St. Leon in Bruges (Belgium). 1910: completes business apprenticeship (just 17 years old).
Occupation	• Runs USA branch of the Gotzes company at Chicago, U.S.A. • Runs independent company, registered as “Hubert Gotzes, Inc”. With Record ID: SILNMAHTL_18295 (Source: Smithsonian Libraries Trade Literature Collections).
Relevance	• 1914: Created branch in Chicago, U.S.A. • (unknown date) : Marries: Werra Gotzes. They give birth to Hubert Gotzes Junior. The live at George Avenue, Chicago, Cook, Illinois (Source: U.S.A. Federal Census).
Events	• 1912: Returns to Krefeld. • 1914: Moves to Chicago, USA Sets up a trading company for Gotzes Company. • 1928: Resigns from Gotzes company. Continues independently.

Name	Karl Matthias Gotzes
Nationality	German
Birth	1884
Death	1935
Education	Commercial apprenticeship.
Occupation	• Initially, worked at Gotzes Company. • 1910: Grocer in Hülserstrasse 118. • 1913: Grocer in Mariannenstrasse 94.
Relevance	Worked as travelling salesman for the company. Initially by train, then by company car. Left for 8-14 days each time

Name	Pauline Gotzes
Nationality	German
Birth	1890
Death	
Education	
Occupation	

Name	Gertrud Gotzes
Nationality	German
Birth	1896
Death	
Education	Commercial apprenticeship.
Occupation	

Name	Henriette Gotzes
Nationality	German
Birth	
Death	
Education	
Occupation	1935 - 1969: Manages Gotzes company.
Relevance	• Steers company through Vatican crisis.

	• Steers company through WWII.
Events	• Marries Matthias Gotzes. • 1935: Takes over the business after husband's death. • (Unknown date): Adopts her nephew Erwin Maus. • (Unknown date): Trains Erwin Maus to succeed her.

Name	Erwin Maus
Nationality	German
Birth	
Death	2004
Education	• Learned the weaving trade from scratch. • Trained from Henriette Gotzes to succeed her.
Occupation	HdS employee, then manager.
Relevance	• Erwin Maus, Henriette Gotzes' nephew, was great support for the business. • Worked in the office and as a sales representative. • Erwin Maus became acquainted with Helga Meyer, on a business trip. • 1954: Erwin Maus & Helga Meyer are married. • January 1962: becomes partner to the Gotzes Company.

Name	Helga Meyer
Nationality	German
Birth	Koblenz
Death	
Education	Design
Occupation	Designer
Relevance	• 1954: Erwin Maus & Helga Meyer are married. • 1955: Revives design workshop.
Events	Takes over and revives the design workshop.

Name	Wendelinus Breuer
Nationality	
Birth	

Death	
Education	
Occupation	Weaver
Relevance	Provided testimony

Name	Paul Amend
Nationality	
Birth	
Death	
Education	1952: apprenticeship in Gotzes Company. Learned the weaver's craft from scratch.
Occupation	Weaver
Relevance	Provided testimony

Name	Andreas Friedenberg
Nationality	
Birth	
Death	1989
Education	
Occupation	Weaver
Relevance	Last weaver of the company

4.3.6.2 The Gotzes company workshops

4.3.6.2.1 Building of Luisenstrasse 15

The house had been built in 1867/68 by Gottfried Diepers. The building, which backed on to it in Mariannenstrasse, also belonged to it.

Table 18. Ownership of Luisenstrasse 15 [Beiswenger, 2019]

1867	Gottfried Diepers
1908	Gotzes company
2000	The Association of Friends of HdS

Architectural facts.

The two-story residential and business building has a typical basic layout of the front and rear house of the second half of the 19th century. It was designed for both residential and business premises. Thus, it included: (a) production facilities at the rear, and (b) commercial building design with windows in the front. Other features are the following:

- Street facade: four windows.
- The rear house is attached to the front house as a side wing.
- Basement covering the entire area of the front house.
- Foundations: Schlitzfundamenten was the cheapest and only sensible solution on the boggy gravel and sand ground. Low arches formed the foundation floors and ensured it remained dry.
- Behind the house, there was also a courtyard and a garden.
- Weaving room (upper floor): possible to position the looms at right angles to the windows, which had been designed as large as possible. This is relevant to the requirement that weaving needs light.

Entrances, stairway, and arrangement of rooms

- Two adjacent entrances and two separate stairways exist. The entrance on the left originally led to the private rooms on the first and second floors of the front house.
- The ground floor rooms were accessed through the business entrance on the right. Entrances for the suppliers and the customers are directly adjacent to one another. The customer entrance leads into the business and office areas and the suppliers' entrance into the courtyard towards the side wing with the workshops and the private rooms on the upper floors.
- From the rooms at the rear, there was a stairway to the upper floor of the side wing where the weaving room was situated.

Function as workshop

Looking at the property from the street, the reception room and the office were located at the front on the right. The side wing at the rear accommodated the workshop for embroidery and needlework, and on the upper floor the weaving room. On the upper floor on the street side there was a large showroom and to the rear of the building the private rooms.

Transformations, by Hubert Gotzes and afterwards

- Extended the rear building with the weaving room on the upper floor.
- The layout of ground floor rooms changed, to accommodate needlework and embroidery workshops.
- Larger windows for display installed.
- Common heating system with Luisenstrasse 17. (The weaving business extended over both buildings).

Infrastructures

- 1930s: Electrical system. Hubert Gotzes obtains a branch connection to electricity soon after acquiring the property.
- Central heating. Early installation of central heating: a low-pressure system with a coal-fired boiler. Later it was replaced with a Schwerkraftheizung.

- Water: Public wells equipped with manual beam pumps ensured the water supply. An appropriate water tap was located in front of the building Luisenstrasse 18.
- Sewage: Effluent and sewage were collected in a pit, which was regularly emptied. In a terraced street, either this procedure was carried out through a so-called Schürgweg between the houses, or the contents of the pit had to be carried through the house hallway in buckets to the cart with the collection tank waiting in the street.

WWII damages and reconstruction

22nd June 1943: Devastating aerial bombardment and subsequent major fire virtually destroys "Crown Prince District".

Damages

- Building of Mariannenstrasse 4: destroyed
- Luisenstrasse 15: Side wing severely damaged. The eastern end wall and part of the wall facing the courtyard were destroyed.

Mitigation actions and reconstruction

- The 8 looms were completely intact. The employees continued to work as far as possible. The needlework and embroidery workshop were moved into the private rooms of the building.
- Shortly after WWII, the wing section in Luisenstrasse was repaired.
- 1954-1955: The house in the Mariannenstrasse 4 was rebuilt and used mainly as residential premises.

Post WWII modifications

- Further reconstruction work in Luisenstrasse. Dormer windows were installed in the attic to create additional living space. The stairway was also redesigned to separate the residential areas from the business areas.
- In the 1960s, health and safety regulations stipulated that sanitary facilities had to be installed at the front of the weaving workshop. That meant that one loom had to be removed. This measure was reversed during a subsequent refurbishment of the building and the original weaving workshop was reconstructed.
- Later the Association of Friends of HdS closed from September 2011 to 4th April 2014 and was refurbished to meet fire protection standards for publicly used buildings. It provided a modern concept without giving up the old structures.

4.3.6.2.2 Building of Mariannenstrasse 4

A shed-roofed building.

A shed-roofed building, which was used by Gotzes for velvet brocade weaving workshop. The velvet brocade-weaving workshop was located there. It is last known location is Mausmobil.

<u>Ownership:</u>

1867	Gottfried Diepers
1908	Gotzes company
WWII	Destruction and rebuilding as residential

4.3.6.2.3 Building of Luisenstrasse 17

Jakob Gotzes had opened his own ecclesiastical fabrics workshop Registered there as a silk producer from 1927 to 1933.

4.3.6.2.4 Neuen Linner Strasse 80

Josef Gotzes was first recorded as having his own weaving workshop for ecclesiastical textiles on the Neuen Linner Strasse in the municipal address book of 1928.

4.3.6.3 Gotzes company biography

- 1908: Hubert Gotzes purchases the property Luisenstrasse 15, probably together with the entire workshop equipment, and set up his business premises there.
- 28 December 1916: Hubert Gotzes dies.
- 1916: Jakob and Josef Gotzes took over the management of the business as executors of his will.
- 1920: Jakob, Josef, Matthias and Hubert (junior) named as joint owners of the company.
- 1928: Hubert Gotzes Jr. left the business and continued independently the USA branch.
- Mid-1920s Josef left the business and set up his own weaving factory for ecclesiastical textiles.
- 5 December 1930 Jakob left the business.
- 1933: Matthias Gotzes finally is the sole owner of the company; he retains the company name.
- 1935: Matthias Gotzes dies.
- 1935-1969: Widow of Matthias Gotzes, Henriette, takes over the business; she retains the company name.
- January 1962: Erwin Maus becomes a partner. Company is registered as a partnership in the Commercial Register.
- 1954: Helga & Maus are married; Helga Maus became responsible for the design workshop.
- 1955: The design workshop was already working at full capacity again.
- 1969: Following Henriette Gotzes death in 1969, Erwin Maus & Helga Mayer take over the company together.
- 1989: Last weaver of the company dies. The company closes the weaving workshop and just maintains sales.
- 16 September 1992: Company entered in the Commercial Register as defunct.
- It was important to the entrepreneur that the last Krefeld silk weaving workshop with its Jacquard looms in its authentic place should be preserved for posterity.
- 2000: The company contacted the town of Krefeld and initiated a process which finally led to the Kulturstiftung NRW together with the Sparkassenstiftung Krefeld (Cultural Trusts) acquiring the property and handing it over to the Association of Friends; the Association of Friends runs the former weaving workshop for ecclesiastical textiles as a museum supported by a team consisting mainly of volunteers.

4.3.6.4 Notable events in the lifetime of the Gotzes company

- Despite the severe losses suffered by the ecclesiastical fabric business as a result of the Second Vatican Council the Gotzes Company was able to hold out for a long time at its original location.
- The USA branch proved a fortunate step because the business in America became an important pillar of the company even during the unstable period prior to WWII. The ecclesiastical fabrics were very popular with the Americans for their excellent quality and colour fastness.
- 1914: Hubert Gotzes Jr. the youngest son of Hubert Gotzes went to America. In Chicago, he successfully set up a subsidiary, procured cloth from the parent company in Krefeld and produced the ecclesiastical vestments in America. Very early on, the company established a reputation for supplying high-quality and sound products. A letter received from a nun in Chicago is repeatedly quoted in this respect. She describes a procession to mark the 26th World Eucharistic Congress in 1926. During this procession, those taking part were suddenly overcome by a heavy shower of rain. This washed the colours out of the ecclesiastical vestments, which they were wearing, making them a sorry sight to behold. Only the vestments made from cloth supplied by Hubert Gotzes retained their true colours. It was the best advertisement that the company could have wished for. Unfortunately, Hubert Gotzes senior, the founder of the Krefeld-based weaving factory, did not live to experience his company's triumph. He had already died in 1916. Initially, Jakob and Josef Gotzes took over the management as executors. Then between 1931 and 1934, Matthias Gotzes was the sole owner of the company.
- In the 1970s, it became difficult to find trainees. Compared to other branches of industry wages were moderate and it was difficult to find workers highly skilled in embroidery and manual weaving.

4.3.6.5 Products and collaborations

- Robes, pluviales, chasubles and stoles for priests, antependiums (altar clothes), as well as canopies and banners for processions.
- The banners normally portrayed the Virgin Mary and the patron saints of the respective churches and were richly decorated. The processions through the streets took place on religious holidays, one of the most important for Krefeld being the Corpus Christi procession, which was one of the largest in the region (depicted in the museum). The first customer was St. Stephan's church in Luisenstrasse.
- Hubert Gotzes followed suit and used motifs such as the stag pattern, pomegranate, birds and symbols such as the cross or floral ornaments. Studio Rentmeister in Krefeld produced the pattern designs for Gotzes. The card punching work for Gotzes was also outsourced. The motifs for embroidered pictures were, however, developed or adapted at the company.

4.3.6.6 Clientele

Prior WWII	After WWII
• Religious institutions are represented by priests and bishops. • Catholic Church ordered richly decorated vestments. • The Orthodox Church. • Associations ordered banners and emblems.	• Neighbouring countries, i.e., the Benelux countries (Belgium, The Nederlands, Luxemburg). • Two sales representatives were employed to cover the entire Federal Republic.

• USA branch in Chicago.	

4.3.6.7 Customer service

Customer service was provided in two ways:

- The Gotzes Company had a reception room or showroom where the various textile patterns and finished vestments could be displayed. This served in particular the customers from the surrounding area. Some regular customers frequently visited the showroom.
- Travelling salesmen. In the early days of the company history, this was carried out by bicycle or by train, later by company car. Sometimes it was the company owners who travelled, as in the case of Matthias Gotzes. Afterwards the samples had to be cleaned and ironed which required time and effort.

Invention event: Erwin Maus brought innovative breakthrough after WWII. Constructed a sales vehicle by attaching a camping trailer to a Mercedes vehicle with driver's cab. The trailer was fitted with cupboards to hang the vestments and also mirrors so that the vestments could be tried on straightaway.

4.3.6.8 Employees and working conditions

Gotzes had a good reputation as a company. Gotzes procured these threads directly from Japan. These stood out as there were no traces of metal discolouration even after longer periods. The gold brocades were an export hit especially in the USA where richly patterned priests' vestments remained popular significantly longer than in Europe.

4.3.6.8.1 Apprentices

Tasks:

- Reel the weft yarn for the weavers
- Keep the workshop clean
- Fetch coffee and run errands for Mrs. Gotzes.
- On Saturdays, thoroughly clean the workshop and work in the garden of the company owner.

Weaver apprentices sat on the loom over time (i.e. the 2nd year) and over time were given more complicated weaving tasks.

4.3.6.8.2 Journeymen

In 1955 the journeyman's wages amounted to 90 Pfennig per hour.

4.3.6.8.3 Weavers

The weavers had to perform almost all tasks necessary in the weaving workshop themselves.

- Prior to WWII female Schererinnen and piecers came from outside into the workshop to complete and install the warp beam.
- Later the manual weavers had to do everything themselves.

Job description (1950s):

- Working times. The working day began at 7 o'clock in the morning. At 9 o'clock there was a coffee break lasting at most a quarter of an hour. The working week was on average 48 hours. If large orders had to be made ready for dispatch, it often happened that the female apprentices stayed overnight at the company following the extra-long shift.
- Supervision. Henriette Gotzes, the strict "ruler" in the production department, could hear exactly which looms were being used at any time and went to inquire what was wrong if there was a standstill.

4.3.6.8.4 Working conditions

- The only toilet in the building was located under the stairs leading to the upper floor. It was not until later that an additional WC was installed on the upper floor.
- Prior to the general proliferation of artificial lighting, the weavers at their workplaces depended on the optimum use of daylight and after sunset on the light from petroleum lamps, candles, and/or pinewood spills. Although the Patricelli Brothers operated their gasworks in the adjacent Mariannenstrasse, there is no indication that the house was connected to the gas network or that gaslight was available. The weaving workshop was heated by a stove.
- The working atmosphere was good. Either a company outing or a company party once a year was held locally or somewhere in the region (i.e. Unkel am Rhein).
- During the lunch break, the weavers' wives brought lunch.

Sources. Interviews with the former weavers Wendelinus Breuer and Paul Amend.

4.3.6.9 Local tradition and folklore

This collection regards the stories behind the symbols and patterns weaved in patterned textiles of the Krefeld industry and particularly that of the Gotzes Company. These are elements of the traditions of the local society. The stories behind these patterns, as explained from the HdS community, provide a compelling journey to the history of Europe, including folk and religious tales, the Arts and Crafts movement, the circle as a religious symbol from the Palaeolithic era in Europe until today, symbols from the countryside and crops, symbolisms from the animal kingdom in religion, and Arabesque patterns that survived in European subjects and local tradition. Corresponding images are in the Mingei dataset. In D1.3, Annex 8, Section 5, the motifs and the stories behind these historical patterns are provided.

In this subsection, two of them are elaborated below, as samples of knowledge collection.

The story of the crow pattern

- A local tale or oral tradition mentions that the town of Krefeld was founded on a crow field.

- The name Crow Pattern is, though, most probably attributable to a former designation of Krefeld, e.g. Krinfelde, Creinvelt, Crenevelt or Creyvelt.
- John Everett-Heath, The Concise Dictionary of World Place-Names, Oxford University Press, (Third edition), 2018, mentions that *"Krefeld, North Rhine-Westphalia/Germany (Gelduba, Krinvelde, Crefeld) Founded as the Roman military camp of Gelduba, the city's name possibly means 'Crow Field' from Kréhe 'crow' and Feld to indicate an area where crows usually gathered."*
- The crow was developed as a symbol and advertising emblem for the town of Krefeld (see Figure 55, left).

Figure 55. The Krefeld crow pattern (image from [161]).

Though simple, the content of this tail avails opportunity to be used in educational programs pointing to biology and cognitive science, as well as, the cultural heritage of scarecrows.

- **Biology:** The crow (corvus) is a widely distributed genus of birds and can be linked to several educational programmes.
- **Cognitive science:** The crow is one of the most intelligent birds. Educational programmes in the domain of cognitive science and the understanding of natural intelligence can be pertinently linked.
- **Cultural heritage:** Crows often feed on fields of crops. Besides the heritage due to the local tale and references of scarecrows in popular culture (i.e., Wizard of Oz), scarecrow festivals are a notable activity of ICH around the world, i.e., Urchfont Scarecrow Festival, festival at Wray, St. Charles, Illinois, U.S.A. annual Scarecrow Festival, 'Pumpkin People' festival in Nova Scotia, Canada, Province of Isabela, in the Philippines, Bambanti Festival.

The story of the elephant pattern

The elephant pattern story is of twofold is relevance. It is related to:

- The Shroud of Charlemagne, a masterpiece of silk textile manufacturing.
- An elephant patterned on this silk, called Abul Abbas and being a widely known folk tale in Central Europe that is based on Medieval European history.

The motif can be found in several variations stemming in central Europe (i.e., see Figure 56). The original motif is some 80 cm in diameter. The HdS variation produced at the beginning of the 20th century is just under 30 cm. The configuration of the motif with the elephant in a circle is also new. In the original, the elephants are standing opposite one another and in strict rows one above the other. Another 20th century variant depicts the elephants in rows but the direction in which they face alternates, in one row the elephants look to the left and in the next to the right. The version which the Haus der Seidenkultur/the historic Hubert Gotzes weaving factory for ecclesiastical vestments brought out in 2004 shows a different possible motif configuration. This pattern belongs to the historic Hubert Gotzes weaving company. The appropriate point paper design is kept in the archives.

The Shroud of Charlemagne. In 1000, German Emperor Otto III opened Charlemagne's tomb in Aix-la-Chapelle. He wrapped the mortal remains of his predecessor in a magnificent cloth. The silk cloth with elephants framed by medallions was made in Constantinople. The fabric represents the pinnacle of Byzantine silk drawloom weaving. The complex and large-scale pattern required about 1.440 manipulations of the warp threads for each repeat[1]. The impressive polychrome silk of five colours (beige, yellow, green, blue, red) probably travelled as a diplomatic gift, perhaps in the reign of Emperor Otto III (reigned 983-1002), son of Byzantine princess Theophanou. The elephant was appropriate as an imperial symbol because the elephant, as one of the strongest animals on earth symbolises the ruler. When the shrine was opened again several times in the 19th and 20th centuries, the pattern was recorded in drawing and later photographed.

In Figure 56, the motif is shown in various versions. Left: photograph of Charlemagne's shroud. Right: the HdS motif.

Figure 56. Versions of the elephant motif (images from [162] and [163]).

[1] The Jacquard attachment was not yet invented.

The story of Abul-Abbas is very interesting to Mingei due to its relation with the history of Europe. The main story points are is the following.

Abul-Abbas was an Asian elephant given to Carolingian emperor Charlemagne by the Abbasid caliph Harun al-Rashid (the calif from 1001 nights). The elephant's name and events from his life are recorded in the Carolingian Annales regni Francorum, and he is mentioned in Einhard's Vita Karoli Magni. On 802, the elephant north arrived as a gift from Harun al-Rashid at Charlemagne's court in Aachen. Led by the first Jew known by name from medieval Europe, the merchant Isaac of Aachen as guide, interpreter, and counsellor for the two Frankish ambassadors Lantfried and Sigismund, the mission to Baghdad negotiated access to the holy sites in Palestine for Western pilgrims. This was a rapprochement of the Frankish Empire and the Abbasid Caliphate against their mutual rivals and enemies, Byzantium and the Umayyads in Spain. Isaac and his embassy brought wondrous gifts and led one exceptional present towards Aachen – an Indian elephant named Abul-Abbas. The way back to Europe is speculated to cross the Mediterranean from Kairouan in Tunisia and landed in Genoa in October 801, wintered in La Spezia and started their trek across the Alps in the following spring. Arriving in Aachen, Charlemagne and his court were overwhelmed by the exotic grandeur of the gifts of "Aaron, the king of the Persians" as the Caliph was called in the chronicles, aromatics, fabrics, an automatic water clock and Abul-Abbas. The imperial pachyderm was probably exhibited in his various "Kaiserpfalzen" (fortified imperial palaces) over the next years, accompanying Charlemagne on his meanderings through his vast domains on a regular basis. In 810, Abul Abbas died of pneumonia, after crossing the Rhine in Lippeham in Wesel. Abul Abbas became the name that inspired the German word "Popanz", a kind of a bogeyman. In Figure 57, a depiction of Abul Abas is shown from Charlotte M. Yonge's "Young Folks' History of Germany" (1878).

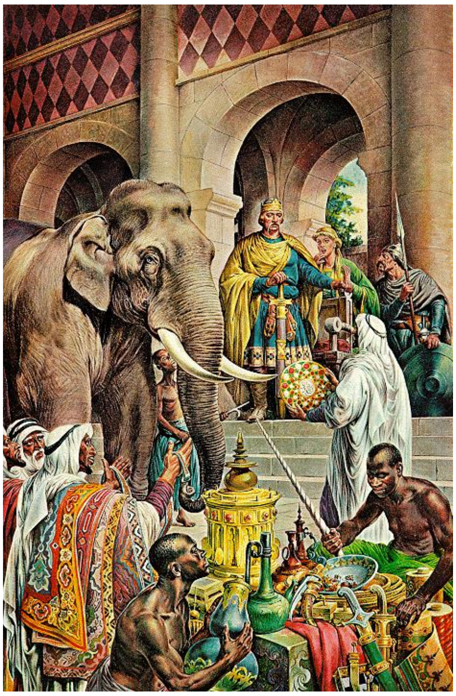


Figure 57. Historical illustrations of Abul Abass (image from [164])

Regarding narrative and educational material, a captivating narration of the story is provided in [82] and transcribed in Annex 2, Section A2.3. The story provides rich inter-culture and geographical educational material as the journey of the elephant a Christian, a Jew, and a Muslim collaborate to transport the elephant 3,000 miles from Baghdad to Aachen. It has been already adapted into an illustrated book for children and a puppet show, the Jewish Puppet Theatre of Berlin (Jüdisches Puppentheater Berlin)[2]. The book [83] is based on research at the College of Arts and Letter, of the University of Notre Dame, and comprises an interesting inspiration. The book incorporates research and accurate depictions in an artistic manner to accompany the text that is interesting and attractive for young readers.

War elephants. Whether Charlemagne used Abul Abbas in war is a matter of debate. Nevertheless, after Abul Abbas there are more accounts of elephants in Europe. In 1255, Louis IX of France gifts his elephant to Henry III, who subsequently installs it in the Tower menagerie and later the Elephant Castle was introduced in heraldry. In 1572 the Italian Vida mentions in Ludus scachorum a castle (rocco) on the back of an elephant, which is often mentioned as the reason why the rook is often called a castle in several languages. The use of war elephants over the centuries has left a deep cultural legacy in Europe (see Figure 58) and other continents. Many traditional war games incorporate war elephants. Chaturanga, the ancient Indian board game from which modern chess has gradually developed, calls its bishop Gaja, meaning elephant in Sanskrit; it is still called an elephant in Chinese chess. In Arabic and Spanish, the bishop piece is called al-fil, Arabic for elephant. In Russian, the bishop piece is an elephant (Слон). In Bengali, the bishop is called hati the word for “elephant". In the Japanese “Shogi”, there used to be a piece known as the “Drunken Elephant"; it was, however, dropped and no longer appears in the contemporary version. In Europe

[2] A trailer of the play can be found here: https://youtu.be/ddCWwDaLzMA

Figure 58. Historical depictions of war elephants in Europe and their relationship to chess (images from [165] [166] [167] [168] [169]).

Jumbo. Besides the German word “Popanz” (bogeyman), the idea of elephants carrying towers, and medieval motifs, inspired the name of a 18th-century public house (pub) called Elephant and Castle, which also became the name of a London district. The glamor obtained by petting an elephant, a symbol of stature, or the curiosity of seeing animals from different continents gave room to the development of zoos and touring groups called “travelling menageries”. The larger zoos had captured elephants, such as the *Jardin des Plantes* in Paris or *London Zoo*. It was in the latter that a tale of an elephant became widely known: the story of Jumbo, the King of Elephants. The elephant was sold to Barnum’s circus in the USA to be the main attraction. In Figure 59, the Barnum trading card (left) and circus poster (center) are shown; on the right, shown is the adaptation of the story by Walt Disney’s classic “Dumbo” (source History Channel Stories).

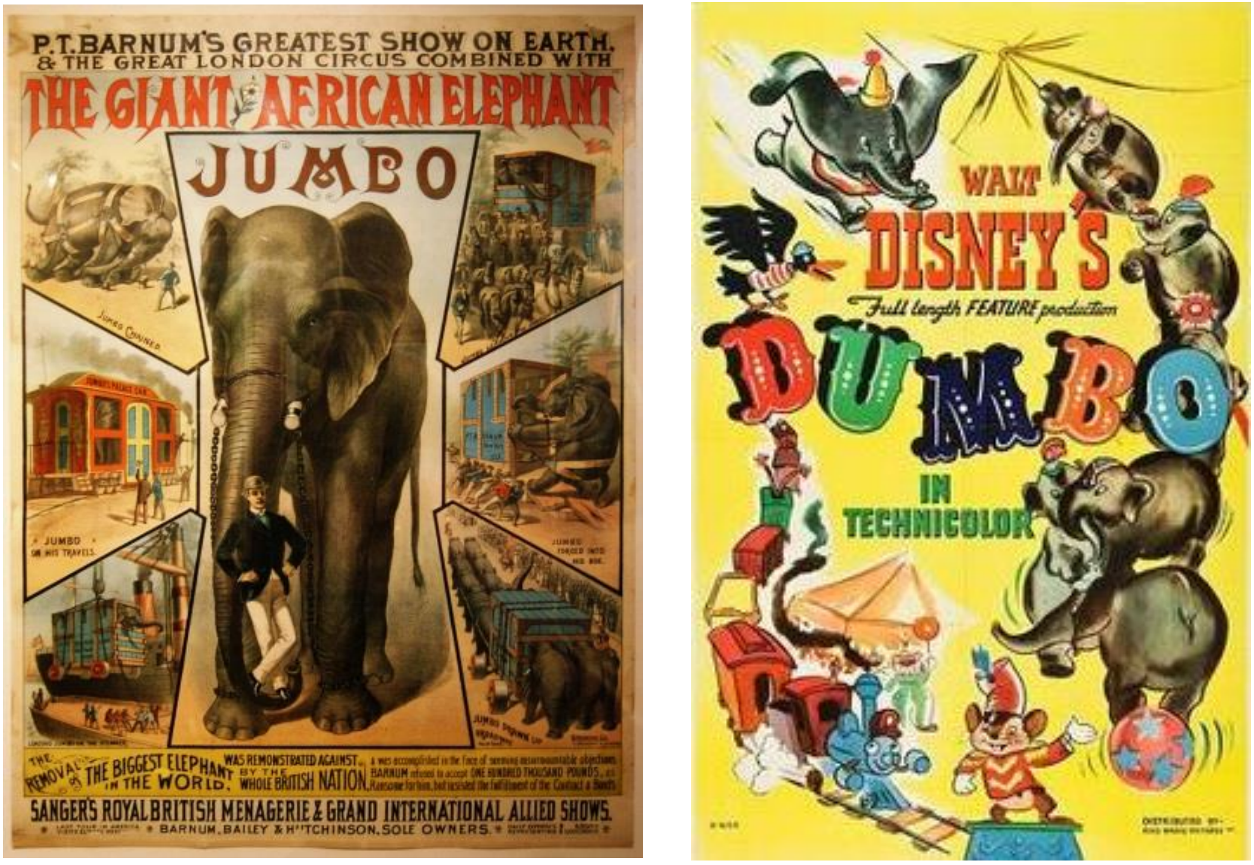


Figure 59. Jumbo the elephant (images from [153] [154]).

4.3.6.10 Haus der Seidenkultur

- After the end of the Gotzes Company, committed Krefeld citizens had become aware of the industrial treasure in Luisenstrasse.
- 1993: Association of Friends takes on the task of preserving the historical workshop as a museum for the public.
- Restoring and re-commissioning the Jacquard looms.
- The temporary exhibition which opened simultaneously ”Time Leaps made by Precious Silk” presented current fashion made of fabrics with historic patterns, thus clearly demonstrating the transition from tradition to the present day. Some two years later the house façade was restored with neo-classic Putzquadern and given the present bright red colour.
- The museum keeps the former handicraft from being forgotten and presents the middle-class aspect of industrialisation.
- Temporary exhibitions also give an insight into the extensive history of Krefeld textile production.
- Educational programmes for children and young persons as well as adults introduce them to the exciting topic of silk thread.

9.1.6 Colours of the Church Year

In Table 19, the colours for 2018-2019 are provided.

Table 19. Colours of the Church Year [Beisswenger, 2019].

Colours		Season	Dates	Alternate	
Dark Blue	Blue	Advent 1-2	Dec 2- Dec 15	Blue Violet	Purple
Pink*		3rd Wk of Advent	Dec 16- Dec 23	Rose*	
Dark Blue	Blue	Advent 4	Dec 24	Blue Violet	Purple
Dark Blue	Blue	Christmas Eve	Dec 24	Blue Violet	Purple
White	Gold	Christmas	Dec 25- Jan 5	White	Yellow
White	Gold	Epiphany	Jan 6	White	Yellow
Green		After Epiphany	Jan 7- March 2	Lt. Green	
White	Gold	Transfiguration	Mar 3-5	White	Yellow
Purple		Ash Wednesday	Mar 6-9	Grey	
Purple		Lent	Mar 6- Apr 20	Red Violet	
Rose*		[Laetere Sunday] (Lent 4)	[March 31]	Rose*	
Purple		Palm Sunday	Apr 14-	Red**	

			17		
Purple		Maundy Thursday	Apr 18	Red**	
Purple	Black	Good Friday	Apr 19	//// No Colours ////	
Black		Holy Saturday	Apr 20	//// No Colours ////	
White	Gold	**Easter**	Apr 21-27	White	Yellow
White	Gold	Eastertide	Apr 27-June 8	Red**	
White	Gold	Ascension Day	May 30-Jun 2 [Sun Jun 2]	White	Yellow
White	Gold	Eastertide	Jun 3-8	Red**	
Red		**Pentecost Sunday**	June 9-15	Red	Gold
White	Gold	Trinity Sunday	Jun 16-22	Red**	
Green		**Ordinary Time**	Jun 23-Oct 31	Lt. Green	Bronze
				Aqua	Olive
Red**		All Saints Day or Sunday	Nov 1 [or the next Sunday]	White	Gold
Green		Ordinary Time	Nov 2-23	Lt. Green	Bronze
				Aqua	Olive
White	Gold	Christ the King	Nov 24-30	White	Yellow
** In some churches, Pink or Rose is used the Fourth Sunday of Advent; in Catholic and Anglican*					

traditions, Pink or Rose is also used the Fourth Sunday in Lent (Laetere Sunday).

*** In some churches, Red is used only on Pentecost Sunday and the following week.*

In the chart above, except for Advent, colours that are more traditional are in the left column and alternate colours in the right column. Some Protestant church traditions use only traditional colours, including purple for Advent, while others are freer to use alternate colours within the basic sequence. Where two colours are given for a particular Sunday, either colour is appropriate. For example, for Advent either Dark Blue or Bright Blue can be used if using Blue (many Protestants), or either Purple or Blue Violet are appropriate if using Purple (Catholic traditions). The exceptions are Holy Days in which White and Gold (or White and Yellow) are usually used together, with White being the primary colour.

Metallic Silver is sometimes used for or with, white, especially at Easter and Christmas. Ivory can also be used for white. Likewise, Metallic Gold can be used for gold or yellow. While some traditions (Roman Catholic, for example) still use for purple for Advent, there is a trend to use a bluish violet for Advent and deep red-violet for Lent.

In most traditions, the sanctuary cross is draped in colour only during Lent (purple), Good Friday (black), and Easter (white). Some churches leave white on the cross through Eastertide, drape the cross in red for Pentecost Sunday, and then leave the cross undraped until the beginning of Lent the next year. Usually, the cross is not decorated during Ordinary Time, nor during the Holy Days of Advent-Christmas-Epiphany, in both cases because (a) the focus is not yet on the cross, and (b) the Greens of Advent and the other symbols of the Christmas season carry the visual message of that season.

9.2 Mastic Pilot

9.2.1 Economy

<u>Trade</u>

According to [59] , among others, mastic was always a great asset of trading for the rulers of Chios. During the Byzantine Empire (4th – 13th century) mastic monopoly was under the emperor's rule. From 1349 to 1566, Chios was under the rule of the Republic of Genoa. At that time a trading company was founded, which was called Maona. Mastic was a monopoly of Maona. Maona had a very strict program regarding the production of mastic. For this reason, they implemented production of maximum42.000 kilos per year. If the production exceeded the limit, the difference of product was kept in storage for the next year or it was burnt. Maona kept contracts of three, six, eight, and ten years with companies from Genoa, Armenia, Cyprus, Istanbul, Alexandria, Greece, and Syria. The transportation of the product was taking place in sealed crates called 'cuffini' that were wrapped in textile. One crate weighed approximately forty-eight kilos. The vessels that transported crates with mastic were called 'mastic boats' and they could transfer fifteen to thirty crates. Maona was even stricter when it came to incidents of theft or acceptance of stolen products. Thus, they implemented punishments for the thieves and rewards for those who would snitch. The table below shows the punishments according to the stolen sum of products.

Stolen product	Punishment
< 10 liters (3,2 kilos)	whipping and cutting one ear
10 – 25 liters	stigmatisation on the forehead with a burning iron
25 - 40 liters	cutting of the nose and the right ear
50 - 80 liters	cutting of the nose and both ears and stigmatisation on the forehead
100 - 200 liters	one eye and cutting of an arm or leg
> 200 liters or second theft of 100 liters	hanging

From the 16th to 20th century, Chios was under the Ottoman rule. The Ottomans had also monopoly of the mastic trade but they allowed some facilitations for the mastic communities. The annual production was approximately 50.000 to 60.000 okades (1 oka = 1.208 gr). Mastic producers had to pay poll tax as well as mastic tax in kind instead of money. Mastic tax was calculated according to the annual production. For example, if production were 21.000 okades, mastic tax would be 5.020 okades.

After the Ottoman Empire, Chios became part of Greece. Mastic producers and the bourgeoisie of the island had intense conversations regarding the organisation of the production and sale mastic. In 1937, the Chios Mastic Growers Association was founded to gather, process, and disseminate mastic. Later on, mastic is calculated to be 20-30% of the total gross value of Chios' plant production.

Available assets include text material.

Market

In overall mastic has been a product destined for markets mainly in Europe and the Middle East. During the Byzantine Empire, the main market destination was Syria. During the Republic of Genoa, crates were shipped to Marseille and London through Trieste to supply the market of Europe. The use of mastic at this market was mainly for medical purposes. Maona would send the product to Bursa in order to exchange it with raw silk with the Ottomans and supply Eastern and Western merchants. Mastic shipped to Kaffa Crimea was destined to supply Eastern Europe and the Baltic. When Chios was under the Ottoman Empire mastic was sent to Istanbul and Europe (France, England, and the Netherlands) through the ports of Smyrna and Venice. Nowadays the Chios Mastic Growers Association is responsible for disseminating mastic worldwide. Some major market destinations include Egypt, Syria, Irak, Turkey, Boulgaria, and India while minor markets exist in Germany, France, England and other European countries.

Available assets include photographic and text material.

9.2.2 Emic (inside) presentation

Varlas and Papastefanaki [57] conducted interviews with former and current employees, or associates, of the Chios Mastic Growers Association and mastic producers. Some interview participants also referred to the significance of the mastic to their lives. They mentioned that mastic was not only important for them because it offered them their income. Activities with mastic were organising their lives in general. Having to go to the field, clean the collected mastic during the winter, or for employees of the Chios Mastic Grower Association, having a regular daily program, enhance work antagonism with co-workers (for personal positive production) and expand other activities of their personal lives, seem to have been constant points for motivation and amelioration of their activities.

Emic (inside) information regarding mastic is an under-researched area. Not much information has been retracted from the archive. Only the research of Varlas and Papastefanaki [57] touched this area. It is intended to gather more information regarding this topic as part of the new content to be acquired for the Knowledge Collection.

Available assets include video and text material.

New content includes audio and photographic material.

9.2.3 Festive events

Festive events can differ from one mastic village to the other. Below is a list of events and their locations. Furthermore, the available assets are indicated per event.

During the period of the carnival in the mastic village of Pyrgi men are dressed up like women. Men as women go around the village, visit their female friends, and re-enact the procedure of choosing the man she loves for marriage. Available assets include video material.

On the 'Clean Monday' of the Orthodox Christian calendar, it is organised in the mastic villages the traditional event of 'Agha'. Every village organizes its own 'Agha' and usually, there is gossip and competition about who had the most successful 'Agha' event. 'Agha' is a satirical impression of the ruler of the mastic villages during the Ottoman Empire. Agha was responsible for the collection of mastic tax. The traditional event is because every time that a Greek would be judged during the Ottoman rule, they would be found guilty. As Fotopoulou mentions [58] , 'Agha' brings forth only the external characteristics of the Turkish officer. Through this tradition 'Agha' represents justice and the relation of the ruler with the peasants: if the peasants feel there is justice, they will cultivate better, thus production will be better as well. Available assets include photographic, text and audio material.

The Dormition of Virgin Mary (15 August) is big festive event for the Orthodox calendar. Women in Pyrgi carry the sacred icon of Virgin Mary around the village asking for her blessing for the village. The characteristic of this event is that the sacred icon changes hands on its way away from and to the church.

Available assets include video material.

9.2.4 Gender roles

According to Varlas and Papastefanaki [57] who conducted research on the female workers of the Chios Gum Mastic Growers Association and gathered oral testimonies of the their experience working with mastic, women whose family is producing mastic go to the field to perform the processes of (1) cleaning the soil and prepare it with white clay, (2) kendima (embroidering) where they also take along their children to teach them the method, (3) collection of the dried mastic gum, (4) sifting to separate the gum from other dirt and leaves, and (5) cleaning the gum with water.

Women who worked at the Chios Gum Mastic Growers Association usually were in need for an extra or their main income. Working at the Association was the only place where a woman could find a job without prerequisite qualifications. Their tasks were to (1) clean the mastic gum with soap and plenty of water, (2) tsimbima (pinching) to remove any dirt attached to the gum, and (3) packaging of the products. As employees of the Chios Gum Mastic Growers Association, they had full health insurance and were subject to comply with the Association's rules. They were considered to act as modern women because many of them had to move from their villages and live permanently to the Chora of Chios· a fact that for many women was the first time they were living alone in a new town. Nevertheless, some of the interview participants mention that the working conditions at the Association were not ideal for women, meaning that the facilities did not cover their needs.

Considering the equality of the work done by men and women in the Association it is shown that while both men and women are employees to the Association, their tasks are differentiated even if they work in the same processing stage. For example, it is mentioned that in earlier years, women also worked when a delivery arrived at the Association. That means they had to carry heavy crates with mastic. When the shop (supermarket) of the Association closed many of its employees started working at the factory of the Association. It was then that deliveries started to be taken care of by men instead of women. Another example of this situation is exemplified through a look at the processing stage of sifting. It is considered that women perform better sifting, i.e. they know better how to move the sieve manually. A video documentation shows this procedure where women sift the mastic and men carry basins of mastic and fill the sieve that women hold.

Available assets include photographs, video, and text material.

9.2.5 History

Mastic has always been a regional product of Greece growing at the island of Chios [58] . There are references to everyday and medical use of mastic in ancient texts by Herodotus and Diodorus of Sicily. In these references, we find that people used to chew dried mastic resin, and particularly young girls in order to have a fresh breath. Furthermore, we learn that mastic was used as an ingredient to mummify human bodies. Dioscorides the Pedanius (1st century) discovered many medical and pharmaceutical applications of mastic. More specifically, he observed that mastic helps indigestion, blood reproduction, cough, while it can be used as a tranquilizer for abdominal diseases. Mastic oil helps in diseases of the uterus, cures carcinoma of the stomach, belly, and dysenteric diseases, and it can be used as facial cleanser and in beauty masks. The medical and pharmaceutical uses of mastic developed through the centuries and spread to help in heart diseases, dentistry, pregnancy, depression, and for cosmetic products. [64]

Currently, we do not possess detailed information regarding trading, economical, and societal organisation in Chios when mastic was involved. Kallinikidou [63] gives an overview of the island's occupation timeline (Byzantine Empire, the Zaccaria family, the Republic of Genoa, and the Ottoman Empire) and the ruler's relation to mastic cultivation (see Annex A2.2 of Mastic pilot, the curated material – catalogue of the Chios Mastic Museum).

Available assets include visual and text material.

9.2.6 Oral tradition

Language

There have been identified some linguistic variations regarding the word 'mastic' from the material of the archive. There has not been professional linguistic research or analysis. We rather present here some preliminary observations that could develop in the future depending on the interested crowd of the material gathered for mastic.

First, we find that in ancient Greece many writers of various specialties, such as Hippocrates, Theophrastus, Dioscorides the Pedanius, Pliny, and Claudius Galenus, mention in Greek the substance that we internationally call today 'mastic' as 'schiniki ritini' which in a word to word translation means 'pistacia resin'. Schinos in Greek or pistacia in English is the genus of the mastic tree. It is later on, in the Latin language that 'mastic' appears. We have a reference that Romans called the mastic oil, 'mastichinum oleum'. The Latin compound is the one that we find in the word 'mastic' in several languages, such as mastice in Italian, mastic in English and French, mastix in German, mastih in Albanian, mastyks in Slavic languages, matiks in Hungarian, mstekki in Kurdish, and mestikka in Arabic. Historically, there is a reference that in Syria during the Byzantine Empire, they called the product 'chio'. This is probably from the name of Chios where it is produced. A different word is used in Turkish where it is called sakiz [59] .

It is worth mentioning here that there is a legend regarding the Greek word for mastic, 'μαστίχη' (mastihi). In a television documentary [65] at the mastic village of Pyrgi called "Like Sisters: Women in a Female Village", the interview participants mention that the word 'mastihi' was formulated during the Roman Empire, after Saint Isidore was tortured and dragged by the Romans around the mastic fields. When beat him, they also beat the trees, and then the trees started to 'cry'. Resin poured out the tree's bark but the residents did not know it. It smelled nice and they felt lucky that they discovered it. When they were thinking how to name it, they said 'it is our luck' ('diki mas tihi' in Greek). By repetition, 'diki mas tihi' sounded like 'emas tihi' and then 'mastihi'.

The village of Pyrgi has an intense dialect with heavy pronunciation. There they call mastic, 'mastichái'.

Available assets include video and text material.

Songs

Through testimonies of local people, at the time of collecting the dried mastic a verse that women used to sing was:

Skinos[3] *my dear skinos*

And my only friend

I take my kenditiri[4] *and go for kendima*

At the fount and the Rikopo to meet you

There is also another song, which women used to sing in praise of the mastic tree. It was ‘skiniatikos’, which means ‘of the mastic tree’.

At the gathering of mastihi

they sang a tune

they liked it and it liked them

Anyone that may have heard it

The underwold my eyes

There he is like the upper one

But please I only wanted

To die soon

When they first saw you

They eyes that are mine

My breast was open

And you entered into my heart

Available assets include audio and text material.

9.2.7 Religion

[3] Skinos is an older word for the mastic tree. See above section 6.3.9.1 Language.

[4] Kenditiri is the tool used for kendima (embroidering).

The collected material shows so far a direct connection of mastic with Orthodox Christianity. Orthodox Christianity is the most popular religion in Greece in general. Despite the many (different in nationality) residents of the island of Chios over the years, there is only the reference of Saint Isidore as directly related to mastic. Kallinikidou [63] notes that,

According to tradition, the skinos trees on Chios shed tears owing to the miracle of Saint Isidore. He was born around 230 A.D. in Alexandreia. While serving as an officer at the Roman navy in Chios he confessed his faith before admiral Numerius. He was jailed, tortured, and finally beheaded. His martyrdom during transport from Chora to Nechori, the beheading, and the tearing to pieces of his body remained indelibly in the collective memory of local society, and his memory is honoured with great glory on 14 May, as he is considered the patron saint of mastic trees. Churches and chapels dedicated to Saint Isidore can be found in the villages Neochori, Nenita, Kallimasia, Armolia, Pyrgi, Mesta, Lithi, Elata, Komi, Koini, Agios Georgios Sykousis and elsewhere on Chios.

It is worth mentioning though that mastic is considered one of the ingredients of chrism, along with olive oil and other aromatic oils. Chrism is apparent in rituals of many religions since it is used in the administration of certain sacraments and ecclesiastical functions by Anglican, Armenian, Assyrian, Catholic and Old Catholic, Eastern and Oriental Orthodox, Mormon churches, and Nordic Lutheran churches.

Available assets include video and text material.

9.2.8 Art

Mastic products are not related to art or artistic movements. We only mention here an artistic tradition of the mastic village of Pyrgi where they use in any prominent position the 'Moons of Pyrgi' (Pyrgioussika Feggaria in Greek). The 'Moons of Pyrgi' are shapes based on a circle symbolizing the moon. The moon is an ancient symbol of fertility and of a civilization that is very bonded to the earth. They can be found in Pyrgi, engraved on the outside walls of the houses. Theyare also weaved, and stitched on clothes, and neck jewellery.

Available assets include photographs and video material.

New content includes photographs and video material.

9.2.9 Clothing

General information regarding the clothing habits of women in Chios can be found in Annex A2.2 on the catalogue of the Chios Gum Mastic Museum and the segment concerning clothing style and social meaning.

The traditional outfit for working in the mastic field is comprised of a pristida (dress) in black, a white long shirt is worn inside the dress, a white apron, a white headscarf, and hand gloves without covering the tip of the fingers in order to be able to work and avoid getting dirty from mastic. Most of the clothing is manufactured by the women at their home either with the use of a loom or by knitting. Almost all women have a look at their own house. In older days, clothing was made out of wool produced in Chios, which was called 'chiotiko'.

Available assets include text material.

New content includes photographs, video and 3D scans.

9.2.10 Customs

There are some customs or habits that the local people of Chios enjoy and that are related to mastic cultivation and processing. For example, in Pyrgi, it is very apparent the connection of women while practicing activities to mastic. In general, it is a tradition of the families in a village to help each other with agricultural tasks related to mastic. What differentiated Pyrgi is that in this village women's bond is stronger than in other villages. In this way, we find women going from one house to the other or from one's field to another's in order to cultivate mastic trees. The women in Pyrgi call each other 'girlfriends' or 'companions'.

The period of collecting mastic used to be a time of celebration and flirt. Women, alone or with their children, go to the fields to collect mastic. Songs, food, and play is taking place at the fields and everyone enjoys it and waits for it every year. It is also said that, because the period is also the time for hunting grouse, women spread on the ground white sheets to become distinctively visible to the hunters and avoid being hurt by one of their bullets. However, flirting then takes place too. Furthermore, it is a general opportunity for young people of a village to meet and spend time together. In the village of Pyrgi, after the second collection of mastic, inhabitants used to organize a feast where young people were dancing in three, holding each other tight by the hands, in a very fast rhythm. This particular dance symbolizes the solidarity of the people of the village. A custom that is still exercised today is the cooking of pancakes when the last collecting of mastic is finished (late September to mid-October). Families gather and make pancakes to eat all together. [59]

Savvidis [59] also mentions that it was customary to leave the mastic dust, left after processing the product, to the wife of the producer. This gesture was considered a gift because mostly women performed all the processing of mastic. She would exchange it then with local merchants against the same weight for rice, spaghetti, sugar, etc.

'Kakoloi' is a custom that existed in past years. After collecting the last part of dried mastic gum from the field, there are always leftovers or resin that is not totally dried yet. Mastic producers would leave this mastic gum at their field and allow poor families to go and collect it. In this way, they could exchange it with other supplies they needed.

This section relates to the 'Ritual' section of the Knowledge Collection form.

Available assets include visual, video and text material.

9.2.11 Media representation

There have been four media mediums where mastic appears: film, photography, press, radio and television.

Known **filmography** includes so far two movies of Dimos Avdeliodis where he pictures life in mastic villages. He has successfully presented aspects of their societal organization and their behaviour in a funny and tragic situation. The simplicity of life, as well as the natural environment and the connection of inhabitants with it, is further apparent. The films are 'The Tree we Hurt' (1987) and 'The four seasons of law' (1999). For more information, see Annex A4.2. Available assets include video files.

Regarding **photography**, see Annex A2.2, the section of film and photography. Available assets include text material. New photographic and video content is under negotiation to be acquired from a local family that holds a historical archive depicting the rural and social life of the mastic villages.

Mastic has been a present agent in the local newspapers of Chios. Tsouchlis [60] did extensive research on the **press** appearance of mastic in local newspapers available in the Korais Public Library of Chios and the archive of the Chios Mastic Growers Association. The Chios Mastic Growers Association used to publish a bulletin regarding mastic production, pricing, and sales. See Annex A5.1, for a selection of available 2D scans of newspapers. Available assets include visual and text material.

Mastic appeared on **radio** and **television** to advertise the chewing gum ELMA. The production of the chewing, as well as the marketing production of the product, was made by the Chios Mastic Growers Association. Available assets include audio and video files.

9.2.12 Social organisation

Organisation refers to the social organisation and stratification of Chios through history. The first record that we have regards when Chios was under the rule of the **Republic of Genoa**. Maona was the company that had the monopoly of mastic. Social figures of their system include (1) the mastic officials (Officiales Super Recullectionem Mastics) which were responsible to gather and deliver the mastic, (2) the investigators (Perquisitores) who researched the vessels for smuggling, (3) the Castellani who was the chief of the castle of Chios and the military force of the island, (4) the accountants (Logiriastitae) who supervised the mastic and divided the duties to the secretary on general duties, secretary on sales, and the weigher, (5) the commissioner (Podesta) who had the juridical, administrative and fiscal control of the island, and (6) the employees (Scriba Masticis) who kept a record of the mastic production. It is interesting to mention that the employees could also be of Greek nationality. The last record of an employee was in 1700 and it was John Mavrocordatos of the historical Greek family. He later became ruler of Moldavia.

During the **Ottoman Empire**, local people seem to have been more involved in the social organisation regarding mastic. Some of the social figures are (1) the Assembly of the Mastic Villages which was comprised of elderly people coming from the twenty-one mastic villages and they functioned as a local parliament meeting at Panagia Sikelia, (2) the sakiz-emini who was a Turkish officer responsible for the collection of the mastic tax (he collected the tax once per year, while his arrival was announced every time with drums so that the prople can prepare their payment), (3) the sakiz-vekileri who was Greek, voted by the Assembly of the Mastic Villages, and functioned as the consultant of sakiz-emini, (4) a team of villagers who kept record of mastic production, (5) the weigher who was Jew and accompanied sakiz-emini on the collection of the mastic tax (it is said that he was taking advantage of his position because every time he weighed an amount, he took a handful of mastic for him and a handful for the Agha), and (6) the field guards who were Greek and were responsible to keep the doors of the village closed during collection of the dried mastic from the fields.

From the **mid-1920s** local people started to freely self-organize. Regarding mastic, we have the creation of masticharia, which were cottage industries owned by former fruit growers and merchants of dried fruit and mastic, and were responsible for processing the mastic gum. It was women migrants from Asia Minor who worked there in order to clean and sort the mastic gum which was then delivered to local facilities for further processing, and to Europe (France, England, Cyprus, Germany, Romania, and Greece), Asia (Turkey, Lebanon, Syria, Iraq, and India), and North Africa (Egypt, Morocco, Tunisia, and Algeria).

The crisis of the mastic price is nevertheless a topic that starts to be discussed among the merchants and leads to a discussion about the future of the market and the use of the product. Among these discussions, it is inserted the priblematization for the creation of a general mastic association, mainly led by the bourgeoisie of Chios. George Staggoulis notes in a newspaper article in 1929 that in order to take serious decisions about the mastic problem and in order to ameliorate the producers' part, it is important that local associations in every mastic village should be created which would defend the producers' interests and would take over to clean the product and define the price and trading. Between 1930 and 1932, most of the mastic villages create associations. In the Chora of Chios, an important figure that helped understand the mastic merchants' part was Constantinos Argyrakis who was raised in Smyrna in a bourgeois family, knew many languages, and was director of a commercial company. He took over as director of the **Chios Gum Mastic Growers Association** where it was founded in 1937.

During the 1940s, the Chios Gum Mastic Growers Associations had to face challenges concerning their organization and management of mastic trading. Trade was taking place till 1945 (with German permission) mainly with Turkey, in exchange for other products such as figs and chickpeas, while from 1942 the Association was responsible to receive food supplies from Evros (Greece) for the people and animals on her own costs and without making a profit. In 1947, professor Spinos was hired by the Chios Gum Mastic Growers Association as technical advisor for the production of mastic products. At the same time Evanggelos Mendonidis, a mastic producer, and founding member of the Chios Gum Mastic Growers Association leaves the Association and applies to the Greek state for a patent certification for the production of chewing gum.

In the 1950s, George Staggoulis becomes director of the Chios Gum Mastic Growers Association. Facts that take place is the construction of offices and storage rooms on all local association, of a chewing gum factory, of new offices for the Association, and the rearrangement of managing all mastic products. The market of Turkey declines while Iraq becomes the main one. In 1952 professor, Spinos stops his collaboration with the Association and Evanggelos Mendonidis takes his place. The first chewing gum 'BEM' is produced while the necessary machines and raw material for the production of chewing gum are bought. 'BEM' was not very successful and the Association stops rather quickly its production. New research is conducted and in 1956, 'ELMA' (ELliniki MAstiha; that is, Greek mastiha) is produced. The name of the product was conceived from a competition among schools of Chios).

During the 1960s, the Chios Gum Mastic Growers Association becomes an important stakeholder of northern Chios when it comes to agricultural topics. The Association gradually expands its tasks by creating industrial facilities and by managing in this way almost the overall agricultural production. The market of Iraq creates a big demand for product, which becomes a problem considering the difference of market demand and mastic production. At the same time, inhabitants of the villages start to flee towards the town. Chewing gum is the main product that offers most of the Association’s revenues. At that time and because of the Association’s implementation on main topics of the Chios society, it acquires an institutional role and develops into a regulator of the political and economic life of Chios.

In 1978, George Staggoulis dies and Thrasyvoulos Kastanias takes his place as director of the Chios Gum Mastic Growers Association. This decade is characterized by the termination of exports to Iraq and a general decline in the mastic production. The priorities for these years after the war was to manage the stock, pay on time the producers for their delivered product, minimize smuggling and develop sufficient regulations that defend the producers’ rights. Above all, the Association’s preoccupation was to defend its institutional role by creating strong bonds with political figures and by conforming to each government.

From 1983 to 1987 Belles was director of the Chios Gum Mastic Growers Association. This decade was rather negative for the Association because of changes in agricultural politics and the presence of political parties among the local associations and the Chios Gum Mastic Growers Association. The Association has many debts and scandals appear from time to time. Consequently, the mastic producers chose to stop delivering their product to the Association because of its negative image. They sell individually and enjoy the height of the mastic price.

Regulation of the debts and reduction of the Association’s tasks lead to positive outcomes. Production and sales of mastic rise while the insertion in European programs and the acquisition of the Certificate of Origin for mastic ameliorates the Association’s image. The director during this decade is Ganniaris, and towards the end of the 1990s, they decide to move towards new approaches for mastic marketing. In the early 2000s, the Mastiha Shops opens and a new era of mastic marketing begins. Mastiha Shop can be found nowadays worldwide.

In conclusion, it can be said that the Chios Gum Mastic Growers Association has been a model of cooperative organization. As an Association, it has managed to become a significant part of the island’s economic life. Furthermore, through its donations, many constructions have taken place at the mastic villages concerning infrastructure works, as well as the development of public institutions, churches, and educational places [61] .

See Annex A2.2, for more information (a) on the amounts of produced mastic, and (b) trade and industrial use of mastic, from 1939 to 2000.

Available assets include photographs and text material.

9.3 Glass Pilot

9.3.1 Timeline of glassblowing and clear, colourless glass

The timeline information was based on the following resources [11] [12] [13] [14] [15] [16] [17] .

Early first century BC: Glassblowing develops in the **Syro-Palestinian region**.

1-50 AD: Ennion works as a glassmaker in the city of Sidon in modern Lebanon. He created the groundbreaking technique of blowing glass vessels into molds.

64 AD: **Roman Empire** annex the Syro-Palestinian region and middle-eastern glassblowing craftsmen arrive in Rome.

64 - 400 AD: The new glassblowing technology revolutionises the Roman glass industry. Development and growth of glassblowing across the Roman Empire. Earlier Hellenistic casting, core-forming, and mosaic fusion techniques are superseded by the new manufacturing methods. Trade of glass vessels increases.

3rd Century: Glassblowing is described in a fragmentary poem printed on papyrus.

6th – 7th Century: With the Decline of the Roman Empire, **Byzantine glassworkers** are still operating in the Syro-Palestinian region, producing luxury pieces.

11th Century: **Venice** becomes a major European glassblowing centre.

1262: State control of glass production in Venice.

1268: Glassmakers in Venice are organized into their own guild.

1291: The Venice Council decides to move the entire glass furnace in the island of Murano, due to the risk of fire hazards from glass furnaces.

14th Century: Glass workshops appear in Lorraine in the Darney forest. The glass from Lorraine is famous in the North of Europe especially for glass mirror (blown glass).

1454: Angelo Barovier, a Venetian glassmaker from Murano invents **'cristallo'**, a clear, colourless glass to emulate the appearance of the prized rock crystal. Cristallo is made with pure sand from grinded rocks from the Tessin river, soda from Alexandria named kali, and lime from grinded Toscana marble.

1492: François du Thiazl and Robert le Lorrain, two French glassmakers, are in Murano to learn the secret of cristallo and to transmit the secret of glass mirror.

1505: François du Thiazl open a glass workshop of cristallo in **Lorraine** using fern ashes instead of kali. Their glass is slightly greenish.

16th Century: Glass in the 'Venetian fashion' is extremely fashionable and traded all around Europe. Copies are made in Glass workshops in **Antwerp, Brussels,** and **Liège**. The Venetian glass is also copied in central **Europe** and **Bohemia**.

1552-1660: The Reformation and conflicts that occur are the cause of the migration of Lorraine's glassmakers and have important consequences on the history of European glass. Protestant glassmakers emigrate to **England** and **America**.

1580: Under the tutelage of Rudolf II, emperor of the Holy Roman Empire, scientists and artists create a substitute of rock crystal: the **'bohemian crystal'**, a thick glass contrary to the Venetian cristallo, easy to engrave.

1611: Due to the lack of wood in England, coal is used as a combustible in glass furnaces.

1612: Antonio Neri publish *L'Arte vetraria* (the art of glass) in Florence, the first guide for glassmaking. It is has been translated and will serve as a reference, for the next 200 years.

1672: George Ravenscroft, an English glassblower who directed the London glass factory 'Glass Sellers Company' produces 'flint glass' a lead-based glass called **'English crystal'**. This colourless glass is now the most luminous glass available in Europe.

18th Century: In Europe, a large number of manufactures work in the 'bohemian fashion' and 'English crystal' expands in Europe through the Netherlands and Belgium.

1764-1767: Baccarat and Saint-Louis Glass Manufacture open in Lorraine and introduce 'English crystal' in France.

1780: Nicolas Leblanc, a French chemist, create an artificial soda with sea salt cheaper than natural soda made with sea plant ashes (salicorne).

1782: France is able to create a lead-based crystal and can compete with England.

1821: Large glass manufactures open in the **Paris** area. **Choisy-le-Roi** is among them.

1829: In the United-States, the New England Glass Company patent a **machine to mold the glass by pressure.** It is the first time that a mechanical system is used in glassblowing since the invention of blow pipe in the first century BC.

1832-1855: Baccarat, Saint-Louis, and Choisy-le-Roi glass factory choose Launay Hautin Company as retailer for their glass production. The shop is located rue Paradis, (now Paris 10e arrondissement).

1851: Maës and Clémendot, directors of the Clichy Manufacture win the first prize at the Great Exhibition with their creation of a lead-free crystal made with zinc. No other French glass manufactures are participating in the Exhibitionas a protest against the FreeTrade promotion.

1868: **Georges Bontemps** publish the *Guide du Verrier: traité historique et pratique de la fabrication des verres, cristaux, vitraux* (Glassmaker's guide: historical and practical treatise about the making of glass, crystal, stained glass), the most important glass making treatise of the XIXth Century in France.

1867: First regenerative glass furnace is patented in Germany by **Carl Wilhelm Siemens**.

1887: Under the direction of Johan Pohl, the bohemian Novy Svet glass factory becomes the most important luxury glass factory in Europe.

1903: Michael Joseph Owens sets up Owen Bottle Machine Company using an automatic glass-blowing machine, which could produce bottles at the rate of 240 per minute.

9.3.2 Georges Bontemps (1799 -1883)

The information on Georges Bontemps has been collected from the following resources [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] .

Georges Bontemps is one of the most famous French glassmakers. Published in 1868 his *Guide du verrier* is a classic about glass history and glassmaking. But Bontemps was not only a historian of glass, he was also a manufacturer, director of the Choisy-le-Roi glass factory in France from 1823 to 1847 and advisor at the Chance Brothers glass factory in Smethwick near Birmingham in England from 1848 to 1856. In 1842 and 1868, he donated an important collection of glass objects to CNAM: more than fifty tools, molds, fabrication steps, and finished pieces. Bontemps was in relation with Eugène Péligot, the chair of the Chemistry Applied to the Arts at CNAM from 1841 till 1889 who published in 1862 *Douze leçons sur l'art de la verrerie* (twelve lessons about glass works) and in 1877 *Le verre, son histoire, sa fabrication* (Glass, its history and fabrication). Both Bontemps and Péligot were members of the Société d'encouragement à l'industrie nationale, an instance created in 1801 to encourage innovation and to improve the national French industries (an ambition close to that of the CNAM created in 1794).

September 7, 1799: Georges Marie Bontemps was born in Paris. He is the grandson of Jean Nicolas Bontemps, a notary in Paris from 1731 to 1786 and the son of Jean-Marie Nicolas Saint-Fare, one of the first graduate of the École Polytechnique and who served first as a teacher of experimental physics and then as an officer in the French first Empire army. His mother is Jeanne Marie Ferat, the daughter of Jean Baptiste Pierre François Ferat, an engineer in mathematical instruments who worked for the creation of the "republican measure" during the French revolution under the guidance of Monge and Berthollet. However, his parents were not married when Georges Bontemps was born, he stood as an illegitimate child for the French administration.

1817: Georges Bontemps was received 28th at the École Polytechnique but was not admitted in the prestigious school due to his bastardy. Very little is known of Bontemps's education, in the *Guide du verrier,* he tells of meeting glassworkers in 1819 at the Saint Quirin glass factory and admits an internship at Baccarat Manufacture.

1823: He became director of the Choisy-le-Roi glass factory at the age of 24 years old. The glass factory had been created by Ponce Grimblot, a glassworker from the Ardennes, in 1820.

1825: 47 males and 39 females worked at the glass factory. 35 workers are between 25 and 35 years old. 17 glassmakers came from the Baccarat factory, 8 from Creutzwald, 7 from the Plaine de Walsh and some from other factories from the east of France.

July 1825: Bontemps established an inventory of the glass factory production where he mentioned an important fabrication of flint glass, cups, glasses, and jars (87 boxes).

1925: Edwards Jones, a student of the Italian glass painter Charles Muss who was established in London around 1800, came to France on behalf of the Comte de Chabrol to establish a glass painting company. Due to his English nationality, he was not able to create his workshops and went to work with Bontemps in Choisy-le-Roi

1826: Bontemps invented red glass made with copper.

1828: Bontemps was able to send quality optical glass (Flint Glass) in laboratory. He met Lucas Chance in England and his production of flint glass was used in Chance Brothers´ glass factory.

1829: Antoine Claudel, Bontemps ’associate, opened a deposit of Choisy-le-Roi’s glass products in London. There, he met Lucas Chance, the founder of the Chance Brothers glass factory.

1830: Lucas Chance visited the Choisy-le-Roi glass factory.

1831: Baccarat, Saint-Louis, Choisy-le-Roi, and Bercy glass factory chose Launay Hautin Company as retailer for their glass production. The location of the shop was 30 rue Paradis, Paris 10e.

1839: A report of the Launay Hautin Company stated that Choisy-le-Roi factory produced amount for 10% of its inventory.

May 11, 1839: he married Marguerite Julie Raymonde Lenoir. His mother-in-law, Marguerite Claudet, was the sister of Antoine François Jean Claudet, the first associate of Bontemps at the Choisy-le-Roi glass factory who did from 1826 a carrier in England.

1839: Bontemps exhibited for the first-time reproduction of the Murano filigree glass made with the collaboration of E. Jones at the Exposition des produits de l'industrie.

1842: Bontemps gave an important collection of glass objects to the Conservatoire des arts et métiers (CNAM): more than fifty tools, molds, fabrication steps and finished pieces (inv. 02787 - 2807).

1844: The Choisy-le-Roi glass factory offered for sale coloured glass in 112 different shades.

1845: The factory had 250 workers. Bontemps published *Exposé historique et pratique des moyens employés pour la fabrication des verres filigranés et du flint-glass et crown-glass* and *Peinture sur verre au XIXe siècle. Les secrets de cet art sont-ils retrouvés? Quelques réflexions sur ce sujet*.

1847: Due to the bankruptcy of the glass factory, Bontemps left Choisy-le-Roi.

June 3, 1848: Bontemps left France to take a position at the Chance Brothers factory in Smetwick, near Birmingham in England. He was in charge of the Coloured and Ornamental departments; he also carried out the manufacture of optical glass in accordance with Lucas Chance’s patent of 1838, and generally advised and assisted in the firm’s glass business.

1851: Bontemps published *Examen historique et critique des verres, vitraux, composant la classe XXIV de l'Exposition universelle de 1851*.

1855: Bontemps came back to France but kept close relation with Chance Brothers until the end of 1860's.

1868: Bontemps published *Guide du Verrier: traité historique et pratique de la fabrication des verres, cristaux, vitraux* (Glassmaker's guide: historical and practical treatise about the making of glass, crystal, stained glass) and gave new items to the CNAM.

November 14, 1883: Georges Bontemps died in Amboise.

9.3.3 Choisy-le-Roi glass factory (1820 – 1847)

There is no proper documentation or a real archive of the history of the Choisy-le-Roi glass factory during Bontemp's life but the 'City Archives, Documentation and Heritage' unit of Choisy-le-Roi and the association 'Louis Luc for the History and Memory of Choisy-le-Roi' helped to better understand this history [34] .

Bontemps himself tells in 1845 in the newspaper *L'Illustration*, journal universel: "the glass factory of Choisy-le-Roi is not built with luxury; but the arrangement of the buildings has been combined according to a regular plan very well adapted to the economy of the manufactures. These buildings arranged around three large courtyards form, as a whole, a large long square, and occupy a space of nearly three hectares. We enter a first court planted with trees, where are barracks for housing workers; from there we pass to a second court, where are all the shops, the workshops of packing, engraving of the crystals, the forge, the carpentry, the saline, the offices, the quarters of the directors, and the stables; it is from this court that every morning four cars leave to drive the products manufactured by the various merchants of Paris. To pass from the second courtyard to the third, one crosses a large hall for three glass-window furnaces, and the workshops of "etenderie"; finally, in the third courtyard, there is the crystal hall, another hall for the manufacture of optical glasses, glass painting workshops, crucible and brick making workshops, carving shops and raw materials shops. The raw materials and fuel are brought by the Seine in a station which communicates with this third court."

The factory had been built in 1820 by Ponce Grimblot and purchased by Bontemps in 1823. In 1828, the city wrote that the glass factory is "the larger company" of Choisy-le-Roi. In another administrative document, we also discover that with the new position of Eduard Jones in the glass factory, a new building is built in 1829.

In 1831, Baccarat, Saint-Louis, Choisy-le-Roi, and Bercy glass factories chos Launay Hautin Company as a retailer for their glass production. The location of this shop was 30 rue Paradis, Paris 10e. In 1850, Baccarat and Saint-Louis purchased the building, which became later the Baccarat museum until 2003.

As Velde [35] wrote, "it is difficult to consider Choisy Manufacture otherwise than as a vast research laboratory active for twenty years, where the methodical activity of an eminent researcher, Georges Bontemps, helped by Jones, had been of an intensity that can hardly be imagined. We must recognize the Guide du Verrier as the essential testimony of this activity, as his most important and most enduring work, as a reflection of the man of whom a member of the

Chance Brothers glass factory wrote *"No one alive knew more than he about every branch of glass manufacture, whether in theory or in practice"*.

In 1847, Gorges Bontemps sold the factory. In 1895, a new factory is built: the Houdaille and Triquet factory, which became the Cristalleries de Choisy le Roi in 1837 until its closure in 1980.

9.3.4 Conservatoire des arts et métiers (1819 – 1889)

Created in 1794 during the revolutionary era, the Conservatoire des arts et métiers (CNAM) is the heir of a pedagogical project characteristic of the 18th-century ideas on education (see [44]). The goal of this new institution is (a) to teach through a collection of artefacts and machinery, and (b) to spread innovative ideas through a public of craftsmen, industrialists, and workers (to have an overview of the different professors of the CNAM see [42]).

1819: Creation of the chair "Chemistry applied to the Arts".

1819-1841: The chemist Nicolas Clément-Désormes held the chair (see [50]).

- In 1822, he became general agent of the glass manufacture Compagnie de Saint-Gobain where he worked at the Chauny plant on soda manufacture.
- In 1826, he worked also in Lorraine.
- In 1844, J.M Baudot gave a manuscript of Clément-Désormes' lessons from 1825-1826 to the CNAM's library. Two lessons are devoted to glass manufacturing.

1841-1889: The chemist Eugène Péligot held the chair (see [49]).

- Péligot was a student of the famous 19th-century French scientist Jean-Baptiste Dumas[5].
- 1842: For the galleries of the museum, he acquires around 50 objects relating to glassmaking (tools, pots, moulds, fabrication steps and finished pieces) from the glassmaker Georges Bontemps (inv. 02787 till 2802).
- 1845: He went to Austria with the directors of the Saint-Louis and Baccarat glassworks, on behalf of the Parisian chamber of commerce, to review the exhibition of national products. 40 pieces of Bohemian glass (inv. 3096) are noted in the inventory (goblets, ewers, and colored pieces).
- 1846: Publication of *Rapport adressé à messieurs les membres de la Chambre de commerce de Paris sur l'exposition des produits de l'industrie autrichienne ouverte à Vienne le 15 mai 1845*. He is particularly interested by the colored glass, noting the considerable advance of the Bohemian glassmakers.
- 1862: (a) Publication of his first book, *Douze leçons sur l'art de la verrerie* (Twelve Lessons about the Art of Glass), based on a selection from the general program oh his chair at the CNAM (see [47]), (b) writing of the report on glassmaking for the 1862 London Universal Exhibition.
- 1867: He wrote with Georges Bontemps the report on plate and window glass of the Paris Universal Exhibition.

[5] https://en.wikipedia.org/wiki/Jean-Baptiste_Dumas

- 1877: Publication of a revised and enriched version of his previous book, *Le verre, son histoire, sa fabrication* (Glass, its history and fabrication). (see [48])

1848: creation of the chair “Ceramics”.

1848-1852: The chemist and mining engineer Jacques Ebelmen held the chair (see Emptoz 1994, p. 480-491) in addition to his main function as administrator of the Sèvres Manufacture where a Musée céramique and vritique has been established by Alexandre Brongniart in 1824. During his short carrier, he gave the glassmaking lessons in lieu of Eugène Péligot and established the first glass catalogue. He also organized a transfer of pieces between the Conservatoire and the Sèvres Manufacture galleries (see [38]).

1848-1880: Arthur Morin became the administrator of the Conservatoire and the director of the now called Musée industriel (see [42]). Under his guidance, administrative practices are renewed and new qualified staff is brought in for the administration and the library. The buildings at rue Saint Martin are renovated and enlarged under the architect Léon Vaudoyer. A precise inventory is issued. Morin designs a thematic catalogue of the collection with 22 sections named from A to V.

1851: The first catalogue is edited. Jacques Ebelmen is in charge of the O section devoted to ceramics and glassmaking. The 316 items of the Glass collections are described between Op and Oy (see [38]).

- “Op” is about technology and comprises raw materials, tools, molds and step by step fabrication all listed by their technique in a very didactic way
- “Oq” for generality has the largest number of items (more than 200) with the Bohemian glass bought in 1845 and more recent donations by Saint-Louis, Baccarat, and Plaine de Walsh.
- “Or” is a small division about window glass and glass specialties
- “Os” is about vases and chemistry instruments
- “Ot” is concerned with artificial gems and lampworked objects.

1868: Creation of the chair “Chemistry Applied to the Industry of Dyeing, Ceramics, and Glassmaking”

1868-1905: The chemist Victor de Luynes held the chair (see [41]) and chose to alternate from one year to another on these two different subjects.

Other relevant references to this section are [34] [35] [36] [37] [39] [40] [43] [44] [45] [46] .

9.4 Industrial Revolution and Global Events

Name of invention	Bouchon Loom
Date	1725
Location	France
Inventor(s)	Jacques Bouchon
Prior craft	Mechanical programmability is said to have begun in the 9th century, with the invention of a musical organ, powered by water, that automatically played interchangeable cylinders with pins (similar to those of musical boxes). This was similar to the piano roll developed at the end of the 19th century and may have been inspired by the patterns that were traditionally drawn on squared paper. In general, a barrel organ is a mechanical musical instrument consisting of bellows and one or more ranks of pipes housed in a case, usually of wood, and often highly decorated. The basic principle is the same as a traditional pipe organ, but rather than being played by an organist, the barrel organ is activated either by a person turning a crank or by clockwork driven by weights or springs. The pieces of music are encoded onto wooden barrels (or cylinders), which are analogous to the keyboard of the traditional pipe organ.
Novelty	Partial automation of the tedious setting up process of the drawloom, in which an operator lifted the warp threads using cords. The invention automated the setting-up process of a drawloom, whereby operators lifted the warp threads using cords. The cords of the warp were passed through the eyes of horizontal needles arranged to slide in a box. These were either raised or not, depending on whether there was or not a hole in the tape at that point. Devised a way of controlling a loom with a perforated paper loop that established the pattern to be reproduced in the cloth.
Description	Automating the process using a strand of perforated paper tape that was used to determine when the stitching would occur. As the perforated tape moves forward it would act as a guide that would help the machine to know when it was that it needed to apply a stitch through the textile or other weaving areas. The perforated tape could be customised in such a way so that the different needles that were contained within the box would operate according to the manner, in which the tape was perforated. Unfortunately, the number of needles used was insufficient to allow larger designs to be weaved. In addition, one tear in the perforated paper loop made the loop unusable.

Technological Significance	The invention automated the setting-up process of a drawloom, whereby operators lifted the warp threads using cords. The ideas created by Basile Bouchon removed out human error from the equation. This process completely revolutionised the way that textiles were to be made. This meant that the same perforated tape could be used repeatedly so that each textile that was made came out the same as the prior one. This made it so that each textile that was placed on the loom would come outxact in exactly the same way because of the perforated paper tape that was used.
Craft & professional significance	In many complicated industrial operations, the setting up of the machines involved can take as much time as is needed for the machines to perform. With mechanical programmability, the means of controlling the actions of numerous interacting components, and quickly changing their operations, maybe set up in advance. For the worker, activating mechanical programs is far easier than setting up machine operations from scratch. This is made so that the number of holes that could be produced by the slide increased as well and work efficiency when increased by more than one-hundred percent.

Name of invention	**Falcon Loom**
Date	1728
Location	France
Inventor(s)	Jean Baptiste Falcon
Prior craft	Expanded the Bouchon loom.
Novelty	Expanded the number of cords that could be handled by arranging the holes in rows. A series of cords were passed to the horizontal needles that were arranged on a device called a slide. As the textile moved forward, the needles on the slide were told which ones needed to move down into the textile created a stitch by the perforations on the paper tape. This made it so that several needles could be operating at a time, and that the same stitch would be applied to a textile every time, because of the manner, in which the perforation worked.
Technological Significance	Bouchon’s slide only contained so many needles for it to work correctly. The new invention increased efficiency but it also required two workers to manage it. Because the textile had to be fed a certain way and monitored to make sure that the machine did not have any issues, the number of employees operating the machine increased. The loom still worked more quickly and efficiently so that it was well worth having two employees operating one machine. However, as the number of cords increased that efficiency decreased markedly. This is where Falcon’s work was so important because he made it so that the number of needles that were working increased while the machine still worked as it should have. Since they were able to expand the number of needles, they were also able to expand the area that could be worked on. This made it so that much larger pieces could be sewn because the additional needles expanded the work area. As time went on, they were able to add even more needles to the slider so that they could

	work on an even larger area. This has been essential to improving the efficiency of the loom.
Craft & professional significance	This addition allowed for much larger patterns and material to be worked on at the same time.

Name of invention	**Flying shuttle**
Date	1733
Location	Manchester, UK
Inventor(s)	John Kay
Prior craft	Manual operation. Shuttles were originally passed back and forth by hand. The operator then had to reach forward while holding the shuttle in one hand and pass this through the shed; the shuttle carried a bobbin for the weft. The shuttle then had to be caught in the other hand, the shed closed, and the beater pulled forward to push the weft into place. This action (pick) required regularly bending forward over the fabric; more importantly, the coordination between the throwing and catching of the shuttle required multiple operators if the width of the fabric exceeded that which could be reasonably reached across; typically 150 cm or less.
Novelty	The shuttle itself has some subtle differences from the older form. The ends of the shuttle are bullet-shaped and metal-capped, and the shuttle generally has rollers to reduce friction. The weft thread is made to exit from the end rather than the side, and the thread is stored on a pirn (a long, conical, one-ended, non-turning bobbin) to allow it to feed more easily. Finally, the flying shuttle is generally somewhat heavier, to have sufficient momentum to carry it all the way through the shed.
Decline	20th century: Other systems had begun to supplant it. The heavy shuttle was noisy and energy-inefficient. Projectile and rapier looms eliminated the need to take the bobbin/pirn of thread through the shed; later, air- and water-jet looms reduced the weight of moving parts further.

Improvements	• Kay's son, Robert, improved on the flying shuttle by establishing a system of up to four shuttles, each with a different-coloured thread, which allowed the weaver to create a variety of colours and textures in the finished product that could be much wider than that made by the single hand-passed shuttle. Although still a hand process, the flying shuttle allowed for much wider cloth pieces and much faster work and stimulated the demand for thread. Thus, the flying shuttle is regarded as the device that in turn led to the invention of the spinning jenny, the spinning mule, and eventually the power loom. • Though air-jet and water-jet looms are common in large operations, many companies still use flying shuttle looms. This is due in large part to their being easier to maintain than the more modern looms. In modern flying shuttle looms, the shuttle itself is made of rounded steel, with a hook in the back, which carries the filler.
Description	The flying shuttle was shot out of a box, backwards and forwards, carrying the weft without the weaver having to touch the shuttle. The flying shuttle employs a board, called the "race" which runs, side to side, along the front of the beater, forming a track on which the shuttle runs. The lower threads of the shed rest on the track and the shuttle slides over them. At each end of the race, there is a box, which catches the shuttle at the end of its journey, and which contains a mechanism for propelling the shuttle on its return trip. The device attached the shuttle to a cord on both ends, allowing the weaver to pull the shuttle through the warp threads without leaving a seated position. The shuttle is thrown through the warp, allowing much wider cloth to be woven much more quickly and making the development of machine looms much simpler.
Technological Significance	The invention had an enormous impact on the woollen industry. The owners loved it because it sped up the process and they could reduce the number of people they employed. The workers were impoverished by it. John Kay was the subject of many personal attacks upon himself as he struggled for financial and literal survival.
Craft & professional significance	• Where a broadcloth loom previously required a weaver on each side, it could now be worked by a single operator. Until this point, the textile industry had required four spinners to service one weaver. Kay's innovation, in wide use by the 1750s, greatly increased this disparity. • The increase in production due to the flying shuttle exceeded the capacity of the spinning industry of the day, and prompted the development of powered spinning machines, beginning with the spinning jenny and the water frame, and culminating in the spinning mule, which could produce strong, fine thread in the quantities needed.

Social significance	• All were attacked as threats to the livelihood of spinners and weavers, and Kay's patent was largely ignored. The resistance of weavers to the innovation is cited as a case of temporary technological unemployment. As the flying shuttle and other devices mechanized the textile industry, greater numbers of people were employed in cloth making, suggesting that the weavers' protests were shortsighted. The shuttle and related devices did eliminate the class of independent weavers. • The flying shuttle produced a source of injuries to the weaving process; if deflected from its path, it could be shot clear of the machine, potentially striking workers. The British House of Commons was moved to take up the issue of installing guards and other contrivances to reduce these injuries. • "Kissing the shuttle" is the term for a process by which weavers used their mouths to pull the thread through the eye of a shuttle when the pirn was replaced. The same shuttles were used by many weavers, and the practice was unpopular. • The resistance of weavers to the innovation is cited as a case of temporary technological unemployment. As the textile industry was mechanized, greater numbers of people were employed in cloth making.
Historic significance	The flying shuttle was one of the key developments in the industrialization of weaving during the early Industrial Revolution.
Related events	Patented by in 1733, in Lancashire, Britain. Title: 'New engine for opening and dressing wool'.
Legends and tales	• The flying shuttle was also dangerous at times as it would "fly" off the loom and maim nearby workers. • Popular histories of the period often draw several moral lessons from the experience of Kay and his flying shuttle. He is presented as a man deprived of a just reward for his major contribution to technological advances.

Name of invention	**Vaucanson Loom**
Date	1745
Location	France
Inventor(s)	Jacques de Vaucanson
Prior craft	Based on the inventions of Basile Bouchon and Jean Falcon.
Novelty	Complete loom automation
Description	Created the world's first completely automated loom.

Name of invention	**Spinning wheel**
Date	11^{th} century

Location	Islamic world
Decline	Industrial revolution
Description	A spinning wheel is a device for spinning thread or yarn from fibres. It was a precursor to later spinning machinery such as the spinning jenny and spinning frame, which displaced the spinning wheel during the Industrial Revolution.
Technological Significance	The spinning wheel increased the productivity of thread making by a factor of greater than 10. Medieval historian Lynn White credited the spinning wheel with increasing the supply of rags, which led to cheap paper, which was a factor in the development of printing.
Cultural Significance	Starting in 1931, the traditional spinning wheel became the primary symbol on the flag of the Provisional Government of Free India. Mahatma Gandhi's manner of dress and commitment to hand spinning were essential elements of his philosophy and politics. He chose the traditional loincloth as a rejection of Western culture and a symbolic identification with the poor of India. His personal choice became a powerful political gesture as he urged his more privileged followers to copy his example and discard—or even burn—their European-style clothing and return with pride to their ancient, pre-colonial culture. Gandhi claimed that spinning thread in the traditional manner also had material advantages, as it would create the basis for economic independence and the possibility of survival for India's impoverished rural areas. This commitment to traditional cloth-making was also part of a larger swadeshi movement, which aimed for the boycott of all British goods. As Gandhi explained to Charlie Chaplin in 1931, the return to spinning did not mean a rejection of all modern technology but of the exploitative and controlling economic and political system in which textile manufacture had become entangled. Gandhi said, *"Machinery in the past has made us dependent on England, and the only way we can rid ourselves of the dependence is to boycott all goods made by machinery. This is why we have made it the patriotic duty of every Indian to spin his own cotton and weave his own cloth."*

Name of invention	**Spinning Jenny**
Date	1764-1767
Location	Stanhill, Oswaldtwistle, Lancashire in England.
Inventor(s)	James Hargreaves
Prior craft	The spinning jenny was confined to producing cotton weft threads and was unable to produce yarn of sufficient quality for the warp.
Novelty	A machine, which took the traditional, spinning wheel and turned it 90 degrees to a horizontal position, allowing it to spin multiple spindles at once. The device reduced the amount of work needed to produce cloth, with a worker able to work 8 or more spools at once. This grew to 120 as technology advanced.
Improvements	• Hargreaves continued to refine the Jenny increasing the number of threads

	from 8 to 80. • In Lancashire, carpenters were knocking up copies of the jenny by the hundred while others were improving on the original, increasing the number of threads to 80 and beyond.
Dispute	• Hargreaves did not apply for a patent for his Spinning Jenny until 1770, by which time many others had copied his ideas. • The inventor of the device is disputed. Relevant resources are: • Richard Guest 'A History of Cotton Manufacture', 1823, • Baines, History of Lancashire, Vol 1 p118 Vol2 p134 • McCullough, Edinburgh Review. • Guest self-published a 233-page book, 'The British Cotton Manufactures: and a Reply to an Article on the Spinning Contained in a Recent Number of the Edinburgh Review' that accused Baines and McCullough of plagiarism and asserted that Highs was indeed the inventor of both these items. • Baines wrote 'History of the cotton manufacture in Great Britain'; it was published in 1835. He discusses Guests´ conjecture in an extensive footnote, where he dismisses Richard Guest's claim.
Social reaction	Hargreaves's growing success sparked jealousy and fear among his neighbours and, in 1768, an irate mob gathered at Blackburn's market cross and marched to Stanhill, where they smashed the frames of 20 machines he was building in a barn. The machine breakers then marched on to Brookside Mill and finally to Hargreaves's home at Ramsclough. Here, if reports are to be believed, one of the rioters placed a hammer in Hargreaves's hands and forced him to destroy his own machinery. This was too much for Hargreaves. He fled to Nottingham, where there was less suspicion of new technology, and opened a small mill in partnership with a man called Thomas James. He continued to develop the jenny, finally taking out a patent in 1770. In Lancashire, traditional hand spinners saw the Spinning Jenny as a threat to their livelihood. They realised that the machine could produce spun cotton thread far quicker and more cheaply than their traditional method. An angry mob marched to Hargreaves' workshop, destroying his equipment and forcing him to leave the county. He moved to Nottingham and built a small spinning-mill, using his Jennies. Although this venture was not successful.
Decline, end of use	The early machines produced thread that was coarse and broke easily, only suitable for the weft of a handloom (that which travels horizontally in the shuttle). The thread they produced was coarse and lacked strength, making it suitable only for weft, but it was a step in the right direction. However, the machine was never more than a stepping-stone to the mechanisation of spinning. Within five years, Arkwright had the water frame in

	mass operation and the following years, Crompton married the best parts of the two machines to produce his hybrid mule, which would quickly take over.
Description	The spinning jenny is a multi-spindle spinning frame. A moving carriage bearing the spindles stretched the thread as it pulled away from the body of the machine, imparting twist to the cotton at the same time. Then the spindles wound up the thread as the carriage returned before the process started again.
Technological Significance	By the time of his death in 1778, over 20,000 of Hargreaves' Spinning-Jenny machines were being used in Britain.

Name of invention	**Spinning mule**
Date	1775 - 1779
Location	UK
Inventor(s)	Samuel Crompton
Novelty	The spinning mule spins textile fibres into yarn by an intermittent process.[4] In the draw stroke, the roving is pulled through rollers and twisted; on the return it is wrapped onto the spindle. Its rival, the throttle frame or ring frame uses a continuous process, where the roving is drawn, twisted, and wrapped in one action.
Intellectual property	• Crompton received no royalties for his invention. • As the mule was unpatented, others soon manufactured it.
Decline, end of use	The mule was the most common spinning machine from 1790 until about 1900 and was still used for fine yarns until the early 1980s.
Improvements	• 1790: The machine was constructed in iron, power was applied to assist the inward motion • Henry Stones, a mechanic from Horwich, constructed a mule using toothed gearing and, importantly, metal rollers. • Baker of Bury worked on drums, and Hargreaves used parallel scrolling to achieve smoother acceleration and deceleration. • 1790: William Kelly of Glasgow used a new method to assist the draw stroke, using first animals and then water. • 1793: John Kennedy addresses the problem of fine counts. • 1818: William Eaton improves thread winding. • 1825-1830: Roberts invents the self-acting mule.
Description	A spinning mule is a machine used to spin cotton and other fibres. They were used extensively from the late 18th to the early 20th century in the mills of Lancashire and elsewhere. Mules were worked in pairs by a minder, with the help of two boys: the little piecer and the big or side piecer.
Technological Significance	It could spin thread better than could be done by hand, which led to finer threads.
Related	The only surviving example of a spinning mule built by the inventor Samuel

objects	Crompton, in the Bolton Museum.

Name of invention	**Power Loom**
Date	1785
Location	UK
Inventor(s)	Edmund Cartwright
Prior craft	Based on Kay's flying shuttle. • 1678: first ideas for an automatic loom were developed by M. de Gennes • 1745: Vaucanson in Paris, designs for automatic loom were never developed and forgotten.
Intellectual property	1785: Edmund Cartwright patented a power loom, which used water power to speed up the weaving process, the predecessor to the modern power loom.
Novelty	Cartwright added parts to his loom, namely a positive let-off motion, warp and weft stop motions, and sizing the warp while the loom was in action.
Improvements	• 1790: Grimshaw of Manchester, dressing the warp. • 1789-1790: Austin, dressing the warp. • 1802: William Radcliffe of Stockport, take-up mechanism • 1803: Thomas Johnson of Bredbury, dressing frame. • 1803: John Todd of Burnley, heald roller and shedding arrangements. • 1803: William Horrocks of Stockport, shedding operated by cams. • 1806: Peter Marsland, lathe motion to counteract poor picking • 1810: William Cotton, letting off motion • 1813: William Horrocks, loom lathe motion, improving on Marsland • 1813: Peter Ewart, use of pneumatics • 1815: Joseph and Peter Taylor, double beat foot lathe for heavy cloths • 1815: Paul Moody, first power loom in North America. • 1820: John Capron and Sons, power looms for woollens. • 1821: William Horrocks, better sizing by wetting. • 1830: Richard Roberts, geared take up wheel to operate multiple heddles. • 1832: Stanford, Pritchard, and Wilkinson, the method to stop on the break of weft or warp. • 1834: Hornby, Kenworthy and Bullough of Blackburn, vibrating or fly reed • 1834: John Ramsbottom and Richard Holt of Todmorden, automatic weft stopping motion. • 1835: James Bullough of Blackburn, automatic weft stopping motion, taking up, and letting off arrangements. • 1836: Andrew Parkinson, improved stretcher. • 1841: William Kenworthy and James Bullough, improved the roller temple. • Today, technology has produced a variety of looms designed to maximise production for specific types of material. The most common of these are Sulzer shuttleless weaving machines, rapier looms, air-jet looms, and water-jet

	looms.
Description	A power loom is a mechanized loom and was one of the key developments in the industrialization of weaving during the early Industrial Revolution.
Technological Significance	By 1850, there were 260,000 power looms in operation in England. Fifty years later came the Northrop loom, which replenished the shuttle when it was empty. This replaced the Lancashire loom. The only surviving example of a spinning mule built by the inventor Samuel Crompton, in the Bolton Museum.
Economic significance	Cartwright's was not a commercially successful machine; his looms had to be stopped to dress the warp. Over the next decades, Cartwright's ideas were modified into a reliable automatic loom.
Historic significance	These designs preceded John Kay's invention of the flying shuttle and they passed the shuttle through the shed using levers. With the increased speed of weaving, weavers were able to use more thread than spinners could produce.

Name of invention	**Jacquard loom**
Date	1804
Location	Lyon, France
Inventor(s)	Jacquard
Prior craft	Jacquard worked on Vaucanson's design to improve it.
Novelty	Replaced the pierced paper system invented by Bouchon in 1725 with a punch card system for controlling looms.
Intellectual property	• 1806: Jacquard patents his invention.
Description	• 1790: working prototype. • What became known as the Jacquard loom was actually: an attachment controlled by a chain of punch cards, in which one complete card dictated one row of a pattern. • More specifically, it is the “Jacquard head” or “attachment” that adapts to multiple dobby looms to create intricate patterns.
Technological Significance	The invention made the production of complex patterns simpler and faster. Before this invention, looms needed many heddles to move warp threads, because these had to shift independently of one another. Thereby the persons working at each loom were at least two: a weaver and an assistant, whose task was to set the heddles going at the right moment.

Craft & professional significance	• A loom can be operated by a single weaver, without the need for help to move the threads, as the Jacquard loom does this automatically. • The invention allowed for more rapid as well as efficient production of patterns. • The invention was capable of weaving complex and detailed patterns in a fraction of the time that a manual master weaver would take to create the same product.
Economic significance	This made patterned fabrics available to more consumers at a lower price.
Cultural Significance	The concept of including art components in usable items clothing, household textiles, and professional textiles is relevant to the Arts and Crafts movement.
Historic significance	One of the automation advancements that marked the Industrial Revolution, transforming the European textile industry. Inspired advances in computer storage.

Name of invention	**Spinning frame**
Date	1769
Location	UK
Inventor(s)	Sir Richard Arkwright and John Kay (see also dispute). In 1769, Arkwright patented the spinning frame.
Prior craft	Spinning wheel
Craft significance	The spinning frame was a significant advance over Hargreaves's spinning jenny, in that very little training was required to operate the machinery, which produced a strong yarn suitable for warp threads.
Improvements	Too large to be operated by hand, the spinning frame needed a new source of power. Arkwright at first experimented with horses, but decided to employ the power of the water wheel, which gave the invention the name 'water frame'.
Description	The spinning frame is an invention for spinning thread or yarn from fibres such as wool or cotton in a mechanized way, rather than human fingers.
Dispute	Richard Arkwright employed John Kay to produce a new spinning machine that Kay had worked on with (or possibly stolen from) another inventor called Thomas Highs. With the help of other local craftsmen the team produced the spinning frame.
Technological Significance	High demand for yarn spurred the invention of the spinning jenny in 1764, followed closely by the invention of the spinning frame, later developed into the water frame (patented in 1769). Mechanisms had increased the production of yarn so dramatically that by 1830 the yarn cottage industry in England could no longer compete and all spinning was carried out in factories.
Craft & professional significance	For some time, the stronger yarn produced by the spinning frame was used in looms for the lengthwise “warp” threads that bound cloth together, while hand-powered jennies provided the weaker yarn used for the horizontal filler “weft” threads. The jennies required skill but were inexpensive and could be used in a

	home. The spinning frames required significant capital but little skill.
Economic significance	As the textile industry expanded its markets and adopted faster machines, yarn supplies became scarce especially due to innovations such as the doubling of the loom speed after the invention of the flying shuttle.

Name of invention	**Carding machine**
Date	1748
Location	UK
Inventor(s)	Sir Richard Arkwright
Intellectual property	1775 patent for a new carding engine, which converted raw cotton to a continuous skein prior to spinning.
Prior craft	1748 Daniel Bourn and Lewis Paul separately obtain patents for carding machines. The carding technology of Lewis Paul and Daniel Bourn seems to be the basis of later carding machines.
Description	The machine used a succession of uneven rollers rotating at increasingly higher speeds to draw out the roving, before applying a twist via a bobbin-and-flyer mechanism.
Novelty	It could make cotton thread thin and strong enough for the warp threads of the cloth.

Name of invention	**Water frame**
Date	1765
Location	UK
Inventor(s)	Sir Richard Arkwright
Prior craft	• Water frames existed since ancient Egyptian times. • The water frame was originally powered by horses at a factory built by Arkwright and partners in Nottingham.
Description	The water frame is a spinning frame that is powered by a water-wheel.
Intellectual property	1769: The design was based on a spinning machine built for Thomas Highs by John Kay, who was hired by Arkwright.
Novelty	• Designed for the production of cotton thread, it was • Could spin 128 threads at a time, which was an easier and faster method than ever before.
Improvements	Unlike the spinning jenny, the water frame could spin only one thread at a time until Samuel Compton combined the two inventions into his spinning mule in 1779.
Technological	• Being run on waterpower, it produced stronger and harder yarn than the

Significance	then-famous 'spinning jenny', thus, greatly ushering the factory system. • The water wheel provided more power to the spinning frame than human operators did, reducing the amount of human labour needed and increasing the spindle count.

Related events	**<u>Birth of the factory system:</u>**
	
	• 1770: Arkwright and partners build a water-powered mill in Cromford, Derbyshire.
	• 1771: Arkwright installs the water frame in his cotton mill at Cromford, Derbyshire, on the River Derwent. One of the first instances where:
	  ○ factories built to house specific machinery, rather than just bringing workers together.
	  ○ working day is determined by the clock instead of the daylight hours
	  ○ people being employed rather than just contracted.
	
	The first factory to use a continuous process from raw material to finished product, in a series of operations.

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