Pin making in the eighteenth century

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Abstract: Adam Smith used an example to illustrate his theory about the division of labour. Pin making was a poorly known industry by all but French encyclopaedists. Archives help us understand French pin making. This text presents the features of pin making in the eighteen century. Labour was not divided among 18 different workers. The great workshops with 20 workers and those with 3 or 4 pin makers operated side by side with equivalent productivity levels. Specializing labour did not appear to increase its productive power.

Keywords: pin making, eighteenth century, French encyclopaedists, specialisation, division of labour, productivity, Adam Smith,

I

'To take an example, therefore, from a very trifling manufacture; but one in which the division of labour has been very often taken notice of, the trade of the pin-maker'[1]. Adam Smith's ideas concerning the division of labour are founded on this one case of pin making. Yet nobody really knows how pins were made in the eighteenth century. Thanks to the many administrative documents available in French archives[2], it is possible to know how pins were made in France. We can then verify if Adam Smith's law holds true for pin making. It is the purpose of this text. I first present the guild in the towns, followed by the production in the eighteen century in Normandy, thirdly the texts which described this industry at Adam Smith's time, and lastly the fit between the facts and the law about the division of labour.

Pins are very old devices used to bind clothes. They were originally made from bone and later from cooper. In Roman civilization the fibula, a sort of brooch, fixed the toga on the shoulder[3]. Fibulas were often made of brass and were manufactured in the Belgian Gaul where there were cooper and calamine[4] mines. They were tinned[5] with a tin which most probably came from

1 Adam Smith, *Wealth of Nations*, Book 1 Chapter 1.
2 Mainly the Archives Départementales de l'Orne and the Library of the ENPC engineering school.
3 Fauduet, *Fibules préromaines*.
4 Zinc oxide.
5 Thouvenin, 'L'étamage des objets de cuivre'.

Cornwall.

From the Middle Ages through until the twentieth century, women had very roomy and long dresses. Pins were used to fix these clothes and to shorten them for work. In pre-revolutionary France a lover would give one hundred or more pins to his beloved. The old expression ‘pin money’ attests to the presence of pins in ancient society. In the eighteenth century, French women bought an average of 100 pins each year.

Pins were mainly used in the royal court. The best pins were dedicated ‘to the queen’. They were made in towns close to London or Paris and sometimes Bordeaux or Toulouse. The Paris pin makers guild was founded in 1268[6]. The guild had the monopoly to draw the wire, make and sell pins. The London pin makers were founded in 1356 and were also in a monopoly position. They had difficulty however meeting the demand in London. Many pins were imported. On two occasions a wealthy industrialist was accorded a monopoly on the trade of pins including imports from Queen Elisabeth I, King James I, and King Charles I. The monopoly always failed.[7]

II

In the eighteenth century, pins were made in the country using a new technical process. The Dutch leaving around Dinan[8] had great experience in make cooper and brass objects. They invented a new pin making process. They began selling their pins to the English court at the end of the fourteenth century. The war with the Spanish King Philip II in 1566 destroyed this industry. The Dutch merchants kept their trade relationships and moved production to France, a less dangerous land with far lower wages[9].

Pin production in France began in a little woody area near the town of Laigle, in the south of Rouen[10]. There was a tradition of smithing, with locals producing iron and ironed objects. The

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6 Secousse, *Ordonnances des roys de France*, tome IV pp. 124-128, Boileau, *Le livre des métiers* pp. 124-127, Lespinasse, *Les métiers et corporations* pp. 255, 256, 564-575, and Franklin, *Dictionnaire historique des arts, métiers et professions* p. 308.

7 Unwin, *Industrial organization* pp. 165-170, 176, 236-240, 259. Unwin, *The gilds* pp. 88, 163, 186, and 315. Levy, *Monopoly and competition* pp. 31-52.

8 Now in Belgium.

9 Aymard, *Dutch capitalism*.

10 Vaugeois, *Histoire des antiquités de la ville de L'Aigle*, Ouin-Lacroix, *Histoire des anciennes corporations* pp. 197-198, Duval, *Les épingles et les aiguilles de Laigle*, and Dronne, *L'Aigle*.

invention of the blast furnace elsewhere challenged their trade. In the fifteenth century, this new technology was brought to Normandy by Walloon smiths. Pins were also made in Wallonia.

For the two hundred years prior to the 1672 war between Louis XIV and the Dutch Republic, Dutch merchants supplied the brass wire to the French pin makers and in exchange for pins. The Dutch then sold them in London.

After the breakdown in trade relations with the Dutch merchants, the eighteenth century was a golden age for French pin makers. French merchants from Normandy organized the purchasing of brass wire from Holland, Sweden, and Germany and built commercial networks across France, in Italy, and in Spain. The pin makers in Paris became resellers of the pins made in Normandy. During the eighteenth century, there were about 1300 workers in the pin making industry made up of 500 men and 800 women. They worked in their houses in the forests near Laigle in Normandy. They purchased about 250 tons of brass wire and sold 1.8 billion pins for 1 million French Livres. Half of all production was exported.[11]

From 1626 onwards, English pin makers based around Gloucester used the same Dutch technology[12].

Many tools for pin making were multi-purpose: the drawplate to make the wire of the required diameter, the gauges to verify the diameter, the solid wine acid[13] to clean the brass, the pincers to draw the wire, the shears to cut the wire and the shanks[14], the grindstone from iron to point, the spinning wheel to turn the wire and make the head, the pots for yellowing, whitening and washing the pins, and the tray to winnow the pins.

Several tools were specific to pin making: the ‘engin’ to straight the wire, the half boxes to cut the wire and the shanks to the required length[15], the heading machine which was activated by the foot, the barrel to dry and trim the pins with bran, the pad to stamp the papers, and the awl of 25 tips

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11 Peaucelle, *Adam Smith et la division du travail* p. 105.

12 Herbert, *The city of Gloucester* pp. 3, 76, 108, 130, 139. Pinchbeck, *Women workers* pp. 273-280. The folk museum of Gloucester shows this industry.

13 In French *gravelle*.

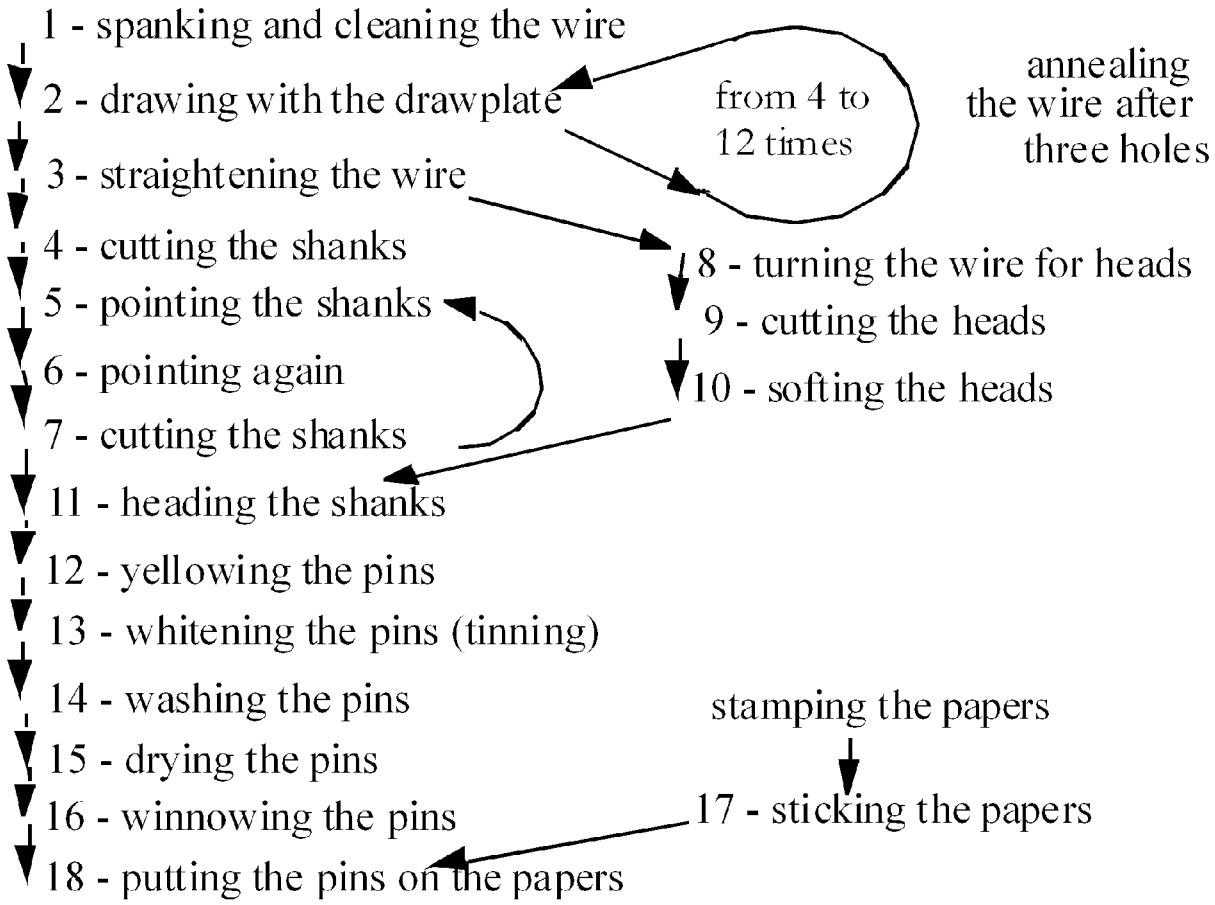
14 The shanks were the pins without a head.

15 The pins had various sizes from number 1 to number 36. The more usual pins were the number 5 (2.7 cm) to the number 22 (5.4 cm).

to pierce the papers. Those tools have strange names that would appear to come from the Dutch language.

The use of each tool for a specific activity was called an ‘operation’. The number of operations is however arbitrary as it is sometimes possible to distinguish two separate operations. Some operations were also repeated, such as drawing the wire to the right diameter. The drawer used successively smaller holes until the required diameter for the pin size was reached. Twelve holes were used for the pin number three and seven for the pin number eight, for example. The wire was annealed after three holes. The shank was pointed twice to obtain a very polished point. These were operations 5 and 6. The cutting of the shanks, operations 4 and 7, also appear to have been repeated. Adam Smith didn't understand this repetitive operation. He wrote ‘a fourth points it, a fifth grinds it at the top for receiving the head’.[16] Yet the explanation for repeating the cutting is simple. It was easier to hold the parcel of wire on the grindstone if it was long. The parcels were as long as two to five pins in length. The pointer made a point at each end. After pointing, each end was cut to be a pin without a head. The eventual remaining piece in the middle came back for pointing.

[16] Adam Smith, *Wealth of Nations*, Book 1 Chapter 1. These were the fifth and the sixth operations, because Adam Smith omitted the first.



Schema 1 The 18 operations with Delaire's[17] numbers in Diderot's *Encyclopédie*

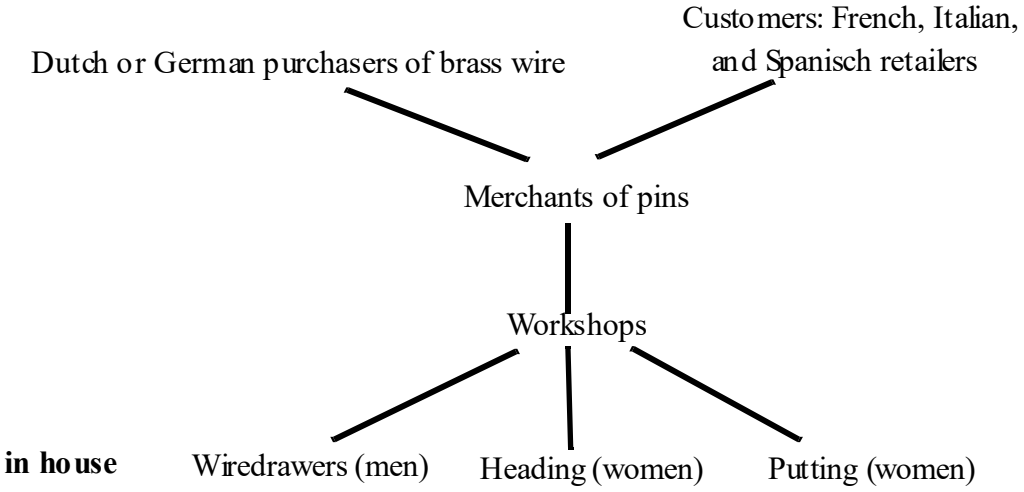
The separation of pin making into different operations was not a division of labour. Sometimes a worker was specialized in one or two operations such as women heading the pins and then putting pins on the papers, or drawing the pins. Sometimes, a worker performed many different operations. The principal reason was the operative time. The longest operation was the heading, which took around three seconds per pin. The women took the pins one by one. The time to point a pin was shorter because the worker pointed a batch of 25 or 40 pins. The bigger batch was for the tinning of a set of 200 000 pins. The physical productivity was about 5000 pins per day and per person from the operation 3 to 18.

[17] Delaire (or Deleyre) was a philosopher who wrote two articles in Diderot's *Encyclopédie* (Kafker, *The encyclopedists as individuals*).

Operation		Daily production (number of pins)	Time taken to make one pin (seconds)	
3	Straightening the wire	108 000	0,35	6%
5	Pointing	108 000	0,2	3%
5	(the turner)		0,2	3%
6	Pointing again	108 000	0,2	3%
6	(the turner)		0,2	3%
7	Cutting the shanks	420 000	0,1	2%
8, 9, 10	Making the heads	156 000	0,2	3%
11	Heading	12 000	3,3	56%
18	Putting	36 000	1,1	19%
		Total	5,85	100%

Table 1: Production rates according to Perronet (approximate figures)

Pin making was not organized according to a division of labour with 18 workers in a single workshop working together in an assembly line. The pin industry involved around 300 workshops and only 20% of the pin makers worked in the 'big' workshops of 10 to 20 workers[18]. The majority of pins were made in the forest houses where three to five people worked. Raw materials were moved by small horses and weighed to pay wages according to quantities produced.



Schema 2 The relationships between the actors in the French pin making industry

This process is known as the 'classical' pin making process as it was described in the well-

[18] Marchand, 'La fabrication des épingles', p. 35.

known texts of the Diderot's *Encyclopédie* and those of the French Academy of Sciences.

III

The published French pin making texts describe the Normandy workshops. The Paris pin makers knew of provincial production because their 1601 charter forbade reselling of these cheaper pins and also imposed taxes on them. The French Administration knew about pins making in Normandy since the 1660s when the Dutch ambassador provided statistics concerning the goods the Dutch purchased in France. Pins and combs accounted for 500 000 French Livres.[19] Exactly how the pins were made however was poorly understood. The first texts which described pin making were written in the course of a larger project to describe all arts and crafts.

In 1675, King Louis XIV asked to the French Academy of Sciences to describe the arts and crafts[20]. The Academy had little motivation to undertake this work. New members were appointed for this task, in particular Billettes in 1699. Billettes most probably discovered a report written by a local trade inspector in 1692[21]. He ordered one illustrative plate, dated of 1702 and he wrote an unpublished report in 1700 which was contrary to the habits of the Academy. In the Academy of Sciences' archives a handwritten note gives the production rhythms (physical productivity) of some operations[22]. Using the price of raw material and the selling price, Billettes computed the value added[23]. With the rhythms he calculated the daily wages. These theoretical wages were very low in comparison with the usual daily wage of the workers in Paris. The situation was an impossible one. Billettes explored two possible solutions, either increase the productivity or decrease the wages for certain operations. Billettes thought that women should work on operations with the lowest wages[24]. It is probably for this reason the Billettes' text wasn't published.

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19 Huet, *Le grand trésor historique*, pp. 108-109. The combs were made in Ezy sur Eure at 70 km far of Laigle.

20 Pinault, *L'Encyclopédie*. Salomon-Bayet, 'Un préambule historique'. Moureau, *Le Roman vrai de l'Encyclopédie*. The goal of the Royal Administration is unknown but in France the Protestants had got many industrial activities. Perhaps, the King prepared the Revocation of the Edit de Nantes (1685).

21 Savary, *Dictionnaire Universel de Commerce*, Préface p. XIX 'Dès l'an 1692, les inspecteurs du Commerce avaient eu l'ordre d'envoyer à la Cour des états de leurs départements'.

22 Peaucelle, Manin, 'Billettes and the economic viability of the pin making'.

23 Naturally he didn't use this expression.

24 Billettes was right; see Babbage, 1832, chapter XIX.

After the death of Louis XIV in 1715, the project to describe the arts and crafts industries was repeated. Local administrative authorities made inquiries and Guéroult[25] wrote a handwritten report[26]. At the Academy, Réaumur gathered this information and ordered new four plates dated 1718. However nothing was published.

In 1723, Savary published the *Dictionnaire du Commerce* which contained information from the central Royal Administration[27], including the Academy of Sciences. In the article 'Espingles' ('Pins') Savary described the guilds and their charters but also the relocation of pin making to Normandy. Savary saw the five existing plates and he counted how many workers were drawn. They were 25 and he wrote 'we count 25 workers which operate successively on it'[28]. This interpretation was wrong as the characters were drawn in Paris to explain the use of tools. Many operations were drawn several times. Chambers translated this text on the pins with the workers numbering 25[29]. These texts contributed to create the illusion of a division of labour.

The number '18' came from Diderot's *Encyclopédie* where the article 'Epingle' was written by Delaire. He described in succession each of the 18 operations. Moreover he gave nouns for the workers in almost all of the operations, as if they were separate professions. Delaire didn't directly observe pin making. He rewrote several sources, in particular Guéroult's 1818 report and Perronet's 1740 report. Diderot wanted his text to appear original. The use of numbering helped structure the details. The illusion of specialized labour is the result of a writing style used to give a unique feel to this technical text.

Perronet[30] was a civil engineer in Normandy. He observed pin making in 1739 and took

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25 He was a civil engineer in Alençon prior to Perronet.

26 Guéroult, 'Description générale de la fabrique d'épingles'.

27 Savary quoted the judgement of the general lieutenant of the Police in Paris dated of July 16th 1695 who sentenced several thousand of iron pins to burning. They were made in Normandy. Chambers translated 'By a sentence of the lieutenant de Police, July 1695, the seizure of some millions of those pins [in iron] are confirmed.'

28 Savary, *Dictionnaire Universel de Commerce*, article 'Espingles' 'Il n'y a guère de marchandise qui se vendent moins cher que les épingles ; & cependant il n'y en point qui passent par plus de mains, avant que de pouvoir être mises sur le marché. L'on compte jusqu'à plus de vingt cinq Ouvriers qui y travaillent successivement, depuis que le fil de léton a été tiré de la filière, jusqu'à ce que l'Espingle soit attachée au papier.'

29 Chambers, *Cyclopaedia*, Article 'Pin' 'Notwithstanding that there in scarce any commodity cheaper than pins, there is none that passes through more hands ere they come to be sold. They reckon twenty-five workmen successively in each pin, between the drawing of the brasswire and the sticking of the pin in the paper'.

30 Perronet succeeded Guéroult. He created in 1747 the first school of engineers in France, l'Ecole des Travaux Publics (see Vacant, 2006).

accurate measures[31]. In his 1740 report he computed the production cost for all sizes of pins. In 1755, he gave his report to Diderot for Delaire's article 'Epingle' but he was disappointed by the result. He later gave his report to Duhamel, a member of the Academy of Sciences. In 1761 Duhamel published the *Description of the arts and crafts*, and pin making was amongst the first published with one plate in 1702 and four plates in 1718[32]. He mixed several sources, including Réaumur's handwritten manuscript copied from Guéroult, Perronet's document, his own notes, and the observations of Chalouzière, a local judge. Perronet looked to publish an entire original report and was helped by Diderot who published a second article called the 'Epinglier' in the 1765volume of the plates[33].

Perronet wrote manuscript about wiredrawing in 1739[34]. His report describes the first operations. Drawing was repeated up to 12 times to obtain the required diameter of the pins. Perronet gave the rhythms. He computed the wages of the drawers and the production cost of each wire size. He transmitted a copy to his friend Diderot and to Duhamel, his colleague in the Academy of Sciences[35]. The accompanying drawings were the source of the first plate in the Diderot's *Encyclopédie*. However the entire text wasn't printed. The production rates for the first operations were omitted[36].

These texts have been referenced, copied and abstracted in many publications, periodicals and dictionaries. Schema 3 shows the French texts about pin making that existed in the eighteen century. Almost all were copies. The texts can all be traced back to their sources. When the texts were rewritten the main ideas were transcribed yet many details were omitted, the fact that women[37] were specialized in heading and sticking, for example. The idea of specialized workers on each the 18 operations was added for stylistic reasons.

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31 Perronet, 'Description de la façon dont on fait les épingles'.
32 Duhamel, *L'Art de l'épinglier.*
33 Perronet, *Encyclopédie*, tome 1 of the plates, article 'Epinglier'.
34 Perronet, 'Explication de la façon dont on tire le fil de leton'.
35 Perronet was member of the Academy or Architecture. He became an associate member of the Academy of Sciences in 1765.
36 Billettes counted the drawing operation but only for one hole.
37 During the seventeenth and the eighteenth century in Paris women worked in a small number of female guilds. The men worked in the other exclusively male guilds.

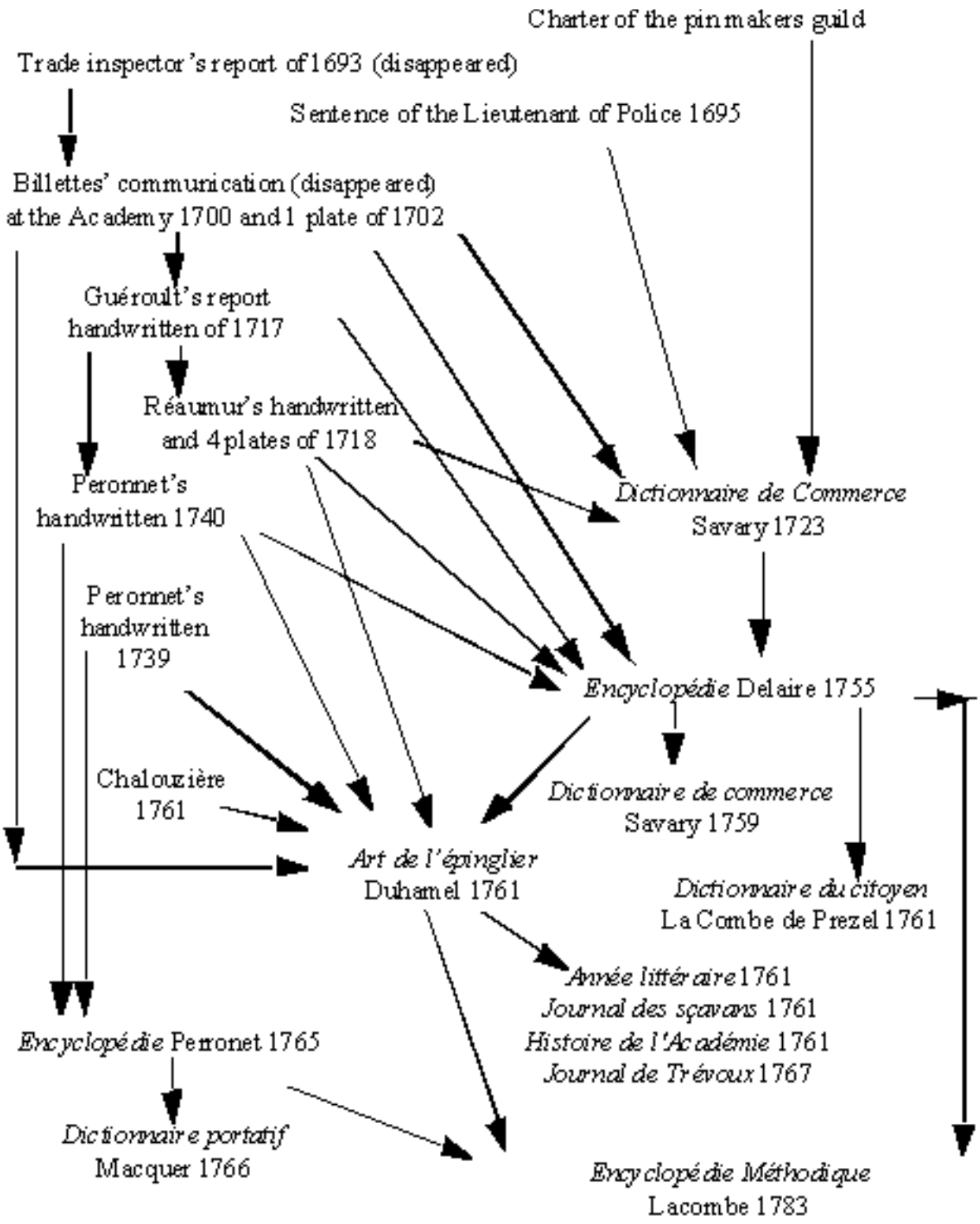
There were only three original sources - Guéroult, Perronet, and Chalouzière - who gave information about productivity, although often as a range of values. There was no well-known standard at the time.

Delaire's article (1755) was well considered and the new edition of Savary's *Dictionnaire du Commerce* in 1759 used the full text. After its publication by the Academy of Sciences many periodical reviews referred to it.[38] The commercial success of the great Diderot's *Encyclopédie* opened a new market for short dictionaries[39]. They often had an article entitled 'Epingle'. From 1782 to 1791, the great publisher Pankoucke reprinted all the texts describing the arts and crafts trades including that of pin making in 1783[40], and those of the Academy and Diderot's *Encyclopédie*.

[38] *Année Littéraire*, 1761, Tome 5, pp. 344-351. 'Art de l'épinglier par M. de Réaumur'. *Journal des sçavans*, 1761, pp. 745-748. *Histoire de l'Académie Royale des Sciences*, 1761, p. 384. *Journal de Trévoux*, février 1767, pp. 315-317, 'Art de l'épinglier par M. de Réaumur, avec les additions de M. Duhamel'.

[39] La Combe de Prezel*, Dictionnaire du citoyen*. Macquer, *Dictionnaire portatif des arts et métiers*.

[40] Lacombe, *Encyclopédie méthodique*, 'L'art de l'épinglier' pp. 450-478.



Schema 3 The French texts about pin making.

Another dictionary was printed in London during the same period. The article entitled 'Pin' brought new information. The organisation of labour had only six workers in London. 'The number of hands employed in this manufacture is very great, each pin passing though the hand of six

different workmen, between the drawing of the brass wire, and the sticking of the pin in the paper'[41].

Twelve years later another technical dictionary distinguished the articles "Pin" and "Pin-maker". This second article described the production process in London. 'This is an art that requiring very little previous learning. The pin-makers of London keep shop, and some of them carry on a very great trade. The work, for the greater dispatch, is carried on by different hands; one hand being employed in cutting the brass wire into proper lengths for the size of the pins, a second in making the heads, a third in putting them on, and a fourth in pointing them, every one of these work with surprising swiftness. Those masters, who work privately and chiefly for the shops, take five or ten pounds with an apprentice who must work from six to nine. When out of this time, he may earn in those hours twelve or fourteen shillings a week; or with fifty pound may set up master. Those who keep shop take twenty ponds with an apprentice, and employ women in sticking the pins on paper, a sheet of which holds five hundred; these masters employ five hundred pounds and some of them above thousand pounds in trade.'[42]

This text contradicts itself. On the one hand labour was divided between five workers (cutting, making the heads, putting the heads, pointing, and sticking on paper[43]). On the other hand the work was performed by a master and an apprentice. Perhaps, women weren't counted. They stuck the pins on paper and perhaps headed the pins too. There were four or five labourers in a workshop and may have specialized.

Workshop production was 500 pounds of pins per year. According to Adam Smith, 'There are in a pound upwards of four thousand pins of a middling size.'[44] The annual workshop production was two millions pins or 6,667 pins a day[45] that is 1,667 pins a day for the each four workers. If production doubled, the productive power of labour in this workshop of five workers was 2,667 pins a day per person. These figures are very low in comparison to Adam Smith's figure of 4,800.

41 Barrow, *A new and complete Dictionary of arts and sciences*.
42 Mortimer, *A new and complete dictionary of trade*.
43 The process was shorter than the described by the French process. There were only the following operations: 4, 8-9-10 gathered, 11, 4, and 18. The order of the heading (11) and the pointing (4) were inversed.
44 Size X with the Perronet's sizes.
45 Based on 300 days of labour in a year.

The author didn't say at which time these observations were made. In the eighteenth century English pin production was based around Gloucester using the same production process as that used in France. The production described by the author was most probably that of the old process used by the guild of London.

In 1767, Arthur Young visited Mr Champion's copper works and pin making workshop in Warmley, near of Bristol. He saw 'the whole process, from the melting of ore, to making it into pins, pans etc. The liquid ore pouring out the furnace into clay moulds. [...] After being several times melted, it poured into a flat mould of stone, to make it into thin plates, about four feet long and three broad. Those plates are then cut into 17stripes and these again, by particular machine into many more very thin ones, and drawn out to the length of 17 feet, which are again drawn into wire, and done up in bunches of 40 s value each; about 100 of which are made here every week, and each makes 100,000 pins. The wires are cut into them and completed here, employed a great number of girls, who with little machines, worked by their feet, point and head them with great expedition; and each will do a pound and half in a day. The heads are spun by a woman with a wheel, much like a common spinning wheel, and then separated from one another by a man, with another little machine like a pair of sheers [...] All the machines and wheels are set in motion by water; for raising which, there is a prodigious fire engine, which raises, as it is said, 3000 hogshead every minute'[46].

The women made 'a pound and half in a day' of pins, i.e. 6000 common pins. The process was shorter than the one used in Normandy with the only operations being those of cutting, pointing, making the head, and heading (operation 4 to operation 11).

In Gloucester, the pin workshops 'employ near 400 hands of whom a great number are women and children: good hands at pointing and sticking earn from 10 to 12 s and 15 s a week, children of 8, 10 and 11 years old, earn 2d and 3 d a day, but some journeymen do not get more than 7s, 8 and 9s a week; the wages in general are good.'[47]

The last text on pin making prior to that of Adam Smith was an article in the first edition of

[46] Young, *A six weeks tour through the Southern* pp. 184-185.
[47] Young, *A six weeks tour through the Southern* p. 141.

the *Encyclopaedia Britannica* in 1771. 'Pin: in commerce, a little necessary implement made of brass wire, used chiefly by the women in adjusting their dress. The perfection of pins consists in the stiffness of the wire ad its whiteness, in the heads being well turned, and in the fineness of the points. The London pointing and whitening are in most repute, because our pin-makers, in pointing, use two steel-mills, the first of which form the point, and the latter take of all irregularities, and renders it smooth, and as it were polished; and in whitening, they use block-tin granulated: whereas in other countries they are said to use a mixture of tin, lead and quick silver.'[48]

After Adam Smith's book (1776), all the English texts on pin making evoke the division of labour.

IV

Today pin making in the eighteen century is well understood[49]. How does it match with the theory of the division of labour? Adam Smith read four of texts[50] and he developed them to formulate the example of his theory. He was misled by the way operations were enumerated. He believed that labour was divided and the productive power of the pin makers was 4800 pins per day. Is this a good illustration of his theory? Was labour divided in pin making? Why was physical productivity so high? Would the productive power of labour in pin making be increased by the division of labour?

There are two sides to any answer to these questions. First, considering the information available at the time how well could Adam Smith have reasoned? Secondly, with what we know today, how true is the theory of the division of labour? Four arguments are presented for the first question: the daily production of each operation, a three way division of labour, the physiological limit to labour speed, and production without the division of labour.

First, the operative times for the different operations were very badly matched. The eleventh operation (heading) lasted more than the all of the 17 other operations. If the theory is true, it is

[48] *Encyclopaedia britannica* 1771, Reprint 1997, ed. Frank Kafker. London: Routedge &Thoemmes Press. Vol. III p. 479 Article 'Pin'.

[49] Peaucelle, *Adam Smith et la division du travail.*

[50] Peaucelle, 'Adam Smith's use of multiple references', *Journal des sçavans*, 1761, Duhamel, *L'Art de l'épinglier*, Delaire article 'Épingle', *Encyclopédie*, and Macquer, *Dictionnaire portatif*. Ross, *The Life of Adam Smith*, did not mention that Adam Smith visited a French pin making workshop (chapter 13).

possible to accelerate the process by dividing this operation. The French pin makers trialled this change. To head the pins a child was employed to thread the head in the shank. But this was useless[51]. This attempt to divide labour did not increase labour productivity.

Secondly, Adam Smith extracted the following information from Delaire's article (1755): 'So that in the making of a pin there are about 18 persons employed. These in a day will make about 36000 pins, and this comes to the same thing as if each one made about 2000.'[52] From Macquer's *Dictionnaire portatif* (1766) Adam Smith computed that 10 workers would produce 48000 pins per day. And from the Chambers' *Cyclopaedia* (1728) 25 workers cooperated to make pins. Adam Smith then had three cases, at three dates 1728, 1755, and 1766, with three divisions of labour, 25, 18, and 10 workers. The oldest text involved a greater division of labour but it was not the more productive. The daily production with 18 workers was 2000 pins per person, and 4800 pins with 10 workers. These texts are completely contrarily to the theory by which the division of labour would increase the productive power of labour[53].

Thirdly Adam Smith saw the market as the only upper limit to the division of labour. 'The Division of Labour is Limited by the Extent of the Market'[54]. He neglected physiology as another limit. He knew horse racing. An ordinary horse can't run faster than the winner. Animal and human muscles have a maximal speed. Dividing labour will not lead to production increases when these limits have been met. In French pin making, productivity was increased by working on batches of pins.

Fourthly Adam Smith invented a fictitious case to enhance the value of the division of labour. It was not a real case. It evokes the beginning of an apprenticeship. 'A workman not educated to this business (which the division of labour has rendered a distinct trade), nor acquainted with the use of the machinery employed in it (to the invention of which the same division of labour has probably given occasion), could scarce, perhaps, with his utmost industry, make one pin in a day, and

[51] Duhamel, *L'Art de l'épinglier*, p. 34. 'Pour enfiler la tête à moindre frais, il y avoit des fabriques où l'on faisoit enfiler par des enfants ; mais il falloit ajuster les têtes au bout des hanses. On a maintenant trouvé qu'il étoit plus expéditif de faire enfiler & frapper par le même ouvrier'

[52] Adam Smith, *Lectures on Jurisprudence*, Monday, March 28, 1763 (pp. 341-342)

[53] As matter of fact, that information is false. We can't conclude that a lesser division of labour is the more productive.

[54] Adam Smith, *The Wealth of Nations*, Book 1 chapter 3.

certainly could not make twenty'[55]. At the end of the apprenticeship, how many pins did an apprentice make? Adam Smith didn't consider this situation. However, this situation was a standard test at the end of apprenticeship, necessary to become a master ('chef-d'oeuvre') in the ancient pin-maker guild. In France the 'chef-d'oeuvre' 'consists in one thousand of pins which after have been finished must be seen and opened out in the attendance of all the masters to speak their opinions'[56]. How long did it take to produce these thousand pins? Probably a half a day and the test of all the pins lasted the remaining half-day. The productive power of labour would be some 2000 pins per day and per pin-maker working without the division of labour. The difference in production levels between a process where there was a division of labour and a process where labour was not divided was not 240 times but only 2.4 times. This gap can be explained by the length of the process and by the older technology used. In the guilds, the pin-makers drew out the wire several times. They headed the pins with a hammer and not with the heading machine like in Normandy.

Despite the structure of the Delaire's 'pin' article, Adam Smith had sufficient information to reject the theory of the division of labour. Today we know that the theory was false in the case of pin making as we have others arguments that Adam Smith could not have know: the pin makers were not specialized, many different sized workshops existed, and new pin making technology in the nineteenth century decreased the division of labour.

The pin makers weren't specialized in 18 operations although a certain specialisation did exist. First, the merchants were not the workers. Secondly, women worked on two operations only, the heading and the putting onto papers[57]. Thirdly the cutter worked so fast[58] that he worked for several workshops. Fourthly the drawer always repeated the second operation (Adam Smith's first operation) using several holes on the drawplate. For the 13 others operations, no details exist in the original sources to suggest any sort of specialization.

The principal argument is the coexistence of 300 workshops at the same time and with the

[55] Adam Smith, *The Wealth of Nations*, Book 1 Chapter 1. Underlined by us.
[56] Savary, *Dictionnaire Universel de Commerce*, article 'Espinglier'.
[57] Number 11 and 18.
[58] Number 4 and 7. He cut 200 to 500 pins in each motion.

same technology. Some were small with only 3 workers, and others were bigger with 20. The organisation of labour varied according to the size of the workshop. No workshop has a significant advantage over another. The productivity of labour and wages were the same. More divided labour wasn't more productive. The theory of the division of labour does not hold true in Smith's first example, that of pin making.

Adam Smith forgot to describe pin making technology. This technology was illustrated at length in Diderot's *Encyclopédie*. Smith believed that the division of labour led to the invention of new useful tools. For pin making, technology did change in the nineteenth century. An integrated machine was invented for the operations 3 to 11. This machine increased the physical productivity and decreased the division of labour.

Adam Smith had enough information about pin making to refute the idea of production increases through the division of labour. We also today know that the bigger pin making workshops did not hold a competitive advantage. The division of labour did not increase the pin making productivity. From a Popperian perspective, the theory is falsified.

V

The aim of this text was to confront how pins were really made in the eighteenth century with the Adam Smith's theory. No fit is observed. The facts contradict the theory. This result poses a number of problems.

Does the theory hold true in others cases?

Under what conditions would be the theory hold true?

What parts of Adam Smith's reasoning about the division of labour are incorrect?

What facts which Adam Smith evoked still remain true while the theory is incorrect?

Why did Adam Smith reason incorrectly?

Does the theory true if we give another meaning to the division of labour?

What have been the consequences of following a theory which has later been proven

incorrect?

What are the theoretical consequences of rejecting this theory?

Why has almost every reader believed the veracity of this theory?

These results lead to many questions. Their answers and the debates they provoke should provide rich opportunities for future research.

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