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"An Optimal Relationship of Familiarity and Trust": Operating Room Nurses' Material Knowledge of Surgical Instruments (1900–1975)

Mieneke te Hennepe

Abstract

This article investigates the development of nurses' knowledge of surgical instruments in the twentieth century. Material knowledge has been an overlooked area of nursing history. Yet surgical nurses in particular gained a great amount of knowledge about the material qualities, handling, manoeuvring, and arranging of many different types and varieties of surgical instruments. By studying objects, film, handbooks, and the first Dutch journal for surgical nurses, this article focuses on three areas of material "literacy", using the Dutch context as a case study. First, it explores the way nurses had to understand and work with different materials before, during and after operations. Second, it discusses training in dealing with instruments. And third, it considers the explicit need for and discussions around uniformity and standards for surgical instruments, which show the professionalisation of surgical nursing during the 1960s and 1970s. By taking a fresh look at surgical instruments from the nurses' perspective, a new picture emerges, revealing the importance of surgical instruments for nursing history.

Keywords: History of Nursing, Material Culture, Surgical Instruments, Surgical Nursing, 20th Century

1 Introduction

Figure 1: Combination of two skull saws (left), Cornelis Solingen, 1650–1684, inv. no. V08028, collection of Rijksmuseum Boerhaave; and Combination of two probed incision knives (right), Cornelis Solingen, 1650–1684, inv. no. V08061, collection of Rijksmuseum Boerhaave.

How can two seventeenth-century surgical tools shed light on the instrument knowledge of operating room (OR) nurses in the twentieth century? In 1965, Ethicon OP Forum, the first Dutch journal for OR nurses, devoted several pages to a discussion of the history and specifics of surgical instruments made by the surgeon Cornelis Solingen (1641–1687) (see figure 1).[1]

[1] Chirurgie in de 17e eeuw 1965, pp. 3–6.

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This journal first appeared in 1963, and provided a much anticipated focus on OR nurses, who were, according to one nurse, in danger of becoming a "forgotten group".[2]

Ethicon OP Forum: een tijdschrift voor de operatiezuster ran under this title between 1963 and 1989 and its first article with a historical focus appeared in the very first issue.[3] It was published by Ethicon, a company producing surgical sutures and wound closures.[4] The free journal published articles written by surgeons, nurses and head nurses for the surgical nursing community. According to the unknown author of the historical article on the seventeenth-century instruments, the surgical tools had "stood the test of time outstandingly".[5] Details concerning the difficulty of disinfecting the instruments and their manufacture must have made the subject interesting to the target readership of OR nurses.

In this paper, I will argue that for the OR nurse in 1965, the discussion of these old instruments, their manufacture, purpose and usage in the seventeenth century appealed to their own material expertise. What (material) knowledge of surgical instruments did OR nurses gain during the formative period of the profession in the first three quarters of the twentieth century?

This paper investigates how (surgical) nurses developed a deep and increasingly professionalised knowledge of surgical instruments between 1900 and 1975. How did OR nurses in the twentieth century learn and internalise instrument knowledge? And what role do material qualities and the senses play? By looking at surgical instruments from a nursing perspective, this paper argues that material knowledge is a crucial and overlooked part of nursing history. What happens when we take a fresh look at material dimensions and objects?

Instrument knowledge today is part and parcel of nursing education and practices for every operation assistant or scrub nurse.[6] Yet when considering surgical collections in museums, and surgical instruments from a historical perspective, scholars have often primarily focused on surgeons as key figures in instrument development and usage.[7] However, historians of nursing have recently published new perspectives on the history of operation nursing. For the German context, a book on the history of the surgical assistant sheds new light on the history and importance of the figure of the surgical assistant,[8] and Bettina Schmitz provides a detailed description of how the duties and training of German surgical nurses changed in the twentieth

2 "We have been talking and asking around for a long time whether there was no magazine for OR staff. All the more so since this is or will become a 'forgotten group'." Original: "Reeds lang hebben wij gepraat en rondvraag gedaan of er niet een tijdschrift bestaat voor personeel van de OK. Temeer daar dit een 'vergeten groep' is of zou gaan worden." Reacties 1963, p. 2.

3 Wie vond de rubberhandschoen voor operaties uit? 1963.

4 Ethicon also published the bimonthly journal *Ethicon OP Forum* in German (*Ethicon Op-Forum; eine Zeitung für die Op-Schwester* 1961–1995) and French (*Ethicon Op-Forum; journal pour l'infirmière de salle d'opération* [1961]–1969). The Dutch edition of the journal was edited by operating room nurse Zuster A.M. van der Laan from The Hague. She was most likely the author of many of the unsigned articles in the journal.

5 Chirurgie in de 17e eeuw 1965, p. 3: "[…] werktuigen […] die voortreffelijk weerstand hebben weten te bieden aan de tand des tijds".

6 See for example Moutry 2018, and Criscitelli 2022, Chapter 11: Surgical Instrumentation. For the history of surgical instruments in museums see for example: Beretta 2014.

7 See for example the scholarly attention to invention and innovation of surgical instruments: El-Sedfy/Chamberlain 2014. See also Jones 2017.

8 Büttner/Pfütsch 2020.

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century.[9] Much revolves around instrument knowledge. Similarly, Thomas Schlich and Audrey Hasegawa's argument for the gender-specific prominence of cleanliness and ordering has a strong focus on surgical instruments in the US context between the 1870s and 1930s.[10] Yet the instruments themselves have hardly ever taken centre stage.

Despite recent attention to the history of operation nursing, the history of material knowledge for the OR nurse has not yet been studied in much detail. While operation nursing can hardly be defined by instrument knowledge alone, this paper will show why material knowledge is an underestimated yet important part of the practice of operation nursing. As Joan Lynaugh argued in New Directions in the History of Nursing (2005), nursing knowledge may form an important subject for studying the history of nursing.[11] A material focus on instrument knowledge in nursing can provide just that. Furthermore, Karen Nolte and Sabine Schlegelmilch have shown how an object-centred approach to the history of nursing can offer a valuable gateway for understanding nursing practices and the ways in which the uses of particular objects – theoretically conceptualised as "hybrid-objects" – demarcate nursing care from medicine as practised by doctors.[12]

Yet a focus on the practices around surgical instruments may highlight not only the responsibilities and boundaries of care, but also the value and extent of material knowledge. Taking a material culture approach, as recently discussed by Serena Dreyer, rather than using objects to understand their role in the demarcation of nursing practices, I discuss the role of "material literacy" for OR nurses in relation to surgical instruments.[13] While Dyer indicates that there is no unified agreed material culture methodology, I take material literacy here to mean the skills and competences for understanding the material world. The senses also come into play. As Dreyer states: "The sensory landscapes produced by and through objects, and the sensory strategies developed to navigate the material world, proffer rich veins for research."[14]

I will explore how nurses' material knowledge of surgical instruments was understood, disseminated and applied.[15] What skills did nurses acquire to deal with surgical instruments?

Nurses became involved in operations from the second half of the nineteenth century. With surgery and surgical specialisation gaining momentum towards 1900, more complex operations and new instrumentation entered the operating theatre.[16] Nurses in surgical wards took on more and more operation-specific duties, including the sterilisation of sponges, instruments and dressings.[17] By the first decade of the twentieth century, the term "operating room nurse" came into general use in the United States, and in the Netherlands the word "operatiezuster" (operation nurse) appears in new nursing handbooks and other publications.[18] World War II sparked a shortage in nurses and, while nursing at that time was not yet an official

9 Schmitz 2020.
10 Schlich/Hasegawa 2018.
11 Lynaugh 2005.
12 Nolte 2020; Schlegelmilch 2021.
13 Dyer 2021.
14 Dyer 2021, pp. 289–290.
15 Dyer/Wigston Smith 2020.
16 Büttner/Pfütsch 2020, p. 11.
17 Hamlin 2020.
18 Hamlin 2020, p. 21; Laan 1907.

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profession, the term in the Netherlands changed in 1966 from the female "verpleegster" to the gender-neutral term "verpleegkundige". Formal specialisation took place in 1974 in the Dutch context, when the operation assistant was formally recognized as a profession with specific training and a degree.[19]

Tacit and material instrument knowledge became crucial for the professionalisation of the surgical nurse, as this paper demonstrates, using the Netherlands as a case study. Whereas surgeons became more and more specialised in procedures after the 1930s, OR nurses consolidated their understanding and handling of instruments and were trained in their use. They thus formally established themselves as overall specialists in "instrumentation", in other words as experts in the material knowledge of surgical materials and equipment.

The central question this article will explore in the following sections is: What is the specific "material literacy" of an OR nurse and how is it acquired? Before discussing education and training and the practice of handling instruments, we first delve into nurses' understanding of and expertise in the material qualities of instruments and other surgical equipment.

2 The Materially Educated Nurse: Books, Photos, Films

For nurses who regularly assisted in operations, knowledge about the material qualities of instruments was indispensable. This included an understanding of the making, handling, manoeuvring, cleaning and stowing of the surgical materials and instruments. Take the example of catgut, a suture material made of animal intestines, mostly from sheep (see figure 2). Before the introduction of synthetic suture materials, catgut and silk were commonly used as surgical suture and ligature.[20] Surgical nurses had to be able to properly prepare and handle the catgut prior to and during a surgical procedure.

The disinfection of catgut in particular proved an important subject for surgeons, catgut producers and nurses. In his 1907 manual of surgical nursing, orthopaedic surgeon Hendrik Laan explained, for example, how to disinfect catgut.[21] While silk could be boiled in water, catgut could not be boiled as that would cause it to "spoil". Sterile catgut in glass bottles with a lid could be bought from the producer (figure 2). But Laan also explained how nurses should sterilise untreated catgut themselves. Unsterile catgut contained lots of fat and intestinal bacteria. The nurse was supposed to spread out the catgut threads and rub them with green soap to remove the fat. After 12–24 hours the threads could be placed in ether which should be refreshed until no more precipitation was visible. After several days, the catgut could be placed in a bottle with an alcohol solution. This detailed chemical description shows the degree of preparatory work and knowledge behind the sterilisation of only one type of surgical material.

Knowing about the constitution and origins of raw materials mattered for the crucial processes of sterilisation, one of the key responsibilities of the OR nurse. This cleanliness went beyond a common understanding of cleaning. It was a chemically informed, scientific and material understanding of sterilisation. In 1912, news of catgut infected with tetanus demon-

19 Bolks 2017.
20 See for example: Surgical Catgut 1929.
21 Laan 1907, pp. 131–132.

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strated how vital it was to have a proper understanding of suturing materials.[22] In Germany, ministerial orders for new production procedures for catgut were issued to prevent future infections. New labels were added to the products with information about the exact treatments and methods of sterilisation used in the factory, which nurses had to be able to interpret.

Figure 2: A ball of sterilised catgut suture material for surgical use in an alcohol solution. 1925–1950, inv. no. V25082, collection of Rijksmuseum Boerhaave.

As treatment and materials changed over time, nurses had to update their knowledge. In the second edition of Laan's manual for surgical nursing of 1927, changes in dealing with catgut for example were clearly present.[23] World War I had caused a shortage of catgut, and companies offering the material sterilised and ready for hospital use grew as a consequence, resulting in a large supply of sterilised catgut during the interwar period.[24] The Rotterdam company Eerste Nederlandse Snarenfabriek brought sterilised catgut to the Dutch market from 1917 onwards.[25] But even these ampules of catgut had to be treated before they could be used in operations.

Laan describes how nurses should have the sterilised ampules inspected by bacteriologists and also boil them.[26] By 1927, the advice was to treat the raw material extensively for several days with different solutions of iodine benzene, potassium iodide and alcohol.[27] By the 1930s, several brands of catgut were available on the Dutch market. In a 1939 manual for nursing gynaecological patients, nurses were supposed to learn about preparing catgut of different

22 Bereiding van catgut 1912. See also: Richardson 1909.
23 Laan/Klein 1927.
24 Mackenzie 1973.
25 Kupferschmidt 2019.
26 Laan/Klein 1927, pp. 124–125.
27 Laan/Klein 1927, p. 125.

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thicknesses on a surgical trolley prior to an operation.[28] Preparing the material, manoeuvring the trolley and handing over the right size of catgut were all part of the nurse's expertise. After World War II, questions about treating and sterilising catgut continued to be relevant for OR nurses.[29]

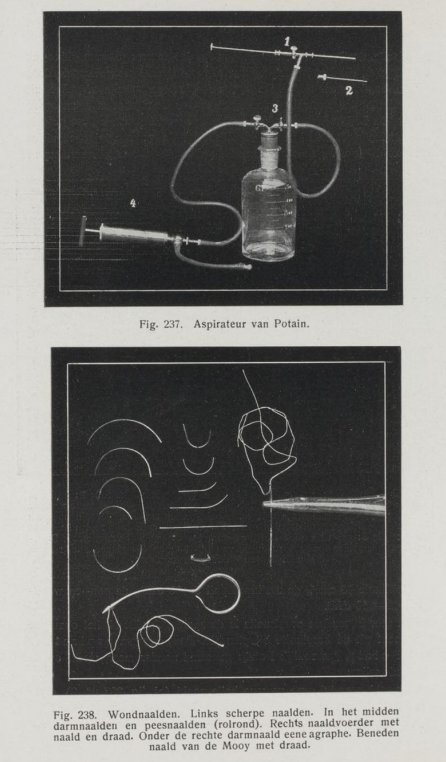

Figure 3: Depiction of instruments in Laan/Klein 1927, p. 238.

For the early twentieth century, sources relating to the actual practices of surgical nurses are scarce. However, handbooks containing instructions on materials and their uses can provide an insight into the proposed handling of surgical materials and instruments. Images and visual instruction matter here. While images in handbooks cannot convey the same knowledge about material aspects of instruments as could be acquired by handling or touching the physical surgical object, they did perform a particular function in providing knowledge about materials. Hence the authors of nursing manuals went to great lengths to make sure that the instruments, for example, were represented in the most detailed way.

For his manual on surgical nursing, Hendrik Laan had photographs of instruments and procedures taken by a professional photographer, Corine Ingelse (1859–1950). Ingelse was a female photographer who was also active in the Dutch Association for Women's Suffrage.[30] Ingelse's photographs in the manual form a particular visual language of surgical instruments. Mostly photographed against a black background or with a black edge around the photographs, the

[28] Dongen 1939, p. 205.
[29] Catgut 1963.
[30] Wachlin 1994.

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scenes are highly staged and orchestrated; the photographs are probably extensively retouched (figure 3). Instruments, for example the wound needles in the lower part of the figure, are neatly arranged and ordered according to type: sharp needles, intestinal needles and tendon needles. The text refers to “straight, slightly and strongly curved” wound needles. Subsequent figures in the handbook show hands demonstrating the handling of needles.

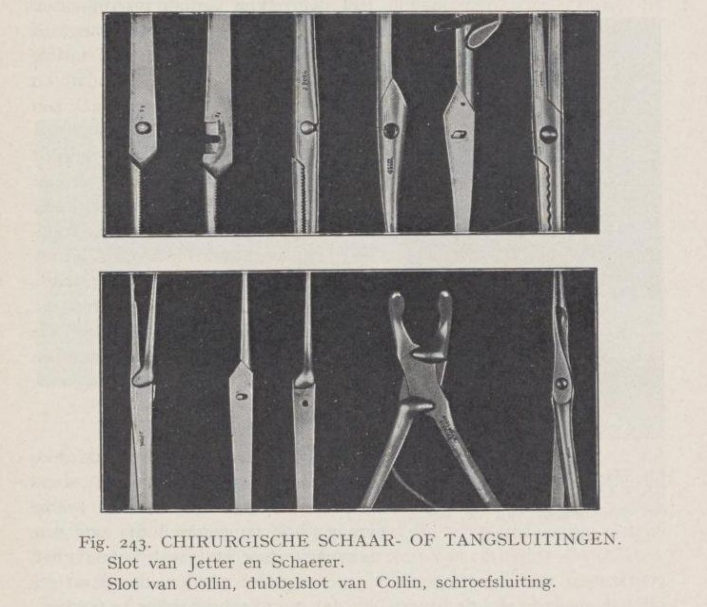
Fig. 243. CHIRURGISCHE SCHAAR- OF TANGSLUITINGEN.
Slot van Jetter en Schaerer.
Slot van Collin, dubbelslot van Collin, schroefsluiting.

Figure 4: Surgical scissor and clamp locks. In: Stumpff 1939, p. 359.

These photographs of arranged instruments and materials mimic the orderliness that the nurses needed to adopt in handling them. As such, the photographs in Laan’s manual can be seen as visual examples to live by. The photographs provide practical examples of handling and caring for surgical instruments, thereby enlarging the nurse's material instrument expertise in a visual manner. Similarly, one image in a 1939 manual shows the different detachable locks of surgical scissors and artery clamps (figure 4).[31]

Knowing about the most common constructions of interlocking parts of surgical instruments enabled nurses to anticipate handling and cleaning them. Nurses had to familiarise themselves with the different types of construction and structure of the instruments in order to dry them properly after cleaning them with soap and rubbing them with denatured alcohol. Photographs of instrument parts played an important role in expanding the material expertise of nurses, helping them to acquire practical knowledge about the structure of instrument parts and the sequence of different tasks.

Films offer another valuable insight into the prescribed practices and material knowledge of surgical nurses. For example, a 1938 British public information film about modern aseptic surgery, features (surgical) nurses handling and cleaning instruments before and during an operation.[32] At minute 3.10 we see a nurse taking a set of surgical scissors from the dust-free

[31] Stumpff 1939, p. 359.
[32] Modern aseptic operating technique 1938.

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cupboard where the instruments are kept, then bundling and counting them. She is shown sterilising the instruments by boiling them, as well as sterilising sharp instruments in Lysol, carbolic and formaldehyde solutions. The nurse takes out each instrument with different clamps to demonstrate it for the camera. Her handling is smooth and contained.

Focussing on the material skills in this film, we discover many more telling examples. At 5.50 we see a nurse preparing the instruments in the operating theatre. She handles sterile forceps to pick up a cloth from a sterilisation drum and spread it out on a table. She then takes sets of instruments (scissors, clamps, etc.) and places them, using forceps in each hand, on the cloth. This manoeuvre requires full control over the forceps. At another point (6.32–6.44) the camera zooms in on a special hook that the nurse uses to pick up multiple instruments at once. We again clearly see the dexterity involved in handling the forceps and hook to manipulate the instruments.

In the following section of the film, the preparation of the ligature table, the intertitles stress the fact that the theatre nurse uses forceps to move the table, because she has not "scrubbed-up" yet (7.31). In the remainder of the film, the nurse is seen handling many objects with either forceps or tweezers, for example a table, a lid from a metal container, swabs (that have to be counted and noted on a board) and bowls. It demonstrates a highly calculated and controlled way of handling and dealing with materials and instruments.

By the late 1960s, disposables proved an important game changer in practices around surgical materials. The increasing availability of disposables reformed the necessary material knowledge for sterilisation of instruments and other surgical equipment. The introduction of disposable gloves meant no more manual or mechanical checking for holes or careful powdering – not too much powder or it could accumulate and reduce the sense of touch for the surgeon, or act as a foreign body in the patient.[33] In the case of disposable needles, shaving knives and catheters, disposables could reduce or improve work processes, provide consistent stability and indefinite shelf life, and ultimately proved to be more cost effective, according to the author of an article in 1968.[34] Not only did nurses, and OR nurses in particular, maintain their knowledge and skills in dealing with a wide range of surgical instruments,[35] they also had to keep up with changes in materials. New materials could imply restructuring or changing workflows in the operating room, as was the case with the arrival of disposables. When disposable paper dresses became available for OR nurses in the 1960s, material knowledge changed as sterilisation was now entrusted to the factory.[36] But how would nurses learn about materials and instruments in the first place?

[33] De operatieafdeling 1968, p. 12.
[34] Het bevorderen van de steriliteit op een afdeling 1968, p. 13.
[35] For a reflection on instrument knowledge see Sandelowski 2000, pp. 35–38.
[36] Papieren zusters 1968, p. 16.

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3 The Skilled Nurse: Instruments

Education and training in the area of surgical instruments has a long history.[37] For nurses in the Netherlands, instrument education became part of the nursing curriculum from at least the early twentieth century.[38] Knowledge of instruments was part of the oral examination for nurses in 1911, organised by Nosokómos, one of the early Dutch associations for nurses.[39] Sterilisation, maintenance and cleaning of surgical instruments were seen as necessary requirements for a proper nursing education. In 1924, a law to safeguard nursing certification in the Netherlands came into effect, although it did not refer to requirements on the contents of the teaching.[40] Most nursing manuals contained a chapter or part of a chapter on instrument knowledge. A 1931 textbook included a separate chapter discussing instrument knowledge, mostly displaying the common instruments, their names and functions, how to keep them sterile, and how to handle them.[41]

Learning how to handle instruments meant practising manual dexterity. For example, early manuals included textual and visual instructions on ways to pass instruments to the surgeon during an operation (figure 5).[42] Handing over an instrument in a safe, timely and correct manner required trained skills and material knowledge on the part of the nurse. What piece is the most important part, how do I hand an instrument over in a ready-to-use state, where is it sharp, and how do I transfer it to the surgeon without compromising sterility? Each instrument could require a different approach, for example handing artery clamps over that are already opened and ready to use, or handing over a pair of scissors with the ring handles facing towards the surgeon.[43] Nurses were also taught to pay attention to the safety of both themselves and the surgeon during hasty transfers of sharp instruments, making sure they knew how to manoeuvre safely in a rushed situation.

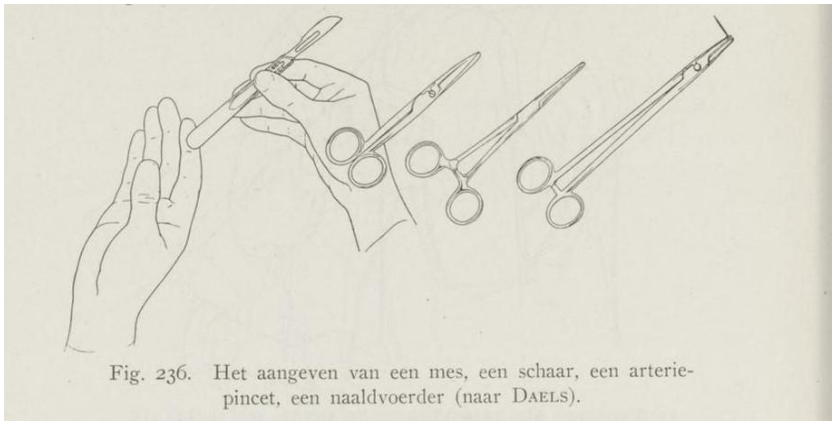
Fig. 236. Het aangeven van een mes, een schaar, een arteriepincet, een naaldvoerder (naar Daels).

Figure 5: Handing over Instruments. In: Van Dongen 1939, p. 234.

[37] Jones 2017.
[38] Dutch name is "instrumentenleer". See for example Centrale Gezondheidsraad 1911, p. 19.
[39] Centrale Gezondheidsraad 1911, p. 71.
[40] Aalberse/Ruijs de Beerenbrouck 1921.
[41] Gezelle Meerburg 1931.
[42] Dongen 1939, p. 230.
[43] Stumpff 1939, p. 360.

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Practice makes perfect, and that also applies to instrument education in nursing. We know at least that surgeons appreciated practically skilled nurses in the operating room. Leiden-based surgeon J.H. Zaaijer for example wrote in 1939 that his popular handbook on surgical nursing was not suitable as a textbook for OR nurses, because "the training to become an operating nurse must take place in the operating room".[44] Surgeons praised the practical experience of OR nurses they worked with. In a testimony on cataract surgery, a Leiden ophthalmologist explained how he nearly always performed a particular operation with the same OR nurse.[45] According to the ophthalmologist, the nurse had acquired a great deal of experience and skill as she was able to squeeze and release an eyelid-holder (figure 6) in such a skilful manner as to regulate pressure on the eye: "She is particularly skilled at squeezing and lifting the eyelid holder to immediately counteract any pressure exerted by the latter on the eyeball."[46]

Figure 6: Eyelid holder, 1925–1950, inv. no. V14279, collection of Rijksmuseum Boerhaave.

This OR nurse knew how to manipulate the instrument, which required a combination of manual dexterity and experience in using the instrument, and the ability to anticipate and react to events during the procedure. The nurse was expected to follow the operation very closely; she had to know in advance what instrument the surgeon was about to ask for, as noted later in the journal *Ethicon OP Forum* in 1964:

> Instrument handling can only be done properly if the nurse can follow the operation closely. She must therefore know what the surgeon is doing [...].

44 Hekman/Zaaijer 1939, Preface: "Men verwachte ook niet, dat dit boek geschikt zal zijn als leerboek voor operatiezusters. De opleiding tot operatiezuster moet in de operatiekamer geschieden; maar bij het verkrijgen van het zoo noodzakelijke begrip voor zich mogelijk voordoende toestanden kan dit boek wellicht helpen."

45 Flieringa 1941.

46 Flieringa 1941, p. 9: "In het bijzonder is zij er op ingesteld door samenknijpen en opheffen van den ooglidhouder een eventueelen druk van dezen op den oogbol onmiddellijk te ondervangen."

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> Actually, the nurse should know in advance which instrument the surgeon will ask for.[47]

A nurse's handling of surgical instruments is often very different from a surgeon's. Nurses hold the instrument at the opposite end to hand it over, and they may have to take instruments apart for sterilisation. Yet I would argue that surgical nurses obtained a wide range of skills in handling instruments, which are as valuable as, and mattered as much as the actual intended use of the instrument during operations. Furthermore, the wide variety of instruments and the material knowledge and experience in using them demanded different manual and intellectual skills than were required by the surgeons who used them. For example, nurses needed to know how to store, organise, clean and manipulate instruments for different surgical procedures. But instrument handling went further than this. Several ophthalmological manuals mention, for example, the importance for nurses of checking the sharpness of instruments prior to operations. They were advised to use a special test drum, which consisted of a very thin membrane of stretched chamois leather fixed inside a ring.[48] To prepare for ophthalmological surgery, the nurse was to test the sharpness of the fine cutting instruments, such as cataract knives and discission needles (see figure 7).[49] To handle the instruments in such a way, the nurse had to mimic the cutting pressure applied by the surgeon: "Fine, cutting instruments, such as cataract blades, lances, discission needles, must slide easily through the membrane without any force having to be applied and without the test drum grinding".[50]

Figure 7: Discission needle, 1925–1950, inv. no. V15909, collection of Rijksmuseum Boerhaave.

From the late 1960s, nurses and doctors started a discussion about the necessity of a legally recognized education for nurses and OR nurses.[51] In the Netherlands, nurses pleaded for a

[47] De operatiezuster als lid van het team 1964, p. 6: "Het instrumenteren kan alléén goed gebeuren als de zuster de operatie op de voet kan volgen. Zij moet dus weten wat de chirurg doet [...]. Eigenlijk moet de zuster van te voren weten om welk instrument de chirurg zal vragen."

[48] Heuven 1936, p. 93.

[49] Discission needles are long needles with two sharp sides. See also: Rompes 1940, p. 452.

[50] "Fijne, snijdende instrumenten, zooals staarmesjes, lansen, discisienaalden moeten, zonder dat er eenige kracht bij behoeft te worden uitgeoefend en zonder dat de probeertrommel daarbij knarst, gemakkelijk door het vliesje heenglijden." Heuven 1936, pp. 93–94.

[51] See also: Büttner/Pfütsch 2020 and Sandelowski 2000, pp. 115–120. For the Dutch context see Binnenkade 1973.

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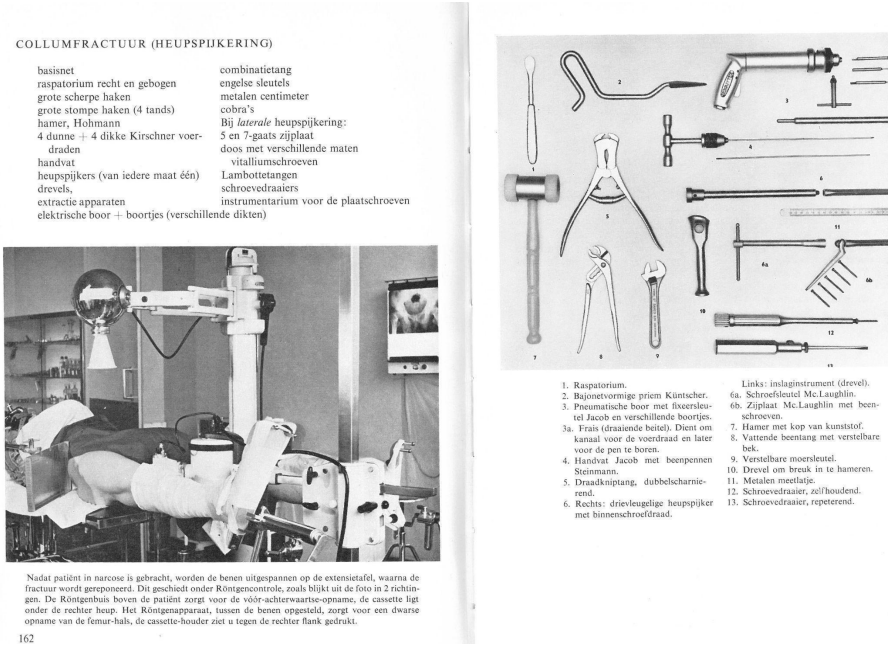
theoretical education in addition to practical training.[52] Instrumentation was still an important part of what had until then been primarily a practical education. But with increasing "mechanisation" and specialisation in surgery, "the days of the cleaning and soaking OR nurse are over".[53] Many OR nurses followed specialised training in orthopaedics, gynaecology or thoracic surgery for example.[54] And with the arrival of more medical staff, including the anaesthetist and the nurse anaesthetist, the division of labour also came under discussion. In a way, specialising in instrumentation for specific types of surgery made the operating nurse an even more integral part of the operating team.

In 1964, the first manual for OR nurses appeared in Dutch. The book, entitled "Instrumentenleer", provided easy orientation for OR nurses regarding surgical instruments, their names and uses.[55] Following sections on the specialisation and standardisation of surgical procedures, the book contains extensive photographic information on different types of instrument sets for any kind of operation common in 1964, including general surgical procedures such as appendectomy, herniotomy, stomach resection, and mastectomy. For urology, it contains specific instruments used for nephrectomy and prostatectomy among others. A similar approach is followed for procedures in orthopaedics and gynaecology. Instruments needed for each procedure are clearly named and displayed in photographs (figure 8). As such, the manual epitomises the continuing highly specialised instrument knowledge that OR nurses had to master.



COLLUMFRACTUUR (HEUPSPIJKERING)

basisnet
raspatorium recht en gebogen
grote scherpe haken
grote stompe haken (4 tands)
hamer, Hohmann
4 dunne + 4 dikke Kirschner voer-draden
handvat
heupspijkers (van iedere maat één)
drevels,
extractie apparaten
elektrische boor + boortjes (verschillende dikten)
combinatietang
engelse sleutels
metalen centimeter
cobra's
Bij *laterale* heupspijkering:
5 en 7-gaats zijplaat
doos met verschillende maten vitalliumschroeven
Lambottetangen
schroevedraaiers
instrumentarium voor de plaatschroeven

Nadat patiënt in narcose is gebracht, worden de benen uitgespannen op de extensietafel, waarna de fractuur wordt gereponeerd. Dit geschiedt onder Röntgencontrole, zoals blijkt uit de foto in 2 richtingen. De Röntgenbuis boven de patiënt zorgt voor de vóór-achterwaartse-opname, de cassette ligt onder de rechter heup. Het Röntgenapparaat, tussen de benen opgesteld, zorgt voor een dwarse opname van de femur-hals, de cassette-houder ziet u tegen de rechter flank gedrukt.

162

1. Raspatorium.
2. Bajonetvormige priem Küntscher.
3. Pneumatische boor met fixeersleutel Jacob en verschillende boortjes.
3a. Frais (draaiende beitel). Dient om kanaal voor de voerdraad en later voor de pen te boren.
4. Handvat Jacob met beenpennen Steinmann.
5. Draadknipkang, dubbelscharnierend.
6. Rechts: drievleugelige heupspijker met binnenschroefdraad.

Links: inslaginstrument (drevel).
6a. Schroefsleutel Mc.Laughlin.
6b. Zijplaat Mc.Laughlin met beenschroeven.
7. Hamer met kop van kunststof.
8. Vattende beentang met verstelbare bek.
9. Verstelbare moersleutel.
10. Drevel om breuk in te hameren.
11. Metalen meetlatje.
12. Schroevedraaier, zelfhoudend.
13. Schroevedraaier, repeterend.

Figure 8: Instruments used in column fracture surgery. In: Laan/Melse 1964, pp. 162–163.

52 Dam 1967.
53 Driel 1969 a, p. 2: "De tijd van de soppende o.k.zuster is voorbij".
54 Driel 1969 b.
55 Laan/Melse 1964.

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4 The Organised Nurse: Uniformity and Standardisation

The practice of working as a team in the operating room implied working together as a well-oiled machine. As one operating nurse put it in 1968: "The team spirit is very important at such a moment. You are working together, en bloc, so you all work together for that one person and everything falls away."[56] This quote comes from a Dutch television programme about an operating nurse. The programme portrays the nurse at work. She explains her motivation to work as a nurse in the operating room. We see images of her preparing for surgery, while she talks about her drive to care for patients, but also her specific interest in the surgical procedures and the variations in instrumentation for a range of different operations.

At one point in the programme, the camera takes the perspective of the patient being wheeled into the operating room. Here we see the nurse preparing the instrument table. She is portrayed in this reportage as the master of her domain; an eloquent, driven professional with lots of experience, who knows her own mind and is able to operate in a team. By the late 1960s, the operating nurse was a specialised team member with instrumentation as one of her main tasks.

Ever since nurses were required to lay out surgical instruments on a table or cloth, an unwritten standard emerged for arranging instruments. In Laan's 1927 manual on surgical nursing, we see an early example of surgical instruments spread out on a sterilised cloth (figure 9).[57] The order of the instruments on the cloth is not explained in the text.

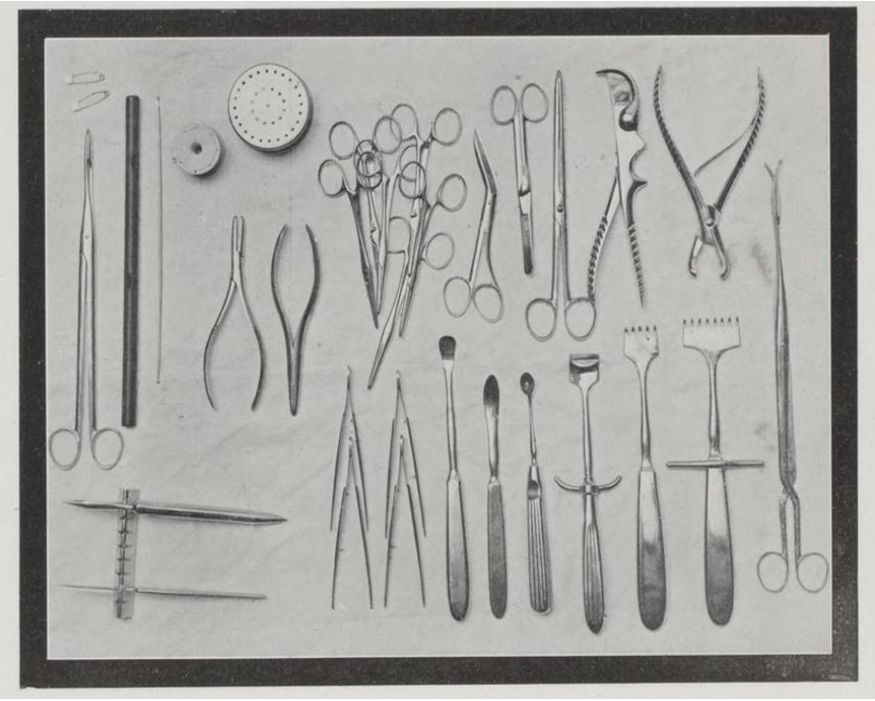

Figure 9: Instruments for rib resection arranged on a sterilised cloth in an early surgical nursing manual. In: Laan/Klein 1927, p. 118.

[56] Pasfoto 1968: "De teamgeest daar komt het op zo'n moment heel erg op aan. Je bent met z'n allen bezig, en bloc, en je werkt dus met z'n allen voor die ene persoon en alles valt alles weg".

[57] Laan/Klein 1927, p. 118.

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However, this way of arranging instruments was clearly functional as well as being aesthetically informed. Instruments are laid out according to their function, yet also in a somewhat symmetrical or visually pleasing order. The space is used as economically as possible. Although we cannot be sure if the depiction in this manual is representative of actual surgical practice, we do see similar arranged sets in other later manuals.[58] In the instrument manual from 1964 by Van der Laan and Melse, the term “basic set” emerges (figure 10).[59] The arrangement of such a set seemed to follow the order of the operation. Like other photographs of instruments, these arrangements may have fed back into surgical practice, with nurses aiming to achieve an arrangement as neat and well organised as in the manual.

A. BASISNET

Het basisnet is de verzameling van instrumenten die voor vrijwel elke operatie noodzakelijk is.
Wellicht ten overvloede wordt hierbij opgemerkt dat voor nagenoeg elke operatie bovendien de daarvoor speciaal aangegeven instrumenten gebruikt worden.

25

Figure 10: Arrangement of a basic set of surgical instruments. In: Laan/Melse 1964, p. 25.

There was no agreed uniform way of presenting and using standard sets of surgical instruments until the emergence of operation nursing as a profession. In the first issue of *Ethicon OP Forum* in the Netherlands, the demand for uniformity in operating practice was already clearly present in an article entitled “More uniformity”.[60] Due to high staff turnover, operating nurses experienced a lot of inconvenience, encountering different working methods in the hospitals and university clinics. By 1974, the call for uniformity had become even louder.

58 See for example Stumpff 1939, p. 99.
59 Laan/Melse 1964, p. 25.
60 Meer uniformiteit 1963.

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Nurses in the Netherlands pleaded for more uniformity after a series of roundtable meetings held throughout the country.[61] It is no coincidence that the same year, the profession of operation assistant was officially recognized in the Netherlands. The training had started in hospitals in 1970, preparing girls and boys from 17 years old to "assist the surgeon and anaesthetist in the operating theatre".[62] Yet, contrary to the American situation, this did not seem to lead to the disappearance of the OR nurse in the Netherlands.[63]

By 1974, a group of OR nurses and assistants were expressing their discontent about one particular aspect of their work. In *Ethicon OP Forum* they wrote that "Many an operating nurse, who can boast of experience, feels insecure when she (he) changes hospitals and, as a result, changes operating theatres."[64] Despite their years of experience, nurses would suddenly feel they were "all thumbs" when it came to dealing with the instruments in a different operating room.[65] Hence a series of photographs of instrument sets for common surgical procedures was published in *Ethicon OP Forum* including a "basic set", a "stomach set", and a "gallbladder set" (figure 11).

This demand for standardisation of instruments can be seen in the context of specialisation in surgery on the one hand, and the professionalisation and emancipation of surgical nurses on the other. OR nurses no longer considered themselves completely subservient to the surgeon. Discussing the issue of collaboration and division of labour on the operating ward in the training of operating nurses, nurse van Driel for example criticised the sometimes short-tempered and difficult behaviour of surgeons, who could behave like a "prima donna".[66] She subsequently refers to a quote about the sign of the times, referring to both the changing status of the specialist and the professionalisation of the nurse:

> This time knowingly tarnishes the professor, who turns out to be an ordinary person with a lot of knowledge about a very limited phenomenon; but also tarnishes the nurse, who turns out to be an ordinary woman with seemingly less of a calling, but with more awareness of collective employment agreements than ever; an ordinary modern worker.[67]

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61 It is difficult to define and research the nature and history of these roundtables. Based on the articles and letters in Ethicon OP Forum, we assume that these discussion meetings were organised by the editor of the journal and/or with Ethicon as a sponsor. During the meetings "specialists tell us something about their profession and we were given the opportunity to have pleasant discussions about all kinds of matters that we as operating nurses have to deal with". Wereldbond voor verplegend personeel 1968, p. 15.

62 Advertentie (Advertisement in *Trouw* newspaper) 1970.

63 Sandelowski 2020, pp. 115–120. National differences in the professional developments surrounding operating room nurses require more study, see also the conclusions section of this paper.

64 Uniformiteit in het gebruik van operatie-instrumentarium 1974, p. 5: "Menig operatie-verpleegkundige, die op ervaring mag bogen, voelt zich onzeker wanneer zij (hij) van ziekenhuis, en daarmee van operatiekamer verandert."

65 Uniformiteit in het gebruik van operatie-instrumentarium 1974, p. 5: "zich opeens voelt alsof zij (hij) beschikt over twee linkerhanden".

66 Driel 1969 b, p. 6: "Door de spanningen tijdens de chirurgische ingreep kan de operateur zich soms kortaangespannen en moeilijk gedragen, als een prima donna en dit schrikt ook de leerling-verpleegkundigen af, die er stage lopen."

67 Driel 1969 b, p. 6: "Deze tijd ontluistert willens en wetens de professor, die blijkt te zijn een gewoon mens met veel kennis van een heel beperkt verschijnsel; maar ontluistert ook de verpleegster, die blijkt te zijn

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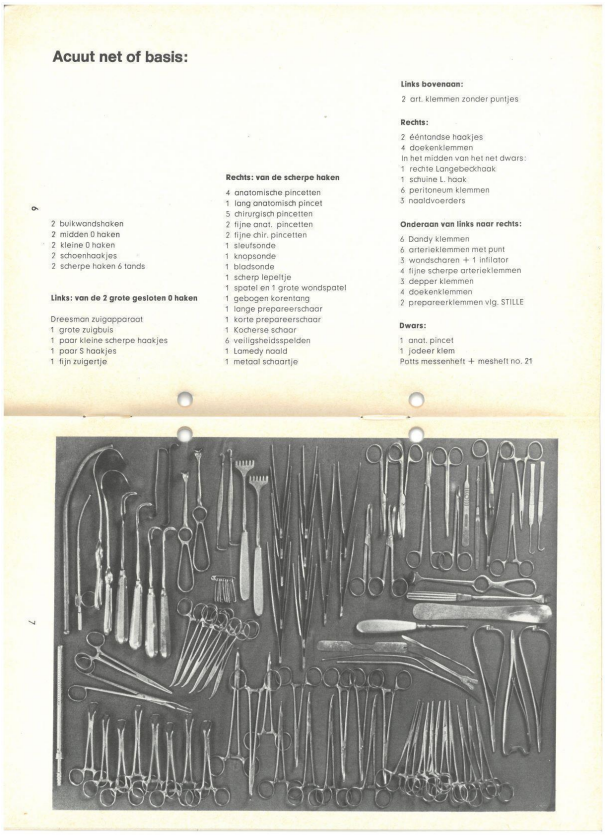

Figure 11: Acute or basic set. In: Uniformiteit in het gebruik van operatie-instrumentarium 1974, pp. 6–7.

In addition to uniform instrument usage, some OR nurses also called for a uniform nomenclature. One OR nurse complained, for example, about the excessive use of nicknames for instruments, such as the Dutch word for "goat's paw" used to refer to a desobstructor in vascular surgery.[68] According to this nurse, uniformity in the composition of the instrument sets should be accompanied by unified nomenclature. Manufacturers' instrument catalogues could serve as a reference for names. Knowing the right names and functions of instruments was a pivotal skill for OR nurses that was already recognized early on in the twentieth century. Handbooks contained pages with drawings and names of all the common instruments used in surgery, as well as explanations of their functions.[69] But the discussion in the 1960s and 1970s marked a new step towards the mastering and professionalisation of material knowledge. The demand for and discussion about uniformity in the nomenclature and composition of instrument sets ties in with the professionalisation of operation nursing in the context of nursing as a science.[70]

een gewone vrouw met schijnbaar minder roeping, maar met meer c.a.o.-bewustzijn dan ooit; een gewone moderne werkneemster."

68 Ook eenheid in naamgeving van operatie-instrumentarium gewenst 1974, p. 18.

69 Dijken 1916, p. 134.

70 Tobbell 2018.

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5 Conclusions

> There should be […] an optimal relationship of familiarity and trust between the OR nurse and the instrument.[71]

In 1974, another article on historical surgical instruments from the collection of Rijksmuseum Boerhaave appeared in *Ethicon OP Forum*.[72] This time, the (unknown) author discussed two decorated eighteenth-century amputation instruments: a saw and a knife. Based on the previous sections of this paper discussing the understanding, education and practices around material instrument knowledge, we may now see why OR nurses would potentially be interested in these old instruments. Notwithstanding the intention of the author, the article did reach a wide audience of OR nurses through the medium of the specialist journal. Remarks about the material qualities of the wooden handle shaped like a falcon's head and the handling of the instrument, and references to the design connected to the world of the OR nurse.

The making and practices resonated with the extensive and detailed material experience and knowledge of the readers themselves. For OR nurses in the 1970s, the relationship between instrument and user was a familiar one. During their training, and following intensive day-to-day handling of the instruments in the operating theatre, these nurses developed a relationship of familiarity and trust with their instruments. They knew with their heads, hands and eyes how to recognize, manipulate, clean, handle, hold and store the materials in an organised, orchestrated, and increasingly standardised manner.

This paper demonstrates how the relationship between nurses and surgical instruments evolved towards professional material knowledge between 1900 and 1975, becoming more and more specialised and part of surgery as teamwork. Unpacking the development leading up to this professional material literacy in the context of surgical instruments in nursing means placing the historical interest in surgical instruments within almost a century of material knowledge development in nursing – handling, cleaning, testing, arranging, recognizing and working with a large variety of instruments and materials. Contrary to Margarete Sandelowski's approach, this understanding, learning and handling material knowledge as suggested conceptually in the term "material literacy" moves beyond instruments as technology.[73]

In this paper I have discussed how instruments can be used in different (intended and unintended) ways by different people in different practices. The focus on these uses in nursing practice highlights other, more practice-based aspects than the role of objects in boundary work.[74] Furthermore, my analysis indicates the differences between the Anglo-American professionalisation developments in surgical nursing in the 1960s and 1970s versus the European, in particular Dutch, context.[75] Further research and study would be needed to unravel the professional history of operating nurses and discuss how these differences may play out.

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71 Ook eenheid in naamgeving van operatie-instrumentarium gewenst 1974, p. 17: "Er dient […] een optimale bekendheids- en vertrouwensrelatie te bestaan tussen o.k.-verpleegkundige en instrument".
72 Een 18e eeuws amputatiemes en -zaag 1974, pp. 12–16.
73 Sandelowski 2000, chapter 2.
74 Nolte 2020; Schlegelmilch 2021.
75 Sandelowski 2000, pp. 115–120: "Requiem for the Instrument Nurse".

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This paper focuses on the evolution of material knowledge of instruments and other surgical equipment. This focus has demonstrated two crucial aspects. Firstly, it demonstrates the very important and so far overlooked aspects of this material knowledge – insofar as they are different from the surgeon's knowledge and handling. And secondly, the paper demonstrates how this knowledge became more and more specialised, discussed and standardised during professionalisation of the operating nurse's role in the 1960s and 1970s. As Rosemary Wall and Christine Hallett discussed, the "significance of the history of nursing for the history of surgery is often underestimated".[76] Insight into material literacy, in particular, may prove a valuable contribution to the history of nursing and surgery alike. Future studies may then involve reconstructions or re-enactments to unpack the practices around instrument knowledge in nursing even further.[77]

Most importantly, this paper may start to provide a much needed historical perspective of instrument knowledge for today's surgical operation assistants. Knowing and learning about the relationship between form and function in surgical instruments, becoming familiar with the names and types, knowing how to manage, prepare and handle instruments, are still crucial tasks for the operation assistant.[78] And even instruments from the seventeenth century may help us understand and appreciate that.

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[76] Wall/Hallet 2017, p. 153.

[77] See the work by Palfreyman and Kneebone on re-enactment as a research method in the history of surgery: Palfreyman/Kneebone 2018.

[78] Weert 2006; Leids Universitair Medisch Centrum 2022.

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