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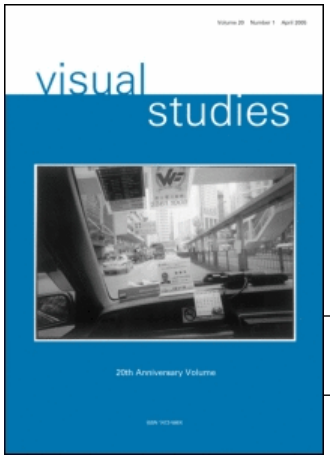

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Working with video: how surgeons produce video records of their actions

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Working with video: how surgeons produce video records of their actions

LORENZA MONDADA

This paper considers video data recorded and used by professionals for the practical purposes of their work. The issues addressed here concern how, in the course of their work, medical practioners deal with the fact that they are filming and being filmed. How they orient toward the video camera and accomplish the ordered character of their work whilst reflexively taking into account the fact that it is being recorded. The fieldwork data comprises a telemedicine project in the domain of surgery. A surgical operation was carried out employing the laparoscopic technique by a team within an operating room, connected by video-conference to an external expert giving advice online, and to an audience of advanced trainees in an auditorium witnessing the operation on a giant screen. This situation involves video materials as a constitutive feature of action. On the one hand, minimally invasive surgery is performed by introducing an optical system into the body, allowing the surgeon to operate by looking at the anatomy on a TV monitor and not directly at the patient's body. On the other hand, broadcasting the operation within a larger public space, beyond the operating theatre, involves also the filming of the surgical procedure. The detailed way in which this surgical procedure is perfomed is reflexively tied to this situation. Surgeons display their attention toward the ways in which their action is being recorded and viewed online by the audience. They accomplish their action in such a way that it is recipient designed, visible and accountable for both the audience and the expert. The analysis of these materials takes into account the way in which the video image is produced and oriented to in work practices.

INTRODUCTION

Laparoscopy, a minimally invasive surgical technique, involves professional vision and technologically mediated images. Surgeons operate on patients not by looking at the patients body but by viewing video monitors where the images produced by an endoscopic camera navigating into the body are displayed. This technique foregrounds the visual skill of the surgeon. It involves worksite-specific ways of seeing and producing new images of the body, characterized by small-scale details, two-dimensional anatomical space and magnified particularities made available by particular optical devices.

A fragment of talk recorded in the operating room gives a vernacular assessment of the changes provoked by this technology (for transcript conventions see Appendix):

Excerpt 1 (TC27028-k1d1 48′10)

1 LE you know / what i what i say always \ it is / . coag .
2 there is not a NEW anatomy by lapascopic approach /
3 but # [. this kind of view/ °montre bien\° was impossible&
4 HE [((small laughter))
im # im. 1
5 LE &to have in a: in a fat patient by open surgery/ . coag
6 HE we are suddenly SEEing things we didn't see before

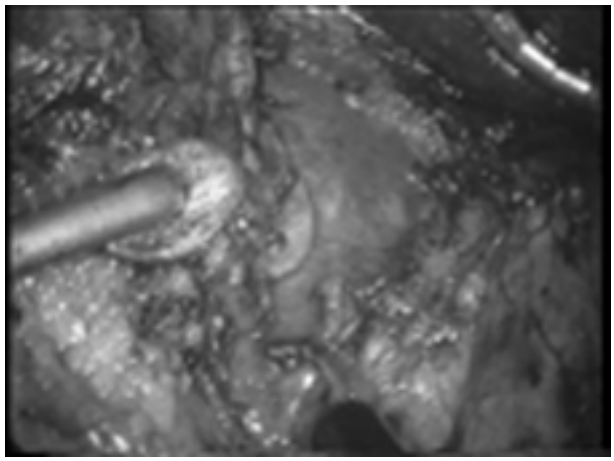

IMAGE 1.

Dr Lelacq, a French surgeon, is operating on a patient, while discussing with an American expert, Dr Herrew, who is remotely observing the operation on a TV monitor. Lelacq makes his statement about laparoscopy while he is coagulating. Coagulation is activated by the assistant, on the basis of Lelacq's verbal instructions ("coag" 1, 5). The general claim about technological change is punctuated by the local work, and it is made in a contingent way at a specific moment of the operation, emerging as a relevant

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formulation from the activity itself. This activity is interactively organized, involving the assistant's tasks to hold the camera and to highlight particular areas for the surgeon's action ("°montre bien°"/"°show well°" 3). The production of the image, its quality and visibility, as well as the general properties of the laparoscopic technique are embedded within work practices. The view referred to by Herrew is attributed to a technological change; this change, however, is locally achieved within the co-ordinated work of Lelacq, his assistant and the technical team accompanying the operation in a control room – thus producing not only a particular way of seeing the anatomy, but also a particular work organization.

In recent years debate has arisen concerning the use of images. Criticisms of the status of the image have co-existed with professional and institutional domains heavily dependent on the trust of images (Jay 1993; Jenks 1995; Latour and Weibel 2002). However, still little has been done in order to observe the very practices by which various professionals actually organize the visual records for their activities, work with the images they produce, eventually trusting or suspecting them.

This paper contributes to two fields of research where visualization, technology, professional talk-in-interaction and work practices are analysed. Firstly, within studies of science and technology, there is an interest in the way in which visualization techniques shape the definition of scientific phenomena (cf. Fyfe and Law 1988; Latour 1986; Lynch and Woolgar 1988). In the study of medicine, these approaches have focused on the technologies and work that shape medical imagery (Boullier 1995; Cartwright 1995; Kemp 1993) including the endoscopic image, its quality and its efficiency (Aanestad et al. 2000, 2001). Secondly, studies of work practices involving technologies that comprise visual mediations have been developed in ethnomethodological workplace studies (Button 1993; Garfinkel 1986; Heath and Luff 2000; Luff et al. 2000b; Lynch 1985a, 1985b), studying the practical circumstances of the local use of objects, artefacts, images, inscriptions and visual technologies. Within this field, surgery is still an underresearched domain (but see Mondada 2001, in press a; Koschmann et al., in press; Pilnick and Hindmarsh 1999).

This paper explores images in surgery as practical accomplishments, the way medical professionals work with video. Our data comprise a corpus of about 24 hours of operations taped in a large French hospital: video recordings of laparoscopic surgery procedures. These video recordings will be exploited here as an interesting locus of observation in order to question the very activity of video production by surgeons (1), and to analyze the various conditions and circumstances of that activity, ranging from the way in which camera is placed and images are selected (2), optics are chosen (3), and finally anatomy is seen and accomplished as a visible phenomenon (4).

VIDEO RECORDING AS A SOCIAL ACCOMPLISHMENT

Increasingly, contemporary workplaces involve the use of technologically recoded images. For example, surveillance cameras in public spaces (Ball 2000), airport control rooms (Goodwin and Goodwin 1996; Suchman 1996), underground station operation rooms (Luff and Heath 2000; Luff et al. 2000a), telecommunications control centres (Hindmarsh and Heath 2000), science laboratories, technologically mediated professional environments (Luff and Heath 1993), or computer-supported virtual spaces (Heath and Hindmarsh 2000).

Medicine is also a workplace (Atkinson 1995; Berg 1997; Hartswood et al. 2000; Hindmarsh and Pilnick, in press) where images are used, produced and exchanged within collaborative activities. Surgery and endoscopic images used in laparoscopic procedures constitute a perspicuous site to study seeing *in* action and seeing *as* action. The work done by the surgeon in order to accomplish intelligible work practices – for instance by establishing a common visual field, taking clear pictures, explaining anatomy, looking for landmarks, arranging the operative field to have an adequate exposure, pointing and describing, choosing the right perspective, optics, or view – presents some peculiarities but also similarities with respect to the practices of glancing, searching, noticing, looking at, identifying, following a trajectory, that characterizes much observational work in other professional settings.

Laparoscopic surgery is a technique that involves introducing an endoscopic camera as well as other surgical instruments inside the patient's abdomen through small incisions and ports, "trocars". The endoscopic image is transmitted to monitors in the operating room. The surgical team operates while looking at these screens. Laparoscopic surgery is an activity in which video recording, the quality of the image, the chosen perspectives, the zooming movements etc. comprise a constitutive dimension of the surgical work.

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In the events we will analyse, a video image is not only transmitted within the operating room but also to a broader audience. In this contemporary version of the ancient anatomical theatre, the operation becomes a locus of experimentation for *tele-expertise* – experts being requested to give advice during the procedure – and for *tele-teaching* – the audience being composed of medical professionals willing to improve their skills in this new technology. In this context, the video image is not only a central dimension of the surgical work, but also a constitutive dimension of a three-fold telemedical event comprising the operation, the demonstration and the expert counselling. The co-ordination of three kinds of participants, the operating team, the audience of advanced trainees and the experts, is made possible thanks to the video transmission of what is happening in the operating room – which functions as a "co-ordination centre" (Suchman 1993).

There is a third sense in which video is constitutive of the production of the intelligibility of what is going on: the event as transmitted to the audience is recorded for archive purposes by the medical institution. Video recording is not just a way of doing surgery; it is also a way of documenting surgery and, for the researcher, of doing his or her inquiry. Video will thus be considered here as a device which configures the very practice it displays and documents, from the multiple perspective of the surgeons and of the researcher.

Video recording actively produces the orderliness of the event it displays and documents. Workers orient to such features in the production of the visual record, accomplishing it in accordance with their practical purposes and in a recipient-designed manner, related to the co-participants, audience and co-workers they are engaged with.

This particular setting is an interesting locus of observation for video and visual activities, in many respects. It invites one to take video recordings and other camera activities as a topic of research (Lomax and Casey 1998; Relieu 1999). Therefore it allows one to develop an analytic stance going beyond the discussions of video as a methodological tool (cf. Heath 1997; Jordan and Henderson 1995), as a source of technical bias or as a way of producing records made transparent for the description of the events they document. It allows the development of, as Macbeth puts it, a "praxeology of seeing with a camera" (1999:151) considering shooting as an embodied exercise of inquiry and analysis (1999:151), as the "work of assembling visible social fields" (1999:152).

Camera movements, technical choices and perspective making are an integral part of the social activities of interest here, embedded in talk-in-interaction and synchronized with it, therefore mutually elaborating each other, and further articulated with other bodily conducts, gestures, object manipulations and the material environment (Goodwin 2000). These activities are constitutive of the production of the visibility, recognizability and intelligibility of the phenomena at hand and contribute to define visual perception as a social and situated action. Seeing as a situated activity (Goodwin and Goodwin 1996), professional visions (Goodwin 1994) and visibility as a social accomplishment are therefore central concerns of this paper.

Thus, it considers the ways in which video data are constituted, in order to gain a particular accountability. Two ways of collecting video data can be distinguished: the video can either be shot by the researcher or recorded by the participants to the action. In the first case, video is produced within the inquiry as situated work. In the second case, video is produced for the practical purposes of the participants, here doing surgery and demonstrating the operation. In both cases, video is not a transparent document but an embodied accomplishment, integrating the recording and the analysis of the recorded event. This allows us to question the availability of the phenomena made visible by the video record: how is this availability locally produced, and by whom? Video embodies ways of seeing that are embedded in the very way it is shot, the procedures by which the records assume an intelligibility. In this praxeology of seeing, seeing is not just a situated activity, it is a professional activity involving a "professional vision", the vision of the surgeon and the vision of the researcher. Thus, the analysis explores the kind of accountability of the surgical procedure which is accomplished through video records: it questions the way in which video recording reflexively produces a specific relevance and intelligibility of action – focusing in this paper exclusively on the views produced by the surgeons (for an analysis of the researcher's views see Mondada, in preparation).

In order to account for this camera work, transcript conventions (listed in the Appendix) of the interactions analysed in this paper choose to figure the camera movements and the screen displays in separate lines. Thus these phenomena are made available for further analysis in their detailed temporal relation both to activity description and to talk transcript.

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SWITCHING BETWEEN THE ENDOSCOPIC AND THE EXTERNAL VIEW

The cameras in the operating room provide two views: an endoscopic view (Image 2) and an external vertical view (Image 3), centred on the patient's abdominal skin. These two views define for all practical purposes the relevant surgical field as a limited space (cf. Mondada, in press a), contrasting with the view the researcher would produce (Image 4).

By privileging the endoscopic view over the external view, the surgical team displays its own way of producing the accountability of its ongoing work, of defining this within the anatomy of the body. However, the exterior part of the body becomes relevant at certain occasions, for example at the beginning of the procedure when trocars are placed, or during the procedure when instruments are changed or cleaned. On these occasions, video image switches from the internal (endoscopic) to the external view, displaying the movements of the surgeons' hands and showing the instruments as well as the location of the trocars where they are inserted. This switch can be made in real time by the technical team working in a control room: this team follows the operation and can either switch from one view to another (full screen) or can inset one view as a small screen, into another. These choices are either tacitly made by the technical staff or are verbally directed by the main surgeon. The changes in the images are a display of the way in which the control room is not merely following but observing, interpreting and anticipating the action carried out in the operating room.

There are moments within the operation that are categorized by the surgeons and by the technical team as demanding an internal or an external view; there are other moments demanding both views, i.e. the display of the relation between the hands' gestures and the handling of the anatomy. This practical categorization embodied in the production of the visual record is made online, locally incorporating the contingencies of the action and the intervening events. These switches of visual perspective are designed for the audience. The medical team operating requires a continuous endoscopic view, but for purposes of demonstration, the audience in the amphitheatre is provided an external view.

In what follows, we analyse some of these switches and the detail of their accomplishment either explicitly (1) or tacitly (2).

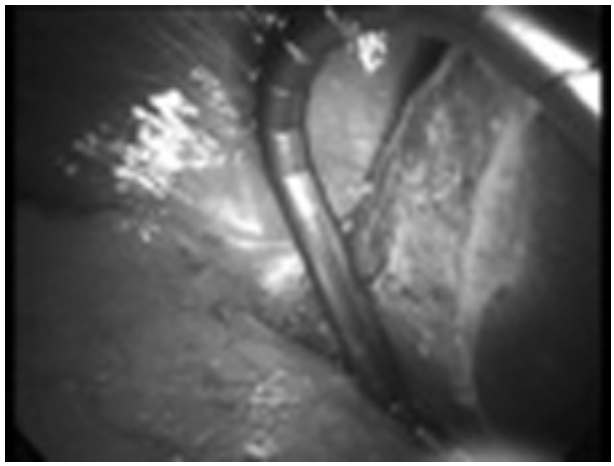

IMAGE 2. Surgeons' internal (endoscopic) view.

IMAGE 3. Surgeons' external view.

IMAGE 4. Researcher's view.

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(1) Explicit Requests to Switch the View

The external view can be explicitely requested by the surgeon in the course of his action:

Excerpt 2 (TC11068)

```
1  DA  SO /   i would like now to have an external view/ .
2          because now  Δ
   scr                  Δ  ext. im.
3          euh   .   we will put the:   .   the banding inside the
4          abdomen \   .   you you have an external view/  okay \
5          tu peux lâcher   .   tu peux lâcher [celle-ci
           you can release   .   you can release   [this one
6  SE                                            [((laughs))
7  DA  so i enlarge/   .   i enlarge/   the the scar/
```

Excerpt 3 (TC11068)

```
1  DA  OKAY/   an external view please/ . .
2          Δ  now/   .   tu peux lâcher\   .   (h)
                         you can release\   .   (h)
   scr     Δ  ext. im.
3          tu mets la   .   tu me donnes la prothèse/
           you put the   .   give me the prosthesis/
4  OR  xxxxx
5  DA  oui mais tu me donnes \   la prothèse est préparée/
           yes but give me \   the prosthesis is ready /
6  (3s)
7  DA  we change the trocar /
```

In these instances the switch is requested in order to make available to the audience a subsequent step in the procedure which takes place outside, on the surface of the body, such as enlarging the scar or changing the trocar. Thus, the request to have an external view anticipates the next appropriate action that this view will make observable-accountable.

Interestingly the expert too, and not just the surgeon, can ask the technical staff to provide for an external view:

Excerpt 4 (p46-855/k2d1 32′43)

```
1  RE  SO /   <trocart de cinq /   bistouri /   ((fast))>
                trocar of five /   scalpel
2          merci   .   montre-moi  ice michelle
           thanks   .   show me here michelle
3  SE  Δ nous pouvons avoir une vue externe   .
         can we have an external view   .
   scr Δ small inset ext . im . - - - >
4          régie /   [ . merci
           control room / [ .   thanks
5  RE              [so as you see i put  .  a trocar number six /  Δ
   scr                                          - - - - - - - >  Δ
```

The request by the expert, Dr Sedaine (3), is sequentially positioned right after the indications given in French by the surgeon to his team, concerning a new trocar and the scalpel (1). These indications project a subsequent action which will take place at the surface of the body (making a new incision to introduce an extra trocar). The overlapping expert's conversational turn and technicians' move (at the beginning of l.3) display their common perspective on the action and the convergent orientation to the relevance of having an external image at that point – just prior to the explanation initiated by the surgeon with "as you see". The availability of the external image makes subsequent references to what is happening at the surface intelligible.

This availability is a major preoccupation of the demonstrating surgeon, as can be seen in the following excerpt:

Excerpt 5 (p18-727/k1d1 57′40)

```
1          Δ Δ  (9s)
   scr     Δ Δ  external image = = = >
2  DA   ★ yo[u see : /
           ★ disposes the band along the grasper; displays the
           grasper across the screen - >
3  A           [jean-daniel / =   #
   im                             # im.  5
4  DA   =yeS / ★
           - - - - > ★
5  A    ★ what is the size of  .  the prothe★sis \
   DA   ★ approaches the gr  .  to his trocar★moves
           the gr  .  away from tr .- - - - >
6  (0,6s)
7  DA   the size of the prothesis /  i think  .  nine point
8          s : even: ★ ty-five \  .★#
           - - - - >  ★ comes again in fr. of the tr.★
   im                              # im.  6
9          ★ hh OKAY/
           ★ moves away again - - >
10         and Now /  i ask to michelle/   ★
                                - - - - - - - - >  ★
11         ★ . . ★  to put  .  the : trocar in the
           ★  puts his hand on M's hand ★ holds M's hand - - >
12         direc ★ tion of the SPLeen \ #  . .  okay / ★
             - - - > ★ orients M's hand - - - - - - - - - -  ★
   im                                          # im.  7
13         . ★ becau:se /  .  while i introduce ★
            ★ takes the grasper again - - - - - ★
14         ★ my prosthesis/  .  euh: i eliminate immediately/
           ★ approaches the gr . with the band to the tr. and - -
15         . the pneumoperitoneum \ . . okay / ★
           - - holds it in fr. of the opening          ★
16         ★ so \  .  look /  perhaps also u- the the both external
           ★ introduces the grasper a little bit - - >
17         view  a-  Δ  okay /  fine / ★
                                - - - - - > ★
   scr                 Δ int.  im.  in the left corner
18         ★ (0.6s)
   DA   ★ introduces the gr.  and the band - - - - >
19 LE   tu les as aux ordres hein les techniciens là
        you have them at your orders eh the technicians there
```

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20 Δ # hein / ((small laughter)) Δ
eh /
scr Δ int. im. : the band brecomes visible Δ
im # im. 8
21 DA very nice / very nice /
22 (8, 6s)
23 SE ° très bien ★ [xxxx °
very well
24 DA ★ [okay / Δ Δ
- - - > ★
scr = = = = > ext. im. Δ Δ int. im. in the corner disappears

In this fragment, Dr Daccard reveals to the audience how to introduce the prosthesis (a nasogastric band) with a grasper into the body. The fragment begins, after a silence, with Dr Daccard initiating a showing move (consisting in "you see" 2 and in the exhibition of the grasper across the screen (Image 5) and, in overlapping, a member of the audience asking for his attention (3). This question suspends the surgeon's gesture, who stops the introduction of the grasper in the trocar and puts it away until the end of his answer. The timing of the answer's turn is configured by its articulation with the gesture, slowing down when the grasper is again approached to the trocar (8; Image 6). The end of the answer is marked by Daccard observably turning back to his demonstration ("hh OKAY/" 9). Here, he doesn't use the grasper, but, again, puts it away in order to exhibit another previous gesture to be made, positioning the hand of Michelle, holding the grasper's trocar, in an appropriate way (10–12; Image 7). This positioning is therefore displayed as a preliminary condition for the correct introduction of the grasper; the grasper is then approached to the fence (14–15) and introduced. This introduction is markedly slowed (16), in order to wait for the combination of the requested internal and external views allowing to display the gesture (18–24; Image 8). This request is formatted within a syntactically unachieved turn-constructional unit (TCU, cf. Schegloff 1996) (17), as the switch occurs before the end of the unit, displaying the convergent orientation of the technical staff to its relevance. The closing of the sequence is marked by the disappearing of the inset image.

Thus, in this fragment, Daccard's turns are finely tuned to the gestures exhibited for the camera, that is not just to the gesture's time but to the gestures' display time. This timing is organized in a way that exhibits the sequential ordering of the different steps composing the procedure. This co-ordination of talk and gesture-for-the camera, of the surgeon's action organization and the technicians' video display, is a feature recognized and oriented to by members, as shown by the evaluations done by both experts

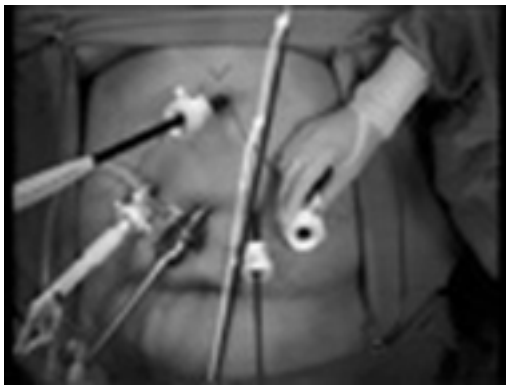

IMAGE 5.

IMAGE 6.

IMAGE 7.

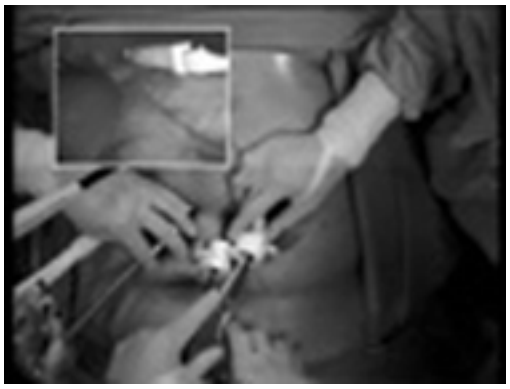

IMAGE 8.

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witnessing the operation, Dr Lelacq (19) and Dr Sedaine (23) and by Daccard himself (21).

(2) Mixing Images as the Display of the Technician's Interpretation of the Next Relevant Action

Images can switch even without explicit requests by the surgeons. In this case they materialize the attention of the technical team watching and anticipating what happens in the operating room.

Excerpt 6 (p54-189/k2d1 57′40)

```
1        Δ Δ (7s)
   scr   Δ Δ int. im. - - >
2  RE    sorry for the fat / so ONE device / . hold (it) the fat SO/
3        and put it to the left side to the pa ΔΔtient / ** . .
   scr                    - - - - - - - - - - >     Δ Δ ext. im. - - >
                                                        ** gives the
                                                          instr. to the ass.#
                                                                  im. 9#
   im
4        one device hold the stomach / . and hold
5        the the fat so /  Δ . so /
   scr                    Δ inset int. im.
6        ** °ouais comme ça° . °comme ça\° . h and with my last device/ .
            ° yeah like that° . °like that\°
         ** gives the instr. to the ass.
7        i try to expo: #se . my . gastro . oesophageal
   im                  # im.
8        junction \ . oui . celui-là quelque-part . oui oké /
                    yes . this on somewhere . yes okay /
9        . tu peux tenir  Δ ceci comme cela michelle /#
         . can you hold  Δ this like that michelle /
   im                                                  # im. 11
   scr                    Δ inset int. im. disappears
10       ** . . so now i am going to try to go through . i am
         ** gives the instr. to the ass.
11       here / . ** okay / . are you agree with that . claude /
   scr     - - - > ** . . int. im. - >
12 SE    euh:  [yes
13 RE          [so it in the: . just in the landmark /
14       (2s)
15 SE    very good Δ Δ
   scr       - - - >Δ Δ
```

In this excerpt, Dr Revmeer is explaining how to hold the folds of fat which repeatedly invade the operating field. Changes of screen display are neither topicalized nor requested by Revmeer, but are tacitly provided by the control room. The sequence begins with a first element recognizable as an element of a list, by the prosody and by the numeral, thus projecting more analogue entities to come. This first element makes reference to an instrument and to its manipulation and localization; the external view provided at this moment (3; Image 9) shows that this list beginning is oriented to by the control room as making relevant what happens on the surface of the body. The external image makes available the view of the first instrument going from the hand of the surgeon, who positions it, to the hands of the assistant, who holds it (Image 9). A similar move is repeated l.4 with another instrument, described with some indexical expressions ("so" 5, "comme ça" 6) whose interpretation requires visual access to both the external and the internal operating field (Image 10). The third instrument of the list (l.5) refocuses the attention on the external view and the instructions to the assistant (9; Image 11). Thus, switching between views or mixing them serves as a way of making the landmarks and other reference points visible-intelligible-recognizible, i.e. a way of securing the indexical reference – thus accomplishing the mutual intelligibility between talk and image (cf. Mondada, in press b).

The inset image appears at 1.5, making the indexicals understandable. The images display here a double relationship, between the hand movements and anatomical exposure inside the body; and the co-ordination between various hands orchestrated by the main surgeon. Therefore it seems that some activities require both an internal and an external view, in order to make understandable the co-ordination between hand gestures (external view) and instrument movements (internal view). The display and mixing of images by the control room reveals the anticipating interpretation of the next relevant surgical action by the technicians.

DISCUSSING THE OPTICS: THE ACCOMPLISHMENT OF THE (VISUAL) CONDITIONS FOR OPERATING

Choosing the Optics

Routinely, the optical system and the lenses used by the surgeon are made explicit at the beginning of the procedure, and questions about the optics are asked either by the experts or by the audience. Arguing in favour of an optical system does not just exploit verbal resources, as the following excerpt shows:

Excerpt 7 (p7-262/k1d1 16′56)

```
1  LE  jean-daniel what is your optic/
2  DA  sor- . sorry/
3  LE  your OPtic/ is euh thirty   [euh: degree optic/]
4  DA                              [yes it is a thirty degr]ee
5      optical system yes
6  LE  and why do you take immmediately euh: a thirty
7      degree optic/
```

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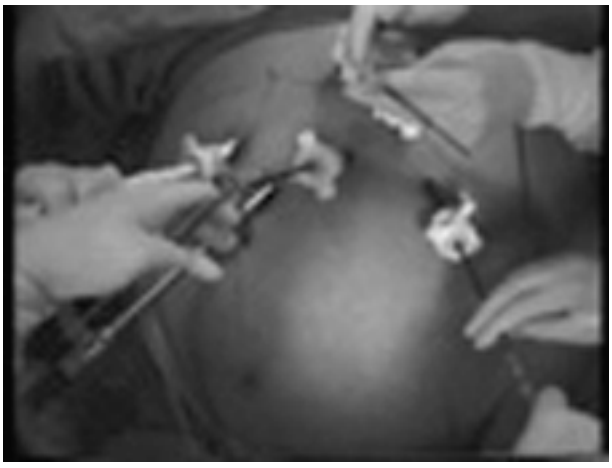

IMAGE 9.

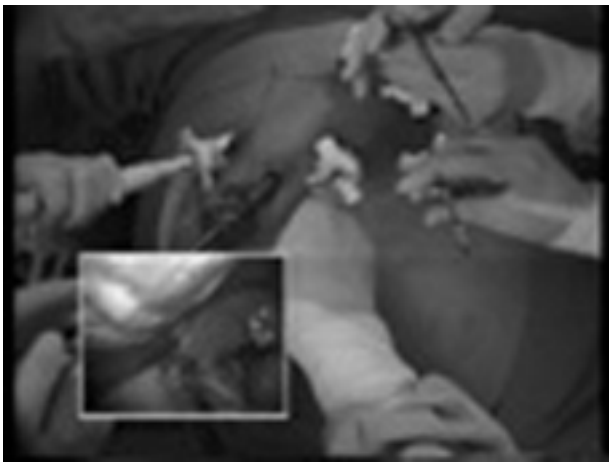

IMAGE 10.

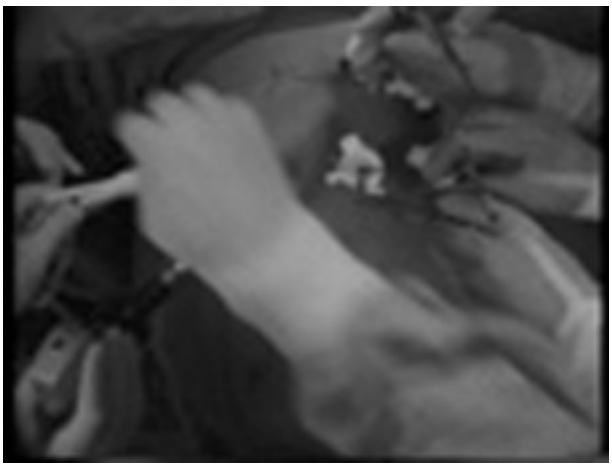

IMAGE 11.

8 DA okay i- i show you\ [because ©i have to # to&
cam ©zooms - - - - - - - >
im # im. 12
9 LE [okay
10 DA & see this© here / . this© is this is the direct view o#kay /
cam - - >© zooms qckly bck© zooms slowly - - >
im #im. 13
11 LE yeah
12 DA and now ©look/ . thanks to the . thirty degree
cam - - - >©camera stops - - - >
13 optical sys©tem/ i can . show you the left si#de
cam - - - - >©zooms further - - >
im #im. 14
14 of ©the oesophagus©
cam - >©zooms back - - - ©
15 LE mhm mhm
16 DA okay /
17 (4s)

The fragment begins with a question from one of the experts, Dr Lelacq. Dr Daccard initiates the repair of the question (2) and Lelacq achieves it by changing its formulation, going from an open question (1) to a yes-no question, prefaced by the dislocated topic (3). Daccard offers a confirming answer in overlapping, choosing a more complete and formal formulation than his colleague (4–5). A second question is then asked by Lelacq, focusing no more on the "what" but on the "why" (6). This question sounds like a potential critique, the adverb "immediately" suggesting a contrast with an alternative decision (taking this optic "later"). The answer is not just verbally designed, but, prefaced by "okay i- i show you\" (8), it is further organized by the zooming movements to which the format of the turns are adjusted. Two formulations of the response are given, the second repairing the first. The first one is given, just after the connective "because" (8), with a zoom in (Image 12), which gives the sense of the indexical "here" (in "i have to see here/" 8, 10). For the second, the repair is initiated by the fast zoom back to the initial camera position (10), in order to organize the contrast between this initial view ("this is this is the direct view okay/" 10– Image 13 – whose formulation is delayed in order to wait for the camera movement), ratified by Lelacq, and another view, obtained by zooming, on the "left side of the oesophagus" (13–14; Image 14). The contrast is further strengthened by the stop of the camera (12), during the insertion of the mention of the technical specifications of the optic ("look/ . thanks to the . thirty degree optical system" 12), before the zoom shows the critical area of

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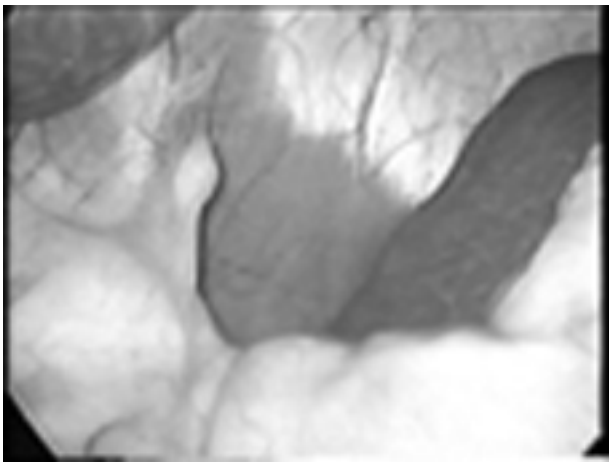

IMAGE 12.

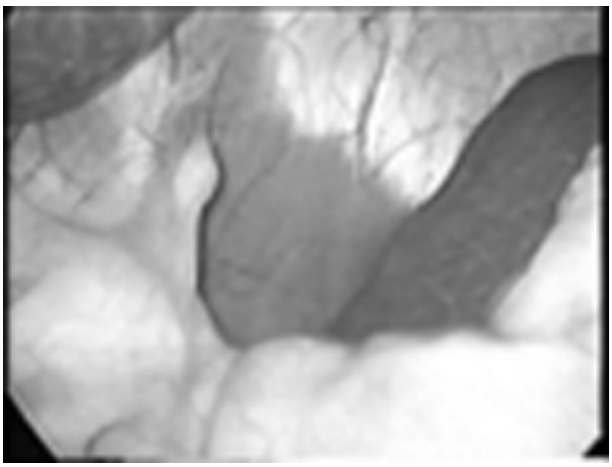

IMAGE 13.

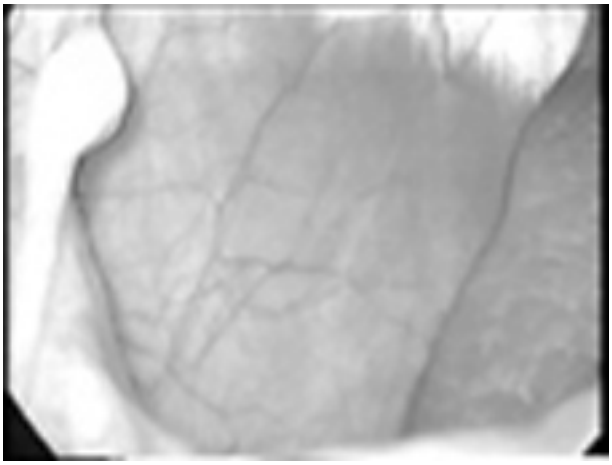

IMAGE 14.

the oesophagus. The answer is here formatted in relationship with the camera movements; it is indeed demonstrated by these movements.

Manoeuvering the Optics

In the laparoscopic approach, the assistant holds the camera and the surgeon holds the dissecting instruments or the grasping forceps. That means that the operation rests on a necessary co-ordination between the work of the surgeon and the way in which the camera makes available the operating field. This co-ordination can be accomplished either silently or by instructions. In the first case, the assistant not only follows the trajectory of the ongoing action, but also anticipates it, in order to accompany and prepare the movements of the surgeon. In the second case, the surgeon gives some indications about the position and localization of the camera, in a more or less precise way, mostly with localizations such as "get close", "get deeper", "avance", "approche", but also with surgeon-centred indications such as "montre-moi" ("show me") or with screen-oriented indications such as "in the middle of the screen". It has to be noticed that most of these indications are highly indexical, the target being very rarely explicitely stated.

Operating the camera is a valued skill, that can be commented on, complimented or criticized. This work can be analyzed in a complex instance where these issues are problematized:

Excerpt 8 (p46-866/k2d1 34')

1 RE ©SO© . now we try to have a better exposure\ .
cam ©camera moves©
2 <zoom avant \ zoom avant\ zoom avant\
*<zoom in \ zoom in \ zoom in *
3 © zoom avant\ ((faster)) > ©
*zooms in *
cam ©zooms in - - - - - - - - - - - - - - - ©
4 (4s)
5 LE c'est michelle qui tient la caméra /
is michelle holding the camera /
6 X non c' [est
no it' [s
7 MI [oui ((laughs))
[yes
8 DA? [(non)
[no
9 LE hein/
what/
10 MI oui oui
yes yes

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11 LE eh ben arrête de bouger alors hein/ ((laughs slightly))
eh well stop moving then eh /
12 ((laughs in the operating room))
13 RE oui tiens ceci (3s) crochet/ (4s) ouais mais une seconde
yes take this (3s) hook/ (4s) yes but just a second
14 je vais d'abord (mettre)
i will first (put)
15 (4s)
16 RE so \ . zoom avant / ou ©i : \ (2s) o ©kay
zoom in / ye ©*s : *
cam ©zooms - - - - - - - ©
17 OR xxxxxx
18 RE ouais tu peux m'montrer /
yeah can you show me /
19 OR ° (ouais) ° /
° (yeah °)
20 RE tu p©eux montrer \ © * ° o:kay ° so here is my landmark/
c©an you show \ ©
*begins to dissect - - - >
cam ©centres the area where the hook is©
21 . sorry there is euh . some blood / . coming from
22 the: / . the liver
23 (7s)
24 SE i think in such case / . the use of a thirty degree
25 angle optics / is VERY very useful \
26 (2s) *
RE - - - > *

This fragment reveals something of the working relationship between the camera operator and the surgeon. In this phase of the operation, Dr Revmeer encounters some problems continuing his dissection in an operative field constantly invaded by folds of fat, disturbing his work.

The camera movements at the beginning of the sequence (1–3) are thematized by the expert, Dr Lelacq, guessing who holds the camera (5). His question provokes different answers (6–10) but Lelacq takes it as a confirmation of his first identification of the camera holder, and thus addresses her directly with an instruction. An external expert commenting on the management of the ordinary optical affairs of the operating room is quite rare in our corpus and it is accompanied by laughter in the operating room. It suggests the possibility that camera movements can be directed from outside the operating room, external participants can monitor what is happening on their screens and trust that what they are seeing, facilitating a "reciprocity of perspectives", for all practical purposes, with the operating team (Mondada, in press a). Later in the fragment, the zooming work as a condition for the dissecting work is displayed in the way in which Dr Revmeer verbally directs the camera ("zoom avant/ oui:\ (2s) okay" 16, "tu peux m'montrer/ tu peux montrer\ °o:kay°" 18–20), by lengthening his turns until the movement is adequate, stopping it with "okay", and by the moment in which he begins the dissection ("°o:kay°" 20), exhibiting it as the adequate moment to start. These movements are again commented upon by the expert, showing his orientation to the camera work being done, and to the choice of optics.

Contrary to occurrences of video shooting and recording analysed by Luff et al. (2000a), the video manipulation does not depend here only on one person, but is a collaborative matter. The surgeon manipulates the endoscopic camera only at particular moments – for example when demonstrating some point of anatomy or when choosing the main view for the subsequent action – and most of the time the camera is manipulated by an assistant. That means that camera movements and dissecting movements are distributed among different participants and have to be finely co-ordinated: this co-ordination depends for one part on explicit commands given by the surgeon but also, more importantly, on the capacity of the assistant to not just *follow* but *anticipate* the movements of the surgeon. But like the case analysed by Luff et al., the partners have to co-ordinate their descriptions of what they are looking at in common (2000a:216) – these descriptions being short and highly indexical.

Moreover, the team is engaged in a double production of the adequate views: on the one side, a relevant next image is sought in order to perform the sequential course of the actions composing the surgical procedure; on the other side, an image is sought that not only allows the next relevant action but also produces an intelligible on-line record for the witnessing audience, for learning purposes.

LOOKING AT THE ANATOMY: THE ACCOMPLISHMENT OF VISIBILITY AS AN INTERACTIVE LOCAL PHENOMENON

To identify particular objects within the patient's anatomy, to distinguish critical features in the body space, to focus on the relevant phenomena in order to undertake the next appropriate action is a permanent activity of the surgical team. Fatty tissues can encumber the operative field, the quality of image can be blurred or moved for many reasons, a haemorrhage can obscure the visual field, other unforseen events can intrude into the visual field and perturb the course of action. Thus, to locate an adequate landmark for the procedure, to recognize this landmark at a glance, to identify the relevant anatomical textures is a matter of specific skill, experience and practice that constitutes

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the surgeon's professional vision. These skills can be presupposed, recognized or considered absent and these expectations shape the way in which reference (by gesture as well as by talk) is recipient-designed.

Through describing, zooming and pointing procedures participants exploit a diversity of semiotic resources (talk-in-interaction, camera movements, instrument movements, features of the anatomical environment etc.) to mutually elaborate peculiar details of the anatomical space as being relevant for the ongoing work. The video-mediated environment is therefore configured by reference activities accomplished by this multiplicity of resources, both verbal and non-verbal.

As Luff et al. (2000a), Hindmarsh and Heath (2000) and Goodwin (in press) have pointed out, these activities of noticing, pointing to, looking at, seeing something and observing a detail are not taken-for-granted but involve intense interactive work from the participants.

In the laparoscopic procedure observed here, these practices both share some similarities with other activities and are achieved in a peculiar way. So, for instance, pointing is done in a mediated space, not using a pointed finger but some instrument (typically the hook), in the course of other activities (such as dissecting, for example), in an unstable environment (such as a blurred or unknown anatomy); pointing something out to the assistant does not take the same form as pointing for the audience. Noticing and making someone notice something is done by orienting not only to the kind of practical geography dealt with, and to the relevances of the ongoing action, but also to the partners engaged in a viewing activity in order to collaborate with the surgeon (within his team or within the expert group) or to follow the procedure (within the audience). Therefore members orient to the production of adequate records for both activities going on, that is, operating and demonstrating. The main surgeon shows to the audience some anatomic details, instructing his vision. In order to show them, and to see himself the relevant landmarks for the operation, he has to ask his assistant to show him relevant portions of the anatomy, thus relying not only on his professional vision but also on that of the the assistant. This complex intertwining of interacting perspectives is the condition for achieving the visibility of the phenomena at hand.

In what follows we will analyse instances of both aspects.

"You See": Showing Within the Demonstration

When the chief surgeon shows the relevant landmarks for the procedure, he orients to the readibility of the anatomical space for the audience:

Excerpt 9 (TC27028/k1)

```
1        (2, 5s)
2  LE    o:ké and you see that the gland / everything
3        is [open / . like . crocket / . like a book
                                  hook /
4  HE      [°beautiful°
5        (5s)
```

The book metaphor expresses the ideal of the dissection, which is to achieve the maximal discernibility of the organs and landmarks by isolating and extracting them from the space blurred by fat, adhesions or blood. The book metaphor is a local gloss for the exposure work done by the surgeon, producing order and visibility, as a condition of further interventions on the pathology (cf. Hirschauer 1991:301; cf. also Lynch 1988 on the procedures of the "exteriorized retina"). Here Lelacq accounts for his dissection in a very similar way, which is acknowledged by the expert's overlapping assessment (4).

More generally, the turn format of such pointings to the anatomy consists of the reference to the seeing activity of the audience ("you see"), the naming of the landmark, normally with a definite description, and the management of transition points allowing a ratification of the recipient:

Excerpt 10 (TC11068/k1d1)

```
1  DA  you see/ the node euh ((points))
2  SE  hé
```

Excerpt 11 (TC11068/k1d1)

```
1  DA  okay i would like to show you the laryngeal nerve .
2      here . you see here / you see /
3  SE  mhm
```

Excerpt 12 (TC27038)

```
1  IH  Δ so what you see now is (1s) the posterior aspect
   scr Δ ext. im. - - - - - >
2      or the posterior white shiny . rectus sheet i'll
3      show you . again/ hh (2s) Δ you see it /
   scr                 - - - - - - > Δ int. im.
4  EX  yes [we can
5  IH        [there's the posterior Δ okay\
   scr          - - - - - - - - - - - > Δ ext. im. - - - - >
6  EX  ° is everyone happy with that \ °
7      (3s)
8  EX  that was very nicely demonstrated Δ
   scr                          - - - - - - - - > Δ
```

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In these fragments, the surgeon's turns are designed in a way that orients to an expected response from the expert, as a representative of the recipients in the amphitheatre. This response goes from a minimal token (Excerpts 10 and 11) to an assessment of the view produced (Excerpt 12). If the ratification does not occur, the turn is further developed, with pauses offering transition points and with post-completion additions, until an answer comes (Excerpt 11 "here . you see here/ you see/" 2). In Excerpt 12 the expert addresses further the audience, managing the very possibility for participants to ask questions at that moment.

"Montre-moi": Looking and Showing as a Collaborative Matter

Showing, pointing, making the audience notice some relevant phenomena is one procedure among others for constituting the demonstration. This procedure is accomplished by the main surgeon in a collaborative action with his assistant, who manipulates the camera and makes it possible to show the details the audience has to notice. This collaborative work between the surgeon and the assistant is not limited to the organization of the visibility of the surgical field for the audience; it is a constituting element of the surgical operation itself. The next excerpt makes observable the way in which the surgeon's demonstration for the audience and the assistant's manipulation of the camera for the surgeon are finely intertwined:

Excerpt 13 (p23-924/k1d2 15'20)

1 DA Δ so i i will open/ . Δ . the leicester
scr Δ ext. im.- - - - - - - - - - - - Δ int. im. - - - >
2 © . . ° omentum ° ° ((whistles)) °
cam ©moves right and left of the band - - >
3 ⋆ (3s) © (5s) © ⋆
⋆ holds the omentum with two pliers ⋆
cam - - >©zooms and stays close to the pliers©
4 DA ⋆ mhm⋆ (3s) Δ from the lower part he:re/ Δ ⋆
⋆ introd. the scissors⋆ ⋆ dissects - - >
scr - - - > Δ ext. im. - - - - - - - - - - - - - - - - - Δ
5 (8s)
6 until i reach /
7 (1, 5s)
8 the extragastric nerve \ . . (h) ⋆ okay /
- - - - - - - - - >⋆
9 (4,5s)
10 DA °and to the lower part/ ° . ° °montre-moi marc / ° °
° °*show me marc*/ ° °
11 © . © ° until i reach the . crowfoot here \ °
cam ©zooms back and focus on the lower part©
12 ⋆ (7s)⋆
DA ⋆ dissects⋆
13 DA okay\ ⋆[1] . ⋆ [2]now / . you can see
⋆[1]scissors disappear ⋆[2]pliers enter
14 ⋆ . . here / . the ©pancrea©tic tail / . you see /
⋆ holds the channel with the pliers
cam ©centers©
15 ° tiens comme ça michelle \ ° . you see
hold like that
16 here / ⋆ the pancreatic tail / ⋆ . .
⋆ reenters α. shows with the scissors ⋆
17 you see here \ ⋆ . ©the r:ight cro⋆ss ©
⋆ points w. scissors ⋆
cam ©moves slightly to the left©
18 © . . ⋆ . okay / ⋆ ©
⋆ points- ⋆
cam©moves and centres©
19 OR mhm
20 SE very well
21 DA and ⋆ you see here / . ⋆ the left gastric artery \
⋆ points ⋆
©. α : nd / © .
cam ©zooms in and out©
22 °un peu plus loin \ . m:arc / avant de plonger
°*slightly further* \ . *m:arc / before digging*
23 ©mets-toi un peu plus loin°©
stay α bit further°
cam ©zooms out - - - - - - - - - - - - - - - - -©
24 . . and you see that ⋆ .© i'm in the leicester sack \ © . ⋆
⋆ holds the tunnel - - - - - - - - - - - - - - - ⋆
cam ©zooms into the tunnel - - - - - ©

Dr Daccard proceeds successively to a dissection and to a demonstration of the anatomy. Both activities require camera movements and video images that are locally produced in interaction, for different purposes and in different ways.

The sequence begins with "i will open" (1), an account in the future tense which projects the next action to be done and its description as it is done, expressed in one single complex sentence (1–11). The sequential organization of this sentence is shaped by the surgical action with which it is synchronized, the timing and pace of the mention of different locations depends on

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the progression of the scissor's dissection actually reaching these landmarks. The priority of the surgical action is manifested through the silences and the low voice, exhibiting the surgeon's focus of attention concentrated on the operation. The camera work follows the scissor's action: at the beginning (1) it encounters some problems with the white nasogastric band crossing the field of vision and obstructing the surgical field by absorbing most of the light; then it zooms to the latter (3). The external view provided l.4 makes observable the change of instrument (the pliers being replaced by the scissors) and disappears when the description uses a deictic reference ("here" 4). The first part of the dissection is made with a stable view from the endoscopic camera on the omentum; the second part implies a camera movement to the "lower part" (10) which is explicitly requested by Daccard ("montre-moi marc"/"show me marc" 10) to his assistant. Once the camera is centred again, it remains stable – as for the first upper part. Thus camera movements are minimized: once the adequate view is reached it is maintained.

At the end of the dissection, "okay" (12) makes accountable the switch to another activity, demonstrating the anatomy: the dissecting instrument disappears and the pliers are used in order to make the space visible; the instruments' movements are made in order to make the description intelligible, namely to display the relevant locations indexed by "here" (14, 16, 17). The main activity is here a pointing activity for the audience, organized by the unfolding talk in the foreground and by the exhibition of the relevant landmarks by the pliers. Turn organization is finely co-ordinated with pointing and exhibiting gestures. Daccard's orientation to this co-ordination is observable in the repair of the first descriptive version (14) which is restarted (16) after having secured a good exposure (by manoeuvring the pliers, which are then given to Michelle, this allowing Daccard to take again his scissors, now used for pointing and not for dissecting). This second version is co-ordinated with pointing gestures absent in the first one. Camera work is now organized according to different relevances: it first centres on the opening Daccard makes to show the pancreatic tail (14), then it centres on the following landmark (18), and it is recentred by a zoom on the subsequent one (22). This last movement is repaired by Daccard's request (23) for a more complex display strategy (zooming back to expose a more general view and then zooming in to penetrate into the tunnel). Within the demonstration, camera work is more mobile, obeying less the imperatives of a good exposure of the dissected field than a display strategy articulated with the verbal description.

However, camera movements for the operation create the conditions for the surgeon's work and demand a stable view; camera work for the demonstration involves more movements, orchestrated by the descriptive and pointing activities of the demonstrating surgeon. "You see" prefaces the accomplishment of the visibility for the audience in the course of the demonstration; this kind of "instructed vision" can be distinguished from the "professional vision" of the surgeon while he operates. Both involve different camera skills of the assistant.

CONCLUSIONS

This paper attempted to give some empirical evidence of a conception of seeing as a contingent interactional activity and more particularly to develop a praxeology of seeing-with-a-camera taking into account the situated video activities of surgical teams. The analysis of excerpts taken from a corpus of video-recorded surgical laparoscopic operations has focused on two aspects. The situated camera work of the researcher can be analysed as a topic, in order to show how the details of the observed phenomena are practically made available by the camera movements (zoomings, centrings, travellings…). These video practices and their peculiar perspective produce a local accountability of what is going on, which reflexively follow *and* configure the way in which the local environment, the members' gestures and the teamwork are organized.The video records produced by the surgeon's team and technical staff offer a distinct specific accountability, for the practical purposes of surgical work. Video is adequately handled in order both to secure the visual availability of the anatomical details relevant for the operation and to display them for a distant audience looking at the image for didactical purposes. The surgeons' video shooting is thus designed for distinct recipients and for different activities, although intermingled one with the other. Various aspects of these professional practices have been analysed, namely the way in which the relevance of the external view on the body or of the internal endoscopic view on the anatomy is selected and displayed in a co-ordinated manner by the surgical and the technical team; the way in which an adequate kind of optic is chosen and legitimated by the surgeon and is manoeuvred collaboratively by his assistants; and finally the way in which anatomical landmarks are relevantly displayed both for the dissection's work and

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for the demonstration. These practices of seeing as involving co-ordinated action, talk-in-interaction and image manipulation, facilitate the "professional vision" of the surgeons as well as developing an "instructed vision" for the audience.

The analysis of these practices shows how relevant phenomena are reflexively made available by the way in which video is shot, by the organization of the shooting as an activity embedded in the ongoing situated work both of the surgeon and of inquiry about surgery. The analysis argues that for exploring the details accomplishing the order and the relevance of the video activities, it is fundamental to take into account the precise timing of these activities. Gestures and turns, as well as camera movements and screen displays, are finely co-ordinated within a collective accomplishment; medical work, talk-in-interaction and spatial environments (concerning both the space of action and the space of the body) are organized by an orientation to their visual display, which is itself the product of an action oriented to the trajectories of the unfolding surgical action. Thus, video practices and medical practices mutually elaborate each other, in their interactive accomplishment.

These detailed analyses aim thus at contributing to the study of the production and use of images in the workplace – where technologies and practices producing the images are of central interest for understanding the way in which they are exploited, interpreted and seen in specific courses of action. They aim also at contributing to the study of referential practices – which are organized by exploiting a multiplicity of resources such as talk-in-interaction, gestures, camera movements, material objects and features of the local environment.

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APPENDIX: TRANSCRIPT CONVENTIONS

[	overlapping
. .. …	pauses shorter than 1 second
(2s)	length of pauses in seconds
xxx	incomprehensible segment
/ \	rising/falling intonation
exTRA	accentuated segment
((laugh))	comments
:	vowel lengthening
(see)	uncertain transcription
(see;clear)	multitranscription
par-	truncation of a word
< >	delimitation of phenomena noted in (( ))
&	continuation of current turn
=	no gap between turns (latching)
h	aspiration
°okay°	low voice
© ©	indicate the beginning and end of the camera movements (cam in the margins)
Δ Δ	indicate the beginning and end of a particular kind of screen (internal or external) (scr in the margins)
⋆ ⋆	indicate the beginning and end of a participant's activities
⋆⋆	indicates the moment at which an activity is performed
#im 5	indicates the exact location of the picture within the transcript

English indicative translation aims just to guide the reader along the French transcript.

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