Phenomenal Fields Forever

Instructed Action and Perception's Work

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Introduction: The Pythagorean Carpenter

'Every schoolboy knows …' was a phrase used somewhat ironically by Bateson (1979) to introduce elementary ideas about nature and science. For example, the Pythagorean theorem is one of the elementary formulae that should be known by every schoolchild, as it has been made a part of the curriculum of the later years of compulsory education. This theorem, $a^2 + b^2 = c^2$, formulates the invariant relationship between the sides (a & b) and the hypothenuse (c) of a right triangle. Accordingly, given any two values, we should be able to find the third value through a calculation using the formula. If the lengths of all three sides are known, they can be used to assess whether the triangle is truly right-angled.

Published in:
M. Lynch & O. Lindwall (Eds.), *Instructed and Instructive Actions. The Situated Production, Reproduction, and Subversion of Social Order* (pp. 57-72). Routledge.
https://doi.org/10.4324/9781003279235-6

In carpentry, the creation of (near) right angles is often of central concern, for instance, when joining studs and plates to construct a wall frame. Thus, it constitutes a case where the practical application of the Pythagorean theorem should be warranted. However, calculating the square root for any random number, without access to calculators, and perhaps while holding on to other tools or parts of the construction, is too much of a challenge for most people. To overcome this, some carpenters work with a specific instantiation of the general formula. When operating within the metric system, the values of 60, 80, and 100 centimeters are used. As a series, these values are known as a Pythagorean triple, or a series of natural numbers (a, b, c) that satisfies the condition $a^2 + b^2 = c^2$ (Livingston 1999). There are many possible such series, and the most commonly recognized triple is probably (3, 4, 5). In carpentry, however, as a matter of practical execution and to minimize errors, the described set of values offers a sizable triangle that is still manageable; the corners can be reached and checked with a wooden rule or a tape measure held in one hand.

The carpenters' reformulation of a general principle into a practical rule of thumb is now a part of their trade in a way that may or may not be presented in formalized accounts of that practice. Used as a technique for assessing the status of the construction thus far ("are these parts skewed or not?") that allows for work to proceed, this reformulation of the Pythagorean theorem is useful in the day-to-day operations of carpenters.

We believe that many practices that rely on similar methods or tricks of the trade regularly fly under the radar when it comes to descriptions of the practice. Even when such accounts are intended as explicit instructions and geared toward the transmission of skills across members and generations, some techniques are considered too trivial or idiosyncratic. Understood as "just a thing we do," they fall outside the canonized descriptions of the practice and may be considered as unremarked-upon matters. Over time, some of the techniques developed to deal with practical problems can become formally acknowledged or even instantiated in practice-specific tools. Presumably, they may also be lost should the continuity of apprenticeship be disrupted.

Beyond the product version of instructions

In the preliminaries to his chapter on instructions and instructed action, Garfinkel (2002, 200) makes use of the distinction between the "product" version of instructions and the in-course, lived work of "following" instructions. Garfinkel's story of how he struggled to assemble a functioning chair from separate pieces with the aid of a series of diagrams has become emblematic of the discussion on the problem of following instructions. We learn that, for someone assembling this chair for the first time, an understanding of the diagram—as a set of complete and factually correct instructions—will only be discovered over the course of the assembly work. Furthermore, understanding what the outcome should look like is also central to comprehending the instruction completely. In a study of third-graders conducting science experiments Amerine and Bilmes (1988) addressed this reflexive relationship and concluded that "It is in this way that the meaningfulness and coherence of instructions is grounded in the perceived relationship between course of action and projected outcome" (p. 338). Accordingly, instructions prepared by others will only take on their full meaning when one is done carrying out the instructions.

This insight into how competence renders instruction intelligible is perhaps ethnomethodology's most important message to pedagogy, and it has mostly been overlooked. We tend to use instructions when much of the needed competence is still lacking. Hence, the reflexive relationship between competence in a task and the instructions' followability becomes a pedagogical paradox. For our purposes, however, we wish to pursue a slightly different line of inquiry—one in which competent action also requires guidance. Regularly, we organize work in ways that help us keep our place in what we do (cf., Livingston 2008). This organization can also be understood as a form of instruction. One example of this effect is the perspicuous setting of Helen's Kitchen (Garfinkel 2002).

Helen was one of Garfinkel's students, and she was afflicted with congenital night blindness. As Garfinkel tells us, she was about to get married in the fall, and in preparation for her husband moving in, she wanted to learn how to cook some new recipes. Her limited field of vision posed a problem to her—a problem unfamiliar to most normally sighted people.

> In anticipation of the recipes that she was preparing to please him she had to spend the summer, taking up one recipe after another, and for each working out for pots, utensils, ingredients, stuff in the fridge and cupboards just where item by item, a next needed item in a developing sequence would be found, and where being found it would be picked up, transported to a collecting area, and within the holding area so placed that she could zero in on each for the last steps that made up the achieved recipe. (Garfinkel 2002, 212)

A photograph displaying the pans and tools neatly organized on Helen's kitchen wall showcased a "residue account of the summer's work" (Garfinkel 2002, 213). Her summer's work consisted of finding this organization, a task that is in line with our specific interests. Had we been there that summer to observe her work, we would have witnessed the ways in which "Helen turned the dishes into transparently achieved, embodied, customized, locally analyzable, locally historicized, rule-governed activities" (ibid.).

The work that enabled her to achieve her desired kitchen arrangement points to certain procedures with objects and their places, in terms of how they were being fitted to afford specific sequences of embodied action. Based on this description, we will attempt to provide a provisional characterization of instructed action. We do not aim to provide a general definition, but rather a delineation for current purposes. In the following, our treatment of instructed action will borrow from the verb *to prepare* and its meaning of creating readiness for a particular end. This notion stems from the Latin *praeparare,* which translates to "make ready beforehand." In adding to this concept, we also want to bring in something that follows—some action owing to these earlier preparations. In this sense, we aim to approach instructed action by focusing on the prospective and retrospective orientations of actions. Our primary example will thus concern a sequence of events wherein the initial operations set the stage for some anticipated subsequent step, and where the preparatory moves are carried out to help guide, i.e., instruct, the actions that ensue.

This stage-setting character of the addressed activity will also make it possible to align our discussion with the investigative field, which Anderson and Sharrock (2019) have dubbed "Third Person Phenomenology." We will later examine how these authors consider uniquely tailored work arrangements as establishing preparedness for action and how the configuration of local specifics, in turn, enables distinctive social production processes. The details of the shop floor work—some of which we will provide in the following sections—should therefore be regarded as facilitating the discussion of how witnessable and recognizable properties of social phenomena are produced. Thus, while our specific case may be of interest as an ethnography of work, its main goal is to help us grasp how instructed action is connected to the accountable coherences of phenomenal field details.

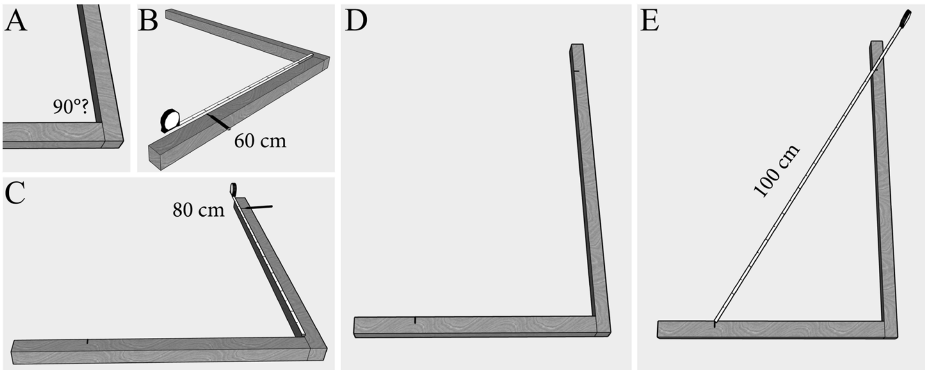

Figure 1. A procedure for creating a right angle

First, however, let us use our preliminary delineation and revisit the Pythagorean example in more detail. As noted, our carpenter lacking access to a dedicated tool for this purpose, such as a speed square, wants to join two studs at a right angle (see Figure 1A). When placing the studs in position, the assessment of the resulting angle must be done as a series of actions. First, a measure is taken from the inner corner and along one side. The carpenter creates a marking at 60 cm (B). Next, the same procedure is repeated in the other direction. Starting from the corner, the position of 80 cm down the other stud is located, and a second marking is made (C). By these actions, the two studs are now annotated (D), and the stage has been set for the assessment proper. The carpenter can now locate the 100 cm position of the tape measure and place it on top of one of the markings. The tip of the tape measure should then match with the opposing mark. If the test is successful, the carpenter can proceed with confidence, knowing that the angle between the two studs is close to 90 degrees. Should the hypotenuse turn out to be too long or too short, however, the 100 cm measurement between the two markings will offer additional guidance on how to tilt the wooden members to achieve the desired outcome. In this way, *the procedure is not merely a test; it is incorporated into a sequence of actions for finding the right answer*. This procedure thus instructs a carpenter on how to discern if or when these parts are, for all practical purposes, joined at a right angle, facilitating the next step of construction.

In this practice, we can also find a somewhat unanticipated relationship between carpentry and the Pythagorean triple. The fact that carpenters may draw on geometry is not a novel idea. Mathematics pointing directly to carpentry, however, is perhaps less expected. In his examination of mathematics and the material practices of constructing proofs, Eric Livingston (1999) argued that we should understand mathematics not as an abstract discipline, but as a concrete part of material culture. Similarly, in "The Origin of Geometry," Husserl (1970, 375) posited a general argument for how the idealized products of mathematics are rooted in concrete material practices involving physical objects. Livingston is more specific, however, and showed how practitioners arrange many proofs visually and sequentially so that they can see through these configurations and discover the properties of mathematical objects. One of his examples concerns the Pythagorean triple and two related theorems (i.e., statements outlining methods for generating such triples). The visual proof that accompanies these theorems is constituted by an array of dots (representing the natural numbers), and an L-shaped subset of this array known as a "gnomon." According to Livingston (1999, 875), the name "gnomon" was taken from a carpenter's tool for making right angles. Thus, embedded in this mathematical proof, we find the same tool that the carpenter does away with when a triplet is used instead.

When carrying out this sequence of measurements, the carpenter relies upon the Pythagorean triple in and through the embodied work and material organization that make available the observable evidence of a right-angle construction. Similarly, through the material array of dots inscribed with the L-shaped gnomon, a mathematician can find the theorem that the proof claims to reveal. Both practices build procedural arrangements for identifying searched-for evidence. We will return to discussing how such gestalts of reasoning and practice can be understood and characterized.

In what follows, we will allow the case of the Pythagorean triple to serve as an analogy for our main example collected from endovascular surgery. We will draw on a case within image-guided intervention—surgery that is performed with the use of minimally invasive techniques and where the actions, similar to laparoscopy (Mondada 2003), are guided by visualizations on screens. In this practice, surgeons primarily use two imaging techniques: fluoroscopy and digital subtraction angiography. The surgeons repeatedly face the challenge of having to shift between the images provided by these different technologies while still remembering certain visualized features that are now lost from view. The medical literature and the technology vendors' technical manuals provide instructions for overcoming this challenge, and these will be examined.

Furthermore, we outline one unique method that is de facto used in practice and frame it according to our initial characterization of instructed action. The method relies on the creative application of a computer cursor as a visual aid for marking locations in images. This workaround is built on local practices and technologies, and it has become an integral part of how the work is performed by practitioners. In addition to describing the method itself, we also discuss how it resides outside of endovascular surgery's formally accepted techniques—that is, how it can be regarded as an intermediate technique. While it gets the job done, it is not formally accountable as a technique worth reporting upon to audiences beyond the local hospital. However, the method occurs regularly and is not entirely idiosyncratic.

In our closing argument, we relate the empirical example to the larger discussion on instructed action and the management of orders of disciplinary and workplace-specific details.

Details of endovascular surgery

Our central case was the surgical practice of endovascular repair of an aneurysm in the abdominal aorta (commonly abbreviated EVAR). An aortic aneurysm is caused by a weakening of the aortic wall, which then begins to bulge out due to high blood pressure. If aneurysms are left untreated, the patient risks rupture, a potentially fatal condition. The EVAR procedure involves the placement of a self-expanding stent graft with the aid of medical imaging techniques. Once in position, this internal stent graft alleviates the pressure of the weakened area and allows the aneurysms to contract gradually.

In percutaneous EVAR, punctures are made in the femoral arteries, in the groin on both sides, and vascular sheaths are introduced. Through these sheaths, the surgeons pass guidewires, catheters, and stent grafts and place them into the right position with the help of X-rays. Getting the placement correct is critical. If the positions are misplaced, there is a risk of occluding other branching arteries that support vital organs, such as the kidneys. Another issue is to create enough seal, which is done by letting the stent graft overlap a healthy section of the aorta proximal and distal of the aneurysm. If the sealing is deficient, blood will leak into the damaged section and the pressure will not be reduced as it should.

The stent graft comes compacted within a sheath; when first introduced, it can be moved back and forth in the vasculature. The stent graft is wider than the aorta in the sealing zones. Once released (i.e., unfolded), it attaches itself to the inside of the aorta through its radial force, which is reinforced by small hooks in the proximal end. This so-called deployment is therefore an irreversible process and is preceded by several checks.

For visual guidance, surgeons are aided by two types of X-ray imaging techniques. The primary type—fluoroscopy—is a form of live image that is used while wires and stents are manipulated and moved. Fluoroscopy requires little radiation and can be employed for extended periods. However, the images produced do not display information about the blood vessels themselves due to their low attenuation (as soft tissues). The secondary technique is digital subtraction angiography (DSA), which is used to visualize the location of the vessels. Here, a radiocontrast fluid is injected for a few seconds, and as it flows through the system, snapshots are created of the structure of the blood vessels. During this quick acquisition, which lasts only a few seconds, the tools or wires are typically not moved or repositioned.

The varying requirements of the separate X-ray techniques, therefore, necessitate the sequential coordination of visual information from different points in time. The location of the branching vessels (information collected from the static DSA image) must be harmonized with the location of the stent graft (information provided by the live fluoroscopic feed). Our analysis aims to describe some of the practices through which this coordination is accomplished. On these grounds, we then consider how this work is illustrative of the general discussion of instructed action.

Our example targets the most critical moment in abdominal endovascular aortic repair: the deployment of the proximal stent graft below the level of the renal arteries. Since this is an irreversible process, surgeons must first ensure that the stent graft is in the correct position before they release it. How they acquire and validate this knowledge is our topic of interest. How is evidence for the precise location of the stent graft gathered? Moreover, when more than one surgeon is involved, what are the procedures for establishing a shared understanding of this location?

Outlining the task at hand

Minimally invasive vascular surgery is very much a visual practice in which large monitors guide the work. The data we collected consist of videotapes of the entire surgical suite as well as the video feed of the main surgical monitor (for an overview, see Figures 3 and 4). We will present this analysis through the information gathered on this working monitor, as it provides the most detailed depiction of the surgery and the decisions examined here.

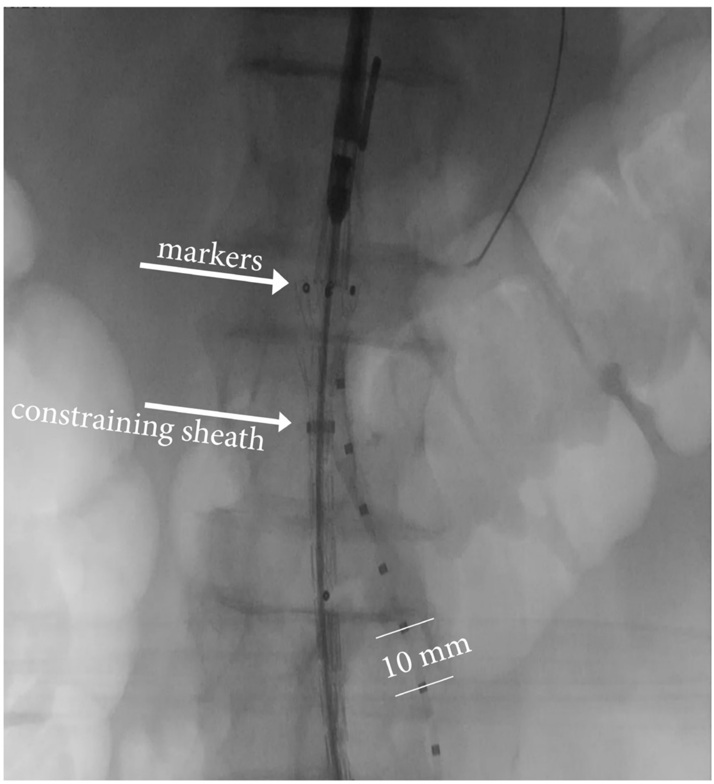

Figure 2. Fluoroscopy. Deployment of the stent graft was initiated as part of the constraining sheath being retracted

The description departs from the main technique of fluoroscopy. In Figure 2, several objects are visible. There is a measuring wire coming in from the bottom, slightly to the right. It has markers spaced at one-centimeter intervals. At the center is the stent graft that is still mostly compacted within its sheath. The most proximal, upper stent is uncovered and has barbs to secure the location once it is fully released. The top of the uncovered stent is still attached to the delivery system. The stent graft is constructed out of a thin metal wire mesh wrapped in a strong fabric. With fluoroscopy, it is only possible to see the metal parts. The fabric is not radio-dense, and it cannot be seen. Instead, the upper end of the fabric is identified by a row of small, stitched radiopaque markers (see the top-most inserted arrow in Figure 2). When these markers are aligned in a straight line, the projection of the fluoroscopic image is optimal and perpendicular to the axis of the stent graft. This function guides the surgeon, and the line of markers to be placed immediately below the lowermost renal artery.

Some anatomical details are also discernible in Figure 2. The lighter regions are the result of air or gas inside the intestines, and the spine comes into view as a darker shadow in the vertical direction. The spine provides some guidance on the selected view's orientation, where the top of the image points toward the patient's head. The lumbar region of the spine has five vertebrae (L1–5), and the center image shows L1 and L2.

Additional anatomical knowledge also informs us that the branching arteries that supply the kidneys with blood may be found in this region. Given this visualization, however, it is not possible to determine their location. Therefore, a stent graft is tentatively introduced, which surgeons will reposition at a later time.

Next, the surgeons will change to the secondary imaging acquisition technique, and their team will perform a digital subtraction angiography. This imaging process involves the coordinated efforts of several participants, and presents its own communicative challenges (Ivarsson & Åberg 2020). As an injected radiocontrast fluid flows through the vascular system, a series of DSA images are captured (Figure 3, top row). These can then be replayed as a moving sequence or paused to display individual frames. The surgeons will select the recorded image that best captures the region of interest to work from (Figure 3, bottom).

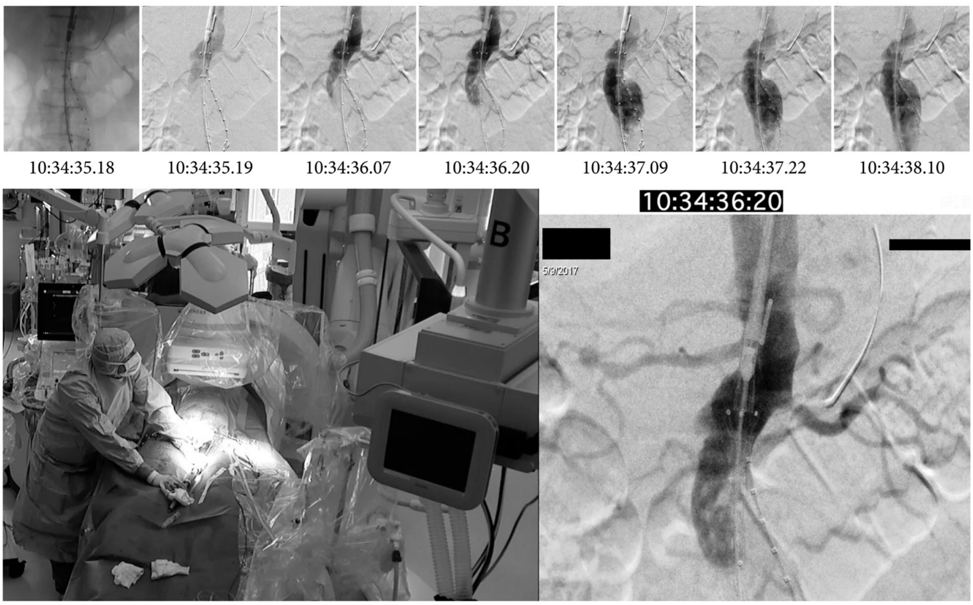

Figure 3. Top: The sequence of images produced during digital subtraction angiography. Bottom: The surgeon holding the instruments in place during the imaging (left) and the selected frame (right).

Digital subtraction angiography operates by first establishing a reference image at a moment before the contrast is injected (see the top-left image in Figure 3). All subsequent images are then processed so that they only visualize the difference from this baseline. This is accomplished by subtracting the reference image's pixel values from those of the newer images. The result is a view that mainly displays the flowing contrast agent, a map of the vessel structure is created. It should be noted, however, that this process is sensitive to movement. Without movement, the stent graft will be subtracted and, hence, made invisible. In practice, particularly in this part of the body, there are regular small movements, even during DSA acquisition. Therefore, structures such as stents and bones become imperfectly subtracted and can often be discerned.

The production of a useful DSA is a deliberate task. The angulation of the X-ray tube and sensor will affect both the image and which anatomical details become visualized. To locate branching renal arteries, surgeons must select the angulation that most clearly depicts the lowermost renal artery in cross-section (in the coronal plane). The take-off of the renal arteries varies, and operators should always check this on the preoperative CT and adjust the C-arm accordingly.

In the selected frame in Figure 3 (bottom-left), the right renal artery, which connects the aorta with the right kidney, is located approximately one centimeter above its left counterpart. This makes the left renal artery the critical focal point in this particular patient. Once clear evidence of where the renal artery branches off from the aorta has been assembled, the material can be brought to the next part of the procedure.

The surgeons' task is now to position the top level of the covered part of the stent graft at the bottom of the left renal artery orifice. Given the provided view (Figure 3), the position can be assessed as being close to the desired position, albeit slightly too low.

Here, we have reached a critical moment in the surgical procedure. The surgeons now face the problem of making fine-tuned adjustments. To observe the effects of the manual manipulations of the stent graft system, however, they must switch back to using fluoroscopy. However, once this is performed, the visualization of the arteries will disappear. Therefore, the surgeons must remember the precise location of the left renal artery.

Two methods and one hack

One technical method that has been developed to support this task is the possibility of blending the two views together. The chosen DSA image can be digitally overlaid on top of the angiography view by selecting a suitable opacity value. Such an overlay is depicted in Figure 4.

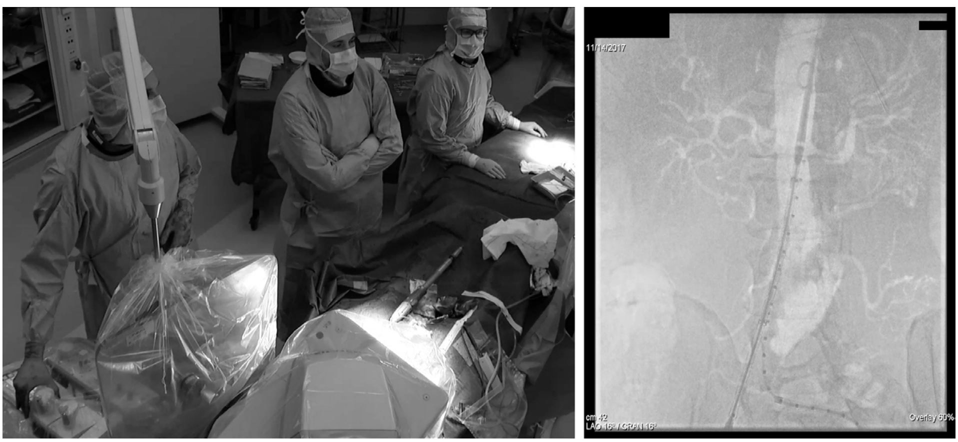

Figure 4. Two surgeons (left) attempt to assess the image on the monitor (right). The image shows fluoroscopy with a 60% DSA overlay.

With the overlay method, it becomes possible to see both the live movements of the wires and the stent graft as well as the previously produced depiction of the aorta and renal arteries. Past actions and current actions become aligned so that the two modes now populate the same image. In this way, the overlay can be understood as a map that guides or instructs surgeons' further actions. As an organized whole, the overlay renders the correct placement visible to the professional gaze. Much of the preceding work has been done in preparation for this situation to enable informed adjustments so that the surgeons can position the stent graft correctly.

Practitioners commonly object to this view, however, due to the clutter involved. While all central components are featured in the visualization, the act of overlaying information simultaneously reduces visibility. Put simply, it becomes harder to identify the relevant details. For surgeons, who rely on their vision to make critical medical decisions, this presents a problem.

When the overlay function is activated in most setups, a separate feed showing the raw fluoroscopic image is simultaneously shown side by side. Shifting the gaze back and forth between the two views is one way to counter the clutter problem. Another approach is to use the overlay only as an intermediate step before switching back to fluoroscopy. In the view that the overlay provides, both the renal artery's soft structures and the much harder spine are discernible at the same time. Both belong to the anatomy of the patient and remain relatively fixed in relation to each other. This opens the possibility of using bones as a landmark for locating the artery once the latter is erased from view. Furthermore, some structures near the artery can be singled out to act as an anchor point for reference. This solution makes it possible to work with a clear fluoroscopy view while still in possession of some procedural memory of the previous work.

Despite its advantages, this method of using the spine for reference also has its drawbacks. It may work well if a distinct and unambiguous bony structure, such as the proximal or distal endplate of a vertebral body, is aligned with the target position in the aorta. Still, this is too often not the case, and the exact bony structure first spotted may not become clear only a few moments later. Furthermore, the location specified by the bone landmark is only collectively realized when overt verbal remarks describe some relation. This form of memory is open to unwanted vagueness. Another problem arising from the use of this method is the lack of material persistence. Other pressing medical events may interfere, and if a location is not documented it could quickly be forgotten.

We understand these complications with the overlay method and the bone landmark method as central to what is outlined below. In the surgeries that we examined, a third alternative was regularly practiced. The method can solve both the visibility issue of the overlay method and the memory problem of the bone landmark ditto.

Figure 5. Left: DSA with an added cursor. Right: fluoroscopy with the same cursor retained.

After the surgeons produce the DSA sequence and select the frame that most prominently features the renal artery, they introduce an opportunistic resource. As part of the interface for the visualization software, there is a cursor that can be moved around freely. This cursor is now brought in and placed at the critical location of the renal artery, which is precisely at the point over which any fabric would occlude the flow of blood to the kidney.

The work of producing, selecting, and validating the DSA image is thereby turned into an instruction for cursor location. The entire preceding sequence of actions is folded into this single point. This trick immensely reduces the complexity of the body's anatomy. All that the renal artery now means for the procedure is contained within this annotation (i.e., the cursor): "Keep the stent graft below this pointing finger."

Once the surgeons return to the fluoroscopy view, the cursor guides the work ahead (Figure 5, right). As the stent graft is adjusted and slowly opened, the top line of the markers is continuously assessed against the position of the cursor. As for the carpenter, the annotation instructs the surgeons to determine *if* or *when* these essential components are correctly aligned. This constructed view allows for the discovery of discrepancies and facilitates their rectification. As illustrated in Figure 5 (right), the stent graft was pushed up too far. If positioned in this location, it now risks occluding the renal artery; therefore, further adjustments are necessary.

Surgery, each next first time

To take stock of what is happening in this example and relate it to the general discussion on instructed action, we will first step out of the work on the screen and examine the larger scene. Surgeries are complex organized endeavors that rely on a suite of standardized and vetted protocols and practices, drugs, and equipment. Nevertheless, even planned elective surgery may present staff members with a unique challenge on each occasion. Within a familiar field of play, surgical teams may run up against an unknown number of unknowns, and they will be tasked to craft a bespoke solution to this patient's medical condition. An example of the delicate placement and fixation of a stent graft is but one point in a succession of moves to such an end.

The series of actions that render the scene coherent and recognizable for the surgical team is neither an entirely fixed sequence nor completely open to improvisation. Specific sequences of actions arise as a consequence of earlier moves and act as precursors of ensuing steps. Due to certain findings, new relevancies may be opened, and other options become untenable. Probing questions can be raised along the way, uncertainties can be pointed out, and measures may be initiated to elucidate what is deemed unclear. Checks on the veracity of the team's current understanding can be repeated, or they can be dispensed with. As viewed from the outside, it is in these selections, repetitions, and omissions that we find the treatment's progression. The picture of practice that emerges—sketched at this intermediate descriptive level as patterns of moves and considerations—is what we regularly find in practical guidebooks (e.g., Falkenberg & Delle 2014). Such descriptions are presented to practitioners who are already familiar with the abundance of the details and contingencies that are necessarily left out of the accounts. Alternatively, for newcomers who are yet to find out what, exactly, a world of endovascular details looks like, the guides will offer some landmarks and pointers on how this task may be approached. If we follow the reasoning in Ethnomethodology's Program (Garfinkel 2002), the interior configuration of these courses of action can only be specified "downwards to the details of actual cases" (Anderson & Sharrock 2019, 38). So, how are such configurations achieved in the first instance? What is the place of instructed actions in the conceptualization of this achievement? To answer these questions, we will take a brief detour to philosophy and experimental psychology.

The phenomenal field

In philosophy, the issue of how an object comes to appear before consciousness has been of longstanding concern. To put the question in more procedural and active terms, we could ask how a specific object is made, on this occasion, to be seen in just this way. In pursuit of such questions, Garfinkel (2002) built on phenomenological ideas and concepts, such as Merleau-Ponty's (1962) notion of the phenomenal field, but he did so through a deliberate "misreading" of phenomenology and, in particular, Aron Gurwitsch's treatise on the *Field of Consciousness* (see Garfinkel 2021). The purpose was to give a reading that would transform this general theory of the coherence of objects into ways that, in actual cases (in their worksite-specific details), would demonstrate just how order became concertedly achieved.

> I'm going to use the term *phenomenal field* to speak of organizational objects specified as the produced coherence of objects in phenomenal details. The problem is always to provide for the achieved produced coherence of organizational objects. (Garfinkel 2021, 33; emphasis in original)

Why was this philosophical tradition of interest in a sociological investigation? Gurwitsch (2010) located what he regarded as an anticipation of one of the fundamental tenets of Gestalt theory in William James' (1893) discussion on the temporality of consciousness. For Gurwitsch, the perceptual gestalt's coherence was seen as an interdependent web of constituent details; the current experience is shaped by prior experiences and takes part in shaping upcoming ones. The constituent parts themselves would not suffice to explain the gestalt. In this idea, we can also observe parallels to sequential organization and its role in the achievement of intersubjective understanding (Garfinkel 1967). By the same token, locating meaning in words or sentences alone would fail.

Phenomenology also acutely emphasizes the embodied character of action. For Merleau-Ponty (1962), the activity of perceiving was always understood as perceiving *with* the body—an idea that was not necessarily new. Gestalt psychology has long explored the role of action in perception. The psychologist George Stratton pioneered the experimental study of visual perception using lenses that would invert or distort the visual field in different ways (Stratton 1896, 1897). These experiments indicated that once breached through the lens's intervention, the visual field's appearance would eventually find its normal state if one continued to be actively engaged with the world. Some subsequent studies that prolonged the experimental conditions from days to weeks would also confirm these findings (Kohler 1964). Others, like Katz (1925), explored the role of active engagement in the perception of touch (for a discussion relating to sensorial aspects of touch in surgery, see Kuroshima & Ivarsson 2021). The ecological psychology developed by Gibson (1966, 1979) similarly addressed self-motion and visual perception.

On the other hand, Garfinkel (2002) devised a different conceptual register for the work needed to produce accountable coherences of phenomenal field details. Not only was action to be understood, as we would expect, in terms of social moves back and forth between partaking members, there is also the added determiner of "instructed" action. Anderson and Sharrock asked, "Why throw in the notion of instruction?" (2019, 38). They offered the following explanation:

> We suggest it has to do with the coherence requirement. Given the in-the-course-of-the-action production of shared understanding, there appear to be just two alternatives for creating the internal coherence experience has. Either actors have to be tasked with trading descriptions (somehow) to provide 'accounts' of what they are doing as an integrated part of the performances of their 'turns' with such descrip-

> tions being recognised and understood (a line of thinking which just pushes the whole problem of understanding and collaboration back to shared expectations and normative compliance) or they must 'exchange' instruction and competent performance in a rolling serially organised way. The advantage the latter has is its termination of the regress on the action pairing. The conception of an 'instruction' and 'performance' exchange is the central move in the 'instructed action' conceptual play laid out in *Ethnomethodology's Program*. (Anderson & Sharrock, 2019, 38)

With this move, Garfinkel locates the instructive character of action as what produces witnessable and recognizable properties of social phenomena in that they come together in the achieved gestalt coherence.

Preparedness for action

When focusing on the temporal flow of action, especially when analyzing the sequential organization of social action, the conditions that enable this activity to occur may recede from view. In their analysis of work, Anderson and Sharrock (2019) called for a discussion on how the work task and the work site are arranged to enable work to be performed in the ways that it is. They speak of these arrangements as "preparedness for action" (p. 51). A central insight here is their observation that "the open possibilities of the field of consciousness are reduced by the choice of structured arrangements for the workflow." (p. 51). Part of the structure is given by the collocation of machines and other resources. We want to emphasize the efforts that go into achieving this preparedness. As this has been our recurrent topic, to clarify the concept further, let us briefly return to the carpentry case used in the introduction.

In Figure 1 (B–D), we described how the carpenter made annotations on the studs to enable a subsequent measurement. As the construction work progresses, however, these annotations will remain. Covered up by plasterboards and layers of paint, they become hidden from view, and no occupant of the finished building will ever notice their presence. Nevertheless, residing in the structure's shadows, the simple pencil markings tell of actions now long past but with a lasting effect. The walls' rectilinear shape and structural integrity are due, in some part, to these signs. Not all actions enabling the next step in an activity leave visible traces, however.

Similarly, with the example on endovascular treatment, we can observe how a large portion of the surgical activity is made up of actions that will not immediately treat the patient. These are rather actions that are oriented to the medical staff—actions organized to produce a phenomenal field that will help the members keep pace with their work and instruct them in how to proceed. In this respect, these activities establish preparedness for action, as Anderson and Sharrock suggest. Expressed differently, these complexes of action and equipment organize perceptual space into local orderings of referential details and visible relations, or what Lynch (1991, 53) called "topical contextures".

In the case we discussed, the trick that relies on a computer cursor to bridge the gap between two types of X-rays is one of these orderings. It is a method for achieving the produced coherence of vascular surgery's central organizational object—the established relation between the stent graft and vascular structure. As this worksite's job uses only this specific set of equipment with just this select group of people, the technique of using the cursor will help extract the phenomenon from the array of surgical instruments and monitors.

Coda

In slip casting, a hollow plaster mold is filled with a liquid form of clay—the slip. The porous plaster sucks water from the slip, resulting in a layer of clay on the inside wall. Excess liquid is then poured out, after which the mold can be carefully removed to reveal whatever shape it has given to the clay. If the notion of instructed action is the fluid, formless slip in this metaphor, our provisional characterization is the mold that should now be set aside. Still, it has helped shape our discussion, and through it, we can point to the profusion of work that is primarily instructive—actions produced such that the members, to the best of their knowledge, should be able to find what is to be observed and what should be done next.

One line from the song Strawberry Fields Forever tells us that "living is easy with eyes closed." With eyes open, the work of perception begins. It can be hard work, especially for professionals operating under visually austere conditions, such as when treating patients suffering from aneurysms in the abdominal aorta. Regardless of the stakes involved, coherence must be recurrently achieved in all situations. Failure to meet this end may result in feelings of confusion, bewilderment, anxiety, or guilt, which have been discussed extensively elsewhere (Garfinkel, 1959, 1963, 1964, 1967). Nonetheless, "the work involved in the coherence of phenomenal field is massively taken for granted" (Garfinkel 2002, 97). By focusing on members' methods in a work's discipline-specific constituents, we can begin to appreciate the monumental character of this work. The task is without end, and we will be forever occupied with producing the coherence of objects in phenomenal details.

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