Drawing Problems: Thought in Action

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Abstract:	I investigate some aspects of the structure of the production of drawings, by developing a practice-based phenomenology articulated around some "drawing problems". The examples I chose cluster around decision making in drawing from life. I make a case for a propositional, explicit judgment-based action structure, that makes it possible to accommodate some typical practices used in addressing drawing problems. I further hint to by-products (e.g., attention modulation) and "surrounding practices" (e.g. communication during the observation of a drawing activity) that find a plausible explanation in the propositional account of drawing.

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Drawing problem: Thought in Action[1]

Drawings are among the oldest documented visual representations, but they are quite peculiar insofar as drawing displays virtually no evolution (although it has a history of marginal technical changes). Drawings of the Lascaux cave (-18k years), use the same representational shortcuts used by draftsmen in all the subsequent history. Drawings' stability over millennia is a strong indicator of their deep biological basis (Casati 2011) Indeed, drawings trigger recognitional abilities by using as representational vehicles lines that refer to occlusion boundaries of physical objects. These boundaries are not visually perceptually marked (objects are not surrounded by thick lines) and conversely a representation of all visual discontinuities by vehicle lines would clutter the picture to the point of non-recognizability – painters have since long acknowledged that drawings do not support outlined shadows.

Fig. 1. In this unreadable drawing, based on a photograph, all contrast boundaries over a certain threshold have been turned into lines. See next page for the original photograph. Image credit: RC.

The working hypothesis is that in mid-level vision objects are represented by their occluding boundaries to economically parse complex scenes; drawings directly tap into this representational level(Cavanagh 1999). This in turn makes it plausible to hypothesize that drawings were discovered and not invented (Kennedy 1975). And this further implies that drawings are an optimal solution for representing objects under time pressure and other constraints: they are both extremely economical to produce and brutally effective in inducing visual recognition. Drawing is thereby the most effective way to visually render imagined situations as e.g. in storyboards for movies; if other media have been proposed to replace the drawing practice for storyboarding, they are way behind the effectiveness of drawing (Cristiano 2017).

The literature on drawing has focused mostly on the perception of drawings (Maynard, 2005), including the retrieval of motor intentions and of the artists's intention (Pignocchi, 2010). Production, on the other hand, is a less studied topic (Casati ed. 2011; see the seminal work by Van Sommers 1984). In this chapter I investigate some aspects of the structure of the

1 John Stewart an I have been working side to side for four years in the large Enactive project (2004-2008) piloted by Massimo Bergamasco. At times dialectically opposed, we appear to share an insane interest for external representations and their mechanics, a penchant for existentially engaged research, and we both think that actual practices still do not attract sufficient attention in the cognitive science community. This paper mans to further the conversation on the topic, keeping the dialectic alive.

production of drawings, by developing a practice-based phenomenology articulated around some "drawing problems". The examples I chose cluster around decision making in drawing from life. I make a case for a propositional, explicit judgment-based action structure, that makes it possible to accommodate some typical practices used in addressing drawing problems. I further hint to by-products (e.g., attention modulation) and "surrounding practices" (e.g. communication during the observation of a drawing activity) that find a plausible explanation in the propositional account of drawing.

Fig 2. The original photograph with superposed lines of contrast and a “natural” drawing parsing of the scene it represents.

Drawing problems: The second line. As I draw a woodstove in my living room, or the ruins of a cathedral, I pause to make a decision. Some occluding contours need reinforcement. I draw a second line over the one I drew earlier. This operation, the tracing of the second line, has its technical difficulties. I am an average amateur draftsman, and my expertise is local, domain specific – I am trained to draw inanimate objects (as opposed to faces or furry animals of fighting gladiators, say). This expertise means that the tracing of the first line was semi-automatic, done in a coherent, smooth gesture. The key problem is, it will be extremely unlikely that I will be able to trace the second line so that it fulfills two constraints: be done with the same smoothness, and perfectly overwrite the first. This in turn means that something must go: either the line will be offset, or it will be seen as hesitant.

Fig 3. Larchant, May 2012. Image credit: RC.

Vintage instructional booklets (Anonymous, 1898) endorsed the practice of tracing a line over a semitransparent sheet through which one could see the template line. The result is immediately seen as hesitant.

Fig. 4. Drawing and tracing book. The old practice of tracing reduces drawing to second line like tracing.

The second line is, actually, a *caricature*, an enhancement of a feature that is conducive to a representational advantage. Its consumer is the perceptual system. By looking at a drawing where the first line is enhanced by the second line, we make a quicker and more robust parsing of the scene into objects. There is something to be said about caricatures, i.e. representational enhancements; the short story, sufficient for our purposes, is that they colonize a representational module (in the way in which certain forms of camouflage colonized recognitional modules (Sperber & Hirschfeld, 2004)), and are typically the result of random discoveries.

Drawing problems: parallel lines. Another example of second lines is the second of two *parallel lines*. Parallel lines are drawn for a number of different reasons: objects can exhibit parallel features, and then there is the ubiquitous hatching used to fill in surfaces. Strictly speaking, the parallel line problem is a special case of the problem of tracing lines at preset

angles; any angle is problematic, but we can limit ourselves to the discussion of parallel lines, one instance of which is the discussion of the tracing of the second of two parallel lines.

Known solutions: training, statistical drawing, and devices. There are some solutions to the second line problem, in any of its forms. It is possible that a sufficiently long training could improve the precision of second tracing, without sacrificing its smoothness, but still the complexity of the task appears to be at the limit of human capabilities. (This is a spot where Computer Assisted Design may have an advantage). A different strategy is statistical drawing. I can try the second line as many times as it is necessary for me to obtain a satisfactory result. Of course the process is costly, both in terms of time and of resources, to the point of being utterly unpractical. It may work for certain types of parsimonious drawings (for Haiku drawings, for instance), but cannot be a general solution. Yet another possibility is the use of devices that strengthen or multiply the relevant line during the tracing process: thicker pencils, double pencils. Multiple brushes hold at the same time seem to have been used e.g. by Hasegawa Tōhaku (1539-1610), in his *Pine trees*, Shōrin-zu byōbu, Tokyo Art Museum to draw groups of pine needles. But here the second line problem all but vanishes, as we have no second line tracing to begin with. It seems thus that, absent mechanical devices, the second line problem is here to stay.

The first line. All of the above implies that the first line, if it is traced with a smooth gesture, is necessarily *imprecise.* If it was possible to trace the first line with reasonable precision, it would be possible to trace the second line with the same precision, and thus it will be possible to trace the second line reasonably precisely above the first line. Thus a normative issue (what makes a line a precise line) looms large here. We'll see aspects of it in a while, but for the time being let us present another problem yet.

Drawing problems: Detail and verisimilitude. I draw the profile of a distant rock. Surely I cannot reproduce each detail, and I know it.

Fig. 5 Kefalonia. 16.08.2011. Image credit, RC.

Much as I cannot reproduce each pebble on the beach. Still, when I look at this drawing, or I confront it with the scene that I depicted, it feels, if not true, at least accurate enough for it to be considered a drawing of that particular rock and beach.

Tracing, fast and slow. If tracing the first line can be done in a single, mindless, gesture, tracing of the second line requires attentional control. The passage from automatic thought and action to controlled thought and action goes nowadays under the heading of "dual process" theory of mental activity. Originally introduced in studies of decision theory, in order to systematize reasoning biases, it turned into a convenient way to point to a general architectural feature of the human mind. (Stanovic and West 2000). (Casati 2016) has proposed to talk of two "modes" or styles, rather than actual processes.) A simple example from wayfinding and navigation is the following. You go mindlessly from your desk to the water fountain

downstairs – your brain does all the work for you without you needing to think about it (Mode 1). But it takes you some conscious thinking and attention to plan a trip to the departement store in the neighborhood (Mode 2). In the case of drawing, second lines are normally executed in M2, whereas first lines go down in M1. The key feature of M2 is the use of attentional and working memory resources.

Talk of M1 does not coincide with talk about innate modules. First line tracing, for expert draftsmen, is in point of fact the result of a long training, the steps of which have been described by (Pignocchi 2008). First, some atomic graphic schemes (sensorimotor patterns) are interiorized and automatized. Second, the molecular graphic schemes that can be assembled out of the learned atomic graphic schemes are automatized in turn, to a lesser extent. There is an above limit to this complexification of automatic operations (one will find it extremely hard to draw, in a single gesture, draw horse and jockey jumping over a fence), but some complex automatic gestures are learned and constantly applied. A simple piece of evidence for the existence of atomic and molecular drawing schemes is the fact that it is very hard to draw objects upside down (from memory, but even from life when confronted with the object right side up).

It is the nature of the task that calls for differences in the style of line tracing. The first line is swift, as it is controlled by the perceptual recognition of the represented object and the availability of a repertoire of atomic graphic schemes. The second line is slow, because it is controlled by the perception of the first line that one must follow. It is an interesting fact in itself that the accomplishment of the second line task is slower than that of the first line task. When tracing the second line, your action and your perception are coordinated in real time: you immediately see whether the second line works or does not work. Evidently, the activation of atomic graphic schemes in first line tracing has a time advantage as no accurate control is needed.

It is further interesting that as atomic graphic schemes are activated by recognition (say, of a door's handle, if you have an expertise in drawing architectural features), they should be activated not only by the recognition of the object to be drawn, but also by the representation of the very same object that is conveyed by the first line. Thus in tracing the second line you should inhibit either recall or launch of the atomic graphic scheme that was used for the first line.

The difference in task is associated in a difference in constraints. There are less constraints, and in the end just verisimilitude for the first line; a much stronger constraint, i.e. exactitude, is operant for the second line.

Drawing problems: the placement of T-junctions. The ability to draw from a repertoire of drawing schemes is not the end of the story. The visual scene is seldom composed of a single objects, it is rather often cluttered by objects that partially hide other objects. The resulting configurations are too many and too random to be apprehended and then delivered through graphic schematization. I draw a tabletop that partially occludes a chair.

Fig. 6. Kalamos. August 2013. Image credit: RC.

The occlusion is represented, in the drawing, by a number of T-junctions, where the lines of the chair are interrupted by the occluding line of the tabletop's profile (Kennedy 1974). Each single T-junction has its (verisimilar) place on the occluding line. I do not make (in the norm) gross mistakes, such as inverting the order of T-junctions (although this may occur, especially when T-junctions are coupled); the topology of the sequence of T-junctions is easy to respect. But respecting the metric is a different issue, and here the random aspect of the scene blocks the deployment of automatic, M1 modes of drawing. I need to make an explicit decision, based on an analysis of the scene; I adopt a measuring look; I observe and describe, as opposed to simply seeing. This generates a mental proposition – an *explicit judgment*. “The first junction is at about one third of the length of the tabletop”. The proposition articulated here is used in turn to generate a tracing action. All this process is conscious, slow, and controlled by judgments, i.e. thoughts that are expressed in propositions.

Drawing problems: virtual alignments and crossings. An analogous problem, again caused by the random distribution of objects in ecological scenes, arises with alignments. I do not precisely measure the position of the T-junction, but I can see that the prolongation of the vertical bar ends at the intersection with the horizon and the profile of an island out there. I register the latter as a crossing, and I register the alignment. All this, one more time, is expressed in a proposition, that is used for generating the tracing action. Crossings, in general, are expressed propositionally. The proposition expressing a crossing has the following *identity form*: "Point a on line A is identical to point b on line B". Parallelism is expressed propositionally: "Line A is parallel to line C".

A line analysis of a scene to be drawn requires a vast amount of propositional encoding, without which no line generation is possible. There could be alternative ways to produce drawings. One is pixelization: you proceed like an inkjet printer, from the top left corner to the bottom right corner, line after line, by marking a black dot each time it is needed, otherwise leaving a blank. Or you can look at the scene and not at the sheet: your tracing gesture is not checked by the eye, you rely on your feeling of where your hand is (artist Morgan O’Hara drawings from her series *The Live Transmission* are described as “a record, performed in real time, of the vital movement of living beings”). Or you can look at the whole scene for as long as you think is needed, and then only look down at the sheet when drawing, with no checking back to the scene((Ballard, Hayhoe, & Pelz, 1995) explain why this strategy is not as effective as back and forth).

But continuous back-and-forth from the scene to the sheet is the norm in drawing practice. At the beginning the check only concerns intersections and alignments, based on the propositional visual analysis. At some point in drawing a scene the check of verisimilitude takes over; the image in your hands is sufficiently verisimilar with respect to the scene, and thus the drawing leans towards success, or is not, and thus the drawing requires fixing (I will not go deep into the notion of resemblance referred to here; cf. (Blumson, 2014), (Casati, 2016)).

From the fact that in the final phases of a drawing "analog control" takes over, one may have been led to infer that it was part of the whole process. But this cannot be the case, precisely as the process is run step-wise, and checkpoints are distributed along the way.

The propositional nature of visual line analysis reveals itself in the possibility of linguistic expression of the activity. Drawing teaching practices abundantly use scene descriptions that refer to crossings and occlusions. Even if we are not overtly talking to others or covertly talking to ourselves in the process of analyzing a scene, the availability, on demand, of linguistic expressions hints at the fact that the format of visual line analysis is compatible with linguistic expressions as it is the best explanation for cases in which actual linguistic expressions are uttered.

Visual line analysis is thus in part point and line tagging: this is an intersection, this is an occlusion line, this is a potential occlusion line, this line can be discarded, this line *must* be discarded. The repertoire of graphic schemes constrains the propositional structure of drawings. The type of line analysis one makes depends on the elements that are available for the analysis, and these are the graphic schemes. If this is the case, learnability is a strong constraint here. What ends up in the repertoire of basic graphic schemes is what one has learned, which in turn depends on what one can learn.

Drawing architectural items allowed me to skip learning of some graphic schemes. As I can compute online the meeting points of T-junctions, I have no need to automatize them. (i.e. no need to move from M2 to M1). And as I know or can judge that some items are repeated over in the architecture, I draw them all without looking back at the scene.

Many a draftsman uses a step-wise process based on tracing construction lines. For instance, when I start drawing a tower, I generate thin verticals that will guide the rest of feature placing (windows, balconies, etc.), and will be discarded in the final rendering. Construction lines in a drawing reduce part of the cognitive costs generated in judging about alignments, crossings and parallelism. (As in other cases, mind the fallacy lurking here: from the fact that you have a lighter cognitive load thanks to features of the drawing, it does not follow that the drawing itself is doing anything cognitive.)

Normative use of the principle of verisimilitude. Given that you can represent a certain scene in many ways, each of which will look verisimilar, you do not have a reason for *not* representing it veridically (your subject will look like a sailboat even if you will not place the winch in the right position and proportion; but you do not have a reason not to place it in the right position and proportion, so why not do it?)

Fig. 7. Adonis moored in Kastos. August 2013. Image credit: RC.

Drawing problems generate drawing encounters

In this second sequence I investigate loosely some of the by-products of the activity of drawing construed propositionally. Some of these are individual (e.g. attention modulation), some are of a more social nature (inquiry about an activity that is considered as unusual, comments on the quality of the craftmanship). This exploration has a simple purpose: the complexity of a human activity, and the theory that accounts for it, are often measured, and evaluated, at its borders, or interfaces with other activities.

Drawing is an unusual activity and when performed in the public space its oddity creates peculiar encounters. Some of them are certainly due to the fact that draftsmen need to stay put for a while in a certain place, thus they are an easy target for bystanders. Others are due to curiosity, some end up in discussions and evaluations of craftsmanship. Here is a short report of some of those encounters.

Manali, 1998, I sit just outside the town boundaries, drawing a Buddhist temple in the woods. A group of young boys and girls gathers around me, they see that I am drawing but they feel the urge to ask "Can we know what you are doing?" It's more a request for explaining *why* I am drawing that a request to explain what I am doing.

Young tourists at Cape Sounios, near Athens, look at my work in 1994, then ask, probably disappointed by its imperfections: "Why don't you take a picture of the temple *instead*?" I answer, unconvincingly, that I am not interested in registering information somehow, but in understanding structures, a slow process that requires looking. But they do not seem to appreciate the point.

Fig. 8. Playing Carmen at the Conservatoire Régional, Paris, 29.3.2015, Image credit: RC.

Paris, March 2015. I am drawing a group of performing orchestra members. People look at me as if I was doing something indiscreet. But the very same people are taking photographs of the whole scene. Maybe the disturbing element was that I was checking the performers individually, in order to draw each of them. Drawing someone is apparently more invasive than taking a photograph of him or her, even though the photograph captures more details, and is more reliable (can be used for forensic evidence). Drawing is observation related (and taking pictures is a very good excuse for not observing.) In other cases (Al-Ain, February 2012) I had to make extra drawings to distribute to bystanders who asked for them.

The point I want to make here is not particularly deep, but I do think that it deserves further study. It is about the social reception of the drawing act. The peculiarities of the reception sit well within a propositional framework. There is something peculiar about the drawing activity, which is not just the displaying of craftsmanship. Drawing is construed socially as a way to put, and answer, *visual questions*. The draftsman is perceived as the person who is able to ask those questions, and who is in the position to answer them. These answers are subject to normative evaluation (“You seem to have missed that wrinkle on the face”). They are recognized as enhancing our visual powers (“You made me see things I did not pay attention to”), or criticized for not enhancing them.

Drawing as attention modulator. At the end of a sabbatical, or before a move, I start drawing frantically the environment I lived in in the previous months. I am always struck by the sudden realization that you never really looked at the house you live in, until you started to draw it. You notice details you never paid attention to before.

There is a tale of a wise man who looks at a stone for his whole life and then in a single swift motion, just before dying, represents it in a quintessential way in a drawing. Possibly the reverse is true: the right thing to do is to draw an object right away, so that you can observe it subsequently with participation. Drawing is a powerful attention modulator, and this is why the act of drawing attracts, in turn, attention.

Mental drawing. Once upon in Greece (Porto Varko), under an oak tree at sunrise, I made a "mental drawing" of the tree as I was stranded without paper and pen. I looked at the branches of the oak tree as if I should draw them on the spot. No physical gestures except for head and eye movements, no movement of the hands - just attention and sequential observation of details. I am not very confident about the outcome, but surely during the exercise I was elated. And surely I would not be able to perform mental drawing if I was not able to draw. This suggests that there are different styles of mental drawing as there are styles of drawing. When I look at objects of the type I know how to draw, I look at it under the profile of the graphic schemes I have available.

I was elated, and this suggests that there is an important phenomenological quality of the drawing episode we should pay more attention to. We should shift some of our theoretical interest from the outcome of drawing to the drawing act.

Looking back at a drawing one made: interactions of the act of drawing and recollection

If I look back at a drawing I made it is introspectively not clear that I recall the details of the scene I observed; something gets in the way, the memory of an action scheme. I remember propositionally what I drew, but do I have a *qualitative* recollection thereof? I recall that there were pipes in a certain conference room in Rio. I do not remember how they looked, but I have a feeling of being in front of those pipes, drawing them.

Fig 9. Rio de Janeiro, Eceme school, Conference Room. Image credit: RC, April 2013.

It is thus true that drawing makes me remember. But when I look at the drawing I made, I cannot actually "see" the pipes with their colors, etc. However, this does not mean that memory is not helped. Probably we need different tests here (for instance, am I facilitated in dsecribing a picture of the same scene?)

Mental redrawing? Looking at a drawing I made, as if I was redrawing it, following with the eye details and traits, activates memories of the drawing act. This is different from the "general gist" of the drawing, which is

however something I am striving for when I draw.

Attention modulation meets social interaction. In her investigation about prosthetic appropriation by terminally ill patients in large healthcare institutions, ethnographer Marine Royer (2015) was not allowed to take photographs. However, she could make sketches. This opened up a window on certain aspects of the caretaker-patient interaction, that were so far hidden from research. The conformity to verisimilitude is certainly an element in making many types of conversation around drawing possible. If the draftsman was unconstrained by verisimilitude, there would be no point in arguing with her. At the same time, if the conversation is to move from a general appreciation of the gist of the drawing to a more detailed commentary on some parts of it, both draftsman and commentator must ascend to the level of judgment, embrace the propositional articulation of the drawing activity.

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Fig. 1. In this unreadable drawing, based on a photograph, all contrast boundaries over a certain threshold have been turned into lines. See next page for the original photograph. Image credit: RC.

182x145mm (96 x 96 DPI)

Fig 3. Larchant, May 2012. Image credit: RC.

184x276mm (72 x 72 DPI)

Fig. 4. Drawing and tracing book. The old practice of tracing reduces drawing to second line like tracing.

369x164mm (96 x 96 DPI)

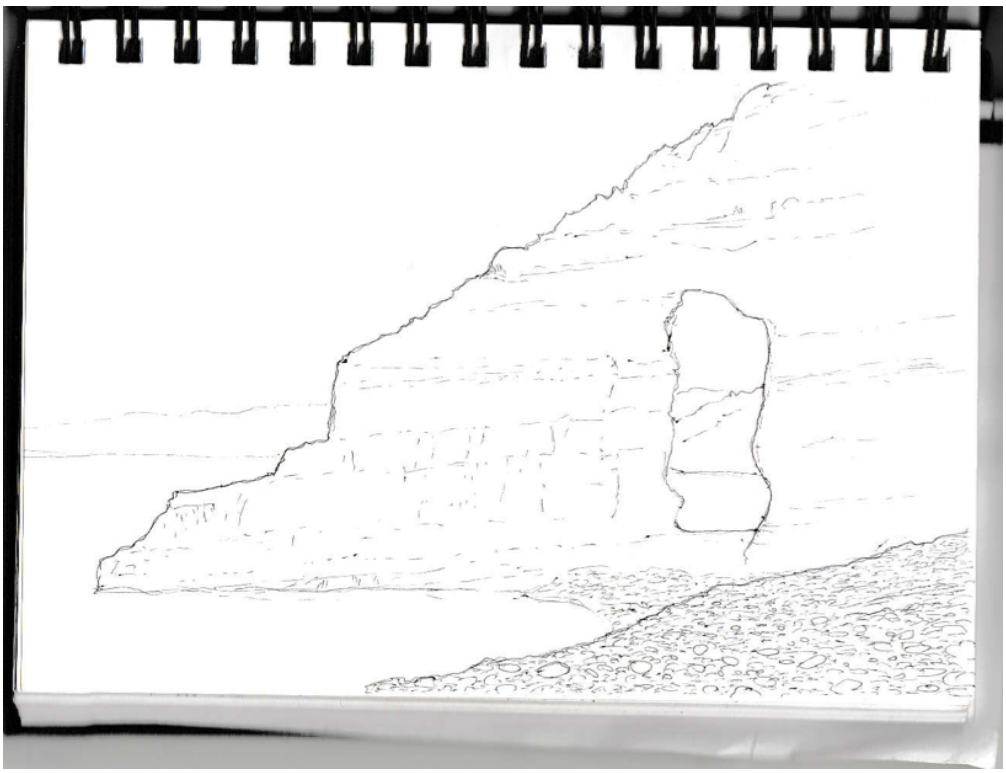
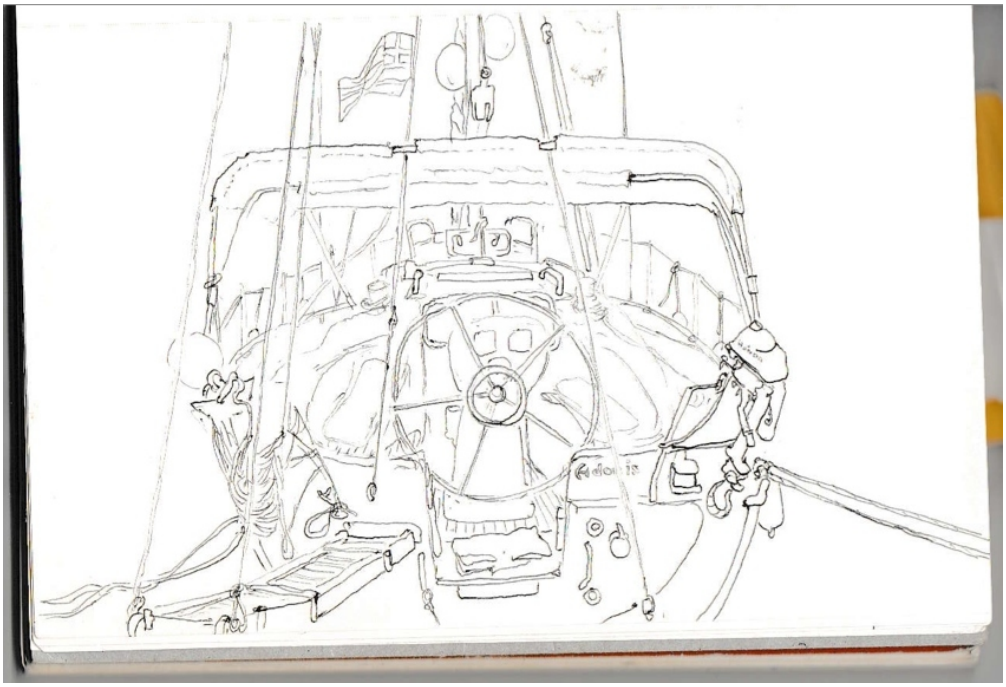


Fig. 5 Kefalonia. 16.08.2011. Image credit, RC.

286x218mm (72 x 72 DPI)

Fig. 6. Kalamos. August 2013. Image credit: RC.

304x204mm (72 x 72 DPI)



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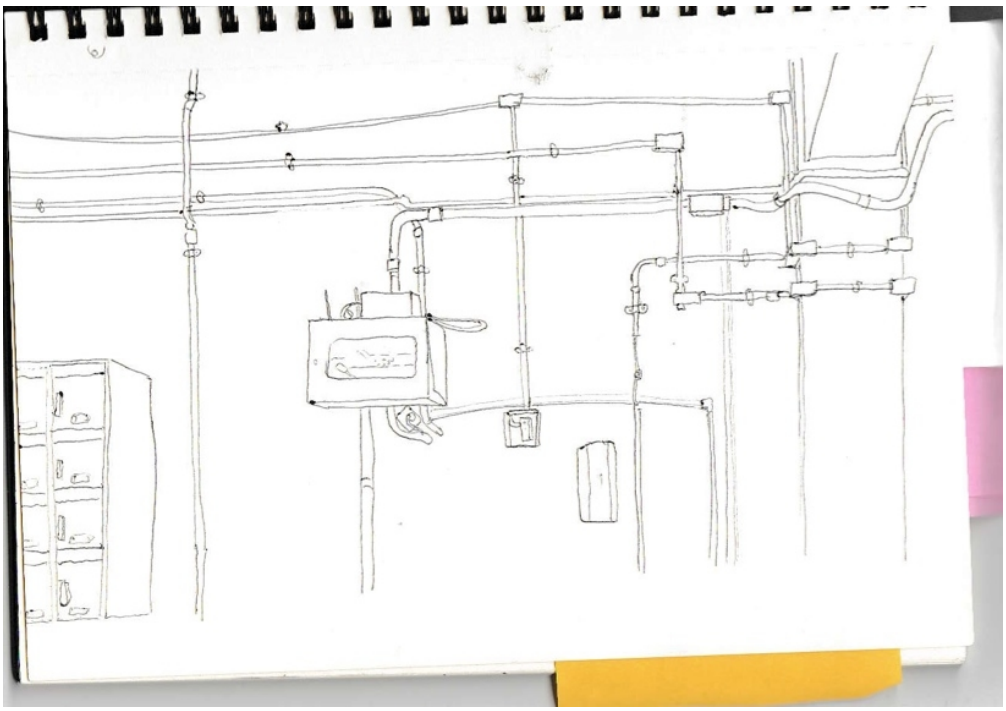
298x202mm (72 x 72 DPI)

Playing Carmen at the Conservatoire Régional, Paris, 29.3.2015, Image credit: RC.

399x279mm (72 x 72 DPI)



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288x202mm (72 x 72 DPI)

Fig 2. The original photograph with superposed lines of contrast and a "natural" drawing parsing of the scene it represents.

369x139mm (96 x 96 DPI)