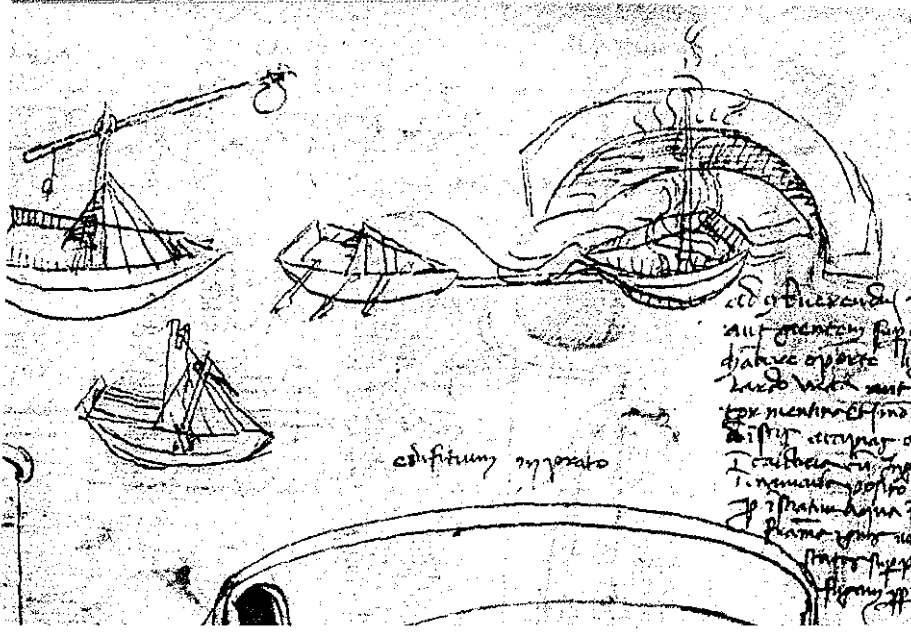


Figure 34: Details from Taccola's Notebook (from first half of C15)
Several sketches of ships are shown exhibiting different types of protective shields, and one with a "grappler." These are the first known examples of using sketching as a tool of thought.
Source: McGee (2004); Detail of Munich, Bayerische Staatsbibliothek. Codex Latinus Monacensis 197 Part 2, fol. 52'

The Anatomy of Sketching

The only true voyage of discovery is not to go to new places, but to have other eyes.
—Marcel Proust

Both sketching and design emerged in the late medieval period, and this was no accident. From this period on, the trend was toward a separation of design from the process of making (Heskett 1980). With that came the need to find the means whereby the designer could explore and communicate ideas. Sketching, as a distinct form of drawing, provided such a vehicle.

The first examples of sketching, as we think of it today, come from Siena, from Mariano di Jacobi detto Taccola (McGee 2004). In the first half of the fifteenth century, he embarked on a four-volume set of books on civil and military technology, called *De Ingenisis*. In a manner not unlike George Lucas and *Star Wars*, he completed volumes 3 and 4 first, and delivered them to the emperor in 1433. Volumes 1 and 2 were never completed. Rather, he went on to work on another project, *De Machinis*, which he completed in 1449.

This might seem like a little too much arcane detail, but you kind of need to know it in order to understand the following excerpt from a recent book about Taccola's work:

> What is significant for our purposes is that Taccola worked out many of the ideas he presented in *De Machinis* by filling the unfinished pages of Books 1 and 2 of *De Ingenisis* with hundreds of rough sketches, turning them into a sort of notebook. Examining these sketches and comparing them to the drawings in *De Machinis* we are able to follow a person actually working out technical ideas for the first time in history. (McGee 2004; p. 73.)

That is, Taccola's sketches, such as those seen in Figure 34, are the first examples of the use of sketching as a means of working through a design—sketching as an aid to thought.

For a discussion of the figure, we turn again to McGee:

> Here we see that Taccola has sketched three different kinds of protected attack boats: one with a stone dropper, one with a ram, and one with a large hook or "grappler" on the side. We immediately see that his technique has enabled him to quickly generate three alternatives. Using paper, he is able to store them. Stored, they can be compared. In short, Taccola's style provided him with a graphic means of technical exploration. (McGee 2004; p. 76)

Now let us move from the renaissance to the present. For the sake of argument, let us assume that design and sketching are related. Furthermore, let us assume that we can gain insights about design by way of cultivating a better understanding of sketching. Doing so is not too much of a stretch. For example, museums such as Boijmans Van Beuningen in Rotterdam exhibit sketches, models, and prototypes in their own right, as a means to inform us about the process of product design.

> In the past few years within the profession of industrial design there has been increasing attention on the story behind the object, in which sketches, design drawings, models and prototypes play a prominent role. They make possible a reconstruction of the interesting history of their origin. Above all they make visible the designer's contribution, which is often very different to what one might expect. (te Duits 2003; p.4)

In this spirit, I want to introduce a number of sketches that were generated in the course of realizing a product, in this case a time-trial racing bicycle designed for Lance Armstrong for the Tour de France. These appear as Figures 35 through 39. The first four images are in chronological order. The first three take us from sketch to engineering drawing. The visual vocabulary of all the figures is different, and it is important to keep in mind that these variations are not random. Rather, they are the consequence of matching the appropriate visual language to the intended purpose of the rendering. The conscious effort of the designer in doing so is perhaps most reflected in Figure 38, where the designer has gone to extra effort to "dumb down" the rendering in order to ensure that it did not convey a degree of completion that was not intended.

In looking at the drawings, keep in mind that they follow only one of the many concepts explored—the one that was eventually built. Early in the design process it would not be unusual for a designer to generate 30 or more sketches a day. Each might explore a different concept. The figures used are intended to show different styles of visual representation of just one of these, not to show the breadth of ideas considered.

Looking at them individually, we see that Figure 35 is clearly a sketch. Its visual vocabulary suggests that it was hand drawn, quickly and effortlessly, by a skilled artist. It says that it does not represent a refined proposal, but rather simply suggests a tentative concept. But what is it in the vocabulary that tells us all this? Largely, it is the freedom, energy, abandon, and looseness of the lines. It is the fact that the lines continue on past their natural endpoints. It tells us no rulers were used.

Even if the designer laboured for hours (or even days) over this rendering, and used all kinds of rulers and other drafting tools, it does not matter. The rendering style is intended to convey the opposite, because the designer made this sketch with the clear intention of inviting suggestions, criticisms, and changes. By conveying the message that it was knocked off in a matter of minutes, if not seconds, the sketch says, "I am disposable, so don't worry about telling me what you really think, especially since I am not sure about this myself."

Figure 36 is a refinement of the previous sketch. It has all the sketch-like properties of Figure 35, but includes rough shading in order to tell the viewer more about the detailed 3D form of the concept being pursued. As in the previous sketch, it would look at home on the wall of a drawing class. It says, "I'm thinking seriously about this form, but the ideas are still tentative. But as I am getting more serious, tell me now what you think."

Figure 37 is not a sketch. This is a "serious" piece of work. Because of the wireframe mesh on the surface, the precision of the lines, and the quality of the corporate graphics, this rendering says that it took a lot of care and work, and that it was done on a computer. It is a 2D rendering of an accurate 3D model of the entire frame. Compared to the previous two drawings, it says "expensive" and "refined" (although the retention of the wireframe mesh in the rendering also says "but not finished"). It says, "We have made some decisions and are seriously considering this path."

Let me put it this way: of the dozens of concepts worked up to the level of the first two sketches, very few would be taken to this stage. To any literate reader of drawings, this is implicit in the style of rendering itself. The funnel is converging.

Now we move to my favourite rendering, Figure 38.

This is a hybrid. What the designer has done is make a photorealistic three-quarter view rendering of the 3D model previously seen in Figure 37. He has then made a composite with it and the hand-drawn sketch seen in Figure 35. But why would he do this? He was working to a tight deadline. He had no time to spare, and this took extra work. He already had done the 3D model. He just could have used the photorealistic three-quarter view rendering on its own. The answer is in the figure itself. The extra effort was undertaken to imbue the resulting image with the quality of a sketch. To make it look all the more effortless. To say, "This isn't finished," and to invite suggestions and communicate that the design was still open to change.

Now look at Figure 39. By this stage it is clear that these are examples of sketches. These types of sketches are actually among the first ones done in a project.

Michael Sagan, the designer, describes his process and use of such thumbnail sketches as follows:

> Typically I do very loose thumbnails to capture a gesture or a theme to start out. Often I will jot down words or phrases that I use as a semantic guide. As a design review step I will have another designer evaluate my 3D work ... checking back against my thumbnails and semantic guide-words. If the designer hits any of the words I count that as a success. In the case of this sheet that I included here ... one designer picked out almost all of the words ... much to his surprise when I showed him these images.

Finally, note the following. First these thumbnail sketches were made in the course of designing what, at the time, was probably the most technologically advanced bicycle ever built. Second, stylistically speaking, they are completely in keeping with, and would be perfectly at home in, the sketchbooks of Taccola.

Figure 35: Early Three-Quarter View Sketch of Time Trial Bike

Although done on a computer, this is a freehand sketch. Notice that the representation is tentative. What tells you this? Contrast this to the representation in Figure 37.

Credit: Michael Sagan, Trek Bicycles

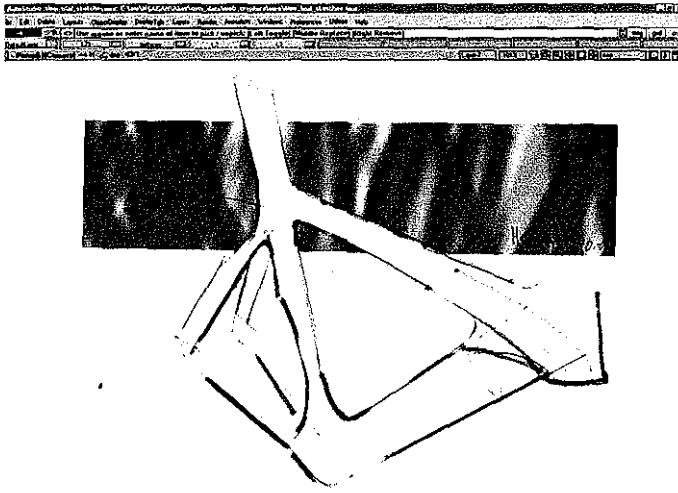
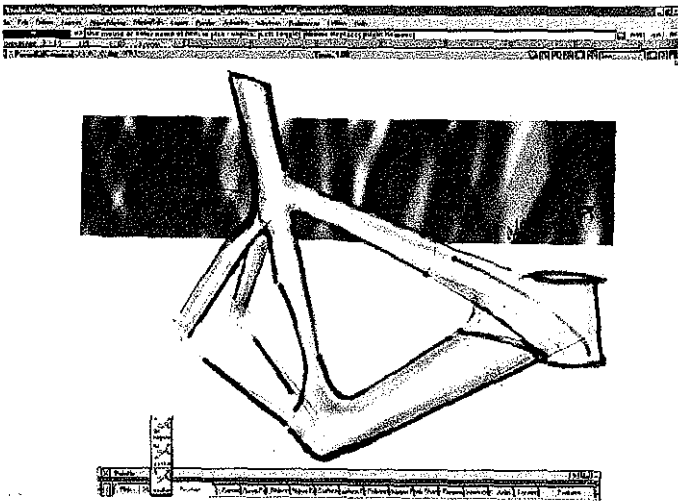


Figure 36: Shaded Three-Quarter View Sketch of Time Trial Bike

This is a refinement of the sketch seen in Figure 35. Through the use of shading, the sketch communicates more about the 3D form of the concept. Notice that despite this refinement lines still extend through the "hard points."

Credit: Michael Sagan, Trek Bicycles



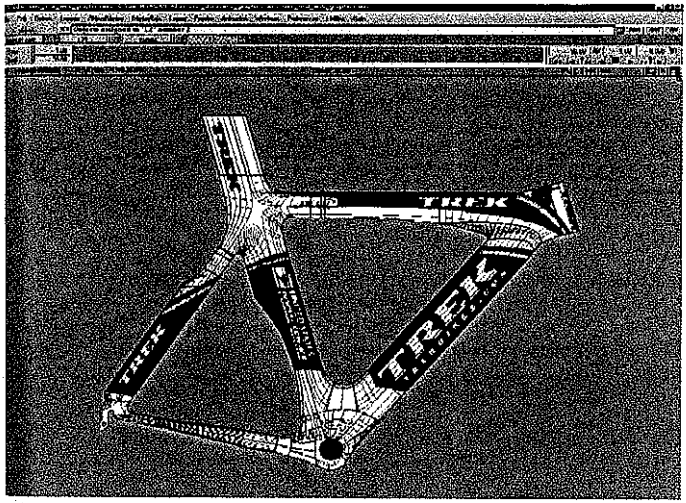


Figure 37: Side View of 3D Shaded Model of Time Trial Bike

This is a side view of the same bike seen in the previous two figures. Contrast this representation to that in Figure 36. Both are shaded to highlight the form. Ignoring the addition of the graphics for the moment, is it obvious, is it clear which of the two is more refined, closer to "final," and which took the most effort to create, and which will take the most effort to redo in the event of a change or suggestion. This image is clearly not a sketch.

Credit: Michael Sagan, Trek Bicycles

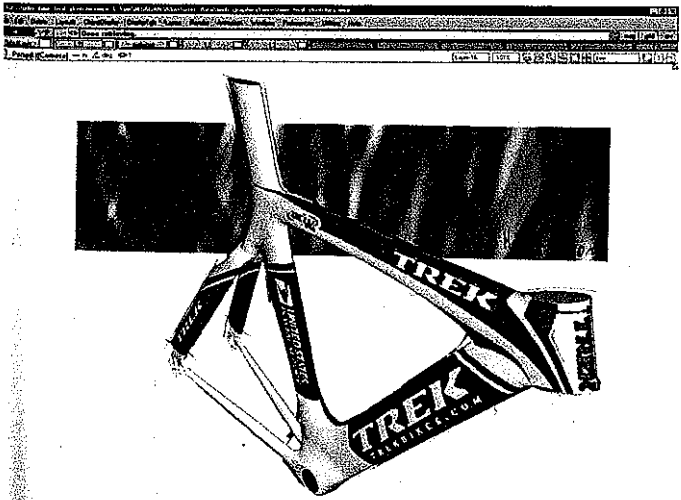


Figure 38: Accurate 3D Shaded Model Superimposed Over Three-Quarter View Sketch

This image is perhaps the most interesting. It is a composite of a three-quarter view of the 3D model seen in Figure 37 superimposed over the sketch seen in Figure 35. Given what we have seen thus far, ask yourself why the designer would do this.

Credit: Michael Sagan, Trek Bicycles

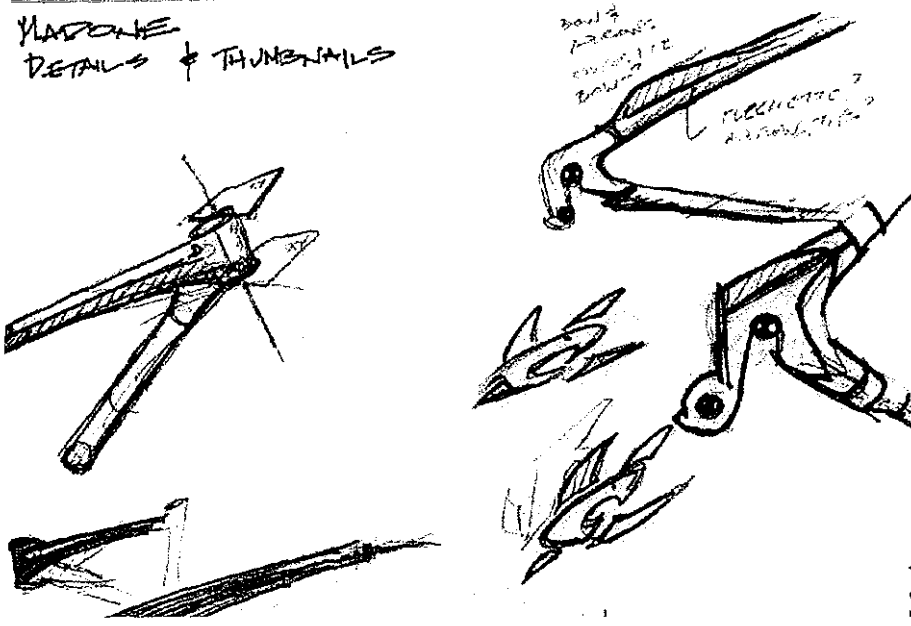


Figure 39: Thumbnail Sketches, Scanned from Sketchbook

In what century were these made? Yesterday? During the renaissance?

You can't tell from the form, only from the content.

Credit: Michael Sagan, Trek Bicycles

Sketching is not only the archetypal activity of design, it has been thus for centuries.

Having come this far, what I would like to do now is step back and try to use what we have seen in these examples as a means to come to some characterization of sketches in general.What I am after here is an abstraction of sketches and sketching. What I want is to go meta and identify a set of characteristics whose presence or absence would let us determine if something is, or is not, a sketch —at least in the way that I would like to use the term.

Here is my best attempt at capturing the relevant attributes of what we have seen and discussed/Sketches are:

Quick: A sketch is quick to make, or at least gives that impression.

Timely: A sketch can be provided when needed.

Inexpensive: A sketch is cheap. Cost must not inhibit the ability to explore a concept, especially early in the design process.

Disposable: If you can't afford to throw it away when done, it is probably not a sketch. The investment with a sketch is in the concept, not the execution. By the way, this doesn't mean that they have no value, or that you always dispose of them. Rather, their value largely depends on their disposability.

Plentiful: Sketches tend not to exist in isolation. Their meaning or relevance is generally in the context of a collection or series, not as an isolated rendering.

Clear vocabulary: The style in which a sketch is rendered follows certain conventions that distinguish it from other types of renderings. The style, or form, signals that it is a sketch. The way that lines extend through endpoints is an example of such a convention, or style.

Distinct gesture: There is a fluidity to sketches that gives them a sense of openness and freedom. They are not tight and precise, in the sense that an engineering drawing would be, for example.

Minimal detail: Include only what is required to render the intended purpose or concept. Lawson (1997, p. 242) puts it this way, " ... it is usually helpful if the drawing does not show or suggest answers to questions which are not being asked at the time." Superfluous detail is almost always distracting, at best, no matter how attractive or well rendered. Going beyond "good enough" is a negative, not a positive.

CREDIT LYONNAIS
Discovery
CHANNEL
AMD
TREK
Discovery Channel
TREK
SHIMANO

Appropriate degree of refinement: By its resolution or style, a sketch should not suggest a level of refinement beyond that of the project being depicted. As Lawson expresses it, " ... it seems helpful if the drawing suggests only a level of precision which corresponds to the level of certainty in the designer's mind at the time."

Suggest and explore rather than confirm: More on this later, but sketches don't "tell," they "suggest." Their value lies not in the artifact of the sketch itself, but in its ability to provide a catalyst to the desired and appropriate behaviours, conversations, and interactions.

Ambiguity: Sketches are intentionally ambiguous, and much of their value derives from their being able to be interpreted in different ways, and new relationships seen within them, even by the person who drew them.

In the preceding, the notions of visual vocabulary, resolution, and refinement are really significant, and interdependent. Sketches need to be seen as distinct from other types of renderings, such as presentation drawings. Their form should define their purpose. Any ambiguity should be in the interpretation of their content, not in terms of the question, "Is this an early concept or the final design?"

> ... a sketch is incomplete, somewhat vague, a low-fidelity representation. The degree of fidelity needs to match its purpose, a sketch should have "just enough" fidelity for the current stage in argument building.... Too little fidelity and the argument is unclear. Too much fidelity and the argument appears to be over—done; decided; completely worked out.... (Hugh Dubberly of Dubberly Design Office; private communication)

> Some of the most serious problems occur if various parties—managers and/or customers and/or marketing—begin to view the early prototypes [read sketches] they see as the final product. (Hix and Hartson 1993; p. 260)

Finally, in its own way, our list is more than not like a sketch itself. It is tentative, rough, and has room for improvement and refinement. And also like a sketch, these same values may very well contribute to, rather than reduce, its usefulness.

Figure 40: Designing a Performance
The outcome of any design process is a desired effect. Sketches have to be understood as steps in this process. While the beauty or clarity of each individual drawing might be appealing to the designer, ultimately the goal is to attain the performance declare at the beginning of the design process. This awareness is what differentiate a dexterous designer from a proficient renderer.
Credit: Trek Bicycles