# Vision and depiction
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# Introduction

## Starman

In februari 2018, Elon Musk launched a SpaceX rocket with a Tesla Roadster on-board. The car served as a test cargo and successfully escaped earth's gravity. It is now driving circles around the sun until the end of times. So enough fuel to escape the earth, but too little to escape the solar system. That scrooge Musk... with a bit more of propellant, "Starman" would have gone interstellar and possibly be found by extraterrestrials.



Figure 1.1: Starman floating away from earth, unfortunately with too little energie to go interstellar.

What would extraterrestrials learn about us, humans, by studying this product, this man-mad tool that we use for transportation? The space suit would give away much about human anatomy, but imagine Starman left the vehicle midway due to homesickness. An empty car. What does the interior, the *interface* for transportation, reveal about the human species? It is an interesting thought exercise, to think what you could learn about humans by studying their tools. The designers and engineers of tools have studied their users in great detail. Thus, the tool reflects the user; studying artefacts as a proxy for studying its user, and their conceiver.

Maybe this reverse engineering makes sense for the alien, but what about us earthlings? Would we learn something new about the humans by studying their tools and interfaces? In some cases, like physical ergonomics, it may be more efficient to directly measure the human anatomy instead of the chair. But in many other cases, the designer, artist, creator did not base their creations on pure measurements but on trial-and-error iterations, undocumented experiments and (expert) intuition. Those cases are extremely worthwhile investigating scientifically.

One area that is particularly interesting from this point of view is that of visual communication. Humans have been using depictions from the Flintstones onwards and have throughout history made many discoveries that would later be rediscovered by scientists. A good example is the use of light and shadow. Throughout history artists have perfected the use of shadows to 'glue' all objects in a coherent scene while also discovering that humans are quite insensitive for certain 'mistakes'. This approach of investigating what pictorial information is selected and ignored remains a lively research area. In other cases it becomes fuzzy who is learning from who, for example in the use of light. While preferred light directions revealed by neuroscience are in line with artistic practice the questions arises: *do artist follow perceptual laws, or do the* create *them?*

How and why humans create and use images and other types of 'information interfaces' has become the focus of attention for a wide variety of disciplines such as art history, (graphic) design, fine art, data visualisation, neuroscience, philosophy, artificial intelligence, computer animation, etc. All these fields are becoming increasingly interconnected, realising that central to all their interest is how humans interact, perceive and experience images.

We used Starman to illustrate that knowledge about visual perception and communication originates both from the arts and the sciences. We fabricated this thought experiment where we let Elon Musk put copious amounts of propellent for interstellar travel to arrive at this fascinating question: *"What would an alien*

Figure 1.2: Famous group portrait by Velasquez that can be used to explain almost everything, one of which is why light is often painted coming from left: for right-handed painters this means no shadow casting on the place where they are painting. If this is unclear, explore the painting a little longer, it will be a good exercise.

*think?".* How much would the design reveal about its maker? How much does art reveal about perception? While Musk did not send his car out of the solar system, NASA did actually do that in their 70's Pioneer and Voyager missions. And they were quite literally considering *"what would an alien think?"* if their interstellar spacecrafts were to be found. The second series of missions contained a golden record containing audio recordings, music and photographs. In figure 1.3 you can see some pictures for the alien to watch. Look at them, for a moment.

What are you attending to? First, you see the content, a highway, some kids, a guy with a stick, breastfeeding woman, supermarket and what looks to be an advertisement. If you were the alien and would be able to perceive the content like humans, you would probably ask yourself... *why?*. There are many ways of interpretation. Maybe you notice that the three bottom pictures show humans eating, but then there are these miniature transportation vehicles in the

Figure 1.3: Images on board of the 1977 Voyager mission

background of the supermarket scene...would they connect in some way to the highway picture top left? No matter what your interpretation might be, you will look for a message, or better, you will first consider whether the images are a message intended for you.

This photographic communication with aliens has a line drawing predecessor that was launched a few years earlier. When you first see it, it may strike you as enigmatically attractive. A link to the Wikipedia page may speed up the process (and save me some time). As you may expect, the plaque met much criticism from society. Besides that people did not find it very smart to give away the location of our precious little planet to unknown species, there were also complaints about the apparent Caucasian looking human couple of which only one had genitals. There was one more peculiar criticism, about the arrow indicating that the Pioneer capsule came from the planet earth. An *arrow*... What are the odds that if aliens will receive the plaque at all, that they also used arrows to hunt for food and would later use it as a graphic symbol?

This very lucid criticism came from Ernst Gombrich. He also wondered how the alien would interpret line drawings. When you think of it, a line drawing is quite different from a photo. So are they a convention? For the outline we could say that it denotes the separation of figure from background, but what are these lines doing within the outline? *We* know that these denote 3D shape articulations
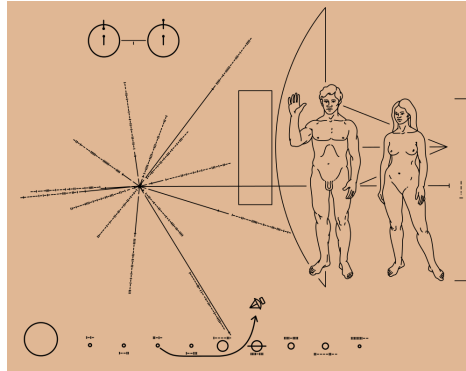
Figure 1.4: Image on board of the 1972 Pioneer mission

like muscles but this is not some kind of optics law (at least not straightforward).

Gombrich proposed an interesting analysis of visual communication. Borrowing from linguistics[1] he made a distinction between the EXPRESSIVE, AROUSING and DESCRIPTIVE functions of images. The expressive is associated with the sender, and the arousal with the receiver. This distinction is important, certainly in the context of *communication*: how much of what an artist/designer tries to express is actually received by the viewer? Not much, according to Gombrich! As an example he refers to the Bedroom and Night Cafe paintings of van Gogh. The Bedroom is rendered under a nonlinear perspective that makes you (me) feel uncomfortable while van Gogh intended to display a peaceful, tranquil space. The Night Cafe makes you long for late night game of billiard under the cozy spherical radiation, whereas van Gogh intended a place to go mad!

Why does visual miscommunication occur? Let's first check out a case where communication works relatively well. Traffic signs are learned symbols that are each visually distinct: the difference between a stop and parking sign is visually unambiguous. Also, the possibilities are limited, interpreting traffic signs is kind off a multiple choice test. Cases where communication may breakdown involve precisely these factors of experience and ambiguity. If an image can be explained in various ways it is ambiguous and the interpretations will depend receiver characteristics such as experience.

The human line drawings on the Pioneer plaque were perceived white by white people and black by black people. This has nothing to do with EXPRESSION

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[1] Karl Bühler

# The Visual Image

*What a picture means to the viewer is strongly dependent on his past experience and knowledge. In this respect the visual image is not a mere representation of "reality" but a symbolic system*

by E. H. Gombrich

Figure 1.5: Click image to read the paper.

nor AROUSAL. All interpretations you make are based on previous experience, you match what you see with an internal library of categories and relations. It is a great faculty of the human brain that it creates categories, it is the basis of (abstract) thinking and also of visual perception, because it is a form of *generalisation.* And because this past experience is not always similar, people sometimes tend to see things differently. Besides past experiences, we might as well add an extra ingredient to the recipe of perception: your (immediate) needs. Except for the Zen Buddhist, you are constantly looking for something, figuratively as well as literally. And also this affects your interpretation of images. Furthermore, your mental state (e.g. mood, intoxicating etc) also obviously affects your interpretation.

The proposal of Gombrich is a classification, i.e. an image can *either* be expressive, arousing or descriptive. This makes less sense in the visual domain than it does in for verbal communication. A verbal expression of anger is easily differentiated from a description of the weather or a command to be silent. With images, it seems, it makes more sense to address more than one of these functions, just like Gombrich did for the van Gogh paintings. A further problem with respect to images may be 'descriptive' is somewhat undetermined.

The rescue comes from Roman Jakobson, who expanded on the model of Bühler. Jakobson starts with communication = a sender, a message and a receiver. Then he adds three flanking functions next to 'message'. Firstly, the message needs a 'context' to which the message refers. Secondly, it needs a 'code' (at least partially) known to sender and receiver, and finally it needs 'contact', a channel through which the message is transmitted. Well, doesn't this sound like an attractive scheme to use in visual communication? Interestingly, Jakobson ac-

> *Visual!*
>
> All these factors inalienably involved in verbal communication may be schematized as follows:
>
> CONTEXT
>
> ADDRESSER          MESSAGE          ADDRESSEE
>
> CONTACT
>
> CODE
>
> Each of these six factors determines a different function of language. Although we distinguish six basic aspects of language, we could, however, hardly find verbal messages that would fulfill only one function. The diversity lies **not in a monopoly of some one of these several functions** but in a different hierarchical order of functions. The verbal structure of a
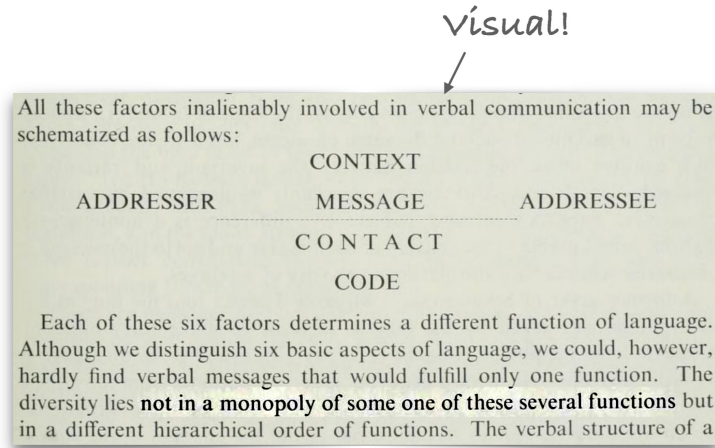
Figure 1.6: The model of verbal communication from Roman Jakobson.

knowledged that a (hierarchical) *characterization* on the basis of these functions makes more sense than a pure classification, just like we wanted. The 6 functions now become 'features' of visual communication. In some cases these features are 'metadata', such as the artist of an artwork (sender), or the gps location where a photo was taken (context).

**Sender**  Who is the sender? Is the sender also the creator? What is the intention behind the message?

**Receiver**  Who will be reached by the message? How is the message interpreted? How does the message affect the receivers' state of mind?

**Context**  What is the historical and social context? But also: what is the physical context, a museum, on the street, in a cave. And a bit meta: what is the form-context?

**Contact**  What physical medium is used? Is it real or a facsimile? What network established contact between the sender and receiver?

**Code**  What visual style is used to convey the message? What are the building blocks of the image?

**Message**  What can be seen in the image, what objects, persons, relations, narratives are present?

Note that these descriptions differ from the verbal version of Jakobson, I've taken some freedom in redefining them for the visual domain. Also, what makes the analysis of visual communication interesting is often the connections between these features. For example, the stylistic (code) references to other times and cultures (context), the relation between style and medium, etc.

Perhaps you already identified some known fields of study that address the functions above. Semiotics, for example, concerns the study of signs, which is a mixture of code and message. Iconography is the branch of art history that entertains itself with pondering what symbolic meaning paintings carry, and how they are related to each other through similar (often biblical) scenes. A step further is Iconology which analyses the image on the context (!) of the artist, time, place, etc.

Both iconography and iconology are concerned with content, meaning, metaphor, which is preceded by form. Before it is a house, it is first a square with a triangle on top. Form analysis, or also called formal (!) analysis, is concerned with all elements that make up the image, the building blocks. One of the founders of formal analysis is Heinrich Wölfflin, who introduced the form differentials[2] linear-painterly, plane-recession, closed-open and multiple-unity, and absolute-relative clarity. With these five principles Wölfflin could describe the stylist change from the Renaissance (where the basically just invented 'realistic' painting with perspective etc) and Baroque (where they started appreciating loose brushwork, light-shadow etc, e.g. Rembrandt & Caravaggio). Although these five dimensions are somewhat abstract and specifically conceived to contrast Renaissance vs Baroque, the idea of analysing images on the basis of their 'form' can clearly apply to any image.

Formal analysis became rather popular in art education, perhaps you already learned some in high school. Some interesting examples include an interesting video of Khan Academy and the dedicated website of the Getty Museum. The Getty scheme consists of the elements line, shape, space, color and texture. Interestingly, these elements of art are also elements of perception. The topics discussed when conducting formal analysis relate directly to topics from vision science. The study of perception is of a different nature than the artistic study of formal analysis Because it is primarily based on empirical evidence and has a certain biological focus: it aims to explain and predict how the brain processes visual

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[2]I'm inventing this term, inspired by 'semantic differential'

information. It doesn't mean it is *better* than the typical humanities disciplines like art history or media studies, but that it is complementary. This combination of humanities and the (behavioural[3]) sciences can often been encountered in ... design!

So where were we? We started at Tesla's and line drawings send into outer space and how aliens would learn from them. This was clearly meant as a metaphor for studying visual communication design. On the one hand we have artists, designers and other visual experts creating imagery, on the other hand we have scientists like ourselves using this imagery as a proxy for studying the human. The most overlapping areas within the communication process are the **receiver**, the **contact**, the **code** and the **message**. There is only one way to really figure out how a visual message is received, which is doing psychological experiments. Certain aspects of contact (medium) and code (style) require understanding of visually relevant physics, mathematics and biology. Finally, the message and what it represents requires an understanding of how representations are formed in our mind. All these topics are studied in vision science, which will be the starting point for our exploration. The real magic obviously happens when you combine everything, also knowledge and insights outside what we will now be discussing. There is no single book or video that can help you with that, it would contradict the basic perceptual law of 'beholders' share', *you* are part of this research too.

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[3]which includes perception