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Flattening and Unflattening
Philosophical Reflections on Images in Scientific Comics
Applatir et désapplatir
Réflexions philosophiques sur les images dans les BD scientifiques

Julia Meer

Article abstract

In my article, I undertake basic research on comics and knowledge transfer by comparing scientific comics with other forms of visualization in (the history of) science. In doing so, I elaborate the central characteristics of comics in reference to current research, and relate them to philosophical theories of images by arguing that the specific materiality of the images in general, and in comics in particular, has received little attention so far. The central thesis is that materiality is decisive for images not only to illustrate scientific theories but to become knowledge-generating media themselves.

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Flattening and Unflattening. Philosophical Reflections on Images in Scientific Comics

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Abstract. *In my article, I undertake basic research on comics and knowledge transfer by comparing scientific comics with other forms of visualization in (the history of) science. In doing so, I elaborate the central characteristics of comics in reference to current research, and relate them to philosophical theories of images by arguing that the specific materiality of the images in general, and in comics in particular, has received little attention so far. The central thesis is that materiality is decisive for images not only to illustrate scientific theories but to become knowledge-generating media themselves.*

Keywords: *comics; visualization; knowledge transfer; image theory; materiality*

Résumé. *Dans mon article, j'entreprends une recherche fondamentale sur la bande dessinée et le transfert de connaissances en comparant la bande dessinée scientifique à d'autres formes de visualisation dans (l'histoire de) la science. Ce faisant, je développe les caractéristiques centrales de la bande dessinée en référence à la recherche actuelle, et je les relie aux théories philosophiques de l'image en soutenant que la matérialité spécifique des images en général, et dans la bande dessinée en particulier, a reçu peu d'attention jusqu'à présent. La thèse centrale est que la matérialité est décisive pour que les images n'illustrent pas seulement les théories scientifiques mais deviennent elles-mêmes des médias générateurs de connaissances.*

The number of scientific comics is steadily increasing. As a result, comics are becoming a central medium for conveying knowledge. This article aims to undertake basic research on the topic of comics and knowledge transfer by comparing scientific comics with other forms of visualization in science. In doing so, I elaborate the central characteristics of comics in reference to current research, and relate them to philosophical theories of images by arguing that the specific materiality of the images in general, and in comics in particular, has received little attention so far. The central thesis is that this materiality is decisive for images not only to illustrate scientific theories, but to become knowledge-generating media themselves. My argument has three parts.

In order to describe the wide thematic as well as historical range, I start at the very beginning, namely with the myth of the Butades and the first philosophical reflections on images in Plato. The former describes image-making as an act of flattening, the latter the ontologically precarious character associated with it. Building on this, I address, secondly, visualizations in the sciences and compare them to scientific comics. This comparison is made both theoretically—by pointing out the entanglement of image/text and sequentiality/simultaneity as central characteristics for comics in reference to the research literature—and practically—by describing Andreas Vesalius' so called musclemen as a proto-documentary comic strip and giving examples from comics. In the third part, I show that image making is in a certain sense flattening, and thus a process of disembodying, but simultaneously, creates a specific spatiality and a twofold corporal exposition. This allows images to move from mere illustration to knowledge-generating. In reference to Sousanis, I call this cognitive figurative potential "unflattening".

HISTORICAL CONSIDERATIONS

According to Pliny the Elder (35,151-152), the young Corinthian Butades is considered the inventor of the art of drawing. Her beloved has to leave, but she does not want to let him go and therefore tries to keep at least a memory by creating a picture of him. So she takes up a pencil and outlines the shadow of his face on a wall.[1]

In this myth, two central transformation processes are addressed that characterize the act of drawing and of visual representation: the shadow implies a reduction of the volume to the surface and thus a first fundamental process of transposition and reduction, which in the myth is not attributed not to the human faculty but to nature. This marks a process of *flattening*. Through the contouring/sketching of Butades this flattening results in a second transformation process: the cultural technique of inscription and sign-making. The silhouette drawn by Butades is thus the representation of a representation, an image of an image (shadow), a copy of a copy (Stoichita 12). We take such pictured or inscribed surfaces for granted, but their flatness, compared to the three-dimensional world in which we move, forms an *artificial space* (Krämer 65) in which depth is missing.

This myth of the origin of drawing shows astonishing parallels to the first preserved philosophical reflections on the image in Plato: found, among others, in his famous allegory of the cave.[2] In the VII

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[1] This *first* image is said to have been present in Corinth as late as the 2nd century AD, as the philosopher Athenagoras writes (17,3).

[2] Although there are no direct references between the two myths, there is a strong connection between central elements in their history of interpretation.

book of the "Politeia" (514a-518b), Plato lets Socrates describe a cave in which people have been living since childhood. They are stuck in the same place, with necks and legs fettered, facing the wall of the cave in front of them, seeing neither themselves nor the others, nor what is behind their backs, namely the exit and a fire. Between the prisoners and the fire is a path, along which rises a wall. The fire illuminates the cave wall, to which the eyes of the inhabitants are directed. They see on it the shadows of artifacts that are passed along the way by carriers, but not the objects themselves (Plato rep. 514a-515a).

In the allegory, the cave stands for the sensual world in which we live; that is, ontologically speaking, the images of the ideas. The shadows on the wall thus stand for the images of those first images. Applied to art, this means that Butades, as the mythical first drawer, captures the images of the world once more when she outlines the shadow of her beloved. She creates another likeness, which is no longer a direct imitation of the ideas, but rather an imitation of the imitation, since she does not portray the young man's face directly, but his shadow.

Consequently, images in Plato are not determined by an extrinsic relation to an object, but by the fact that they are intrinsically bound to something absent, an archetype. If this is done directly, they are *likeness-making* (Plat. soph. 235d, 266d, *mimesis eikastike*). Their relation of resemblance to what is represented is true, since it is based on the mathematical relations of *calculating, measuring, and weighing* (Plat. rep. 602d) and thus ensures that they are not deceptive. For this, however, it must be accepted that the images do not necessarily appear visually correct. (Plat. rep. 602d-602e) In the case of artistic images, and thus also in the case of Butades, the depiction takes place via the detour of another image. For this reason, they are *appearance-making* (Plat. soph. 266d, *mimesis phantastike*), which, according to Plato, is limited to reproducing the appearance which is itself an illusion (Plat. rep. 596e). Accordingly, Plato criticizes the painters: like the sophists, they pretend to possess abilities which they do not have at all. They pretend to produce all devices and things, everything that grows from the earth, all animals, the people, even the gods, and in general everything in heaven and under the earth, while they could not make the things themselves as they truly are. (Plat. rep. 596e) Thus, they pretend to create being, while they would at best be able to depict it and to refer to it. If the silhouette of the lover of Butades pretends to replace the real man, or to claim to be perceived in his own being, this represents an unacceptable danger for Plato: it comes to a confrontation with the non-being, which is "unthinkable, unsayable, unutterable, and unformulabe" (Plat. soph. 238c). To sum up, the allegory of the cave contains a fundamental criticism of images, but it testifies *ex negativo* Plato's acknowledgement of the power of images.

## VISUALIZATIONS IN SCIENCE AND SCIENTIFIC COMICS

Similar to Butades, a twofold image-making and twofold flattening takes place in the visualizations of scientific theories: it is theories or models of the world that are then illustrated.

The need to visualize theories seems to be genuinely connected with science. Despite his criticism of the image, Plato also uses visualizations: he likes to speak in allegories (like in the Allegory of the Cave) in order to illustrate his dialogues. Furthermore, it is possible that his Analogy of the Divided Line was diagrammed: the line construction in the text remains very indeterminate, which seems strange given the importance of the analogy. However, it is likely that diagrams were drawn and discussed during practical exercises within the Platonic academy (Netz 39). The indeterminacy of the line construction would thus be a reference to the fact that a real drawing corresponds to it. The ontological-epistemic meaning of the line configuration is explained by the illustrative real diagram. This is corroborated by a Parisian

manuscript of the "Politeia", which is provided with a drawing that then appears for the last time in an edition of 1938 (Krämer 147).

Visualization seems to be an integral part of science (even if there are relatively few in philosophy (e.g. Boehm 2001, Bredekamp 2015, Rosenblum 1994). However, the forms are very diverse: besides a variety of technical and abstract representations, such as diagrams, models, and sketches, there are also figurative-artistic ones. Some of the latter, such as Leonardo's technical drawings or Diderot's sequential drawings in the "Encyclopédie" (starting 1751), have been interpreted as proto-documentary comic strips. Not to join in the overbidding of historical predecessors in research, but to supplement them with a very specific example, I would like to consider Andreas Vesalius' so-called *musclemen* in more detail.

Vesalius' treatise *De humani corporis fabrica* from 1543 is considered the foundational book of modern anatomy. Over the course of about 700 pages, divided into seven books, Vesalius summarizes his knowledge, describing bone structure, muscles, veins, nerves, abdomen, thoracic cavity, and brain. He aims to describe the laws of anatomy and the technique of dissection: for this purpose, the text passages are accompanied by very famous woodcuts. On these, fourteen so-called *musclemen* can be seen, who do not stand in a vacuum like an abstract model, but move in a landscape that is far too small in relation. Their attitude seems exaggerated, almost comic-like. They come into particular proximity to comic strips through their sequential structure: the musclemen lose, image after image, page after page, another layer of their body.
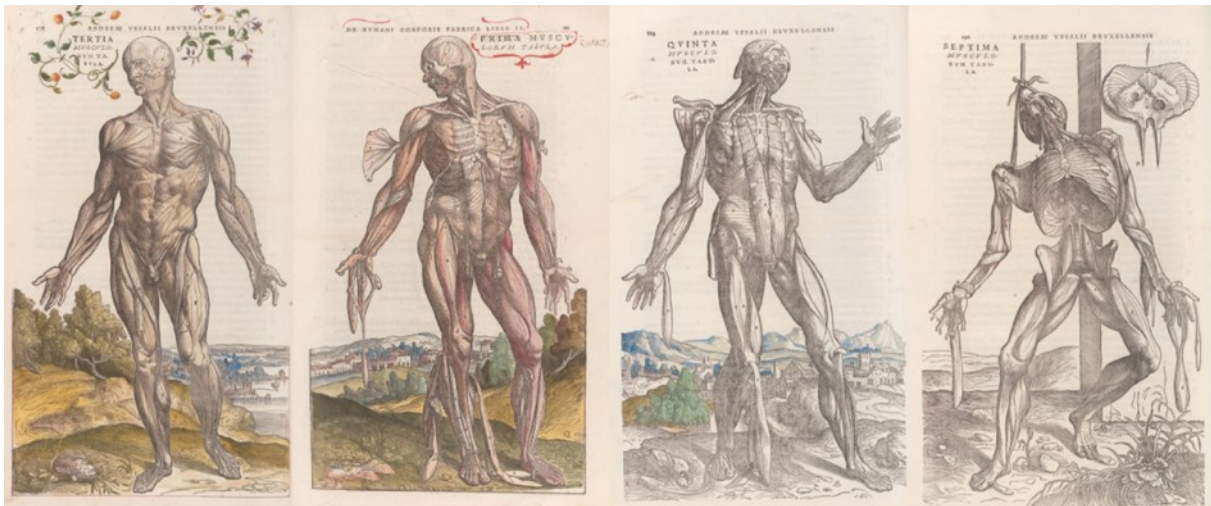
Vesalius. "*Musclemen*" (178; 181; 184; 187).

Even if Vesalius' musclemen show elements of comics, there is still a long way to modern comics. In addition to the drawings themselves, technical and cultural factors are also required: mass literacy in the transition from the 18th to the 19th century, and the planographic printing process in 1796. Narration by means of pictures, in which the story emerges from the pictures without long discursive passages, becomes more important from the second half of the 19th century (Knigge 3-4). Non-fiction comics have been increasingly popular in the United States since the 1940s, and in English- and German-speaking countries since the 1960s (Hangartner 293).They include quite different genres, such as reportage, documentary, autobiography, biography, travelogue, infocomics, and scientific comics. According to Kuttner, Sousanis and Weaver-Hightower, the latter can very generally be understood as "a broad set of practices that use the comics form to collect, analyze, and/or disseminate scholarly research." (397)

There is a broad consensus on two characteristics of comics in general and thus also for scientific comics: first, the "hybrid, visual-verbal form" (Chute 4)[3]. This distinguishes comics significantly from other forms of visualization in the sciences. Although these are also often a visual combination of drawing and writing, they are not so strongly intertwined and, secondly, usually consist of a single image highlighted from a continuous text. In comics, by contrast, the visual and the verbal are strongly related to each other, and the images have become autonomous from the original text (namely, the scientific theory). However, this distinction is not strict, but rather fluid: the "becoming an image" of a visualization increases with its independence from the accompanying text (Krämer 61). Scientific comics achieve a particularly high degree of autonomy here: they become image/text weavings themselves. This is rarely the case with diagrams, for example—although these can also become independent from their archetype. Vesalius' musclemen are in-between: they are images in the continuous text, but over time they have acquired an autonomy that has decoupled them from it. I will go into this in more detail in the next part.

The second widely accepted characteristic is the *sequential character*[4] of comics. That is, comic panels are likely to be read in sequential order. The frames can be understood as boxes of time, and present a narrative that is threaded through with absence in the form of the white spaces, the gutter (Chute 5-6). The reader plays an active role by connecting the images together and giving it a sense of continuity (Kuttner et al. 202; McCloud 202).

This sequentiality as specific temporality of the comic, however, takes place in the spatial juxtaposition that arises precisely through the flattening in the course of the artistic act: time is shaped spatially on a page through panel size, shape, placement, and rhythm. And different temporal dimensions can also be gathered in one image without problems. Spiegelman, for example, brings past and present moments together in panels that are traditionally understood to represent only one temporal register (Chute 7; McCloud 27). This simultaneity is one of the fundamental pictorial achievements (Jonas 248). Sousanis describes this as follows: "While comics are read sequentially like text, the entire composition is also taken in – viewed – allatonce." (62, also 74)

In particular, I would like to point out that the specifically sequential element of the comics is twofold: the juxtaposition of the images can be read not only as the connection of individual units to a sequence, but also as the *sequencing* of a larger composition into smaller parts. This segmentation seems structurally inherent to comics in view of their organization in boxes. This brings the sequential art of comics back into a close relationship with anatomy (Ault; Packard) and the musclemen of Vesalius. The white spaces in comics sometimes look like they are cut with a knife. The aesthetics of comics include a process of flattening, like in the myth of Butades. In turn, on the two-dimensional surface takes place pluralization through the different elements brought into play (image, words, time, space, humor, etc.). Moreover, this process is also combined with the dissection, cutting, and repetition of the depicted bodies.

This mode of representation is different from other visualizations. For example, diagrams also have a temporal simultaneity and can express temporal progressions, even make forecasts for the future, but comics have a much broader course due to the multitude of images/texts, which they develop

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[3] Spiegelman calls that "picture-writing" (27) and Satrapie speaks of "narrative drawing" (Hill 11); see also Knigge 5; McCloud 1; Kukkonen 4; Harvey 75-76.
[4] Eisner: "sequential art" (1985); Knigge 5; Kukkonen 4; McCloud 9: "Juxtaposed pictorial and other images in deliberate sequence"; Kuttner et al. 202: "combination of sequence and simultaneity".

autonomously from the original, i.e. they add or omit something. They also differ from other artistic forms of representation, such as central perspective: while in the latter, a vanishing point becomes the organizing principle of the picture surface, spatial simultaneity draws on the arrangement of different points of view and perspectives. In this way, the comic also departs from Plato's level of likeness-making: images in comics are not oriented according to mathematical principles, but rather by the ability to assemble different elements on one level, regardless of their size, and to make them appear.

In summary, and brought to a more general level with regard to the current state of research, it can be said that comics have a "multimodal nature" (Kuttner et al. 196)[5]: besides image and text, they combine space and time; simultaneity and sequentiality; and furthermore, gestures, handmade and mass-produced elements (Chute 9), and also humor (Eisner 142; Tisseron 64).[6] In research on comics, multimodality has been interpreted very differently: Hatfield (32-67) sees comics as characterized by their synoptic principle as popular and easy to understand. Hangartner even describes comics as the "art of complexity reduction" (297). For Sousanis (62-63) and Tisseron (67-68), on the other hand, it is an increase in complexity that necessitates multiple in-relation and multimodal reading. All these positions, however, agree that the engagement with images and texts, the simultaneity and sequentiality, requires a different reception than the reading process that is otherwise characteristic in the sciences. While in the latter the eye strictly follows a linear movement, in non-fiction comics, the eye is forced to stop in the linear movement in order to grasp the image. Thereby, the thinking necessarily slows and can start to observe itself (Krämer 75), i.e. to become self-reflective. This may allow a deeper and/or modified understanding of complex scientific issues.

In addition to these characteristics, or rather in close connection to them, the specific materiality in comics seems to me particularly important. Chute (7) points this out, but nevertheless it remains little explored in research. In the following, I will consider this issue and its relation to referentiality/resemblance in more detail, and derive from it a power to generate knowledge.

THE (INVISIBLE) BODY OF THE IMAGES

When Butades outlines the shadow of her beloved on the wall, a remarkable process of image-making begins: the stroke ceases to be stroke, the wall ceases to be wall. They step back and reveal a view of something absent, the young man. However, they themselves become absent insofar they withdraw behind the representation. In the course of the image's becoming, a flattening occurs, and with it an extremely remarkable transformation of materiality: an object is brought onto paper/wall/canvas, it loses its own body, it becomes flat.

At the same time, however, the body of the image loses its materiality in a certain way: a "looking through" (Jäger 60) occurs, the intrinsic materiality recedes to reveal the view of the object, the representation. Although what is depicted has lost its corporeality, it can be seen. For this, however, the paper, the line, the canvas, etc., must become medial as such, become transparent, and thus release the sight. But if a "looking at" (Jäger 60) occurs again, the image loses its pictoriality (for the most part) and becomes materiality: wall, wood, canvas, paper. Image-making, then, seems to be accompanied by a flattening and thus a double loss of corporeality: the body of the depicted is transformed into surface by the artistic process. In order to bring this to representation on the picture surface, the picture body must become medial.

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[5] See also: Kuttner et al. 200; Chute 2: "cross-discursive form"; Packard 60.
[6] These undoubtedly important elements would require their own investigation, which cannot be done in the following due to the conciseness of the article.

This clear separation of image body and representation, coupled with a clear referentiality, is also what Plato addresses in his reflections on the philosophy of images, and what he intends to bring under control through *mimesis* (imitation of ideas) and *methexis* (participation in ideas).[7] That he finds it necessary to clarify the (precarious) ontological status of images and their referentiality already suggests that images do not always fulfill their referential function. Thus already the legend of Zeuxis shows the danger of deception: Parrhasius is said to have engaged in a contest with Zeuxis. The latter exhibited grapes painted so successfully that the birds flew towards them. Parrhasius, however, had put up a linen curtain painted so true to nature that Zeuxis, proud of the birds' judgment, demanded that the curtain finally be taken away and the picture shown. When he realized his mistake, he awarded him the prize in sincere shame, because he himself had been able to deceive the birds, but Parrhasius had been able to deceive him as an artist (Pliny 35,64-65).

As the legend shows, there is a material difference between the original and the image, especially in the case of the artistic image. The representation purports to be the original: it purports to have a body, although it is flat. When Zeuxis touches the curtain, he does not feel a soft material, but rather he bumps hard against the body of the image. The artistic image, in all epochs of art history, works again and again on this difference, subverts it, closes it, brings it to representation itself. This is also the reason why Plato is so skeptical about painting and the artistic image. According to Plato, images are appearance-making because they deceive and seduce. How relevant this fear still is could be seen in the 1950s and 1960s in the US, where a great discussion about the danger of comics, especially for young people, took place. Wertham, in particular, saw in it a subversive, and "un-American" potential that influences negatively the youth (154).

Materiality, however, does not withdraw completely as it does not completely fulfill its serving role. It always remains present and thus also potentially resistant. When a body is brought onto a surface, it does not lose its corporeality entirely. The artistic process, as the myth of the Butades also shows, is a transformation of corporeality into another plane. As Deleuze (59) has shown using the example of Francis Bacon's paintings, the body undergoes a radical deformation in this process; it does not become incorporeal, but remains body: an exposed body on a surface (Nancy 97). This also is relevant for comics: especially in the autobiographical genre we see many authors, in particular women, who bring their stories and their bodies on the surface (Chute 10). By materializing their lives and histories in this way, they are exposing themselves radically, there is no chance to hide again. They put the body on the page. This exposition can be very radical and was in some cases mistaken for pornography. At this point I would like to go into more detail on two examples by Phoebe Gloeckner. The first picture is from "A Child's Life", in which she describes the story of a young girl called Minni that is also a story of sexual abuse and drug abuse. The picture itself is in the preface and shows Gloeckner covered with bullae because of Pemphigus Vulgaris. Although she never had the disease herself, she exposes her body, showing it deformed on the surface of the picture. The gaze is tormented and averted full of shame, but the body, once put on the picture, deformed with bullae cannot hide anymore. The injuries of the autobiographical subject are thus translated into the visual register right at the beginning of "A Child's Life" and inscribed on her body, giving a foretaste of the suffering that will unfold in the pages that

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[7] Plato's considerations are not merely theoretical-ontological. Rather, it can be assumed that he is making a concrete statement about a painterly practice and an aesthetic dispute, which is considered an Attic precursor to the *Querelle des anciens et des modernes* (Alloa 41).
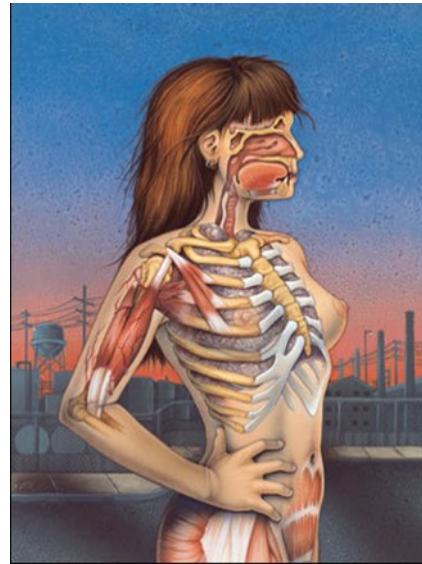
follow (Michael). In the second picture, the cover of the experimental novel "The Atrocity Exhibition", Gloeckner's professional background as medical illustrator becomes very apparent. Again, the figure shows parallels to herself. Beyond that, however, it also shows clear parallels to Vesalius' musclemen. The body is slit, stripped to the muscles and the skeleton and stands in a landscape that is proportionally too small. Unlike the musclemen, however, the figure is depicted in an urban setting and not as a whole. Compared to drawing one and the musclemen, it does not appear to be suffering, but has a proud posture. Gloeckner's drawings very often have this anatomically exact and scientifically descriptive character.

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"Self-Portrait with Pemphigus Vulgaris", 6. ©Gloeckner   Cover illustration for Ballard, J. G. ©Gloeckner

The deformation and transformation of the body also play an important role in scientific comics. For example, McCloud, in his metacomic "Understanding Comics", opts for an autobiographical narrative by constantly bringing his body into the picture. In this way, his book is far more strongly tied to his body (not his person) than is usually the case. The reader constantly has a physical impression of him whereas other scientific publications neglect this dimension.

Thus, even if materiality recedes in order to bring something to presentation, it shapes and configures the image through and through: in the body of the image, which gives the image a body in space; as well as on the surface of the image, through the radical corporal exposition. This can also be seen impressively in Vesalius's musclemen: the bodies take up almost the entire picture and appear as if pressed into it. Their posture seems unnatural, they seem to be writhing. The transformation to the surface seems to have been a deforming, challenging one for the dead bodies as well. Almost tortured, they stand in a landscape for which their bodies are too large in relation. They stretch out their skinned bodies to the reader, then their organs, and finally their skeleton. A body can hardly be more exposed.

Body and representation, depth and flatness, always go hand in hand in the image: the ontological structure of the image consists precisely of this gap. Plato was completely aware of this and saw in it the threat of images. To depict and to refer to something absent is just as much a part of its structure as the present body, and thus always implies the possibility of transcending the depictive function and becoming active oneself. On the basis of linguistic research (Austin; Rorty; Searle) this "becoming active" is often

described as performativity in the field of the performing arts (Wulf/Zirfas 8-14; Fischer-Lichte). In regard to (figurative) images, Bredekamp speaks of the pictorial act ("*Bildakt*", 51).

The precarious ontological structure of images also effects visualizations in the sciences. They are characterized by a particularly strong reference to the other, and a particularly weak *self*-reference. They rarely, if ever, stand for themselves. Their task is to open the view to something else. This *referring to* is not dispensable, its range is diverse and the variation is high (Krämer 79). Thus most visualizations in the sciences no longer start from an object of the world, but already from a text or a theory. Similar to Butades, the first flattening has already taken place here, and a second-order flattening occurs, in which the body of the image, however, also recedes to reveal the representation. Unlike the artistic image, however, these visualizations attempt to close the difference in materiality and do not deal with it so openly. But even in these forms, the materiality of the image can always open up. Diagrams, for example, do not fulfill in representing factual situations but can intervene in factual situations Krämer calls this active aspect in dealing with diagrams *operativity* or *cartographic impulse* (87): when an image or a diagram becomes active, it comes out of its disembodied two-dimensional flatness and intervenes in three-dimensional space. Thus an act of unflattening and embodiment takes place. A metamorphosis of the graphic figuration into an extra-graphic constellation can occur, whereby they not only describe knowledge, but can demonstrate it, lay new tracks in our knowledge space, and generate new one.

The scientific comic is an intermediate between artistic image and visualization: it refers to scientific theory/text and creates from it a multitude of artistic images, which, in their figurativity, in turn show a clear reference to the world. In contrast to Bredekamp, I would like to call this the *unflattening*, in order to get away from the subject-centeredness that is inscribed in the concept of the act. In doing so, I refer to Sousanis comic "Unflattening" as well as the artistic process of drawing shown in the myth of Butades. The cognitive potential of the figurative is already apparent in Vesalius' musclemen: initially intended to illustrate the dissected body of anatomy, they become a model of the human (body) itself and advance to a template in the visual arts. The development of human anatomy and the related image of man are in constant exchange with the representation of man in painting and the fine arts: the Florentine Academy of Art of the Cinquecento was the first educational institution to introduce anatomy as a compulsory subject. Anatomical knowledge thus became the basis of the art of painting in the European tradition (Jullien 84), and the "Anatomy" published by François Tortebat in 1667 is the first French work of this kind, specifically aimed at artists and featuring the musclemen after Vesalius. Also Diderot's "Encyclopédie" contains depictions of humans that clearly refer to Vesalius. The musclemen without skin are thus further transmitted and the necessity of anatomical knowledge for the artists is strongly emphasized. This begins a process of depicting the human body in perfect proportions and, on the other hand, installing the body as an object of scientific curiosity and as the antipode of the self or ego, which is increasingly understood as disembodied (Belting 100-106). In this sense, the musclemen lead to an inversion of the *explanans* and the *explanandum* (Kutschmann 394): they are perceived independently from the text and are no longer a mere illustration, but have themselves become a model for man and his representation. Thus, they themselves produce knowledge and become a model and object of knowledge for students of drawing and anatomy. By flattening knowledge on a second level (visualization of scientific text on anatomy), knowledge is thus carried back into life … is thus *unflattened* again.

The situation is similar in comics, and is particularly manifest in self-referential non-fiction comics. This becomes especially apparent in metacomics. Kuttner et al. state that there has been a methodological turn,

with scholars integrating comic creation into the research process itself: "We use comics-based research (CBR) to refer to research that integrates the comics form into one or more steps of the inquiry process" (Kuttner et al. 196). In this way, the artistic form of scientific comics, which was previously intended to depict science, itself becomes a form of science and generates knowledge about comics (and possibly also about psychoanalysis, pedagogy). At the beginning of this turn is Tisseron's medical dissertation which he submitted in comic form. This was noticed with interest by Roland Barthes and Michel Foucault,[8] among others, but then lost attention again. In 1995, Nick Sousanis presented a dissertation in comic form, in which he also explored the nature of comics in comic format. Sousanis calls his comic "Unflattening", referring to Edwin A. Abbott's novella "Flatland" in which the inhabitants could not fathom the concept of upwards. The novella has clear parallels to Plato's Allegory of the Cave and its immanent political dimension: the people in the cave live in illusion and are unable to gain knowledge. They believe that truth is nothing other than these shadows. For Sousanis, in turn, flatness is a type of narrow, rigid thinking (see for instance 6, 14). He says, we are often unable to see past the boundaries of our current frame of mind. Through its graphic innovations and restless shape-shifting, "Unflattening" is meant to counteract this. By fusing words and images to produce new forms of knowledge, "Unflattening" shows us how to access modes of understanding beyond what we normally apprehend.
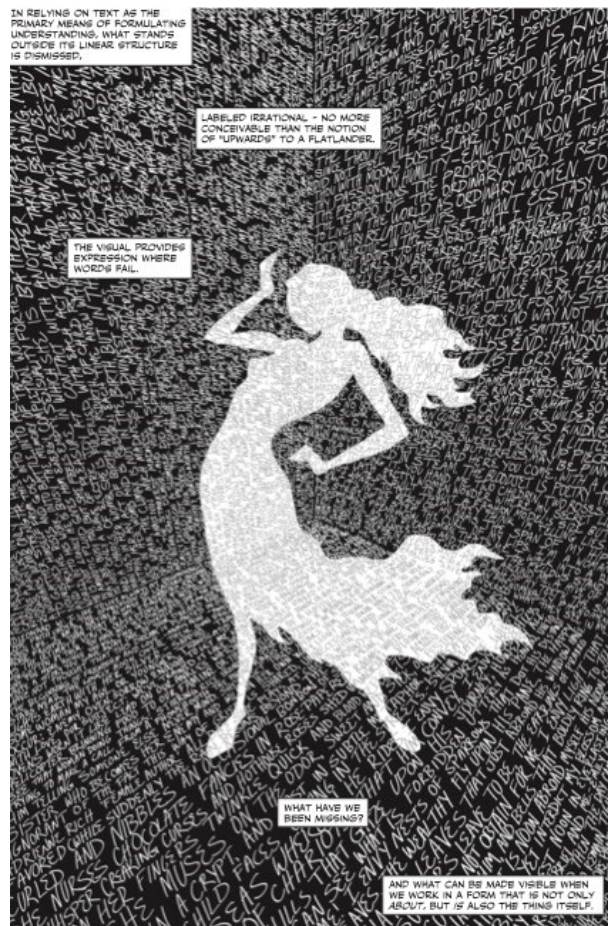
Sousanis 59 ©Sousanis

Today there are many self-referential comics, including many female cartoonists like Lynda Barry, Alison Bechdel, Phoebe Gloeckner, Aline Kominsky-Crumb, and Marjane Satrapi. The inversion of *explanans* and *explanandum* also becomes clear in another area: some of today's most riveting feminist culture production is in the form of graphic narratives. This results in a growing interest from outside the field of comics, i.e., the field of science. Feminist graphic narratives play an important role in defining feminism (Chute 2).

In conclusion, and once again brought to a more general level, the figurative power means that an image is created through flattening; at the same time, images are always capable of going beyond this flatness, of allowing materiality to break through and thus become *unflat*. Images not only illustrate, but have the power to generate knowledge.

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