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From fact to fantasy: Scientific illustrations and visual representations in the early work of Gaston Backman

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Abstract

Purpose – The purpose of this paper is to examine the characteristics and functions of images in scientific practices and how scientific images differ to other types of representation (e.g. textual, numerical or artistic images). To address these questions, the study looks into the illustration practice of the Swedish researcher Gaston Backman, who wrote several books on the origin of the human species, human anatomy, physical anthropology and race biology in the beginning of the twentieth century.

Design/methodology/approach – A comparative and functional analytical method is applied to show how the images act in his writings and how rhetorical and technical circumstances affect the way the images communicate and document scientific facts and ideas. Theoretically, the study relates to ideas suggesting: images to be serious partakers and vehicles of representation in the practice of science; and the need for images to be schematic and more abstract in comparison to an iconic image in order to work in this practice.

Findings – The findings of this study show that Backman used both schematic and iconic images in his research writings, and that these different image expressions had different functions: where the former was based on facts and had an informative and scientific function, the latter was based on fantasy/myth and used to promote ideological values and ideas.

Originality/value – This study stresses the importance of images in the practice of science, i.e. how images alongside verbal or numerical expressions act as important information and knowledge carriers in the work of science. Even though images intermingle with verbal and numerical expression, they also have a unique and specific, a role that needs to be taken seriously and investigated further in the realm of information studies and document studies. The authors also need to be aware that images can have different functions in the scientific practice, and are not always there to carry scientific facts or ideas, but ideologies and fantasies.

Keywords Information theory, Information science and documentation, Information media, History, Documentation, Audiovisual media

During the 19th century it became more and more common within the scientific community to visually illustrate scientific knowledges, processes, and results. This development was partly due to the dominance of observation as the main scientific method, and partly to technical improvements launched in the century – new printing techniques such as lithography, xylography, and in the end of the century, photo mechanical reproduction methods made it both much easier and cheaper to produce and print image illustrations. However, this illustration practice varied in different scientific disciplines and different research branches; various techniques and visual rhetoric were put into practice, and also the reason for using image illustrations varied.

Fig 1. The creation of a cave painting during the Magdalénien era. After Bölsche. (Backman, 1911, p. 144).

Fig. 2. Fragment of the top of a cranium. Notches and retouches. (Backman, 1911, p. 248).

Both images above are illustrations in the book *Människans förhistoria/The Prehistory of Man* from 1911, by the Swedish physician, anatomist, and anthropologist Gaston Backman (1883-1964), and can be seen as examples of this variation. Although they are part of the same publication, they differ completely in function and expression. In this article, these differences are taken as a starting point for a discussion on the role of images as representations and information tools in scientific publications and practices.

Thus, the purpose of this text is to discuss the characteristics and functions of images in scientific practices, and the following questions will be asked: What makes an image scientific/informative? Why are some images informative and other images not? What characterises a scientific image in comparison to an artistic image? And can images be informative in different ways?

To address these questions, the text will look into the illustration practice of the above-mentioned Swedish researcher Gaston Backman, who wrote several books on the origin of the human species, human anatomy, human physical anthropology, and race biology.

Fig. 3. Portrait of Gaston Backman, Uppsala, Sweden, 1913. Uppsala University Library
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In his publications, Backman made extensive and varied use of images to illustrate his scientific ideas and reasoning, such as graphs, maps, drawings, photographs, oil paintings, and prints. His interest in images was not unique: images had long played an important role in the research practice to which he belonged, e.g. anatomy, physical anthropology, eugenics, and scientific racism (Jahoda, 1999; Bindman, 2002; Kjellman, 2013, 2014, 2016; Gould, 1996, pp. 202-203; Maxwell, 2010; Pinney, 2012). *How* images were used and *what functions* they played in these scientific contexts varied, however. Taking as a starting point Backman's use of scientific illustrations, the outcome and consequences of this variation will be analysed, i.e. what did different image types bring to the scientific practice? Even if this study is mainly limited to the practice of the above-mentioned disciplines, it will hopefully shed some light on the role of images as scientific documents on a more general level.

Material, methods, theoretical aspects, and previous research

This text will focus particularly on one of Backman's books: *Människans förhistoria* (*The Prehistory of Man*), 1911. The book was a popular scientific text with an ambition of bringing the most recent knowledge on the origin of the human species to the Swedish audience of the day. It was published as part of *Populära etnologiska skrifter* (*Popular Ethnological Writings*) by Professor Hartman at the Swedish Museum of Natural History. The book is illustrated with 146 images and makes use of photographs, drawings, and prints, both in black and white and in colour.

To analyse the role images play in the publication, a comparative and functional analytical method will be applied. Thus, the analysis will focus on how the images act in the context of the book and how rhetorical and technical circumstances affect the way the images communicate and document scientific facts and ideas. In this aspect, the study relates to theories and concepts from three different areas: science and technology studies, information studies, and visual studies. Two texts in particular, Latour's *Drawing Things Together* (1990) and Lynch and Woolgar's *Sociological Orientations to Representational Practice in Science* (1990), have been of great importance to the paper, along with ideas and concepts from other scholars who have discussed the role of images in scientific practice (e.g. Kemp, 1990; Topper, 1996; Rudwick, 1985; Mason, Morphet and Prosalendis, 2006; Daston and Galison, 2007; Mitchell, 2015), not least from archaeology (Moser, 1998; Smiles and Moser, 2005) and scientific racism (Bindman, 2002; Browne, 2009; Jahoda, 1999; Kjellman, 2016, 2017). From the field of information studies, the following texts can be mentioned: Frohmann, 2004; Lund, 2010; McKenzie, 1986/1999; and Buckland, 2017.

One reason to address the role of images in scientific practices, is the fact that images are still under-investigated as cognitive and informative tools. In our society, knowledge and information – especially in the realm of science – have primarily been associated with verbal or numerical expressions. Images, on the other hand, have in the culture at large been perceived as emotional and aesthetical expressions, and in science primarily as illustrative devices; the idea has been that they primarily function as mirrors to the statements in the text, rather than adding something extra or unique to the research process (Topper, 1996, p. 218; Moser, 1998, p. xiii).

Sometimes they have been avoided altogether, with the argument that they are misleading (Latour, 2002; Kemp, 1997, p. 124).

However, in recent years a new attitude to image material can be discerned. Scholars from different disciplines have started to show an increasing awareness of the role of images as information and knowledge tools, both in the culture in general and in the scientific domain. In the field of information studies, not least in document studies, scholars have argued that images, like verbal or numerical expressions, must be seen as documents and knowledge-carriers (see e.g. Frohmann, 2004, chapter 7; McKenzie, 1986/1999, p. 13; Lund, 2010, p. 743). In the field of science and technology studies, Lynch and Woolgar talk about “the heterogeneity of representational order” in the scientific representational practice and include, in this practice, “graphs, diagrams, equations, models, photographs, instrumental inscriptions, written reports, computer programmes, laboratory conversations, and hybrid forms of these” (1990, pp. 1-2). Latour, when explaining how science is put into practice, works with an inclusive representational concept and defines science as “the way in which groups of people argue with one another using paper, signs, prints and diagrams” (1990, p. 21); Mitchell concludes, in the same vein, that science uses many different types of image: “Models, diagrams, photographs, graphs, sketches, metaphors, analogies, and equations (the whole Peircean family of icons or symbols by resemblance are crucial to the life of science)” (Mitchell, 2015, p. 23). Also, Moser argues for the importance of images to science, and emphasises the different roles they play in the practice of research: “Visual representation is not only crucial to the communication of scientific discoveries and ideas, it is also a central component of the scientific process, playing a role in the production of theories about scientific phenomena” (1998, p. 2).

At the same time, scholars have stressed that images work differently to numerical or verbal expressions. A common idea about the demarcation between images and words is that words are arbitrary/symbolic while images are iconic, ~~i.e.~~ they share a likeness with the object they represent (Atkin, 2013). However, in the work of science, it is not likeness in some ‘naïve’ sense that makes images efficient tools in the service of science. The idea that an immaculate representation of reality, which captures all the aspects of the individual object, is a good scientific image, is a tenacious idea that needs to be abandoned if we are to understand the functions of scientific images. Since science wants to discuss and pinpoint the typical and signifying aspects of an object, a good scientific image excludes – from reality – individual and

irrelevant aspects of the examined object. Thus, as Mason, Morphet and Prosalendis explain, a scientific image needs to reduce all “visual data that are extraneous to the intended meaning of the image. These may include colour, perspective, background, organic elements, depth and texture”. They define three processes of reducing: “framing”, “focusing” and “filtering” (2006, pp. 12-13). Accordingly, a schematic pictorial rhetoric, where the accidental and circumstantial can be left out, is more appropriate in the context of science than an iconic and immaculate reflection of reality (Rudwick, 1985; Topper, 1996, pp. 246–247; Kjellman, 2014). A similar idea is put forward by Latour when he claims that images need to be consistent. He says that when it comes to a visual scientific language, we need a stability in our visual representations which allows us to transport them, to depict objects on different scales and from different angles and perspectives, in separated pieces, etc. without risking a loss of information. Latour states that they must “allow translation without corruption” (1990, p. 28). This translation process is assisted by a more schematic pictorial language and not a naturalistic language striving for likeness.

Even if all scientific disciplines need optical consistency, and the properties presented above are commonly shared by images used in scientific practice, it is also important to stress that these representations can vary, and may take many different forms and expressions depending on the disciplinary context and task. Lynch and Woolgar stress that scientific disciplines tend to develop their own special pictorial rhetoric adjusted to their needs. Like any language, the visual scientific language is a social one; it is developed and practiced within a specific social and scientific milieu, and it is this context that gives meaning to the images developed. “The organisation, sense, value, and adequacy of any representation is ‘reflexive’ to the settings in which it is constituted and used” (Lynch and Woolgar, 1990, p. 11). Or, as Clarks writes when discussing images within the context of evolutionary scientific practice: “Scientists develop visual lexicons, sets of motifs that stand for ideas and assumptions familiar among colleagues. Scientists formed a community that increasingly spoke a private language, and even the pictures they drew contained specialised professional vocabularies. Outsiders might well have misunderstood” (2001, p. 1278). Hence, in the long run, the most important or signifying aspect of scientific images is not how similar they are to the “real world”, but how well they serve as objects of representation in the scientific process and practice, and the fact that a scientific community agrees on what they represent and how to read them.

Rudwick makes a similar point. He claims that a schematic pictorial language is actually something that characterises a mature scientific discipline. When disciplines evolve, and develop shared methods, scientific goals and institutional structures, they also produce a stable visual language, focusing on the central aspects of the objects of interest to the disciplines. In this process, picture elements become more abstract and theory-loaded (Rudwick, 1985). From this it follows that scientific images cannot be interpreted “openly”. The correct (intended) reading of a scientific image is important as opposed to the reading of an aesthetic or popular image, which is more open to personal interpretation (Mason, Morphet and Prosalendis, 2006, p. 12).

Also, in those disciplines where Gaston made his major contributions, for instance physical anthropology, anatomy, and archaeology, specific pictorial languages were developed, or at least efforts were made in that direction. Kjellman (2016, 2017) has shown that the discipline of physical anthropology in Sweden, during its heyday in the end of the 19th century and beginning of the 20th century, tried to produce stable graphical codes and symbols. But without a mutual theoretical framework and shared methods – aspects which (according e.g. Rudwick, 1985) generally characterise a mature scientific discipline – and a research agenda more driven by ideological presumption than by serious scientific endeavours, physical anthropology ended up with a very disparate and dysfunctional pictorial rhetoric that soon became obsolete. Archaeology, on the other hand, took a completely different line of development. Smiles and Moser (2005, pp. 1-6) have shown how important it was to the discipline of archaeology to construct, early on, reliable pictorial codes and conventions when reporting from excavations. The discipline heavily relied on competent artists to achieve a graphic style that was maximally informative – both to be able to record data in an efficient way and to circulate and communicate research results among peers and to the public in general. But, as both Smiles and Moser (2005, pp. 1-6) and Moser (1998, p. 166) emphasise, not all archaeological images were objective and truthfully performed. Moser shows, in her discerning book *Ancestral Images: The Iconography of Human Origins*, how the visual representations used to illustrate the lives of our ancestors were not primarily based on scientific fact but on an iconic tradition that can be traced back to classical ideas on human evolution in the writings of Hesiod and Lucretius (Moser, 1998, pp. 22-28). Thus, these images were based more on myths than on scientific data.

This distinction between “fantasy” images and “informative” or “scientific” images

must not be understood in the sense that some images are a product of imagination and others represents the objective truth. On the contrary, in line with Foucauldian ideas, this text states that in every historical period, scientific truths are conditioned by an epistemic regime which dictate what can be considered knowledge and facts. This means that the very same object can be investigated and interpreted differently in different periods (Foucault, 1994, pp. xxi-xxiv).

Imaging the human race/s

Before discussing Backman's image production, it may be worthwhile to contextualise his scientific work and writings. Backman had a PhD in Physiology, and in his research, he specialised in comparative human anatomy and embryology studies. The cranial variation of humans was in particular focus in many of his studies; in line with the general ideas in anatomy and physical anthropology at this time (e.g. Retzius), he believed that the differences in shape and size of the cranium could form the foundation for classifying humans into different races – both in modern times and in the past. In *The Prehistory of Man*, he used archaeological skeletal material to identify different prehistoric human race types, and in a later publication in 1935, *Människoraserna och moderna rasproblem (The Human Races and the Race Problem in Modern Times)*, he used more recent material to classify the modern races.

In his research on the human cranium, Backman connected to a craniometrics tradition established by the Swedish professor of anatomy Anders Retzius, who invented the Cephalic Index in 1842 to measure human skulls. The index shows the ratio of width of the head multiplied by 100 divided by its maximum length. An index of less than 75 means that the skull is long and of dolichocephalic type, and an index over 80 denotes a broad and short skull, also called brachycephalic. The long skulls were thought superior to the shorter ones, and the Nordic race type belonged to the former (Retzius, 1843). Backman applied and developed Retzius' theories and methods of craniometrics and became with time one of Sweden's most prominent experts in the art of skull-measuring (Backman, 1935, pp. 27-30; Kott, 2009, p. 66). Backman also had a legacy in the work of Gustaf Retzius, the son of Anders Retzius. He was a Swedish physician and anatomist who dedicated a large part of his life to researching the histology of the sense organs and nervous system, but he also contributed significantly to the discipline of physical anthropology. One example is *Crania Suecica Antiqua* (1889), in which he studied

prehistoric skulls, and proved, in coherence with his father's ideas, that the ancient inhabitants of Sweden were of the long-skulled type (Ljungström, 2004, p. 294).

This connection of anatomy/craniometrics to physical anthropology was thus common in the “epistemic regime” in the beginning of the 20th century – anthropology was in general more focused on the physiognomy of humans than on human behaviour and societies – and after Backman finished his PhD at the anatomical department at Uppsala University, he secured a position as an anthropological expert in the division of Ethnography at the Swedish Museum of Natural History. His main duty was to attend to and arrange the anthropological collection, and one of his contributions was an anthropological exhibition in which craniums and gypsum busts (fig. 4 a and b) were used to exemplify and represent different folk types (Svanberg, 2015, p. 98, 165).

Fig. 4 a and 4 b. Bust in plaster and bronze by Gaston Backman. Photograph by: Anderzén, Hannes Copyright: Statens museer för världskultur. License:

These busts were also used in *The Exhibit of Swedish People-Types*, which toured in Sweden in 1919 and was held by the famous race biologist Herman Lundborg, with the purpose of displaying the racial constitution of the Swedish population and also disseminating eugenics and race biological ideas to the Swedish public (Eriksson, 2013, p. 2). The exhibition was in many ways the starting point of race biological scientific work in Sweden – at least on a larger

scaleⁱ - and in his later research Backman became an important partaker in this race biological project (Kott, 2009, pp. 65-68; Sotto and Weston, 1984).

It is not surprising that Backman, with his interest in craniometrics and physical anthropology, became a part of Swedish race biology,ⁱⁱ since the form and size of the skull – Backman's area of expertise – was one of the main characteristics taken into account in the attempt to document and classify the Swedish population according to race criteria (Lundborg and Runnström, 1926). Backman's work can actually in many ways be placed in the shift – or perhaps be seen as a link – between a more quantitative physical anthropology and race biological science and eugenics.ⁱⁱⁱ His affiliation with the latter is more obvious in his later writings; in his book *The Human Races and the Race Problem in Modern Times* (1935), he is explicit about a race hierarchy and the inferiority of the black race (Kott, 2009, pp. 69-70; Ljungström, 2004, p. 42).

In *The Prehistory of Man*, published more than 20 years earlier, he is much more of an anatomist and physical anthropologist, even if there are also already some indications of his affiliation with race biology, as the image analysis in the next part of this text will show. The aim~~aim~~ objective of the book was to describe the prehistory of the human race for a general audience, and Backman presents these prehistoric humans as represented by six different races: Homo heidelbergensis, Homo neanderthalensis, Homo aurignacensis, Homo grimaldiensis, the human races present during the Solutrean Era, and Homo cro-magnonensis. The aim was to describe when and where they lived, what they looked like and, to some extent, how they lived. The presentation consists basically of a description of each race's physical appearance, with a focus on the cranium and skeleton. The chapter on each prehistoric race type starts with an extensive presentation of the bodily characteristics of the race type in focus, and ends with a brief description of cultural practices, e.g. the use of different tools and the production of art objects. This preoccupation with the bodily and anatomical aspects of humans, at the expense of cultural and psychological expressions, was, as mentioned above, in line with a general disciplinary identity within ethnographical and anthropological research during this period (Svanberg, 2015, pp. 98-99).

Images of facts and fantasies

Since it was the biological and physiological characteristics of humans, the looks and the visual aspects of the human body, that were taken as the starting point for scientists to arrange humans into different categories of race, visual tools (photographs, drawings, etc.) became important and commonly used in the scientific practice of both physical anthropology and race biology (Maxwell, 2010; Kjellman 2013, 2014).^{iv} When looking at the work of Backman, it is striking to note both the quantity of images he used and how many different types of images he put into practice. The illustrations that form part of his work represent a great variation in image techniques, motives, and pictorial rhetoric. Some illustrations are photographs or drawings of archaeological objects and artefacts, others of human skulls or skeletons, others are photographs representing different human race types, and still others show paintings or drawings of our ancestors taking part in daily activities such as hunting, cave painting, and preparing meals. Looking at Backman's production of illustrations from 1911 to 1935, one notices a development toward a more extensive use of photographs, at the expense of other image-producing techniques such as drawings. This development can be seen as an adjustment to a more race biological image discourse and practice. This aspect will not be further discussed in this text, since it is outside the scope of the study at hand, but it may be worth bearing in mind, since the image material presented in this text bears seeds of what will come.

The Prehistory of Man from 1911 is dominated by illustrations showing skulls or parts of skulls or skeletons (fig. 5-10). Also common are drawings exemplifying and pointing to significant parts or aspects of a skeleton or cranium (fig. 9). Many of them are photographs of plaster casts of craniums or parts of skeletons from Retzius' anatomic collection, but Backman also extensively reproduced image material that had been published in other books on the subject. This reuse of images in scientific publications was common practice during the period (Moser, 1998, p. 7).

Fig. 5. Photograph of plaster cast of a cranium from La Moustier in Retzius' collection (Backman, 1911, p. 101).

Fig. 6. Geometric drawing of a jaw from Heidelberg. After Shoetensack (Backman, 1911, p. 58).

Fig. 7. Photograph of a lower jaw from Heidelberg. After a photograph by Shoetensack (Backman, 1911, p. 55).

Fig. 8. Geometric drawing of a cranium (Backman, 1911, p. 95).

Fig. 9. Thigh bone from Galley-Hill. After Newton (Backman, 1911, p. 147).

Fig. 10. Cranium from Galley-Hill. After Newton (Backman, 1911, p. 146).

Both the images above of skeletons and craniums and those below of artefacts and tools (fig. 11-13) make important contributions to the written text; they are commented on in the text and also graphically included in it (see fig. 12). The craniums in particular are extensively discussed and analysed in the text, which comes as no surprise since craniometrics was Backman's main research area (Kott, 2009, p. 66). When looking at the skeleton and cranium material, it is also striking how de-contextualised the depicted objects are, how their natural and

original context is excluded and how all redundant information is erased. What is left in the image are only the aspects of the objects that carry meaning for the scientific context and the community working with them. This is in line with the reasoning of Mason, Morphet and Prosalendis, who claim that a scientific image needs to reduce all visual data that does not carry information of value to the scientific community (2006, pp. 12-13), and with Latour, who argue that this reductive practice produces a more stable visual language which facilitates and secure the communication of scientific data among peers (1990, p. 28). And, as mentioned above, this way of reducing the accidental and circumstantial, and thus producing a scientific pictorial language that is more schematic, can also be considered a token of the maturity of a scientific discipline. With shared scientific goals, instruments, methods, etc. focusing on the central aspects of the objects that are in focus in the research area of the discipline, picture elements not only become more schematic but also tend to become more abstract and theory-loaded, which in the long run makes them hard to understand by someone outside the research community (Rudwick, 1985; Topper, 1996, pp. 246–247).

It is thus not surprising that Backman used a more schematic pictorial language in the illustrations representing objects where he was scientifically most at home, i.e. in craniometrics and anatomy. In this image material, it is obvious that his aim is to pinpoint and highlight those aspects of the cranium and skeleton that could be seen as race-specific anatomical characters, the height of the skull, the face angle, jawbone, etc. These aspects are of course highlighted and commented upon in the text (see e.g. Backman, 1911, p. 146), but they are also pointed out in the illustrations by different means (fig. 5-9). As mentioned above, Mason, Morphet and Prosalendis define three processes of making images informative by reducing information that is of no significance: “framing”, “focusing” and “filtering” (2006, pp. 12-13). In the pictorial rhetoric Backman uses when presenting the skeleton and cranium, the “focusing” method is most salient; by enhancing some body parts (fig. 7 and fig. 9) and adding lines and pointers (fig. 6, 8 and 10), he can guide the reader to the most significant aspects of the image. This can be compared to how tools, arts and artefacts are represented in the book (fig. 11-13). Here, Backman uses a slightly different pictorial language; the images are less schematic; he does not use pointers or enhance parts of the objects to highlight certain aspects.

Fig. 11. Drawing of a flint tool from the Acheuléen culture. After Capitan (Backman, 1911, p. 127).

Fig. 12. Weapon from the Magdalenian culture (Backman, 1911, p. 233).

Fig. 13. Figurine, woman, in steatite from one of the caves in Mentone. After L'Anthropologie, 1898 (Backman, 1911, p. 163).

Apart from the illustrations so far discussed, the book also features reproductions of coloured prints, in which we meet the prehistoric people performing various tasks – e.g. hunting (fig. 14, 15 and 16) and cave painting (fig. 1). In contrast to the other image material, these images are not commented on, or linked to, in the text. In the list of figures at the end of the book, they are separated from the other illustrations as “Posters in colour printing” (Planscher i färgtryck), while all the other images are listed under “Figures in the text” (Figurer i text). In the captions, directly under the images in the book, it is explicitly pointed out that the print is a “Fantasy image” (Fantasibild).

Fig. 14. Hunting of bison in the Magdalenian epoch (Backman, 1911, p. 272.)

Fig. 15. Cave bear hunting in the Palaeolithic period (Backman, 1911, p. 96).

It is apparent that these illustrations have a different function than the images with more scientific ambitions. Even though these images are out of context in relation to the text, they are also, at the same time, creating the context. The fantasy images have the possibility to present to the reader an idea of the lives of these prehistoric humans; they give flesh to the bones and life to the tools and artefacts, e.g. by showing how *Homo neanderthalensis* or *Homo cro-magnonensis* worked to obtain food or how they amused themselves.

The need to provide this “animation” stemmed from the fact that the book was published as a popular scientific text to be read by ordinary people. It is not likely that Backman had used them in any publication intended solely for his peers in anatomy or craniometrics. However, at the same time, it may be worth mentioning that earlier on, in the discipline of archaeology for instance, it was common to see this mix of different image rhetorical expressions (Moser, 1998, pp. 22-28, 166). When presenting new data on the lives of our ancestors, archaeologists, on one hand, needed informative images to document and communicate data among peers in a reliable way, and on the other hand they wanted images designed to dramatise information or make science entertaining to the audience (Moser, 1998, p. 14). These dramatised images were not based on scientific fact, but on a long and prevalent historical tradition where myth and fantasy had created an iconographical canon on how to depict our ancestors - often naked and “equipped with a spear and a shield, a skin cloak and iron chains” (Moser, 1998, p. 82). They were also presented in certain reoccurring and standardised scenes, such as hunting, struggling with a wild beast, sharing a meal, gathering at a fireplace, or creating tools or art objects (Moser, 1998, p. 134). This way to illustrate life of prehistoric man also became popular in dioramas and paintings in natural museums during this period. Objects in museum collections, such as fossils and artefacts, were contextualised into scenes where e.g. clothing, jewellery, physical and facial expressions and social dynamics - not verified by scientific data - gave the visitors a vivid idea of the life of our ancestors (Cain, 2010, p. 293).

The coloured prints in Backman’s book are clearly this period infused by this iconography: we see the hunting scene, the fireplace, the making of art, and also the nakedness, the skin cloak, and the spear. Even if Backman clearly states that these images are not a part of his scientific text, that they are “fantasy images”, they are still there, and have the power to steer the viewer’s interpretation, and reproduce the old myths, of our ancestors. These types of

scientific illustrations provide for a much “richer” reading in comparison to the schematic image, and they are also therefore much more effective in reproducing ideologies and preconceptions. Moser states that such images “can fill in gaps in a theory with small details such as a background scene” (Moser, 1998, p. 16). These details may not be immediately connected to the scientific objects studied but will nonetheless affect the way we see it. These details, which scientifically might be insignificant, tend to sneak into the mind of the viewer unnoticed. Or, as Gould puts it: “Iconography comes upon us like a thief at night – powerful and remarkably efficacious, yet often so silent that we do not detect the influence” (Gould, 1993, p. 12). The power of these images lies not only in that they tend to sneak into our minds without our noticing it, but they are also hard to get rid of, and they tend to steer our conception of reality even if they are contradicted by empirical facts. As Moser puts it: “The importance of the pictures is that they show how empirical data do not really have the power to challenge some of the speculative versions of the past” (1998, p. 7).

One example of how Backman makes use of this iconography to direct the reading of his text is his presentation of the Cro-Magnons. In the text, the Cro-Magnons are presented as “the most wonderful race in human prehistory” (Backman, 1911, p. 218). Physically, they are described as tall and with a dolichocephalic skull (long-headed). In the struggle for existence, the Cro-Magnons are the “triumphant” winner and surpass all other prehistoric race-types, i.e. *Homo heidelbergensis*, *Homo neanderthalensis*, *Homo aurignacensis*, and *Homo grimaldiensis*. They are described as superior in a physiognomic sense, and also appointed masters of art, having produced excellent tools and cave paintings (fig. 1 and fig. 12), (Backman, 1911, pp. 218-276). But Backman also gives examples of other remains from the same period that suggest more inferior forms of cultural expression. In certain areas, in the southern and eastern parts of Europe, artefacts and tools are poorer and shabbier. The people and the culture associated with these areas are illustrated by e.g. figure 16 (Backman, 1911, p. 274). Compared to the cave-painting people in figure 1, who have a more elongated, refined, and hairless bodily constitution, and who take part in the civilising activity of cave painting, the people in fig. 16 are more squarely built, hairier, and in the middle of hunting mammoths, all of which bring about associations with savages and a more barbarian lifestyle. That these people are depicted hunting mammoths is no coincidence, since the creatures were only common in the eastern parts of Europe (Backman, 1911, p. 218).

Fig. 16. Mammoth hunting in the Magdalenian period. From the Russian Historical Museum in Moscow by W. M. Wasnetzoff (Backman, p. 275).

In the book, Backman thus uses these “fantasy-images” to impress that this poorer and “inferior” southern/eastern culture belonged to people of a different physiognomy and expression than those from the more richly developed western culture. This was not something he could prove with his “factual” images of craniums and bones; instead, the more open and richer rhetoric of the fantasy-image could offer an opportunity to present these ideas. This way of differentiating the Cro-Magnons into two different race-types is clearly echoed in the rhetoric that Backman and other figures in the race biological project some decades later put into practice when they described the Nordic race as superior, tall and dolichocephalic compared to other shorter, brachycephalic and more “inferior” races from the east and south (Backman, 1935; Lundborg, and Runnström, 1926).

If we return to the more schematic images, it is obvious that they have other functions and also that they are perceived in a different manner to the fantasy-images. The schematic, scientific images cannot be interpreted “openly”, rather there is a correct or intended meaning of utter importance (Mason, Morphet and Prosalendis, 2006, p. 12). According to Latour, a scientific image needs to be consistent; our visual representations need to be stable so we can transport them, depict objects on different scales and from different angles and perspectives, in separated pieces, etc. without risking a loss of information (Latour 1990, p. 26). Latour identifies nine attributes that ensure optical consistency: a scientific image needs to be “mobile”,

“immutable”, “flat”, “scalable”, “reproducible”, “possible to recombine”, “possible to superimpose”, “made a part of a written text”, and “merged with geometry” (Latour, 1990, pp. 44-47). The requirements of stability and optical consistency are in many ways met in Backman’s schematic illustrations (and not in the fantasy-images). They are obviously “part of a written text” and “flat”. They are also “scalable”, not least by his meticulous way of recording the scale of almost every cranium, skeleton and tool. They are “possible to recombine”, “possible to superimpose”, and not least “mobile”; it is striking to see how many illustrations are brought from other publications, which indicates that the illustrations were to a high degree circulated among scientists within the same research area.

To Latour and Wolgar, representations, and not nature, are the working objects in science: “If it is a scientist’s task to plumb the ‘depths’ of a given phenomenon, available representations provide the material with which such ‘plumbing’ is visibly constructed” (1990, pp. 6-8). Or, as Latour puts it: “Scientists start seeing something once they stop looking at nature and look exclusively and obsessively at prints and flat inscriptions” (Latour, 1990, p. 39). When looking at the work of Backman, it is easy to agree with Latour and Wolgar. Even if Backman and his peers obviously examined craniums and skeletons per se, the images played an important role in this research practice. Backman constantly uses and refers to illustrations of craniums, skeletons, and tools from other publications and, more rarely, to the collection at hand at his own department, i.e. the Retzius collection.

Even though the schematic illustrations are characterised by a higher scientific ambition in comparison to the fantasy-images, it is important not to overestimate the objectivity of these schematic images. These images are not only part of an epistemic regime but also an ideological discourse that affects how the objects are presented and interpreted. The selecting of illustrations to represent the object studied, the order in which they are placed, and how extensively different objects are presented are all aspects that may affect the reading of a book. These are all aspects that may not be apparent (and discerned as biased perspectives) but which still affect our understanding of the objects depicted. That the Cro-Magnon race type was the most extensively presented and illustrated in the book might be explained by the fact not only that the archaeological findings were more plentiful of this type, but also that Backman regarded them as most important. He actually saw them as the forerunner to the western European contemporary race type (the Nordic long-headed race type).

Conclusion

Even if scientific images intermingle with other representational expressions (e.g. verbal or numerical) in scientific practice, and also share important properties with them (they are e.g. mobile, immutable, presentable, readable and combinable), they also have their own specific characteristics and functions: they need to be immutable, flat, scalable, reproducible, possible to recombine, possible to superimpose, made a part of a written text, and merged with geometry – and thus have a more abstract and schematic character compared to iconic images. Although these properties are commonly shared by images accompanying scientific texts, they also tend to develop, within a specific scientific community, their own discursive patterns and pictorial rhetoric, adjusted to the epistemological and ontological specificities of the community.

But, as has been presented in this paper, a scientific community may also make use of images that do not have the specific character of a “scientific image”. This study shows that Backman used both images of a more schematic, scientific type and more iconic ones, and where the former were based on what was considered scientific facts, the latter were based on fantasy or myth. The role of these images in Backman’s works also varies: the schematic images have a more informative function while the fantasy images are used to promote ideological values or ideas.

Many scholars have shown that images, in the realm of scientific racism, have been used in this most biased way (Jahoda, 1999; Bindman, 2002; Kjellman, 2013, 2014, 2016; Gould, 1996, pp. 202-203, Maxwell, 2010; Pinney, 2012). This misuse of images can partly be explained by the fact that in comparison to verbal and numerical expressions, images used in science are much less formalised. Images have not been perceived as serious partakers in the practice of science and thus have not been restrained by scientific regulations. Also, the fact that iconic images are open to a much “richer” reading and free interpretation, compared to verbal and numerical expressions and also schematic images, makes them easier to infuse with ideology and preconceptions. Details in the background or periphery that might appear completely insignificant can still carry meaning even if they are not consciously noticed by the viewer.

Why is it important to scrutinise these fantasy images if they are not scientific and true? Even if we today can see that these images are far from truthful, they are also hard to get rid of. One explanation to why they are still in the loop, is that images in science tend to be reused,

since they are expensive and labour-intensive to produce, and because of this they are not always replaced when scientific results change and develop (Moser, 1998, p. 7). Another explanation is that scientific images do not stay within the realm of science. Many images produced in a scientific context tend to “quickly circulate into popular culture” (Mitchell, 2015, p. 23) and in this new context propagate ideas that are eventually contradicted by new scientific facts. In particular, images depicting the human origin quickly became a part of 19th-century popular culture and have since been a common ingredient in different cultural expressions (Browne, 2009, p. 19; Scott, 2010).

What then are the implications of this for information studies? It has been a fruitful discussion among scholars in the field for some years where images have been considered as knowledge-carriers and important actors in information process, and also defined as “documents” alongside verbal or numerical expressions (see e.g. Frohmann, 2004, chapter 7; McKenzie 1986/1999, p. 13; Lund 2010, p. 743). But it is important not to get lost in the inclusive representation concept; even if images, numerical and verbal expressions intermingle in the scientific process, they also distinguish themselves from one another. Thus, an informative image has a unique and specific role in the practice of science – even if this role can vary slightly in different settings – and this role needs to be taken seriously and investigated further in the realm of information studies. We also need to be aware that images can have different functions in the scientific practice, and are not always there to carry scientific facts or ideas, but ideologies and fantasies.

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ⁱ Backed up by the good reception of the exhibition Lundborg was able to convince the Swedish parliament of the importance of a eugenic research centre to secure a healthy Nordic (Swedish) race. In 1922 The Swedish State Institute for Race Biology was founded in Uppsala and the work to survey and classify the Swedish people according to race criteria – with the help of measurements and visual analysis – could get started (Lundborg, 1921, pp. 1-19). It is important to stress that even though the eugenic research was strong in Sweden it was in no way limited to the Swedish context only. On the contrary, the work performed within the institute was part of a larger movement of scientific racism, well established and institutionalised in the 17th and 18th c, both in US and Europe, and put into the horrible practice of the Nazi regime during WWII (Gould, 1996; Kevles, 2004; Bashford and Levine, 2010).

ⁱⁱ That Backman was a part of this Swedish race biological projects is not only proved by his contribution to this exhibition, but also by the fact that he wrote many texts where he presented ideas on race where the Nordic race type is presented as superior to other races. Backman was, according to Kott, far more active in both Swedish and Nordic racial biology and eugenics than has been noticed so far, and he also took an active part in disseminating his racial scientific ideas abroad, e.g. to Germany and Latvia (Kott, 2009, pp. 65-68).

ⁱⁱⁱ The anatomical / physical anthropology becomes a component of race biology even though genealogy, blood tests, etc. were practiced to some extent (Svanberg, 2015, p. 39, 208). Although the race scientific community had started to consider Mendel's laws to determine racial heritage, it was still in most cases, the physical and external expression of the body, that was counted for when determine race affiliation (Ljungström, 2004, p. 352).