

# Representations of technology in the “Technical Stories” for children of Otto Witt, early 20th century Swedish technology educator

Cecilia Axell and Jonas Hallström

**Linköping University Post Print**



N.B.: When citing this work, cite the original article.

The original publication is available at [www.springerlink.com](http://www.springerlink.com):

Cecilia Axell and Jonas Hallström, Representations of technology in the “Technical Stories” for children of Otto Witt, early 20th century Swedish technology educator, 2013, International journal of technology and design education, (23), 4, 817-834.

<http://dx.doi.org/10.1007/s10798-013-9232-1>

Copyright: Springer Verlag (Germany)

<http://www.springerlink.com/?MUD=MP>

Postprint available at: Linköping University Electronic Press

<http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-100522>

## Representations of Technology in the “Technical Stories” for Children of Otto Witt, Early 20<sup>th</sup> Century Swedish Technology Educator

Cecilia Axell & Jonas Hallström  
Department of Social and Welfare Studies  
Linköping University, Sweden  
e-mail: jonas.hallstrom@liu.se

### *Abstract*

Children’s fiction in school libraries have played and still play a role in mediating representations of technology and attitudes towards technology to schoolchildren. In early 20<sup>th</sup> century Sweden, elementary education, including textbooks and literature that were used in teaching, accounted for the main mediation of technological knowledge to schoolchildren. An investigation of children’s literature for schools is therefore important in order to understand what was considered worth knowing about technology at the time. The aim of this article is therefore to analyse the representations of *technology* and *attitudes towards technology* that were mediated through two children’s fiction books in Swedish elementary school libraries in the 1910s. We have limited the analysis of empirical material to the books *Technical Stories for Young and Old* (*Tekniska sagor för stora och små*, 1914) and *Technical Stories of the War for Young and Old* (*Krigets tekniska sagor för stora och små*, 1915) by the Swedish inventor, author and technology educator Otto Witt. Gauging Witt’s influence on the schoolchildren and educators of his time is very difficult, but in this first English-language article on his “technical stories” one can conclude that he was in many ways unique and probably fairly well-read in the schools of early 20<sup>th</sup> century Sweden and onward. He was also a particularly perceptive forerunner of today’s technology and science educators in his use of anthropomorphism as an educational tool.

**Keywords:** technology education, history, children’s fiction books, Otto Witt

”Well, some crazy Westerner has come up with a device – technology, modern technology they call the miserable thing you see – that has made *a thousand horses* go through a pipe which is not thicker than my neck.”

“No kidding”, the dromedary exclaimed in amazement. “It’s not true, is it?”

“Yes, yes, it’s true! But I don’t understand how they do it. I was concerned, you see. I never could stand the darned horses, and now they can come through a pipe, a thousand of them. It makes me crazy.”

Otto Witt, *Technical Stories for Young and Old* (1914)

A crucial aspect of technology education is the subject content that various stakeholders consider relevant for children to learn, that is, what is regarded as worth knowing about technology at a particular time. This is usually expressed in formal curriculum documents but also, for instance, through text books and other teaching material and tools. Literature is one

such tool that mediates knowledge of technology and attitudes to technology which is increasingly used in science and technology education. Unfortunately it has largely been overlooked in technology education research, both as regards the function as a mediator for what is considered to be worth knowing about technology and as a teaching aid in classrooms (Foster, 2009 and Axell & Hallström, 2011 are exceptions, however). In this article we will study the former function by analysing the technological content of a couple of fiction books for children that were available in elementary school libraries in the 1910s. Although there was still no subject called Technology, the period from ca. 1900 to the 1920s was in many ways formative for the emergence of a technological domain of knowledge in the school in the sense that there was an increased spread and use of technology in society as Sweden was being industrialised, which also affected the school and the content of its various subjects (Hallström, 2009). The importance of using children's fiction books in elementary classrooms was also a topic of discussion in Sweden at this time. School teaching, including the literature that was used, accounted for the main cultural influence on children as the availability of other sources of information was very limited, which means that representations of technology and attitudes towards technology that were mediated through literature had the potential to affect schoolchildren more than has been acknowledged in the research literature.

The aim of this article is therefore to analyse the representations of *technology* and *attitudes towards technology* that were mediated through two children's fiction books in Swedish elementary school libraries in the 1910s. We have limited the analysis of empirical material to the books *Technical Stories for Young and Old* (*Tekniska sagor för stora och små*, 1914) and *Technical Stories of the War for Young and Old* (*Krigets tekniska sagor för stora och små*, 1915) by the Swedish inventor, author and technology educator Otto Witt. Thus the main research question for the study is: What representations of technology and attitudes towards technology were mediated through Otto Witt's children's fiction books *Technical Stories for Young and Old* and *Technical Stories of the War for Young and Old* and how did they relate to the Swedish historical and educational context of the 1910s?<sup>1</sup>

The reasons for selecting these two books by Otto Witt are several. First of all, the books were categorised in the libraries as written for children of elementary school age, that is, ages 7 to 13 (Witt's other books were written for an adult audience). Secondly, his books were among several fiction books that came with Government grants should they be included in elementary school libraries in 1914-1920. They were thus very likely part of a majority of Swedish school libraries from their publication through the first half of the 20<sup>th</sup> century. Thirdly, although the representations of technology mediated through Witt's stories were not the only ones at this time they constitute particularly illustrative examples of what could be communicated to elementary school children through children's literature. What makes the books special is the fact that they were a mix of primers (instructional books) and fiction. Other children's books from the same time period that includes technology were either "pure" primers, books presenting scientific experiments or fictional stories that convey an attitude towards technology without going into any detail of how technology works.<sup>2</sup> Lastly, there were books in these libraries that celebrated inventors and technological progress, but Witt was an engineer who was more ambivalent, even critical, to technological development, which is why his two books have been selected as more nuanced examples.

---

<sup>1</sup> This study is part of a Ph.D. project in which several other Swedish children's fiction books with technology educational content from the period 1900 - 1920s and 1960s - 1980s are analysed and put in relation to the historical and educational contexts of the periods of investigation.

<sup>2</sup> One exception is *The Wonderful Adventures of Nils*, in which Selma Lagerlöf describes, for instance, the technological processes in an ironworks (Axell & Hallström, 2011).

## ***Background and Research Context***

Around the turn of the century 1900 the meaning of the concept “educated” was discussed in Sweden, and there was a desire among intellectuals to convey education to all. The interest in adult education at the time also came to be a breeding ground for the involvement in children and children’s literature (Kåreland, 1977). As a part of this a significant educational debate was taking place within the Swedish community of elementary school teachers. They questioned the influence of the church on the school, and they also started producing their own text books. This was also a renaissance period for children’s literature generally, and there was a growing literature published for the specific purposes of schooling. The elementary school therefore became a vehicle for the spread of new children’s literature, in which technology and its place in society played an increasingly prominent part (Axell & Hallström, 2011; Ekholm, 2006; Englund, 1992).

According to researchers such as Ingersoll (1992), Kylhammar (1985) and Marx (1964) one way of approaching a specific society’s attitudes toward science and technology is to investigate literature. Marx (1964), for example, identifies the steam boat as a metaphor for how technological development is described in Mark Twain’s *The Adventures of Huckleberry Finn* and Ingersoll (1992) uses a similar metaphor when he writes:

A typical representation of our culture’s reaction to technology is the image of a tranquil, rural Eden violated by the sudden appearance of a steam locomotive [...] (Ingersoll, 1992, p. 2).

Grenby & Reynolds (2011) make a case for zooming in specifically on the literature written for children:

[B]ecause children’s literature is one of the earliest ways in which we encounter stories, it plays a powerful role in shaping how we think about and understand the world. Stories are key sources of the images, vocabularies, attitudes, structures and explanations we need to contemplate experience; because they are often bound up with education of one kind or another they can be important carriers of information about changes in culture, present and past. Indeed, because of its long history and because writing for children straddles the domestic and institutional, official and unofficial, high and mass cultures, and often includes visual elements, material written for children can be a particularly valuable repository of historical information about everything from how children in the past looked and the environments they occupied to shops, servants, the treatment of disease, religion, wars, migration, scientific development, exploration and much more (Grenby & Reynolds, 2011, p. 1).

Hintz (2008) refers to certain scholars who regard children’s literature as uninteresting in cultural history due to its “simplicity” and low status. Hintz, on the other hand, claims that it is precisely because of this that children’s fiction should be the object of historical and cultural studies. Hintz says that the implicit norms and values of a society at a particular historical moment are often hidden in the more sophisticated adult texts, but explicitly expressed in texts for children. Therefore, it is just the “simplicity” and the overly educational message that most clearly reflect the prevailing culture and what is considered worth knowing about technology for children.

Apart from the examples mentioned above, very little research has been done to address these issues, at least if we look at the fields of children’s literature studies, history of education and technology education. Pandora (2009), however, writes about technology in children’s literature in 19<sup>th</sup> century America, and claims that children’s fiction books became tools by which young readers could be made to seek knowledge. The goal was, in Pandora’s words, “a

children's republic of science" (Pandora, 2009, p. 75). Westin (2003 a,b) has studied technology and cyborgs in Astrid Lindgren's books about Karlsson on the roof. In the field of science and technology education more broadly defined there are some studies that address children's literature in education such as Sackes et al (2009) and Schroeder et al (2009), which deal with possibilities and obstacles in using children's fiction books in the science classroom.

### ***Methodology and Theoretical Model***

The primary source material is made up of a selection of children's books found in Swedish school libraries in the period 1910-1920, exemplified in this study with Otto Witt's *Technical Stories for Young and Old* (1914) and *Technical Stories of the War for Young and Old* (1915). A hermeneutic method, that is, a method of text interpretation, is employed. Hermeneutics is a theoretical approach to interpreting and understanding the underlying meaning of a text. The hermeneutic sciences seek possible meanings of their study objects, which must in turn be studied in their context(s) to be understood. To clarify the meaning is the main purpose of the interpretation, and the meaning of a part can only be understood if it is related to the context. At the same time the context is composed of the parts. This relationship between the parts and the whole gives rise to the hermeneutic circle or spiral. The circle/spiral shows the relationship between what is interpreted, the pre-understanding that exists and the current context within which interpretation occurs. Thus, single texts are related to the whole body of texts, the genre(s) and the historical context in a reciprocal, re-interpretive way (Alvesson & Sköldbberg, 2008; Ödman, 2007).

In the interpretation and analysis of Otto Witt's books we have to characterise technology and its various dimensions and we do this in two ways. The first one is to identify how Witt himself and other actors of the time defined technology and gave it a meaning in an educational context. An obvious disadvantage in the analysis is that the term technology has changed a lot since the early 20th century, which Schatzberg (2006) also points out:

[Technology] attained the status of "keyword" only in the 1930s, and [...] before this time, issues that historians now discuss in terms of *technology* were framed in such terms as *useful arts, manufacturing, industry, invention, applied science, and the machine*. In other words, when historians now address "attitudes toward technology" before 1930, they are employing an analyst's category not used by the historical actors themselves (Schatzberg, 2006, p. 486).

We address this problem by relying on dictionaries of the time, most notably the *Nordisk familjebok* (1891;1919). In Swedish, just as in other Germanic languages, technology is translated both as *teknik* and *teknologi*, but it is the former we are interested in since it was the concept Witt used. In the early 20<sup>th</sup> century the Swedish concept of *teknik* had a similar meaning to the English equivalents "*useful arts, manufacturing, industry, invention, applied science, and the machine*" (Schatzberg, p. 486). However, the Swedish concept was also increasingly connected to engineering, which can be seen in the 1919 edition of the dictionary (*Nordisk familjebok*, 1919).

The second way of dealing with the definition of technology is to rely on a modern, broader characterisation. The historian of technology Thomas P. Hughes writes: "Technology is messy and complex. It is difficult to define and to understand. In its variety, it is full of contradictions, laden with human folly, saved by occasional benign deeds, and rich with unintended consequences. [. . .] Few experienced practitioners, historians, and social scientists try to inclusively define technology" (Hughes, 2004, p. 1-2). Thus there is no universally

accepted definition of technology, but an important starting point is that technology has to do with something material, that is, the designed or human-built world and how we as humans relate to it (Ibid.; Blomkvist & Kaijser, 1998).

Having pointed this out, as a modern characterisation of what technology is we use Mitcham's (1994) definition of technology which encompasses various dimensions of technology that abounded in the early 20<sup>th</sup> century but were not necessarily defined as such by the historical actors. Mitcham's fourfold description of technology is as *volition*, *knowledge*, *activity* and *object*. Technology as *volition* comprises the will, wish, intention or power that starts the technological activity. Technology as *knowledge* consists of the skills and knowledge necessary to perform the technological activity. Technological *activity* is the activity performed to reach a goal or fulfil wishes, either by designing and making or using technology. In everyday language, technology is used mainly when talking about an *object*, i.e. a technological artefact. This object is used in a technological activity or it is a result of this. Technology as *volition* is supposed to be fulfilled by the artefact that results from the activity (Mitcham, 1994; cf. Hallström, 2012).

### ***Otto Witt and his technical stories for children***

The author, engineer and inventor Otto Witt lived between the years 1875 and 1923. According to his own statement, he was also active as an inventor of aeroplane technology and rock works systems. He was born in Falun, where his father worked as an engineer in the copper mine. The son was to follow in his father's footsteps. He first studied in the Norrköping technical secondary school, and then in Germany at the Technische Universität Bergakademie in Freiberg. He then worked as a mining engineer and manager at various rock works in Finland and Norway. In 1912 he returned to Sweden to devote himself full-time to his writing and his inventive activity (Witt, 1916)

There is not much written about Otto Witt and his work. Although he was a prolific writer in the 1910s, few people have heard of him today. If he is mentioned it is as one of the prominent figures in early Swedish science fiction (Nyblom, 2002a; Ashley, 2011). He wrote his first book at the age of 35 and died only 13 years later; probably from a heart attack, the death certificate stated "chronic heart disease" (Oscars kyrkoarkiv, 1923). Despite his short career, he managed in the years 1911-1921 not only to publish 85 issues of his magazine *Hugin*, but also some thirty books and scientific articles and works.

*Hugin* was a science and technology magazine, written single-handedly by its editor and publisher Otto Witt. The magazine was espousing every possible idea of scientific advance that Witt could imagine in both factual and fictional form (Ashley, 2000). Otto Witt first published some of his technical stories in *Hugin* and other magazines, before he decided to collect them into books. In 1915 he also started to give lectures all over Sweden in the "technical story style for young and old" (Witt, 1916, p. 6). In the first issue of the magazine, Witt defines what he means by a "technical story". He writes that he sees it as "a popular way to describe the daily phenomena that surround us" (Witt, 1916, p. 6).

*Technical Stories for Young and Old* was published in 1914 and consists of 17 different stories. The scientific and technical phenomena and artefacts mentioned in the book include for example: the value of technical work, the pencil, the ink pen, the light bulb, coal mining, diamond mining, the sun's importance to modern technology, man and fire, the match, the

railway bridge's weakest point, the steam boiler, the stone crusher, the gun, the buckshot, and tea and coffee production.

In *Technical Stories for Young and Old* Witt's view of nature is not as clearly expressed as in *Technical Stories of the War for Young and Old*. When Witt wrote the latter, the First World War had broken out and he let the War run like a thread through the stories in the book. His repudiation of the war is clear, and the technology that people invent is not solely for their benefit. A consequence of the War is that man's imperfection has become clearer. Examples of technologies in different forms that are represented in the 17 stories are, for instance, the torpedo boat, the submarine, the barbed wire, the telephone, the telephone network, the telegraph, the camera, the airplane, the airship, the compass, the electric canon, the pistol, the rifle and its bullets, grenades and chemical gunpowder.

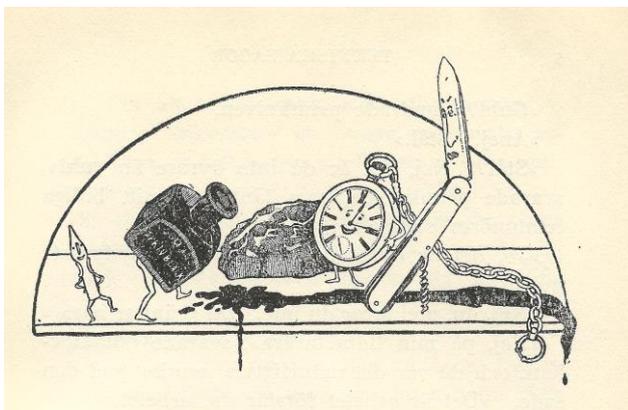
### **Representations of technology and attitudes towards technology as expressed in Otto Witt's technical stories**

In his two children's books, Witt uses anthropomorphic metaphors and analogies by letting the artefacts come to life. In the story *The Value of Work* in *Technical Stories for Young and Old*, a golden watch, a pocket knife, a light bulb, a toy train and a piece of iron ore, brag about which one is the most valuable. In the story the economic benefits of technological innovation are discussed. For example, the toy train argues that it is a testament to the value of work, as it is a result of how practical machines have managed to produce it so cheaply:

Work is one thing you have to economize on. It costs money; and it yields money. Therefore it should always be of use to at least our own country's workers (Witt, 1914, p. 9).

In the story *The Value of Work*, Witt also lets the ink link work with thought and will. The ink believes that it is not only the work the body performs and the mechanical work that is important. Without the idea and the desire of "commanding", as well as the "brain's planning", there would be no work of any kind at all. This story shows that the technology Witt takes up can be identified with Mitcham's all four descriptions of technology. The *objects* are a result of design and manufacturing, an *activity*, but to make this happen human *knowledge* and "thought and desire", *volition*, are needed. In the story Witt also tries to make connections between these different aspects of technology (see figure 1).

**Figure 1. Illustration from *The Value of Work*, by Edwin & Ingeborg Lindborg, 1914.**



Source: Witt (1914).

Witt shows his view of how scientific and technological knowledge should be conveyed pedagogically in the story about The Match in *Technical Stories for Young and Old*. Since little Hans's father knows that scientific matters are difficult to understand by long descriptions, the father weaves the facts of the manufacturing of the match into a "fairy tale". In the tale, the inventor of matches goes on a hunt for the best wood, for "*he wants to know what tree will be the eternal carrier of fire*". This ultimately turns out to be the aspen tree. This is one example, among others, when Witt shows that an artefact is a result of a process or an activity, driven by human will, i.e. volition.

The stories in *Technical Stories for Young and Old* are imbued with a desire to bring to children a fascination of and interest in the technology that surrounds them. For example, Witt expresses concerns that Swedish agriculture had not yet reached an advanced stage in its technological development:

Everywhere one sang the praises of technical work. Its worth was generally acknowledged. It was only farther away, in the countryside, that the voices of discontent were heard. Arable and pasture land complained: "We are being neglected. Why does not technology give us a thought? Why cannot technical work multiply our crops?" Still today the foreman sends out his hinds, his horses and his old plough. Still the reaping Swedish men use scythes and the women rake by hand. When will the time come to press a button in the office, the electric button which will start the whole machinery (Witt, 1914, p. 10-11)?

A harvester, which finds itself very "modern", answers that one must understand that it is not so easy to design:

In America, the land beyond the sea from whence I come, they already plough by electric power and even thresh by this aid. But still it is a long way to the goal, before one succeeds in inventing so many cheap agricultural machines that it is worth using them in the small fields here in Sweden. Yet the work with this goes on tirelessly [...] (Witt, 1914, p. 11)

In some of the stories Witt criticizes the hunting and killing of animals. In the story of The Buckshot eight-year-old Gunnar gets upset when he realizes that the buckshot was in the hare that the family had for dinner:

Now he understood how the buckshot had entered into the hare. Of course the hare had leapt around in the woods, happy and content, but the hunter had lain in wait with his gun by a glade in the forest. Gunnar imagined vividly how the poor hare had shouted out just like daddy a moment ago: "Ouch, ouch, what an awful nuisance", when the buckshot came whining and penetrated the thick fur (Witt, 1914, p. 110).

Later in the story, Witt writes that the thoughts in Gunnar's head were swirling around like "light birds":

Imagine *killing* animals. Well, of course; flies and such – it was obvious – but animals that lived happily and freely in nature, *larger* animals, so to speak (Witt, 1914, p. 11).

In the story Witt makes a distinction between the boy's view and his father's view of killing animals. The father is described as a "grand hunter" with numerous hunting trophies. And the technological content in the story is concerned with how a hunting rifle works and how a shotgun's shots are produced, which fascinate the curious Gunnar.

One of the most interesting stories in *Technical Stories for Young and Old* is The Weakest Point, in which Witt lets something more abstract come alive; the weakest point of a railway bridge:

The great railway bridge was dissatisfied; dissatisfied with itself, with the engineer who had designed it, with the workers who had built it, with the material of which it had been made, with

the rivets, the stretch bars, the beams, the brackets [...] And yet the bridge was the pride of the new, rapidly flourishing industrial city. It connected the bustling traffic of two districts and it was so high that steamboats could go underneath it without folding down their chimneys. [...] But it was still dissatisfied, and this dissatisfaction had started a day when an unusually heavily loaded railroad train had passed over it. The weight had made the bridge tremble and then it felt something that can be compared to a human lumbago or something similar. There had been stretching and tension, and it had felt so strange in one particular place, in a joint near the centre of the bridge. And now the bridge was lying there pondering. It remembered all too well the words that the design engineer had often repeated: "A design is never stronger than its weakest point" (Witt, 1914, p. 92-93).

Then the weakest point decides to walk out into the world to search for his own benefit. It visits the "the rulers of the Earth", "the kingdom of fire", "the kingdom of animals", and the "kingdom of plants", but everywhere he is told that the weakest point is of no benefit at all – quite the contrary. The seventh day, the weakest point decides to visit the "kingdom of people", "and with her all the modern technology". There he meets, among others, the steam boiler, which tells him that in modern technology human beings actually benefit from the weakest point. The steam boiler shows him its safety valve where clean, hot steam may escape. The weakest point is content and returns to the railway bridge to tell him what he has been told. At first he is laughed at, but after giving a number of examples the bridge's different parts understand that he is right. The biggest part of the bridge notes:

You have won. Henceforth you shall be left alone. And what is more. You are the progenitor of a large and useful family. From your mistakes, technology has been brought to the benefits your family should own (Witt, 1914, p. 108).

Petroski (1992) writes that the development and expansion of the railroads in the beginning of the nineteenth century required bridges. Iron was to become a natural replacement for wood bridges. But the iron bridges seemed not only new but also unpredictable and they collapsed in numbers. Petroski argues that no history of bridges is complete without an acknowledgement that many ambitious designs did fail, and therefore that the technological development of bridges can be seen as a result of failures:

The collapse of a *single* bridge made from a relatively new material or design should have been enough to make engineers of that era and their customers, the railroads, reflect on the new technology (Petroski, 1992, p. 70).

In the same way as Petroski, Witt describes technological development as a result of "failures". Thus failures are something important and good for humans in their creation of technology. On the other hand, in nature the weakest point can often be devastating. This may suggest that Witt believed that man has power over technology, while nature is more difficult to govern. The story about The Weakest Point is an expression of Witt's view of technological knowledge. The story shows that failures are necessary in successful technological design and development. The failures in the construction of new bridges contribute to the development of the engineering skills, which can be connected to Mitcham's technology as knowledge.

Several of the stories in the second book, *Technical Stories of the War for Young and Old*, are expressions of what happens when humans make use of the destructive power of technology (primarily military technology). However, the criticism that is expressed in the stories is not primarily concerned with technology itself, but more with human nature.

Animals are more often the protagonists in this book compared to the previous. There are animals that come into contact with technology and try to understand it, and it is mainly the animals in the sea that face the war technology. Witt also uses animals and nature as metaphors when he explains how technology works, e.g. in *The Magic Swan* the periscope explains to a

gull how the submarine can rise and lower itself in the sea, by saying that this works “just as fish swim bladders”. And by calling the torpedo boat “steel *fish*” and using the whale’s hunting technique when attacking a shoal of herring as a metaphor to explain how the torpedo boat attacks a ship, he also shows how humans use nature as inspiration in the creation of new technology. Another example is in a story entitled *Father’s Snuff Box*, in which a snuff box made of tortoise shell comes to life and tells the little boy Karl Edvard:

Humans, who learned everything else with animals as role models, also learnt from me (Witt, 1915, p. 147).

What the “turtle” is referring to is how humans have designed their armoured boats.

In some of the stories Witt makes a comparison with other, more “primitive” cultures and he uses technological development as evidence of the superiority of Western culture. In the story of *The Camel and the Thousand Horses* the camel’s master Sheik Djalumet meets a European man:

“This,” said Sheik Djalumet to the white man, pointing to the newspaper notice, “this, my white brother has to be good and explain to me. Your Western technology is advancing by leaps and bounds so much that a poor Easterner becomes downright giddy” (Witt, 1914, p. 15).

The basis for a view that placed Europeans at the top rung of civilisations had its origins in late Victorian thinking, according to which civilisation and the rule of the fittest was opposed to less civilized peoples and nature itself. Charles Darwin’s theory of evolution thus not only influenced the view of nature but also had an impact on how people viewed society. Struggle and competition became widely perceived as something natural and not something that should be curbed. These interpretations of evolution, promoted by sociologists such as Herbert Spencer, gave legitimacy to expanding Western interests outside of Europe and America (Bowler, 2000; Worster, 1994).

In several of the stories Witt highlights the importance of the sun. Everything on Earth, even human technology, has the sun to thank for its existence. In the story *The Power of the Sun* a candle explains that it is the sun that has driven the plants and animals which have since become the fat in the candle. And a kerosene lamp says that the animal and plant remains which were the basis for kerosene have the sun to thank for their former lives, which is also true of gasoline and the automobile. Even the light bulb must thank the sun for its existence, since the dynamo that generates electricity gets its energy from water and it is the sun that turns water into steam which is converted into rain:

It is the sun that gave it its force, by which it drives the machines and then induces electrical currents (Witt, 1914, p. 58-59).

Concerning the emphasis of the importance of the sun, it is possible that Witt may have been inspired by Nobel laureate Wilhelm Ostwald (1853-1932), who believed that the primary power in a society was the energy supply and the sun was the main such source. According to Ostwald all other organic materials were merely derivative of this ultimate giver of life (Sörlin, 1991).

In *Technical Stories of the War for Young and Old* the animals not only express their surprise that humans destroy what they themselves have created, but also that people for inexplicable reasons kill each other, despite the fact that none of this has anything to do with hunting for food. This is something the animals themselves would never do. But although he has reservations about the war and its technology, Witt shows that the same technology can be

used for peaceful purposes, i.e. that peaceful technology may have its origins in military technology.

In the story *The War and its Relatives* the young boy Karl Axel meets the war, portrayed as an iron giant, deep in the woods. Karl Axel is surprised to see the war in such a place, and the giant answers:

Look at me. I am the modern human war. I am technology's perfection in our time. I am the war of the machine guns, airships, wireless telegraphs, submarine boats and the giant cannons. I am the war of humans (Witt 1915, p. 9).

But the giant wants to find a peaceful place, as he is tired and needs to rest. He asks the boy to help him find such a place:

[...] you are the master of the animal, plant and mineral kingdoms. I am nothing but a slave of humans (Witt, 1915, p. 9).

In the story of *The Ghost Fish* a whale and a dolphin ask the "steel fish", the torpedo boat, why it harpoons warships. The torpedo boat answers that it has actually never thought about it, but there must be some sense in it:

Man has made me into what I am, and I only have to fulfil my duty and do the best I can (Witt, 1915, p. 36).

What the giant says reflects an anthropocentric view of nature where man rules over both the living and the non-living. The war is described as "technology's perfection in our time", but the giant also notes that it is "a slave of humans". This represents an absence of a deterministic view of technology (cf. Smith & Marx, 1994) since the statement of the giant can be interpreted as implying that it is humans who control technology – technology is their slave not their master. Technology itself is not evil, it is neutral. Technology is merely an extension of humans, so it is people's use of it that may have devastating consequences (cf. Latour, 1999).

In contrast to this, at the end of the story of *The War and Its Relatives* Witt testifies to a different approach when he writes:

But there is a far greater being than man, nations and races. *It is our Earth*. Because our own Earth is a creature. It is alive, it breathes and it puts its clothing on and off. It has a soul and an inner life. The Earth's clothing is green in the summer and white in the wintertime, the ebb and flow are its solid breathing, as its sharp chest heaves in harmonious step with moon and sun. Its bodily abscesses are volcanoes and earthquakes, its tears are the bubbling springs, while its sweating is the dew (Witt, 1915, p.18).

What Witt calls "the soul of the Earth" is human culture, which he describes as spiritual. The war, however, is the world's spiritual disease.

Regarding Witt's view of the relation between nature and technology, Nyblom (2001) writes that there is hardly any doubt that Witt was influenced by the German naturalist Ernst Haeckel (1834-1919), who played an important role in the spread of Darwin's as well as his own version of evolutionary theory. Haeckel was a holist, i.e. he saw nature as a complex and balanced whole. Through his so-called monism, Haeckel believed that the world could not be split up into a spiritual/mental part, on the one hand, and a material part on the other – it was all the same stuff. Witt expresses something similar when he writes that the Earth has a soul and a spiritual life. Haeckel, however, rejected anthropocentrism, which Witt does not seem to have done (Sörlin, 1991).

Witt's vision also stands in stark contrast to how Haeckel regarded the scientists. The Monism League, founded by Haeckel in 1905, was against democracy and advocated that society should be governed by the sense of the scientists. Despite Witt's fascination with technology and scientific progress, he also had a critical approach and in many of his stories he mixes his fascination with sharp criticism. The scientists are portrayed satirically, as he finds them austere and inflexible. Witt meant that what actually was amusing and interesting was inaccessible to ordinary people, including children, as it was presented in a too complicated way. The hero of Witt's novels written for adults is often an engineer, who with the help of his rich imagination and transboundary knowledge can solve all the problems in the world. Professors and Nobel laureates, on the contrary, are portrayed as stiff characters devoid of imagination and, finally, their arrogance leads them to ruin (Nyblom 2002a). According to Witt, the scientists lacked a critical approach and had a reluctance to take on new evidence that did not fit into their own theories. In one novel, he ironically observes that:

And as we all may understand, if the theories are so simple that they can be *understood*, the scientists might become *redundant* (Witt, 1912, p. 19).

Witt also expresses a concern for man's ruthless exploitation of the Earth's resources, such as how the trees in the forests are cut down at a furious pace, even though they grow and recover slowly, how mining operations lead the blast furnaces to consume more and more carbon all over the world and how the growing use of water closets dispose of nitrogen which is difficult to replace. Witt saw culture as something that is never satisfied and believed there was an imminent risk that industrial society would rapidly deplete the Earth and its natural resources.

In an article in the first edition of *Hugin* Witt argues that the Earth needs a representative who can monitor its resources, a representative of the outside world – even other planets. He sees the war as a “controller” which should have given people a lesson in how they utilize the resources. But people live as though they are the only generation that will ever live on Earth. Instead of “listening” to the war, they continue to make plans for deforestation, killing animals in the forests and emptying the mines. There is still hope for humans, as they will eventually gain insight. When all the country's assets are depleted, they will be forced to leave the country and move to countries where “you do not need anything artificial to make a living” and where the soil can give people what they need.

Man has returned to nature. And this, to *understand* nature not only to *master* it, is happiness (Witt, 1916, p. 10-11).

## **Response from the public**

Witt's science fiction novels attracted a good deal of attention when they were published and they still do (see, for example, Lundwall, 1977, 1984; Ashley, 2011). A number of reviews from the 1910s confirm this. He is, for example, attributed the flattering name “a Swedish Jules Verne” and in a book review he is also called “our Swedish Flammarion” (Rivaldo, 1911; E.A-n, 1912). The reception of his educational work at the time it was published is another matter, however. The impact on schoolchildren is nearly impossible to trace since there is no library statistics, but there are ways to circumvent this and gauge the response from the general public.

There is evidence that Witt tried very hard to become accepted as a real, literary writer and specifically to promote his ideas about technical stories in the finer literary circles. He therefore approached some of the most prominent Swedish literary dignities of the time – Ellen Key and the Nobel laureate Verner von Heidenstam (letter from Witt to von Heidenstam, 1

January 1916). He was turned down and never subsequently gained support for his educational ideas in the distinguished literary circles or the “schoolteacher elite” of the time, a small group of elementary schoolteachers who were very influential in Swedish society in the early 20<sup>th</sup> century and who directed much of the debate about the school and its content. A study of the most important teacher and pedagogical journals also reveals that there were no reviews at all of either of Witt’s two books.<sup>3</sup> Consequently, to access the public response we have to look for reviews especially in newspapers, which due to the scarcity of bibliographies and indexes are few and scattered, especially concerning the technical stories.

Sigrid Elmlblad wrote a rather critical review of one of Witt’s earlier books in the journal *Dagny* in 1913, but commented on his way of writing about science and technology in fictional form. The book was considered

a novelty: namely lessons in natural science as fairy tales, delivered by engineer Otto Witt. I do not know to what degree children will appreciate this way of learning. . . . the author undeniably goes about it with great skill and would surely be a very good storyteller had it not been for the fact that he is simultaneously obliged to give lessons. . . . However, I may be mistaken about the evaluation of these stories by children . . . they are instructive beyond any doubt” (Elmlblad, 1913, p. 386).

The fact that the reviewer questioned Witt’s being ”obliged to give lessons” was perhaps an expression of the view of children’s literature that was being increasingly dominant at the time; children’s literature should not be too educative in a strict sense, but instead promote the development of imagination and feeling in children (Klingberg, 1966).

There were examples of more positive reviews, which were cited at the back page of *Technical Stories of the War*:

*Stockholms Dagblad*: “This is a new and agreeable side of Otto Witt’s varied authorship. Thanks to a vivid and captivating descriptive power the author has successfully been able to utilise the fictional form – to let his readers gather much useful knowledge.”

*Svenska dagbladet*: “It is really ‘up-to-date’ stories that the book is built upon, and there is no doubt that it will create interest.”

*Stockholmstidningen*: ”It is a book that all boys should have.”

Another example of public response is from the newspaper *Dalpilen* in April 1916, in which one of Otto Witt’s lectures, The Professor’s desk, is reviewed. The reviewer writes that the lecture hall was filled to capacity when the ”popular engineer and author Otto Witt” lectured. The lecture is interesting in that Witt here employed the pedagogy of the technical story:

As one had almost expected the lecture turned out to be of a comprehensive [*allmänbildande*] nature, in the form of Mr Witt’s well-known fascinating storytelling. It was about the things on the professor’s desk: the pencil, the rubber, the stick of sealing wax, the candle, the ink, the match etc., which after agreement between them were allowed to tell one story each, and naturally these stories came to be about themselves and became each on its own a little scientific talk. The lecture . . . was received with great acclaim. After the lecture a free copy to everyone was distributed of the first issue of Otto Witt’s newly established popular scientific journal *Hugin*, which has as its goal to make our knowledge of the forces and phenomena that surround us daily as plain, interesting and amusing as possible and therefore uses the genres of scientific romance, technical causerie, thought-provoking humorous story, adventure story and technical story. In short: its mission is to spread knowledge and insight to everyone, so that they can find it interesting to

---

<sup>3</sup> The journals in question were *Pedagogisk tidskrift* 1914-15, *Verdandi* 1913-16, *Svenskt arkiv för pedagogik* 1912-16, *Tidskrift för folkundervisningen* 1914-1915 and *Folkskolans vän* 1914.

acquire more knowledge. Otto Witt should be the man to advance this beautiful idea and we wish his *Hugin* a bright future (Professorns arbetsbord, 1916).

### ***Concluding Discussion***

Technology education in elementary school in the early 20<sup>th</sup> century was rudimentary. There was some technological subject matter, most clearly in educational sloyd, but there was no subject called Technology. As a consequence, we have focused on the potential for learning technology through children's fiction books – in this case two story books in Swedish school libraries written by Otto Witt, *Technical Stories for Young and Old* (1914) and *Technical Stories of the War for Young and Old* (1915). With reference to the aim of this study, it is Witt's clearly stated educational goal that makes his stories interesting for analysis: to disseminate knowledge about technology to children through fiction. In this sense he was an important Swedish technology educator long before there was a technology subject in the school.

Otto Witt wanted children to realize that modern technology is a result of human imagination and thought. He believed that by awakening children's interest in and knowledge of how the technology of the time worked, a breeding ground for a future competitive nation could be created. The representations of technology in the books show what Witt considered to be worth knowing for the school children of the 1910s. He considered it to be particularly important that children learnt about the technology they came into contact with in their everyday lives. Otto Witt's technical story books were selected to be a part of a body of literature for the Swedish elementary school libraries in the early 1900s. This suggests that the representations of technology and attitudes towards technology that were conveyed in his books are examples of what was considered important by the educational elite to mediate to elementary school children at this time.

The book *Technical Stories for Young and Old* is imbued with a desire to arouse children's interest in and fascination for the technology that surrounds them. The only criticism woven into the stories is concerned with the fact that Swedish agriculture had not yet reached a stage in its technological development comparable to other developed countries such as the USA, the disadvantage of state monopolies, and the devastating consequences of the lack of knowledge on the part of the person who manages technology. Although some criticism of hunting and killing of animals is also woven into the message in some of the stories, it is above all everyday technology that comes to life in the book, that is, the technology that children encounter in their daily lives.

In many of the stories an artefact tells another object or animal how it works or how it is produced. By using anthropomorphic metaphors and analogies and letting technology express human emotions, Witt not only uses an effective educational tool (cf. Stocklmayer & Treagust, 1996) but also ties together humans and technology. Technology becomes a kind of extended human arm; it is humans who control technology and not vice versa. In the descriptions of technology Witt also often uses nature as a metaphor. Technology is portrayed as a kind of extension of nature, or a modernised form of the same. At the same time, he often makes a distinction between nature and the human-made technology: it is technology that separates us from animals. This message is particularly pronounced in *Technical Stories of the War for Young and Old*.

Sörlin (1991) writes that in the decades around 1900 there was a kind of anthropocentric optimism that was characteristic of the human-centred enlightenment humanism. There were

no limits for what humans could achieve or manage to do on Earth. Sörlin calls it the “discourse of opportunity”. Modernity replaced religion and society was transformed into a “machine” that would create wealth. From this perspective Otto Witt can be seen as a representative of the time. What makes him different in this context is his holistic approach, where planet Earth is one big, living organism with a soul (human culture). According to Witt, the attempts of humans to master nature will not lead them to happiness; the only way to achieve happiness is to understand nature.

Mitcham’s fourfold description of technology can be identified in Witt’s technical stories in both books; technology as *volition, knowledge, activity, and object*. By showing that technology is a result of human imagination, determination and knowledge and that technological activities and objects have been developed and refined over time to meet human needs and wants, Witt addresses all the four aspects of technology which Mitcham considers to be essential. Witt also uses the word *teknik* which in early 20<sup>th</sup> century Sweden included primarily industrial appliances, machines and inventions (*Nordisk familjebok*, 1919; cf. Schatzberg, 2006). However, by his broader characterisation of the technology that surrounded people on a more daily basis Witt was part of and contributed to the development of the wider meaning of the concept of technology that was under way. Witt also highlights another important aspect of technological development; that it is a result of “failures”. By making mistakes we learn and develop our skills and knowledge so as to improve technology, which was suggested, for example, by Petroski much later (Petroski, 1992).

When comparing the two books, the tone is more pessimistic in *Technical Stories of the War for Young and Old*, for the war is described as horrific. The technology that people invent is not solely for their benefit, and the War has had the consequence that man’s imperfections have become clearer. Animals are often protagonists in the stories in this book, and some of them are surprised about human destructiveness. On the other hand, some of the stories show that war is a result of technological perfection, which can be seen as an expression of the dual nature of technology. Like the Roman God Janus, technology has two faces: one positive and one negative, one constructive and the other destructive.

This indicates a sort of ambivalence towards technology. Military technology is criticised and animals are portrayed as good but sometimes uneducated. Unlike humans they are not able to create complex technology. At the same time Witt wishes to combine technology–humans–nature, including animals. This is partly expressed through the use of nature and letting the animals act as metaphors when a particular technology is described. Witt also lets the reader understand that humans, in their creation of technology, have got much of their inspiration and knowledge from animals. The ambivalence in this book may seem like a contradiction to the optimistic ideas of technology and progress that were expressed in *Technical Stories for Young and Old*. However, under close scrutiny it appears that the lost faith in the idea of progress that Witt and many other intellectuals of the time expressed during and after World War I primarily concerned human nature. That is, it was the idea that human nature could progress into a peaceful and good humanity that was shaken during the war, not the faith in science and technology *per se* (Skovdahl, 1996).

Witt was apparently influenced by the two most prominent and influential science fiction writers of the late 19<sup>th</sup> and early 20<sup>th</sup> century – Jules Verne and H.G. Wells – who also expressed a rather ambivalent attitude towards technological development (Linder, 1915; Nyblom, 2002b). There was also a good deal of influence from popular text books and fiction for adults and young people (mostly boys), which dealt with natural science, technology and industry in a popular way, for this was a time when there was also a strong belief in general

education – *allmänbildning* or *folkbildning* in Swedish – as well as scientific and industrial progress (Hintz, 2008; Pandora, 2009). For example, Lidforss (1908) could be placed in a near-fiction category of light popular articles in Swedish. There were also a lot of popular books in the English-speaking world about science and technology for young people around in the early 20<sup>th</sup> century that were sometimes fictional. Titles like the following abounded: *Electricity for Boys* (Zerbe, 1914), *The Boy Inventors' Radio Telephone* (Bonner, 1915) and, much less frequently, *Handicraft for Girls* (McGlaulin, 1910).

Witt went one step further, however, by bringing in anthropomorphism into his stories. Anthropomorphism had been common in old fairy tales with talking animals, and even, for example, in the works of more modern storytellers like Danish Hans Christian Andersen one could find artefacts brought to life such as the wine bottle in the *Bottle Neck* (Andersen, 1857/1949). Andersen was also interested in how new technology affected society and included it in his stories for children (Westin, 2003b). It is very likely that Witt was inspired by Swedish storyteller Richard Gustafsson, who in turn showed influences from Andersen. Gustafsson involved talking artefacts in his stories, partly as an educational tool (von Zweigbergk, 1965). The English writer A.L.O.E (Charlotte Maria Tucker) may also have been a role model since she wrote very similar anthropomorphic stories of various artefacts such as *The Story of a Needle* (Tucker, 1871).

By bringing artefacts to life and letting them tell the reader how they work and in what ways they are a result of technological activities, Witt thus made the world of technology come alive. However, it is not only the artefacts that come to life but also the more abstract forms of science and technology such as the Weakest Point, the War (in the guise of a giant) and the Second. Consequently, what made Witt unique in comparison with the dominant writers and genres of the late 19<sup>th</sup> and early 20<sup>th</sup> century was the combination of fiction and fairy tales *and* stories where anthropomorphic metaphors and analogies with talking artefacts served an educational purpose concerning technology. He was also more ambivalent towards technological development than contemporary writers of popular books about inventors and industry. Interestingly, using anthropomorphism became an educational tool especially in science education text books later in the 20<sup>th</sup> century (Stocklmayer & Treagust, 1994).

Gauging Witt's influence on the schoolchildren and educators of his time is, as has been noted, very tricky, but in this first English-language article on his "technical stories" we can at least conclude that he was in many ways unique and probably fairly well-read in the schools of early 20<sup>th</sup> century Sweden and onward. He was also a particularly perceptive forerunner of today's technology and science educators in his use of anthropomorphism as an educational tool.

## **References**

Archival material

Riksarkivet, SVAR, Oscars kyrkoarkiv, Död- och begravningsböcker, SE/SSA/6025/F I/4, 1923-1927 .

Letter from Witt to von Heidenstam, 1 January 1916, Brevskrivarregistret, Linköpings Stiftsbibliotek, Övralidsarkivet, E005/1984:5.

## Literature

- Alvesson, M. & Sköldberg, K. (2008). *Tolkning och reflektion. Vetenskapsfilosofi och kvalitativ metod*. Lund: Studentlitteratur.
- Andersen, H.C. (1857/1949). *The Complete Andersen*, translated by Jean Hersholt. New York.
- Ashley, M. (2000). *The Time Machines. The History of the Science Fiction Magazine from the Beginning to 1950*. Liverpool: Liverpool University Press.
- Ashley, M. (2011). *Out of This World: Science Fiction, but Not as You Know it*. London: British Library.
- Axell, C. & Hallström, J. (2011). Representations of Technology in Educational Children's Fiction in Sweden in the Early 20th Century: The Example of *The Wonderful Adventures of Nils*. In K. Stables, C. Benson & M.J. de Vries (Eds.), *PATT 25: CRIPT 8: Perspectives on Learning in Design & Technology Education*. London: Goldsmiths, University of London.
- Blomkvist, P. & Kaijser, A. (1998). *Den konstruerade världen. Tekniska system i historiskt perspektiv*. Stockholm: Symposion.
- Bonner, R. (1915). *The Boy Inventors' Radio Telephone*. New York: Hurst. Retrieved August 10, 2012, from [www.gutenberg.org](http://www.gutenberg.org).
- Bowler, P.J. (2000). *The Earth Encompassed: A History of the Environmental Sciences*. New York: Norton.
- E.A-n (1912). Otto Witt: Det magnetiska luftskeppet. *Aftontidningen*, December 6, 1912.
- Ekholm, M. (2006). Den hållbaraste läroplanen – 1919 års undervisningsplan för rikets folkskolor. *Vägval i skolans historia. Tidskrift från föreningen för svensk undervisningshistoria*, 6(3-4), 3-5.
- Elmblad, S. (1913). Barnens julböcker. *Dagny. Tidning för svenska kvinnorörelsen*, 49, 386.
- Englund, T. (1992). Tidsanda och skolkunskap. In G. Richardson (Ed.), *Ett folk börjar skolan. Folkskolan 150 år 1842-1992*. Stockholm: Allmänna Förlaget.
- Foster, P.N. (2009). An Analysis of Children's Literature Featured in the "Books to Briefs" Column of *Technology and Children*, 1998-2008. *Journal of Technology Education*, 21(1), 25-43.
- Grenby, M. & Reynolds, K. (Eds.) (2011). *Children's Literature Studies: A Research Handbook*. New York: Palgrave.
- Hallström, J. (2009). Technical knowledge in a technical society: elementary school technology education in Sweden, 1919-1928. *History of Education*, 38(4), 455-474.

- Hallström, J. (2011). Looking Back in Order to Move Forward: The Position of Technology Education in Past Swedish Curricula. In M.J. de Vries (Ed.), *Positioning Technology Education in the Curriculum*. Rotterdam: Sense Publishers.
- Hallström, J. (2012). Om teknikhistoriens roll i grundskolans historie- och teknikämnen. In Anna Johnsson Harrie & Hans Albin Larsson (Eds.), *Samhällsdidaktik: Sju aspekter på samhällsundervisning i skola och lärarutbildning*. Linköping: Linköping University.
- Hughes, T.P. (2004). *Human-Built World: How to Think About Technology and Culture*. Chicago: University of Chicago Press.
- Hintz, E.S. (2008). Heroes of the Laboratory and the Workshop: Invention and Technology in Books for Children, 1850-1950. In M.M. Elbert (Ed.), *Enterprising Youth: Social Values and Acculturation in Nineteenth-Century American Children's Literature*. New York: Routledge.
- Ingersoll, E.G. (1992). *Representations of Science and Technology in British Literature since 1888*. Worcester: Worcester Polytechnic Institute.
- Klingberg, G. (1966). *Sekelskiftets barnbokssyn och Barnbiblioteket Saga*. Pedagogiska skrifter 239. Stockholm: Svensk Läraretidnings Förlag AB.
- Kylhammar, M. (1985). *Maskin och idyll. Teknik och pastorala ideal hos Strindberg och Heidenstam*. Malmö: Liber.
- Kåreland, L. (1977). *Gurli Linders barnbokskritik*. Stockholm: Albert Bonniers Förlag.
- Latour, B. (1999). *Pandora's hope: Essays on the reality of science studies*. Cambridge, Mass.: Harvard University Press.
- Lidforss, B. (1908). *Naturvetenskapliga kåserier*. Malmö: Framtidens bokförlag. Retrieved August 10, 2012, from [runeberg.org](http://runeberg.org)
- Linder, G. (1915). Book review *Hur månen erövrades*. *Dagens Nyheter*, 22 December 1915.
- Lundwall, S.J. (1977). *Science fiction på svenska. En antologi med svensk science fiction sammanställd av Sam J. Lundwall*. Bromma: Delta Förlags AB.
- Lundwall, S.J. (1984). *Bibliografi över science fiction och fantasy 1741-1973*. Bromma: Delta Förlags AB.
- Marx, L. (1964, 2000). *The Machine in the Garden: Technology and the Pastoral Ideal in America*. Oxford: Oxford University Press.
- McGlaufflin, I. (1910). *Handicraft for Girls*. Peoria, IL: The Manual Arts Press. Retrieved August 10, 2012, from [www.gutenberg.org](http://www.gutenberg.org).
- Mitcham, C. (1994). *Thinking through Technology. The Path between Engineering and Philosophy*. Chicago and London: The University of Chicago Press.
- Nordisk familjebok*, 15. *Socker – Tengström*. (1891), 1516. Retrieved October 10, 2010, from [www.runeberg.org](http://www.runeberg.org).
- Nordisk familjebok*, *Uggleupplagan*, 28. *Syrtenvikarna – Tidsbestämning*. (1919), 698. Retrieved October 10, 2010, from [www.runeberg.org](http://www.runeberg.org).

- Nyblom, A. (2001). *Den tekniska sagan. Samtidsförankring och framtidsvision i fyra svenska science fiction-romaner 1911-1932*. Master's thesis. Uppsala: Uppsala University.
- Nyblom, A. (2002a). Giv släktet gosselynne, hoppfull håg och fantasi. *Tvärnsnitt. Humanistisk och samhällsvetenskaplig forskning* (3), 14-25.
- Nyblom, A. (2002b). Svart på Witt. En svensk Jules Verne i glömska. *DAST Magazine* (3). Retrieved May 4, 2012, from <http://www.dast.nu/artikel/svart-pa-witt-en-svensk-jules-verne-i-glomska>.
- Pandora, K. (2009). The Children's Republic of Science in the Antebellum Literature of Samuel Griswold Goodrich and Jacob Abbott. In C.E. Harrison & A. Johnson (Eds.), *National Identity. The Role of Science and Technology*. Chicago: The University of Chicago Press.
- Petroski, H. (1992). *To Engineer is Human. The Role of Failure in Successful Design*. New York: Vintage Books.
- Professorns arbetsbord. (1916). *Dalpilen* (30), April 14, 1916. Retrieved May 4, 2012, from Royal Library Digitalised Journals: <http://magasin.kb.se:8080/searchinterface/page.jsp?id=kb:171022&recordNumber=1&totalRecordNumber=2>
- Rivaldo (1911). En svensk "Jules Vernare" och en dito "Flammarion". *Stockholms Tidningar*, December 13, 1911.
- Sackes, M., Trundle, K.C. & Flevaris, L.M. (2009). Using Children's Literature to Teach Standard-Based Science Concepts in Early Years. *Early Childhood Educ J*, 36, 415-422.
- Schatzberg, E. (2006). *Technik Comes to America: Changing Meanings of Technology Before 1930. Technology and Culture*, 47(3), 486-512.
- Schroeder, M. et al. (2009). The Contribution of Trade Books to Early Science Literacy: In and Out of School. *Res Sci Educ*, 39, 231-250.
- Skovdahl, B. (1996). *Framstegstankens förfall? En forskningsöversikt över 1900-talets framstegstanke*. Stockholm/Stehag: Symposion.
- Smith, M.R. & Marx, L. (Eds.) (1994). *Does technology drive history? The dilemma of technological determinism*. Cambridge, Mass.: MIT Press.
- Stocklmayer, S.M. & Treagust, D.F. (1994). A historical analysis of electric currents in textbooks: A century of influence on physics education. *Science & Education*, 3, 131-154.
- Stocklmayer, S.M. & Treagust, D.F. (1996). Images of electricity: How do novices and experts model electric current? *International Journal of Science Education*, 18(2), 163-178.
- Sörlin, S. (1991). *Naturkontraktet. Om naturumgängets idéhistoria*. Stockholm: Carlsson Bokförlag.
- Tucker, C.M. (1871). *The Story of a Needle*. London: T. Nelson and sons. Retrieved August 10, 2012, from books.google.com
- von Zweigbergk, E. (1965). *Barnboken i Sverige 1750-1950*. Stockholm: Rabén & Sjögren.

- Westin, B. (2003a). Karlsson som technobody. *Tidskrift för litteraturvetenskap*, 32(4), 128-142.
- Westin, B. (2003b). Världens bästa Karlsson: barnlitteratur och teknologi. *Nordisk tidskrift för vetenskap, konst och industri*, 79, 293-300.
- Witt, O. (1912). *Det mystiska ljuset*. Stockholm: Åhlén & Åkerlund.
- Witt, O. (1914). *Tekniska sagor för stora och små*. Stockholm: Lars Hökerbergs förlag.
- Witt, O. (1915). *Krigets tekniska sagor för stora och små*. Stockholm: Lars Hökerbergs förlag.
- Witt, O. (1916). *Hugin*, 1916:1.
- Worster, D. (1994). *Nature's Economy: A History of Ecological Ideas*. Cambridge & New York: Cambridge University Press.
- Zerbe, J.S. (1914). *Electricity for Boys*. New York: The New York Book Company. Retrieved August 10, 2012, from [www.gutenberg.org](http://www.gutenberg.org)
- Ödman, P.J. (2007). *Tolkning, förståelse, vetande. Hermeneutik i teori och praktik*. Stockholm: Norstedts.