Critiquing Literature: Children's Literature as a Learning Tool for Critical Awareness

Cecilia Axell

Abstract A starting point for this chapter is that children's literature can be a source of reflection and can encourage children to think critically about technology. In contrast to many textbooks and non-fiction books, fictional stories reflect the complexities and contradictions inherent in technology and at the same time reveal its less obvious and concealed aspects and messages. By using books with a strong story line, which are of interest to children, technology can be presented as part of the world around them. Children's literature can thus be seen as a mediator of values and attitudes, which makes it an interesting subject matter for Design and Technology education. This chapter involves an exploration of critical aspects of technology found within a selection of children's books. The stories originate from different historical and cultural contexts, and the basis for the selection is that it represents a variety of critiques and aspects of technology found in children's literature. The conclusion of the analysis is that children's literature can contribute to making technology and the nature of technology more comprehensible and visible to pupils. The ambiguous messages in the books reveal the multifaceted and complex nature of technology and make it possible to problematise it in ways textbooks seldom can. As the stories form the basis for critical discussion about the nature of technology, they could also help to broaden perspectives, thereby acting as a pedagogic tool in fulfilling the aims of Design and Technology education.

Keywords Technology education • Technology • Critique • Children's literature

> Children's literature is one of the means by which children are socialized and are acquainted with important aspects and features of their civilization. It is, therefore, only natural that gadgets and machines should loom prominently in children's books in an era and a society that is, in fact, based on technological development (Schwarcz 1967:82).

C. Axell (✉)
Department of Social and Welfare Studies, Linköping University, S-601 74, Norrköping, Sweden
e-mail: cecilia.axell@liu.se

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1 Introduction

In the wake of rapid technological change, society increasingly expects more of its citizens, and this is reflected in school policy documents. Becoming an active and responsible citizen with the ability to make well-informed decisions is dependent on basic technological literacy and critical abilities for evaluating technology in everyday life. In the Swedish curriculum for the compulsory school, the aim of teaching technology is to give pupils the "opportunity to develop their understanding of the importance of technology and its impact on people, society and the environment" (Swedish National Agency for Education 2011:254).

Similar writings can be found in curricula in other countries. The importance of critical thinking is highlighted in the English curriculum, where the purpose of design and technology teaching in KS1–3 in schools is to ensure that "[p]upils learn how to take risks, becoming resourceful, innovative, enterprising and capable citizens. Through the evaluation of past and present design and technology, they develop a critical understanding of its impact on daily life and the wider world" (Department for Education 2013).

The importance of history and context in teaching technology is also highlighted in the South African curriculum for Grades 4–6. One of the specific aims of this subject in schools is that "[l]earners should understand the practical uses of Natural Sciences and Technology in society and the environment and have values that make them caring and creative citizens" (Department of Basic Education 2011:11). Moreover, through teaching, learners should be given the opportunity to develop their understanding of "the history of scientific discoveries and technological solutions, and their relationship to indigenous knowledge and different world views [. . .]" (Ibid.).

Since technological knowledge is often a matter of decisions and preferences, it also involves the values in society. Technology, in terms of making and using artefacts, is largely a practical activity. But due to the inherent complexity and practical efficacy of modern technology, we also need to reflect on it and think about it more (Mitcham 1994). Discussion and reflection should therefore be regarded as an important part of a technology syllabus (Dakers 2006; de Vries 2006). Failing to place technology in a broader context ignores the connections between artefacts and human intention, as well as the social implications of how artefacts are used (Axell 2015; Axell and Boström 2015; Klasander 2010; Mawson 2010; Siu and Lam 2005; Turja et al. 2009).

A further important aspect is that technology is global, and knowledge about it should therefore include technology from different cultural contexts. It should not simply focus on modern technologies used in a limited number of parts of the world (Edgerton 2006; Gumbo 2015). However, in order to understand and reflect critically on the impact of technology on people's lives, on society, on nature and the environment, technology needs to be made visible and understandable. In this chapter, knowledge about technology is linked to children's fiction. A starting

point is that fiction can be a source of reflection and encourage children to think critically about technology. In this way, it can become an integral part of technology education.

1.1 Technology Landscapes in Children's Literature

Fiction can be considered an arena where the conversation about technology and its impact on humankind takes place in a specific context. Identifying with the characters in a story not only contributes to an understanding of other people, but it also helps develop knowledge and understanding of the world we live in. As Don Norman notes, people are innately disposed to look for causes of events, to form explanations and stories. Stories not only resonate with our experiences, they also provide examples of new instances (Norman 2013). When we engage with a story, we are free to explore our own perceptions of it and follow a variety of suggested prospective realities. These provide an opportunity for alternative possibilities, for visions of the future; an opportunity to reflect on what *is* and what *could be*. The stories can also invite us into a dialogue about the effects of technology on the individual, society and nature. Moreover, in contrast to many textbooks and works of non-fiction, fictional stories highlight the inherent complexities and contradictions of technology, revealing its less obvious and concealed aspects and messages. Children's literature can thus be seen as a mediator of values and attitudes, which makes it a useful subject matter for Design and Technology education (Axell 2015).

Technology landscape is a concept I use to examine the books detailed in this chapter. Technology landscapes vary in different cultural contexts, and also change character over time. In other words, they are a kind of empirical "reality" which includes values and attitudes about technology (Hagberg 2008, 2009; Lindqvist 2011). This chapter can therefore be described as an exploration of critical aspects of technology found within the landscapes in children's literature. The stories originate from different historical and cultural contexts, and they have been selected for the extent to which they represent a variety of critiques and aspects of technology found in children's literature: *mechanising and homogenising aspects of technology*, *older versus newer technology*, *colonising aspects of technology*, *technology versus nature and enduring technology*.

2 Critique of Technology in Children's Literature

2.1 The Mechanising and Homogenising Aspect of Technology

> The people in this country are far ahead of us in everything. All of our remarkable inventions like the telegraph and the telephone and the phonograph and the flying machines and the cinemas, they have had for several hundred years in Kringelkrokien. Skilled as they are at inventing, almost everything in the country is done by machines. (Beskow 1919/1996:55)

The technology landscape in the fairy tale *Doctor Klokamundus' Invention* (1919/1996), written by the Swedish author Elsa Beskow, involves a fantasy land, Kringelkrokien, which is technologically advanced. Inventions such as the telephone, the phonograph, the aeroplane and the cinema have existed there for hundreds of years. Most tasks are done by machines. In Kringelkrokien, the inventor Doctor Klokamundus is the king's closest adviser. The description of Kringelkrokien is reminiscent of Edward Bellamy's (1850–1898) utopian society. Bellamy's utopia is based on rational industrial production, and the capacity of the individual has little value (Frängsmyr 1990). Society in Kringelkrokien is also based on rationality and technological solutions. However, dependence on technology and science has gone too far, and they are used as tools to mechanise people's lives. When the children (boys) start to misbehave, the adults believe that the problem can be solved by technology in the form of a high-tech fostering machine.

Doctor Klokamundus initially constructs a prototype on a small scale. Five baby rabbits are placed in the machine and released after a month. When they are put into the machine, each rabbit has its own individual colour and personality, but after a month in the machine, they are all identically speckled and perform exactly the same tricks. The king is delighted with the small, perfect, well-behaved rabbits and recognises the machine's potential.

In the fostering machine, everything is managed by sophisticated and automated technology, replacing the need for human coexistence. The boys are stuck inside the big, boring machine which is completely lacking in aesthetics and cosiness. Each room is equipped with a clock, and every hour a loud voice announces what needs to be done. If the boys do not obey, they are given an ice-cold shower. In the morning, an alarm clock rings, and as soon as it stops ringing, all the beds are turned upside down and folded into the wall. At 7 o'clock, school starts. The pupils sit at their desks, and a gramophone repeats the lessons over and over again. Twice a week the boys watch a film which teaches them how to behave, such as how to hold a knife and fork in the correct way. Children are therefore brought up with no human contact. If the boys feel they need someone to talk to, they can do so at a certain hour in the afternoon via a receiver on the wall. The answer comes from a gramophone. In contrast to Bellamy's utopia, the machines in the fairy tale take over *all* tasks, not just some of them. A vacuum device sucks up all the dust from the rooms, and the boys use a "clean clothes machine" at a set time every Saturday. They put their dirty clothes in one tray and clean ones appear in another one. There is even a hair-cutting machine which resembles a dentist's chair and which cuts hair "as easily as if it were peeling a potato". However, the children do not have the slightest intention of staying in the fostering machine. They have no desire to be corrected and disciplined in the way the adults wish. "Maybe because they knew that all the baby rabbits had been speckled when they came out of the machine [. . .], what is certain though is that the children felt a real horror of that machine" (Beskow 1919/1996:64).

As in most fairy tales, the story has a happy ending. The boys escape from the fostering machine and live a "Robinson Crusoe life" in the ruins of an abandoned castle. By using their creativity, they develop new skills and learn how to survive

in the wild. The story illustrates the consequences of placing too much faith in technology and shows how it is used as a tool to homogenise people. The implicit message is that there is a risk in a technological world that people's innermost needs and desires will be forgotten. The boys' experiences, however, illustrate that there is an innate social need for human connection and belonging which cannot be fulfilled by technology and that adults need to meet children's emotional needs. The critique in the story can therefore be interpreted as a reflection of our ambivalent view of technology and its consequences. This ambivalence, according to Brian Arthur, comes not from our relationship with technology but from our relationship with nature: "[w]e are caught between two huge and unconscious forces: Our deepest hope as humans lies in technology; but our deepest trust lies in nature" (Arthur 2011:11). Our hope is that technology will solve our problems, make our lives better and help develop the future we want. At the same time, as human beings, we are attuned to nature, a dependence which comes from millions of years of feeling at home with it. Jacques Ellul, on the other hand, traces the roots of this ambivalence towards technology to the shift from spiritual to modern societies which are governed by technological means (Ellul 1964, 2010). George M. O'Har refers to Ellul when he suggests that "[w]hen science and technology replaced magic, what was removed was that physical-mechanical part of the magical system that simply could not compete with a new world based on scientific method and technological efficiency [...] Machines cannot calm fears, or provide answers to our deepest questions" (O'Har 2000:864).

Moreover, the way technology and technological development are criticised in the story can be interpreted as the consequence of a deterministic view of technology, in a similar way to Ellul (1964, 2010). Technological development and new technologies in Kringelkrokien follow their own principles based on rationality and efficiency, and development takes place outside people's control. As the solutions in Kringelkrokien's technological landscape have social consequences which go far beyond their intended application, the fairy tale can also be interpreted from the perspective of Langdon Winner. He suggests that if we simply see technology as a neutral tool which can be used for either good or evil, we fail to take into consideration any unintended consequences in its design or construction (Winner 1989).

2.2 Older Versus Newer Technology

Mike Mulligan had a steam shovel,
a beautiful red steam shovel.
Her name was Mary Anne.
Mike Mulligan was very proud of Mary Anne.
He always said that she could dig as much in a day
as a hundred men could dig in a week,
but he had never been quite sure
that this was true. (Burton 1939/2005:3)

Some children's books carry the message that early technology is better than modern technology and that old technology has greater value. One example is *Mike Mulligan and his Steam Shovel* (1939/2005) by the American writer Virginia Lee Burton, which illustrates several of the problems of a rapidly changing society. In the story's technology landscape, an anthropomorphic steam shovel, "Mary Anne", becomes outdated and is replaced by more modern technology, introducing a message about change and obsolescence. Mike and his steam shovel are described as a team or a couple, as Mary Anne is a female. They have been digging together "for years and years", and Mike has taken such good care of his steam shovel that "she never grew old" (Burton 1939/2005:4). The steam shovel is assigned a feminine gender and embodies values as well as attitudes traditionally associated with women (Lee 1992).

Anthropomorphism, the practice of ascribing human traits and attributes, such as feelings, to animals or things, is quite common in folk tales and children's literature. One suggested reason for the use of anthropomorphic technology is that it helps the reader feel at ease with technology in general as a part of the human world. Where a form of technology is so complex that it is hard to grasp, a way of bringing it closer to us is to depict it as being alive. Anthropomorphism also helps to build an emotional bond between human beings and machines (Schwarcz 1967; Waytz 2013, 2014). This is reinforced by showing how humans and machines can be the best of friends.

In the book, the reader is told that Mike and his steam shovel ("among others") have dug the great canals for the boats to sail through, they have dug out the high mountains so trains can pass through and flattened hills and curves in nature to make roads for the cars. Mike and Mary Anne have also packed down the ground and filled in the holes to make landing strips for the aeroplanes and dug deep holes for the cellars of the tall skyscrapers in the modern cities. Mike and his steam shovel are celebrated as heroes, as they are the basis of industrial society. From this perspective, technology is portrayed as a servant to humanity and seen as a powerful tool in helping human beings achieve their dreams and aspirations. These aspirations include mastering nature. The depiction of how humans use their technology to transform nature for their own needs can be tied to an anthropocentric view of nature. This represents a human-centric approach, where nature is seen as something which exists largely for the benefits of humans. It means that nature itself has no intrinsic value. In the history of Western ideas, Francis Bacon (1561–1626) and René Descartes (1596–1650), more than any other philosophers, provided the basis for consolidating an anthropocentric ethic. Bacon regarded nature as something to be disciplined and harnessed as an obedient slave (Merchant 1989; Sörlin 1991). George Henrik von Wright describes Bacon as "the master philosopher of technology", as he prophesied more eloquently than anyone else how technological inventions, representing the benefits of science, would establish human sovereignty over the universe (von Wright 1987/2010). Descartes held a mechanistic view of nature and believed that animals were nothing more than complex machines. According to Descartes, humans are differentiated from animals by the fact that they have a soul, and this is extended to justify human dominion over animals and

nature. Through philosophers such as Bacon and Descartes, the anthropocentric view was therefore lent a kind of scientific legitimacy. A more recent definition of the anthropocentric point of view is that it represents an approach in which each impact on nature should be assessed according to the effect it has on humans. From this point of view, living people must act so that the lives and well-being of future generations is not threatened (Sörlin 1991). This means that an anthropocentric view of nature need not necessarily be the same as the ruthless exploitation of nature. On the other hand, it justifies a view that humans have the right to exploit nature for their own purposes. This message is also incorporated into the story about Mike Mulligan and his steam shovel. The main message in the story, however, focuses on how contemporary technology outperforms and replaces older technology:

> Then came along the new gasoline shovels, and the new electric shovels, the new diesel motor shovels and took all the jobs away from the steam shovels. Mike Mulligan and Mary Anne were VERY SAD. (Burton 1939/2005:13–14)

The steam shovels are sold off for junk or left in gravel pits to rust and fall apart. Mike, on the other hand, loves his machine so much that he cannot do that to "her". However, the "good old days are gone" and no one wants or needs them anymore.

As Kevin Kelly indicates, a technique or artefact which may be rare in the modern urban world can be quite common in the rural developing world (Kelly 2010). In Mike Mulligan, for example, the older technology plays an important role in a smaller town in the countryside. Mike reads in the newspaper that a new town hall is going to be built in Popperville, and he and Mary Anne decide to go there and offer the residents of the town their services. They are given the job of digging the cellar. Mike promises to do all the work in only 1 day, and if he and Mary Anne do not manage it, the town will not have to pay for their work. They succeed in carrying out their task in 1 day, but there is a problem: they have forgotten to leave a way out from the bottom of the pit. A little boy finds a solution, however, when he suggests an alternative use for the steam shovel as a heating plant for the town hall. Mike and his old shovel are required again when they are given the important task of controlling and warming up meetings from the boiler room of the new town hall. As Kelly notes, this kind of anachronistic technology is not at all unusual. For example, as recently as 1962, in what was then called the atomic age, many small businesses in Boston ran machines using steam power delivered to them by overhead drive shafts (Kelly 2010).

From a gender perspective, the fable not only presents an egalitarian relationship between males and females, the female machine in the story paves the way for more democratic social development and, in the end, satisfies a basic human need for warmth when she is installed in the basement of the town hall (Lee 1992). The message about technology in the story also illustrates David Edgerton's argument is that 'new technology' is often a result of transferring existing knowledge and technology to a new use (Edgerton 2006). In the story, the steam shovel is transformed from an instrument for digging to a modern boiler, and what happens in the small town of Popperville can be interpreted as a testament to old-fashioned hard work and ingenuity.

2.3 The Colonising Aspect of Technology

> It was the largest and most famous in the whole world! It was WONKA'S FACTORY, owned by a man called Mr Willy Wonka, the greatest inventor and maker of chocolates that there has ever been. And what a tremendous, marvellous place it was! It had huge iron gates leading into it, and a high wall surrounding it, and smoke belching from its chimneys, and strange whizzing sounds coming from deep inside it. And outside the walls, for half a mile around it in every direction, the air was scented with the heavy rich smell of melting chocolate! (Dahl 1964/1985:18)

Charlie and the Chocolate Factory (1964/1985) by the English author Roald Dahl depicts not only the mechanising function of technology but also its ability to colonise. Charlie's family is poor. Some days Charlie has nothing to eat, and his clothes are dirty and torn. His father, Mr. Bucket, is the only person in the family with a job, and he works in a toothpaste factory, "where he sat all day long at a bench and screwed the little caps on to the tops of the tubes of toothpaste after the tubes had been filled" (Dahl 1964/1985:16). Wonka's Golden Ticket contest, however, brings a sharp rise in sweet consumption, along with a rise in cavities and a subsequent increase in toothpaste sales. To keep up with demand, the toothpaste factory which employs Mr. Bucket mechanises the plant and fires the slower and more expensive human workers. Eventually, the toothpaste factory goes bankrupt. Charlie's father is left jobless, and money for the Bucket family becomes even tighter than before.

The story can be interpreted as a critique of capitalism and consumerism. The mechanisation of people's labour leads to stress, illness, economic inequality and the creation of power structures. The problem is rooted in the fact that human beings no longer develop technology to solve problems but as a basis for greed and a lust for power. Humankind has been reduced to a "cog" in a mechanistic system, and people in industrialised society are identified and valued for what they do and not for who they are (Ewerman 1997). Luckily for the Bucket family, everything changes when Charlie finds his Golden Ticket. On the other hand, their entire future lies in Wonka's powerful hands.

The world inside Willy Wonka's factory, however, differs greatly from other industrial settings. Instead of being dominated by machines in dull colours, Wonka's factory consists of colourful rooms, reminiscent of the countryside:

> They were looking down upon a lovely valley. There were green meadows on either side of the valley, and along the bottom of it there flowed a great brown river. What is more, there was a tremendous waterfall halfway along the river [. . .] Graceful trees and bushes were growing along the riverbanks – weeping willows and alders and tall clumps of rhododendrons with their pink and red and mauve blossoms. (Dahl 1964/1985:73–74)

Willy Wonka explains that he hates "ugliness" and that everything in the landscape is edible and "made of something different and delicious" (Dahl 1964/1985:75). The description of how the factory was transformed into a beautiful and colourful landscape with waterfalls of chocolate and large fields with edible sugar is reminiscent of William Morris' (1834–1896) utopia. As in the technology landscape in Wonka's factory, Morris' ideal society, the factory is a pleasant place

with gardens and parks (Ambjörnsson 2004; Frängsmyr 1990; Hård and Jamison 2005). However, it is not a wilderness that is described as beautiful in the story but a form of nature which has been "tamed" and created by humans with the help of technology. A wilderness is described as something dangerous, the place Wonka's labour force, the Oompa Loompas, come from.

The description of the Oompa Loompas supports a view of technology as a colonising force. They are described as "imported directly from Loompaland". Before they moved to Wonka's factory, they spent every moment of their day climbing through the treetops looking for things to mash up with caterpillars to make them taste better. The food they loved more than any other was the cacao bean, but this was hard to find. In Wonka's factory, the Oompa Loompas can have all the cacao beans they want. The Oompa Loompas' place of origin and the description of them as a happy slave workforce make them interchangeable with the cogs in the various machines throughout the factory. This can be traced to Lewis Mumford's idea that early technology was in some ways more democratic, since it was used in a context where human beings were more closely involved in constructing it. In contrast to crafts, industrial technology is autocratic (authoritarian) and therefore a potentially destructive power (Mumford 1964). Based on Mumford's classification, Willy Wonka and his factory can be seen as representing authoritarian technology. However, the message is ambiguous. On the one hand, Wonka and his factory create hierarchies and are sometimes the cause of unemployment. On the other hand, Wonka and his Golden Ticket allow Charlie and his family to rise out of their poverty. Technological development thus creates both winners and losers.

Another ambiguous message can be identified where certain technology is portrayed as revolutionary and amazing, while other technology, like television, is portrayed as harmful. However, Wonka creates a new invention out of television technology, which is depicted as good:

> But first of all, do you know how ordinary television works? It is very simple. At one end, where the picture is being taken, you have a large ciné camera and you start photographing something. The photographs are then split up into millions of tiny little pieces which are so small that you can't see them, and these little pieces go whizzing around all over the place until suddenly they hit the antenna on the roof of somebody's house. They then go flashing down the wire that leads right into the back of the television set, and in there they get jiggled and joggled around until at last every single one of those millions of tiny pieces is fitted back into its right place (just like a jigsaw puzzle), and presto! – the photograph appears on the screen . . . . (Dahl 1964/1985:136)

Even if Wonka's description of how television technology works is not realistic, this is the way in which his own "television-chocolate" works. On the one hand, the message can be explained by the fact that Wonka does not know how the real technology works, but on the other hand, the message is consistent with Arthur (2011) and Edgerton (2006): that existing technology and technological knowledge are often used to create something new.

As in the story *Doctor Klokamundus' Invention*, technology is used as a tool to homogenise people. Children with Golden Tickets who are nasty and greedy first

have to learn a lesson, and then they all become victims of Wonka's technology. The winner in the end is Charlie, who is a kind and considerate boy, and Willy Wonka decides that as soon as he is old enough to run it, the entire factory will become his.

2.4 Technology Versus Nature

> I started as a tree. I was a giant Wawa tree in the forest of the hinterland [. . .] For years, we shared the peace and quiet of our forest with animals and man, who only chopped down small trees for his use. (Asare 1982/1990:1)

The Canoe's Story (1982/1990) written by the Ghanaian writer Meshack Asare is, like *Mike Mulligan and his Steam Shovel*, a story about the tension between old and new technologies. However, it also involves a critique of the fact that humans do not show due respect when nature is used to create technology. The story is anthropomorphic, as it is told from the tree's point of view. The tree tells its life story, from its beginning in the Asante forest to its role in the traditional Ga fishing industry. The story includes descriptions of traditional rituals, like Asante tree-cutting ceremonies and the Ga canoe-naming ceremony.

At the beginning of the story, the Wawa tree is happy to use its branches and leaves to give shade to the humans. But one day, something dramatic happens – people with big, modern machines arrive in the forest and start cutting down the trees. The new machines are destroying everything in their path. The tree can hear the other trees' desperate wailings, and soon the whole forest is "hurt". The animals, which have lived since ancient times among the trees, escape the "iron monsters". As the trees are unable to escape, one by one, they fall victim to the humans' "horrific machines". The Wawa tree realises that soon it will be its own turn. But the tree's fate will differ from that of its friends. One early morning, a couple of men turn up. They have brought with them a piece of fabric, a bird, a bottle of gin and some eggs. These are all votive offerings to the spirit of the tree, which has been with it during the hundreds of years it took to grow into a stately giant tree.

Although the tree is cut down, it is content. It was not cut down by "vicious" machines with jagged chains. Instead, through their gifts, the humans showed respect. By using their tools, axes and chisels, the men give the tree a new guise: "My new shape was not like anything else in the forest and I was very pleased with myself" (Asare 1982/1990:6). By depicting the development from Wawa tree to traditional canoe, and finally to motorised sailing vessel, both the fear of change and the benefits of technological development are illustrated. For example, at the end of the story, the Wawa tree says: "The engine works hard to move me through the water; and for me as fast as a leaf in the wind. So now I'm not afraid of machines anymore" (Asare 1982/1990:20). Technology is the result of evolution, a gradual development, and novel technology (a motorised fishing boat) is descended from earlier forms (Arthur 2011). It is an illustration of how the technological world consists of both modern and indigenous forms of technology (Gumbo 2015). It also portrays the strong tie between humans, technology and nature.

Moreover, the story's critique of exploitation introduces a theme of sustainable development. The tale shows how much the fishermen value the trees from which they indirectly derive their livelihoods. They cannot build their canoes with technological skills alone and know they need the trees. At the same time, the story describes the ongoing mass depletion of the forest, with little consideration for replacing this valuable resource. An implicit message is that we should start asking ourselves what would happen to humanity if this depletion did not stop and all the trees in the rainforest were cut down. The tree's understanding and generosity may cause the reader to rethink the relationship between humans and nature, as well as how humans relate to objects made from nature. There is a spiritual life force in natural objects and materials that must be respected. However, although the story is told from a tree's perspective, there is a message that humans have the right to make use of natural resources if they do so with respect and consideration. This can be described as a *weak anthropocentric view*; a view premised on the centrality of human beings' needs but more than a purely instrumental view of nature (Dobson 2000). Technological progress should be implemented in harmony with nature and with consideration for future generations. Humans are part of nature, and their very survival depends on the preservation and protection of non-human species. By destroying trees, we destroy ourselves.

In the technology landscape of the story, contexts where people have a close relationship with the design process are seen as a beneficial tool which can help human beings solve problems and steer society in a positive direction. In contrast to the design process where fishermen build their own canoes, the modern "iron monsters", or powerful deforestation machines, can be interpreted as representing what Mumford describes as authoritarian technology (Mumford 1964). The monster metaphor is used as a criticism of technological development built on ruthless exploitation of nature. The deforestation machine is related to a techno-centric context, in which human beings use technology as a means of acquiring power or economic resources with no regard for nature or future generations (Axell 2015). The canoe's final thoughts about whether anyone has ever liked him as much as they do now, when he is a useful human tool, is an illustration of the tension between conservation and change. The story presents a careful balance between the values of nature, modern and indigenous technology and technological change.

2.5 The Enduring Aspect of Technology

> Old man Pettson and his cat Findus lived on a little farm deep in the country. They had a few hens in the henhouse and plenty of wood in the woodshed and everything else they needed was in the tool shed. They did not often get visits and that was just as well, thought Pettson (Nordqvist 2000:1)

The technology landscape in the books about Pettson and Findus, written by the Swedish author Sven Nordqvist, involves an idyllic countryside setting with

close ties to nature. Rather than highlighting negative images or the consequences of technological development, the books about Pettson and Findus offer alternatives. Their inventions are created from reused artefacts and do not deplete natural resources or require much energy to function. Pettson mends his clothes instead of buying new ones, grows his own vegetables and is self-sufficient in eggs. Everything about Pettson's life on the farm is on a small scale.

What makes the stories unique compared to many other children's books is that they portray the enduring aspect of technology; it is "born" but does not "die", although it is in a constant state of change. During the summer, Pettson travels either on foot or by bike. In winter, he uses his sledge, and Findus uses skis. Sledges, skis and kick sleds are all examples of artefacts which have a long history and which are still in use today. In this sense, they are not linked to a particular time and, as artefacts, have hardly changed through time. By underlining the enduring dimension of technology, it becomes easier to appreciate technologies which have been an important part of people's lives for many generations and continue to serve a purpose today. New technologies emerge and others disappear, but some continue to be used over time. This dimension is also discussed by Kelly when he notes that very few technologies disappear once they have been established. His conclusion is partly based on a review of nearly 600 pages of the Montgomery Ward Catalog for the years 1894–1895. He concludes that a majority of items sold in the catalogue are still available for purchase today. The actual design or style may have changed, but the underlying technological function remains the same (Kelly 2010).

Edgerton notes a similar aspect to Kelly but from a different angle. He challenges the common practice of categorising technological development in terms of a historical timeline, where each invention is denoted by the year it was invented. This presents each technological development as "new", even if "new" often involves building on existing knowledge and applying it in new ways (Edgerton 2006). Kelly's description is similar to how Pettson creates his technology. In the stories, technology is the result of a creative design process in which Pettson is a *bricoleur*. The term *bricoleur* was first introduced by anthropologist Claude Lévi-Strauss (1962), who considered it to be in some ways the opposite of an engineer. He/she is skilled in a variety of tasks but, unlike the engineer or scientist, uses only what is available, both in terms of tools and material. A bricoleur is a "Jack of all trades", and Pettson solves his own technological problems. A great deal of technological evolution occurs, as Arthur notes, when components are improved and used in other applications (Arthur 2011). For example, Pettson invents a device to scare away foxes, made from a balloon, pepper, a roll of steel wire and firecrackers. Another of Pettson's inventions is a "fishing bow":

> Pettson had invented a fishing bow. Down by the lake he explained to Findus how it worked. The hook and the float were attached to an arrow. The arrow was attached to the fishing line. The rest of the line was wound onto a reel, which was attached to a bow. With it he could shoot the arrow with the hook far out into the water, much further than he could reach with the fishing rod. It worked quite superbly. (Nordqvist 2003:11)

Pettson and his cat also use their artefacts differently from how they were originally intended to be used: an electric jigsaw becomes a breadknife, a brace and bit become a cup holder, a hat is transformed into a lampshade and a small plane is used as a cheese slicer. Don Ihde (2006) uses the term "the designer fallacy" to explore whether a designer can really include the purpose of an artefact in the design itself. Technology is embedded in different cultural contexts, writes Ihde, which affect both the design and its applications. The same kind of technology can apply to different but specific contexts, and artefacts can incorporate a variety of technological uses and trajectories of development (Ihde 2006). This is an aspect noted by Kay Stables (chapter "Critiquing Design: Perspectives and World Views on Design and Design and Technology Education, for the Common Good") when she discusses how we expect an object to be designed with a particular purpose in mind, such as meeting a human need or solving a problem. Sometimes, its purpose may be to protest, and one person's purpose or need may be completely the opposite to that of another person. From this perspective, Pettson's technological solutions can be construed as a protest against the mainstream expectation that the design of an artefact must be linked to a specific technical function. Daniel Dennett sees this in a similar way to Ihde and Stables and gives the example that old irons are frequently used today as bookends and doorstops. He concludes that "[. . .] the inventor is not the final arbiter of what an artefact is, or is for; the *users* decide that" (Dennett 1990:186). Norman uses the terms "affordance" and "signifier" to describe the relationship between an object which has been designed and the agent with which it interacts. Affordances are, according to Norman, the possible interactions between people and the environment, while signifiers signal what actions are possible and how they should be carried out. Affordances determine possible actions, while signifiers communicate where these actions should take place (Norman 2013). The books about Pettson show that there are many different affordances in Pettson's technology. The signifiers are to be found in the illustrations, for example, how a clamp on the kitchen table holds a loaf of bread and how a jigsaw beside the bread slices indicates how the tool can be used.

Building on the discussion above, the books about Pettson and Findus can also be said to represent a view of technology consistent with Joseph C. Pitt's approach that technology should be considered a neutral tool which can be used in a "good" or "evil" way (Pitt 2014). As Pettson is using and developing his technology with good intentions, his technology can also be considered "good".

A further dimension of technology in the books about Pettson is that it does not have to solve problems, be "useful" or lead to the performance of a task in a simpler or more efficient way. Pettson's Santa Claus machine (Nordqvist 1994) is an example of an artefact that neither rationalises nor improves the efficiency of human activity.

Some of Bruce Archer's, Ken Baynes' and Phil Roberts' characteristics of design can be identified in the way Pettson makes his Santa Claus machine. Pettson "envisages" what he is going to create, and his invention is also going to meet a particular need: to make Findus happy on Christmas Eve. Pettson's design is *intentional*, *integrative* and *inventive*, but in the end, it turns out not to be *useful*

or *expedient*, and the machine can hardly be described as *productive* (Archer et al. 1992). The Santa Claus machine, as well as some other of Pettson's and Findus' inventions, can therefore be described as "Rube Goldberg machines" which perform tasks in a more complicated way than is necessary (Acharya and Sirinterlikci 2010). Many of their bricolages are only good for doing things in an alternative way or for "solving" what could hardly be regarded as a technological problem. Examples of these are pots on wheels and tea cups with "teaspoon holders".

In the stories about Pettson and Findus, crafts and early technology are given a higher value than industrial and more technically advanced inventions. As in Morris' utopia, there is a belief in technology in Pettson's world, but only in the technology that relates to crafts, and is handmade. Morris distanced himself from both the pessimistic and the uncritically positive settings of technology and industrial society. Instead, he wanted to combine the old and the new, the innovative and the traditional and the functional and the aesthetic (Frängsmyr 1990; Hård and Jamison 2005).

There is no explicit critique of the impact of technology on society in the books, but they could be interpreted as an implicit critique of industrialisation, harking back to the past in a nostalgic way with an inherent message that "it was better before". They could also be read as depictions of a technology landscape which represents an alternative and more sustainable way of living and which stands in contrast to a modern society built on consumption (Axell 2015; Axell et al. 2014). What places the Pettson and Findus books in a special category in their relationship with technology is that the aim of their creations is not to produce something perfect, but something unique.

2.6 Concluding Analysis

An examination of the technology landscapes in the books included in this chapter shows that a critique of technology is very much present in many children's books and involves discussions about the advantages and disadvantages of technology. The focus is on the creative process, rather than making a technological process or artefact more effective or profitable. From a design perspective, the stories illustrate the critical point that it is the user of an artefact, not the designer, who ultimately decides how it is defined and can be used (Dennett 1990; Ihde 2006).

Furthermore, anthropomorphism is common in children's fiction. Ascribing human traits to technology and aspects of nature helps built an emotional attachment to machines and/or the natural environment. Caring relationships contribute to bridging barriers between human beings, technology and nature (Schwarcz 1967; Waytz 2013, 2014). A caring relationship with machines also prevents technology from becoming obsolete; there are always new applications for old technologies (Edgerton 2006; Kelly 2010).

The stories convey a belief in technology but mainly in technologies which are related to crafts: handmade and indigenous technologies which have a long history. Well-designed objects can bring a sense of pride and enjoyment and a

feeling of being in control (Norman 2013). This can be related to the idea that early technologies are in some ways more democratic, since they are used in contexts where human beings share a closer relationship with the artefact and the process of making it (Mumford 1964). The books therefore involve a nostalgic, but not dystopic, view of technology. Some of the stories can be interpreted as calling for a shift in how we see technological development, as well as in the design process: from the new to the old, from the big to the small and from the spectacular to the mundane (Edgerton 2006). What is missing, however, is a context that shifts the focus away from a technology dominated by men to one which also includes women.

All in all, the critique of technology and technological progress in the stories is often ambiguous. It advocates that a life in harmony with nature is a path to the future. On the other hand, there is a message that as long as humans aim to create technology that can satisfy their needs and desires, they are morally justified in using and transforming nature as they see fit. However, this must be done with consideration and respect towards nature. The stories also seem to have a built-in duality, describing how technology can establish individual freedom but also weaken human bonds. Like the Roman God Janus, technology is two-faced, with a positive and negative side, one constructive and the other destructive.

So finally, how can children's fiction be used as a learning tool for developing critical thinking?

2.7 Children's Literature as a Learning Tool for Critical Thinking

Thinking critically about technology is about drawing conclusions, evaluating and seeing things from different angles, i.e. being open-minded and considering alternative ways of looking at something. Questioning is therefore an important part of learning. By asking questions that challenge children's conceptions and ideas, teachers can help children to continue developing their critical thinking abilities. Examples of activities where teachers can use fictional children's books as springboards for critical discussions about technology include:

- *Identifying.* Identifying how technology is represented in the story. "What is technology?" "What kind of technological artefacts, activities, processes and systems can be found?"
- *Making comparisons and contrasting*. Identifying similarities and differences related to different technologies. "What are the similarities and what are the differences?" Comparing designs of the same type of artefact. "What are the recurring characteristics?" "For example, how do we know from the design that an artefact is a chair?" This helps children to analyse and categorise.
- *Exploring technology from a cultural and temporal perspective*. Cultural and historical perspectives can help children discover the nature of human desires,

needs and aspirations throughout history and in different cultural settings, and how these needs have been fulfilled using different types of technology. "How do people solve this problem in other parts of the world?" "Are there any similarities and differences?" "How did people solve this problem a hundred years ago/a thousand years ago, etc.?" "How could this problem be solved in the future?" "What are the positive and negative aspects of the different solutions?"

- *Asking questions which have no direct answers*. This helps children infer and draw conclusions based on their own understanding of technology. Questions starting with "Why do you think . . . ?" encourage them to think more freely.
- *Relating the technological content in the story to children's own lives and outside events*. This can encourage children to use their own knowledge about technology in new ways and apply it to different ideas and contexts.
- *Not telling the whole story.* Asking the children to finish a story encourages them to use critical thinking skills. When they are not given an ending, they have to develop the story in a creative way, drawing conclusions, coming up with their own solutions and finding counter-arguments. "What do you think happened next?" "How can X solve this problem? Are there different ways?"
- *Providing cooperative learning opportunities.* Reading with peers promotes the development of critical thinking skills in children. When children read together, they share ideas and learn from one another. Encouraging them to identify technology in the stories, examine its role and find alternative solutions can form a basis for creative discussion.

To summarise, an examination of children's fiction shows that by reading children's literature through a "Design and Technology education lens", we discover that technology plays an important role in many children's books. By using books that have a strong story line and are of interest to children, technology can be presented as part of the world that surrounds them. The stories can lead to critical discussions about the nature of technology but can also contribute to an understanding of how human beings have related to technology in other cultures and in earlier generations. The ambiguous messages in the books reveal the multifaceted and complex nature of technology, which makes it possible to problematise it in ways that textbooks seldom can. The technology landscapes in children's literature could thus contribute to making technology and the nature of technology more comprehensible and visible to pupils. These landscapes could also help broaden their perspective and therefore act as a pedagogic tool in fulfilling the aims of Design and Technology education.

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