AMAZING AFFECTS

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Introduction

Since the late 1980s, increasing attention has been paid to the perceived gap between science and the rest of society. This has been discussed in the first place as a deficit in knowledge, in response to the 1989 study by John Durant which revealed, among other things, that no more than thirty-four per cent of the British lay public knows that it takes a year for the Earth to go round the Sun (Durant et al. 1989: 11). Such research has been conducted at regular intervals since, with results that have always been considered similarly upsetting. Science popularisations often have as their main purpose to fill this knowledge gap, or, in the case of children's books, to try to prevent this gap from coming into being.

The science and society gap has also been debated in terms of influence: society seems to lack understanding of the way in which science would influence their lives. This was especially important to those scientists who foresaw an increased research budget as a consequence of improving the public's knowledge of science. In the decade following Durant's study, the general belief was that appreciation would automatically come with this increase in knowledge. The public support of science that was needed to fund costly projects and to put people's minds at ease over potentially hazardous experiments would be created through education. Popular science writing fit in well with these goals, and increased attention was directed to various media outlets through which new scientific insights were distributed.

Popular science writing of course already existed long before the late twentieth century, though earlier works were often written for different reasons. Science books that were meant to educate children outside the classroom have been in existence as a genre of their own in various European countries and North America since the nineteenth century. The works from that period, in fact, already established many of the rhetorical traditions that can be found in popular science writing to this day (Lightman 2004: viii), including in my case study. At the time, they were mainly written by women, who, together with children, were considered unfit for participation in the official scientific sphere. Reading these books was the only way for young girls in particular to engage with science, and the same applied to writing and researching these books as one of the very few acceptable scientific employments for adult women. Therefore, many works, such as Jane Marcet's *Conversations on Chemistry*, were written especially for a young female audience.[1] In the twentieth and twenty-first century, popular science writing for adults and children alike grew to a phenomenon that both scientists and laypeople, of all genders, participate in.

As the intentions behind popular science writing began to change in the late twentieth century, the connection between science and literature received renewed attention. The rhetorical choices that writers made to describe their particular branch of science to the public at large became an impor-

[1] Ironically, this very example is rumoured to have had a significant influence outside its projected audience. Bernard Lightman notes that Michael Faraday, who worked as a bookbinder at the press where Marcet's book was bound, apparently started his research in chemistry and electricity when he became inspired by reading *Conversations on Chemistry* (Lightman 2004: xxii), an assertion which is repeated in *Suffering Scientists* (174).

tant topic. This research topic grew hand in hand with the formation of the Science and Technology Studies (STS) field, which is related to the philosophy of science field. Their research established that the content of popular science writing goes far beyond the merely informative. In an environment where it is considered vital for as many people as possible to learn about science, a populariser would want to use all the tricks in the book that are uncommon in 'real' or 'serious' scientific writing, in order to draw a large audience. The audience must be made to feel something by reading these works, and to go beyond that: to be moved, to be coerced into action. This clashes with the image that science tries to uphold both internally and externally: that of emotional distance, factuality, and structure. It is necessarily to turn this world of apparent factuality and objectivity into something the untrained reader can engage with and enjoy, but how is this rhetorical leap made? This applies even more strongly to those popularisers who write for children. As science is also taught in schools, the authors will have to take into account that they will cover material that is similar to that which the child will obligatorily have to learn for school. They will therefore have to put in extra effort to make the children voluntarily engage with the material beyond their textbooks. One way in which this is achieved is to emphasise the entertainment value of science (Mellor, Davies and Bell 2008: 7), the aspect of science that is most often used to connect the public to science in popular media, in particular in science fiction.

Surprisingly enough, no explicit link seems to have been made yet between science popularisations for children and the equally young field of affect theory, even though this theory could prove a very interesting approach in this regard. Affect theory explicitly addresses that hard-to-grasp concept of what moves and motivates people. In all of its incarnations, it goes beyond mere emotion, as it analyses how and why people are physically and mentally changed by interactions with others and with the objects they encounter. As it is possible to change someone's thinking and behaviour through an affective interaction with, for instance, art, the evocation of affect is an important rhetorical strategy for science popularisers.

It is therefore that I have decided to take a popular science series for children as my case study concerning affect theory: Scholastic's *Horrible Science* (1996-present). The British series, aimed at eight- to eleven-year-olds (Bell 2008: 79) is created by Nick Arnold, an author with a degree in history, and illustrator Tony De Saulles.[2] The series is one spinoff of the immensely popular *Horrible Histories* (1993-present) by Terry Deary – other spinoffs have been made on football and geography. All *Horrible* series alike, though produced by different authorial teams, have as their key selling point the way they explicitly set themselves off against the regular school curriculum. School, and especially teachers, are presented as boring and dull, presenting material that is simply not horrible enough. Though it began as a spinoff, *Horrible Science* has attained quite a name for itself, as millions of its books have been sold in the UK alone and dozens of translations are available. The series has even generated its own spinoff merchandising. Arguably, therefore, one of the best-selling popular science series of this century, I have chosen this series because of the universal appeal

[2] In the original edition of the *Horrible Science* books, only Arnold was credited on the cover. The 2014 reprint lists both Arnold and De Saulles as authors on the cover. This is arguably a positive development, as I will show that De Saulles's illustrations and cartoons are an essential component of creating and maintaining the affective bond with the young reader.

it seems to have on children. Which affects does Arnold evoke in his works, why these affects, and what makes them so effective?

Arnold and De Saulles have published twenty-eight *Horrible Science* titles over the eighteen years the series has been in existence. This does not include the various spinoffs within the series, such as jigsaw, sticker, and puzzle books, the *Horrible Science Annuals* (2008-2014) and the *Horrible Science Collection*, a series of magazines with over eighty issues published to this date. This, I think, is too massive a bibliography to analyse in its entirety in this thesis. I therefore chose to exclude the spin-offs from my analysis, and to focus on those books that dealt with what are generally considered to be the most abstract sciences: physics, chemistry and mathematics. Arnold and De Saulles have not published any math books in the *Horrible Science* series, as *Murderous Maths* is a separate Scholastic series authored by Kjartan Poskitt. The books I will discuss therefore all cover physics and chemistry, or science in general. I have chosen to focus on these more abstract sciences because they stand in the starkest contrast to the physicality of affect. Biology and anatomy, on the other hand, have a closer physical relationship with the reader, which would make it easier to create affective responses, as affects in themselves are closely tied to the physical. I therefore have settled upon using the following *Horrible Science* books for my case study:

- *Fatal Forces* (1997, reprint 2014)
- *Chemical Chaos* (1998)
- *Sounds Dreadful* (1998)
- *Frightening Light* (1999)
- *Suffering Scientists* (2000)
- *Shocking Electricity* (2000)
- *Killer Energy* (2001)[3]
- *Explosive Experiments* (2001)
- *Really Rotten Experiments* (2003)
- *The Stunning Science of Everything* (2005)
- *Evil Inventions* (2007)
- *Wasted World* (2009)

For the third chapter, which concerns the translatability of affects, I have additionally consulted the following Dutch translations:

- *Chemische Chaos* (1998, translation of *Chemical Chaos* by Gerard Kingma)
- *Explosieve Experimenten* (2003, translation of *Explosive Experiments* by Gerard Kingma)
- *Extreme Energie!* (2007, translation of *Killer Energy* by Inge Pieters)
- *Machtige Krachten* (1997, translation of *Fatal Forces* by Paul van den Belt)
- *Schokkende Elektriciteit* (2004, translation of *Shocking Electricity* by Gerard Kingma)

The term 'popular' in 'science popularisation' is a controversial one, as many authors point out (e.g. Broks 2006: 1-2). Since the term carries a connotation of vulgarity, using it is seen as perpetuat-

[3] My edition of *Killer Energy and Shocking Electricity* is a "Two Horrible Books in One" version (2006). The same goes for *Frightening Light and Sounds Dreadful* (2001).

ing the apparent chasm between scientists and laypeople, as it implies that knowledge needs to be dumbed down before it is comprehensible to the larger public. However, by choosing the *Horrible Science* series as my case study, I mean to avoid this controversy by taking the term literally. These science books are popular, in the sense that everyone engages with them – immensely popular, in fact, as sales records and various prizes have shown.

A major problem in my research is that there is no single 'affect theory', in the sense of an approach that attempts to fully describe the workings of affect in all of its contexts. There are in fact quite a few of them around to choose from, and they each apply to very specific contexts. This makes it difficult to perform a concrete analysis using affect theory, as following a very specific approach would be extremely limiting. In *The Affect Theory Reader*, perhaps the most comprehensive work on current developments in affect theory, editors Melissa Gregg and Gregory Seigworth identify no fewer than eight theoretical approaches to this phenomenon (2010: 6-8). It seems that in every field of study, the term 'affect' has come to mean something different. This is problematic in the increasingly interdisciplinary world of cultural analysis, especially if the topic exceeds the boundaries of the humanities and social sciences, to include the natural sciences as well. It is therefore necessary, first of all, to establish *what affect is*. Is the concept really so ungraspable that it needs eight different approaches? Or are these theories perhaps more closely connected to each other than one might think at first sight?

Since I will have to properly describe what affect is, and is not, before I can apply it to my case study, my first chapter exclusively focuses on the different theorisations of affect. Therefore, in this chapter I will limit bringing in the *Horrible Science* case study to where this can illustrate my argument. I will attempt to trace back the different forms of affect theory to their origins, both in psychology and philosophy. Whereas the psychological approach to affect did not come into being until the late nineteenth century, in philosophy the concept was already present in ancient Greek thought. In psychology, I will focus on the works of Silvan Tomkins, who took affect out of the subordinate position Freud had placed it in. His approach to affect was appropriated into cultural analysis less than a decade after Deleuze's, which will be my main focus in philosophy. Since his work on affect was strongly influenced by Spinoza, in particular by his *Ethics*, this work will merit its own analysis. I will then continue to discuss more contemporary affect theorists, such as Brian Massumi and Ann Cvetkovich, and see in which ways affect theory has further developed after Deleuze in ways that are applicable to the case study.

One thing that immediately becomes clear in many affect theories, is the distinction between positive and negative affects. It is a key aspect of both Tomkins's and Deleuze's affect theories. This is why, in my second chapter, I will analyse the *Horrible Science* books in this light. What defines whether an affect is positive or negative? Which positive and negative affects are evoked in these books? What is their effect? I will here look at how important this dichotomy is in theorising affect. I will pay special attention to the ways in which negative affects can be evoked to create a positive connection with the reader, a method that at first sight seems to be counterintuitive.

Finally, in my third chapter I will look at audiences and cultural differences. The *Horrible Science* books are written with a very specific British audience in mind; yet the books have been translated in more than thirty languages, and are popular in cultures that are wildly different from the British context. This long-lasting international success suggests the use of extremely effective rhetorical strategies that function interculturally. Taking the Dutch translation as my example, in this chapter I will focus on the translatability of affects. This means that I will look at how linguistic differences inhibit the creation of an affective bond, and at the extent to which translators are able to overcome these differences and achieve the affective bond with the reader in spite of the language and/or culture gap.

This thesis, then, endeavours to delimit the definition of 'affect' through taking the *Horrible Science* series as a case study. I will attempt to indicate which rhetorical strategies can be used to evoke a positive affective bond, and how effective this is on an international scale. Nearly all of the subtopics I have touched upon have been written about extensively by scholars more well-read and qualified than I am; I do not attempt here to provide a complete overview in the limited space and time granted to me. In fact, the large scope of the existing writing on various types of affect is exactly why I am conducting this research. What I am trying to do here is to understand the underlying structure of the many affect theories, and the ways in which this concept can be used effectively in the still-young field of science and technology studies.

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Chapter 1: Approaches to Affect

"There is no single generalizable theory of affect: not yet, and (thankfully) there never will be," claim Melissa Gregg and Gregory Seigworth in the first chapter of *The Affect Theory Reader* (2010: 3). This statement seems distinctly off-putting to anyone who, like myself, is about to attempt an analysis using affect as a theoretical basis. Yet does the lack of a single, generalisable theory automatically imply that the concept is an unstable ground for an analysis?

Though Gregg and Seigworth identify no fewer than eight different theoretical approaches to affect, each with their own sub-theories, in their essence these approaches are quite similar: in all of them, the origins for the affect theory seem to be found in either of two approaches. The first path takes off in psychology, in which field Silvan Tomkins (1911-1991) is often considered to be the originator or developer of affect theory. Tomkins is considered to have 'rescued' affect from the marginal position to which Sigmund Freud had delegated it. His seminal work in this respect is the four-volume series *Affect Imagery Consciousness*, which deals with the positive affects in Volume 1 (1962) and with the negative affects in Volume 2 (1963). The third volume in the series, in which he discussed the negative affect sets of anger and fear, was published posthumously in 1991. It was followed by the fourth and final volume, in 1992, which concerned the relation between affect and cognition, rather than the specific affects in themselves. In these works, he operationalised the concept of affect, dividing it up into eight discrete affects with well-described physical boundaries, an approach that would spark manifold uses of his theory in the late twentieth and twenty-first century. The publication of the third volume in particular sparked a renewed interest in and application of his affect theory; his work on affects was taken up especially by Eve Kosofsky Sedgwick and Adam Frank. Their 1995 article 'Shame in the Cybernetic Fold' introduced Silvan Tomkins's ideas on affect to cultural theory. In this article, the authors point out that it is almost irresistibly easy to attack Tomkins for his reductionist categorisation of affects into nine categories (Sedgwick and Frank 1995: 497), yet they emphasise that his approach to the topic is original and insightful, and therefore not to be ignored.

The second approach comes from ancient philosophy, and in the seventeenth century was taken up by Baruch Spinoza (1632-1677), especially in his *Ethica* (*Ethics*, 1667). In the twentieth century it was Gilles Deleuze, later joined in this work by Guattari, who took up his ideas again. Deleuze emphasised the differentiation Spinoza made between *affectio* and *affectus*, which became Deleuze's notions of 'affection' and 'affect'. Though Deleuze's approach was introduced later than Tomkins's, in the 1980s, his form of affect theory has been much more influential in cultural analysis. Though his distinction between emotion and affect is less clear than the one Tomkins makes, his notion of 'affections' is an important one that has many implications for the social dimension of affect theory that is less pronounced in Tomkins.

In this chapter, therefore, I will attempt to construct an overview of the various ways in which affect has been theorised since its first inception as a concept. I will mainly focus on the distinction between emotion, affection and affect, and point out where these distinctions have become blurred. Thus the question I will attempt to answer in this chapter is: to what extent are the many different forms of affect theory similar, what are their most important differences, and what implications do these differences have for choosing rhetorical techniques in science writing for children?

1.1 Silvan Tomkins's Affect Theory

The definition of 'affect' as employed by Tomkins is first found in psychology in the nineteenth century, in the second volume of James M. Baldwin's *Handbook of Psychology* (1889-1891): "Affects […] are the feeling antecedents of involuntary movements; as motives, including affects, are the inner antecedents of acts of will" (Baldwin 1890: 314). This aspect of involuntariness is crucial in future uses of affect theory. Tomkins begins his work by explaining that the affect system is highly personal and biologically controlled. He begins with a clear distinction between 'drives' and 'affects'. Comparing his own theories to the writings of Sigmund Freud, he claims that Freud mistakenly subordinated the affects to the drives, regarding them as less and less consequential as his work developed (Tomkins 1962: 6, 48). Tomkins contends instead that affects are most important: they steer and influence the experience of the drives, and the manner in which an individual acts upon their drives. He defines drives as locally experienced and singular, whereas affects are plural and not related to a specific location in the body. Thus, hunger is always located in the mouth and stomach, thirst on the palate, and pain at the locus where this pain is caused. A drive always has a singular cause: lack of nutrition leads to hunger, violation of the body leads to pain. On the other hand, different drives may lead to the same affect: thus, both the stilling of hunger and the quenching of thirst may lead to the affect of joy, and both hunger and pain can cause distress, or even fear.

Different people can also associate different affects with the same drive: thus anorexia patients may experience excitement when confronted with their hunger drive, an affect that is not shared with most healthy people. Tomkins later felt the need to more strongly emphasise that affect is social and dynamic, further differentiating the phenomenon from the drives. In a later work on affect that Tomkins edited with Carroll E. Izard, *Affect, Cognition and Personality: Empirical Studies*, he writes in the introduction that "affects are not private obscure internal intestinal responses but facial responses that communicate and motivate at once both publicly outward to the other and backward and inward" (Tomkins 1965: vii).

According to Tomkins, drives are subordinated to affects because the affect system is what motivates human beings, and our drives only lead to action if they are "amplified by the affective system" (1962: 6). Conversely, if an affect is experienced that opposes the drive, it may "mask or even inhibit" this drive (1962: 22). Hunger, for instance, is a drive, and a person will immediately act upon this drive if they experience the distress affect because of it: for instance, when the subject has had no food for a very long time, and is directly aware of this. If a person, on the other hand, is absorbed in a good book – experiencing the positive affect of interest – the hunger drive can be suppressed or subconsciously ignored for extended periods of time (1962: 49). Similarly, someone on a hunger strike may be able to suppress their hunger drive by reminding themselves of the goal they are fighting for. The strong positive or negative affects that motivate the fast make a rational suppression of the hunger drive possible.

But what exactly qualifies as an 'affect'? Tomkins identifies three "classes of affect":

1. affect for the preservation of life
2. affect for people
3. affect for novelty (1962: 27).

These three classes are only mentioned in passing, and not taken up further on in his work, where he divides up the affects according to a different system. This second system is based on the difference between positive and negative affects, a dichotomy that is much easier to uphold consistently. In the tenth chapter of the first volume, Tomkins lists his affects according to this system (1962: 337):

- Positive affects
  - Interest-Excitement
  - Enjoyment-Joy
- Resetting
  - Surprise-Startle
- Negative affects
  - Distress-Anguish
  - Fear-Terror
  - Shame-Humiliation
  - Contempt-Disgust
  - Anger-Rage

Since Tomkins does not elaborate on this himself, it is hard to place the affects, as distinguished in the positive-negative system, into the 'classes of affect' system. This latter system, however, seems much more useful to the present purpose, as Tomkins here directly speaks of the social qualities of affect. This characteristic is taken up more elaborately by Deleuze and Guattari in *A Thousand Plateaus,* the English translation of their work *Mille Plateaux*. In the 'Notes on the Translation' of this work, translator Brian Massumi explains that neither the term 'affect' nor 'affectation' denotes "a personal feeling", but is rather employed to denote a network between people affecting each other. For personal feelings, Deleuze and Guattari employ a different term in the original French, *sentiment*. Affect, taken from Spinoza's *affectio*, is an "ability to affect and be affected" (Massumi 1988: xvii). It is an encounter and most notably, the encounter is between two *bodies*. According to Massumi, this word 'bodies' can also include "'mental' or ideal bodies" (ibid.), but the use of this term does draw attention to the fact that affects are not merely psychological, they are physical.

Noteworthy here is that, according to Tomkins, the social function of affect is only one out of three classes. An affect does not need to be produced in a social setting, it can apparently also be experienced in solitude. One could argue that even in solitude the evocation of an affect is always induced by a social network that has previously influenced the situation, or will do so later on. Yet one must bear in mind that Tomkins differentiates between affects that are directly produced through social connections, and affects that are only indirectly produced through social interaction: novelty and life preservation need not be evoked through direct social interaction.[4] The *Horrible Science* books offer many options for social interaction, for instance through experimentation and asking adults questions, but the act of reading the book and being excited about it can be done in

[4] If interaction with an object evokes an affect, I would not call this a social process. However, since human interactions cannot be made without a social network (learning to read, writing a book), even these interactions are *indirectly* social.

solitude. The definition of affect according to Deleuze and Guattari precludes such a non-social working of affect, and does not allow for differences in the contexts of evocation. Regarding his further classification, it seems that all of Tomkins's positive and negative affects can at some point fulfil the functions of all three classes of affect, depending on whether the affect is produced through interaction with a drive (preservation of life), a person (affect for people) or an object (affect for novelty). It seems that the classes can intermingle, as meeting new people can lead to the evocation of both affect for people and for novelty; similarly, asking someone for help in an emergency evokes affect for preservation of life and for people.

The eight affects that Tomkins describes would at first glance be called 'emotions' in everyday language. At several points he indeed apparently conflates the two terms, for instance when he describes an experiment in which rats die from exposure to a stressful situation:

> "Whatever the nature of the response, it appears clearly to be affective in nature and sufficiently powerful to inhibit normal escape and avoidance reactions to interference with breathing. Richter presents the following evidence in support of the interpretation that this is essentially an emotional response…" (1962: 47).

Further on, however, he contrasts emotions to drives in the same way in which he throughout his book contrasts affect to drives, when he claims that "in marked contrast to the separateness of each drive, the emotions readily enter into combinations with each other and readily control one another" (1962: 137).

One example will prove how easily Tomkins's affects may be read as emotions. In 2012 Hugo Lövheim proposed a three-dimensional model to classify emotions based on the way serotonin, dopamine and noradrenaline influence their production. For this model, now known as the 'Lövheim Cube of Emotion,' he used the terms for the "eight basic emotions, as described by Tomkins" (Lövheim 2012: 343). Tomkins's system has been simply renamed. Noteworthy in this model is that 'startle' is left out, leaving 'surprise' as a singular emotion. Lövheim's model gives Tomkins's system a further validation that Tomkins was unable to give it: biological evidence at the level of neurotransmitters.

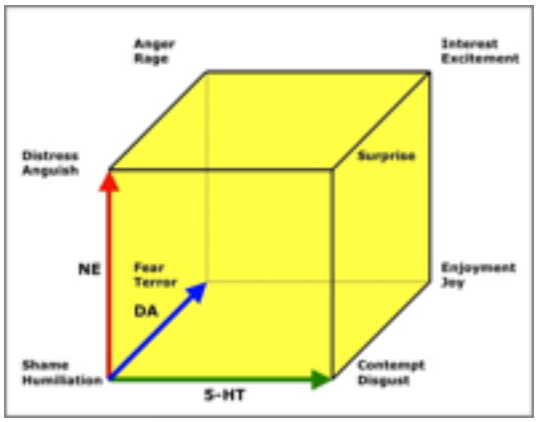

Fig. 1. The Lövheim Cube of Emotion (Lövheim 2012: 342).

However, it is not entirely clear whether Tomkins would have agreed with this rebranding of his affect theory. His affects are meant to be read as different from emotions, as he makes clear in Part II of his work. Here he makes an explicit distinction between affects and what he calls 'feelings'. "One should not lightly assume," he writes, "that there are different affects for the great variety of experienced feelings" (1963: 6). Affects are the underlying system, the expression of which is a 'feeling'. This is how different people experience different feelings even when the underlying affect is similar: "one individual may characteristically feel fear in the stomach, another in an in-

creased heart rate" (1963: 6). If 'feelings' can indeed be equalled to emotions,[5] then Tomkins saw his affects as different from emotions, despite both intuitive belief and scientific interpretation of the two phenomena as being equal.

One occurrence in Tomkins's work further supports this idea. Not all of the phenomena he calls affects would be considered emotions. Aside from the list quoted above, he also alludes to depression and grief as being affects (1962: 48). It is strange that he should mention these two phenomena as affects here, while leaving them out in his most important dichotomy. Is depression indeed an emotion or an affect, or is it a state of being that goes beyond this? And how about grief? Depression and grief are similar to affects in their physicality: they are physically experienced and their effects on the body can be objectively measured. However, these two phenomena are usually experienced over a longer period of time, in contrast to emotions, which are normally experienced in more rapid succession.

Surprisingly, later on in both the first and the second volume, Tomkins identifies depression as "an oscillation between increase and decrease of positive affect which alternately activates distress or anger and shame" and as "a state in which there is conjoint shame, distress and reduction of level of amplification" (1962: 290; 1963: 194). This further weakens Tomkins's initial claim that depression is an affect in itself, if it now turns out to be a compound of two or more affects. Whereas the normally short-lived affects can together stretch over longer periods of time due to their alternation, the states of depression and grief can last for many months or even years.

It is also hard to sustain the claim that depression and grief are affects if one takes into account Tomkins's idea that "any affect may be learned to be activated by any object" (1962: 324). With this claim, Tomkins means to say that a single set of objects will not evoke a single set of affects, but it is difficult to maintain his argument in a reverse direction. Think of the children's books studied in this thesis. Can any object evoke any kind of affects? Perhaps so, but can any object then evoke grief or depression? This would be a difficult case to make for children's books, let alone for objects that are not forms of art and therefore are not created with the purpose in mind to evoke affects. A few children's books come to mind that are capable of evoking grief – Anne Frank's diary, or Jacques Vriens's *Achtste-groepers huilen niet* – but it would be extremely hard to find a children's book that would be capable of evoking depression, which due to its being a prolonged situation to me seems to be a disease rather than an affect. I do not think that art can evoke a depression, since a disease would need a much longer-lasting and more severe impetus to emerge. If art, the practice which produces the most affective of objects, cannot do this, then I do not think that any other objects are capable of making people ill, either.

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[5] The *Oxford English Dictionary* seems to agree with conflating emotions with (strong) feelings:

> **Emotion, n.** 3 a. Originally: an agitation of mind; an excited mental state. Subsequently: any strong mental or instinctive feeling, as pleasure, grief, hope, fear, etc., deriving esp. from one's circumstances, mood, or relationship with others.
>
> b. [S]trong feelings, passion; (more generally) instinctive feeling as distinguished from reasoning or knowledge. ('Emotion', *OED*).
>
> **Feeling, n.** 4. a. The condition of being emotionally affected; an instance of this; an emotion. Often specialized by of with fear, hope, etc. ('Feeling', *OED*).

The most important difference between drives and affects is that affects are not natural. They can be physically measured, as both Tomkins and Lövheim proved, but what causes them is not naturally determined. The drives come naturally and similarly to nearly all people, whereas affects can be learned and unlearned through interactions with objects and other people. Though most human beings never manage to control their affects fully, we are able and expected to exert some degree of influence over its visibility and expression (1962: 113-114). Furthermore, one affect can be used to suppress other affects, even from one person to another. For instance, a child is taught which actions or feelings they should be ashamed of, and which things they are allowed to show interest in: Tomkins repeatedly presents the example of children who are made to suppress or overcome their shyness – a form of shame – when meeting another person, as most parents will not accept it if a child shyly hides behind a parent's legs. The parent becomes ashamed of the child's shyness, and their shame will shame the children into presenting themselves to the stranger (1963: 171). In the second and third chapter, I will further look into the way in which the *Horrible Science* series turns disgusting or uninteresting objects into sources of positive affect, countering parental instruction; the third chapter in particular will look at the way in which such an approach may be more or less effective in different cultural contexts.

Tomkins presents four ways in which affects are artificially constructed: through signs, symbols, analogs and powers (1963: 68).

Sign-affects are connected to objects: being presented with something which previously was immediately followed by the experience of a certain affect, now itself evokes the affect. Tomkins gives the vaccination as an example, when "a child learns to cry at the sight of a needle which had previously given pain upon injection" (1963: 68-69).

Symbol-affects are linguistic: a direct communication, such as "I don't like you," activates affect. Through language disciplining, parents and teachers in particular teach children to express a certain affect in a certain situation, but also *not* to express the affect, up to a certain extent: Tomkins in various instances mentions 'keeping a stiff upper lip' as an example. Different languages, therefore, have different ways of communicating affects, and of teaching which affects are acceptable and which are not. The third chapter will cover this topic in detail. Ann Cvetkovich compares this teaching of affect to Foucault's notion of "disciplining the body." Affect is "discursively constructed," as one can clearly see in this notion of symbol-affects, but it is too often understood to be natural (Cvetkovich 1992: 30). Cvetkovich compares it in this context to sexuality, which too is for the largest part discursively constructed yet perceived to be natural. Affect as a disciplining of the body is effective "precisely because it functions as if it were natural rather than imposed" (1992: 25). This becomes especially clear when looking at the gender differences in expressing symbol-affects: Tomkins describes the way in which parents tell boys to stop crying because it is not masculine, comparing it to girls being less often chastised in this manner because it remains more socially acceptable for a woman to cry in public. The apparently natural functioning of the affects makes it hard to distinguish affects from drives, but they can be distinguished through recognising that all drives will be experienced by all people in the same situations. Every-

one will feel hunger if their stomach is empty long enough, and everyone will feel pain if they are cut deeply enough.[6]

Analog-affects occur when a situation is similar enough to a previous situation that this in itself evokes the affect associated with the previous situation. In this case, Tomkins explains, "the frown on the face of a parent […] may appear to the child to be a similar [*sic*] to a learned symbolic activator, such as the verbal expression 'I don't like that,' which in turn has been learned to activate distress" (1963: 69).

For *power-affects,* the failure of the subject's power activates the same affect as "the original circumstance which the power was designed to remedy" (1963: 70). Thus, if the subject is unable to change the circumstances in which they experience a negative affect, their being incapable to change this circumstance will cause them the same distress or disgust that they had experienced from the event itself. Similarly, Deleuze claims that power (*puissance*), meaning the ability to act, is an essential element that determines whether an affect is experienced as positive or negative; I will come back to this in the next chapter. Power-affects, then, would be extremely important in popular science writing: when a circumstance such as global warming is presented as negative, it is essential that the reader will not become frustrated both at the actual occurrence of global warming *and* at their being incapable of reversing or combating it. This problem is addressed repeatedly in, for instance, *Wasted World*. Though the book begins with addressing a problem children cannot overcome, overpopulation (*Wasted World* 7), the book ends with the chapter "Some Seriously Sensible Ideas In Which to Save the World" (115-125), in which children are challenged to combat global warming themselves, at home. Nowhere in the book is it made clear how small the impact of a single child at home would be, compared to the impact made by the industry. This holds up the illusion that the individual reader can help combat the problem that is painted out in its gruesome detail in the chapters the child has just read.

Seen from this side, this theory resembles Deleuze's a lot more in its social interconnectedness than might at first be expected. Though the two theories originate in the quite different fields of psychology and philosophy, respectively, they are intrinsically connected through the way in which they argue that affect and society cannot exist without each other. They in fact reinforce each other in a feedback loop, as affect is not only personally and physically experienced: social interaction shapes it, and is shaped by it. In order to clarify the many different theories of affect it is necessary first of all to see how they relate to this social aspect.

Theorising affect, and comparing the different ways in which this has been done, to me seems to be a fruitful approach that will be helpful in many forms of cultural analysis. Sedgwick and Frank, however, raise one important argument against the theorising done by Cvetkovich: "This one has no feelings in it," they claim.

> Affect is treated as a unitary category, with a unitary history and unitary politics. There is no theoretical room for any difference between being, say, amused, being disgusted, being ashamed, and being enraged. […] And Cvetkovich's implication throughout is that genres

[6] That is, unless a person has a physical defect that prevents the perception of this drive, such as congenital analgesia. The experience of drives is therefore limited to the physical and the personal, it cannot be shared between people. One person in pain cannot make another person feel their pain.

> are differentiated not in relation to the kinds of affects they may evoke or generate but far more simply by the presence or absence of some reified substance called Affect (Sedgwick and Frank 1995: 514).

Whereas Tomkins very specifically differentiated between his nine classes of affects, and then again between positive and negative affects, these differences seem to have disappeared in many later theoretical approaches to affect. Sedgwick and Frank claim that this, in fact, is unavoidable in affect theory: "insofar as they are 'theorized', affects *must* turn into Affect" (1995: 515). Seeing affects as inherently different from each other would lead to essentialism, which is a problematic occurrence when speaking of affects which are analog and fluid rather than digital or binary. This is what happens for instance in the work of Deleuze and Guattari, which I will discuss now. Affect in their works is nearly always referred to as a singular phenomenon that seems to be produced in the same circumstances regardless of its nature.

1.2 Deleuzian Affect and Spinoza's Philosophy

Gilles Deleuze, even before he started collaborating with Felix Guattari, took affect theory in a direction that at first sight seems to be entirely different from Tomkins's, embedding it in a more social discourse. He based his theory on the philosophical writings of Spinoza, rather than on Tomkins's psychological approach. Deleuze, too, emphatically claimed that affects are not the same thing as feelings, but for a different reason. Where Tomkins presented affects as inherently personal and physical even when they are caused by social interaction, Deleuze sees them rather as something outside and between individuals: Daniel W. Smith describes his interpretation of affects as "becomings that go beyond those live through them [*sic*] (they become other)" (1998: xxx). He claims that the fluid interaction that is central to affects is a necessary consequence of living in the modern world, in which individuals can no longer be seen as 'monads' or singular units; instead, individuals have become "multiplicities", open to all sorts of singular influences that together constitute the subject. Through this process of openness and influence, the individual loses hold of its identity "as a self" (Smith 1998: xxix). In this approach, affects are the entities that connect and fuse these singularities.

Deleuze based his affect theory on the notions of *affectio* and *affectus* that Spinoza coins in his *Ethica*. From the beginning, therefore, Deleuze used two very similar terms to refer to two different approaches to social interaction: he translated *affectio* as 'affection' and *affectus* as 'affect' (Deleuze 1978: 1). He laments that many translators did not distinguish between the two terms, since to him they signify two entirely different concepts. Affects, he claims, are enveloped by affections: "within the affection there is the affect" (Deleuze 1981: 17). This does not mean that the affect is dependent on the affection; the affect is considered to be the passage from one state to another, and these states are considered to be the affections (1981: 18). In a move that is similar to Tomkins's disavowal of the similarities between feelings and affects, Deleuze disagrees with the translation of *affectus* as 'feeling' (*sentiment*), claiming that French has a much better alternative in the word 'affect', even though "on the one hand this doesn't say much, in French, the difference between affection and feeling" (Deleuze 1981: 17). One noteworthy difference between the two approaches is their consideration of positive and negative affects. The way *affectus* functions is also directly related to the

way in which positive affects function according to Tomkins: "affectus is variation […] continuous variation of the force of existing" (Deleuze 1978: 3). In Tomkins's theory, positive affects in particular only come into being through variation and novelty. Many negative affects, however, do not have to be induced by change, and can even be effected through a lack of variation: anger, for instance, can come forth from frustration at an unchanging situation. I would add boredom to Tomkins's list of negative affects because the *Horrible Science* books employ so many different rhetorical tricks to avoid this particular affect, something I will discuss further in Chapter 2. Boredom is an affect that is incurred by the prospect of having an unchanged situation for a prolonged stretch of time. Deleuze's affect theory therefore seems to relate mostly to Tomkins's approach to positive affects.

Regarding Deleuze's translational demands, a curious confusion here comes into being when looking directly at Spinoza's texts. I have used two Dutch translations, in which the terms 'affectio' and 'affectus' are indeed translated differently, as Deleuze prefers it, but with other confusing consequences. In the first, the 1915 translation by Nico van Suchtelen, 'affectio' is translated as 'inwerking' and 'affectus' as 'aandoening' (Spinoza 1915: 129). In the 2008 translation by Henri Krop and Wiep van Bunge, however, 'affectio' is translated as 'aandoening' and 'affectus' as 'hartstocht' (Spinoza 2008: 165). This despite the fact that 'affect' is a valid term in Dutch, too, where it means "emotion or feeling related to a specific state or event" and is derived from the Latin 'affectus' (Van Dale).[7] 'Aandoening' seems to be the more fitting translation for 'affectus', as it is a term that implies passivity and being overcome by something: literally, something is 'done to' the subject, in a manner that is reminiscent of the way affects cannot be summoned or rejected at will. In the section discussing Tomkins's affect, it has become clear that a person certainly is overcome by affect, and that it is not possible to make oneself experience or stop experiencing a specific affect at any given moment. For the 2008 translators to have settled on the term 'hartstocht' I find very strange indeed, as it is a synonym for 'passion' and is therefore usually associated with drives rather than emotions or affects. Further confusion ensues when one looks at the translation of Spinoza's *Appendix continens Cogitata metaphysica* (c. 1660), in the same 2008 volume, as in its third chapter the Dutch term 'affect' does make its way into the work – as a translation of the word 'affectio' (Spinoza 2008: 76). Frustratingly, this is in spite of the fact that Spinoza means exactly the same thing in the two works, since he uses the Ethica to further develop his theory first coined in the *Metaphysica*: the translators use two different translations for 'affectio', depending on which work the word appears in.

In the context of the *Metaphysica*, Spinoza's interpretation of *affectio* is far removed from the way we think of affects today. *Affectio*, according to Spinoza, is that which is called an 'attribute' by Descartes: a way of conceiving the essence of a substance. A substance can have several attributes, all of which are radically different from each other and have no overlap. In fact, attributes are what distinguish different things from each other (Spinoza 2008: 107). This approach to affects is one that is not taken up in Deleuze's theory of affect as part of a social exchange that changes all those involved, nor is it taken up in the approach from psychology in which affects are shared and conta-

[7] "(psychologie) emotie of gevoel mbt. een specifieke toestand of gebeurtenis" (Van Dale)

gious states that can be exchanged between people or from objects to people and vice versa.

Deleuze, for instance, points out that affects are shaped by ideas, according to Spinoza, and affects and ideas are irreducible to one another. Affections, *affectio*, on the other hand, are one out of three types of ideas; the other types being notions and essence ideas (Deleuze 1978: 4). Affects and affections are thus essentially different notions, that interact with each other and shape each other, but that are not reducible to one another. This notion undergoes an extensive development throughout the *Ethics*, however: Deleuze describes how *affectio* at first referred to "a state of a body insofar as it is subject to the action of another body" (Deleuze 1978: 4). This is a one-way principle: one body affects another, but is not affected itself through this interaction. In this manner, *affectio* resembles Tomkins's notion of an object being able to affect a person. It is a function that applies much more to inanimate objects evoking affects than to two human beings affecting each other, as social interaction always influences both participants.

Based on Spinoza's *Ethics*, Part II and III in particular, Deleuze creates a distinction between the terms 'affect'/*affectus* and 'idea'. Affect, he claims, "doesn't represent anything" (Deleuze 1978: 1): ideas represent, and affects need ideas in order to come into being – since affects are non-representative, they cannot exist separately in themselves. Deleuze gives love as an example: it is not possible to love if one does not have an idea of what exactly is being loved (1978:1). Surprisingly, in order to substantiate this claim, he now does equate affect with feelings: "Take at random what anybody would call affect or feeling, a hope for example, a pain, a love, this is not representational" (1978: 1). This phrase can suggest two things: either that the average person will not have a word for what Deleuze terms 'affects' and will therefore call them 'feelings', or that he here equates the two terms himself. The latter becomes problematic when comparing this text to *What Is Philosophy?* in which Guattari and he claim that an affect is an entity that is inherently different from "perceptions or feelings" (Deleuze and Guattari 1994: 24). Again, the question is left open whether feelings are the same as emotions here, but a strong claim can be made in favour of this generalisation. Deleuze and Guattari's affects indeed do seem to be different from emotions, in their sociality. Though emotions can be communicated between people, they originate in a single person and can be experienced in solitude, whereas affects in this context must exist between at least two people.

Perhaps surprisingly, in *What Is Philosophy?* Deleuze and Guattari assert that affects (and percepts) are extracted by art – and explicitly not by science, which extracts functions and prospects, or by philosophy, which extracts concepts (Deleuze and Guattari 1994: 24). One aspect that surfaces in all three disciplines is that of creation. Creation is in all cases preceded and facilitated by experiment (1994: 127). When one looks at the *intentions* of these three disciplines, it is easy to see where these claims come from: art is made to evoke affects, whereas science holds up the explicit claim that affects or emotions are not part of scientific research. Though both disciplines attempt to reach their goals through experimentation – in laboratories in the sciences, in discarded drafts in the arts – these goals are intrinsically different. This makes popular science writing, in its intention of evoking affect in the reader, part of the arts, and not of the sciences. The didactic intention of the books is achieved through this connection with positive affects. The goals of science have been reached

before the popularisation is made. Popularisation is art with scientific functions and prospects as its topic.

Art and philosophy are more mutually compatible than art and science, it seems: Deleuze and Guattari write that art and philosophy can concern each other's fields, with concepts and affects flowing into each other. However, he explicitly notes that even here, in spite of their continuous communication, there is an essential separation between art and philosophy in terms of what they intend to extract (Deleuze and Guattari 1994: 66). Philosophy must bring original concepts, else it will be dismissed as lacking "importance or interest" (1994: 82-83); art must evoke affects, and in order to do so, it must necessarily be original. A didactic intention does not have to be present in art, but here, too, evocation of affects through its essential originality will aid its function. Similarly, science and philosophy are essentially different in terms of the functions and concepts that they respectively mean to extract. Whereas variations in concepts are inseparable, functions are based on independent variables (1994: 126). This means that science and philosophy are inherently different in nature (1994: 127).

Deleuze and Guattari present another similarity between science and philosophy that is hard to apply to art, and especially to popular science writing.

> On both sides, philosophy and science (like art itself with its third side) include an *I do not know* that has become positive and creative, the condition of creation itself, and that consists in determining *by* what one does not know (Deleuze and Guattari 1994: 128, italics in original).

Not knowing is of course central in science: curiosity is the driving force behind the discipline. But if popular science writing is an art, as I established previously, could one maintain the same assertion? Though Deleuze and Guattari here mention art itself as also including an *I do not know*, the context here seems to be different. Art seems to be driven by a desire to communicate, rather than or alongside with curiosity. In science and philosophy, the subject really does not know, and this is what drives them to *do* science and philosophy. Subsequently, the information found is communicated, but this communication is secondary to the investigation. In popular science writing, however, something that is already known is communicated in a different way, in order to appeal to a wider audience: this is what makes it art. It is the connection between art's ability to evoke affects and the didactic intention of the creator that is most important here. The author writes with the explicit intention to inform the reader, to evoke curiosity in others through presenting something that is new to *them*.

Writing slightly more recently than Deleuze and Guattari, Brian Massumi too bases his affect theory on Spinoza: "a body's capacity to enter into relations of movement and rest" is its power to affect or be affected (Massumi 2002: 15). Affect, according to Massumi, is relational, and goes beyond emotion. Indeed, he writes that emotions do not belong to the field of affect. He even differentiates between affect and interest, the latter of which Tomkins defined as one of the most important affects (Massumi 2002: 208). I disagree with Massumi here, and in the second chapter, I will elaborate further on why interest and lack of interest may be the two most important affects that the authors of the *Horrible Science* series have to work with. However, the way he distinguishes emotion from

affect is important here. Massumi describes emotion as "contextual" and affect as "situational" or even "trans-situational": affect goes beyond the context and is therefore more enduring and continuous than emotion (2002: 217). Affect is what connects events together, whereas emotion is specific to the event. Affect can thus create order, by holding contexts together even as unpredictable new elements can enter into individual ones (2002: 220). This does not mean that the experience of an affect itself has to last long. It means that one will be able to remember their affective experience, and will even be able to experience it again by recalling the event in which it was experienced. Contrarily, it is not possible to precisely re-experience, for instance, a panic attack. Lauren Berlant adds to this that emotions are in fact manifestations of affect, and one affective response can be manifested as many different emotions: the emotions can vary while the overarching affective structure remains the same (2011: 81). Emotions are, therefore, even more prone to change than affects.

It is possible to distinguish the affective and the emotional by looking at a series of books, such as *Horrible Science* in this case. Whereas each book individually will bring in new elements and new knowledge, individual facts to be horrified about or interested in, the entire series will be held together affectively in the mind of the reader. One book may be liked less than another – I liked *Really Rotten Experiments* less than *Chemical Chaos*, for instance – but the books are connected as a series by the affect that holds them together: a sense of excitement, enthusiasm and fascination. The presence of affect opens one up to an intrusion of newness, claims Massumi, which seems to imply that affect is always positive. If this is so, then again the affects surrounding *Horrible Science* can be used to prove his point: first of all, as all *Horrible Science* books are connected because they evoke the same affects, the introduction of a new title in the series will be eagerly anticipated, even though the reader will not know its exact contents yet. The development of the series seems to corroborate this claim indeed, as the series has been growing steadily for nearly twenty years now (1996-present). Secondly, if the series is successful in its aim of interesting children in science, then reading the books should also develop an affective network that connects these books to a broader field of science. If the affect has become strong enough, then the introduction of new information, such as books outside the *Horrible Science* series, should be able to be integrated. These books could then inspire children to learn more about science at later ages, even up to the point where these readers become scientists themselves, as Arnold, in an interview, claims his books have done: "He is 'particular pleased' when he receives an email from a scientist saying if it hadn't been for his books they wouldn't be in science now" (grapevineonline).

This analysis makes clear the differences between emotion, affect and affection. From antiquity onwards, affect has been imagined as a physical state that is related, but not identical, to emotion. Affects precede emotions, and they are much more closely associated with a relationship with an object or other person. This idea has been appropriated differently in psychology and in philosophy, but in a closer analysis it becomes clear that the phenomenon of 'affectio,' as it used to be called in antiquity, is still present in both modern affect theories. The notion of 'affection' to denote a social network of affective influence has been added to this theory later on, by Spinoza. Though only the philosophical track of affect theory uses the term 'affection,' this idea too can be found in Tomkins's psychological approach, as he admits the importance of a social factor in the evocation

of affects. In fact, affections are the most important of the three when one is attempting to influence rhetorically, as these imply and influence a larger social network, and the largest reading public is drawn by influencing as large a group as possible. However, affects seem to be most easily evoked through interaction with an object, so a successful book will likely cover both approaches. In the third chapter, I will look into the extent to which this affective network can be globally similar in the case of *Horrible Science* and its translations, since science claims it is part of a worldwide community that works outside the national sphere. Having made this distinction now makes if possible for me to investigate to what extent these two notions are applicable to my case study, Nick Arnold's *Horrible Science* series. In the following chapter, I will focus on a specific subdivision I have already mentioned with reference to Tomkins: that between positive and negative affects, and the way in which this applies to the system of affects and affections that I have established here.

Chapter 2: Positive and negative affects

In many of the most prominent affect theories, positive affects are treated quite differently from negative ones. Silvan Tomkins, for instance, devoted two works entirely to negative affects (1963, 1991) and one to positive ones (1962). In this chapter, I will therefore look at the differences between the production of positive and negative affective responses in the *Horrible Science* series. For both Deleuze and Tomkins, the distinction between these two kinds of affects is a crucial component of their respective affect theories. However, the *Horrible Science* books problematise these approaches. Arnold and De Saulles prove that there is no clear demarcation between positive and negative affects, as their effects change in different contexts. Also, what can be considered an evocation of negative affect may in fact be a deliberate move to effect a positive response. Tomkins in fact already hints at this possibility when he notes that it is not possible, and in fact not healthy at all, to live one's life in the sole pursuit of positive affects. With regard to negative affects, there seems to be a huge variety even among this half of the alleged dichotomy. An author can actively employ the evocation of some negative affects as a rhetorical strategy, but other negative affects should be avoided at all costs, since these will more likely estrange the reader.

The *Horrible Science* books make much use of rhetorical strategies that are intended to disgust or scare the young audience, but which in fact evoke positive affects in these children. As Alice Bell pointed out, such strategies are used to distinguish these books from the standard school curriculum, presenting a 'version' of science that is more interesting than the supposedly cleaned and censored books that students must read in schools (Bell 2008, 2011b). One affect that Tomkins does not mention but which I consider to be negative, boredom, is much more stringently avoided. Boredom is actively demonised in these books as an awful affect that is associated with regular classroom teaching. Other negative affects are evoked that contrast with boredom, implying that being grossed out or scared is much better than being bored. I will therefore here look at how far the *Horrible Science* books (can) go in evoking negative affects, and whether any theorisations of affect offer insights as to why this approach to negative affects is successful. One important issue that arises here is the way in which an association with negative affects can influence the status of science and scientists: is the evocation of fear or disgust irreverent toward science? Do scientists and non-scientists make equal use of it? Does it threaten the status of science as objective?

The approach to affect theory I am particularly interested in with regards to my choice of case study is the final one from the list of eight that Gregg and Seigworth present: an approach in which "affect is the hinge where mutable matter and wonder (oftentimes densely intermingled with world-weary dread too) perpetually tumble into each other" (2010: 8). This approach can be equated with Tomkins's affect of interest. This positive affect, and boredom, its negative counterpart, are the most directly influential affects that an author will need to address. In this chapter, I will attempt to categorise this particular approach: does it really concern affect, or is it a form of affection? If so, what are the consequences of using this approach for an analysis of the *Horrible Science* books? Affection, through its social implications, is a more effective approach to evoke interest, as it aims at a larger audience at once, and at that audience's preferences. However, if a larger group at once is approached, cultural differences may prove to be an obstruction.

Taking these three issues together, in this chapter I will attempt to answer the following questions: how can popular science writing make effective use of both positive and negative af-

fects, and to what extent may these be affections rather than affects? And if a negative affect is employed to increase the affective bond with the reader, is it still considered a negative affect?

2.1 Deleuze on sadness and joy

The previous chapter introduced Tomkins's dichotomy of positive and negative affects, with surprise and startle somewhere in between as 'resetting' affects. These two groupings seem quite different from Deleuze's approach to Spinoza's *affectus*. However, Deleuze's approach is actually an extreme reduction of Tomkins's two sets: according to Deleuze, there are "two fundamental affects: sadness and joy" (1978: 7). All positive affective interactions will eventually lead to joy, and all negative ones to sadness. This is inherently related to power: if one's power, one's ability to act, is increased, joy will ensue, and one will become sad if one's power is decreased. Deleuze therefore claims that affect is less related to emotion, and more to agency. The success of the experiments in the *Horrible Science* books prove his point. First of all, every regular book from the series contains multiple experiments under the header "Dare you discover…".[8] Secondly, these have become such an important part of the series that several 'activity books' have been published that focus exclusively on experiments, such as *Really Rotten Experiments, Explosive Experiments, Famously Foul Experiments* and *Freaky Food Experiments*. The experiments ostensibly put the reader in a place of power, allowing them to control the is physical surroundings, and even claim to their parents that what they are doing is important and has educational value, even when this is not really the case. Deleuze adds to this the idea that the extent to which one can *be* affected is equally important: this is what separates different animals from each other, including humans from other animals, and different cultures from each other. The implications of this statement for translating affects, interculturally as well as inter-lingually, will be explored further in the next chapter. Meanwhile, this further reinforces the notion that Deleuze's affects are different from emotions, since rationality must be closely tied up with affect. "Inevitably reason is an ensemble of affects, for the simple reason that it is precisely the forms under which power is exercised," he claims (Deleuze 1981: 13-14). Rationality implies power, and rationality is the polar opposite of emotion. If Tomkins's affects are motivated by the drives, then Deleuze's system, which it would be easier to name 'affections' after the Spinozan term, implies a moving away from or overruling the drives.

Lauren Berlant, in *Cruel Optimism*, gives a definition of affect that is quite similar to Deleuze's, but less problematic in the aforementioned culturally differentiating sense. She defines the affective structure of optimism as involving "a sustaining inclination to return to the scene of fantasy that enables you to expect that *this* time, nearness to *this* thing will help you or a world to become different in just the right way" (Berlant 2011: 2). Optimism, then, is expecting positive affect: by returning to a certain scene, the subject expects to obtain agency, the ability to act and change the world. As Deleuze describes, this form of agency is inherent to positive affect. This is what can hold together a series: a reader will return to it again and again as a new part is published, expect-

[8] Very unusually, *Evil Inventions* only contains one "Dare you discover…" experiment, on communicating in Morse code (89). The book does contain multiple warnings *against* repeating certain experiments, however, as most of the inventions mentioned in the book have killed people. This ties in more with a positive use of the fear affect.

ing the same, or perhaps even a better, positive experience. It is what allows the *Horrible Science* series to release spinoffs that may be unrelated in format, but all promise the same 'horrible' enjoyment, such as sticker books, magazines, and even a stage play.

Deleuze adds to this, in a line of reasoning that resembles Tomkins's, that it is possible to be sad and joyous at the same time. He refers to Spinoza, who gives being tickled as an example: it is "a local joy; this does not mean that everything is joy in the tickling, it can be a joy of a nature that implies a coexistant [*sic*] irritation of another nature, an irritation which is sadness: my power of being affected tends to be exceeded" (Deleuze 1978: 8). Some joys are inherently connected to sadnesses, which makes it more difficult to pinpoint an exact split between positive and negative affect. Positive affect can be evoked through the employment of something negative, and this is what all of the *Horrible Science* books hinge their renown on.

2.2 Quite Interesting

Interest is the one affect that Tomkins lists that is particularly compelling in the context of popular science writing. This affect, more than all others, explains the difference between affects and emotions: if affects, according to Tomkins, are people's prime motivators, then surely interest must indeed be an affect. It is what motivates scientific research, discovery and learning in general. Richard Dawkins, for instance, names "an appetite for wonder" as his main impetus into the world of science, endowing his autobiography with this phrase as its title (Dawkins 2013). It is also a useful affect to regard when connecting Tomkins's affect theory to that of Deleuze and Guattari: the social dynamics of interest are extremely important, as it is through interest that people communicate and connect with each other, in person or otherwise. Interest, then, is one of the most important affects in the context of popular science writing, especially that for children. Works of popular science are meant to educate, but it is necessary to invoke interest for a writer to be able to do so. As Glenn Murphy writes in an article in the children's book section of *Nature*: "Without [interest], most attempts at imparting information – whether formal or informal – will either fail or be actively counterproductive. […] The wrong books will put [children] off science completely. The right ones can inspire them for life" (Murphy 2007: 952). The issue of interest leaves one question open, however: if interest is a positive affect according to Tomkins, then why does he not mention boredom, its exact opposite, as a negative affect?

The ultimate positive affect that popular science writing often strives for, is a sense of what is variously called 'wonder,' 'awe' or 'awesome' – the superlative of the interest affect. Science journalist John Pavlus even goes so far as to call it the "first principle" of science writing. "We […] work within a Maslow's Hierarchy-esque triangle, and I think of awesome being up at the apex" (Pavlus 2010). In this hierarchy, mere 'interest' is actually at the very bottom. An audience is only beginning to be drawn in at the next level, 'awful/delightful'. It is at what Pavlus distinguishes as the third level, 'engrossing', that things become actually relevant to an investigation of affect. This is where physical action is first enticed and readers become motivated: "the material somehow makes us feel something AND engages the mind at the same time. [It will] ACTIVATE us to think, question, react, recoil, seek more, get lost, remember … DO. Not just consume and excrete" (Pavlus

2010). The final level, 'awesome', works on a mental as well as physical level, and notably, it will work on the subject for an extended period of time, leading to inspiration.

One striking occurrence in the *Horrible Science* series is the way in which it evokes positive affects at the cost of others. The *Horrible Science* books employ negative affect in various ways. First of all, they seem to ridicule science: scientists are almost invariably described as "boffins" (*The Stunning Science of Everything* 11; *Wasted World* 103) or "bods" (*Suffering Scientists* 8), and in the most recent publication, "geeks" (*Annual 2014* 57). Biographical anecdotes always include an odd or repulsive personal trait of the scientist. Still, this will not produce any permanent negative affect toward science or scientists in the child, argues Alice Bell. Scientists in the series are described as odd and different, but they are also successful. "They are not normal, which makes them funny, but it also gives them power" (Bell 2008: 86). The books therefore appeal to a sense of unconventionality in the child, a desire to be different, and show that being different can lead to great successes. At the same time, children are led to identify with the image of the scientist as successful, especially through the quizzes and experiments. The books also carry out a child versus school opposition that is much stronger than the child versus science one. By showing that science is not at all similar to school, a place of boredom, the child will be inclined favourably toward science. This is done both in the context of school and science as an institution, and in the case of individual teachers and scientists. Though the historical portrayals of individual scientists portray them as 'boffins', the examples in which modern scientists are at work portray them as people in impressive white lab coats, regardless of what they are doing. On the other hand, teachers, as Bell points out, "wear heavily patterned jackets and ties, or other 'bad' fashion choices (women teachers often wear too much make up and large jewellery)" (Bell 2008: 87). Teachers, then, are portrayed as all-round ridiculous, whereas a much more complicated picture of scientists is drawn, which is therefore more interesting.

By evoking a sense of awe about a scientific or technological achievement, the author will make the reader realise what humankind is capable of. More importantly, the reader will feel part of the human network that can make all this possible, "because [the scientists and inventors] are other humans, even if we might also feel that these people are a bit cleverer than us" (Bell 2011). The *Horrible Science* books emphasise this affect by connecting the history of each book's topic to specific people, and by mentioning dozens of names of scientists and inventors, even if their results are only mentioned in passing. Every development can thus be traced back to an individual – but surprisingly rarely to a group of individuals. For instance, in the paragraph on proving Einstein's special theory of relativity in *Suffering Scientists*, no details are given on the many collaborations that were needed to come up with this proof. It merely states that "scientists already have the proof" (*Suffering Scientists* 205). Group work is often dismissed in these books, in favour of attention to individual achievements. An author will have to make a choice concerning in which direction the child should be motivated. By naming individuals, the reader is made aware of their own ability to perhaps one day be such a successful individual, too, yet it could also have the negative effect of showing the reader that only the most brilliant individuals can be successful scientists, making the reader feel inferior. On the other hand, by emphasising the group collaboration, the reader is aware of the way science works in a social context, and the way in which it is possible for

the reader to become a part of it; yet such an approach would also emphasise the sheer size of science projects these days, its hierarchies, and its controversies.

2.3 Boredom

So if interest is of the utmost importance in science itself and the way science is communicated to the general public, then the absence of interest must be a central problem that these authors should avoid. Is the absence of interest a negative affect in itself? I think so, and we call it boredom. No such notion appears in Tomkins's works, however, as I briefly mentioned in the previous chapter. Boredom to me seems to be the direct opposite of interest, but this apparently is not enough for Tomkins to classify it as a negative affect, while he claims interest is a positive one. His theory seems to exclude it quite specifically. Take this instance where he elaborates on his positive/negative differentiation through the notion of stimulation: "There are both positive and negative affects (interest, fear, startle) activated by stimulation increase, but […] only negative affects are activated by a continuing unrelieved level of stimulation (distress, anger) and only positive affects are activated by stimulation decrease (laughter, joy)" (Tomkins 1962: 252). This difference can be measured physiologically: "It might also be argued that cardiac deceleration accompanies neutral or positive affect and cardiac acceleration negative affect" (1962: 100). Boredom seems to be the ultimate stimulation decrease, but it does not fit unto this system, unless one were so bold as to claim that this is a positive affect. In fact, Tomkins mentions boredom in a list of goals that affects lead one to strive for and against:

> The human being is equipped with innate affective responses which bias him to want to remain alive and to resist death, to want sexual experiences, to want to experience novelty and to resist boredom, to want to communicate, to be close to and in contact with others of his species and to resist the experience of head and face lowered in shame (1962: 27).

A person cannot help experiencing an affect, and one must therefore adapt one's own circumstances in order to prevent experiencing negative affect or induce positive affect. The 'want' that Tomkins refers to usually happens before the experiencing of an affect, as a person is entirely passive and helpless in the actual encounter. Tomkins's formulation is therefore perhaps too ambiguous: a person is biased to want certain things through having experienced certain affects that cannot be recalled or repelled at will. A person will therefore adapt their circumstances toward what is likely the most optimal way of experiencing affect, which is found in such things as sexual experiences and novelty.

Boredom seems to be classified as a drive here, rather than an affect, as Tomkins in the quotation above places it on a par with sexual experiences. This classification cannot be explained through using the definitions of drives and affects as mentioned above: there is no single way to resolve boredom effectively, in the way that eating will resolve hunger and drinking will resolve thirst. Boredom can be a motivational factor like the affects Tomkins does mention: some people will start snacking because they are bored, others will try and find increasingly excessive stimulants to combat their ennui. Boredom, in fact, can be experienced as an affect so negative it can equal anguish: in Terry Pratchett's ~~*Faust*~~*Eric*, Hell is portrayed as a place so boring that even Tantalus wishes he had his eternal punishment back (Pratchett 1990: 134). Absolute boredom is the ultimate hell. In an

affect theory that will apply to writings for children, boredom is certainly an affect to take into account. It is entirely up to the author to prevent this affect from overcoming the child: just as one cannot choose to be bored, one also cannot choose *not* to experience it. It would be extremely difficult for the child to make the book more interesting than the authors have made it, except perhaps through trying out the various experiments that the authors try to dissuade the child from with a "Horrible Health Warning".

One may argue, of course, that boredom is not an affect, but a *lack of* affect – a lack of interest, to be precise. I do not think this is the case, however. There is a difference between a lack of affect and boredom: feeling 'neutral' does not imply negativity. Not experiencing affect for a long time can indeed be painful because an absence is felt, but there is a difference in the manner of perception. Boredom implies a lack of action, rather than a lack of affect. It is closely connected to Deleuze's definition of negative affect as being caused by a lack of power: the individual does not seem to have the power to act in a meaningful way.[9]

Sedgwick and Frank emphasise that Tomkins places 'shame,' rather than 'boredom', on one end of the polarity of which 'interest' is the other end (1995: 500). This, to them, makes shame a very important affect: they refer to Francis Broucek, who has called it "the keystone affect" (qtd. in Sedgwick and Frank 1995: 502). The opposition they make between shame and interest is not entirely valid, however: Tomkins describes shame as being activated by "the incomplete reduction of interest–excitement or enjoyment–joy, rather than by the […] complete reduction of interest or joy" (Tomkins 1963: 186). Since shame is invoked by an incomplete reduction of an affect, it cannot be its exact opposite. Instead, I believe that boredom is the opposite end of interest. Shame can indeed prevent interest to a large extent, as a person would not want to be recognised as being interested in the shameful object. The difference between shame and boredom is that shame is a social inhibitor, whereas boredom is a personal one. One may be ashamed to interact with an object because the consequences of being seen with it will be bad: for instance, it would be shameful to be seen watching or reading pornography. Shame, then, will only work as an inhibitor in social settings: a person will gladly indulge in 'guilty pleasures' when alone. Boredom, on the other hand, will not work very differently in a social context than in a solitary one. This does not mean that boredom cannot be experienced in a social context: as the *Horrible Science* books claim all too often, classroom education can bore a group of students collectively. However, in many cases the subject will find a certain object boring even when alone. The difference between collective and individual boredom, in fact, can be related to shame. It is possible for someone to be shamed into thinking that a book should not be read because it is boring, so that the individual will not read the book where the group will be able to find out about it, but this person may very well secretly pick up the book in the safety of their bedroom. Though the two affects may not be diametrically opposed, shame and interest are certainly related to each other, and shame may be overcome if enough interest (curiosity) is experienced. Conversely, a lack of interest implies a lack of shame: if society does not find an action or an object interesting, then a person will not feel ashamed in performing the action or interacting with the object. This particular effect is inextricably bound to its

[9] Of course, this power to act is relative. A parent can mention ten things to do to a child who is bored because there is noting on TV; a group of people can be bored even though they are together and therefore have the possibility to interact with each other.

social setting: an individual may not be interested in something and not feel bad about it, but society can then shame them for not being interested – as the teacher will do when the pupil is staring blankly out the window.

Regardless of their specific relation, both shame and boredom are indeed affects that should be avoided at any cost when trying to invoke interest. These two negative affects are more detrimental to interest than the other ones: disgust and fear can evoke a morbid fascination, provided that the object or topic does not come too close. I would argue that boredom is a more 'toxic' negative affect, to borrow Tomkins's terminology, since it is possible to experience shame from an object that is not strong enough to renounce the object entirely: Tomkins calls this the "I want, but–" condition (1963: 185). This notion returns in Kristeva's discussion of the ambiguity of the abject, which I will discuss in the next section. It can be easily seen that the authors of popular science writing do their very best to prevent and avoid the evocation of shame and boredom.

Avoiding boredom is the most obvious strategy of the two in *Horrible Science*. Many tactics have been employed to ensure that the individual young reader does not abandon the book for a more interesting object. As Tomkins wrote, too much familiarity can inhibit interest, since interest is sparked by novelty. Though Tomkins made these claims from the perspective of familiarity in a romantic relationship, this can be extrapolated to any object that becomes boring through an excess of familiarity. The *Horrible Science* books attempt to combat this boredom through presenting enormous variation within a book, even within a single page, as Nick Arnold himself explains: "by presenting the material through a range of constantly varying approaches we ensure that the child's imagination is constantly engaged" (Arnold 2007: 1). Not only do text blocks and cartoons follow each other in rapid succession, they are also interspersed with text that is formatted to look like newspaper articles, random facts written on a 'torn-out note', anecdotes, quizzes, and experiments. (Fig. 2.1.)

Arnold and De Saulles also avoid boredom through encouraging children to act upon the things they read in the book. The quizzes do this at the simplest level: children have to physically interact with the book in diverse ways, they are allowed to write in it, and have to turn the book upside down in order to read the correct answers.[10] At the same time, having to turn the book upside down provides a barrier for the child against looking up the answer before thinking of it themselves. Of course, as becomes clear in *Wasted World,* which ends with a long all-encompassing quiz, these quizzes are only substitutes for the standard classroom quiz.

Alice Bell remarks that there are too few options for physical interaction with the books, since they "provide little or no space for the child to make a mark on them (even to the extent of lacking a 'this book belongs to' frontispiece)" (2008: 88). However, the *Annuals* do provide such a frontispiece (e.g. *Annual 2014*), and this is not the only time when a child is invited to mark the *Annual*: open boxes are provided for the reader's answers to the quizzes (*Annual 2014* 39). Another great example of physical interaction with the book comes from *Frightening Light*. The chapter "Crucial Colours" opens with the following "Note to the reader": "We apologize for the loss of

[10] In what I consider to be a rather unfortunate development, the 2014 reprint of the series no longer presents the answers upside down. Instead, the answers are provided in a separate box, marked "Answer" (e.g. *Fatal Forces* [2014]: 72). This takes away a large part of the physical interaction with the books, and removes an incentive for the child to think for themselves.

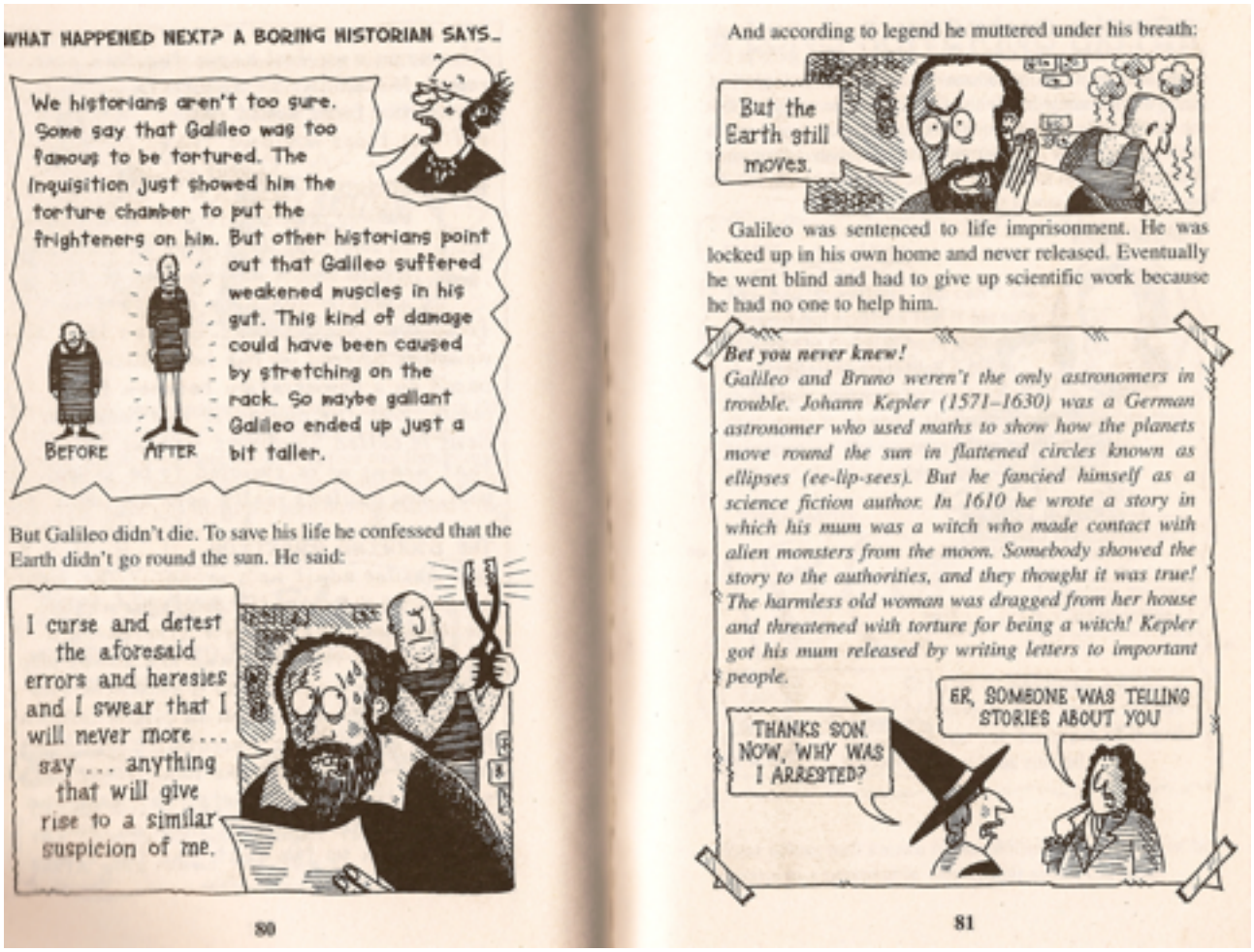

Fig. 2.1. Avoiding boredom through a variation of styles in presenting the material: two pages from Nick Arnold's *Suffering Scientists* (80-81).

colour. Readers will have to imagine the wonderful glowing, vibrant colours described in these pages. And if you do get bored you can always colour them in. **PS** If it's not your book go and buy your own before you pick up your crayons" (124). Such physical interaction with the book has its limits, though: *Killer Energy* warns the reader: "DON'T cut out the shape from your *Horrible Science* book, *especially* if it comes from the library!" (26). Readers should instead trace the outline of the shape (for a paper toy).

The experiments take the encouragement to act much further: the book becomes a mere tool, a recipe book, instigating games and – usually not-so-dangerous – exciting experiments that will keep a child occupied and interested for a much longer period of time than the mere reading of the book would allow for. These experiments most visibly employ affect to engage with the child. Experiments are embodied, drawing in many more senses than the visual alone. The experiments are meant to convey what the book in its text and cartoons cannot. The experiment in which the reader builds a stomach makes the child *feel* how digestion works and *hear* a burp they have produced in a self-made stomach. (*Really Rotten Experiments* 14). Another experiment makes the child experience that *taste* disappears when one cannot *smell (*ibid. 24-25). And a third one makes the child and a peer together *feel* what it is like to be a gluon (*Suffering Scientists* 218). But even when the purpose

of the experiment is to *show* something, the experiment adds an affective dimension that would be absent in the book. When the reader gets to roll a rubber ball off a table to test Galileo's theories on falling bodies, the interaction with the materials adds a tactile dimension (*Suffering Scientists* 75-76).

There are clear limits, however, as to which affects can be evoked by these experiments, due to the limitations in their setup. Whereas the experiments help to avoid boredom, they will not enable the child to positively identify with the role of the scientist. The experiments are purely physical manifestations of a learning process that is planned in advance, instead of being aimed at the true discovery that is such an essential part of science. Alice Bell points out that "the books provide not so much interaction as pre-scripted 'audience participation" (Bell 2008: 93), claiming that the experiments are in fact "largely closed demonstrations" (91).

It is always possible for the reader to learn what is to be learned from the experiment even without performing it, which goes directly against the definition of experimentation. At the end of the experiment, a question concerning the outcome is asked, often with multiple choice answer options. Only one answer is correct. There is no option for the reader to come up with aberrant results, even though this is the most common occurrence in scientific experimentation: deviating results are explained in only a few instances, and in these cases the reader is simply explained what to do in order to get the correct result (*Fatal Forces* [2014]: 194). The reader is thus put below the scientist in terms of knowledge and the ability to participate: the reader's participation is limited to the repetition of knowledge that has been previously determined by the authorial team. The purpose of the experiments, then, is solely to produce positive affect that will strengthen the connection between the child and the books, and not between the child and science per se. One notable exception can be found in *Fatal Forces*, in which the child is taught how to juggle, which is certainly a trial-and-error process ([2014]: 160-162). Though this is not a scientific experiment in the strictest sense, it does provide an opportunity for the child to discover something, as no answers can be provided by the book. Connections to the previously learned information are provided throughout the instructions. It is up to the reader to find out how juggling feels, how to hold and throw the balls, and how difficult it can be.

It is harder to point out where Arnold tries to avoid the evocation of shame, but it is certainly present in his books. One way to prevent shame is to make sure that the book will be considered acceptable reading material by peers, parents, and teachers alike: three categories of people who are able to shame the child into abandoning the book. At first glance, the book is expressly aimed at presenting an image of itself that makes it acceptable for circulation among peers. The contents are presented to children in such a way that parents and especially teachers are set off as strange, ignorant, intrusive others against the young readers: *Really Rotten Experiments* begins with the disclaimer that "it's NOT about causing cruelty to dumb animals, little brothers, or family pets. There is some cruelty to teachers, but only in the interests of science and education (and having a good laugh)" (*Really Rotten Experiments* 10). *Fatal Forces* refers to the reader's parents as "feeble-minded folks" and "gullible folks" ([2014]: 113, 160). Furthermore, the many experiments and quizzes invite collaboration between peers, introducing the book as a social object within a limited group from which adults are excluded. This does not mean, however, that parents and teachers would

shame their children into abandoning the book because it portrays adults as different, strange, stupid or creepy. The underlying scientific content has been appreciated so greatly, especially by teachers, that Nick Arnold has published ten teacher manuals on his website to help teachers with implementing the *Horrible Science* books in their classroom teaching. Finally, parents too will have to recognise the educational value of these books – else they would not be spending their money on them[11] – which is ensured first of all through the name of the well-known publishing house Scholastic, but especially through the way in which they are made to interact with the children in spite of the many assurances that the books are for children only. The best example in this case is *Really Rotten Experiments* (2003), in which the readers are repeatedly advised that they should let adults perform tasks such as cutting and lighting candles – in language that suggests that *the children* are the ones who should keep an eye on *the parent*, who is presented as more childish and more irresponsible than the child:

> Naturally, being a horrible scientist you'll get an adult to do any cutting for you. That way *they* can put themselves in danger. If they do cut themselves, sternly tell them off for carelessness and order them not to bleed all over your nice experiment!
>
> […] It's only kind to round up any nearby adults and warn them about the danger [of experiments marked as dangerous]. That way they won't harm themselves when they try the experiment secretly after you've gone to bed. (*Really Rotten Experiments* 10-11).

These passages show how carefully controlled the affective experience is in these books. This seemingly negative portrayal of the parent will keep the child safe, *and* evoke multiple positive affects. First of all, the parent and child are made to bond closely over the experiment, strengthening their personal ties through solving a scientific problem together. Secondly, it is possible that the parent, too, learns something from performing the experiment together with the child. This both bridges the generation gap that is often implicit in science popularisations[12], and gives the child a sense of accomplishment at being on the same knowledge level as their parent.

2.4 It's Gross, It's Fascinating

At first glance it may seem incomprehensible that a children's book trying to evoke a positive attitude toward science would resort to evoking negative affects in its readers. Yet this is what happens many times in every single *Horrible Science* book. The one negative affect that is evoked particularly often is disgust. Two kinds of disgust are evoked in these books, disgust at ingesting inedible food and disgust at faeces and urine. The very first cartoon that appears in *Really Rotten Experiments* evokes a disgust response toward food (Fig. 2.2).

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[11] Alice Bell points out that the *Horrible Science* books are cheap enough for a child to be able to buy them from their own pocket money (Bell 2011: 495), granting autonomy to the child. Indeed, the 2014 reprints are priced at £6,99 and the older, less glossy editions at £5,99 (horrible-science.co.uk). This, however, hardly changes the fact that most children would not be allowed to spend their pocket money on something their parents do not approve of.

[12] All *Horrible Science* titles are written around a linear description of historical scientific progress: in *Suffering Scientists* Aristotle is described as having contributed a lot to science, but equal attention is paid to the facts he got wrong, accompanied by a warning that describes exactly how badly erroneous these observations are (30-34).

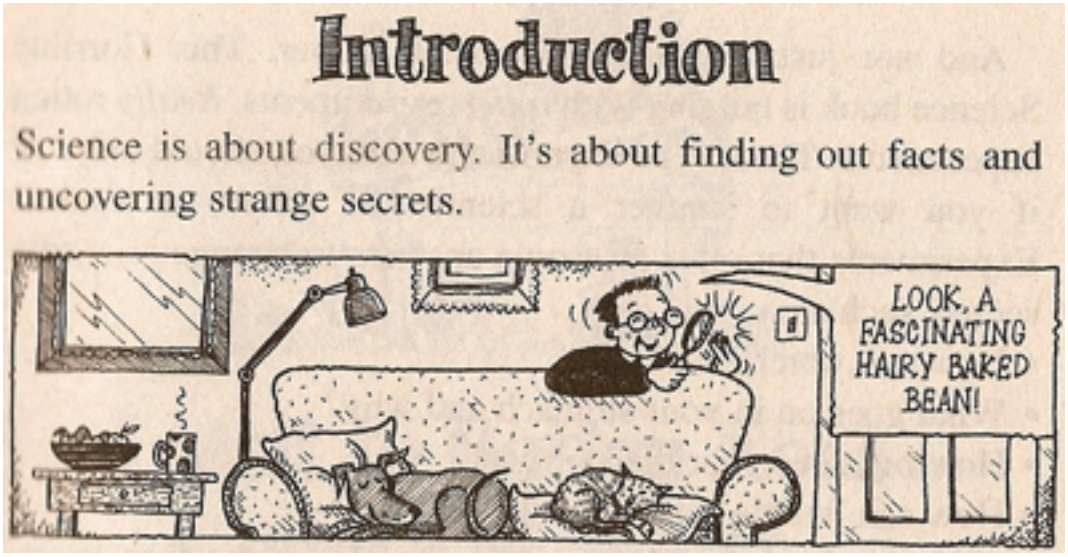

Fig. 2.2. Evoking disgust toward food in *Really Rotten Experiments* (5).

Another interesting disgust response toward food is found in the surprisingly frequent mention of school lunches, which are invariably described as disgusting, inedible, and containing unidentifiable ingredients, e.g. "Here are some fascinating food facts to impress your friends during school lunchbreak. (You'll impress them even more if you can work out what you're eating)" (*Chemical Chaos* 24). This ties in with the way in which the child and school are opposed in these books in favour of a closer relationship between the child and science, as discussed in the previous chapter. Interestingly enough, this particular joke is left intact in the Dutch translation of *Chemical Chaos* (*Chemische Chaos* 28), though Dutch children have lunches they take to school from home. This reinforces the parent-child opposition through disgust, rather than the school-child opposition, which is an opposition that is also present in the original version of the series, but to a lesser extent.

Similarly, faeces and urine are often drawn into the story where they have no direct relevance: in *Suffering Scientists*, a paragraph and a cartoon are dedicated to Newton's side job emptying his professors' chamber pots (*Suffering Scientists* 167). Though this seems to be fairly innocent because the disgusting fragment is only in writing or in a black-and-white cartoon, one experiment goes beyond the visual and brings the disgust physically extremely close to the child. In another book, one of the 'experiments' suggested to the reader is to make fake vomit (*Explosive Experiments* 40-41). It is described as "an educational scientific activity" (40), even though the only direct educational value was in the written explanation of why certain ingredients should be added, and not in the end result, that of the child ending up with a bowl of something that closely resembles vomit. This is a method that draws in those children who are made enthusiastic by experiencing a stronger and physically closer disgust affect, while at the same time ensuring that more sensitive readers can stick to the relative distance the book offers them: there is no obligation to actually perform any of the experiments in the books. The solutions to any questions posed in the introductions to the experiments are always given at the end. This makes for a more individualised experience, that makes the learning come physically closer to students who have a greater desire to learn in this way.

Alice Bell also points out that this treatment of excrements may serve an educational purpose that works affectively rather than scientifically: it makes the child aware of and comfortable with their own body and bodily functions (Bell 2010b), helping "liberate children from fears of their bodies" that they have learned to consider abject.

Silvan Tomkins compares the disgust–contempt spectrum quite negatively to that of shame–humiliation: where some form of enjoyment remains when someone is ashamed, all positive affect has disappeared in disgust as it entails a "complete […] reduction of excitement or enjoyment" (Tomkins 1963: 233). And if contempt is evoked, there is no way back at all: "in contempt the renunciation is complete and permanent" (1963: 263). If Arnold's books try hard to avoid shame, then it seems odd that they do not attempt to avoid this even more negative affect. However, Tomkins argues that even disgust can have an attractive side to it. "To the extent to which the individual has learned with some reluctance to renounce with disgust what initially was a delight, there lurks a positive affect about much towards which the individual also feels disgust" (1963: 241). Disgust, and especially the visual evocation of disgust, is nearly always a taught response (1963: 247). If children have been taught to avoid the topic of excrements and other disgusting objects, there can be a secret enjoyment in the moment in which the topic is discussed again. This works similarly to the way in which parents and teachers in these books are portrayed as unknowledgeable: the books distinguish themselves as being different from the restrictive status quo, allowing children to see, and most importantly, *do* things they would not be allowed in a regular social setting.

Such an approach requires careful control, however, to make sure that the disgusting aspects of the books do not cross the threshold, at which the object becomes abject and the reader would refuse to identify with it. Tomkins and Julia Kristeva both explain why it is possible for these situations to function in a non-abject way. First of all, Tomkins claims that it is impossible for a person to desire to avoid all negative affect at any cost. Such a person "must pay the price of surrendering not only the maximising of positive affect but even the price of abandoning completely all excitement and enjoyment. There is no zest in his life, because its pursuit might entail punitive negative affect" (1963: 262-263). Kristeva explains this fascination with the abject from a Freudian viewpoint. The disgust toward what is ejected from the body is counterbalanced by the desire to be reunited with the mother. Thus the abject, as a source of disgust, both repels and draws the observer closer. This fascination with bodily excretions is particularly strong in young children, and the disgust response becomes stronger as people enter adolescence and adulthood (Mills 2006: 4). In the ambiguity of the abject, the child sees the possibility to escape from the discipline of the adult authorities. Of course, in the case of the *Horrible Science* books, they merely escape to another adult authority, which uses this ambiguity to awaken enthusiasm in the reader. While the child is under the impression that they are engaging with the abject, which their parents would disagree with, they are in fact being taught. Even disciplining is present in *Horrible Science*, though this is deferred to the true adult authorities: "Never swing your tweeter [a device the reader has just been instructed how to build] anywhere near people or priceless ornaments. Otherwise you can expect dreadful tweetment from your parents" (*Sounds Dreadful* 298).

Another negative affect that is recurrently used as a rhetorical device in Arnold's work is fear. This affect is frequently evoked in particular in the biographical parts of the *Horrible Science* books, which comprise a considerably large part of the books in spite of the fact that they are not directly related to the particular science discussed in the book. Nearly all biographies contain information that evokes some negative affect, usually disgust, but at certain instances the text seems to go beyond disgust and explicitly seems to attempt to evoke a feeling of discomfort or even fear. Many biographies describe the scientist coming to a gruesome end: Lavoisier's beheading opens *Chemical Chaos* (15); Galileo is threatened with torture in *Suffering Scientists*, a story which is spread out over three pages (79-81). At the same time, the young readers are repeatedly reminded of the possibility that they themselves could one day be a scientist: "Could you be a stunning scientist?" (*The Stunning Science of Everything* 12), "Could you make a similar discovery?" (*Fatal Forces* [2014]: 142), "If you like to think about really deep questions then you'll definitely want to be a physicist when you grow up" (*Suffering Scientists* 218). When put into opposition with these fear-evoking anecdotes, the invitation to become a scientist becomes a challenge.

A similar approach is used in *Wasted World*, in which fear and shame are slowly evoked together throughout the book, but in the final chapter the fear is assuaged. Here, the reader is told how to personally aid in preventing the world from going to waste. The generational opposition of adult versus child is nowhere as significant as in the issue of environmental pollution (Bell 2010a). It is a problem that will affect the next generation more than the current one. Therefore it is important to realise that in *Wasted World* the children are granted agency, but not on their own: they are asked to influence the energy consumption of their entire household (*Wasted World* 122-125). Children are given more power and control than adults, but measures are taken to prevent the role of adults from being marginalised in the process. Throughout the book, hints are made at scientists – and occasionally, world leaders – working hard to save the world, too, so as to provide comfort to the reader and prevent the fear or shame response from taking over. There are clear limits to the extent to which shame and fear can be evoked, but even these distinctly negative affects can be employed to empower the child and goad them into physical and social action.

The above examples show that the *Horrible Science* swerve from one extreme affect evocation to another, and the sales figures suggest that children love it. Apparently, then, children do not find the affect of "normativity" that Lauren Berlant focuses on very important. Berlant describes this phenomenon as "the sense that one ought to be dealt with gently by the world and to live happily with strangers and intimates without being torn and worn out by the labour of disappointment and the disappointment of labour" (2011: 45). Contrary to this desire, the *Horrible Science* books teach the child that science *is* horrible, that science *should be* horrible, and that anything that is gentle, clean and in any sense not horrible is boring. And boredom, of course, is the worst affect of all. The *Horrible Science* series establishes school as a norm that these books deviate from, and normativity becomes a negative affect through this association, proving once more that affects are artificial and cultural, and that they can be shaped by interactions.

An important question to ask here is: If evoking a negative affect provokes a positive response, to what extent is this affect still negative? Is disgust negative if the reader delights in it? Based on my

findings in this chapter, I think distinguishing between positive and negative affects is more difficult than Silvan Tomkins first proposed. In a construct where a positive affect is engaged through ostensibly presenting something negative, a clash can occur between different social contexts that would require different affective responses: the parent would demand a negative affective response to bodily waste, whereas the peer group demands a positive one. All affects in fact seem to be interactions of the positive and the negative: as Tomkins described, the singular pursuit of positive affects through reducing the negative affects to zero is impossible and even damaging. Exactly how personal affects are, and how culturally determined, I will investigate in the next chapter.

Chapter 3: The Translatability of Affects

> Yes I wrote [a] book for Chinese readers and it is only published in Chinese. I am not sure what it is called!
> - Nick Arnold (private communication, June 2014)

In this final chapter I will look at the way in which affects are translatable between discrete world views and identities. Since affects are largely unnatural and learned, as the two previous chapters have shown, this means that they must be locally determined and culturally specific. Because the *Horrible Science* books have become internationally popular, they form an interesting research object in this regard. Authored by two white males, frequently referring to the British school system, and containing various statements that are not always entirely politically correct, the series still manages to draw in audiences from extremely varied backgrounds, whether this is in the original English or in translation. Affect is closely connected to interpersonal networks, but how (un)limited are these networks? Both in translation studies and in affect theory it becomes clear that certain things cannot simply be translated from one context into another. Even at the level of single words, translation is impossible more often than one would think, as Barbara Cassin's *Dictionary of Untranslatables*[13] proves. Cassin focuses specifically on the problems of untranslatability in philosophy, pointing out that there are "measurable differences" between languages which hinder translation (2014: xvii). This does not mean that some words cannot be translated at all; instead, "the untranslatable is rather what one keeps on (not) translating" (ibid.). Even as a word or phrase is translated, part of its meanings or connotations is not carried over into the new language. A connection between this issue and affect theory has not been expressly made yet, and therefore it is important to dedicate this chapter to making such a connection. If words are not always translatable, then what happens to the affects these words attempt to convey? Are affects translatable along with the words that express them, or are they part of what Cassin claims is left behind?

Another issue arises when part of a translation does not involve words. Almost half of any *Horrible Science* book consists of cartoons and other images, which display culturally specific imagery. It is important here to consider to what extent culturally specific details of the illustrations, such as children wearing school uniforms, may influence the extent to which a young reader will identify with the book. This identification is crucial for the careful cultivation of positive affects and an affectionate network, which may be done through the employment of negative affects, as I showed in the previous chapter. How does one translate an image? Can a translation involve changing an image, or is the affective component of the image irretrievably lost in the new linguistic or cultural context?

To answer these questions, I will compare the original British books with two foreign editions: the US/Canadian one and the Dutch one. The US/Canadian edition of *The Horrible Science of Everything* is particularly interesting because it concerns a translation within what is considered to be one language. The Dutch translation, aside from it being the most accessible translation for me, is particularly interesting because the Dutch and English cultures are relatively similar. Speaking strictly in terms of the UK and the Netherlands, the cultural differences are quite small compared

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[13] Almost ironically, the *Dictionary of Untranslatables* (2014) is a translation from the French *Dictionnaire des intraduisibles* (2004).

to, say, the translation into Korean or Chinese – two other examples of languages to which the series has been translated. Those parts of the series that really are untranslatable will therefore stand out more strikingly, if they cannot even be translated to a cultural context which at first sight is quite similar.

3.1 Cultural Determination of Affects: Shame

Though affect theory and translation studies have not been explicitly linked yet, both Deleuze and Tomkins have made several claims concerning the cultural, albeit not the linguistic, specificity of affects. Deleuze's text in fact becomes problematic at the point where he discusses this issue. In one of his lectures, he points out that, according to Spinoza, the ability to be affected in a certain way is what distinguishes different species of animals from one another. He subsequently extends this idea to a differentiation between kinds of humans, pointing out that "depending on the culture, depending on the society, men are not all capable of the same affects" (Deleuze 1978: 7). By drawing this parallel, Deleuze implies that there is a species differentiation within mankind. Comparing humans to animals, Deleuze boldly claims that

> [i]t's obvious that the racehorse and the draft horse are the same species, two varieties of the same species, yet their affects are very different, their maladies are absolutely different, their capacities of being affected are completely different and, from this point of view, we must say that a draft horse is closer to an ox than to a racehorse. (Deleuze 1978: 7).

Deleuze claims that certain kinds of one species are more like certain kinds of another species due to the differences in their affect perceptions. In suggesting that the same reasoning can be applied to humans, Deleuze is implying that some kinds of humans may be more similar to other species of animals than to other kinds of humans. Here, affect theory is dragged into a racist discourse, providing a tool to differentiate among groups of people in terms of the way in which they are affected.

Is it possible at all to use Deleuze's approach in a productive manner? He unfortunately does not directly connect these ideas on affects to language. However, it is highly likely that his ideas concerning the connection between affects and languages would be similar to that of affects and cultures, as these are strongly mutually influential and as good as inseparable. I disagree with his claim that cultural differences, including linguistic differences, make it impossible for some people to experience certain affects. All humans are capable of experiencing all affects, though context and intensity may vary. Perhaps shame is the only affect that humans may be able to do without: it is possible to imagine a culture without shame, but I have not found an actual example of such a culture yet.[14] And if one looks at the simple distress/joy dichotomy that Deleuze claims underlies the affect system, then it is completely impossible to imagine a culture in which either part of this binary does not exist. Deleuze's approach is useful to such an extent that it hints at cultural differences in being affected. What evokes a strong affective response in one cultural context, may evoke very little in another. What evokes a positive response for some, may for others be consid-

[14] The *Genesis* chapter of the Bible suggests a similar idea, as Adam and Eve did not know shame until God made them aware of their nakedness: "And the eyes of them both were opened, and they knew that they were naked" (*King James Bible*, Gen. 3.7).

ered in an extremely negative light. However, I strongly disagree with his claim that similarities in being affected are stronger between species than within a species itself, especially at a human level.

Silvan Tomkins too claims that culture plays an important role in determining which affects are perceived or evoked in which contexts: "many affects… are enlisted in support of conformity to norms and ideologies" (1963: 232). Again, shame holds a special status in this discussion. Tomkins points out that shame, in particular, is created through the confluence of three factors: "ideology, affect and action" (1963: 307). As a matter of fact, Tomkins's work itself clearly reflects the way in which shame functions as a social construct. His work is highly specific to the 1960s US situation and at certain instances politically charged in this regard. This becomes painfully clear in one section on shame, where in an ironic reversal Tomkins's writings themselves evoke shame or for some readers perhaps even disgust:

> In the constrained relationships between white and Negro Americans, it is the loss of distance which can shame either party […] If the Negro in the South were permitted to achieve and display excellence, to become a respected public figure, intolerable shame would be provoked (1963: 193).

Aside from this example, however, Tomkins's approach in general is less problematic than Deleuze's on the topic of the cultural determination of affects. He emphasises that language is an essential factor in maximising affects through communication:

> [A]bove all language is the lens of thought through which affects can be brought to a magnifying, searing, white-heat focus. The worlds which have been constructed out of words have promised the wildest excitements, the deepest enjoyments, the most abysmal distress and the ultimate shame and terror … There is no affect which cannot be activated and maintained endlessly by the magic of the word (1963: 71).

One can see how this centrality of language would make it difficult for affect evocations to be translated, since affect conditioning is culturally determined. Tomkins indicates that this cultural determination works on a very specifically national level, for instance, when he describes how French children are much more often shamed into immobility than American children, who are allowed to freely run around (1963: 196-201). Language is nearly always central in the issue of nationality, which again reinforces the idea that the evocation of an affect cannot simply be achieved through literal translation.

Leaning on these two approaches, it becomes clear that what would evoke a positive affect in one culture may evoke a negative one in a different one. This is an important consideration to make when looking at the *Horrible Science* series in translation, as I have argued in the previous chapter that this series leans heavily on the idea that positive and negative affects can easily transform into each other. Take, for instance, the uncomplicated evocation of enthusiasm in the series. Tomkins describes how in some cultures positive affects, too, can be restrained by society. He describes how in "Western civilization" a child may be reminded of "elementary decencies" which would restrain him from exclaiming in joy at the sight of his favourite food (1963: 229). Interestingly enough, in the *Horrible Science* series such a restriction is largely absent. Positive affect is stimulated, and only limited at the point where too enthusiastic an engagement with the experiments would lead to

damage or injury, e.g. "Ask an adult to help you…" (*Chemical Chaos* 19). Both interest and joy are evoked, and the child is invited to express these affects to their social circle.

Since the books intentionally position themselves as contra-institutional, both against the institution of school and against the one of parenthood, this celebration of unrestrained joy can be seen as another tactic through which the authors position themselves as opposed to the institutions that do not allow children to express their joys in full. When looking at Tomkins's description of French children being much more restrained, it seems that such a contra-institutional position would be stronger in a culture that would restrain its children more. However, the question is whether the books would not be considered highly inappropriate even by the young readers themselves in cultures that place a large emphasis on children having to be modest: the *Horrible Science* books do not restrain the child's insolence to an appropriate extent at all, and give many joking examples of children making impertinent remarks toward adults, or even physically victimising them.

The child is only restrained in the expression of the positive affects that are caused at the expense of adults by their own sense of propriety: though the suggestion is made multiple times in every book that the reader should knock on the door of the teacher's room and ask their teacher an obnoxious question, many readers would find the idea shameful or at least inappropriate, and refrain from acting upon the book's suggestion. Indeed, the books to an extent expect children to observe the basic rules of polite behaviour by not harassing their teacher too much: teacher interaction is not the real purpose of the 'Teacher's Tea-Time Teaser' quizzes, as the answers are always provided in the book. These sections are as much intended to convey information to the reader as the rest of the book, but they are made to look different in order to keep the reader interested and to make them physically interact with the book, as described in the previous chapter. Still, many of the quiz questions are innocent and a teacher would likely not mind being asked one of the questions they pose – in a culture in which it is appropriate to ask your teacher random questions. Some of the 'tests,' however, are clearly meant as a joke that is not at all meant to ever be performed on the teacher. One example of the latter is a 'Teacher's Tea-Time Teaser' in *Suffering Scientists;* see also Fig. 3.1:

> All you need is an empty crisp packet and the kind of courage that is often mistaken for foolhardiness. Simply creep up behind a teacher at break and burst the crisp packet. When the teacher recovers, smile sweetly and enquire. 'Was the Big Bang louder than that?' (*Suffering Scientists* 88).

This provocation is followed by an explanation of the answer to the question, printed upside-down – and only then a 'Horrible Health Warning': "If you actually do this teaser, don't blame me – you're on your own, OK?" (*Suffering Scientists* 89).

It is – hopefully – clear to all readers in all cultures that this particular test is meant as an unperformable prank. The situation becomes more complicated when taking into account that in some schools, none of the teacher tests may be socially acceptable. Teachers may not be allowed to be disturbed for *any* tests, quizzes or questions during their tea break – if such a thing exists at all in these schools. So how does a translator make it clear to a child in a different culture which calls to action in the books to follow, and which to interpret as a joke? In different cultural, national or otherwise varying contexts, this may become confusing. If a reader would have to interpret *all* Test

Fig. 3.1. An unwise suggestion for testing one's teacher in *Suffering Scientists* (88).

Your Teacher quizzes as hypothetical, it is easy for them to also dismiss the instructions for experiments as jokingly delivered thought experiments.

Another problematic situation that can arise from the opposition between experiments and questions, is that the reader may not be encouraged to ask any questions at all anymore. Since questioning one's teacher is presented as an action which is obnoxious and meant to disturb the teacher on their break, there is no option left open for a child to be genuinely inquisitive and curious toward their teacher. And even if the reader is not suggested to ask their teacher the question at an inconvenient moment – some quizzes are named 'Test Your Teacher,' which does not suggest that this test be conducted during the teacher's leisure time – the purpose of asking the question is always moot, since the answer is already provided in the book. The only real purpose of asking the question then becomes to show off to the teacher or to fellow students. In a situation where such individualism or bragging is less acceptable, such an approach may not evoke any positive affect at all, especially not in a wider social circle.

3.2 Translating affects

Such cultural differences must in some way be accounted for if the book is going to be translated, and in the case of *Horrible Science*, this has been done many a time. Since the series has proven to be such an international success, it would be interesting to look at the translation figures more closely. Unfortunately, however, no data are published concerning translation numbers. Scholastic, the publisher, only mentions on the *Horrible Science* website that the series is available in 24 countries (horrible-science.co.uk), but this number is not high enough to be accurate.[15] Even Nick Arnold himself has lost track of the number of translations: "I am not entirely sure which languages the series has been translated into as the books have been in print for 18 years" (Arnold 2014, private

[15] An interview with the university newspaper of Arnold's alma mater, York University (UK), gives a more likely estimate of forty countries (grapevineonline).

communication). The translations Arnold is certain about are the following, their titles have been added where I have been able to find them:

Europe
- English (UK): *Horrible Science*
- Spanish: *Esa Horrible Ciencia*
- Dutch (Netherlands/Belgium): *Waanzinnig om te weten*
- Portuguese (Portugal): *Os Horríveis: Ciência Horrível*
- Polish: *Monstrrrualna erudycja*
- Czech: *Děsivá věda*
- Italian: *Brutte scienze*
- Swedish: *Förfärliga fakta*
- Danish: *Vanvittig viden*
- Finnish: *Karmea totuus*
- French: *Horrible Science*
- German: *WahnsinnsWissen*
- Russian
- Slovakian
- Croatian
- Norwegian
- Greek
- Bulgarian
- Hungarian
- Latvian
- Lithuanian
- Estonian

Americas
- English (US/Canada): *Horrible Science*
- Portuguese (Brazil): *Saber Horrível*

Asia
- Thai
- Vietnamese
- Korean: *Aht!*
- Japanese: ゾクゾクするほど、おもしろい科学 *(Zokuzoku suru hodo, omoshiroi kagaku)*
- Simplified Chinese
- Chinese (Taiwan)
- Traditional Chinese: 可怕的科学 *(Kěpà de kēxué)*

This confusion concerning translation figures may in part be caused by the way in which the UK publisher, Scholastic, markets its educational series internationally. In the Netherlands, Denmark, Germany, Finland and Poland, for instance, the *Horrible Science*, *Horrible Histories*, *Horrible Geography*, and *Totally/The Knowledge*[16] series have all been published together as one series, the one named in the list above. This may have to do with the fact that the series is not as popular in these countries as it is in the UK, and that therefore it would not pay off to translate all books, especially not the 'specials', 'annuals' and 'magazines'. The Dutch series, for instance, does not include a translation of *Suffering Scientists*, which was initially published as a *Horrible Science* 'special'. At the moment, the Dutch publisher, Kluitman, lists only fourteen books in the series as currently available; several, including the translations of *Fatal Forces* and *Chemical Chaos*, have apparently gone out of print (kluitman.nl). Only one out of these fourteen is a physics book, the translation of *Killer Energy*, and all other books concern history, biology and geography. This is different from the UK situation, where *Horrible Histories* is by far the most popular series, but *Horrible Science* is a close second, with many more spinoff products than the Geography series. Further research would be necessary to find out whether this is due to differences in interest, differences in affective engage-

[16] This *Horrible Histories* spin-off series was known as *The Knowledge* until around 2010, when the series was gradually re-issued under the name *Totally*. It is one of Scholastic's most diverse educational series, including works by Nick Arnold, Terry Deary (*Horrible Histories*), and many others. The series itself led to two further spin-offs: Kjartan Poskitt's *Murderous Maths* and Michael Coleman's *Foul Football*. As stated in the introduction, this explains why there is no book on mathematics in the *Horrible Science* series.

ment due to translation, or perhaps differences in engagement due to ingrained cultural differences, such as the Chinese context I will talk about further on.

Is translating science books easier or harder than translating other kinds of literature? Barbara Cassin's notion of the untranslatable indicates that some aspects of words or phrases often remain untranslated during the translation process. This is, for example, what makes translating jokes so difficult: the words as well as the double meanings must be translated. Whereas she points out that this issue is particularly difficult in philosophy, I would say that this is equally hard, if not more so, in the sciences. The form of science that has been practiced since the advent of modernity appeals to the idea of a worldwide community of scientists, in which national differences no longer matter. However, science cannot claim to be exact in every language if the words it uses do not mean the same everywhere. Science pretends, assumes, and strives for universality, but there is no universality in language, Cassin says: "the universality of concepts is absorbed by the singularity of languages" (2014: xix). It is problematic to convey science into any language at all, as language will always be open to multiple interpretations, and science works under the pretence that scientific data display only one truth.

However, no science book is entirely untranslatable, in the way that some of Scholastic's 'Horribles' are. In some cases, the content of the entire book proves to be untranslatable, as is the case with Terry Deary's *Wicked Words*, a 1996 *Horrible Histories* special. This book covers the history of the English language, explaining among other things where English sayings and swear words originate from. This book is therefore not translatable to another language. Either the book would have to be entirely rewritten so that it becomes a history of the language it is 'translated' into, or it would become a book about the English language for non-native speakers, which would imply an older, more educated audience.[17] Similarly, it is very unlikely that Deary's *The Terrible Tudors* and *Even More Terrible Tudors* would ever be translated into another language. Such general untranslatability does not seem to occur in books on science, a field that claims more universality than linguistic history.

The problem here is that the *Horrible Science* books contain enough national, historical elements to cause issues of recognisability in translations. Untranslatable concepts that are connected to a specific nationality are a special kind in themselves, Emily Apter argues in *Against World Literature:* "A nationally marked Untranslatable … operates as a bête noire: a philosophical fetish that serves as a rallying point of national pride or slips into becoming a cultural marketing device or touristic cliché" (2013: 138). Though Apter is here mainly concerned with concepts that are literally untranslatable, I would argue that this notion can extend to concepts that other languages do have a translation for, but that are simply not used because they do not exist in the lived experience of these languages. All nations have such concepts, that when translated would still continue to refer to the nation where the original was produced. A simple example would be the use of Fahrenheit for temperatures (US), or the habit of counting in *lakhs* and *crores* (10^5 and 10^7 respectively, South Asia). It is such untranslatables that lay at the heart of the translation issues in *Horrible Science.*

[17] In fact, this book proved to tie in quite well with my second-year undergraduate *History of the English Language* course.

Nearly all books contain a timeline in some form, often fragmented and scattered throughout the book, and always including scientists of many different nationalities. In spite of this careful diverse inclusion, though, certain scientists are clear favourites: Galileo appears in *Fatal Forces*, *Suffering Scientists, Wasted World, Killer Energy* and *Space, Stars and Slimy Aliens*; Newton is covered in *Chemical Chaos, Fatal Forces*, *Suffering Scientists, Killer Energy* and *Frightening Light*. Not unexpectedly, a lot of attention is paid to British scientists in particular. The description of historical development is a rhetorical device that has been used in science popularisations for children and adults alike, as Felicity Mellor points out: "Popularizations reinforce the authority of physics by recounting origins stories of scientist-ancestors" (2003: 530). When a child is reared in school with a large emphasis on national history, which is as good as always the case, the historical approach of popularised science must to some extent match this experience in order to evoke the effect Mellor describes. An approach oriented toward a different national context may feel unfamiliar and therefore less appealing: a child will be more likely to respond to a name they may already have heard in a different context. In the Dutch translation, therefore, some rewriting has been done to appeal to a child raised in this context.

"To translate is an act of rewriting," Apter, Lezra and Wood write in the preface to the *Dictionary of Untranslatables*. And indeed, in certain instances rewriting has taken place in order to relate the historical narration more closely to the daily experience of the readers. This has been achieved through, for instance, the simple act of adding the information that railway tycoon Cornelius Vanderbilt was "van oorsprong een Nederlander" (*Machtige Krachten* 87). Another very interesting translational addition can be found at the beginning of *Extreme Energie!*. Energy is introduced to the reader as being some kind of monster, which in *Killer Energy* is described as "…don't go thinking that the Energy Monster is a helpful gentle giant" (7). *Extreme Energie!* has translated this phrase using a reference from another children's book, giving us "Maar denk nu vooral niet dat dit Energiemonster een soort Grote Vriendelijke Reus is" (7-8). Grote Vriendelijke Reus is the Dutch translation of Big Friendly Giant – Roald Dahl's works are as popular in the Netherlands as in the UK. Recognition of the familiar will bring joy to the reader, and in a context where some of the familiarity has become lost in translation, the translator can choose to add elements that will reinstate this familiar feeling. At the same time, the science will reinforce its sense of authority by appealing to a history that is recognisable to the child.

Extreme Energie!, the Dutch translation of *Killer Energy*, similarly adds culturally specific knowledge that will be more familiar to Dutch readers than to UK ones, in the meanwhile correcting a mistake that had made its way into the original English work through oversimplification. In the UK edition, the biography of Julius Robert von Mayer contains the phrase "and that's how he came to be in Java in 1840" (*Killer Energy* 21). The Dutch translation is more elaborate concerning the topography: "En zo kwam hij dus in 1840 in Batavia terecht, de hoofdstad van Nederlands-Indië, die tegenwoordig Jakarta heet" (*Extreme Energie!* 21). Incidentally, the translator has also corrected all the UK edition's references to "Mayer" into "von Mayer" as Dutch readers will be familiar with prepositions in surnames: it is unclear whether the preposition has been left out in the UK edition due to ignorance on the part of the editors or as the consequence of a deliberate move to make the name more familiar in the eyes of young readers.

In fact, many of the translators's actions could be considered what Apter describes as "translating untranslatably," which she defines as "using a kind of over-translation that embraces

wild infidelity to the original and pushes the envelope of translatability" (2013: 147). The translators sometimes go extraordinarily far in changing information, through adding or removing text. Adding text that was not present in the original language can be done to clarify information that would be better known to English readers than to Dutch ones. It makes sense that this would be a method less often resorted to, since the methods mentioned above would be more effective without lengthening the book too much. However, in *Extreme Energie!* a third of a page is devoted to an entirely new section which explains what the Royal Society is, and how its Dutch equivalent, the KNAW, functions (33). When taking into consideration that this information had to be explained so lengthily even though a similar system is in place in the Netherlands, it becomes clear what a difficult task it would be to translate the books into a cultural context that has a much different way of treating science in society. This particular example of translating untranslatably shows that Pieters, the translator, had to become knowledgeable on the topic almost to the same extent as Arnold did, in order to be able to offer a translation that through its aberrance would be accessible to Dutch readers.

When such methods fail and the text still proves untranslatable, it is sometimes taken out entirely. This happens in the first chapter of *Chemical Chaos*, which contains the following note to the reader: "Dear reader, as far as this book is concerned a chemist is NOT a shop where you buy pills. A chemist is someone who studies chemicals. O.K.?" (9). This paragraph, together with the cartoon effect that made this note look like it was written on torn-out notepaper, is left out of the Dutch translation (*Chemische Chaos* 12). This is due to its untranslatability: in Dutch, the words *apotheek* (where you buy pills) and *scheikundige/chemicus* (who studies chemicals) are different enough for there not to exist any linguistic complications. The translator here needs to consider both the engaging effect of the torn-out note cartoon, which increases the variety on the page and reduces boredom as described in the previous chapter, and the estranging effect of having a linguistic explanation in the book that cannot be replaced by a Dutch equivalent. Clearly, the latter effect is much more important, but this case does show how minor affectively engaging effects sometimes must be sacrificed in the translation process.

A similar kind of edit, though less drastic, is applied in removing the pronunciation markers in the Dutch translation. The English books provide pronunciation markers for difficult words, such as "oscilloscope (o-sill-oscope)" (*Sounds Dreadful* 197); all of these have been removed in the Dutch translation. Though arguably in some cases Dutch children too could use some guidance in pronunciation, Dutch difficult words are easier to pronounce because the language is so structured that a spelling has a very consistent pronunciation, much more so than English.

One other interesting aspect to consider with regard to the Dutch translations of *Horrible Science* is the fact that several translators have worked on these books, as can be seen in the introduction. Even so, all of them have employed the translational methods outlined above to the same extent. Such harsh editing therefore seems to be commonly accepted in this form of translation work – even when it is not in other areas, as the translation of single words can be problematic enough to warrant a *Dictionary of Untranslatables.* The translation of the affects that this series attempts to achieve is by all of these translators considered more important than literality. Such a move shows the extent of what Apter calls "the decisionism of translation" (2013: 169): the fact that an autho-

rised person, i.e. the translator, made these choices, validates them. The translators are given a lot of freedom in the choice of their words and phrases in order to maximise their rhetorical effects.

3.3 Translating within the English language

Children's science popularisations encounter a different set of translation issues still. They are required to convey complex concepts into simplified language, which may lead to the author having to leave out essential information that is necessary for a full comprehension of the issue, but that is too difficult for the child to understand. Take the issue of the greenhouse effect in *Wasted World,* for instance. The authors describe this concept, as well as global warming, in the following paragraph:

> In fact, a lot of CO_2 is produced naturally – for example, by microbes in the soil. The Earth deals with it because plants take in CO_2 and lock up the grisly gas for a while. What's more, a bit of global warming is *good* for us. Greenhouse gases keep our planet warm and without them your bedroom would be as cold as your freezer. But – and it's a MASSIVE BUT – the Earth can't handle the extra greenhouse gases from the Mighty Planet-Munching Machine… (*Wasted World* 54, emphases in original).

In trying to explain a complicated scientific phenomenon in one child-friendly paragraph, a few inaccuracies have found their way into the text. It is *the greenhouse effect* that keeps the Earth liveable by reflecting outbound heat back onto Earth. *Global warming* is the consequence of an *enhanced* greenhouse effect, which causes more heat to be reflected back and thus to heat up the Earth further than the climate can handle. Global warming is therefore *not* good for us, but the greenhouse effect is a phenomenon we need to survive.

Those who want to translate the *Horrible Science* books into other languages thus have three problems to contend with: the impossibility of conveying science in language, the difficulties of simplifying science for children, and the complications that, as Cassin points out, are inherent in all forms of translation. The simplification for children here works on a double level, too. First of all, in the original language, science must be simplified so that an untrained, unscientific mind can grasp it. Secondly, in translation, regular translations can in some cases refer to more obscure parts of the vocabulary to convey a certain nuance – but children's books cannot convey all the nuances of the original language as they have only a limited vocabulary to work with. A phrase with a certain connotation can be known to children in one language, but can be more obscure in another language.[18] And whereas in literature for adults it is sometimes possible not to translate at all – according to Apter, it is sometimes even a duty (2013: 253) – this is not possible in children's books, as the readers will likely not know the source language. The consequences of this issue for translating Britishisms can be seen in two noteworthy instances, where in the original UK books local linguistic differences are used to evoke positive affects in the readers of Horrible Science.

Even within the English language, literature is often translated. Many children's books have separate British English and American English editions, as during this translation the spelling is adapted and British words such as 'queue' and 'lift' are replaced with their American equivalents 'line' and 'elevator,' or vice versa. Such small linguistic differences can be an impediment to

[18] Take, for instance, the word 'influenza': this word exists both in English and in Dutch. It will be easier to mention to children in an English context, because the word the children will know is its derivative 'flu', whereas the common Dutch word for it is 'griep'.

creating an affective bond, as the child is confronted with unfamiliar words in a book that otherwise attempts to address the child on a familiar level. One famous instance of such a translation has been done in the case of the Harry Potter books: the first novel in the series is titled *Harry Potter and the Philosopher's Stone* in the UK and *Harry Potter and the Sorcerer's Stone* in the US. A similar translation would be possible for the content of the *Horrible Science* books, since they are riddled with Britishisms, but in a surprising move the editors point out that they have chosen to keep these linguistic differences intact. In the US edition of *The Stunning Science of Everything*, the final page contains a glossary of all the British words used in the book, such as 'boffin', with parallel American 'translations'. On this page, the US editors explain that this has been done on purpose, in order to preserve the quirky British tone of the original work (*The Stunning Science of Everything* 94). Here, untranslatability is not an impediment to creating an affective bond; instead, it is used to strengthen this bond. In a way that is similar to Arnold and De Saulles's portrayal of science as interesting through its oddities, these linguistic differences are kept intact to enhance the status of the series itself as slightly aberrant.

The original British editions also frequently employ linguistic differences within the English language, which creates a situation that does lead to untranslatability when translating the books from English into other languages. Scottish and Australian are most frequently employed in this manner. The most striking example is from *Killer Energy*, in which the running gag throughout the book is that all the difficult bits are explained by the lazy and gluttonous "Harvey Tucker, the BIGGEST journalist in Australia – well, he's certainly the largest" (*Killer Energy* 17). His explanation of such concepts as the laws of thermodynamics are embellished with Australianisms such as "no worries", "yakka", "fair dinkums" and "vegemite" (17-19, 44). Since Harvey Tucker is depicted as a lazy and perpetually hungry character with a big appetite for lager, Australians are generalised as an oddity – yet at the same time the use of their language can reinforce the connection with Australian readers, as it is an acknowledgement to this group of readers in an internationally popular series. In the same way, therefore, that the US edition sees the use of Britishisms as positive, this irreverent use of Australian slang may actually strengthen the positive affects of Australian children toward this book. After all, it is still a lot less irreverent than the series' treatment of teachers, parents and younger siblings.

Such linguistic diversity is difficult to address in translation. Taking the Dutch translation as an example, one option for the translator would have been to create a character who speaks a version of Dutch that is not spoken in the Netherlands: a character from Flanders, South Africa or Suriname, for instance. However, the Dutch edition presents him in a literal translation as "Harvey Tucker, de grootste journalist van Australië – nou ja, in elk geval de dikste" (*Extreme Energie!* 17). Whereas he introduces himself with a quintessentially Australian "G'day, sports!" in the UK edition (*Killer Energy* 17), in the Dutch edition what makes him stand out is the fact that he speaks English, i.e. that he is not Dutch – his introduction there is "Hello, kids!" (*Extreme Energie!* 17). Similarly, the Vegemite sandwiches have been replaced by "pindakaas en jam" – peanut butter and jelly, which a Dutch reader might recognise as American rather than Australian (*Extreme Energie!* 47). Of course, this treatment of Harvey means that the translators could leave the introductory cartoon, which contains a kangaroo, intact (*Killer Energy* 17). Affective inclusion of a certain readership is not the intention of the Harvey Tucker subplot in the Dutch edition. Since there are not

many preconceived notions concerning Australian linguistics for Dutch speakers, the translation is forced to leave this layer out.

Interestingly enough, the omission of this play with accents is performed consistently throughout all Dutch translations. *Killer Energy* opens with another play on accents, this time between German and English. Scientist Julius Robert von Mayer is quoted as saying "Ach mein Gott - I hev cut an artery! Hold still or you vill bleed to death!" (*Killer Energy* 20). *Extreme Energie!* on the other hand quotes him as speaking perfect Dutch: "Och, jeetje! Ik heb een slagader geraakt! Zit stil, anders bloed je dood!" (*Extreme Energie!* 20). No traces of German are left in this translation of the citation. This may be because accents from other languages are much more common in English than in Dutch, due to the number of people who speak English as a second language. It is also quite common in English-speaking countries to dub people who speak a language other than English on TV, oddly enough often with an English speaker who has the accent of the language the original speaker was using. In the Netherlands, children are exposed, through the use of subtitles, to other languages at an early age, but not to very many different accents in Dutch. This imitation of an accent, then, would not evoke the same positive affects and recognition as it would in children in an Anglo-Saxon context.

Notably, even between the US and the UK a cultural gap seems to exist that problematises the position of *Horrible Science* and the other *Horrible* series beyond the quaint. As Alice Bell explains, the scatological humour of the *Horrible Science* franchise is less enthusiastically received in the US:

> poo-books aren't very American. I've noticed that *Grossology* [a US 'horrible science' book] is a lot milder than *Horrible Science* (and the *Horrible* books have never really made it in the USA). Maybe, despite the various efforts of Warner Brothers, Nickleodeon [*sic*] and the Simpsons, the more anarchic image of childhood is still less acceptable in the USA (Bell 2010b).

In cultures that are more fundamentally different from the UK situation, many anecdotes that are meant to evoke positive affects in one audience would prove problematic in a different context. This problem becomes clearest in *Wasted World.* This book is aimed clearly at evoking the affects of rich children in Western Europe and North America. This audience choice makes sense considering the purpose of the book: as can be seen in one of the final chapters, the author intends to make children aware of the ways in which they can contribute to combating global warming. Since the richest nations and individuals contribute most to this issue, it is to be expected that their conscience should be addressed. To this purpose, nearly all statistics concerning individuals refer to Western situations. Remarkably enough, most statistics are taken from the US in particular, even in the UK edition of the book: "Americans dump 85 million tonnes of paper … At the same time the world throws out over 360 million tonnes" (*Wasted World* 23).

The book quite deliberately assumes the readers have a certain background, and excludes others: e.g. African and Muslim readers – "In parts of Africa the only meat that people can afford comes from rainforests. Obviously we're not talking ham and bacon - we're talking crocodile and hippo […] Personally, I think you might need a strong stomach to sample one" (*Wasted World* 17).
In this respect, the most bizarre element of several of Arnold's books is the way it discusses slavery in a jocular and even positive tone:

> Wouldn't it be great to have your own slave? You could even send your slave to school in your place. With so little to do, some of the smarter ancient Greeks used their time thinking up new ideas. (*Suffering Scientists* 23)

Unfortunately, these two books have not been translated into Dutch – it would be interesting to see how such a paragraph would be treated in translation into a language that has similarly been connected to imperialism and slavery.

3.4 Translating cartoons

The cartoons are an indispensable component of the *Horrible Science* books. They explain concepts and processes that could not be rendered in simple language. At the same time, they also create opportunities for the reader to see the affective responses that certain experiments, past or present, can evoke in their surroundings. This can provide guidance especially in contexts where it is unclear to the reader whether it is appropriate to ask a certain question or to perform a certain experiment. The nastier experiment or quiz suggestions involving teachers are accompanied by cartoons that display the angry response of the adult victim. The teacher who was scared by the Big Bang experiment mentioned above is shown to be furious at the child, and it is quite certain that the child's question is not going to be answered (Fig. 3.1). The cartoons accompanying 'real' experiments do not show any negative consequences, thus encouraging the reader to actually perform them.

Cartoons, however, cannot be rewritten as easily as text sections in the case of culture clashes. The untranslatability of cartoons is a problem that surfaces in every single *Horrible Science* book. Harvey Tucker is not the only character whose cartoons display his nationality: British idiosyncrasies appear in many cartoons. For instance, all of the school settings display children in school uniforms. These, however, are uncommon in nearly all of the countries that have their own translations of the *Horrible Science* series. At the moment when the uniforms are featured prominently in the story, this becomes problematic. One cartoon in *Fatal Forces* therefore had its annotations re-

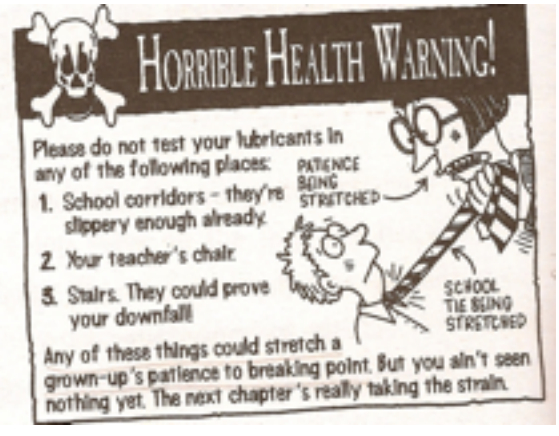

Fig. 3.2a and 3.2b. The same cartoon in *Fatal Forces* and *Machtige Krachten*: the comment about the school tie has been removed in the Dutch translation (*Fatal Forces* [2014] 117, *Machtige Krachten* 110).

moved in the Dutch translation, so as to make the school uniform less conspicuous (Fig. 3.2a and b.)

Mostly, however, the cartoons have not been meddled with in translation. A quaint example can be found in *Killer Energy*, where two aliens are having a conversation about the second law of thermodynamics in an 'incomprehensible' language (Fig. 3.3). A translation of their conversation is provided underneath the cartoon. Close scrutiny, however, will reveal that these aliens are speaking English which is written in made-up characters. In the Dutch translation, the aliens are still speaking this form of English (*Extreme Energie!* 30). The same book also contains a cartoon of children going to school on a school bus, another phenomenon that only appears in a handful of countries around the world. This cartoon, though it is not relevant to the Dutch situation in which nearly all schoolchildren go to school by bike, is not changed in any way (*Extreme Energie!* 64)

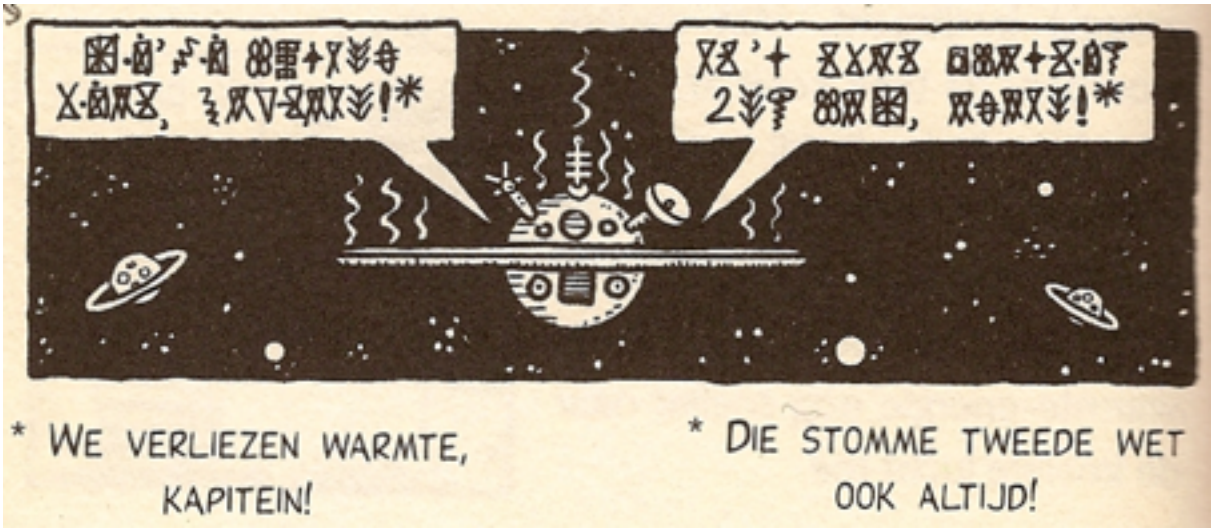

Fig. 3.3. The 'alien' language is actually English in a made-up alphabet, and you can still recognise how it reads: 'We're losing heat, Captain!' 'It's that blasted 2nd law, again!' (*Extreme Energie!* 30, *Killer Energy* 29).

Similar untranslatable topics can easily be seen when looking at the list of other languages in which the books have been translated. Chinese is the most obvious one here. Aside from the fact that the impertinence of the children in the *Horrible Science* books is far beyond what many Chinese parents and teachers would consider acceptable, it is in the details that one finds the most painful untranslatable moments. Nearly all books, for instance, warn that the reader should not "eat … your brothers and sisters", "give nasty shocks to your … brother/sister" or "scar[e] your little brother or sister" (*Killer Energy* 59, *Shocking Electricity* 198, *Frightening Light* 71). Having multiple siblings is even seen as something terrible: "Would you like 15 cheeky little brothers and sisters breaking your things? Obviously this could drive a person to desperate measures" (*Shocking Electricity* 175); "If I had seven siblings, I'd want to explode too" (*Wasted World* 11). Such remarks may be amusing to Western readers with small nuclear families, in a manner that is similar to the way in which abusing parents and teachers is considered funny, but they are no less than painful in a context where many readers will not have been allowed to have siblings, such as China before 2014.

Such differences, especially in this Chinese context, have proved to be so big that Nick Arnold decided to publish a book for a Chinese audience in 2013, which is only published in Chi-

nese. The book must be a product of a very close co-operation between Arnold and a Chinese translator, as Arnold himself has not mastered Chinese: he does not know what the book is called (2014, private communication). Here, the borderlines between translator and author become entirely blurred in order to achieve maximum audience engagement. However, it is clear that Arnold's original approach is still appealing to this entirely different cultural context, since he, as a British author, has been able to get this Chinese book project on its way. The three different Chinese translations (Simple, Traditional and Taiwanese) of his *Horrible Science* books support this idea, especially when taking into account the fact that more different Traditional Chinese titles are available on the Beijing-based Amazon competitor Dangdang.com than there are available on the website of the Dutch publisher. However, the fact that there is a separate Taiwanese edition also shows how much editing may have been done to make the books agree with different cultural contexts, the differences between which may not necessarily be linguistic.

The *Horrible Science* books prove how difficult it can be to translate affects into different languages because of their accompanying cultural contexts. They prove that much needs to be adapted in translations in order to evoke the same affects in these new readers, even though the scientific topics suggest universality. The books therefore prove not only that affects are indeed culturally specific, but also that science communication is strongly dependent on its linguistic and therefore cultural context. Linguistic differences can influence the perception of affects enough for the translators to have to re-write entire paragraphs in order to make the young readers experience similar affects in different languages. However, when this translating and rewriting has been done, it becomes clear that these affects *can* indeed be shared by a global young audience. The most important rhetorical choices concerning affects function in many languages, though they are more effective in some contexts than in others, e.g. the British versus the American situation. The premises on which the series has been built do not change, and as the Dutch translation proves, different translators can achieve the same affective connection with the readers. The wide range of *Horrible Science* translations proves that the extensive scope of the series creates an affectionate bond that is strong enough to overcome individual affective differences. Indeed, the *Horrible Science* books and the affects they intend to produce are almost unexpectedly translatable.

Conclusion

In this thesis I have attempted to delimit the definition of the concept of 'affect' through taking the *Horrible Science* series as a case study. My research discovered that even affects that are considered to be negative can be employed to evoke a positive affective bond with young readers, and how effective this can be in translation.

Popular science books for children are not merely written for entertainment. Alongside this function, they are also intended to inform, to educate, and even to inspire. Affect theory provides a theoretical basis that may be the most suitable for explaining the rhetorical strategies that underly this kind of writing. Unfortunately, affect theory is a very broad subject, with origins both in philosophy and in psychology that seem to emphasise entirely different characteristics. Therefore, my goal in this thesis had to be threefold: first of all, I needed to establish the essence of affect theory; secondly, I wanted to figure out what the implications were of a distinction between positive and negative affect and whether this distinction could be upheld at all times; and finally, whether it is possible to evoke the same affects cross-culturally through translations.

In my first chapter, I established the difference between emotions, affects, and affections. Though the psychological approach of Silvan Tomkins and the philosophical approach of Gilles Deleuze, based on Spinoza, seem to differ greatly in this respect, it turns out that both use similar concepts, although they employ different terms for them, and the threefold distinction can be found in both authors' works. Whereas emotions are personal, short-term states, affects are created through interaction with a person or object. Affects are the overarching frameworks of emotions. Affections are even more extensive frameworks, encompassing a range of human interactions. All three of these are important factors to consider in a rhetorical analysis of popular science writing, as they are all used in different ways to strengthen the audience's affiliation with the books.

The second chapter proved the difficulties of distinguishing between positive and negative affects, even though this is a key factor in many different affect theories. The kind of affect that is evoked by a certain rhetorical device strongly depends on the context. This again proves the importance of the affectionate network in devising a successful way to communicate science to children. What a child may loudly express to be fascinating in a group of peers – blood, excrement, violent deaths – may not be considered acceptable in a family setting, when contesting affects are more easily evoked. At the same time, negative affects are necessary for positive affects to be enjoyed more fully, and avoiding confrontation with all negative affects may in fact lead to increased frustration. Disgust is one affect that will strengthen the positive affective bond with children in particular.

Finally, I looked at the translatability of affects. Children need recognisable contextual references in order to strengthen their affective connections with the reading material. This leads to difficulties in translation, even if the culture of the target language is largely similar. It turns out that many experiences are dissimilar when the content is literally translated. Therefore, in the case of the *Horrible Science* series, the translators have taken great liberties in re-writing, adding, and removing information in order to evoke the same affects in readers in the target language as the original

books did in English. In cultures that are even less similar, this could lead to a situation of complete untranslatability, which in the case of *Horrible Science* has led to some books not being translated into all languages, and one book being written especially for a Chinese audience. There are limits to the translatability of affects, and it takes a lot of creative handling to use the same rhetorical devices in different cultural contexts.

Recommendations for further research

This thesis could only begin to tap into the possibilities of using affect theory in popular science writing. Further research can be done, first of all, further in-depth: the *Horrible Science* franchise has spawned a large range of spinoff products that invite children to interact with the material in different ways, other than reading followed by quizzes and experiments. It would be interesting to see how these different forms of interaction strengthen the affective bond: some offer simply more of the well-known affective experience, but others allow the children to physically interact in ways that are different from the original books. I also chose to refrain from including those books and sections that concern biology, but this topic certainly invites a separate analysis. Evolution is a particularly interesting case, not in the least because the very first *Horrible Science* book, *Evolve or Die* by Phil Gates, covered this topic. The way *Horrible Science* discusses evolution and Darwinism would in many cultural contexts be considered much more problematic or offensive than the other instances where negative affects are employed to create a positive effect.

Secondly, a cross-medial affective analysis of popular science for children may be useful: when telling people about my thesis topic, many suggested I should analyse TV series such as *Bill Nye the Science Guy* or *The Magic School Bus*. Such an analysis could also include the *Horrible Science* stage show (2010, 2013). How would a dynamic audiovisual, rather than a static and visual, presentation of the subject matter influence the way the affective bond with the reader is created?

Finally, a similar analysis may be extended to popular science for adults, to see to which extent a similar attitude toward science and toward negative affective responses is useful in writing for adults. Especially interesting in this regard would be the use of the disgusting and the gross in popular science books for adults.

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