Life in the Underground: The Portrayal of Invertebrates in Children’s Literature and Comics

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Abstract

Invertebrates represent a large portion of the world’s animal species, yet many are at risk of extinction (e.g. Dunn 2005, Wilson 1987). While invertebrates provide many valuable ecosystem services, studies often highlight that they are negatively perceived by the public and that they are often excluded from conservation strategies. Therefore, several authors call for the importance of rethinking our relationship with invertebrates, and with our environment in general.

This thesis focuses on one possible way in which attitudes towards invertebrates can be assessed and addressed: via literature or stories. I analysed 73 children’s books and comics on their portrayal of five groups of invertebrates: ants, beetles, spiders, wasps and worms. The results suggest that while stories portrayed invertebrates mostly positively (69.9%), portrayals were often ambiguous: positive stories were often not completely positive, while negative stories were often not completely negative. Invertebrates were often portrayed in a human context and were often highly anthropomorphic, embodying positive characteristics of humans, negative ones, or both. Points of ambiguities included the portrayal of invertebrates as “destructors”, for example by depicting them in graphic battle scenes (superhero comics). Other ambiguities were conflicting encounters between humans and invertebrates; portrayals that shifted from negative to positive (especially in children’s fiction); positive narratives that framed invertebrates as “creepy crawlies” in the titles (children’s non-fiction); and negative narratives that depicted invertebrates aesthetically in the images. Species preferences were notable too: beetles were most often positively portrayed, and wasps least often. Finally, comics were characterised by more overall negative portrayals than children’s fiction and non-fiction. As such, Lemelin’s (2013:153) notion that interactions between humans and insects are “fluid, complex, unsettling and rewarding” was supported by my analysis.
The results highlight several points that authors could take in consideration, if and when their aim is to create positive, yet truthful invertebrate narratives. I am one of such authors. For the creative component of the thesis, I created two narratives in comic book format, in which I portrayed positive relationships between humans and invertebrates. Similar to invertebrates, comics have long remained in the “underground” with regards to their lowly perceived critical and communicative values.

All in all, the goal of the thesis was threefold. It sought to 1) assess invertebrate portrayals in literature; 2) explore ways for creating better reputations for “creepy crawlies”; and 3) highlight comics as a useful science communication medium.
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# Table of Contents

Abstract .................................................................................................................. i
Acknowledgements ................................................................................................... iii
List of Figures ............................................................................................................. vii
List of Tables ............................................................................................................. viii

Chapter 1. Introduction ......................................................................................... 1
  1.1 Invertebrates and the Extinction Crisis......................................................... 1
      Public attitudes: surveys and studies ............................................................. 2
      Public attitudes: cultural indicators ............................................................... 4
      Implications of attitudes for conservation ................................................... 5
  1.2 Research Aims ............................................................................................. 7
      Conceptual underpinnings ............................................................................. 8
  1.3 Structural Overview of the Thesis ............................................................... 9

Chapter 2. Review of Invertebrates in Literature ............................................. 11
  2.1 Introduction ................................................................................................. 11
  2.2 Types of Studies .......................................................................................... 12
  2.3 Types of Portrayals ..................................................................................... 15
      Negative portrayals ...................................................................................... 15
      Positive portrayals ...................................................................................... 17
      Ambiguities in portrayals ........................................................................... 21
  2.4 Portrayal Types for Different Invertebrates ............................................. 22
      The literary spider ...................................................................................... 22
      The literary ant ......................................................................................... 24
      The literary beetle .................................................................................... 26
      The literary worm ..................................................................................... 27
      The literary wasp .................................................................................... 29
  2.5 Conclusions and Implications for Analysis ............................................. 29
Chapter 3. Analysis: Invertebrate Portrayals in Children’s Literature and Comics

3.1 Method

Selection of invertebrates
Selection of media and genres
Selection of stories

3.2 Results of Invertebrate Portrayals in Children’s Literature and Comics (Overall and Individually)

Overall results
Results per invertebrate

3.3 Results of Contributing Writing Techniques and Story Themes

3.3.1 Basic characteristics of invertebrate portrayals
Type of character
Type of environment
Type of reality
Perspective

3.3.2 Writing techniques and themes contributing to (partly) positive portrayals
Similarities and feelings
Inherent value
Metanarratives and addressing the reader
Text-image interactions
Other

3.3.3 Writing techniques and themes contributing to (partly) negative portrayals
Interactions with environment (human and non-human)
Text-image interactions
Transitions in human encounters and feelings
First impressions

3.4 Results per Genre or Medium

3.5 Conclusions
Chapter 4. Discussion

4.1 Fluidity and Complexity
Attitudes vs. portrayals; analysis vs. literature review

4.2 Recommendations for Narratives

4.3 Recommendation 1. First Impressions (Title and Cover)

4.4 Recommendation 2. Content of Narratives

4.4.1 Similarities and feelings
Aesthetics
Symbols
Otherworldliness and wonder
Other anthropomorphisms
Examples of relevant analogies

4.4.2 Ecosystem interactions

4.4.3 Human-invertebrate encounters
Examples of relevant encounters

4.4.4 Positive spins and transitions

4.4.5 Metanarratives and addressing the reader directly

4.4.6 Inherent value

4.5 Recommendation 3. Medium
Comics

4.6 Creative Component

Chapter 5. Conclusions

Bibliography

Appendices
Appendix 1. Analysed Stories
Appendix 2. Analysis Sheet and Definitions
Appendix 3. Results: Raw Data
Appendix 4. [CD-ROM] Results: Quantitative and Qualitative Analysis per Story

Creative Component: Shadow Costume / An Undercover Romance
Candy House [CD-ROM]
List of Figures

Fig. 1. Occurrences of portrayal types in children’s literature and comics………40
Fig. 2. Percentages ambiguous and unambiguous portrayals…………………….42
Fig. 3. Occurrences of portrayal types per invertebrate………………………43
Fig. 4. Total positive and negative portrayals per invertebrate…………………43
Fig. 5. Percentage of total negative portrayals per invertebrate………………..44
Fig. 6. Portrayed invertebrate hierarchies within stories…………………….45
Fig. 7. Type of character (writing technique 1)………………………………….47
Fig. 8. Type of environment (writing technique 2)……………………………..48
Fig. 9. Type of reality (writing technique 3)………………………………………52
Fig. 10. Perspective (writing technique 4)……………………………………….53
Fig. 11. Occurrences of themes…………………………………………………54
Fig. 12. Occurrences of portrayal types per theme…………………………….55
Fig. 13. Positive feelings per invertebrate (theme 3)…………………………57
Fig. 14. Positive portrayals in ambiguously positive and ambiguously negative
  stories………………………………………………………………………..57
Fig. 15. Mixed messages in ambiguously positive and ambiguously negative
  stories………………………………………………………………………58
Fig. 16. Negative portrayals in ambiguously positive and ambiguously negative
  stories………………………………………………………………………67
Fig. 17. Transition portrayals in in ambiguously positive and ambiguously negative
  stories……………………………………………………………………….68
Fig. 18. Percentage of total negative portrayals per medium/genre…………….69
Fig. 19. Occurrences of portrayal types per medium/genre……………………70
List of Tables

Table 1. Occurrences of portrayal types in children’s literature and comics........40
Table 2. Ambiguous and unambiguous portrayals.......................................42
Table 3. Total positive and negative portrayals per medium/genre...............70

Table in Appendix 2

Table 1. Analysis sheet............................................................................142

Tables in Appendix 3

Table 1. Total stories (= 73)......................................................................151
Table 2. Wasps (Total = 14).................................................................152
Table 3. Spiders (Total = 18).................................................................153
Table 4. Beetles (Total = 13).................................................................154
Table 5. Worms (Total = 15).................................................................155
Table 6. Ants (Total = 13).................................................................156
Table 7. Comics (Total = 23).................................................................157
Table 8. Fiction (Total = 35).................................................................158
Table 9. Non-Fiction (Total = 15)...........................................................159
Table 10. Ambiguous portrayals: positive.............................................160
Table 11. Ambiguous portrayals: negative.............................................160
Chapter 1. Introduction

1.1 Invertebrates and the Extinction Crisis

The faunal group of invertebrates represents the largest percentage of the world’s animal species, especially arthropods (Wilson 1992). Yet several human activities, such as monocultural and intensive agriculture and forest clearing, result in reduced soil biodiversity (Birkhofer et al. 2008, Thiele-Bruhn et al. 2012); and put a lot of invertebrate species at risk or drive them into extinction, as part of the great mass extinction (e.g. Dunn 2005, Jackson 2008, McDaniel & Borton 2002, McKinney 2002, MEA 2005, IUCN 2014). Invertebrates provide many valuable ecosystem services (e.g. Del Toro, Ribbons & Pelini 2012, Lavelle et al. 2006, Losey & Vaughan 2006, Waldbauer 2003, Wilson 1987), yet their values remain often unappreciated, especially in Western countries (e.g. Kellert 1993, Davey 1994).

While there are reasons to perceive some invertebrates negatively, as some destroy crops, spread disease, sting, bite and itch (e.g. Beisel, Kelly & Tousignant 2013), many invertebrates are harmless or beneficial to us; some fears thus appear to be less overtly rational (e.g. Davey et al. 1998). For example, insects such as flies, wasps, beetles, butterflies, moths and bees are crucial for pollination of plants (Buchmann & Nabhan 1996); several insects also help plant reproduction by dispersing their seeds (Hölldobler & Wilson 1990) or help plants by providing protection or defense (Waldbauer 2003). Many invertebrates recycle dead animals, plants and dung (David 2014, Nichols et al. 2008, Slade & Riutta 2012, Hanski 1987), aiding in improving soil conditions including aeration, drainage and nutrient recycling and availability for plants

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1 In this thesis I am mostly concerned with arthropods, such as insects and spiders, as well as soil invertebrates like earthworms, nematodes, slugs, and snails: invertebrates that we are likely (but not restricted) to encounter in our gardens and houses. In Japanese, the word “mushi” grasps the essence of all these creatures at once. It means “small crawling animal”, and in the broadest sense of the word it can also include creatures like earthworms (Berenbaum 1995:325).
(e.g. Birkhofer et al. 2008, Bottinelli 2015, Lavelle et al. 2006, Feller et al. 2003); while some invertebrates also aid in limiting “weed” populations (Coulson & Witter 1984, Jolivet 1998, Lake et al. 2011), or help controlling invertebrate “pest” populations or parasites (Hajek 2004, Lavelle et al. 2004). As such, invertebrates both control and nourish populations by eating and being eaten by animals, plants and even humans (e.g. DeFoliart 2009, Ramos-Elorduy 1997). As Clark (2013a:33) and Wilson (1987:345) point out, we are far more dependent on them than they are on us. Therefore, several authors stress the importance of conserving invertebrates during the extinction crisis (e.g. Dunn 2005, Kellert 1993, Thomas et al. 2004, Wilson 1987).

Public attitudes: surveys and studies

Kellert's (1993) study is often regarded the “definitive” study on (Western) perceptions towards invertebrates (Lockwood 2013a:165). The results of his survey pointed towards a dominance of negativistic attitudes, and limited public knowledge about invertebrates. Other studies suggest similar negative trends, contrasting attitudes in non-Western countries in which invertebrates are often perceived according to a multitude of positive values; from food, to medicine, to stories in myths and legends (e.g. Hogue 1987, Lauck 1998, Ramos-Elorduy 1997).

For example, Byrne et al.’s (1984) survey suggested that 88% of 1117 households in Arizona disliked indoor arthropods, and Hahn & Ascerno’s (1991) survey suggested that 85.9% of 447 home dwellers in Minnesota disliked indoor arthropods while often being more tolerant towards outdoor arthropods. Prokop et al. (2010) and Davey (1994) highlight negativistic perceptions towards spiders specifically; and Wagler & Wagler (2012) and (2013) found that external morphology of an insect as well as knowledge of

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2 I elaborate on this study below and in Chapter 4.
arthropod carnivory and herbivory can negatively affect American preservice elementary teacher’s attitudes, including the likelihood that they will incorporate them into future science education settings.

Entomologists Coulson & Witter (1984) noted common responses towards encounters with insects in nature, many of which were negative, including the “Dead insect syndrome”, the almost automatic inclination to kill insects; and the “Perfect leaf syndrome”, the concern about leaf-feeding damage (1984:623-624).

Attitudes among children are addressed in Barrow’s (2002) study, suggesting that American elementary students had more knowledge about the harmful effects of insects than their helpful effects. Low awareness is also articulated by Snaddon & Turner (2007), which suggested that children in the United Kingdom knew more about groups of insects represented in popular culture, rather than local insects; and by Strommen’s (1995) study on American children who rarely included insects on their drawings of forest ecosystems.

Several studies also articulate species preferences. For example, Bjerke & Østdahl’s (2004) study suggested that in a Norwegian city, the butterfly was liked, the grasshopper was “neutral” and many other invertebrates were disliked. Similarly, Kellert (1993) noted that invertebrates with well-known utilitarian values (honeybees) or aesthetic values (butterflies) were generally positively perceived, contrasting the perceptions of other invertebrates; and Gerdes, Uhl & Alpers (2009) suggested that spiders evoked significantly more fear and disgust than bees/wasps, butterflies/moths and beetles. Even Japan, a nation known for its tolerance of insects or “mushi” (Hogue 1987), species preferences become apparent via the popularity of some species, like rhinoceros beetles, stag beetles and fireflies, rather than others (Hoshina & Takada 2012, Takada 2011).
Public attitudes: cultural indicators

Besides surveys and studies, other cultural sources further articulate species preferences and the ubiquity of negative perceptions in the Western world. For example, many components in English language highlight fears, disgust or annoyance related to invertebrates in general, and some species in particular.

Figuratively speaking, an insect refers contemptuously to persons as insignificant, despicable, or annoying (OED 2014a); while an invertebrate denotes a “man without strength of character or principles”; someone who lacks a moral “backbone” (OED 2014b). With regards to specific invertebrates, a beetle can refer to an “intellectually blind person” (OED 2014c); wasp can be applied to persons “characterized by irascibility and persistent petty malignity” (OED 2014d), and worm is “figuratively applied to miserable or grovelling creatures” (Rockwood 2009:1442). Also, several spider-inspired phrases or idioms portray spiders negatively, such as “Spider-and-fly”, which is described as a “Destroyer and victim relationship; ensnarer and ensnared” and even to “Spin a web” is described as to “Practice an intricate and involved deception” (Wilkinson 2013:236). Finally, ant-phrases like “to have ants in one’s pants” have negative associations, such as “to fidget constantly; to be restlessly impatient or eager” (OED 2014e). Phrases like these can be set in contrast with more positive phrases like “busy as a bee” and “social butterfly” (Hogue 1987:184).

More informally, cultural observations noted in The Encyclopedia of Phobias, Fears and Anxieties (Ronald & Kahn 1989) are telling, too. The fear of worms (vermiphobia) “may be related to a fear of slimy things, slime, or of other small creatures that thrive in the water or ground, such as frogs, toads, and lizards” (Ronald & Kahn 1989:429). This notion is much in line with Feller et al.’s (2003) comments on the
lingering perceptions of earthworms being unpleasantly slimy, ugly, blind, deaf, and senseless animals, of little use except for fish-bait, and a general nuisance because of their “unsightly” surface castings.

Similarly, the fear of wasps (sheksophobia) is often related to fear of “stings, pain, bees, or flying insects in general (Ronald & Kahn 1989:429), and the fear of ants (myrmecophobia) may also apply to other tiny insects. “Some individuals who have fears of dirt or contamination may also fear the presence of ants near food or in kitchens” (Ronald & Kahn 1989:43). This is further articulated by a simple Google search of “ants”, of which the second “hit” links to a website on the eradication of household ants. Finally, arachnophobia is arguably the most widespread fear, and refers to the irrational fear of spiders (e.g. Gerdes, Uhl & Alpers 2009, OED 2014f, Prokop et al. 2010).

Implications of attitudes for conservation

Despite many indicators of negativism, Kellert (1993) noted that different perceptions prevail among different groups of people within Western societies. In his study, scientists and members of conservation organisations had more positive attitudes compared to the general public and farmers, yet the attitudes of members of conservation organisations were not as positive as scientists’ attitudes. These results may remind one of the valid point that attitudes and conservation strategies are closely intertwined. As Lemelin (2013) points out, in line with e.g. Clark & May (2002) and Leather (2009):

“Since people care about what they know, conservation and protection strategies have been enacted to protect and enhance the well-being of charismatic mega-fauna (…), the results from this taxonomic bias (…) are that numerous insects are excluded from conservation strategies, research
and management approaches. After a while, this exclusion or absence becomes accepted as a norm. In the case of insects, this absence (...) has helped to reinforce stereotypes and certain prejudices” (2013:155).

Even in the sciences, research into and acknowledgement of soil invertebrates as an important part of soil science is relatively recent: in much of the 19th and 20th centuries soil science and agriculture were dominated by chemistry, soil fertility and management paradigms, much overlooking the roles of invertebrates like earthworms (Feller et al. 2003, Lavelle et al. 2006). Lavelle et al. (2006) highlight that when “conventional agricultural scientists” do pay attention to invertebrates, it is often in relation to them being parasites or pests (Lavelle 2006:S3, S11). As a result, many specific functions and interactions of invertebrates are still unknown; and some soil scientists still do not consider their influence on soil structure (Bottinelli et al. 2015).

Speciesism is often pointed out as a main reason for such biases (Lemelin 2013). In Chan’s (2012) words:

“We are naturally attracted to those that are similar to us and similarities have long been known to enhance empathy between humans, and between humans and animals” (2012:1890).

Invertebrates are often considered to be radically different from us, and this, additional to “danger” (e.g. Davey 1994), may be important in contributing to negative perceptions: a fear of the unknown (e.g. Kellert 1993).

Various authors point at the relevance of rethinking our relationship with invertebrates, and our environment in general (e.g. Bertoni 2013, Last 2014, Rautio
Reducing fear and disgust of the spineless kingdom and creating a better reputation for these “creepy crawlies” is motivated by conservation, ecology, human welfare and biodiversity arguments (e.g. Kellert 1993, Wagler & Wagler 2014); yet Lockwood (2013a) and Clark (2013a) also point at seemingly contrasting motivations. When one is not concerned with specific species, but with invertebrates in general, it becomes clear that invertebrates occupy the planet in huge numbers: they have been here for much longer than us, they may well outlive us, and they have shown time and time again that they are very hard for us to control (Clark 2013a). As such, rather than fighting “wars” against “bugs”, it would be good for all of us if we became more accepting of and comfortable with our inevitable co-existence (Lockwood 2013a).

1.2 Research Aims

In this thesis, I look more closely at the issue of invertebrates’ reputations. I provide a window into this topic by focussing on portrayals of them in literary media. I analyse the portrayal of five groups of invertebrates in children’s literature and comics. These are the ants, beetles, spiders, wasps and worms, that, as articulated above, are at least some of the time associated with negative perceptions. Based on quantitative and qualitative components of the analysis, I assess and address attitudes via the following questions. 1) How are invertebrates portrayed in children’s literature and comics? And 2) what recommendations for future stories do these portrayals highlight?

While I do not deny the realism of existing negative encounters with invertebrates, several of the above mentioned studies articulate that people are often very familiar with negative encounters, yet may be less familiar with positive encounters (e.g. Barrow 2002). As such, an insight into invertebrate portrayals may be relevant for assessing to what extent stories overlap with described attitudes, and where potential focus points lie
for authors who aim to create a better reputation for invertebrates. The analysis aims to highlight both successes and points for possible improvements.

Moreover, while I do not make any claims that there is “one right way” to approach the issue, I scope and apply recommendations in my own invertebrate stories in comic book format: the creative component of this thesis. As such, an additional goal of the thesis is to highlight an often-underappreciated medium relevant for science communication: the medium of the comic book (Tatalovic 2009).

Conceptual underpinnings

An underlying assumption of the thesis is that literature can give an indication of attitudes, as well as influence attitudes, in line with several studies (e.g. Matthews, Flage & Matthews (1997), Mobley, Vagias & DeWard 2010, Wells & Zeece 2007, Williams, Jr. et al. 2012). Naturally, there are several media or platforms in which people’s attitudes may be influenced; literary media being some of them.

Moreover, an important starting point of the analysis concerns a reassessment of what we currently know about public perceptions of invertebrates. Lemelin (2013) highlights that many studies on human-insect interactions tend to support positive-negative dichotomies, and within these dichotomies, the negative perceptions have mostly been emphasised. As such, Lemelin (2013:155) points out, variables and inconsistencies of interactions between humans and invertebrates are often overlooked, including socio-cultural variations, spatial inconsistencies (where do we encounter them?), and variations with inter and intra species/order (do we like some better than others?). This insight is in line with Norton’s (2000) recommendation that we should consider the nuances and inconsistencies of human values of nature. Lemelin (2013:153) argues that human-insect interactions are “fluid, complex, unsettling and rewarding”. Similarly, Beisel et al.
highlight the wide-ranging capacities of insects to “connect and carry, inscribe and destabilize, disgust and inspire”.

In this thesis, I argue that considering such variables and inconsistencies may inform relevant insights for science communicators who aim to create a better reputation for invertebrates. Inconsistencies may articulate moments in which invertebrates are already viewed more positively, even when overall perceptions are negative; and vice versa. This knowledge could be used to one’s advantage when creating narratives.

Therefore, in the analysis I keep an eye out for inconsistencies and variables in portrayals. I analyse writing techniques and story themes used in narratives, and how they influence portrayal of both specific species/orders and invertebrates in general. While the results are focussed on children’s literature and comics, the discussion of writing techniques and themes sparked by the results may also have implications for narratives in other literary media.

1.3 Structural Overview of the Thesis

In Chapter 2, I explore how invertebrates have been portrayed in literature from historical times until today, across various literary media and genres: from ancient epic poems, to nursery rhymes, to “classic” prose. I also discuss the types of studies that have been conducted on invertebrates in literature. As such, these reviews inform hypotheses for invertebrate portrayal in comics and children’s literature; provide points of comparison, and also inform insights into a type of analysis that may contribute to new knowledge.

Chapter 3 consists of the method of the analysis and the results, addressing the question of how invertebrates are portrayed in children’s literature and comics. In Chapter 4, I discuss various implications of the results, addressing the question of what recommendations for future stories the results highlight. I explore to what extent public
attitudes overlap with the portrayal of invertebrates in literature, and give recommendations for writing techniques and story themes that, based on the analysis and supporting studies, may enhance more positive yet truthful portrayals in future narratives. Finally, the discussion is relevant to the creative component of the thesis, since I explore communicative and educational benefits of comics, and apply some of the recommendations in my own invertebrate stories in comic book format.

In Chapter 5, I give conclusions and summarise the recommendations into a list that may serve as a reference tool for future science communicators or authors who are concerned with portraying invertebrates and their reputations.

In summary, my goal in this thesis is threefold. Not only does the thesis assess invertebrate portrayals in literature and highlight recommendations for positive narratives; it also seeks to create awareness for the potential of comic books as a useful medium for science communicators. Arguably, this medium is in need of tolerance by the academic field of science communication, just as much as invertebrates are in need of tolerance by the public.
Chapter 2. Review of Invertebrates in Literature

Surely these little creatures, so numerous in our own country, abound in the Land of Literature.

Immediately I decided to go in search of them.

I equipped myself with all the paraphernalia of the entomologist. As a miniature collecting kit I purchased a little notebook. For nets I secured many kinds of concordances. Some of these nets were of such coarse mesh that they would contain only the larger insects, allowing the smaller to slip through unnoted. Others were of fine, closely woven fabric, but the entrapped insects cleverly camouflaged themselves under pseudonyms and were thrown out as worthless.

My field glasses were powerful books of quotations. Standing upon some vantage ground, I could look through these glasses and sight the insects hovering over great stretches of territory.

- Quote from “Insects in English poetry”, by Pearl Faulkner (1931)

2.1 Introduction

In this chapter I review studies on literary invertebrates. I focus on Western literature that has been written in or translated into English: while I mention ancient and medieval literature, the main focus is on literature from the 19th century until today.

The review provides a background from which hypotheses for invertebrate portrayals in the analysis can be developed. It also aims to highlight the types of studies conducted in this field, informing the method of my own analysis. As such, this chapter includes initial explorations of portrayal patterns, including potential species preferences, characteristic story themes, and possible characteristics for different literary media and genres. The findings, in turn, may be compared to public attitudes towards invertebrates

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3 I refer in this thesis to “literary” invertebrates. The word “literary” has connotations of being “refined” or “elegant”. While I acknowledge these connotations, “literary invertebrate” is here solely a way of referring to “invertebrates in literature” in a quick subject-form, to retain ease of readability and simplicity of sentences.
(as mentioned in Chapter 1), articulating possible relationships between portrayals and attitudes (discussed in Chapter 4).

I start with a review on types of studies, followed by reviews of portrayal types, including portrayals of the five analysed groups of invertebrates. I conclude with a summary and implications for my analysis, including the method and hypotheses.

2.2. Types of studies

Studies on literary invertebrates are found in the academic fields of literary criticism, cultural entomology and human-animal studies. Studies cover a wide range of topics, and touch occasionally upon occurrences of positive versus negative portrayals. Yet few studies touch upon science communication implications: the possible relations of public attitudes towards invertebrates and their portrayal in literature.

Not all authors support the cultural relevance of invertebrates. For example, Rowland (1973) apologises for his inclusion of ants in his historical study on animals in (literary) symbolism:

“And I confess for including one insect, which should not be here at all, merely for the fun of it” (1973:viii).

However, invertebrates have featured in literature since ancient times, as becomes clear from various reviews in cultural entomology. Brown (2006) notes that:

“insects have repeatedly been fusion points for the worlds of science and letters: a number of entomologists have been celebrated for their literature (Jean-Henry Fabre, Howard Ensign Evans, Edward O. Wilson), while a
number of writers (Maurice Maeterlinck, Franz Kafka, Virginia Woolf, A.
S. Byatt [and Vladimir Nabokov] have cross-pollinated the entomological
and literary fields” (2006:x).

Moreover, entomologist May Berenbaum (2006) writes that:

“Insect references abound in prose and poetry irrespective of class or
status – writers of all descriptions, from the greatest literary geniuses to
the most obscure hacks, have relied on the insect world to make a point,
elicit an emotion or evoke a memory” (2006:3).

She highlights that “proportionately speaking, relatively few poems, novels or plays are
exclusively about insects” (my italics), yet they appear in a variety of guises and “span the
continuum from Petronius to Pearl Jam. It’s unlikely that any other class of organisms
creeps so relentlessly into the written pantheon” (2006:3).

Other reviews in cultural entomology include Hogue’s (1987) study on novels and
short stories on (English) literary insects, Faulkner’s (1931) overview of insects in
English poetry; Bauer’s (2013) bibliography of fictional works published/produced in the
United States between 1950 and 2012 including insects as main characters; Marcovitch’s
(1949) short review on insects in literature, poetry, and language; Berenbaum’s chapter
“Insects in Symbolism” in her book Bugs in the System (1995); Dunn’s (1990)
quantitative reference book Buggy Books, mainly on “bugs” in children’s non-fiction; and
Bruce’s (1958) overview of insect and arthropod references in the Bible.4 Finally,
invertebrates in comics are mostly informally reviewed on websites like

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4 Some of these studies were published before Charles Hogue officially coined term “cultural entomology”
in 1987.
www.comicvine.com and www.tvtropes.org. Many of these studies highlight the diversity with which invertebrates have been portrayed; yet few studies have counted portrayals quantitatively.

With regards to science communication, I found two studies that touch upon the potential of narratives to (positively) influence attitudes, despite not being embedded in this academic field. Environmental educator Joanne Lauck (1998) reviews insect narratives mainly from non-Western, traditional and oral cultures (yet also several Western ones), highlighting that awareness of positive narratives may inspire more positive appreciations of insects. Similarly, Dodd’s (2008) PhD thesis on insects and anthropomorphism in popular culture (including 19th century popular entomology books), discusses ways to “alleviate psychological barriers to ecological realities” (Dodd 2008:229). Dodd shines a light on this issue by highlighting a particular type of insect portrayal: the otherworldly portrayals.

Most studies on literary invertebrates, it appears, can be found in the field of literary criticism. Some of such studies include invertebrates incidentally: they are focussed on a particular work that happens to portray invertebrates, rather than that the “literary invertebrate” itself is under investigation. Alternatively, studies investigate the use of insect imagery in prose or poetry qualitatively (e.g. Barr’s (1999) study on insects as “emblems of affection” and Spasova’s (2008) study on insects and revolution in 20th century Russian literature); or touch upon invertebrate portrayal and symbolism amongst discussions of portrayals of other animals (e.g. Carroll 1954, Lewis 1996).

All in all, it seems that qualitative and theoretical studies on literary invertebrates are most common. Quantitative studies that count and analyse occurrences of positive and

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5 She also puts forward some less “rational” theories on human-insect connections: Lockwood (2013a:157) calls her a “New Age mystic”. In this thesis, I cite her with regards to her reviews of insect portrayals in literature, rather than her potentially “irrational” theories.

6 I come back to this study in Chapter 4.
negative portrayals of invertebrates in literature, as well as discussions from a science communication perspective, are limited.

2.3 Types of portrayals

When existing studies on literary invertebrates are combined, different portrayal patterns are notable.

**Negative portrayals**

Hogue (1987:182) notes that insects in English novels and short stories are “useful for establishing a variety of moods or images, both negative (more usual) or favorable”. This is one of the few studies that clearly articulates the dominance of one type of portrayal over another. Examples of negative portrayals include an emphasis on dangerous qualities of insects, like their poisonous stings (*The Furies* by K. Roberts), their potential to haunt us (R. Marsh’s gothic novel *The Beetle: A Mystery* (1897), their rapaciousness (*Bugged* by D. Glut), and swarming instinct (*The Swarm* by A. Hertzog) (Hogue 1987:182).

Similarly, Lauck (1998) notes several Western stories of fear and disgust: T. S. Eliot’s short story “The Cocktail Party” includes dangerously swarming ants; the ants in William Patrick’s novel *Spirals* carry viruses; Charles Garofalo’s short story “Itching for Action” includes fleas that take revenge on a man who poisons cats and dogs; and the narrator of the short story “Caterpillars” (E. F. Benson) “encounters a pyramid of immense luminous caterpillars, each a foot or more in length with rows of crab-like pincers and gaping mouths without faces” (1998:36).

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7 G. J. Umphrey & C. L. Hogue also collected a list of insects in “modern” English novels and stories, but this has remained unpublished (Hogue 1987).
Negative portrayals occur in diverse genres. For example, William Blake’s poem “The Sick Rose” (1794) refers to an “invisible worm” who literally destroys the rose, which is noted to have various (negative) symbolical meanings (e.g. Kawasaki 1995). An example of a popular non-fiction book on encounters between humans and invertebrates of the “creepy crawly” type is Amy Stewart’s (2011) *Wicked bugs: the louse that conquered Napoleon's army & other diabolical insects*. Hogue (1987) notes that the genre in which negative portrayals culminates is science fiction. In this genre, insects are either monsters from earth or from other worlds or planets. Examples include *Bugs* (T. Roszak), and *Bug Wars* (R. Asprin). “Alien” characteristics of insects like “antennae, bulbous and faceted eyes, articulated bodies, armored exterior, and biting mouthparts” made them suitable for such portrayals (Hogue 1987:186). Von Koppenfels (1992) too, notes these characteristics in relation to intimidating, monstrous depictions.

An example of monstrous alien portrayals in comics is the trope called “The Worm That Walks”: a monster whose body consists of worms or other invertebrates clung together (TV Tropes 2014). Examples include the villain “Horde” in *Savage Dragon* (Comic Vine 2014a); and the killing human-alien who is made up of a colony of ants in the comic *Daniel X: Alien Hunter* (TV Tropes 2014).

Finally, some negative portrayals are slightly more nuanced and reflective. For example, MacInnes’ (2012) suggests that invertebrate portrayal in Renaissance literature mainly served to signify the uncomfortable blurring of lines between life and death. Along similar, more subtle lines, are the destructive “tent worms” in Tennessee Williams’s fiction “Tent Worms” (1980), portrayed as garden pests; yet, as Kolin (2006) points out they also serve various symbolic roles, such as projecting the psyche of Clara, one of the main human characters.
“The ‘grey canopy’ the worms spin around the stunted trees may be analogous, symbolically speaking, to the curtain that falls on Clara’s marriage. Imagery of webs, tissue, smoke and vapors further suggest the depletion, corruption, and closure, of feelings in her marriage” (2006).

Positive portrayals

Berenbaum (2006:6), too, acknowledges the diversity of feelings insects may evoke. While many “evoke frightening, dark, weird and creepy sensations, (…) there are even species whose activities bring to mind love, romance, and even occasionally raw passion or naked lust”.

Positive portrayal culminates in popular and likeable insect-characters, such as the “musician” Jiminy Cricket in *Pinocchio*, or the intelligent cockroach Archy in the newspaper series *Archy and Mehitabel* by Don Marquis (Hogue 1987). Hogue notes:

“As teachers, humanized insects are common in children’s literature (…), often because they provide an amiable, impartial narrator or actor within which the child can identify” (Hogue 1987:183).

He characterizes the spider character in *Charlottes Web* (E. B. White), as having a “cute, rotund form” that “speaks a message of friendliness and good humor”. Insects such as “little round beetles, bumblebees, [and] woolly caterpillars” (1987:183) are her friends, rather than her prey. Hogue (2009) notes that the “essence of insects in literary humor typically involves the superimposition of insects into aspects of human behaviour. The depiction of insects engaged in human activities is a common avenue of insect
humor. This is particularly true of the role of insects in comic strips and cartoons, such as *The Far Side* cartoons by Gary Larson. In other works, factual entomological information is cleverly presented in a humorous format. Such essays serve to popularize insects and their study, to educate, and, of most relevance here, to entertain” (2009:242).

An example of a book that articulates the “romance” sparked by insects for various authors over time is Hoyt & Schultz’s (1999) compilation *Insect Lives: Stories of Mystery and Romance from a Hidden World*. This work is a collection of insect-related texts in literature, popular culture and science. Several of these texts exclaim “odes” to various insects, and articulate the delight and fascination they have brought to their observers: from Alfred Russel Wallace’s travel account “So Great the Excitement” to British poet William Cowper’s “Ode to the Cricket”. Similarly, Barr’s (1999) study highlights insects as “emblems of affection” or desire in the poems of Elizabeth Bishop. Faulkner (1931), too, established several recurring themes for insects in poetry, such as metamorphosis, plague, minuteness, colour, motion, sleep, the lover; most of them referring to positive portrayals.

Related to this endearing appreciation of insects is Berenbaum’s (2006:9) remark that the insect’s small size has evoked its vulnerability to the “vicissitudes of life”, like expressed in the poem “The Fly” by William Blake (1794). When it comes to the association of insects and sex, Berenbaum reasons that this could be a consequence of their “procreative powers” or the frequency with which we can observe them mating, as well as their important role as “entremetteurs in the sex lives of plants” (2006:6).

Other recurring themes are creation myths, which especially occur in preliterate cultures (Berenbaum 1995). Berenbaum notes that there may be “an innate recognition of
the relative evolutionary age of organisms” (1995:317), referring to the ancient origins of insects.

A theme perhaps less commonly found is the theme of entomophagy or insect eating, although Gordon (2006) notes that this theme is especially abundant in children’s literature in relation to humour and disgust. An example of (adult) poetry in this theme is Mary Oliver’s poem “The Honey Tree” in which the eating of bees “is part of her ecstatic consumption of nature” (Gordon 2006:348).

Arguably one of the most famous insect themes draws specific analogies between insect biology and human lives: metamorphosis. A famous example is Ovid’s epic poem “Metamorphoses”, and Dante’s retelling in the second book of his Divine Comedy, including the half-human, half-spider Arachne. In Ovid’s epic poem, goddess Athena and Arachne (who is sometimes described as a princess) have a weaving competition. Athena tears Arachne’s web apart, and this causes Arachne much grief; she hangs herself and Athena transforms her into a spider (De Vos 1985:186).

Metamorphosis or Die Verwandlung (1915) by Franz Kafka, too, plays in on this theme. The insect into which character Gregor Samsa metamorphoses, is met with disgust by his family. However, as Leadbeater (1986) notes, despite the mostly negative portrayal of the insect in this book, the narrative still allows for an element of hope. Gregor’s sister Grete is the only one who still cares for Gregor after his metamorphosis, and the story ends with “the recognition that from dark conflict something new, something positive, something associated with life, not death, has emerged” (1986:177).

Other examples include novels and short stories by A.S. Byatt that have insect references and of which metamorphosis is a common theme (Alban 2010). It can even be pointed out that the “metamorphosis” in general has become a widely applicable literary technique, which is articulated in studies like Wilson (1996) and Mikkonen (1999).
metamorphosis. According to Quammen (1984) (as cited in Kellert 1993:848), in ancient Rome and Greece they were considered delicate enough to suggest a “pure being, freed of the carnal envelope. Both were known to perform a magical metamorphosis”. As such, an insect-characteristic has become a significant metaphor for human developments and change, and is sometimes even associated with magic.

Finally, analogies between human societies and social insect societies are recurring themes. Social insects either reflect man or pose an example to mankind. In Hogue’s (1987) words:

“Parallels between human and insect societies provide a foundation for interplay between two life forms” (1987:183)

While analogies may result in positive portrayals, they do not always do so. For example, while honeybees have often been praised for their organized societies in which each individual knows its place (e.g. Carroll 1954), there are also examples in which the beehive is an example of corruption and luxury. In “The Fable of the Bees” (1723) by Bernard Mandeville, bee societies inspired a “political satire against governmental hypocrisy in 18th century England” (Hogue 1987:183). In turn, John Gay’s poem “Degenerate Bees” (1738) could be seen as a reaction to this fable. First, the bee society is described as greedy and full of luxury, arrogance and vanity. But there is hope. One drone detaches himself from hive and starts a new society (Lewis 1996). Such ambiguities lead me to the next section.
Ambiguities in portrayals

As becomes clear from some of the above-mentioned examples, narratives do not always portray invertebrates consistently as positive or negative; insect-themes can be interpreted differently; and authors may portray different, or even the same, species differently (e.g. differences between the fly and the worm in the above-mentioned poems by William Blake). Matthews, Flage & Matthews (1997) note that:

“Some arthropods generally evoke good will; others are generally regarded as repulsive. Popular literature and films feed our biases. On the one hand we have the fictionalized charisma and charm of spider Charlotte and her web (...), on the other, “killer bees” (...)” (1997:270).

On a similar note, preferences are visible through the absence of certain invertebrates in cultural expressions and studies, in favour of the presence of others (e.g. Takada 2011). Dunn’s (1990) reference book Buggy Books articulates that some insects feature more often in books than others. Particularly butterflies feature often; bees feature more often than wasps, and only a small number of beetle-books are noted. Similarly, Faulkner’s (1931) study also articulates an abundance of butterfly-related poetry. As mentioned (Chapter 1) the aesthetic appeal of butterflies can be seen as a reason for their popularity; while the popularity of honeybees relates to their usefulness to humans (e.g. Kellert 1993).

Species preferences are also notable in what is arguably the most famous piece of literature, the Bible. For example, entomophagy is endorsed, but only for certain winged insects: other insects should be despised (Bruce 1958).
Moreover, other noted ambiguities are stories in which the portrayal shifts from negative to positive. For example, stories in which a character starts off disliking cockroaches, yet finds a personal affinity later, are written by authors from various cultures (e.g. Australian story *The Cockroach that Wrote a Symphony* by Trevor Todd (1979), Chinese story *Cockroach* by Yichang Liu (1995)). In the American story “The Roaches” (T. M. Disch), the female character Marcia is at first repelled by cockroaches, but then finds that she can control them, and as such comes to love them (Lauck 1998:7); and in William H. Gass’s (American) short story “Order of Insects”:

> “the main characters moves from being repulsed by cockroaches to curiosity, sympathy, and finally a kind of passionate obsession” (Gervais 2006 in Lockwood 2013a:157).

### 2.4 Portrayal Types for Different Invertebrates

*The literary spider*

Out of the five invertebrates selected for the analysis, the spider is probably the most often examined invertebrate in literature, (oral) folktales, legends and mythology (e.g. Barzilai 1997, Bloomberg 2001, Burns 2008, Dundas 1987, Hillyard 1999, Link 1995, Meadows 1990). The Oxford English Dictionary (2014) summarizes the diversity of spider portrayal succinctly:

> “The cunning, skill, and industry of the spider, as well as its power of secreting or emitting poison, are frequently alluded to in literature“ (2014g).

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9 I call these “transition” stories in the analysis.
The various connotations of spiders have made it difficult to define this arthropod “in terms of its cultural meanings” (McKechnie 2012:508). For example, Meadows (1990) analysed spider symbolism in French literature in which spider webs are symbols for traps and an unavoidable fate, but also connote a positive web of thought, symbolising creativity. Johnson (1994) notes (as cited in Bloomberg 2001:2) that:

“The word spider comes from the Old English spinan, meaning ‘to spin.’
The modern word spinster, unwed woman, arises from the ancient idea
that the spinners of fate were virgin goddesses who spun not only human
life but the fate of the world.”

Yet, Barzilai (1997:90) writes about “arachnomorphosis” as a woman-to-spider trope in which the woman is “brought down” to a crawling creature. McKechnie (2012), too, highlights negativity:

“In the latter half of the nineteenth century, the spider was imagined as
domestic and alien, harmless and dangerous, intelligent and evil and these
seemingly oppositional categorizations led to it becoming a disturbing
symbol of anxiety in modern culture" (2012:516).

Other examples of negative portrayals include evil spiders in Renaissance emblem books (Dundas 1987), evil spiders in Tolkien’s literature (Burns 2008); famous nursery rhymes (Little Miss Muffet) and Mary Howitt’s symbolic warning against flattery in the poem “The Spider and the Fly” (1829);10 De Vos’s (1996) comment that especially
contemporary (urban) legends and folklore focus on our phobias; Junichiro Tanizaki’s

10 I analyse a contemporary version of this poem in the analysis (Chapter 3).
famous short story “The Tattoo” (1910) in which the black widow is a symbol of cruelty and sexual aberration (Lauck 1998); and excerpts in the Bible that associate spiders with hypocrisy and untrustworthiness:

> “Whose [the hypocrites] hope shall be cut off, and whose trust shall be a spider’s web” (Job 8:14, as cited in Bruce 1958:77).

Other examples of (mostly) positive portrayals include comics in which spiders play a role as the alter ego of superheroes. Undoubtedly the most famous spider-superhero is Marvel’s Spider-Man, originally created by Stan Lee and Steve Ditko in the 1960s. Spider-Man is protagonist Peter Parker’s alter ego, as a result of a bite of a mutant spider. He gains (exaggerated) spider-characteristics and general strong superpowers. For example, he combats evil by shooting web fluid from his wrists (a “webshooter”), he is able to climb almost anything, and his costume is decorated with black webbing (Rockwood 2009:1251). Spider-Man’s popularity has resulted in various adaptations of his character. An example of a spider “villain” in comics is “Arachnid”, the cannibalistic mutant who possesses spider-like qualities in Savage Dragon (Comic Vine 2014b).

*The literary ant*

Historically, ants have often been considered praiseworthy because of their hard labour and industry (e.g. Taylor 1984, Rowland 1973, Rockwood 2009:50). For example, this happens in the Greek myth of Psyche in which the sympathetic ants sort bad seeds from good (Brown 2006:xv). This connotation has likewise resulted in utopian narratives. For

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11 I elaborate on Spider-Man adaptations in the analysis (Chapter 3).
example, F. Grove’s *Consider Her Ways* (1947) is a utopian satire that compares industry and functioning societies for ants and humans. Yet, not only does the narrative include utopian thoughts, it also includes anti-utopian thoughts (Warken 2000), highlighting that this convention does not necessarily lead to positive portrayals.

Similarly, in Aesop’s fable “Ant and the Grasshopper”, the grasshopper is punished for its laziness and the ant rewarded for its industry. Yet, as Taylor (1984) points out, several poets in the nineteenth and twentieth centuries have adapted and reversed the portrayal of this narrative:

> “James Joyce attacks the entire theme of the fable itself through a highly complex and satirical parable. His ploy is imbedded in *Finnegans Wake* as Shaun tells his brother Shem the “feeble” of the “Ondt” and the “Gracehoper” in which *Ondt* is a Danish word meaning “evil” and *Gracehoper* is likewise cast, being simultaneously the original sluggard and the poet in whom we observe grace and take hope” (1984:101).

Alternatively, the ants in poems of Robert Bly serve more reflective roles, related to human awareness of labour and life (Nelson 1981).

Finally, other recurring portrayed analogies between humans and ants seem to be their ability to fight battles and wars. Examples include H. G. Wells’ “The Empire of the Ants” (1905), *Leiningen Versus The Ants* (1938) by Carl Stephenson, Edward Owen Wilson’s *Anthill: A Novel* (2010), Thoreau’s “Battle of the Ants” in *Walden* (1854) and the mythical Myrmidons, the ant-people, warriors who where commanded by Achilles in Homer’s *Iliad*, written around 8 BC (Del Toro et al. 2012, Ross 1965, Sears 2010). As I
argue in Chapter 4, this focus on “destructive” behaviours may have a negative impact on overall portrayals.

The literary beetle

Many studies on the “literary beetle” focus on Victorian literature, especially Marsh’s previously mentioned novel The Beetle (1897) (e.g. Garnett 1990). Negative portrayals seem abundant. For example, Hurley (1993) highlights the association of the beetle and sin. The transformation from woman into beetle in The Beetle is a “monstrous embodiment of her sexuality”; and the beetle is an “abject embodiment of her genitalia” (1993:213). However, Schmitt (2007) also points at Victorian “beetlemania” that is more positive as it relates to enthusiasm for collecting beetles, even though Oscar Wilde described this as a pointless and uninteresting hobby in The Picture of Dorian Gray (1891).

Robert Bloch's horror story “Beetles” (1938) could be interpreted as a story that uses “metamorphosis” as a theme, with a potential wink to Kafka (Burleson 1995). In this story, an archaeologist becomes cursed by the ancient Egyptian curse of the Scarab beetle, and dies with a swarm of beetles pouring out of his mouth. According to Burleson (1995) this could be read as a transformation (metamorphosis) in terms of insects: a way of portraying the human-to-insect-metamorphosis negatively.

Lauck (1998) notes Marvel comic books in which Beetleman is a villain; and J. M. Alvey’s story “The Green and Gold Bug”, in which an “evil magician uses an African beetle to destroy a young man’s human qualities until he is driven mad and murders his wife” (1998:122).

More positively, while not referring strictly to literature, Hogue (1987:185) notes that metallic beetles in artistic expressions are often depicted aesthetically because of
their “pleasing colors and curious shapes”. Moreover, in other cultures beetles seem to be more positively portrayed. Berenbaum (1995) writes that while scarab beetles symbolise sinners in early Christian mystical writings, scarab beetles (*Scarabaeus sacer*) in the Egyptian scarab cult are metaphors for life, death and resurrection. Furthermore, as mentioned above, Japanese culture and literature is characterised by a positive “beetlemania” (e.g. Takada 2011), which is, among others, notable in manga-artist Tezuka Osamu’s “Dr. Fabre’s Bug Story” (1958): a story full of humour and pathos in favour of dung beetles (Knighton 2013). I come back to Tezuka’s work in Chapter 4.

*The literary worm*

Studies on the literary worm reveal diverse interpretations of the word “worm”: from serpent or dragon, to maggot and earthworm (e.g. Berenbaum 2006, Clark 2013b, Patenall 1985). Several of these worms have been associated with the blurring of lines between life and death (e.g. MacInnes 2012) and, in some cases, with immortality (Pesch 1985). Berenbaum notes that the worm’s association with decay and putrefaction since biblical times “contributes to the power of insect images in eliciting dark feelings of mortality” (2006:6). She notes Percy Bysshe Shelley’s poem “Queen Mab” (1813):

> “Hell, a red gulf of everlasting fire, / Where poisonous and undying worms prolong / Eternal misery to those hapless slaves / Whose life has been a penance for its crimes “ (as cited in Berenbaum 2006:6).

Biblical references too, are negative in various ways: some relate to decay, the grave, and the consumption of human flesh; while other “worms” such as “palmerworms” are
articulated as devourers of human crops, and others again, draw negative similarities between humans and worms (Bruce 1958).

Along similar lines, Heinecken (2014) notes that children’s book *The Witches of Worm* (1972) by Zilpha Keatley Snyder, contains a demonic kitten called “Worm”:

> “the name “Worm” also signifies an animal associated with rot, decay, corruption, and pollution—the qualities of abjection” (2014:73).

This interpretation is enhanced by physical descriptions of the Kitten, such as a “squirming hairless blob,” and the fact that he is blind. Yet, the story may be regarded as a transition story, since young girl Jessica builds a relationship with Worm and nurtures him as if she were his mother, and grieves for him when she thinks he falls to his death (Heinecken 2014).

Alternatively, McLean’s (1999) study on the Gothic novel *The Monk* (1796) by Matthew G. Lewis, notes other connotations: “worming” can serve as an “emblem of the probing of both body and text, a motion which seems, here, to ruin even as it comes to ‘know’” (199:113); while Clark (2013b) points at similarities between worms and humans via John Gray’s tale “The Great Worm” (1889) and its sexual imagery, such as the worm’s (or dragon’s) physique compared to the human male sexual organ.

Finally, informal sources seem to highlight destructive portrayals of worms in comics (Comic Vine 2014c, TV Tropes 2014). I mentioned “The Worm That Walks”; another example is “Worm” in *The Uncanny X-Men* who is a “Savage Land Mutate who secretes a liquid to control the actions of others” (Comic Vine 2014d).
Studies on the literary wasp are scarce, yet found studies point at negative wasp portrayals. For example, the Greek comedy *Wasps* by Aristophanes:

“offers a rich image of political persuasion as a process in which the citizen is purified of corrupting influences and restored to his true, if incorrigibly waspish,\(^\text{12}\) political self” (McGlew 2004:13).

The Bible contains three references to the hornet (Bruce 1958), referring to the hornet’s ability to drive people away. For example, Deuteronomy 7:20 states:

“Moreover the Lord Thy God will send the hornet among them until they that are left, and hide themselves from thee, be destroyed” (as cited in Bruce 1958:76).

Similarly, Berenbaum (1995) mentions the wasp as a symbol in Egyptian hieroglyphs, embodying destructive values. In early Egyptian hieroglyphs (3100 BC), King Menes, the founder of the First Dynasty, “chose the hornet *Vespa orientalis* as the symbol for his kingdom due to its reputed fierce and dangerous nature” (Berenbaum 1995:317).

### 2.5 Conclusions and Implications for Analysis

*Patterns and hypotheses.* Invertebrate portrayals range from positive to negative, and according to Hogue (1987) negative portrayals are more usual. Yet, closer inspection revealed that portrayals are not always consistent, which is for example notable in stories

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\(^{12}\) Definitions of “waspish” are “Quick to resent any trifling injury or affront; irascible, petulantly spiteful”; and “Marked or characterized by virulence or petulance, spiteful” (OED 2014h).
in which portrayals shift from negative to positive, and in alternative interpretations of the same theme. Examples of recurring themes include the metamorphosis, analogies between human societies and social insects including industry, labour, and skill, yet also corruption, battle and war themes; entomophagy, and the blurring line between life and death. Species preferences are notable too, both in stories and in studies on literary invertebrates. Literary wasps appear “least favourite”, as speaks from their negative portrayals and a lack of studies. Spiders on the other hand, seem popular based on the multitude of studies and at least partly positive portrayals, similar to ants. Also, while worms and beetles are studied more than wasps, studies seem to point mainly at negative portrayals. Possible species preferences across narratives could thus be written down as follows: spider > ant > worm = beetle > wasp. This contrasts Gerdes, Uhl & Alpers (2009) finding that spiders evoke the strongest fear and disgust responses.

Thus, based on the literature review, it seems that studies on negative public attitudes (Chapter 1) are not easily comparable to portrayals of invertebrates in literature. This speaks to the complexity of narratives: often, several layers of interpretations are discernible revealing conflicts or nuances. Also, the findings seem in line with Lemelin’s (2013) comment on the fluidity and complexity of interactions between humans and insects. As such, I hypothesise that I will find similar patterns in the analysis of children’s literature and comics, regarding the variables and complexities in portrayals; including species preferences and uses of themes.

Method. The review suggested that especially invertebrates in classic or (adult) “high” literature have been under examination, while discussions of other literary

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13 There is no clear or final definition of high literature, and the term in itself has sparked controversy for a long time. The Encyclopaedia Britannica (2014) compares “high” and “popular” literature:

“Popular literature includes those writings intended for the masses and those that find favour with large audiences. It can be distinguished from artistic literature in that it is designed primarily to entertain. Popular
genres and media seemed scarcer, sporadic, or were mostly found in informal sources. This informed my focus on children’s literature and comics as media deserving more attention. Moreover, studies are greatly rooted in literary criticism and cultural entomology: they are qualitative and provide theoretical frameworks, and are less focussed on quantitative trends or discussions of relations between portrayals and public attitudes. This informed my method of combining quantitative and qualitative analyses.

Chapter 3. Analysis: Invertebrate Portrayals in Children’s Literature and Comics

3.1 Method

To analyse how invertebrates are portrayed in comics and children’s literature, I reviewed 73 stories (Appendix 1) that portrayed worms (15 stories), ants (13 stories), wasps (14 stories), beetles (13 stories) and spiders (18 stories). These constituted 35 children’s fiction books, 23 comics, and 15 children’s non-fiction books. I analysed whether these stories portrayed invertebrates as “positive”, “negative”, "transitional" or with “mixed messages”. “Transition” stories referred to stories in which a change in portrayal took place: from negative to positive, or vice versa. “Mixed messages” referred to stories in which, in different degrees, invertebrates were portrayed with both positive and negative elements. In either case, I assessed whether such ambiguous portrayals resulted in mostly positive, or mostly negative portrayals. These decisions were based on quantitative and qualitative analyses of writing techniques and story themes used in stories.

literature, unlike high literature, generally does not seek a high degree of formal beauty or subtlety and is not intended to endure”.

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The analysis aimed to avoid a dualistic approach or positive/negative dichotomies. Instead, the stories were systematically analysed on a predetermined set of criteria: the four abovementioned portrayal types, nine writing techniques, and five story themes. An analysis sheet and the definitions of the criteria that were used are included in Appendix 2. The overall patterns were compared to patterns per invertebrate and per genre or medium.

In this way, the analysis aimed to articulate potential variables and inconsistencies in portrayals, focusing on three types of results: 1) general portrayal patterns for invertebrates (overall and individually) across and within stories; 2) the writing techniques and story themes that contributed to these portrayals; and 3) patterns per genre or medium. Together, these results aimed to inform the question: How are invertebrates portrayed in children’s literature and comics?

Due to small and variable sample numbers, the results need to be regarded as a starting point, an indicator of possible trends. The analysis does not seek to make definitive statements about invertebrate portrayals. Moreover, analysing stories is not a science, and it is subject to interpretations and a certain degree of subjectivity. I acknowledged the potential complexities of stories on the analysis sheets: the detailed examination of stories according to predetermined definitions, aimed to reduce subjectivities. Yet the possibility for alternative interpretations always remains.

In the quantitative component of each analysis, relevant criteria were highlighted by coding appropriate categories with an “X” or “x” (see below). In the qualitative component of each analysis I elaborated on the interaction between themes and writing techniques and their impact on portrayals.

With regards to the nine writing techniques, the first four writing techniques were concerned with basic portrayal characteristics: character, environment, reality and
perspective. The remaining five writing techniques referred specifically to negative or positive applications influencing the portrayal of invertebrates. They either enhanced the dominant portrayal (1); nuanced, or even contrasted it (2), or did both. In some cases, writing techniques had multiple applications at once. For example, writing technique 2 referred to the environment in which a story took place. Yet, rather than always coding for one type of environment, for some stories it was necessary to code for several environments: human, invertebrate and/or wider ecosystem environments. In these cases, I ticked multiple categories, coding for dominant (“X”) and less dominant (“x”) environments.

With regards to the five story themes, complexities were articulated both by potential inconsistent use of different themes, or ambiguous use of themes themselves. For example, some stories portrayed positive similarities between them and us (theme 1), while portraying mixed messages with regards to human-invertebrate encounters (theme 2); the latter being an example of an ambiguous use of the theme itself.

The distinctions between themes and writing techniques were mostly theoretical, and allowed precise dissection of stories. In practice, themes and writing techniques were closely intertwined; they overlapped and were inseparable. For example, a conflicting relationship between humans and invertebrates (theme 2) was likely to go hand in hand with negative feelings (theme 3). Similarly, pest control has benefits for humans (theme 2), yet could refer to an interaction in an ecosystem, too (theme 4).

Finally, the conclusions of the analyses summarised whether stories were unambiguously positive or negative; or whether they were ambiguously positive, or ambiguously negative.
Selection of invertebrates

The selected invertebrates were 1) invertebrates with which frequent encounters in our personal spaces (houses, gardens) occur; 2) likely to be often perceived negatively, as articulated in Chapter 1.

Inevitably, many other invertebrates and their portrayals deserve to be investigated, too. My selection was only a selection, and the exclusion of other invertebrates (e.g. cockroaches, mosquitoes) should not be regarded as an implicit statement on their relevance. On one hand, the results and their implications may apply to these other invertebrates, too. On the other hand, particular orders or species may be characterised by their own unique portrayal patterns. As such, future research into other orders and species is desirable.

Selection of media and genres

Within children’s literature, I analysed two genres: fiction and non-fiction. I looked at a wide range of children’s, pre-teen or teenage books, from books for very young readers up until the mid-teens.14 Within comics, I looked at a plethora of genres, including science comics, children’s comics, superhero comics, and underground comics, aimed at a wide range of audiences. Due to small sample numbers per genre I mostly focussed on the medium as a whole.15

As such, while most selected books were targeted at younger audiences, some were also targeted at adult audiences, while others may have reached adults as they can be read to children by parents or caregivers. This focus on diverse audiences supported the aim to create an insight into what extent story portrayals overlap with public attitudes,

14 Arguably, Larson’s There’s A Hair in My Dirt! does not fit perfectly within my criteria. The book may be intended for older audiences, but may well be enjoyed by teenagers, especially enhanced by the anthropomorphic animals and the style of the book: it could be regarded as both a comic and a picture book. 15 Yet, I do briefly elaborate on observations for different genres in comics.
beyond the more well-known and well-studied (adult) literature (Chapter 2). Inevitably, there is still a plethora of other literary genres and media begging to be analysed. My selection is only a selection of several genres and media that deserve further study in relation to the literary invertebrate.

Chapter 2 suggested that invertebrates in children’s literature and comics have not much been investigated. Yet, as noted by several authors, popular culture or other “peripheral” cultural constructions, are both relevant cultural signifiers and cultural forces, and should not be dismissed (e.g. Rauch 2001, Zimmerman 2011, Williams Jr. et al. 2012). Bernard Lightman (2007) argued that popular culture can:

“actively produce its own indigenous science, or can transform the products of elite culture in the process of appropriating them, or can substantially affect the nature of elite science as the price of consuming the knowledge it is offered” (as cited in Zimmerman 2011:408-409).

Pescosolido, Grauerholz & Milkie (1997) summarise succinctly the relevance of studying children’s literature.

“Children’s picture books (…) are potent cultural objects – they are readily available, have rhetorical force, resonate with children and adults, and are retained in institutions. In addition, the intended clarity and moral certainty with which adults provide children with tales of their world offer a fortuitous opportunity to examine social relations and belief systems” (1997:444).
For the portrayal of sciences specifically, Zimmerman (2011) highlights how juvenile literature consistently frames natural history in terms of human experience, contributing both to scientific and cultural discourse. Limited research into (contemporary) portrayals in children’s literature and their potential influence on environmental attitudes (Williams, Jr. et al. 2012) suggests that many recent children’s picture books contribute little to positive environmental attitudes, since narratives take increasingly place in built or modified environments, rather than in natural environments. This is especially relevant, as the experiences of nature at a young age may influence adult environmental attitudes (e.g. Wells & Lekies 2006).

With regards to comics, while some are part of popular culture (e.g. superhero comics), other comics may be seen as both art and literature (Tatalovic 2009), whether they are well known (e.g. Spiegelman’s *Maus* and Satrapi’s *Persepolis*) or not (underground comics). Contrarily to children’s literature, academia have long doubted the capability of comics to produce critically-relevant narratives (Groensteen 2000, Wright 2006). As Simon Locke (2005) summarises (as cited in Tatalovic 2009):

“damned as culture, being popular not ‘high’; damned as a medium, being neither art nor literature but some perverse hybrid, at best suitable only for children (and retarded adults), at worst positively harmful . . . and they are damned as a genre, being the most outlandish fantasy involving absurd characters acting in the most bizarre fashion – the very antithesis, one might think, of plausibility.”

Yet, as articulated above, comics are expressions in a variety of genres; and even when they do fit with “popular culture” this can be seen as a strength rather than a weakness, as
it allows reaching diverse audiences (Tatalovic 2009). Today, comics are widespread in the publishing world and other literary institutions, and are increasingly studied (Weiner 2003); yet comics in relation to the academic field of science communication specifically, have remained relatively unexplored (Tatalovic 2009). The focus on comics in the analysis; discussion (Chapter 4), and the creative component aim to contribute to this field.

I use Scott McCloud’s (1994:20) definition of comics, as “juxtaposed pictorial and other images in deliberate sequence, intended to convey information and/or to produce an aesthetic response in the viewer”. They come in different formats: comic strips, cartoons, comics and graphic novels. According to McCloud comic strips and cartoons are the shortest narratives. A cartoon may only consist of one panel, and comic strips are often not longer than three panels; while comics or comic books contain longer narratives and consist of several pages. Finally, the term graphic novel can be used to describe even longer narratives. Jee & Anggoro (2012:205) describe graphic novels as “essentially a long comic, often bound in more durable format and found in bookstores rather than magazine stands”. In the analysis I was concerned with comics or graphic novels with a minimum length of one page, containing more than three panels.

Selection of stories

The stories were tracked down via www.worldcat.org and became available through the interloan service of the University of Otago via libraries throughout New Zealand and Australia; as well as in Dunedin-based collections, including the Dunedin Public Library and the Robertson Library. As such, the selected children’s and teenage books were greatly based on availability in local (Australasian) libraries.
Due to the restricted availability of comics in libraries, I also searched in other places: I gained access to underground comics via the database “Underground and Independent Comics, Comix, and Graphic Novels” available through the English subject guide of the University of Otago. Also, I retrieved comics via other online (public) sources such as http://digitalcomicmuseum.com/, which makes comics available that are copyright-free and in the public domain. I found other comics through Google searches, directing me towards science comics created by scientists, educators and illustrators (Myrmex). Finally, I ordered books online via Amazon (Marvel’s Ant-Man and The Wasp). Since invertebrates in comics are much less abundant or easy to find than invertebrates in children’s books, I have searched as widely as possible for this medium, and used every comic I could find, in any genre.

The main selection criteria for the chosen stories were as follows. 1) Stories written in the 20th and 21st century; 2) written in or translated into English, mostly stories from Western cultures. I included a few translated works from other cultures, based on popularity of the story (e.g. Ananse Stories) or author (e.g. Tezuka Osamu). 3) The presence of images as well as text.

The slight differences in numbers per medium/genre and per invertebrate partly reflected the availability of these books: I found considerably more spider books available, compared to the other invertebrates. Similarly, I found more children’s fiction available than non-fiction and comics that included invertebrates. These findings in themselves were partly anticipated through the literature review (Chapter 2), in which I discussed the spider as one of the most represented and studied invertebrates. Also, the portrayal of invertebrates in fiction (though be it mostly adult fiction) seemed at the heart of literary studies, rather than other literary genres and media, probably related to the cultural status of the literature.
3.2 Results of Invertebrate Portrayals in Children’s Literature and Comics (Overall and Individually)

The detailed raw data are found in Appendices 3 and 4. Appendix 4 includes the individual analysis sheets per story (73 total), attached on a CD-ROM found at the back of the thesis.

*Overall results*

Out of the 73 analysed stories, 69.9% of invertebrate portrayals were positive, and 30.1% were negative. However, relatively few stories portrayed invertebrates unambiguously positive or negative (see Fig. 1 and 2, and Table 1 and 2).

![Occurrences of Portrayal Types](image)

Fig. 1. Occurrences of portrayal types in children’s literature and comics

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
<th>Transition</th>
<th>Mixed Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>8</td>
<td>18</td>
<td>37</td>
</tr>
</tbody>
</table>

Table 1. Occurrences of portrayal types in children’s literature and comics
In total, 75.3% of portrayals were ambiguous: 80.4% of the positive stories were not completely positive, and 63.6% of the negative stories were not completely negative.

Examples of unambiguously positive portrayals were found in several beetle narratives, such as Beetle and Bug and Dung Beetle’s Dinner, but also in other invertebrate narratives such as Boobela, Worm and Potion Power, Wasps’ Nest and Spiders Spin Webs. These stories portrayed positive human-invertebrate encounters such as friendship; constructive ecosystem interactions such as nest building, positive similarities with humans, and/or wondrous and aesthetic portrayals.

Examples of unambiguously negative portrayals were found in A Plague of Wasps in Winter, The Spider and the Fly, The Lost Ladybirds, and The Worm Turns. These stories portrayed negative human-invertebrate encounters; destructive ecosystem interactions such as predator-prey relationships, negative similarities with us, and feelings of fear and/or disgust.

Ambiguous stories were classified as either “transition” portrayals or “mixed messages”. “Transitions” were expressed in different ways, yet the common characteristic was that transitions occurred from negative to positive, and never vice versa. Often, invertebrate characters needed to overcome negative perceptions towards them as expressed by other characters, including humans (Mary, the Big Brown Hairy Spider, We Want William! and Johnny Whistler and the Spiders); fantastical characters (fairies in Friends Forever); other invertebrates (Miss Spider’s Tea Party), and/or other animals (Lonely Wasp). The overall portrayals in transition stories were often mostly positive, but sometimes remained mostly negative. This depended on different factors, which I discuss in Chapter 4.
“Mixed message” portrayals consisted of both positive and negative messages. Some stories were mostly positive, yet included elements of negative portrayals; while other stories were mostly negative, yet included elements of positive portrayals. Occasionally, “mixed message” portrayals also contained a (small) transition. Similar to transition stories, this resulted in either ambiguously positive or ambiguously negative stories. I elaborate in examples below.

All in all, the final portrayals including their ambiguities were divided as follows. I distinguished between positive unambiguous and positive ambiguous portrayals, and negative unambiguous and negative ambiguous portrayals.

Fig. 2. Percentages ambiguous and unambiguous portrayals

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Positive Ambiguous</th>
<th>Negative</th>
<th>Negative Ambiguous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>10</td>
<td>41</td>
<td>8</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 2. Ambiguous and unambiguous portrayals

16 In some stories, transitions occurred, yet the story as a whole did not qualify as a “transition” story. An example is The Golden Wasp: in this story, the transition was unexpected and took place at the very end, and the story was also characterised by other mixed messages. As such, the “transition” component was yet another mixed message.
Results per invertebrate

Different patterns were found for the five analysed invertebrates (Fig. 3, 4, 5).

Fig. 3. Occurrences of portrayal types per invertebrate

All the invertebrates scored highest on “mixed message” portrayals, except for beetles, which scored highest for unambiguously positive stories. Unambiguously negative stories were most often found for wasps, followed closely by worms and spiders. Most transition stories were found for spiders, and ants were always portrayed ambiguously. The total positive and negative portrayals were divided as follows (Fig. 4).

Fig. 4. Total positive and negative portrayals per invertebrate
As such, the analysis suggested a trend for species preferences for invertebrates *across stories*. The percentages of negative portrayals suggest the following hierarchy: wasp < worm < spider < ant < beetle (Fig. 5).

Fig. 5. Percentage of total negative portrayals per invertebrate

Finally, species hierarchies existed *within stories*. I counted whether invertebrates were portrayed as being equal to each other, or whether there was a hierarchy within stories:
whether some were portrayed more positively than others. I observed hierarchies more often than equal portrayals. However, the differences were relatively small (Fig. 6).

Hierarchies often depended on perspectives. For example, portrayals depended on whether stories were written from the perspective of the predator or the prey. Children’s fiction _Bug Buddies_ portrayed the predator-prey relationship of spiders and beetles (and other insects). The story was told from the perspective of the prey, resulting in a positive portrayal of beetles (and other insects) at cost of a favourable portrayal of the predatory spider. This also happened in _The Spider and the Fly_ and _The Lost Ladybirds_.

I also encountered counterexamples of the predator-prey hierarchy. In these cases, hierarchies were much subtler: the perspective was with the predator, for whom others were only “mere” prey (rather than obvious villains). In general, hierarchies were created by posing the protagonist invertebrate as a central subject, compared to other (less important or positive) invertebrate characters, unless there was a specific mutualistic relationship (e.g. between aphids and ants in _Myrmex_) or other types of “friendships” (e.g. in _Ladis and the Ant_, all insects were portrayed as friends, except for the robber ants that invaded the ant colony). I come back to hierarchies in Section 3.3.3.

Fig. 6. Portrayed invertebrate hierarchies within stories
3.3 Results of Contributing Writing Techniques and Story Themes

In this section, I mostly focus on the ambiguous stories (representing 75.3% of the analysed data). Precisely the ambiguous portrayals point at the diversity of positive and/or negative applications of writing techniques and story themes, influencing the overall portrayals. In this regard, the unambiguous results speak for themselves, since themes and writing techniques in these stories have been used consistently positively (in positive portrayals) or consistently negatively (in negative portrayals). Due to small sample numbers per invertebrate, I have refrained from further analysing the results per invertebrate, however, I point out notable observations when relevant.

3.3.1 Basic characteristics of invertebrate portrayals

The first four writing techniques on the analysis sheets were concerned with basic portrayal characteristics: type of character (1), type of environment (2), type of reality (anthropomorphic or not; 3) and perspective (4).

The results suggested that most stories were written from a “human” angle. They were set in human environments, from human perspectives; and they anthropomorphised invertebrate characters, which often remained one-dimensional (Fig. 7, 8, 9, 10). Similarly, story themes most often articulated a “human” angle, too (Fig. 11).

Type of character

Invertebrates were most often portrayed as flat characters (Fig. 7). This meant that the reader received a one-sided view of the characters. The characters did not undergo any personal development nor gained new insights throughout the story.
An example of a round character is the anthropomorphic beetle in *The Beetle*, that comes to realise by the end of the tale that he should not complain and take things as they come. In non-fiction, I encountered a difference between invertebrates that featured as active actors whose actions were described by a narrator in “real time”, instead of being passively described from a distance (indicated with N/A). For example, *Wasps’ Nest* started with:

“The warmth of spring wakes the female wasp and she crawls from her winter home”.

In such stories, the non-fiction became more like a story, which created opportunities for identification without imaginative anthropomorphisms (theme 1), and for suspense and curiosity (theme 3), see also Section 3.3.2.

Fig. 7. Type of character (writing technique 1)
Type of environment

Stories often took place in multiple environments. Human environments featured most often, followed by (and often combined with) invertebrate environments (Fig. 8). For example, *Ladis and the Ant* shifted from a human environment, to inside an ant colony; and the ants also interacted with other insects above ground, such as locusts.

Fig. 8. Type of environment (writing technique 2)

![Type of Environment](image)

Type of reality

Fig. 9 shows to what extent invertebrates were anthropomorphised (or not).\(^\text{17}\) Most invertebrates were, in different degrees, attributed with both anthropomorphic and ecological elements. In some cases, the ecological realities were more prominent than the anthropomorphic elements; but in most cases the anthropomorphic portrayals (including otherworldly) portrayals were prominent.

Examples of otherworldly portrayals (type 1) were sometimes found in negative portrayals: in *Wormwood* and *Gobs of Worms* the worms are intimidating “aliens” or

\(^{17}\) See Appendix 2 for definitions of the categories.
demonic hybrids of humans and worms. Yet most of such otherworldly portrayals were positive and enhanced wonder and/or an aesthetic appreciation (e.g. *Johnny Whistler and the Spiders, The Spider Who Created the World; Ant Colony, Little Worm Book* and several superhero comics). Sometimes, otherwordliness, wonder and aesthetics even formed positive elements in mostly negative portrayals (e.g. *The Golden Wasp; Vespick the Wasp Queen*). For example, the wasp in *The Golden Wasp* lived in a fantastical world, and was a fantastical big, golden, glowing, and wondrous creature (+), whose behaviour was mostly dangerous and destructive (-).

Within otherworldly portrayals, I observed variation in the presence of ecological elements. In *Wormwood*, the ecological reality was restricted to the given that the maggot lived in a dead corpse. *Johnny Whistler and the Spiders* portrayed spiders as fantastical beings: they were coloured “mutant” spiders as a result of industrial pollution. However, they still conveyed an ecological reality: spiders were portrayed as ecologically sensitive to toxins humans put in the environment. In *The Spider Who Created the World*, ecological elements were relatively prominent and more detailed as the fantastical and symbolic plot was rooted in spider biology and ecology: the female spider spins webs, has eight legs, uses sticky silk, has sharp fangs, and hatches offspring from an egg (ecological), and these characteristics enabled her to create the world (otherworldly).

I encountered misrepresentations, too. For example, in *Ant-Man*, the worker ants were referred to as “he”, rather than “she”. In superhero comics, I observed “metamorphoses” of humans into human-invertebrate hybrids, whose behaviours were often fantastical and only recalled ecological realities in limited ways, such as flying (Marvel’s *The Wasp*), creating webs or sticky threads (*Spider Queen* and other *Spider-
Man adaptations), and communication via signals (Ant-Man). Often these qualities were exaggerated or misrepresented: for example, spiders do not “shoot” webs. Alternatively, misrepresentations arose because of blurry lines between fact and fiction. For example, this happened in Ant Colony, in which the human-ant hybrids behaved partly according to ecological realities (communication via pheromones, social structure with queen, battles of ant colonies), but the facts were blended in with “fantastical facts”, such as misrepresentations of the specific functions of pheromones. In stories like these, the reader may constantly wonder: what is real and what is not?

In underground comics, human-invertebrate hybrids highlighted evil traits or weaknesses, such as the risk of getting squashed by humans (Crawl, Worm!). Another rough distinction that could be made between superhero comics and underground comics, concerns portrayals fostered by interactions between texts and images and contributing positive or negative associations/feelings. In superhero comics, characters often conformed to “classic” beauty ideals: men were muscular; ladies had a tiny waist (e.g. Ant-Man and The Wasp). In underground comics, the appearances of invertebrates were rather monstrous or disgusting (Spider Joy, Gobs of Worms).

Another observation on anthropomorphic characters involved their size. When invertebrates were portrayed in relation to humans, they were sometimes sized up (James and the Giant Peach, The Golden Wasp, Vespick the Wasp Queen), or the humans were sized down (Ladies and the Ant, Carly’s Adventures in Wasp Land). In many cases, the invertebrates could talk and were thus attributed with imaginative anthropomorphisms. Similar to the otherworldly portrayals, these anthropomorphic portrayals differed in their representation of ecological elements. In most cases, the ecological elements remained very basic, such as web spinning (Miss Spider’s Tea Party), and stinging behaviour (Lonely Wasp: Friends Forever). In other cases, the talking invertebrates functioned to
make comments on their own ecology and biology in more detail (*There’s A Hair in My Dirt!*). In other cases again, there were no ecological realities at all (*Beetle and Bug*).

Interpretative anthropomorphisms were especially common in non-fiction, and often allowed for the communication of detailed ecological realities. In non-fiction they occurred especially in chapter- and section titles on invertebrate behaviour. Examples are “spider love” (*Spiders and Scorpions*); and beetles as “caring mothers”; having a “cradle of dung”, and eating “tasty dung” (*Dung Beetle’s Dinner*). Interpretative anthropomorphisms occurred in fiction too. For example, the narrative of *The Lady and the Spider* refers to the “spider’s breakfast and lunch” and a spider that can “live and love life”. Most of the times, such analogies between humans and invertebrates resulted in positive portrayals.
Fig. 9. Type of reality (writing technique 3)
Most stories were written from a human perspective, followed by stories written from invertebrate perspectives (Fig. 10). In some cases, perspectives shifted within stories, and both human and invertebrate perspectives were observed (e.g. *The Lady and The Spider, Boobela, Worm and Potion Power*). The perspective of the own order or species resulted in positive portrayals (See section 3.2; but not always unambiguously, see Section 3.3.3); and human perspectives either resulted in positive or negative portrayals. Examples of positive human perspectives included transition stories in which a human character warmed up for invertebrates; or stories that highlighted positive relationships between them and us, such as friendship (*Boobela, Worm, and Potion Power*), an ecologically beneficial relationship (*Yucky Worms, Be Nice To Spiders, Dung Beetle’s Dinner*), or close observation and study (*Worm, The Ant: Energetic Worker*). Positive human perspectives, too, were rarely unambiguous, as becomes clear in Section 3.3.3.

Fig. 10. Perspective (writing technique 4)
Finally, Fig. 11 highlights that stories portrayed most often similarities between them and us (theme 1), encounters between them and us (theme 2), and our feelings towards them (theme 3). These three themes were more often observed than ecosystem themes (theme 4), and invertebrates as inherently valuable (theme 5). All in all, these findings suggest that invertebrates are most often portrayed in human contexts.

Fig. 11. Occurrences of themes

<table>
<thead>
<tr>
<th>Occurrences of Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
</tr>
<tr>
<td>Theme 1 (Similarities)</td>
</tr>
</tbody>
</table>

3.3.2. Writing techniques and themes contributing to (partly) positive portrayals

In this section I further elaborate on positive portrayals and/or positive elements in negative portrayals. Fig. 12 highlights how the themes contributed to both unambiguous and ambiguous portrayals.
Fig. 12. Occurrences of portrayal types per theme

![Bar chart showing occurrences of portrayal types per theme](image)

#### Similarities and feelings

Both Fig. 12 and 14 suggest that theme 1 (similarities), 3 (feelings), and 5 (inherent value) were more often characterised by positive portrayals than theme 2 (human encounters) and 4 (ecosystem interactions).\(^{19}\)

Positive similarities (theme 1) mostly consisted of imaginative anthropomorphisms: some misrepresented invertebrates more than others. As mentioned, interpretative anthropomorphisms provided more opportunities for highlighting positive similarities between them and us, rooted in ecological realities. Besides the above-mentioned examples, other examples of positive analogies included both humans and worms that have strong muscles (*Yucky Worms*); both insects and humans that are

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\(^{19}\) While theme 5 scored high on positive portrayals, establishing the occurrence of this theme was problematic, and as such the results are better appreciated qualitatively, in their relationship with writing techniques, than quantitatively. The occurrence of this theme depended much on several factors within stories, which differed for every story. This made it hard to use pre-defined criteria for finding its presence or absence. As such, assessing theme 5 was often subjective: it was easier to verify its positive use than its negative use. Hence, I only briefly elaborate on this theme. Especially writing techniques 4 (perspective) and 6 (title and cover) and theme 4 (ecosystem interaction) played relevant roles. For example, were invertebrates evil predators? Or also individual subjects with their own motivations or role outside of the predator-prey role?
engineers (*Dung Beetle’s Dinner*); ants that are energetic workers and teachers (*The Ant: Energetic Worker*); the analogy between underwater beetles and U.S. Navy Seals (*The Beetle Alphabet Book*); and the analogy between crickets and musicians (*10 Little Insects*).

Besides the wonder that was often associated with otherworldly portrayals, positive feelings (theme 3) were categorised as expressions of aesthetics, symbols, curiosity and intrigue, magic, cuteness or friendliness. Especially beetles seemed to be portrayed according to their colourful and aesthetically pleasing biodiversity (*Beetle Bedlam, The Beetle Book, The Beetle Alphabet Book; Fig. 13*). Yet, this happened for other invertebrates too, such as the anthropomorphic and diverse worms in *The Little Worm Book*, and aesthetically pleasing wasp diversity in *The Really Wicked Droning Wasp*.

Symbolic and cultural meanings were observed too, including the positive connotations of web spinning in *Spiders Spin Webs* and *The Spider Who Created the World*; and the analogy of ant queens and queens in Western fairy tales in *Myrmex*.

Fig. 14 suggests that not only were positive portrayals in theme 1 (similarities) and theme 3 (feelings) often used to enhance overall positive portrayals, I also found an example in which theme 3 (feelings) formed a positive element in an otherwise negative portrayal. This happened in *Cuthbert the Caterpillar and Wilfred the Wasp*, in which the wasp, despite his deceiving and mischievous role, was depicted visually as a cute-looking anthropomorphic invertebrate, whose opinions and proposed adventures formed an element of curiosity for Cuthbert the Caterpillar.
Similarly, Fig. 15 highlights that “mixed message” portrayals revealed something about the positive applications of theme 3. Theme 3 was the only theme in which I found an almost equal number of “mixed messages” for both ambiguously positive and negative stories, while in the other themes “mixed messages” occurred mostly in ambiguously
positive stories, highlighting the application of negative messages in otherwise positive portrayals.

I mentioned the elements of aesthetic and wondrous appreciation of otherwise fearsome wasps in *Vespick the Wasp Queen* and *The Golden Wasp*; and I give counterexamples in Section 3.3.3. While in general, the occurrences of mixed messages in theme 3 were comparatively low (see also Fig. 12), the stories in which they did occur provided interesting insights related to portrayed feelings that may be closely connected with our attitudes, as further discussed in Chapter 4.

Fig. 15. Mixed messages in ambiguously positive and ambiguously negative stories

Examples of mixed messages in other themes include *An Earth Man on Venus* in which ants are portrayed according to negative similarities with humans (theme 1): they are ruthless, and they embrace slavery, yet they are also portrayed as very intelligent. Moreover, one ant (“Doggo”) is friendlier and more forgiving than the others.
Similarly, in superhero comics, the human-invertebrate hybrids were portrayed according to both positive similarities (heroes), and negative ones with regards to their destructive interactions with their environment, like aggressive battles with humans (theme 2) and non-humans (theme 4); see also Section 3.3.3.

*Inherent value*

A positive use of theme 5 (inherent value) was most often found when narratives were written from the perspective of the invertebrate in question (writing technique 4), rather than from other invertebrates or humans, which was especially relevant in stories on predator-prey relationships. The predator was portrayed as not being relevant in itself, but only relevant in its (destructive) relation with others (e.g. *The Lost Ladybirds*), when the narrative was written from the prey-perspective.

Moreover, inherent value became visible in book titles (writing technique 6). For example, while in *Conqueror Worm* and *Wormwood: Gentleman corpse* the dominant portrayals were negative, the “worms” in these stories still demanded a certain respect or inherent relevance due to their centrality in the titles. The title presented the invertebrates as a central topic on their own, instead of portraying them in relation to something or someone else: humans or other invertebrates. The latter happened in the title *The Spider and the Fly*, which enhanced the idea that in this narrative, the spider is only relevant in relation to the fly.

*Metanarratives and addressing the reader*

Both metanarratives (writing technique 5) and narrators that addressed the reader directly (writing technique 8) were relatively uncommon, yet were especially useful for
highlighting authors’ intentions and involving readers more directly, inspiring them to think about their own relationship with invertebrates.

Metanarratives, comments of the narrator on the narrative, included explanations of moments in the narrative (e.g. explanation of ant behaviour in Ant-Man), or an elaboration on unsaid things in the narrative, creating the opportunity to enhance a positive portrayal (e.g. a side-comment on wasps’ positive roles as pest control in Carly’ Adventures in Wasp Land). The above two examples featured as text boxes inserted into an image in comics.

In children’s literature, metanarratives mostly featured as forewords or afterwords. For example, in Under One Rock, the foreword was framed as a letter of a spider that commented on positive similarities between humans and invertebrates, as well as on a close relationship: humans and invertebrates are neighbours.

“Dear Neighbors / You may live in a large city. / Or, you may live in a small town.”

In the above example, the metanarrative also addressed the reader directly. The second person (“you”) is used.

The latter technique also occurred within narratives, especially in non-fiction, creating an opportunity for readers to contemplate their own attitudes. Sometimes, this resulted in mixed messages. For example, in The Really Wicked Droning Wasp, the narrator reassured the reader that wasps do not sting humans often, but also highlighted the painful moments when they do sting. Similarly, narrators in Spiders and Scorpions and Spiders and Minibeasts highlighted that most spiders are not poisonous, but also emphasised the ones that are lethal to us. Positive phrases like “Don’t worry” or “You
and your worm” (The Little Worm Book) pointed the reader in the right direction, and inspired positive encounters between humans and invertebrates.

Moreover, the suspense of narratives was enhanced by including the reader in the first person (“us” and “we”): the narrator let the reader know he/she was about to find out what happens next in the story (e.g. in Ant-Man, Ananse Stories), increasing the hope for a good ending for the invertebrate-protagonist. Finally, addressing the reader created the opportunity for asking the reader questions, encouraging him/her to actively think about applications of the narrative to their own lives. For example, in The Beetle Alphabet Book:

“June Bugs usually appear in early summer during the month of June.

That’s how they got their name. How did you get your name?”

Text-image interactions

As mentioned, text-image interactions (writing technique 7) enabled colourful or otherwise aesthetic or friendly images to enhance positive feelings such as wonder and curiosity. Also, they enabled depicting positive encounters between humans and invertebrates, even though rarely unambiguously. Dung Beetle’s Dinner included a photograph of a human hand holding a big beetle, showing a tactile human-invertebrate encounter that was peaceful rather than harmful. Similar tactile interactions (a friendship) were depicted in Boobela, Worm and Potion Power. Alternatively, The Ant: Energetic Worker included an image of a boy on his knees on the ground, closely observing ants, which brought a human body harmlessly closer to ant bodies. Finally, in relatively rare cases images showed constructive ecosystem interactions (nest building in Wasps’ Nest).
Other

Finally, I encountered several writing techniques unspecified on the analysis sheet (writing technique 9). Some were stylistic, other ones related to the content. In many stories, stylistic techniques added to the fun of the reading experience. Examples include rhyme (*Beetle and Bug*), songs (*Hey, Little Ant*); a playful or poetic lay out (*Bug Buddies, Are You an Ant?*); humour (“worm” recipes in *How To Eat Fried Worms*) and the appropriation of comic techniques in children’s literature (speech and thought balloons in *Boobela, Worm and Potion Power*). A pleasant reading experience in itself may well transfer over to positive associations of the portrayed invertebrate. Other techniques related to format of the narrative itself, such as a diary (*Diary of an Insect Shojo’s Vagabond Life* and *Diary of a Spider*), creating opportunities for (emotional) identification with the invertebrates.

With regard to the content of the narratives, especially the use of strategic language stood out. For example, strategic language in *The Beetle Alphabet Book* positively enhanced theme 1 (similarities), 2 (encounters with humans) and 3 (feelings). Even when the beetles’ less favourable characteristics were described, it was done with positive words. For example, the fungus beetle was described as a beetle that “needs to go the beauty salon”, instead of simply described as “ugly”. The language provided a constructive evaluation of the beetles’ “unfavourable” appearance. Also, the cucumber beetle was described and depicted as a “cute beetle”, before it was described as a pest to farmers.

Metaphors, too, invited readers to perceive invertebrates differently. In *Stephen and the Beetle*, the dinosaur triceratops is used as a metaphor for a rhinoceros beetle. This had a positive impact on theme 2 (encounters with humans) and 3 (feelings). The beetle
became more interesting for Stephen when he perceived it as a triceratops. The analogy became possible through physical similarities (horn) shown in the images.

### 3.3.3 Writing techniques and themes contributing to (partly) negative portrayals

In this section I elaborate on negative portrayals and/or negative elements in positive portrayals.

*Interactions with environment (human and non-human)*

As shown in Fig. 12, unambiguously positive portrayals for theme 2 (encounters with humans) and theme 4 (ecosystem interactions) were scarce. For theme 2, positive portrayals even scored the lowest: it is the only theme in which I found more negative portrayals than positive ones.

Instead, theme 2 and 4 were most often characterised by “mixed messages”. Fig. 15 revealed that “mixed message” portrayals scored highest in ambiguously positive stories for these themes, articulating that invertebrates were rarely portrayed in completely peaceful or constructive interaction or co-existence with their human and non-human environments, while they were otherwise positively portrayed.

Examples of (moments of) destructive interactions range from the heroic action heroes in comics; to ants in battle scenes and wars (*Ant Colony, An Earthman on Venus*), to worms as killers (by eating: *Gobs of Worms, Worm Turns*); wasps as attackers (by stinging, *The Really Wicked Droning Wasp, Boffin Boy, Friends Forever*); spiders as killers (by capturing prey in webs, biting and injecting poison: *Spiders and Minibeasts, The Spider and the Fly*); to the occasional beetle that was depicted in a fight-scene (*Beetle Alphabet Book*). These portrayed interactions went sometimes hand with portrayals of
fear and disgust (theme 3). For example, the following text informed the interpretation of an image of an enlarged close up of a wasp’s jaws (in *The Really Wicked Droning Wasp*).

“A jewel wasp seizes prey in its fearsome jaws and stings deep into the victim’s nerve centre to paralyze it”.

As briefly mentioned, perspective (writing technique 4) in particular seemed important for the portrayal of human-invertebrate encounters. In several cases, human perspectives resulted in the portrayal of invertebrates as invaders of the human space. For example, in *The Giant Jam Sandwich* wasps were portrayed as intimidating, swarming masses that invaded town. Similarly, *Gobs of Worms, The Worm Turns,* and *Conqueror Worm* portrayed worms as monsters that devoured humans.

Yet, conflicts that went hand in hand with overall positive portrayals were more common, and related to several different factors. Narratives written from the invertebrate perspective frequently enhanced a conflict at cost of a favourable portrayal of *humans*. This happened in e.g. *Two Bad Ants, The Very Clumsy Click Beetle, There’s A Hair in My Dirt!, Are You An Ant?* and *Ant Colony*. In these stories, invertebrates were portrayed positively, yet the humans posed a threat to them, such as squashing them with their big feet, cleaning them up with brooms or vacuum cleaners, or simply by ignorantly misunderstanding them.

Some of such portrayals went hand in hand with otherworldly portrayals (type 2). In these cases, stories portrayed invertebrates as literally separated from the “human world”, resulting in conflicting encounters of these worlds. Examples include the wasps that lived in their own “land” and that chased the human character away in *Carly’s Adventures in Wasp Land*, and the ants in *Two Bad Ants*. In the latter narrative, ants
explored a human kitchen, concluding they should never return: their “own world” was a better place for them.

“This was their home, this was their family. This was where they were meant to be.”

As such, while the narrative was based on the reality of ants looking for sugary treats in kitchens, the story portrayed a “desired” separation of ants and humans. In contrast, *Diary of a Spider* portrayed the dangers that humans form to spiders, yet the spiders appropriated the human environment regardless: they lived in and amongst human artefacts.

Other factors contributing to conflicts were the mix of fear and reassurance directed at the reader (Section 3.3.2), and species hierarchies, both in human and non-human environments. These included encounters between the mentioned prey and predators (Section 3.2); and the “damage” done by one invertebrate, posing risks to the habitat of others (the bark beetle in *Beetle Bedlam*). Species hierarchies in children’s non-fiction often related to their use to humans: in *The Beetle Alphabet Book*, some beetles were pests, while other ones were pets; in *Wasps Up Close* some wasps were pests, while other ones were beneficial for pest control and pollination; and in *Worms*, some worms were solely described as blood-suckers, while others worms aerated the soil. In these examples, encounters with humans and ecosystem interactions became closely intertwined.

Finally, even within the same species, individuals or colonies, portrayal of interactions were mixed. As mentioned, this happened in superhero comics like *Alias the Spider* and *Blue Beetle*, that saved the day by destroying and killing others (humans and
other creatures), yet also by invertebrate characters whose behaviour was articulated from multiple angles: in the comic *Ant Colony*, ants loved and supported each other, but also fought a war against another colony.

**Text-image interactions**

Text-image interactions also had the potential to highlight these destructive elements, even when overall portrayals were positive. Especially battle scenes were common or at least easier to notice visually (especially in comics), compared to some constructive interactions, like mutualism and pollination. In some stories, constructive interactions featured only in a quick metanarrative, such as the comment on wasps’ roles in pest control in *Carly’s Adventures in Wasp Land*; or as a quick comment in the narrative, such as the brief mention of wasps’ roles as pollinators in *Wasps Up Close*.

In addition, some images also thrived on enlarged and monstrous or disgusting appearances of invertebrates, sometimes in overall positive stories (*The Spider Widow, Worms*), but mostly in overall negative stories (*The Worm Turns*).

**Transitions in human encounters and feelings**

Along these lines, Fig. 12 and 16 further highlight the occurrences of negative portrayals not only in theme 2 (human encounters) and 4 (ecosystem interaction), but also in theme 3 (feelings). As such, the portrayal of feelings towards invertebrates was diverse: not only did I find many positive instances; I also encountered several negative ones. Fig. 16 also reveals that theme 2 and 3 were the only themes in which negative portrayals occurred in otherwise positive stories.
Similarly, “transition” portrayals were, as shown in Fig. 12 and 17, most often found in relation to these two themes. While most transitions from negative to positive resulted in mostly positive portrayals, they did not always do so, influenced by factors discussed in Chapter 4. Moreover, transition stories supported the persistence of conflicting human-invertebrate relationships, and made them a central point of attention, despite the change in perception. The similarities in results for negative themes (Fig. 16), and transition themes (Fig. 17) motivated their inclusion under the (partly) “negative” results: as I discuss in Chapter 4, they may articulate a perceived need of overcoming our negative feelings and encounters with them.

Examples of transition stories included *Mary, The Big Brown Hairy Spider*, in which Mary’s scary appearance was put to good use as she scares away burglars. In *Friends Forever*, the feared stinger of the wasp was put to good use as the wasp chased away a threatening dog, an in *Lonely Wasp*, the wasp chased away a threatening toad. In *How To Eat Fried Worms*, a boy comes to realise that worms are not so disgusting after
all; and the spider and her “messy webs” become appreciated when the zookeepers realise her use in pest control of flies in the zoo, which benefits both zookeepers and vertebrate animals in *Be Nice To Spiders*.

Fig. 17. Transition portrayals in in ambiguously positive and ambiguously negative stories

![Bar chart](image)

First impressions

As mentioned, while “mixed message” portrayals for theme 3 (feelings) were relatively scarce, they resulted in strong ambiguities in ambiguously positive stories. This related especially to the first impressions that children’s non-fiction books provided (writing technique 6). These included titles, series titles, cover texts and cover images. I observed several instances in which positive non-fiction narratives contrasted a negative portrayal on the cover.

For example, this happened in “creepy crawly” series, such as *Worms (The New Creepy Crawly Collection)*, and *Ant (Creepy Crawly World)*, or in the titles themselves: *Under One Rock: Bugs, Slugs and other Ughs*. Sometimes, titles were also enhanced by
larger-than-life images, creating an intimidating effect. On the one hand readers were invited to perceive invertebrates as creepy crawlies, on the other hand the books aimed to create a better understanding of them, taking away the fear-aspect.

3.4 Results per Genre or Medium

Comics were characterised by the highest percentage of overall negative portrayals (Fig. 18 and Table 3), compared to children’s fiction and non-fiction.

Fig. 18. Percentage of total negative portrayals per medium/genre

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
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<tr>
<td>Comics</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Fiction</td>
<td>26</td>
<td>9</td>
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<tr>
<td>Non-Fiction</td>
<td>13</td>
<td>2</td>
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“Transition” stories were most characteristic for children’s fiction, while “mixed messages” were most characteristic for comics and non-fiction (Fig. 19). I mentioned the
negative first impressions in children’s non-fiction, resulting in ambiguities. Many mixed messages in comics were attributed to the mentioned superheroes that battled and destroyed to save the day. As such, it can be noted that the mixed messages in non-fiction were stronger than in comics.

Fig. 19. Occurrences of portrayal types per medium/genre

With regards to specific invertebrates, I noted differences in portrayals per medium particularly for worms. Worms in comics seemed to often draw upon the association of decay, flesh eating, and overall destruction: mostly maggot-like (Conquer Worm, Gobs of Worms, Wormwood), yet also earthworm-like (The Worm Turns). Worms in children’s fiction on the other hand, were much more positively portrayed, and various positive interactions between humans and earthworms were highlighted, such as friendship, pets and benefits in the garden.

Finally, some other observations include the tendency of narrators to address audiences directly in non-fiction (writing technique 8); and the use of metanarratives inserted in narratives (writing technique 5) in comics. Also, non-fiction used the widest range of additional writing techniques, enhancing a more “fun” reading experience.
Examples are quizzes, fun facts, see-through pages, and glossaries. I even found one instance of non-fiction that employed the comic technique of embedding text balloons into images (*Yucky Worms*).

### 3.5 Conclusions

The results suggest that while stories portrayed invertebrates mostly positively (69.9%), portrayals were often ambiguous: positive stories were often not completely positive, while negative stories were often not completely negative.

Basic characteristics of portrayals highlighted that invertebrates were often portrayed in a “human context”: they were often anthropomorphic flat characters in human environments, as seen from a human perspective. Stories often portrayed our similarities, relationships and feelings. Some anthropomorphic portrayals contained more ecological realities than others, or alternatively, misrepresented invertebrates more than others. Species preferences were notable across and within stories. Across stories, beetles were most often positively portrayed, and wasps least often. Within stories, preferences depended amongst others on perspectives of predators or prey, or the uses of invertebrates to humans.

Positive portrayals were especially found for stories that drew upon similarities between them and us, and our feelings towards them. In these stories invertebrates resembled humans through imaginative anthropomorphisms, analogies, symbols and “metamorphoses” from human to invertebrate. Similarly, positive feelings were fostered by (some) otherworldly portrayals, aesthetic imagery or cute and friendly appearances. In some cases, such elements even formed a positive moment in a mostly negative narrative, yet the opposite was also observed.
Additional positive writing techniques included authors that addressed the reader directly or that commented on the narrative, which enabled connecting the reader with author’s intentions (amongst others), enhancing positive portrayals. A plethora of previously unspecified writing techniques, whether they were stylistic (rhyme, playful layout) or informed the content (strategic language), also played positive roles.

Points of (negative) ambiguities were found in conflicting encounters between humans and invertebrates: some of them written from the human perspective, others written from the perspective of invertebrates. Similarly, regardless of overall portrayal, invertebrates were frequently portrayed as “destructors”, for example by being depicted in graphic battle scenes (superhero comics). Other ambiguities were stories in which portrayals shifted from negative to positive (especially in children’s fiction); positive narratives that framed invertebrates as “creepy crawlies” in the titles (children’s non-fiction), and comics that were more often characterised by overall negative portrayals than children’s fiction and non-fiction.

Finally, determining the portrayal of invertebrates as inherently valuable was problematic, but relevant indicators were perspective and titles: inherent value seemed to be especially enhanced by stories written from the perspective of the analysed invertebrate, and the centrality of the invertebrate in the title.
Chapter 4. Discussion

4.1 Fluidity and Complexity

The results of the analysis support Lemelin’s (2013) suggestion that interactions between humans and insects are fluid and complex rather than either positive or negative, similar to the findings in Chapter 2.

At first sight, the results seemed to be in line with Williams Jr. et al.’s (2012:155) finding that while “nature is included less in recent [children’s picture] books, [but] when present, it is less likely to be portrayed negatively”. Similarly, 69.9% of invertebrate narratives in my analysis were mostly positive. This contrasted Hogue’s (1987) comment that negative insect portrayals are more usual in English fiction.

Yet, closer inspection revealed that most stories contained, in different degrees, mixed messages: positive portrayals were often not completely positive, while negative portrayals were often not completely negative. While such ambiguities were partly anticipated by other studies on literary invertebrates, I did not find any studies that articulated ambiguities as clearly and systematically: they were more often implied “in between the lines”.

The results reflect fluidity and complexity in different manners too, with regards to the dynamic between stories and interpretations of the reader. While determining the overall portrayal per story was for some stories straightforward, in other stories the ambiguities troubled making final judgments. For example, some “transition” stories were categorised as ambiguously positive, while others were ambiguously negative, depending on several factors including timing: how long it took for the transition to take place. Yet, the possibility for alternative interpretations always remains. Moreover,
“fluidity” was observed in relation to invertebrate characters themselves, especially in comics which often blurred the lines between human and invertebrate.²⁰

Attitudes vs. portrayals; analysis vs. literature review

The partial discrepancies between surveyed and described negativistic attitudes (e.g. Kellert 1993) on one hand, and story portrayals on the other, may be attributed to several factors.

Firstly, studies like Kellert (1993) may not give an adequate representation of people’s attitudes partly due to the used definition of “negativistic”, which for Kellert included “indifference”. As Lockwood (2013a) convincingly argues, indifference could be seen as a desirable attitude, pointing towards tolerance rather than negativism. As such, Kellert's study may have had different results, had he employed a different definition of “negativistic”.

Secondly, portrayals in literature on one hand, and public attitudes on the other, may not overlap or influence each other as easily as assumed. In the case of my analysis, the 73 analysed stories may not represent books that are often read by people who dislike invertebrates, and thus may have not contributed in influencing their attitudes. While this is hard to control for, it can be pointed out that most books were available through public libraries, while others were classics, “bestsellers” or adaptations of classics. As such, most books were either well known or at least easily available, except for a few underground comics. It is perhaps more relevant to point out that most analysed books presented themselves clearly as narratives about invertebrates (in the title, on the cover), and that this, rather than availability or popularity, may be a more important determinant for reached audiences (see Section 4.3).

²⁰I elaborate on both examples below (resp. in Section 4.4.4 and 4.4.1). To keep the analysis as transparent and objective as possible, I have included the used definitions and each individual analysis sheet in Appendices 2 and 4 so that my decisions can be tracked down.
Thirdly, there is the argument that the media of children’s literature and comics may result in biased or limited audiences. Yet, as mentioned in Section 3.1, there are good reasons pointing at the cultural relevance of these media. With regards to children’s literature, several generations of children (and their parents) may have been exposed to the analysed books, potentially informing their attitudes as adults. I further elaborate on audiences for comics in Section 4.5.

Alternatively, the focus on children’s literature and comics may partly help explain discrepancies between my results and Hogue’s (1987) comment on the dominance of negative insect portrayals. Hogue seems to suggest that children’s literature in general is more prone to positive portrayals of anthropomorphic animals (Section 2.3), which may point at possible differences in portrayals for adult and children’s literature. Yet, the multitude of ambiguities found in both the analysis and in the literature review, suggests that one should be careful about making such generalised statements, as they may not provide the complete picture. Further research is recommended.

The analysis also articulated discrepancies between attitudes and portrayals with regards to species preferences. Beetles were most often positively portrayed, and wasps least often. This contrasts Gerdes, Uhl & Alpers (2009) study which suggested that spiders evoked significantly more fear and disgust than beetles, butterflies/moths and bees/wasps.

The particular hierarchy my analysis suggested was also unexpected in relation to the discussed portrayals in the literature review. Apart from Hogue’s (1987) comment on the abundance of aesthetic beetles in artistic expressions (not specifically literary), the literature review suggested a history of mainly fearsome and negative beetle portrayals in Western narratives.
The negative portrayals of wasps were partly anticipated. Both my analysis and the literature review articulated negative wasp portrayals, however I found more positive portrayals than expected. These were especially fostered by aesthetic portrayals and transitions from “feared stingers” to “useful stingers” (e.g. *Lonely Wasp; Friends Forever*). The literature review suggested a lack of studies on literary wasps. Similarly, studies on public perceptions of wasps *specifically* are uncommon: wasps are usually grouped together with other animals that are often viewed as fearsome or disgusting (e.g. in Davey et al. 1998). These observations may be reflections of the notion that fear and/or disgust can lead to avoidance behaviours (Nesse 1990, Öhman & Mineka 2001). Lemelin’s (2013) comment may be relevant in this regard, too:

“In some ways, the absence of insects in most of the literature on human-animals studies has helped to support the fear of insects (…)” (2013:156).

Quite the opposite was true for spiders. As mentioned above, while spiders seem to elicit the strongest fear/disgust responses; arachnophobia being one of the most common fears in Western society (Davey 1994, Kirkpatrick 1984, Muris, Merckelbach & Collaris 1997, Prokop et al. 2010); this has not resulted in limited spider narratives and studies, similar to wasps. Cultural references to spiders, both positive and negative, are ubiquitous, and so are studies on cultural references and attitudes, which, when compared, articulate discrepancies.

Yet, the analysis gained insight into a portrayal “trend” for spiders that may relate to attitudes in a different way. Compared to the other analysed invertebrates, spider portrayals were most often characterised by transitions from negative to positive. Perhaps the latter could be explained by the author’s possible awareness of the prevalence of
arachnophobia. It may be possible that “transition” stories were created in an attempt to address these fears, and by putting them in a new perspective one can emphasise that fears are not always rational. Whether intentional or not, such narratives may well spark self-reflection for the reader.

Finally, some overlapping points of the analysis and other studies include studies like Barrow (2002) and Snaddon & Turner (2007) that articulated limited knowledge of (helpful characteristics of) invertebrates (Section 4.4.2); studies that highlight the phenomena of anthropomorphisms and otherworldly portrayals (e.g. Dodd 2008, Hogue 1987; Section 4.4.1); and findings on ants and worms in particular. The suggestion that ants are often portrayed in war- and battle scenes (e.g. noted in Del Toro et al. 2012) was supported by the analysis (e.g. Ant Colony, Ant-Man, An Earth Man on Venus). Similarly, the analysis further articulated the (historical) blurry line between worms, maggots, and fantastical hybrids (e.g. Berenbaum 2006), especially in comics. Lastly, connections between attitudes and portrayals were suggested in findings on metanarratives and narrators that address readers directly (Section 4.4.5).

All in all, while our attitudes towards and encounters with invertebrates may be (and likely always will be) variable and may perhaps not always overlap with portrayals in stories; literature or stories may still form a relevant route for science communication, for influencing and adjusting attitudes positively (e.g. Mobley et al. 2010, Negrete & Lartigue 2004, Tatalovic 2009, Wells & Zeece 2007, Williams Jr. et al. 2012), at least for some invertebrates and their behaviours, or in certain circumstances and places of encounters. As such, reducing variables and ambiguities in narratives in favour of highlighting constructive behaviours and encounters may be desirable if and when one’s aim is to create a better reputation for invertebrates (e.g. Kellert 1993). Next, I discuss and recommend such options.
4.2. Recommendations for Narratives

The focus of the recommendations is less concentrated on narratives that foster complete, deeper understanding of invertebrates, yet more on creating positive (yet truthful) awareness, comparable to Burns, O’Connor & Stocklmayer’s (2003) described distinctions between science communication approaches:

“Public awareness of science aims to stimulate awareness of, and positive attitudes (or opinions) towards science” (2003:190).

They pose this as a different goal from creating an understanding of science, which relates to content, processes and social factors. As such, I discuss the portrayal of invertebrates and their possible relations to public attitudes towards invertebrates: the recommendations are concerned with reaching audiences, and inspiring tolerance and further learning about invertebrates.

The recommendations should not be regarded as final or complete: rather they were inspired by the results of the analysis. While the focus on children’s literature and comics may not always or easily transfer to narratives in other literary media and genres, the focus on writing techniques and story themes aim to articulate broader implications for literary media and genres in general.

As such, this chapter may form additions to other emerging studies that recommend themes that may result in decreased fear and disgust for invertebrates, such as Wagler & Wagler’s (2014) recommendation of integrating the “great mass extinction” as a theme into existing curricula. Finally, some of the recommendations are highlighted as

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21 One could certainly try to achieve awareness and understanding at once, yet this is a highly ambitious goal. I believe it is more realistic to take one step at a time. My creative component needs to be regarded in this light, too: my narratives aim to create a positive (yet truthful) awareness of invertebrates; rather than aiming for a deeper understanding.
applications in the creative component of the thesis: my own invertebrate stories in comic book format.

4.3 Recommendation 1. First Impressions (Title and Cover)

An important first step for reaching audiences in literary media (or any medium or event with a title), is considering the effects of the first impressions: the “promise” a book makes to its reader about what is yet to come. In literature, especially the title, tagline, series titles and other texts and images on the front and back cover play important roles.

I found series in both comics (“Insect Fear”) and children’s non-fiction (“Creepy Crawly Collection”) that highlighted fear and disgust, contrasting titles like “Minibeasts”: a much friendlier word to describe the same thing. Especially in non-fiction, negative first impressions resulted in strong ambiguities, as they were often followed by (mostly) positive narratives. As such, the invertebrate as “creepy crawly” was used as a hook to attract readers. It is hard to predict the effects this may have on different audiences. Sleigh (2006) suggests that disgust may even have a somewhat positive, engaging effect.

“Writers at various points on the disgust-desire continuum have gone on to shape Western reactions to the insect to this very day. Each extreme of reaction invokes its opposite and their overlap is titillation. Ugh! Show it to me again, only this time ten times life size!” (2006:294)

Similarly, Lockwood (2013b) writes about the “negative sublime”, the horrific yet deeply engaging experience of insects that both pushes us away and pulls us in. So, despite negativity and reinforcements of stigmas, such portrayals may be appealing to some audiences. Further study in this area is recommended. What type of audiences are reached
with “creepy crawly” portrayals? Are they audiences that are already engaged with or tolerant towards invertebrates, or not? What effects do such portrayals have on people’s attitudes?

A relevant insight is provided by preliminary research by Siebentritt (2014) who studied the impact that titles may have on attracting audiences. More specifically, the study investigated the impact the word “science” had in the title of an event, and whether this limited audiences to scientifically engaged audiences or not. The contributors created two titles for the same event, one with the word “science”, the other one without. The results suggested that the word “science” indeed limited who came to the event. Titles with the word “science” attracted more audiences that were already engaged with the sciences, while the absence of the word “science” in the title also attracted audiences that were not scientifically engaged. As such, Siebentritt suggests that “in order to engage the science-disengaged, we need to consider the impact of the word ‘science’ when promoting events and engagement opportunities to attract a less engaged audience.”

Here, I draw an analogy between science and invertebrates. Arguably, the words “science”, “invertebrates”, “insects” or “creepy crawlies” all have the potential to either attract or deter audiences. As such, when science communicators want to engage (currently disengaged) people, they need to be careful with the words they choose in the titles. Therefore, the following options may be considered.

A first option includes positive and constructive messages delivered via the title and cover image, beyond the “creepy”, the “monsters” and the “terrible tarantulas”. Titles could refer to actions rather than entities, such as constructive ecosystem interactions (e.g. mutualism, nest building). The analysis suggested that many invertebrate portrayals are written from a human angle, which may reveal something about our need, or even, our

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22 This study is currently unpublished. I refer here to the Australian Science Communicators 2014 Conference abstract, and personal communication with Carly Siebentritt per e-mail on 28/03/2014.
limitation inherent to “being human”, to perceive invertebrates from our own perspective. As such, highlighting positive human-invertebrate relationships, similarities and feelings may be relevant strategies.

Alternatively and more extremely, it is an option to not portray invertebrates at all in the title and on the cover. It seems possible that any clear hint giving away that invertebrates are the subject of a narrative, may deter audiences that dislike invertebrates. Instead of framing stories as “invertebrate narratives”, stories could present themselves as human (or other) narratives, and introduce invertebrates gradually or suddenly into the story. This may allow readers to engage in a narrative they would have otherwise not chosen to engage with.

I apply the latter recommendation in both stories of the creative component: *Shadow Costume / An Undercover Romance* and *Candy House*. The stories mostly disguise the invertebrates in the first impressions. *Shadow Costume* only includes a small image of an insect on the cover, while the first hint of invertebrates in *Candy House* features in the foreword. Apart from these elements, both stories present themselves initially as human stories: *Candy House* depicts a human house on the cover, and *Shadow Costume* hints at interactions between human characters.

Benefits of this strategy also relate to possible inclusions of invertebrates in almost any literary genre or medium including comics, (fictional) memoirs, romances, and detectives, and a variety of human relationships with invertebrates can be highlighted (Section 4.4.3). In this way, wider audiences may be reached, and “preaching to the choir” (reaching audiences that were already tolerant towards or engaged with invertebrates) may be easier avoided.23

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23 See also Section 4.5.
A potential downside of this strategy is that it often “restricts” stories to portraying invertebrates in wider environments and from wider perspectives (human, animal, plant): they are portrayed in interaction with something else, rather than as inherently relevant and valuable in themselves.\textsuperscript{24} Yet, as highlighted in Section 4.4.4, portraying invertebrates in a wider perspective and in a wider environment is arguably exactly what may be needed to shine new lights on uncomfortable feelings with their presence in our personal spaces. Moreover, once the invertebrates are introduced, it may be possible to “zoom in” on their own traits and behaviours. I applied the latter technique in \textit{Shadow Costume}: once the invertebrates are introduced, a few pages are dedicated to descriptions of their biological traits and inter-species interactions, outside of the human context.

\textbf{4.4 Recommendation 2. Content of Narratives}

\textbf{4.4.1 Similarities and feelings}

\textit{Aesthetics}

While Kellert (1993) did not elaborate much on positive attitudes in his survey, he did record aesthetic attitudes as the second most common attitude after negativistic ones. In the analysis, especially beetles benefitted from aesthetically diverse and colourful portrayals, yet I observed aesthetic portrayals for other invertebrates too, even for negatively portrayed wasps (e.g. \textit{The Golden Wasp}).

While aesthetic portrayals seem relevant in fostering positive feelings and portrayals, they may not easily apply to every invertebrate. However, Lockwood (2013a:151) notes that beauty is also associated with balance, harmony, order and diversity. He explains that in “evolutionary terms, there was an advantage in being

\textsuperscript{24} Unless the narrative as a whole is a metaphor for invertebrate-life. This is the approach of my story \textit{Candy House}. I come back to this in Section 4.6.
attuned to” such properties. Moreover, in narratives, aesthetics may not only relate to depictions of invertebrates themselves, but also to the style in which they and the narrative as a whole are depicted. My comics are characterised by an aesthetic component, which mostly relates to the colourful hand-painted images.

**Symbols**

Berenbaum (1995) noted a plethora of symbolic interpretations of invertebrates, many of them positive. Similarly, the analysis highlighted examples of symbolism. Lockwood (2013a:165) noted that people may mostly perceive insects to be compelling representations of powerful ideas and feelings. These inevitably refer back to representations of us. While some symbols are highly imaginative, there is a particular symbol I want to highlight here, as it clearly draws on ecological realities. This is the symbol or metaphor of invertebrates as teachers.

Throughout history, people have observed and looked closely at invertebrate life, and found much inspiration applicable to human life, some of the most famous ones being ants and honeybees as examples of cooperation and industry. Ritchie’s (1979) history of insects and humans, dedicates a chapter to insects as friends and teachers. He notes that various people, including designers, architects and engineers have drawn upon invertebrate behaviours or structures (biomimicry). For example, architecture inspired by invertebrates includes hexagonal structures (beehives); certain bridges may well have been inspired by spider’s strong silken thread to cross distances (over water); and the “diving bell” of the water spider was arguably an inspiration for early human diving techniques. Similarly, yet less visible to the eye, Wylie (2012) notes an example of scientists in the 1970s that developed the first pesticides that mimicked insect hormones.
Even on a more personal level, invertebrates have inspired humans. For example, Ritchie (1979) notes histories of prisoners who gained hope by looking at an ant carrying a heavy seed along a vertical wall, which taught them about persistence. My comic *Shadow Costume*, too, embraces the metaphor of invertebrates as teachers.

*Otherworldliness and wonder*

Otherworldly portrayals were classified as a type of anthropomorphism and referred to “aliens” in a broad sense of the word, including various types of fantastical creatures and the interpretation of “invertebrate worlds” as separate from “human worlds”. Dodd (2008) outlined that both historically and today insects have inspired and enabled us to imagine other worlds. A function of such representations of insects is that they:

“mediate the familiar, ‘here and now’ world of the human, and other, more mysterious spatial, temporal, and cognitive realms to which human beings feel tenuously connected (2008:176).

Thus Dodd argues, otherworldly portrayals of insects are much connected with ourselves:

“If we choose to find in the figure of the insect a purpose related explicitly to human life, as well as to human culture, then its ability to astound and intrigue us, and to draw us closer to both the natural world in which we are embedded, and to our own imagination, may be that purpose” (2008:228).
He notes that portrayals like these may revive a sense of wonder, and can inspire self-reflection of our own place on the planet, including our relations with other entities in nature.

Stories that draw upon our emotions and anthropocentric interpretations of invertebrate behaviour may be considered unscientific. Some authors highlight disadvantages of “wondrous” portrayals. For example, Watts (2014) highlights the risk of losing a critical perspective.

On the other hand, Searles’ (2010) study suggests that especially playing in on emotions may be important for influencing (environmental) attitudes. Similarly, Rachel Carson (1998) in her book *The Sense of Wonder* argued for re-connecting with a wondrous experience of the natural world, which often comes so natural to us when we are children. Again, deciding whether one’s goal relates mostly to creating awareness or positive attitudes, or to a deeper understanding of invertebrates through their particular portrayal in narratives, may be a relevant determinant for the appropriateness of drawing upon this angle.

At the same time, such themes may well go hand in hand with science. With regards to the analysis, while some encountered otherworldly portrayals were highly fantastical (e.g. superhero comics), other stories (e.g. *The Spider Who Created the World* and *Johnny Whistler and The Spiders*), combined otherworldliness with distinguishable ecological realities: the former by a focus on traits and behaviours, the latter by focus on the spiders’ place in the environment.

In addition, otherworldly perceptions are even notable among well-respected scientists, as the following quote by entomologist E.O. Wilson demonstrates, in an interview about his novel(la) *Anthill* (Treisman 2010).
“And it’s as though I were describing, I think many will see, as though I were describing in that novella—as you say correctly, it takes about a quarter of the book—as though I were describing accurately how life might have evolved up to a high social level on another planet” (my italics).

Raffles (2010) highlights another function of perceiving insects as otherworldly. It can provide a therapeutic quality, and form an escape from the stresses of daily life. Raffles mentions historical figures Cornelia Hesse-Honegger, Li Shijun, Joris Hoefnagel, Karl von Frisch, Martin Landauer, Jean-Henri Fabre, for whom:

“an insect universe provided an often-unexpected refuge. Perhaps it brings to mind people who, to put it another way, entered the world of insects and were, in turn, entered by it, who at times were swallowed up by it and who at other times found their bearing inside it, such that the normal scale of existence – the standard hierarchies of being- in which we know small things because they are physically smaller than we are and we know lesser things because they lack our capacities, was no longer a basis for either action or meaning, and such that the enormity of the circumstances that bound their lives could assume another proportion and a different place in their world, such that the world itself could become immeasurable larger and unconfining” (2010:370).

Again, this angle highlights the emotional appeal invertebrates can have, which could form a relevant approach for positive narratives.
Other anthropomorphisms

Other anthropomorphisms provide useful science communication advantages, too. They may foster emotional attachment to characters (Jee & Anggoro 2012) and readers may relate the characters to themselves (self-reference), which, as Symons & Johnson (1997) point out, is associated with producing stronger, more resilient memories. Yet, for science communication it is important that these anthropomorphisms do not result in misrepresentations (Chan 2012).

Here, I highlight ecologically real analogies between humans and invertebrates (interpretative anthropomorphisms). This strategy may be particularly relevant since humans and invertebrates may seem radically different at first sight, from morphology to behaviour. As mentioned in Chapter 1, the perceived “radical differences” between invertebrates and humans may be important factors contributing to people’s negative perceptions (Kellert 1993), while perceived similarities may enhance empathy (Chan 2012).

When one looks closer, it becomes possible to point out some more subtle or basic similarities. Examples encountered in the analysis are social structures and queens, family structures, family care, and other constructive behaviours, such as invertebrates that transform landscapes (“engineers”) or that are entertainers (to us; “musicians”). Even basic physical similarities can be pointed out (e.g. “strong muscles” in Yucky Worms).

Analogies like these could help appreciating invertebrates (ecological realities) better while retaining a human perspective. So, while speciesism has long worked against invertebrates, stories may focus on similarities so that the insight that similarities enhance empathy can be used to an advantage. Besides the above-mentioned examples, the following options could be considered.
Examples of relevant analogies

Berenbaum (2006) gives several examples of similarities between them and us.25 Firstly, we seem to share similar perceptions of beauty.

“insects appear to appreciate the beauty of flowers as we do because we share their ability to see the spectacular display of colors and shapes” (2006:6).

Secondly, we enjoy the same foods (e.g. honey). Thirdly, acoustic communication is a similarity between humans and insects.

“Literature is about language and sound, and many insects are unusual among living creatures, particularly among invertebrates, in that they share the human capacity for acoustic communication. Certainly, birds can sing, and birdsong figures prominently in poetry, but the eight thousand species of birds in the world are easily outchorused by the tens of thousands of species of noisemaking insects; these include the familiar grasshoppers, crickets, and cicadas, as well as the less-renowned deathwatch beetle, bess beetle, and hissing cockroach. There are even singing caterpillars known to science, if not to poets” (2006:5).

Sleigh (2006) argued that portraying similarities between humans and insects was especially much at heart in early 20th century literature. Both humans and insect were represented as creatures of the mass:

25 These analogies are based on her observations in past and current invertebrate portrayals.
“it was the crowd (…) that encouraged the most primitive human instincts to come to the surface, just as it was the insect crowd – social insects - that displayed instinct at its most complex and sophisticated” (2006:293-294).

This phenomenon still recurs in contemporary books; even carefully in popular non-fiction. Marlene Zuk’s comments on her popular non-fiction book, *Sex on Six Legs: Lessons on Life, Love, and Language from the Insect World*, highlight that while she makes comparisons of insect behaviour and human behaviour to address our under-appreciation of insects, her aim is to be careful and considerate while drawing such parallels, going beyond simplistic views of insect life in human terms (Zuk 2012).

Clark (2013a) notes another remarkable similarity: both humans and insects have successfully globalised the planet. While we currently feel responsible for eliminating “exotic” insects (resulting in a biosecurity crisis), we could benefit from remembering that landforms are not stable, and that insects have been dispersing themselves for millions of years. Even more so, Clark points out that we could not have globalized without the insect-angiosperm alliance.

“It hints at why human agents had to go to extraordinary lengths to mimic the quite ordinary capacities at every turn – from taking to the air, spreading pathogenic micro-organisms and deploying species-specific hormones – in order to have any chance of containing insect vitality” (2013a:33).
Alternatively, Bertoni (2013) notes that “eating” is a way of relating. Eating is a similarity between them and us that is not just material; it is relational. Bertoni (2013:80) argues that imagining “organisms and environments as eating together or, better still, as eating *each other* and *with each other*”, is a relevant angle to improve our perceptions of and relationships with invertebrates, and the environment in general.

"Ecologists tell us that life on this planet is enmeshed in intricate *food webs* through which everything, living and nonliving alike, circulates. In ecology, eating emerges as crucial to the ways in which life-forms relate to each other and with their environment. However, the relations in food webs are unstable, balances may shift and their overall coherence is frail. Now that a vast portion of the world’s natural resources is being used to feed a growing human population, our relations with our companion species and our environment are emerging as a locus for public debate” (2013:61-62).

Both Bertoni’s (2013) and Clark’s (2013a) studies highlight similarities as well as our interrelatedness and interdependence (more in Section 4.4.3).

Finally, another relevant similarity is the metamorphosis. Parikka (2010) wrote that “(…) metamorphosis marks for the majority of us a defining feature of the image of “insect life”: transformation, development, and change“ (2010:85). So, metamorphosis is both a scientific and a cultural concept, from “myth to biology, fiction to science” (2010:86).
“With roots in metaphysical and spiritual thought, metamorphotic processes served as a key tool for understanding metaphoric and metonymic transformations of language, as well as mythical, abrupt crossings between men and animals, for example, when they could suddenly, by metamorphosis, start to speak” (2010:85-86).

According to this description, all anthropomorphic animals would fall under the concept of metamorphosis. Yet, especially in comics I observed literal transformations from human characters into human-invertebrate hybrids. These were often highly fantastical or exaggerated ecological realities and may seem problematic from a science communication perspective.

However, studies on manga (Japanese comics) highlight possibilities for human-invertebrate hybrids and metamorphoses that are more realistic, especially in the work of famous manga artist Tezuka Osamu (Knighton 2013, Marran 2013). Instead of characters within whom (misrepresented) invertebrate behaviours and/or appearances complement human behaviours and/or appearances; narratives may contain characters whose behaviour could, at times, apply to both humans and invertebrates (overlapping characteristics). Marran’s (2013) study articulates that Tezuka himself considered the metamorphosis an important element both for insects and animation. Marran highlights that the integration of text and images influences the ways in which characters can be portrayed: identities are less fixed, enabling characters to morph from one state into another.

“Graphic novels, for their capacity to allow for the bending and stretching of morphologies and line, can generate visually a sense of
corporeal possibility. Scholar of animation and aesthetics Thomas Lamarre (...) calls this capacity for elastic deformation and transformation “plasmaticity”. This malleability in form enables animated characters to oscillate between humanoid and animal being, and a similar claim can be made for the characters in graphic novels. Plasmaticity makes possible a visual and narrative rendering of nonhumanist ontologies because the medium enables the representation of life beyond anthropomorphic design” (2013:76).

Marran argues that Tezuka embraced this approach, as he created anthropomorphic animals and zoomorphic humans in his manga. Similarly, McCloud (1994) noted that in comics it is almost unsurprising when entities come to life that normally would not come to life. Such possibilities may well be used as an advantage for bringing humans and invertebrates closer together, and making strong associations between the two: not just imaginary, but also reflecting ecological realities.

For example, in Tezuka’s The Book Of Human Insects, explicit comparisons are made of human behaviour, metamorphosis, and mimicry, while the characters physically retained their human appearances (Knighton 2013). In the analysis, the phsyical appearances of human-invertebrate hybrid characters in Tezuka’s Diary of an Insect Shojo’s Vagabond Life were imaginary, yet this story too, drew parallels between human and invertebrate behaviour. Both insects and humans were portrayed as living miserable lives, but a positive recommendation also came forward: that of tolerance of others in
society. A short metanarrative at the start enabled clarification of the analogy between humans and ants.  

My comics are much inspired by Tezuka. Shadow Costume highlights mimicry as a similarity between humans and invertebrates; and Candy House takes advantage of “plasmaticity”: the characters have human appearances while the narrative hints at their invertebrate behaviours, and by the end of the narrative, they transform into actual invertebrates. Similarities that come forward are our shared interests in food and a place to live. Also, metanarratives are included to clarify the analogy between humans and parasitic nematodes.

Tezuka’s manga articulates the potentials of comics and invertebrate portrayals, yet also reveals something about the lessons that can be learned from the long history of love and respect for invertebrates or “mushi” in Japanese culture in general (Hogue 1987, Section 4.4.3). For example, the documentary Beetle Queen Conquers Tokyo, provides an insight into Japanese culture and beetles, and highlights several underlining similarities between beetles and us: beetles are posed as “model persons”, from behaviour, to cultures, emotions and even similarities in appearances of humans and insects (Murray & Heumann 2013).

4.4.2 Ecosystem interactions

Invertebrates as “destructors” seems to be a recurring trope, not only in literature but also in other media (e.g. science fiction movies; Hogue 1987). Superhero comics and underground comics in particular, were characterised by portrayals of battles and other destructive scenes. Such portrayals did not necessarily translate to negative portrayals, nor were they necessarily misrepresentations of behaviours, yet they may still reveal...

26 Despite the relevant technique, the portrayal of ants in this particular story remained ambiguously negative.
something about our (the authors’ and/or readers’) association of invertebrates with destruction, which, generally speaking, is not a desirable (Western) human value. It may be easily transferred to people’s feeling of unease related to well known “destructive activities” such as crop destruction, plagues, biting and stinging.

This is exactly what Barrow’s (2002) study suggested: elementary students in the United States had more knowledge about the harmful effects of insects than their helpful effects. Similarly, Kellert’s (1993) study suggested that the general public in America had limited knowledge about invertebrates in general.

Also, perhaps battle scenes make for a better story; in some cases they are inherent to genres (from superhero comics to action films and computer games, even ancient literature is often characterised by wars and battles). Additionally, battles and other destructive interactions could be “justified” by their role of conflict in stories: conflict in itself arguably being one of the defining components of what makes a story a story. Yet even if so, conflicts in stories could well arise from other things than “human versus invertebrate” or “predator versus prey” scenarios. For example, conflicts could be articulated in narratives in which different invertebrates (or even: invertebrates and humans) have to work together or cooperate to stand strong against something else (for example, a natural disaster).

Perhaps some of Lockwood’s (2013a) suggested explanations of our aversion against (invertebrate) predators play a role too. Similar to my findings, he notes that insect-related language is full of military metaphors. He sees this in the light of pest control and the human battle against insects, especially when it comes to food security (2013:159). Moreover, “perhaps the benefits of these creatures are unnoticeable and delayed, while the harms are apparent and immediate” (2013:146).
Similarly, some positive interactions are perhaps just more difficult to show visually in images and/or integrate into a story line. This could explain why occasionally I encountered positive characteristics like biological pest control and pollination in quick comments and metanarratives, rather than having narratives built around them, and being visually displayed. Yet, as Berenbaum (1995) notes:

“the creative activities of insects are readily visible: webs are spun, tunnels are dug, nests are constructed, cases are built, galls are formed, and so on” (1995:317).

These examples allow constructive imagery, just like observed counterexamples in the analysis (e.g. *Wasp’s Nest*, some stories in *Myrmex*).

As such, I recommend careful selection of words and images, and careful selection of portrayed traits and interactions, keeping effects on invertebrate portrayal in mind. Images could be less violent, and focus more on constructive scenes: different types of action. Even when portraying destructive characteristics, words and story setting could be chosen strategically, allowing to create a positive spin, similar to examples encountered in the analysis (Section 4.4.4).

De Waal’s (1996:8) observations, too, serve as a reminder for choosing words carefully. He noted negative biases in scientific language for the description of destructive species behaviours, while constructive behaviours (such as helping each other) are often more neutrally described. Words like “suckers,” “grudgers,” and “cheaters” who act “spitefully,” “greedily” and “murderously”, are not uncommon, while words to describe more favourable animal behaviours (according to human values), are
often more neutral or negative, to prevent authors from being judged as “hopelessly romantic or naïve”.

Hence, in my comics, I mostly highlight constructive ecosystem interactions. *Shadow Costume* focuses on mutualism between ants and other insects; and *Candy House* creates a positive spin on nematode parasitism, focussing on feeding habits and shared habitats of soil invertebrates.

### 4.4.3 Human-invertebrate encounters

Many analysed stories articulated (moments of) incompatibilities of humans and invertebrates, rather than their coexistence. In some cases, humans posed threats to invertebrates; in other cases, the opposite was the case. Occasionally, conflicts were enhanced by a portrayal of invertebrates and humans as living in separate worlds, which highlighted that otherworldliness did not always contribute to positive portrayals.

These are especially relevant findings, since the analysed invertebrates are the ones we often find in human environments: they are the animals we “have to deal with”. As such, narratives could benefit from portraying positive human-invertebrate interactions. This is in line with Rautio (2013:445) who argues that environmental education may benefit from a focus on “finding and composing connections to our surrounding nonhuman world”; and an interest in “how humans and nonhuman animals continually create the conditions for each other’s existence”. Similarly, Kellert (1993:852) wrote that highlighting the roles of invertebrates in human welfare and survival may “do much to dampen prevailing negative attitudes”. Insect collector and scholar Yoro Takeshi (in personal communication with Raffles 2010), too, noted that
“a truly deep relationship with other beings results from interspecies interaction, not separation (...)” (2010:381).

An additional benefit of portraying encounters is that they can be used as a method of getting around imaginative anthropomorphisms. Such stories can be written from the human perspective and do not “need” anthropomorphic invertebrates; the humans do the talking and can be portrayed in close (yet harmless) interactions with invertebrates.

**Examples of relevant encounters**

Several types of encounters can be portrayed. Some interactions are strictly speaking ecological yet can be of use to humans. Highlighting such interactions is in line with Kellert’s (1993) ecologistic and utilitarian attitudes. Encountered examples in the analysis include the portrayal of worms as beneficial in the garden and for plant growth in general (*Yucky Worms, There’s A Hair in My Dirt!*); beetles that serve roles as clean-up crews (*Dung Beetle’s Dinner*), and wasps as pollinators (*Wasps Up Close*).²⁷

Other utilitarian values that may be highlighted are the benefits of entomophagy: the human consumption of insects. In the analysis I encountered two narratives on this subject (*How to Eat Fried Worms* and *Chocolate-Covered Ants*), containing a mix of both humour and disgust; yet disgust was arguably the central focus point. Yet, authors like Last (2014), Loo & Sellbach (2013) Oonincx et al. (2010), Ramos-Elorduy (1997), and even the Food and Agriculture Organization of the United Nations (2013) argue that it is time that awareness of the benefits of eating insects starts to increase, rather than discouraging or ignoring it. Not only are there benefits from a sustainable and nutritional point of view; Last’s (2014) study reminds it may well be a relevant way of bringing

²⁷ See also examples of ecosystem services in Chapter 1.
humans and insects closer together and help overcoming fear and disgust, as long as the opportunities are created to become more used to this idea.\textsuperscript{28} Hence, the idea of eating insects is raised in my story \textit{Candy House}.

Alternatively, invertebrates could be framed as companion species, which would fit with Kellert’s (1993:848) defined humanistic attitudes (“Primary orientation of strong emotional affection for invertebrate animals”), yet also with scientistic and naturalistic attitudes.

> “Companion species are (…) organisms who share and shape each others’ evolutionary trajectory” (Haraway 2003, in Wylie 2012:64).

Various authors (e.g. Beisel et al. 2013, Bertoni 2013, Wylie 2012) highlight insects as companions for scientists. From forensic entomology (measuring decay of bodies through maggot populations), to approaching other particular scientific issues, including pest control methods and indicators of soil quality:

> “Companion laboratory species determine both the kinds of research questions scientists can ask and their research timetables” (Wylie 2012:64).

> “Companions” can also refer to other relationships, like pets or friends (e.g. Ritchie 1979, Boobel, Worm and Potion Power in the analysis). While the idea of invertebrates as pets

\textsuperscript{28} Arguably, the names given to edible insect products will play an important role, too. For example, a Dutch supermarket has recently started selling insect burgers and other snacks consisting of meal worms, buffalo worms and moth larvae (RTE news 2014). Yet, rather than “worm burgers” or “larvae burgers” they are called "buggy burgers". Again, this points at the relevance of considering language as a cultural force related to public attitudes, as highlighted in Chapter 1.
may be uncommon in the Western world, I observed other, more subtle elements that drew upon friendly and close relationships: when invertebrates were given names (e.g. *Mary, the Big Brown Hairy Spider*); or images that showed tactile yet harmless encounters, like an image of a human hand holding a beetle (*Dung Beetle’s Dinner*); images of close studious observations (*The Ant: Energetic Worker*); or tips for keeping them as “educational pets” (*Worms*). Such closely connected images also feature in my story *Shadow Costume*: one of the human characters calls his insect collection his “unquestioning company”.

Finally, in some Asian countries like Japan and China, insects are much more common as companion animals (Hogue 1987). In Japan, selling insects in “insect pet shops” is a profession. Currently, there is even a so-called “beetle mania” in Japan, and people keep beetles like rhinoceros beetles and stag beetles as pets (Laurent 2000). Also, the “musician” insects such as crickets and cicadas are popular to keep in cages, and their songs are considered a welcome company. Some of these traditions are hundreds of years old (Ritchie 1979).

### 4.4.4 Positive spins and transitions

Several encounters between invertebrates, humans and the feelings that came along with them, were characterised by transitions from negative to positive. As mentioned, these results could be interpreted as a testimony of our negative feelings and relationships, and the authors’ awareness of the need to overcome these.

A possible explanation for the absence of positive-to-negative transition stories, may similarly relate to authors’ awareness of attitudes towards “creepy crawlies”: perhaps there would be less point in transforming positive perceptions into negative ones when
one assumes that perceptions were already negative to start with (unless one aims for an extra strong negative message, along the lines of “the friends whom betrayed”).

Not all of the negative-to-positive transition stories resulted in overall positive portrayals, either. This mostly related to the timing of the transition and the potential stories created for the reader to anticipate the transition. Anticipation of transitions was fostered by 1) stories written from the perspective of the invertebrate that was perceived negatively; 2) stories written from the perspective of a non-invertebrate protagonist who empathised with invertebrates, contrasting the perceptions of his/her friends or family; and/or 3) the title that gave the positive portrayal away.

Contrarily, in stories in which the transition was unanticipated, the reader and (human) protagonist went through the transition at the same time. When such unanticipated transitions took place only via a swift turn in the plot at the end (rather than earlier in the narrative), most of the narrative highlighted the fear or disgust, and the transition seemed only a minor component in comparison.

Sometimes, transitions were enabled by a positive spin on an otherwise “destructive” invertebrate characteristic. For example, in Be Nice To Spiders the predator-prey relationships of spiders and flies were first viewed negatively by human characters, yet the spider and her “messy webs” turned out to be useful for pest control of flies in the zoo, which benefitted both zookeepers and vertebrate animals. As such, the benefits of predators on a wider environment and/or on other characters than the prey/victim were emphasised.

While transition stories are inherently ambiguous (and thus, in theory, do not fit with my recommendations for reducing ambiguous portrayals); they do have their place. Transition portrayals that result in mostly positive narratives may be powerful since they “respect” people’s current fear or conflicting perceptions initially, while highlighting
explicitly how one may learn to overcome negative encounters and feelings. Perhaps, for some audiences this may even be more powerful than wholly unambiguously positive stories.

Finally, while my comics do not portray clear transitions as such, *Candy House* gives a positive spin on some “destructive” interactions. For example, one of the characters is a parasitic nematode that kills insects, yet this is used as a pest control technique in the garden.

4.4.5 Metanarratives and addressing the reader directly

Narrators’ comments on narratives, as well as narrators that address readers directly, created opportunities for engaging narrator-reader interactions, like enhancement of suspense, reducing fear, or encouraging the reader to see similarities between us and them.

While both techniques were relatively uncommon phenomena, and formed sometimes an almost “random” interruption in, or a distraction from the narrative, they fostered a relevant insight. They provided moments in which the narrator and reader were “closest” to each other. The narrator made the reader aware of his/her presence and pointed the reader in the right direction.

In other words, via these techniques, readers’ attitudes on the one hand, and stories on the other hand, are linked. By addressing the reader, whether it is in a metanarrative or part of the actual narrative, narrators can “shake up” readers and make them aware that the narrative may have implications for, or is applicable to their very own life and attitudes. I apply these techniques in my story *Candy House*, by including a foreword, afterword and small comments within the narrative.
4.4.6 Inherent value

Analysing the portrayal of invertebrates as inherently valuable was inspired by the notion that awe can arise from “the awareness of the unfathomable mystery of life itself” (Orr 1993:423).\(^{29}\) While it was difficult to determine whether stories employed this theme, the results articulated that if future authors aim to write stories in this theme, important considerations are the effects of titles and perspective. The title has the power to either frame an invertebrate according to constructive or destructive characteristics relevant to the invertebrate itself, or its interaction with others. For example, the title “The Spider and the Fly” anticipated a destructive predator-prey interaction: arguably, the spider is not portrayed as inherently valuable, because it is portrayed only in its destructive relationship with another. Alternatively, while stories written from the perspective of the invertebrate in question may often be anthropomorphic, they do enhance reader identification and a sense of an invertebrate’s inherent value.

4.5 Recommendation 3. Medium

Comics

I highlight comics since the analysis suggested that comics scored highest for negative portrayals compared to both genres in children’s literature. Moreover, comics are the chosen medium of my creative component. The results are in line with other studies that analysed the portrayal of sciences in several media, including comics. For example, Van Gorp & Rommes (2014) highlight that the portrayal of scientists in Belgian comics is often stereotypical. Such stereotypes can result in a negative image of science in society, which could form an important explanation of young people’s lack of interest in science subjects. With regards to insects specifically, Lauck (1998:7) pointed at negative

\(^{29}\) Orr writes this in relation to Albert Schweitzer’s (1969) notion of “Reverence for life”.

101
portrayals in comics, too, highlighting that they express “the culture’s beliefs about insects in exaggerated fashion”

This is not to say that such negative stereotypes are inherent to the medium, or that they form the only ways in which invertebrates can be portrayed (Section 4.4.1). Other studies articulate the potential of creating positive attitudes towards sciences via comics, and called for more attention to this medium in relation to science communication (Tatalovic 2009). For example, Lin’s (2013) study on the impact of comics on audiences’ attitudes towards wind energy suggested that, compared to photographs in brochures, comics in brochures provided a “more efficient path toward the development of stronger intentions to perform recommended behaviors” (2013:iv). One important component that played a role was that the participants expressed they found the comics more cognitively engaging. Similarly, Naylor and Keogh (1999) point out that cartoons may be a useful medium for creating public awareness and interest in science-based questions.

There are several educational advantages of comics. Studies suggest that comics can make children think about science, and help teaching science in schools (Olson 2008, Rota 2003, Weitkamp & Burnet 2007). McCloud (1994) highlights that comics enable various possibilities of creating dynamics between texts and images, from overlapping, to complementing, to contrasting and other ways of conveying information; they provide means for direct dialogue and inner thoughts of characters, and for narrators to include detailed visual information that convey information beyond the text. Jee & Anggoro (2012) note that such rich visualisations, text and dialogue, may enhance science learning, and can help making abstract scientific concepts more concrete.

Moreover, studies point at other reasons for educational benefits of comics. Mayer et al. (1995) suggested that embedding texts in images may lead to a better understanding
of the content than when both components are presented separately, and that static images may lead to robust memory representations. While dynamic images may be effective, too, Tversky, Morrison & Betrancourt (2002) highlight that dynamic animations pose the risk that the viewer may not always know what to pay attention to due to speed and complexity. Gentner & Markman (1994) articulate that static images allow side-by-side comparison, which can help determining relevant commonalities and differences. So, while comics’ readers can take their time, such time is not permitted in moving images. Also, comics allow freedom of the reading experience in a different way.

“These texts do not dictate what students notice first, how or what they “read”. Like scanning a work of art, the reader can decide where to begin and how long to look. Readers can choose to look at the words or the images first, or take the page in all at once as an integrated design” (Williams 2008:13).

Additionally, comics have an informal nature, and are mostly read outside of the classroom. Hughes-Hassell & Rodge’s (2007) survey suggested that 44% of American fifth to eight graders read comics in their leisure, while 30% read books for pleasure. Comics are viewed as recreational reading rather than academic reading (McVicker 2007:87). This can be used as an advantage for science communication. In Jee & Anggoro’s words:

“One potentially powerful way to expose students to scientific ideas is through mediums that they already enjoy and use (2012:196)
Moreover, the informal nature of comics creates “freedom and distinctiveness of experience [which] could make informal learning more engaging, enjoyable and memorable” (2012:204). Greenfield (2009) and Bell et al. (2009) suggest that informal learning experiences can form important foundations for formal learning. Comics form an alternative to “traditional” science communication media such as popular non-fiction books and documentaries. This has the additional advantage that comics may reach audiences that do not necessarily choose to educate themselves in their leisure, or expect to be educated.

Several of the mentioned benefits may not only apply to science learning, but to readership in general. In McVicker’s words:

“Comics help motivate disengaged readers, offering an ingenious hook to reading that can ultimately bridge their literary interests to more conventional text structures” (2007:86).

With regards to invertebrate portrayals specifically, I highlighted inventive potentials of the medium, inspired by Japanese manga (Section 4.4.1). The idea that invertebrate portrayal in Western comics could benefit from looking at techniques used in Japanese comics, is partly supported by Scott McCloud’s comparative analysis of Western comics and Japanese comics. McCloud (2006) points out that inspiration of Japanese comic-writing techniques in Western comics is becoming increasingly relevant and more noticeable in recent Western comics in general.

Even more so, McCloud (1994:68) argues that reading comics requires a specific type of engagement unique to this medium. For example, a close up image of a character’s eyes can imply the expression of an emotion. Such an image only shows a
fragment: the viewer is required to infer what is happening, or what emotion is expressed. As such, the reader needs to connect the panels and the white spaces in between them. McCloud calls this action “closure”, and points out that this requires voluntary participation of the viewer. Similarly, Kukkonen (2011) notes that:

“When each semiotic mode serves a variety of functions, and they interact as comics readers create the cognitive construct of the narrative on the basis of the clues provided throughout all comics modes” (2011:49).

This type of engagement may well be used in advantage of invertebrate portrayals, including close ups of invertebrates or human characters observing them, and the portrayed emotions that may come with such representations. Such shifts in scale may provide shifts in perceptions of hierarchies: the entities that are perceived as important or not. As such, the engagement required for making sense of the story, may well enhance the portrayal of entities within the story. I apply this technique of close ups in my comic *Shadow Costume*.

The numerous benefits of comics do not exclude potential risks the medium can pose for science communication. Jee & Anggoro (2012:202) remind of possible reader misinterpretations due to the mix of story and science, such as the risk of personification leading to “unwanted moral attributions to nonhuman entities”. Tatalovic (2009) points at problems that may arise from collaborations between scientists and artists, including miscommunications of the content, too little focus on a good story, or too much focus on impressive art. While finding the right balance between story, art and science will always be a recurring issue, it may considerably help for comics’ creators to define goals and
desired effects on readers, so that the comics can be appreciated in the right context (see also Section 4.6).

A final consideration relates to the actual audiences that may be reached via comics. Reid (2007) noted that in 2006, $330 million dollars worth of comics were sold in the United States and Canada. Reasons for the growth of comics or graphic novels, are according to comics scholar Stephen Weiner (2003) related to movies that are based on comics, publishers that are producing large numbers of literary graphic novels, including the use of graphic novels as a “springboard for prose novels” (2003:61), and their usefulness as literacy and education tools in classrooms. The ranges of reached audiences are further highlighted by studies like Botzakis (2011), Jee & Anggoro (2012), Sabeti (2011) and Schwarz (2002), articulating child, teenage, adolescent and adult audiences. As such, while comics reach adult audiences, the integration of text and images sets this medium apart from much other adult literature.

4.6 Creative component

My creative component consists of two stories that have relationships between humans and invertebrates at heart. Adolescents and adults who are interested in comics (not necessarily science comics) are the targeted audiences.

Both comics have in common that they mostly hide the invertebrates in the first impressions. The titles do not use the word “invertebrate” or “insect” or a species name, nor does the blurb on the back cover. The cover images mostly articulate human environments, presenting the stories mostly as stories about humans. Also, both stories highlight aesthetics by colourful hand-painted images. They are both written and illustrated by myself, rather than products of (potentially risky) collaborations between scientists and artists.
In *Shadow Costume / An Undercover Romance*, the invertebrates are not anthropomorphic, and are introduced by human characters. The invertebrates are posed as teachers and companions. The crux of the story is that some of our behaviours are comparable to them; and that we can observe them to remind ourselves of these similarities, and learn from them. The similarities include mimicry and mutualism: our tendency to imitate each other to fit into societies. The invertebrates are shown in tactile interaction with the human characters: I included close ups of hands and faces that either touch the invertebrates, or are in close proximity to them. The humans are not harmed but inspired by them.

In *Candy House*, similarities between them and us are articulated through metaphor and metamorphosis. The human characters are proxies of invertebrates. In this way, invertebrates are portrayed without overly anthropomorphising them; rather, the story makes use of the “plasmaticity” of the medium. The story highlights our shared interests in food and a place to live, and as such it depicts ecosystem interactions of parasitic nematodes, giving positive spins on them. So, the character interactions (“humans” and a “cat”) can be interpreted as metaphors for interactions within soil communities. The metaphor is hinted at by the foreword.

The story starts as a search for identity of three men. Their attempt to find out who they are or what they are supposed to do with their lives, leads them to find out that they are not human, but invertebrate. This explains, in retrospect, their characteristic habits and skills that led to a surrealistic tale: Tode likes mushrooms because he is fungivorous nematode, Steiner kills and eats insects because he is an insect parasitic nematode used for pest control; and Nema wants to be inside the lady (earthworm) because he is a parasitic nematode that lives part of its lifecycle (harmlessly) inside an earthworm.
In turn, the lady lives in a “candy house” and eats her own house, since the soil is both a home and a food source to earthworms. The true identities of the characters are revealed in the end through metamorphoses: they lose their human appearance, and take on the appearances of invertebrates. The afterword is an integral part for clarifying the behaviours that would otherwise remain unclear for many readers: few people are aware of the very existence of nematodes and what they do.

As such, the story needs to be regarded as a story that seeks to create a positive awareness of the existence of certain invertebrates and their interconnectedness in the soil community; more so than a story that communicates facts in order to achieve a deeper understanding.

Instead, the metanarratives (foreword and afterword) allow for readers to choose what they want to get out of the story; the level of understanding they want to achieve. They can choose to learn more or re-read the story with their (newly learnt) knowledge that became available in the afterword. Alternatively, they can read the story once, and mostly learn the basic message of the story: an awareness of the interconnectedness of the busy life that takes place under our feet, and, hopefully, a positive appreciation of all this life.
Chapter 5. Conclusions

*Life in the Underground*, the title of this thesis, refers to separate yet interconnected meanings. The first one indicates the literal location of (most of) the organisms I investigated: invertebrates that live in close proximity to, or inside the soil. The second meaning is metaphorical. The “underground” refers to the place in our minds many invertebrates are condemned to. For centuries “the underground” has represented a place of fear and the unknown: from the Greek God Hades, who lived in the underworld or the abode of the dead; to Christian “Hell” where the devil resides, deep under ground. Today, the connotations of hidden, obscurity and secrecy are still contained within the word “underground” (OED 2014i).

Similarly, the thesis highlighted that the medium of comics has long remained in the underground: it has long been marginalised by academia, accused of not producing critically relevant narratives; and is still only marginally referred to in science communication. Not to mention that underground comics are a genre on their own.

As such, the term “underground” brings two important components of the thesis together. Not only does it refer to the status of invertebrates, but also to the status of comic books. The thesis aimed to shine a light on both from a science communication perspective. I analysed the portrayal of invertebrates in children’s literature and comics, and created my own invertebrate stories in comic book format. Based on these academic and creative components, I explored recommendations for creating more positive and truthful portrayals of invertebrates, as well as potential science communication benefits of using comics as a medium. For invertebrates, motivations included a reconciliation of conservation concerns and our inevitable co-existence; for comics, motivations included the cultural and educational legitimacy of the medium.
Admittedly, there are invertebrates with negative impacts on our lives, and similarly, not everybody will enjoy or be attracted to reading comic books. As Greenfield (2009) highlights, no medium is perfect: every medium has its strengths and weaknesses. Moreover, not all authors will have the particular aim of creating positive invertebrate portrayals in mind. Yet, while stereotypes have often resulted in negative perceptions, a multitude of positive aspects deserve to be further articulated. The results of the analysis partly support this idea, as well as studies that articulate low awareness and knowledge of invertebrates (e.g. Snaddon & Turner 2007) and of comics in science communication (Tatalovic 2009).

The results of the analysis suggested that while many invertebrate portrayals are currently mostly positive (69.9%), the majority of the analysed narratives portrayals were ambiguous: many positive portrayals were not completely positive, and many negative portrayals were not completely negative. Moreover, comics were characterised by more negative portrayals than children’s literature. As such, Lemelin’s (2013:153) emphasis on interactions between humans and insects that are “fluid, complex, unsettling and rewarding” was supported by my analysis.

The overall results are perhaps more positive than may have been expected based on the plethora of studies that highlight negative attitudes, yet this is not to say that such studies are irrelevant. Rather, the thesis articulated that attitudes on one hand, and portrayals on the other, may not always easily overlap. The clearest similarity between the two seems to be their fluidity and complexity, yet precisely this connection makes it hard to compare the two. For example, wasp portrayals were characterised by more negative portrayals than spiders, contrarily to what might be expected based on public attitudes (Gerdes, Uhl & Alpers 2009).
The analysis indicated possible trends in invertebrate portrayal and should be regarded as a starting point, due to small sample numbers. Future research in this area is desirable. Yet, the results informed insights for my own stories *Shadow Costume* and *Candy House*, and some of the found patterns do support other studies. They pointed at similarities of portrayals in children’s literature, comics and adult literature over a long timespan, as well as similarities of portrayals and (some) observations on public attitudes.

Firstly, the analysis suggested patterns for basic characteristics of invertebrate portrayals. Narratives were often written in a human context: invertebrates were frequently portrayed in human environments, from a human perspective, as flat characters, and they were often greatly anthropomorphic. These findings were partly supported by overview studies like Hogue (1987) and Dodd (2008) that scoped a variety of invertebrate portrayals across different media and genres. While invertebrates in my comics are not overly anthropomorphic, they too, are described in a human context: *Shadow Costume* portrays positive relationships between humans and invertebrates, while in *Candy House* the human characters are proxies of invertebrates.

Secondly, the analysis provided insights into the story themes and writing techniques that helped establishing or nuancing positive and/or negative portrayals, in line with other authors who comment on the ways in which animals are framed. Was the invertebrate described in a predatory, aggressive or defensive role? Was it a “monster”, with “sharp, piercing jaws” or “yucky”? These elements made for good candidates for negative or destructive elements in portrayals, in line with De Waal’s (1996) observation on biased scientific language in descriptions of “destructive” behaviours. Alternatively, did the invertebrates make nests, babies, nurture their young, pollinate plants and protect trees? Were they beautiful or otherworldly? These were candidates for constructive or
positive portrayals (e.g. Berenbaum 2006, Dodd 2008), sometimes even within portrayals that were mostly negative.

Such ambiguities had various impacts. Many narratives were characterised by conflicts between invertebrates and humans, either at costs of invertebrate portrayal or at cost of the portrayal of humans. Moreover, some invertebrates were portrayed as better than others, especially through portrayals of predator-prey relationships or other interactions like battles, wars and other threats invertebrates may pose upon each other or their wider environments, in line with e.g. Del Toro et al.’s (2012) and Hogue’s (1987) overviews on literary invertebrates. Especially superhero and underground comics thrived on visual depictions of battle scenes and murders.

These elements did not necessarily result in negative portrayals, nor were they necessarily misrepresentations. In some cases they arguably even formed part of the appeal of the narrative. Yet, they may relate to public attitudes in different ways. The results articulated associations of invertebrates with destruction rather than construction, in line with studies like Barrow (2002), which suggested that elementary students in the United States knew more about the harmful effects of insects than their helpful ones. Also, in some narratives conflicts between humans and invertebrates were resolved (transitions from negative to positive), which, too, can be seen as a connection between portrayals and attitudes: the portrayed transition in stories may remind readers of possible transitions in their own attitudes.

The variety of found anthropomorphisms also had different impacts. Imaginative anthropomorphisms went often hand in hand with elements of ecological realities, yet these mostly remained basic, and in some cases they were misrepresented. Analogies or interpretative anthropomorphisms on the other hand, allowed highlighting ecological “real” similarities more clearly. Either way, they reflected both positive similarities with
humans, negative ones, or both (e.g. the ruthless yet intelligent ants in *An Earth Man On Venus*), which again, highlighted ambiguities. In Hogue’s (1987) words:

“...In spite of a hard external skeleton, extra appendages, and robot-like instincts, arthropods still sufficiently parallel humans in structure and behavior to serve as models of friends, enemies, and teachers” (1987:192).

My comics thus aimed to mostly highlight constructive characteristics and similarities based on ecological realities. *Shadow Costume* focuses on mimicry and mutualism of ants and other insects while drawing reflective analogies between humans and insects, and depicting close yet harmless encounters. *Candy House* puts a positive spin on nematode parasitism, and depicts our shared interests in food and a place to live. Moreover, the stories are presented in colourful images to address an aesthetic appreciation for the invertebrates.

Additionally, the analysis formed a starting point for explorations of the first impressions that books provide, especially via the title and the cover. A notable pattern involved children’s non-fiction books that combined positive narratives with negatively portrayed “creepy crawly” titles and covers. While future research could further investigate effects on readers, one could say that, regardless of the old saying, books are judged by their covers: first impressions fostered by titles play a role in attracting audiences (Siebentritt 2014). As such, authors could well benefit from considering whether their titles and covers refer to actions rather than entities; or to humans rather than invertebrates. In my comics, I chose to frame the stories as “human” stories.
Finally, the chosen medium is important for attracting audiences, too. The
analysis articulated the relevance of creating more positive and truthful portrayals in
comics, while other studies highlighted educational benefits of the medium, including
potentials for invertebrate portrayals. Their interaction between text and images and
informal nature may benefit learning and memorisation (e.g. Jee & Anggoro 2012); and
their appeal to wide-ranging audiences may allow reaching audiences beyond
“traditional” science communication media like nature documentaries and popular non-
fiction books. They provide a chance to avoid “preaching to the choir”, especially since
comics’ readers do not necessarily expect or choose to be educated.

Arguably, especially Japanese comics, such as Tezuka Osamu’s “mushi” manga
may inform insights on invertebrate portrayals in this medium. Tezuka’s work articulated
how metamorphosis is not only an insect-characteristic, but also a characteristic aspect of
the malleability in form in which characters in comics may be depicted; allowing to draw
similarities between us and them. As such, Tezuka’s work brought insects, humans and
comics together, and my comics aimed to do the same.

Thus, while portrayals and attitudes may not always simply overlap, the notion
that literature may positively influence environmental attitudes remains valid (e.g.
Mobley et al. 2010, Wells & Zeece 2007). If and when authors aim to write narratives in
attempt to create a better reputation for invertebrates, a focus on interactions and
behaviours that are more constructive than the well-known destructive ones may be
important, in line with e.g. Kellert’s (1993), and Last’s (2014) recommendations. This
was the aim of the stories in my creative component.

I conclude with a summarising list of recommendations for invertebrate
portrayals, most of which may be applicable in any desired literary medium or genre. The
recommendations are especially relevant for narratives with the primary aim of creating
awareness for invertebrates through positive (yet truthful) portrayals, rather than creating in-depth understanding of invertebrates. They explore ways to reach non-interested audiences and to create narratives that may inspire readers to learn more. The recommendations should not be regarded as final or complete; rather they explore implications of the analysis. Some of them are applied in my comics, which you, dear reader, will read next.
Summary of Recommendations for Invertebrate Narratives

First Impressions

- **Title and cover.** Consider avoiding negative terms (“creepy crawlies”), and even words like “insects” or species names in the title, when trying to reach audiences that are not already engaged with or tolerant towards invertebrates. Instead, consider constructing first impressions that highlight positive ecosystem interactions (related to humans or other), similarities with humans, or positive feelings (aesthetics, curiosity, wonder). Alternatively and more extremely, consider framing a narrative as a human (or other) narrative, rather than an “invertebrate narrative”.

Narratives

- **Similarities and feelings.** Consider highlighting positive analogies between humans and invertebrates based on ecological realities. In this way, the insight that similarities enhance empathy can be used to an advantage without overly anthropomorphising the invertebrates. Examples include our shared ability of acoustic communication; our abilities to construct and alter landscapes, creating our own residence; our tendency to mimic each other or our environments; our achievements in globalizing the planet, or even more generally, our need for food (and each other) for survival. Metaphoric similarities or symbols may apply as well, including invertebrates as “teachers”; and the metamorphosis that signifies development and change. Such similarities may also increase a sense of wonder and curiosity.
o **Ecosystem interactions.** Highlight constructive ecosystem interactions, rather than wars or battle scenes. Instead, consider focussing on behaviours such as parental care, nest building, or mutualism.

o **Human-invertebrate encounters.** Highlight positive interactions between invertebrates and humans. Such narratives emphasise that we co-exist and are interdependent, rather than that we live in separate and conflicting worlds. They can be written from invertebrate and/or human perspectives: in the latter case, imaginative anthropomorphisms are easily avoided. Encounters can refer to utilitarian values like pollination, pest control or clean up crews; but may also be more personal, like companion animals. Images may show close encounters between humans and invertebrates other than bites, stings or exterminations. Instead, images depicting tactile interactions, like a hand holding an insect may enhance the idea that encounters can be (and often are) harmless.

o **Positive spins and transitions.** When narratives do include fear, disgust, battle scenes or other destructive interactions it is possible to give a positive spin on these by situating the interactions or behaviours in the right environment and in the right perspective. For example, highlighting the effects of destructive predator-prey interactions in a larger environment and from a wider perspective, may allow for a positive interpretation (e.g. pest control). Also, strategic language may give a positive spin on an otherwise potentially negatively perceived trait or habit. Such stories can form positive “transition” stories, especially when the change in perspective takes place earlier than an unexpected twist at the end of the story. These narratives highlight how one may learn to overcome negative encounters and feelings.
○ *Metanarratives and addressing the reader.* Addressing the reader directly may enhance suspense and/or creates the opportunity to make the reader aware of and reflect on his/her own attitudes and responses to invertebrates. Via this technique reader’s attitudes on the one hand, and stories portrayals on the other hand, are linked. This can be, but is not necessarily, done via metanarratives like forewords or afterwords. Metanarratives may further serve as comments or brief explanations of (moments in) narratives, enhancing positive portrayals and author’s intentions.

*Medium*

○ *Comics.* Comics may be a valuable choice for science communicators. Benefits include reaching diverse audiences, and educational advantages of integrating texts and images, as well as the perceived association with leisure and entertainment rather than education or academia. The possibilities for malleability in form and the requirement of reader participation in connecting the panels may benefit portrayal of entities in comics, including invertebrates.
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272-290.


Appendix 1. Analysed Stories

Ants

Children’s fiction

Children’s non-fiction

Comics

Beetles

Children’s fiction


**Children's non-fiction**


**Comics**


**Spiders**

*Children's fiction*


**Children’s non-fiction**


**Comics**


**Wasps**

*Children’s fiction*


*Children’s non-fiction*


*Comics*


*Worms*

*Children’s fiction*


*Children’s non-fiction*

*Comics*
### Appendix 2. Analysis Sheet and Definitions

#### Table 1. Analysis sheet

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<th>Flat character</th>
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<th>Order or species environment</th>
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<th>Wider ecosystem environment</th>
<th>Fantastical environment</th>
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<th>Anthropomorphic</th>
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<td>Destructive portrayal</td>
<td>Transition portrayal - to +</td>
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**Themes**

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<th>Negative Similarities</th>
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<td>Theme 5. “Inherent value”</td>
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<td>5. Invertebrate portrayed as not being relevant in itself; only in relation to other creatures</td>
<td>+ to -</td>
<td>Mixed Messages</td>
<td></td>
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</table>

**Multiple Invertebrates**

| Hierarchy: some more positive than others | Equal | Transition unequal (-) to equal (+) | + to - | N/A |

**Conclusion**

| Positive | Negative | Transition - to + | + to - | Mixed Messages |
Key: X = dominant category  
  x = present, but less dominant  
  + = constructive  
  - = destructive  
  > = more positive than  
  < = more negative than  
  W.t. = writing technique

Definitions

Multiple Invertebrates. In stories with multiple invertebrates, I focus on one selected invertebrate. I analyse whether this invertebrates is portrayed more positively (>) or negatively (<) than other invertebrates; or whether invertebrates are portrayed equally, based on the analysed writing techniques and themes. When a species or order of invertebrates is portrayed “collectively” (e.g. in a swarm) I count these as “one” invertebrate.

Writing Techniques

Writing Technique 1. Type of Character

Round character. The character is an important driver of the plot who is characterised by personal development: he/she changes attitudes, feelings, opinions or gains new insights.

Flat character. The character does not experience any personal development: his/her thoughts, desires or actions remain consistent throughout the narrative.
**Actor.** The invertebrate is observed from a distance, articulated by a narrator voice. Invertebrates are “actors” when a book is written in a narrative form, rather than as a series of descriptions: an overarching plot links different components together. The invertebrates are actively described: their actions take place within the timeframe and events of the narrative, rather than being “timeless” actions that take place any time.

**N/A (Not Applicable).** The invertebrates are observed from a distance, articulated by a narrator voice as a series of “timeless” descriptions: their actions take place any time, not necessarily part of a narrative.

---

**Writing Technique 2. Type of Environment**

**Human environment.** Invertebrates are portrayed in relationship to humans.

**Order or species environment.** Invertebrates are portrayed in relationship to their own order or species.

**Invertebrate environment.** Invertebrates are portrayed in relationship to other invertebrates than strictly their own order or species.

**Wider ecosystem environment.** Invertebrates are portrayed in relationship to a wider ecosystem: other animals and/or plants.

**Fantastical environment.** Invertebrates are portrayed in a non-existent, fantastical environment.

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**Writing Technique 3. Type of Reality**

**Ecological reality.** The invertebrates are portrayed according to their ecological interactions and biological traits and/or behaviours, without anthropomorphic elements.

**Anthropomorphisms.** I distinguish between two types of anthropomorphisms, which are partly in line with Fisher’s (1991) definitions.
1. **Interpretative anthropomorphisms.** This type of anthropomorphism portrays invertebrates according to (subtle elements of) human perspectives, values or emotions. It often includes analogies between invertebrates and humans that are based on the invertebrates’ actual behaviours or traits. For example, invertebrates can be portrayed as “caring mothers”, reflecting human family-systems.

2. **Imaginative anthropomorphisms.** Via this type of anthropomorphism, invertebrates can talk, have thoughts and feelings, wear clothes, and/or behave otherwise human-like. Misrepresentations are included as anthropomorphic elements, too.

*Otherworldly portrayals.* These are subcategories of anthropomorphisms, and I distinguish between two types, partly in line with Dodd’s (2008) study.

1. The invertebrates are portrayed as aliens or fantastical entities that are neither comfortably human nor invertebrate. They can be human-invertebrate hybrids, monsters, demons, or be associated with magic, gods, fairies, space-travellers; or be characterised by any other fantastical activity, behaviours or traits. As such, “otherworldly” in this analysis refers to a broad range of fantastical entities.

2. The invertebrates are portrayed as coming from a world (an “invertebrate world”) that is separate from the “human world”. I include this type of portrayal when contrasts between human and invertebrate worlds are made explicit.

*Ecological reality with anthropomorphic elements.* Invertebrates are mostly portrayed according to ecological realities, yet there are still anthropomorphic elements, such as human interpretations of their behaviours or feelings; or invertebrates that talk and/or express feelings, while still mostly representing invertebrate behaviour.

*Ecological reality with otherworldly elements.* Invertebrates are mostly portrayed according to ecological realities, but with a focus on their separation from humans, or
with an imaginary spins, such as an elaboration on behaviours that could be seen as “magical” (imaginative).

*Anthropomorphic with ecological elements.* Invertebrates are mostly anthropomorphic, yet some (basic) ecological characteristics are still highlighted. For example, an “emotional” spider that lives in a web.

*Otherworldly with ecological elements.* Invertebrates are portrayed as fantastical entities or entities that are clearly separated from humans, yet some (basic) ecological characteristics are still highlighted.

**Writing Technique 4. Perspective**

Perspectives articulate from whose point of view a narrative is told. This is often the protagonist, yet perspectives may shift between characters or narrators. Stories told or descriptions given by (distant) narrators are categorised as “human perspectives”, while narrators may also take on “invertebrate perspectives”, which can become especially clear when other humans are perceived through the invertebrates “eyes”.

**Writing Technique 5. Metanarrative**

Metanarratives are narratives concerned with the idea of storytelling. They are (sections of) narratives that enclose or introduce the main narrative; that comment on it, or set it in context (OED 2014j, OED 2014k). I include forewords and afterwords, as well as comments inserted into the narratives.
**Writing Technique 6. Title, cover and other first impressions**

This writing technique highlights the effects that book titles, front and back covers, chapter and section titles can have on portrayal of invertebrates. It could even include font size and colour, or the size of books themselves.

**Writing Technique 7. Text-image interaction**

This writing technique highlights the effects that images can have on texts: whether they enhance or nuance them, and how, in turn, this effects invertebrate portrayal.

**Writing Technique 8. Narrator addresses reader directly**

Narrators address the reader in the second person (“you”), or in first person (“we”, “us”). This can be part of a metanarrative, but may also be part of the main narrative.

**Writing Technique 9. Unspecified**

These may be any other characteristic writing techniques (including images), related to form, style or content of narratives, influencing invertebrate portrayal.

**Themes**

**Theme 1. Similarities between us and them.** These include interpretative and imaginative anthropomorphisms, and can reflect ecological realities, misrepresent, and/or result in invertebrate characters that are more human than invertebrate. Some similarities may highlight positive characteristics (e.g. helping each other), while other similarities may highlight negative characteristics (e.g. deceit).
Theme 2. Encounter with humans. This can include various types of encounters, from friendship and companions, to (scientific) observations, to beneficial roles of invertebrates in human environments, such as pollination of flowers in gardens (positive); or negative encounters such as invertebrates invading picnics, destroying human crops, or biting, stinging or poisoning humans. Alternatively, the encounter can be negative because the humans pose a threat to the invertebrates.

Theme 3. Feelings towards them. Positive feelings can be enhanced by several factors, such as aesthetically pleasing images, symbolic interpretations, cute or friendly illustrations, and (poetic) word-use that articulates mystery, curiosity, wonder or magic. Negative feelings can be enhanced by monstrous depictions; narratives that are based around fear and disgust.

Theme 4. Interactions in ecosystem. Ecosystem interactions can refer to interactions with invertebrate (own species/order or other invertebrates), animal, plant and even fantastical ecosystems or worlds. This theme can be separate from theme 2 (encounters with humans), but may also overlap with theme 2, since ecological interactions may have impact on humans. While invertebrate behaviour (like most other animals) includes both constructive and destructive elements; the selection of behaviours and interactions in narratives fosters a focus on certain characteristics over others. This may influence portrayal or interpretation of these behaviours: constructive behaviours may be regarded as positive, while destructive behaviours may be regarded as negative. However, depending on the use of other writing techniques, it may also be possible to give a positive spin on destructive interactions. Examples of constructive behaviours are nest

30 When narratives highlight interactions only in relation to humans (despite it being an ecological interaction) I include this as theme 2.
Building and mutualism; examples of destructive behaviours are predator-prey relationships, attacking and defending.

Theme 5. Inherent value. This theme highlights whether invertebrates are portrayed for “the sake of themselves” or whether they are only portrayed in relationship others, including other invertebrates, animals or humans. For example, are spiders only portrayed as predators of insects? Or are they (also) highlighted in their own (other biological) characteristics?
## Appendix 3. Results: Raw Data

### Table 1. Total stories (= 73)

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<tr>
<th>W.t. 1 (character)</th>
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<th>12</th>
<th>9</th>
</tr>
</thead>
<tbody>
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<td>20</td>
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<td>W.t. 3 (reality)</td>
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<td>W.t. 4 (perspective)</td>
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<td>2</td>
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<td>W.t. 7 (images)</td>
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<td>W.t. 9 (unspecified)</td>
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<td>Theme 5 (inherent value)</td>
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<tr>
<td>Conclusion</td>
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<td>22</td>
<td>18</td>
<td>37</td>
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### Totals:

| Positive (unambiguous) | 10 |
| Positive + mixed messages | 25 |
| Positive + transition | 16 |
| Negative (unambiguous) | 8 |
| Negative + mixed messages | 12 |
| Negative + transition | 2 |
Table 2. Wasps (Total = 14)

| W.t. 1 (character) | 0 | 11 | 1 | 2 |
| W.t. 2 (environment) | 7 | 5 | 3 | 2 | 4 |
| W.t. 3 (reality) | 2 | 1 | 2 | 1 | 2 | 0 | 6 |
| W.t. 4 (perspective) | 11 | 1 | 1 | 0 | 1 |
| W.t. 5 (metanarrative) | 3 | 0 | 0 | 11 |
| W.t. 6 (first impressions) | 12 | 3 | 0 |
| W.t. 7 (images) | 12 | 7 | 0 |
| W.t. 8 (address reader) | 3 | 1 | 0 | 10 |
| W.t. 9 (unspecified) | 4 | 4 | 1 | 10 |
| Theme 1 (similarities) | 2 | 1 | 0 | 0 | 5 |
| Theme 2 (encounters) | 0 | 4 | 1 | 0 | 5 |
| Theme 3 (feelings) | 4 | 3 | 2 | 0 | 4 |
| Theme 4 (ecosystem) | 1 | 3 | 2 | 0 | 4 |
| Theme 5 (inherent value) | 3 | 3 | 0 | 0 | 0 |
| Multiple invertebrates | 5 | 3 | 0 | 0 | 6 |
| Conclusion | 7 | 7 | 2 | 0 | 8 |

**Totals:**
- Positive (unambiguous): 1
- Positive + mixed messages: 4
- Positive + transition: 2
- Negative (unambiguous): 3
- Negative + mixed messages: 4
- Negative + transition: 0
Table 3. Spiders (Total = 18)

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<td>W.t. 4 (perspective)</td>
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<td>0</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td>W.t. 7 (images)</td>
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<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>W.t. 8 (address reader)</td>
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<td>0</td>
<td>14</td>
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<td>W.t. 9 (unspecified)</td>
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<td>0</td>
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**Totals:**

| Positive (unambiguous) | 1 |
| Positive + mixed messages | 6 |
| Positive + transition | 6 |
| Negative (unambiguous) | 2 |
| Negative + mixed messages | 3 |
| Negative + transition | 0 |
Table 4. Beetles (Total = 13)

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<td>0</td>
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<td>0</td>
</tr>
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<td>0</td>
</tr>
<tr>
<td>Theme 5 (inherent value)</td>
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<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Conclusion</td>
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<td>1</td>
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**Totals:**

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<tr>
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Table 5. Worms (Total = 15)

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**Totals:**

- Positive (unambiguous): 3
- Positive + mixed messages: 3
- Positive + transition: 3
- Negative (unambiguous): 2
- Negative + mixed messages: 3
- Negative + transition: 1
## Table 6. Ants (Total = 13)

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<td>6</td>
<td>3</td>
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<td>W.t. 3 (reality)</td>
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<td>0</td>
</tr>
<tr>
<td>W.t. 4 (perspective)</td>
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<td>1</td>
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<tr>
<td>W.t. 5 (metanarrative)</td>
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<td>9</td>
</tr>
<tr>
<td>W.t. 6 (first impressions)</td>
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<tr>
<td>W.t. 7 (images)</td>
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<td>0</td>
</tr>
<tr>
<td>W.t. 8 (address reader)</td>
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<td>0</td>
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</tr>
<tr>
<td>W.t. 9 (unspecified)</td>
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<td>4</td>
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<td>Conclusion</td>
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### Totals:

- Positive (unambiguous): 0
- Positive + mixed messages: 8
- Positive + transition: 2
- Negative (unambiguous): 0
- Negative + mixed messages: 2
- Negative + transition: 1
Table 7. Comics (Total = 23)

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<td>2</td>
</tr>
<tr>
<td>WT. 3 (Reality)</td>
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<td>1</td>
<td>3</td>
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<tr>
<td>WT. 4 (Perspective)</td>
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<td>2</td>
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Totals:

- Positive (unambiguous): 2
- Positive + mixed messages: 10
- Positive + transition: 0
- Negative (unambiguous): 4
- Negative + mixed messages: 7
- Negative + transition: 0
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**Totals:**

| Positive (unambiguous) | 5 |
| Positive + mixed messages | 6 |
| Positive + transition | 15 |
| Negative (unambiguous) | 4 |
| Negative + mixed messages | 3 |
| Negative + transition | 2 |
Table 9. Non-Fiction (Total = 15)

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**Totals:**

| Positive (unambiguous) | 3 |
| Positive + mixed messages | 9 |
| Positive + transition | 1 |
| Negative (unambiguous) | 0 |
| Negative + mixed messages | 2 |
| Negative + transition | 0 |
Table 10. Ambiguous portrayals: positive

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Table 11. Ambiguous portrayals: negative

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