Animal Characters and Characterisation in Science Fiction:
A Scientific Contextualist Stylistic Approach

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Abstract

From mechanomorphic ants to slovenly rats and raining fish-lizards, this thesis explores connections between the scientific contexts of behaviourism, entropy and Gaia theory and sf's animal characters. I position this research within the contextualist school of stylistics, arguing that such an approach is necessary not only because of sf's constitutive relationship with science (Parrinder 1979, Landon 2014), but also because the genre's privileging of ideas over character development means flat characters predominate in sf (Amis 1960, Gunn 2002). To conduct my analyses, I employ Culpeper's (2001) framework, the most comprehensive characterisation framework, and amend its categories for use with animal characters. This framework is combined with a variety of corpus linguistic methods which have been at the forefront of stylistic explorations of literary character (Archer & McIntyre 2010, Bednarek 2011, Mahlberg 2012, Balossi 2014). My focus on scientific contexts and animal characters addresses large gaps in stylistics research. It is the first attempt within stylistics to consider the influence of scientific contexts on characterisation, the first to engage exclusively with animal characters, and the first to rework a characterisation framework for use with animal characters. In addition, this research attempts to connect stylistics with the contemporary field of animal studies research.

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1 Introduction

Throughout the humanities and social sciences, there has been a burgeoning of scholarly interest in animals as a focal point of study. Beginning around the 2000s and known as 'animal studies', this development is considered 'comparable in significance to the "linguistic turn" that revolutionised […] disciplines from the mid-twentieth century' (Armstrong and Simmons 2007, p. 1). Though the means by which animals are scrutinised varies, animal studies scholars' most fundamental concept is 'taking seriously the animal presences that haunt the margins of history, anthropology, philosophy, sociology and literary studies' (Ohrem & Bartosch 2017, p. 1). When animals are considered the focal point of study, this has often facilitated a fundamental revaluation of the academic methods and concepts used in that particular discipline, elucidating how '"rethinking animals"' is often a way of '"rethinking the humanities"' (Borgards 2017, p. 229). Within literary studies, specifically, such focus has led to a serious engagement with animal characters, revealing 'the history of animal narration, such as clusters of animal species [or] type' and elucidating how 'concepts from animal agency to zoopoetics [can] increase[] the theoretical complexity of the investigation of animals in literature' (Jacobs 2017). Beyond close textual analysis level, literary scholars also aim to explore how categories of literary criticism are challenged when animals are included in the scope of disciplinary concern, as well as, the way 'literary texts appear as media of the representation and reflection of historical and present-day animal situations' (Borgards 2017, p. 229). Positioned amongst animal studies, this thesis will similarly be taking animal characters seriously and aligning itself with these aims.

Despite making its presence felt in many disciplines, animal studies has not, as yet, been embraced by the field of stylistics. This gap is puzzling considering how frequently animal characters feature in many literary texts and genres, from talking animals in children's fiction (beast fables and fairy tales), and tales of physical transformation or encounters with animal-like aliens or monsters in genre fiction (horror and science fiction), to more naturalistic animal characters that appear in literary fiction. Mchugh notes that 'animals abound in literature across all ages and cultures, but only rarely have they been the focal point of systematic literary study' (2009a, p. 487). Given that 'character'

remains a core concept in the discipline (Mahlberg 2012, Culpepper 2001, McIntyre 2015a, Balossi 2014), the lack of sustained analytic focus on animal characters is notable. Similarly, little has been done in stylistics particularly to consider how underlying concepts and frameworks developed for characters and characterisation might require amendment when an animal character is of central concern. As Herman has stated 'stories that cross the species boundary may necessitate a reconceptualisation of some of the most basic concepts in the domain of narrative theory, including […] character' (2018, p. 9).

This lack of engagement with animal studies is puzzling not only given the prolificness of animal characters in literary texts, with stylistics viewing character as a core concern, but also considering that stylisticians have turned away from their universalising structuralist origins. Stylistics no longer focuses solely on narrative structures – or structuralist approaches to character – but is a burgeoning field where 'stylistic methods are enriched and enabled by theories of discourse, culture and society' (Simpson 2004, p. 2). Hall (2016) argues that turning away from structuralism allowed ready traffic between stylistics and critical theory (p. 250) (see also: Verdonk 2013, pp.116-117). Narratology also has gone through a 'reassessment of the place of scholarship on narrative', which 'takes stock of how stories and traditions for analysing them relate to norms, institutions, and practices that structure academic […] engagements with today's most pressing concerns' (Herman 2018, pp. 1-2). Amongst these pressing concerns, stylisticians and narratologists have shown an increased sensitivity to how literary texts – and their represented characters – might reify or challenge ideological and discriminatory practices. For example, feminist stylisticians have repeatedly focused critical attention on representations of female characters in fiction (see: Burton 1982, Montoro 2012, Mills 2014). As important and insightful as these critical accounts are, stylistic analyses have, to a large extent, not crossed the species boundary. This thesis therefore takes a critical approach to the literary texts analysed and the characters presented within these texts.

Specifically, this thesis takes a scientific contextualist approach to the animal characters presented in sf. Whilst viewing science as a context like any other may seem radical in stylistics, it is

standard practice in sf scholarship, as will be outlined below (section 1.4). It has also gained traction outside of sf scholarship. For example, since the publication of seminal monographs in the mid-80s (Beer 2009), attempts to consider the engagements of science and literature have proved fruitful, culminating in the development of 'science and literary studies', hereafter SLS. SLS elucidates how positioning literature amongst scientific contexts can highlight that science 'is neither value free nor outside cultural influence' and that literature can be implicated in the 'production of meaning and the transmission of knowledge' (Willis 2015, p. 9). In essence, SLS views science as a context that influences literature like any other, which can be implicated in social, political or ideological critiques. It positions acts of reading literature in light of science as an example of new historicism:

> It is very important to give scientific novels a historicist reading, that is, to place ourselves in the shoes of the original readers. There is no point in judging a text by today's science; it is utterly immaterial whether the science was right or wrong […]. What matters is what it meant to people at the time. We have to ask how an original reader might have responded to the themes and metaphors of a text […][,] to consider both text and context, asking questions that derive both from literary and historical study (Sleigh 2011, p. 14).

Such a position facilitates a shift away from the separate cultures of literature and science, as proposed by C P Snow, to a more singular view, where both disciplines derive from 'common cultural sources' (Levine 1987, p. 4). As Heringman states, 'the scientific backgrounds of specific texts are important in themselves and as distinct moments of scientific culture, but they are also jointly important as evidence of [a] shared culture' (2003, p. 6). SLS research, therefore, accounts for the ways scientific contexts appear in literary works, exploring how 'scientific ideas [are] variously re-expressed, elaborated and tested in fictional, "poetic", or "non-scientific" imaginative formats' (Marsden 2013, p. 2). Such a scientific contextualist position, I argue, is relevant for animal characters not only because of the genre I have chosen to focus on, but also because of this thesis's position within animal studies scholarship.

Contextualising narratives and their constituent elements – like characters and characterisation – is also common stylistic practice. Stockwell acknowledges that '[l]iterary stylistics […] has always necessarily integrated the effects of context into its discussion', and, despite frequent claims to the contrary, very few stylistic analyses are 'purely decontextualised' (2000b, p. 17). Verdonk, who attempts to reconcile the 'messy world outside' with stylistic analysis, notes that 'the conscious or unconscious choices of expression which creates a particular style are always motivated, inspired, or induced by contextual circumstances' (2002, p. 7). Busse's (2014) usage and popularisation of the term 'new historical stylistics' acknowledges the importance of context for stylistic analyses and the interconnectedness of literary and stylistic analyses. Similarly, Zyngier agrees that stylistics ought to go 'hand in hand with developments in linguistics, literary and cultural theory' and can meaningfully 'contribute to the understanding of the text as cultural praxis' (2001, pp. 365-375). Busse suggests, in new historical stylistics, '[c]ontext is multi-layered and includes the immediate linguistic co-text as well as conventions of genre and register, socio-historical conditions and contexts of culture' (Busse 2016, p. 179). She has continued to argue that stylistic analyses reveal that 'language [is] a social and context-oriented phenomenon' (2006, p. 86). Zyngier claims that functionalist perspectives, such as Halliday's, 'led to context-oriented forms of stylistics', referred to as 'contextualised stylistics' (2001, p. 371) (see also: Weber 1996). Stylistic analyses that account for scientific contexts, however, are extremely rare (Butt 2007, Nerlich et al 2001), a situation compounded, perhaps, by the lack of stylistic scholarship on science fiction (Mandala 2010, Stockwell 2000a, 2003a & 2003b, Ryder 2003, Walsh 2003). This thesis's scientific contextualist approach to animal character is an extension of contextual stylistic approaches, and an attempt to show how stylistic analyses might be utilised to explore scientific and literary interactions.

In my introductory sections, I outline the limited research that stylisticians and narratologists have done in relation to animal characters (section 1.1). I consider how the concept of character has been expanded to account for animal characters, and the ways that narratologists, specifically, have attempted to analyse animal characters in narratives. I highlight the limitations of such studies and

suggest that scholarship on animal characters so far has focused on particular modes (realism) and genres (children's literature) at the expense of others, and that narratologists have tended to focus on heavily anthropomorphised animal narrators and focalisers. I, however, explore animal characters in science fiction, noting that, as in other areas of literature, animals feature heavily in sf. In section 1.2, I note that various scholars, literary critics and narratologists, have suggested that science fiction is a genre that offers a number of generic affordances that open up space for animal characters. Science fiction is therefore often concerned with other-than-human beings, presents hypothesised futures in which humans may no longer dominate, and the genre's constitutive relationship with science makes it a useful genre for exploring the damaging conclusions reached by scientific discourses on animal beings – a core concern for sf scholarship (Suvin 1979, Kress 2007) and animal studies (Crist 2000, Enenkel & Smith 2007, Harré 2009).

After a brief definition of science fiction, section 1.3 outlines research that has been conducted on character and characterisation in science fiction. I show that in sf, 'flat' characters have tended to predominate. Despite flat characters' prevalence, I suggest that this need not be aligned with evaluative associations of poor characterisation. I note that many scholars have seen flat characters as being connected to sf's privileging of ideas over character psychology. Overall, I suggest that characters in sf tend to be subordinated. Sf's prolific use of flat, subordinated characters also addresses the gaps in scholarship I noted in section 1.1, where research on animal characters so far has prioritised 'round' animal narrators and focalisers. Within the broader contexts of character analysis, this section highlights connections between the analyses conducted in my chapters (sections 3, 4 & 5) and research conducted by Phelan (1989), Eder (2010) and Mikkonen (2017). These narratologists have similarly highlighted how characters in certain genres should be analysed not solely via 'mimetic' aspects of characterisation, but via 'synthetic', 'thematic' and 'symptomatic' aspects also. This conceptual underpinning is not only useful for the flat animal characters present in sf, but also connects animal character presentations to the broader contexts within which they are produced.

In the next section (section 1.4), therefore, I outline sf's constitutive relationship with scientific contexts, covering both 'hard' and 'soft' sf. I scrutinise the hard/soft sf distinction to show how varied scientific influences can be in sf texts. With hard sf, scholars claim only texts that remain fidelitous to science fact or draw on the rigor of the scientific method to explain their speculations count as science fiction. Others, however, have created compelling cases for more expansive considerations of sf's interaction with science. They argue that: fidelity to science fact is irrelevant (Csicsery-Ronay 2011); that sf can draw on social as well as physical sciences (Westfahl 2005, Prucher 2007); and that sf does not need to contain scientific explanation (Kress 2007). Indeed, even those proponents of hard/soft distinctions in sf acknowledge that most hard sf draws on a 'generally "scientific" background' to anchor its narratives (Lambourne et al 1990, p. 48). I note how the scientific contextualist approach is put forward not only by scholars in relation to the sf genre, but also frequently by animal studies scholars. This section works to underpin the scientific contextualist perspective that I take towards animal characters in sf. To outline the potential of such an approach, in the final section of the introduction (section 1.5), I outline a case study, Ryan's (2011) "Narrative/Science Entanglements: On the Thousand and One Literary Lives of Schrödinger's Cat", to highlight how this has previously been attempted. Ryan, for example, outlines the influences of the cat paradox on a variety of sf narratives, focusing on its interaction with narrative structure, plot, time and character. Although the scientific context's influences on characters represents only a small part of Ryan's study, it offers compelling evidence for the potential of a scientific contextualist approach to character.

In my methods section (section 2), I outline how Culpeper's (2001) characterisation framework is a useful framework for this study's approach to animal characters. I highlight how it has been used by some to explore contextual approaches to characterisation (Vaeßen & Strasen 2015, Montoro 2007, Balossi 2014) with many arguing that cognitive approaches to the text are inherently contextualist (Palmer 2010, Zunshine 2010, Woldemariam 2014, Ahmad 2017, Stockwell 2020) – In addition, Strasen's very similar framework has been used by the author to situate characters within broader contexts of production (see: Strasen & Wenzel 2012, Strasen 2013, Vaeßen & Lothmann 2014). I then

amend Culpeper's framework to account for the fact that animal characters are the focus of this study. I draw on many examples of animal characters in literature to justify the categories or expansions I have made to the framework. This framework is the predominant framework I draw on for my analyses, but I also utilise methods from corpus linguistic approaches. Indeed, research around corpus linguistic approaches to character has burgeoned recently, with collocational analysis (Hori 2004), keywords analysis (Mahlberg & McIntyre 2011), semantic tagging (Balossi 2014) and n-grams (Mahlberg 2012) providing original insights into the characterisation strategies used by particular authors. I therefore draw on these methods during my chapters to support the animal character analyses conducted, aligning myself with McIntyre's (2015b) call for an integrative approach towards corpus stylistic analysis. Finally, I briefly outline how I sourced my node and reference corpora.

In my analysis sections (sections 3-5), I outline how animal characterisation in these sf texts is being influenced by scientific contexts. These analyses are developed around Culpeper's (2001) textual cues categories, schematic categories and corpus analytic approaches, with the accumulation of various characterisation strategies connected to scientific contextualist interpretations. They follow a similar structure: I outline the scientific context, its key ideas and concerns, highlight how sf writers and critics have explored these contexts previously, justify why this context is worth exploring, and finally conduct my character analyses. The behaviourism section (section 3) analyses squirrel, ant (Kateley 1930), newt (Čapek 2010 [1937]), and dog (Orwell 2008 [1945]) characters. It suggests that behaviourist influences can be noted at the level of characterisation in a variety of ways, including: anti-mentalism, specifically the downplaying of the mind or brain as a cause of behaviour, the methods employed to operantly condition animal subjects, the extreme position of environmental determinism found in behaviourism, the influence of physiological reflexes on early behaviourist psychology, the conditioning of verbal behaviour, and the use of animals themselves as aversive stimuli and punishers.

In the entropy section (section 4), I look at the wub, an animal alien character whose animal features are varied (Dick 1999 [1952]), arthropod, reptile (Ballard 2012 [1962]), and rat (Platt 1966) characters. These animal characters are similarly influenced by the scientific context. I highlight, for

example, how these animals are frequently linked to: depictions of physical exhaustion, depictions of homogeneity associated with equilibrium distributions found in closed (entropic) systems, behavioural changes which can be associated with increasing levels of environmental entropy, such as increased appetite and metabolism, entropic and physicalist perspectives on animal death and life, and entropic processes such as degradation, destruction or dissolution.

In the last analysis section, the Gaia section (section 5), I analyse the Yanfolk, a bipedal animal alien species (Brunner 1974 [1972]), the yelk, elk-like creatures, assatassi, fish-lizards, and wutra worms (Aldiss 2010). Animal characters are linked to Gaian themes through depictions of them maintaining homeostasis, depictions of them as part of the planet's physiology, drawing on the cybernetic influences in Gaia, presenting them as machine-like, connections between them and the gases associated with Gaia's functioning, presenting them as being involved in element cycling, distinctions between atmospheric forces and them being blurred, and foregrounding those species important to Gaia's functioning. Overall, the analyses conducted offers compelling evidence for the need to take a scientific contextualist approach when analysing animal characters in sf, and shows the utility of my amendments to Culpeper's (2001) characterisation framework to achieve such ends.

1.1 Animal Characters and Characterisation in Narratological and Stylistics Research

A lack of focused scholarship on animal characters in stylistics and narratology is due, in part, to an underlying assumption that narrative has an 'anthropomorphic bias' which 'reflects a cognitive schema of embodiedness that relates to *human* existence and *human* concerns' (Fludernik 1996, p. 9 – my emphasis). Cohn similarly suggests that characters reveal 'the hidden side of [...] human beings' (1978, p. 5). As some scholars have criticised, these represent anthropocentric notions of literary character, and unfortunately they have tended to prevail in the research literature (Nelles 2001, Bernaerts et al 2014, Caracciolo 2018). These anthropocentric definitions of character, however, can only exclude animal characters from consideration if we assume that animals are not themselves embodied beings, able to perform actions, display intentionality and be conceived of as possible, though different 'beings'. Given well-known advances in evolutionary biology – homologous brain structures between

mammalian and avian brains – cognitive science – tool use and complex social behaviours – comparative psychology – the 'self-recognition' or mirror test – and legal proceedings – the extension of habeas corpus law to zoo animals – it becomes increasingly untenable to sustain such anthropocentric positions regarding narratives and the animal characters they represent.

The focus of this section, therefore, will be to outline how narratologists and stylisticians have engaged with animal characters in their research. It will focus on: (1) how narratologists and stylisticians' theories of the concept of character has been extended to account for animal characters, though sometimes only in limited ways; and (2) the characterisation strategies narratologists have drawn on for analysing depictions of animal characters in literary texts. As will become clear in this section, this area of research is underexplored and contemporary, and much more research is needed to provide the theoretical underpinnings and analytic methods that can fully account for animal characters' presences in literary texts.

Whilst stylisticians concede that literary characters may be 'imaginary beings', i.e. 'not actual people or representations of actual people', they note that '*anthropomorphic* animal characters' represent a core example of the category (Culpeper & Fernandez-Quintanilla 2017, p. 95 – my emphasis). Such positions, however, do not seem to problematize the issue of anthropomorphism in relation to the concept of animal character. Indeed, for some, anthropomorphism is not a problematic underpinning for the concept. Bernaerts et al (2014), for example, suggest animal characters ought best be understood through the double dialectic of empathy and defamiliarisation. Drawing on both natural and unnatural narratological research, animal characters they argue both prompt readers 'to project human experience onto creatures […] [both] "empathiz[ing]" and "naturaliz[ing]"' them and 'to acknowledge the otherness of non-human narrators, who may […] defamiliarize […] some of the readers' assumptions and expectations' (ibid, p. 69). They discuss this in terms of blending theory, where animal characters can broadly be seen as a 'conceptual integration of human and non-human traits' (ibid, p. 71) – Keen (2011), focusing on comic books, also agrees with this position. Although Bernaerts et al (2014) and Keen (2011) suggest animal characters have the capacity to challenge human

beliefs, values, and experientiality, they argue ultimately that animal characters inevitably incorporate human features. This is largely because Bernaerts et al's concept of animal character centres only on animal character-narrators and hence anthropomorphism features heavily in their textual case studies.

However, it is also possible for narratives not just to present animal character-narrators but also to present animal characters 'accurately from a behaviouristic viewpoint, […] to produce mimetic representations based on the knowledge […] [of] real nonhuman animals "from the outside"' (Varis 2020, p. 83). Indeed, as noted by animal studies' scholars, the majority of animal characters in literary texts are presented acting in species-typical ways (Shapiro & Copeland 2005). In light of these ideas, limiting the concept of character solely to anthropomorphised animals appears restrictive. As Eder et al note, definitions of character that position them 'as fictive persons or fictional analoga to human beings' are not unproblematic as 'they are restricted to anthropomorphous characters and exclude […] [naturalistic] animal characters, aliens, monsters, [and] robots' (2010, p. 7). It is, therefore, unsurprising that Caracciolo damningly suggests 'the prime suspect for anthropocentrism in narrative [is] […] the notion of character as intrinsically human-like' (2018, p. 172). Such views on fictional animal characters 'treat an animal as nothing more than a symbol for a human experience [which] […] radically devalue[s] that animal, and animals generally, in fiction as in life' (Hogan 2009, p. 156).

Anthropocentric notions of character and problems theorising literary animal characters are, some have argued, 'best understood […] as an instance of broader philosophical and scientific problems in theorising the human-animal divide' (Boehrer 2010, p. 3). Boehrer traces back particularly human-centred notions of character to Descartes' cogito, suggesting that 'the Cartesian self arises from and entails the exploration of a new notion of character', one which prioritises the mind over the body, the interior over the exterior, and the human over the animal (ibid, p 9). He traces these Cartesian influences through contemporary narratological and literary theoretical approaches to character, noting that most 'scholarly discussions of literary character [are] […] committed to a notion of character that privileges interiority' (ibid, p. 8). They also often assume that characters are human, as noted above. He suggests that the pre-modern notion of persons – including animals who were closely

associated with economic and civic life, liable to prosecution in courts of law, considered as individuals – might offer a path towards reconstructing theories of literary character that include animals within their scope.

Caracciolo, too, tries to consider ways 'to extricate character from anthropomorphic conceptions' (2018, p. 174). A promising starting point, he argues, are structuralist approaches to character, where the focus on what characters *do* and not what they *are* might 'reduce characters to textual device, and therefore […] undermine the notion's inherent anthropomorphism' (ibid, p. 175).[1] Drawing on Griemas's notion of characters as 'actants', he focuses on the roles nonhuman characters fulfil in narrative. As has been noted by previous scholars, structuralist approaches are 'resolutely anti-psychological, displacing attention from the interior states to the manifest deeds of participants in a story', meaning that animal characters, often backgrounded, might fulfil important roles (Herman 2004, p. 123). Rather than use Griemas's structural roles – Griemas's model uses the transitive sentence structure as its underpinning, which 'is deeply bound up with a dualistic worldview' (ibid, p. 178) – Caracciolo develops Goatly's 'consonant' green grammar categories (1996) to highlight the roles nonhuman actants might fill. This, as with Griemas's model, is scaled-up to highlight narrative strategies that decentre human characters. For example, when scaling-up the ergative category, he notes that animal characters can be conceived of as a collective actant, whose interactions with human characters 'locate the human within a longer, evolutionary history that undermines any separation between human agency and an allegedly inert natural world' (Caracciolo 2018, p. 181).[2] Caracciolo admits that this approach to character is not systematic, but that his research is an attempt to 'open[] up the notion of character to nonhuman actants' (ibid, p. 187).

Other approaches, particularly cognitive approaches to character, also propose an expansive definition of animal character that moves beyond anthropomorphic limitations. Such theories argue

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[1] He suggests that a move away from a focus on the 'mimetic' aspects of characterisation might facilitate a less anthropomorphic perspective. But, such rejection of mimetic aspects of characterisation seems to be prefaced on the 'character-as-person' definition of Phelan's (1989) category, which could be conceived more species-neutrally as 'character-as-individual'. It is hard to concede that mimetic reading strategies would be necessarily anthropomorphic, and even if partly anthropomorphic, undesirable – see my argument below.

[2] The other categories are more useful for an econarratological, rather than zoonarratological perspective of character, and so are not outlined here.

that when readers come across an animal character in a text they activate a 'basic' character schema which affords that character agency and intentionality. Zunshine (2008), for example, refers to animal characters as 'counterontological' entities, but argues that they are likely to be conceived of as entities to which we can attribute intentions and emotions, as opposed to the inanimate objects in the storyworld. Similarly, for Eder et al (2010), when a reader is presented with an animal character, the reader draws on a 'base type' schema, where the assumption is that the entity has mental states and a body. Eder suggests that character covers a spectrum that 'encompasses smart animals', where inner life can be assumed, but not necessarily presented (2010, p. 17). Both Zunshine and Eder's research expands the concept of theory of mind and folk-biological knowledge to animal characters:

> If we categorise a given entity as an animal (e.g. a cat), we can do some *limited* processing over the folk-psychological domain. We can infer, for example, when [a] cat hisses at her owner […], she is angry at him. The majority of our inferences, however, will belong to the folk-biological domain, that is, we will think of this specific cat in terms of what is "natural" to her species (Zunshine 2008, p. 105).

These more expansive positions theorise and justify a focus not only on anthropomorphised animal characters, but also more naturalistically presented ones.

Overall, recent scholarship on character shows theorists are beginning to expand the concept of character to account for animal presences. Some of these concepts, particularly those that rely on anthropomorphism, are however limited. Indeed, animal characters, some have suggested, need not be human-like to be defined as characters. Following more expansive definitions, the concept of character can be applied to all animals in literary texts, as such characters can be considered conscious, intentional and physical beings, capable of being involved in the unfolding narrative's events. Intuitively and ontologically, this feels correct.

After discussing how the concept of animal character has been theorised by stylisticians and narratologists, I now move on to consider the animal character analyses that have come out of the field of narratology. Contextually, these studies appear part of a historical shift in which 'narrative interest

[has] gradually moved away from the idea of using animal narrators for purely human concerns toward the actual experience of animals, and […] the notion of a reciprocal relationship between humans and animals' (Alber 2016, p. 69). These animal character analyses highlight the strategies various narratives have used to present animal characters, and offer a grounding for the analyses conducted in my chapters. It also not only outlines the scope of the research conducted so far, but also highlights how this research area needs further development.

Herman (2012) focuses on narrative time disparity in a graphic novel, *Couch Tag* (Reklaw 2006). He argues that disparity between an older 'narrating I' and the younger 'experiencing I' in this narrative 'provides a model for representing nonhuman experiences' (ibid, p. 108). For example, the vignette 'Frosty' juxtaposes cat (Frosty) and human (experiencing I) ways of engaging with the environment: whilst the cat is interested only in the tumbling lego blocks, unbothered by the rain, and indifferent to the sunshine, the human character is depicted as the exact opposite. Herman argues that the human character (the experiencing I) fails 'to appreciate fully what it was like for [the cat] to experience the world as [an] autonomous being[]' (ibid). The narrating I, on the other hand, understands that the cat's subjectivity differs substantially from his younger self's. Despite the cat being externally presented, the narrative works to foreground differences between human and animal character's perspectives, interests and preferences, something which is achieved through the reflexive older narrator's experience and knowledge.

Later Herman (2013) explores how animal phenomenology is presented in Woolf's (1933) *Flush* through canine focalisation. The dog focaliser is an animal reflector who has a different way of experiencing the world around him, particularly foregrounded because of Woolf's technique of switching between human and animal focalisers. The dog's greater acuity and sense of smell is particularly emphasised in the text. He argues, against others, that animal focalisation is not necessarily a crude anthropomorphic characterisation strategy that must be avoided. The focalisation of the dog character in *Flush* he suggests is not meant as an exploration 'into the inner recesses of canine consciousness, but rather […] an effort to ground a dog's way of experiencing the world in that

creature's biophysical attributes as well as his specific life history' (Herman 2013, p. 558). The dog, for example, is unable to understand the human character's activity (reading and writing) as he is unable to smell anything on the printed page, and is also attributed episodic memories through FID. The dog character highlights the continuity, not differences, between human and nonhuman minds.

As in earlier research (2012), Herman (2014) similarly explores minor animal characters, highlighting the functional roles they can perform in narratives. He explores the short story, 'Above and Below' (Groff 2011), noting that animal characters 'serve as gatekeepers at key transition points during the protagonists journey' (Herman 2018, p. 35). For example, evicted from her apartment, the human protagonist spots camping equipment and remembers that she was '"petrified by the bellows of bull gators"' during a camping trip with her ex-boyfriend (quoted in ibid, p. 35). Similarly, after she becomes homeless, the protagonist again connects herself with animal characters. Driven by hunger, she decides to go and collect food from a nearby college dormitory. She becomes '"ratlike on campus"' and notices '"[a] small creature […] moving at the edge of the lawn, and […] c[an] hear the others sleeping, [and] their small movements and breaths"' (quoted in ibid, p. 36). This characterisation strategy, Herman argues, is an instance of biocentrism, where the human character's connection to animal characters challenges selfhood and highlights the permeability of human and animal character boundaries. Herman's analyses highlight how animal characters can be functional but still of fundamental importance in narratives, highlighting that 'self-other relationships […] do not stop at the species boundary' (ibid, p. 38).

Bernaerts et al (2014) focus on animal character narrators, which despite being heavily anthropomorphised, appear to capture nonhuman experientiality. Focusing on Kafka's (2005) 'The Burrow', for example, they suggest the narrative's use of stream of consciousness is able to capture the mole character's 'captivation' (Heidegger 2001) in its environment. This internal presentation allows the narrative to present the mole's innate behavioural patterns, particularly its digging habit, as being beyond the mole's reflexive understanding. The narrative they argue thereby presents 'a dimension of animal experience that is both nonlinguistic and largely unknown to its readers' (Bernaerts et al 2014,

p. 81). In the 'Axolotl' (Cortazar 1985) also, the animal's 'captivation' is presented but via different narrative strategies. The 'Axolotl' thereby features a narrator, whose 'fascination with the axolotls mirrors the animals' own captivation in their environment' (Bernaerts et al 2014, p. 78). This empathic alignment with the salamander character facilitates a metamorphosis, whereby the human narrator becomes the animal he has been obsessed with. The narrative draws on shifting focalisation and deictic shift to present the human character's metamorphosis. Both characters, often read as allegorical figures, are read by Bernaerts et al in more literal terms, in ways that align with animal studies' position that animals should be taken seriously in cultural artefacts.

Caracciolo (2016) similarly explores animal narrators. He notes, however, the importance not just of the internal presentation of animal characters, but suggests they also offer the chance to experience the 'animal's embodied consciousness, putting the reader in contact with an animal body – its size, sensorimotor affordances, and […] its […] needs' (ibid, p. 145). Animal narrators thus encourage readers to draw on the animal body schema for that species, which might include knowledge about that animal's physical capabilities. Zaniewski's (1994) rat narrator, for example, highlights that species' ability to fit through incredibly small spaces. Drawing on Kuzmičová's (2013) categories, animal narrators can therefore be characterised through 'enactment imagery' which 'involves a sense of enacting a character's bodily experience' using quasi-sensory and kinaesthetic experiences (Caracciolo 2016, p. 149). To give an example, this description of the rat narrator's childhood nest draws on enactment imagery, with the use of second person pronoun aligning readers with the rat character's bodily experience: 'With her teeth, Mother gently grasps me by the skin, draws me near, lays me down next to her. Close to the warm milky belly, you forget the gray patch' (quoted in ibid, p. 147). Caracciolo's research highlights the importance of corporeal dimensions of animal character presentations.

Returning to internal depictions of animal characters, Herman (2016b) explores how Fowler's (1977) mind style can be used to present animal characters' minds. Mind style 'refers to modes of textual patterning that encapsulate, or even iconically reproduce, an intelligent agent's moment-by-

moment negotiation of its lived environment', and the concept could be usefully extended for use with animal characters (Herman 2016b, p. 59). For example, a narrative, presenting the mind style of a seabird, uses iconicity to evoke the footsteps of a fox, whose approach is likely to threaten the bird's chicks. Animal narratives can, however, expand the range of textual phenomena often associated with conveying a particular mind. In Baker's (1967) *The Peregrine,* the author uses a string of imperatives to highlight the behaviour of the bird and its ways of making sense of the world. Explorations of animal characters' mind styles, Herman argues, not only potentially expand the mind style framework further, but can also raise questions about 'what sorts of experiential worlds are available [to animals] [...] [and] the strategies used to present (and interpret) different kinds of minds' in narrative (2016b, p. 60).

Danielsson (2017) has used Genette's taxonomy of embedded narratives to explore zoo animal characters' intradiegetic narratives in *The Wind on the Moon* (Linklater 1944). Unlike human characters, the animal characters in the novel are never focalised, their minds instead presented via direct speech. This asymmetry in characterisation, she argues, suggests 'a reluctance [...] to interpret nonhuman behaviour in human terms [...], [and] to engage in crude anthropomorphism' (Danielsson 2017, p. 5) – as noted above, not all instances of animal focalisation are considered necessarily problematic (Herman 2013). Despite lack of focalisation rich characterisation is shown through direct speech, and Danielsson makes a compelling case for affording animal characters critical attention even though they are 'under-characterised' in comparison to human characters. The falcon character, for example, speaks of 'the enormous expanses of his former homeland and especially his birds-eye perspective [...] [which] contrasts with his life in captivity' (ibid, p. 10). The falcon's narrative also aligns with Genette's third function, the thematic function, developing the important theme of lost freedom. These intradiegetic animal narrators, as with the animal characters in Herman's research (2014), not only affect a critical anthropomorphism, but also 'shoulder important narrative functions' (ibid, p. 13).

Lastly, like Herman (2013), Höing (2017) focuses on animal focalisers, the dog characters, in Adams's (1977) *The Plague Dogs*, centring analysis on the narrative technique of unreliability. She notes that talking animal stories often utilise unreliability, particularly of the kind borne out of animal

characters' unfamiliarity with human society and conventions. Snitter, the dog focaliser, therefore fails to understand that newspapers (and poking his nose under the bottom of them when his owner is reading) are not designed for play. This kind of 'naïve defamiliarisation' is common with animal character focalisers. However, the story explores other kinds of unreliability that are more critical and unusual. For example, Snitter's past – he is an escaped experimental animal – causes further unreliability, with Höing suggesting the character suffer symptoms akin to PTSD. Snitter thus frequently confuses the environment as being an extension of his own scarred body: walking over a rocky outcrop, referred to as *Walna Scar*, Snitter thinks he is walking over his own head. Drawing on Phelan's (2007) categories of unreliability, Höing suggests that Snitter's kind is 'bonding' unreliability.[3] This characterisation strategy of unreliability helps bring to the foreground the suffering the animal characters have endured and 'the devastating consequences of anthropocentrism' (Höing 2017, p. 1).

Overall, narratologists have explored a variety of ways that narrative's resources can be used to present animal characters. Not only has it connected animal characters to higher-level narrative structures like time (Herman 2012), plot (Herman 2014) and theme (Danielsson 2017), it has also shown how specific textual features or narrative devices can be employed to present animal characters. Narratives can characterise animals via focalisation and FID (Herman 2013, Höing 2017), symmetry or asymmetry between human and animal characters (Herman 2012, Herman 2014), stream of consciousness (Bernaerts et al 2014), deictic shifts (ibid), animal body schemas (Caracciolo 2016), mind style (Herman 2016b), direct speech (Danielsson 2017), and unreliability (Höing 2017).

Outlining the research that has been conducted by scholars in narratology and stylistics on animal characters and characterisation has enabled this thesis to locate some of the gaps. Firstly, there has been a tendency to focus largely on focalised and narrating animal characters. Elick has acknowledged that many studies of animal characters focus on 'anthropomorphised [characters] […] endowed with the ability to speak' (2015, p. 3). Indeed, literary critics have consistently engaged with said characters across various genres, including children's fiction (Elick 2015, Cosslett 2006) and animal

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[3] Despite being literally unreliable, the statement is metaphorically reliable.

biographies (DeMello 2015). A focus on such characters has extended into narratological accounts of character, though, along with literary critics, they have considered the ways that anthropomorphised animals might challenge anthropocentric perspectives. If the purpose of focusing on these types of animal characters, as many of the above critics argue, is to engage empathic responses, then it is worth noting that narratologists have noted that even 'relatively externalized and brief statements about a character's experiences and mental state may be sufficient to invoke empathy in a reader' (Keen 2006, p. 219). Similarly, some taxonomies of animal characters argue that 'talking animals' are merely one mode of representation (Ortiz-Robles 2016, p. 22).[4] As will be outlined later (see section 1.4), animal characters that do not speak or are not focalised form an important focus of this thesis's interest.

Secondly, the overwhelming majority of the texts considered in the above research fall into either children's fiction (Danielsson 2017, Höing 2017) or literary realism (Herman 2012, 2013, 2014, 2016b, Bernaerts et al 2014, Caracciolo 2016). As Ortiz-Robles notes, however, 'if we were to construct a scale of genres arranged according to the presence of animals, we would have to settle on two or three genres that seem to aggregate animals in larger proportion than other genres' (2016, p. 20). According to Herman, what is needed is for animal studies scholars to conduct research that situates animal character analyses 'both diachronically [...] and synchronically, across cultures, [and] genres [...] in any given epoch' (Herman 2018, p. 2). Whilst this aim is beyond the scope possible for this thesis, the above research has suggested that focusing on particular modes and genres – literary realism and children's literature – has proved productive, and, though not outlined in detail above, such research can elucidate how 'issues of genre bear on narrative engagements with animal experiences' (Herman 2018, p. 157). I have, therefore, chosen to focus on one genre, science fiction, which will frame this thesis's exploration of animal characters.

1.2 Why Look at Animal Characters in Science Fiction?

It might appear odd, at first glance, to look for animal characters within a genre that 'readers do not intuitively associate [with] science fiction, "the literature of technologically saturated societies"' (Vint

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[4] Others include 'fantastic animals', 'symbolic animals' and 'real animals' (ibid).

2010, p. 1). However, in an article of *Science Fiction Studies* (*SFS*) entitled 'Unjustly Neglected Works of Science Fiction', what becomes evident is how frequently science fiction includes animal characters (1993). The article featured responses to a request for science fiction texts and authors that have been overlooked critically.[5] Amongst those listed, many heavily featured animal characters. These included Aldiss's (2008 [1961]) *Hothouse*, Boulle's (2013 [1964]) *Planet of the Apes*, Smith's (1975-79) *Instrumentality* series, Crowley's (2000 [1976]) *Beasts*, Tepper's (1989) *Grass,* Simak's (2011 [1952]) *City*, Scott's (1986 [1977]) *Passing for Human*, Norton's (1959) *The Beast Master*, and Mitchison's (1985) *Memoirs of a Spacewoman*. The article also featured frequently ignored sf authors, showing a similar tendency: McCaffrey (1989 [1969], *Decision at Doona*), Ellison (2014, *Vic and Blood*), Stapledon (2011 [1944], *Sirius*), McIntyre (1978, *Dreamsnake*) and Miller (2016 [1962], *Conditionally Human*). Although this was not its central focus, the article highlighted that science fiction featuring animal characters is prolific, but often ignored.

Supplementary to the prolificness of animals in science fiction, Vint (2010) has argued convincingly for science fiction's strengths in exploring animal characters:

Animals are at the core of many questions central to sf: what does it mean to be human? How can we communicate with another species, and how might we be changed by the experience? How might the world be otherwise were we to share it with other beings? [...] What is the relationship between the culture of science and our ways of understanding and relating to animal others? (Vint 2010, p. 225).

Other literary scholars (Yampell 2008, McGuirk 2008, Murphy 2008, Miller 2008, Gordon 2010) and narratologists (Herman 2018), as will be outlined in this section, have also put forward well-reasoned arguments regarding science fiction's affordances for engaging critically with animal characters.

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[5] Some of these texts and authors outlined in this article are analysed in this research, including Aldiss's (in particular, *Helliconia*) and Capek's work (in particular, *War with the Newts*).

First, science fiction is a genre distinctive for the way it exploits world-building techniques, presenting the world as radically different from the status quo. Science fiction's potential to alter the norms of the reimagined society means it is able to 'convey[ ] the fullness of life before it is contained within [...] reductive categories' (ibid, p. 6). In *Memoirs of a Spacewoman* (Mitchison 1985), for example, ecological interactions are reimagined through the animal characters known as 'grafts', a parasitic species. But these parasites are not greeted with disgust. Instead, the protagonist chooses to host a graft on her body, which she names 'Ariel'. When the protagonist hosts Ariel, her body goes through a state of pseudo-pregnancy, and when Ariel detaches itself the protagonist is struck with grief. The text thus reinscribes a formerly exploitative biological interaction as one of mutual care (see: Miller 2008). The world-building techniques of sf encourage reconceptualisation of the animal characters represented therein, allowing human and animal relationships to be redrawn.

Second, some of science fiction's most established tropes are non-human beings, like aliens. The genre therefore 'offers a wider scope than does most literature for enabling animal agency to become part of the quotidian world' (Vint 2010, p. 6). Animal characters' perspectives might be presented as quotidian via 'uplift', where the animal characters are bio(-techno)logically altered. In *City* (Simak 2011 [1952]), for example, 'uplifted' dogs become the dominant species after humans become extinct. The narrative is structured around origin stories of the dominant species, dogs, with humans appearing as mythical creatures. In one of these origin stories, humans attempt to resettle on Jupiter, where they transform themselves and a dog into an endemic species called Lopers. After transformation, the human protagonist realises his dog continually tried but failed to communicate with him (see: Gordon 2010). The animal characters in *City* are speaking subjects, but animal characters might be 'uplifted' via a variety of means. In *The Jonah Kit* (Watson 1975), for example, a whale is imbued with a human consciousness. All of these animal characters aim to unsettle human perspectives, and seem to embody a 'continuing desire [in sf] to connect with another being whose subjectivity is unlike our own' (Vint 2010, p. 22).

Third, science fiction can conceptualise the animal characters as 'alien animals', and though they might bear some resemblance to standard taxonomies, it can foster defamiliarisation, encouraging fresh engagements with differently embodied subjects. For example, in *Memoirs of a Spacewoman* (Mitchison 1985), the protagonist encounters a race of 'starfish', and begins to question her own conceptual system. The starfish, she states, never think '"in terms of either-or"', but many of her own '"judgements were paired; good and evil, black or white"' (Miller 2008, pp. 254-55). The protagonist therefore allows her conceptual system to shift and accommodate the starfish perspective of a '"five-choiced world"' (ibid, p. 255). Similarly, rendering the animal character as 'alien' means that such characterisations won't necessarily inherit and/or reify prejudices attached to certain species. In 'The Large Ant' (Fast 1965 [1960]), the protagonist discovers an 'ant' at the foot of his bed, and disgusted kills the creature. He takes the ant's body to a curator, learning that the ant is '"To us [humans] – well, what we are to an ordinary ant"' (Vint 2010, p. 139). The narrative ends with the protagonist '"no longer [able] [to] live with himself [and] content to be judged"' for having killed the intelligent creature (ibid). Alien animal characters can afford fresh focus on the materiality and lived experiences of animal life and unsettle misconceptions attached to particular species.

Fourth, science fiction has a long history of representing beings that are 'hybrid', including some of its most enduring tropes, like cyborgs and sentient computers/machines. These naturalised tropes also extend to animal-human hybrid characters, whose roots can be traced back to the genre's inception, particularly *The Island of Doctor Moreau* (Wells 2005 [1896]). As well as animal-human hybrid characters disrupting divisions between human and animal, they can also challenge the species hierarchy. In *Eva* (Dickinson 2008 [1988]), for example, a girl's consciousness is transplanted into the body of a chimpanzee. The text challenges commodification of the chimpanzee body, however, by suggesting that the chimpanzee must accept the girl's consciousness. In other words, the 'transplant' must be accepted by both animal and human. The text shows how the animal-human hybrid character experiences 'opportunities for escape, rebellion, and assertions of self that have been previously denied' (Yampell 2008, p. 219). Human-animal hybrid characters also frequently raise ethical concerns

regarding broader exploitative human and animal relationships, such as animal labour (the Underpeople in Smith's (1975-79) *Instrumentality* series) and pet-keeping (Peony in Miller's (2016 [1962]) *Conditionally Human*).

Fifth, science fiction's frequent focus on futurity means that it is able to explore speculative evolutionary developments of animal life, to imagine a world that is fundamentally post-human, and where animal characters proliferate. Science fiction then engages with 'counterfactual scene building afford[ing] means for engaging with macro-level phenomena unfolding on suprahuman timescales' (Herman 2018 p. 270). Focusing on far-reaching timescales can decentre human dominion over the animal world. Ballard's (2012 [1962]) *Drowned World*, for example, engages with such ideas by presenting a world that is returning to the Carboniferous period, an environmental change fundamentally hostile to human life. The novel depicts a 'drastic upsurge of all lower plant and animal forms' and sightings of Pelycosaurs, an extinct mammal-like lizard (ibid, p. 33). Futurity and vast timescales might also depict evolutionary developments of humans into more animal-like forms, as in the monkey-like characters of *Hothouse* (Aldiss 2008 [1961]) and rabbit-like characters in *The Time Machine* (Wells 2005 [1895]). Science fiction's futurity means it is excellent at engaging in 'storytelling at species scale', which works to undermine anthropocentrism and reimagine what other species might fill the gap left by humans (see: Herman 2018).

Sixth, science fiction is a genre that is intimately connected 'to the rising culture of science and its values of technical rationality' (Vint 2010, p. 23). In a number of fields, particularly biomedicine, psychology and biogenetics, research is conducted largely on animal beings, the 'materials' through which developments in those fields are constructed. Experimental animals can also be seen as products of the laboratory, like OncoMouse.[6] This sixth point is linked to hybridity (fourth point), since laboratory culture positions animals as 'cyborgs', i.e. 'a hybrid figure, disturbing traditionally-upheld boundaries between nature and technology, organic and machine' (Ratelle 2015, p. 90). Science fiction can

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[6] OncoMouse is 'a genetically engineered lab critter, patented under the name OncoMouse, whose work was to serve as a breast cancer model for women' (Haraway 2008, p. 76).

reimagine laboratory animal characters as experiencing subjects rather than experimental objects in its depictions. In 'Mazes' (Le Guin 1990a [1971]), for example, an alien animal laments the human scientist's inability to understand its acts of communication. Running through a maze, the creature's kinaesthetic performance is ignored by the human scientist, who is merely focusing on whether the creature is 'taking the shortest route through the maze' (ibid, p. 184). Science fiction also frequently explores the ethical ramifications of laboratory culture. For example, in *Doctor Rat* (Kotzwinkle 2014 [1971]), the rat protagonist satirically claims 'just because we haven't yet determined the deep significance of stitching two rats together does not mean we won't eventually find out' (p. 35). Presenting the animal characters as subjects subverts instrumentalisation of animals reduced to 'data on a spreadsheet'.

Seventh, the 'science' in science fiction highlights the genre's connection, though sometimes tenuous, to scientific culture more broadly. Science fiction is seen as a genre that 'should in some way reflect both the content of current scientific knowledge and the scientific technique of logical extrapolation', entailing 'that the genre's imaginings of animal being are inclined to incorporate knowledge gained from ethology [...] and thus approximate what we know of animals' experiences of their worlds' (Vint 2010, p. 6). Though science fiction is connected to ethology in this instance, the genre has historically had broader scientific influences. Indeed, there are numerous attempts to contextualise animal characters in science fiction, via concepts drawn from 'hard' and 'soft' spheres of scientific endeavour, including biogenetic engineering (Yampell 2008), cognitive science (Miller 2008), ecology (Miller 2008), entomology (Murphy 2008), evolutionary linguistics (Gordon 2008), laboratory culture (Ratelle 2015), and sociobiology (Vint 2010). Contextualising animal characters amongst scientific concepts can challenge distinctions between human and animal along lines mentioned above, or challenge how such ideas might position animal characters. Despite offering immense detail of ant colony ecology, *Peril Among the Drivers* (Olsen 1934), for example, has a strong sociobiological bent that depicts ant behaviour as heavily determined by genetic inheritance. The 'princess ant' is thus a slave to '"the cumulative instincts of ages"' and wishes '"to become the mother of a great nation!"' (as

quoted in Vint 2010, pp. 97-98). Such examples suggest that science fiction is frequently aligned with scientific culture, and that animal characters might be productively interpreted amongst these concepts.

Although science fiction does sometimes depict animal characters in reactionary ways, the above affordances suggest science fiction is a genre particularly suited for exploring animal characters. Indeed, the strengths of the genre allow wider scope than most for critical engagement and interpretation of animal characters. The genre's world-building elements and focus on futurity make it ideal for exploring posthuman concepts, ontologies and timescales, decentring humans. Its proclivity for engaging with 'Other' beings means animal characters are frequent inhabitants of science fictional worlds, either as speaking animals, animal aliens or hybrid animal-humans. Finally, its current and historical engagement with science enables critical analyses that engage with some of the damaging conclusions encouraged by particular scientific contexts, which seems particularly in line with an animal studies perspective.[7]

1.3 Science Fiction: Definition, Characters and Characterisation

In this section, I will first outline a definition of science fiction drawn from one of the most influential scholars of the genre, Darko Suvin.[8] Suvin's definition of science fiction is useful in grounding this thesis's position as his 'ideological' approach brings to the foreground characters that are frequently marginalised such as animal characters. As Schneider has pointed out in his model of the characterisation process, 'literary theory may influence [...] processes of character reception' with some theories teaching readers to look for 'the marginalised, the subaltern, or the subversive characters' (2001, p. 626). I will briefly outline in this section how science fiction characters have often been conceived of as impoverished, with little stylistic merit. However, sf critics and stylisticians have challenged this, suggesting sf merely differs from other literary genres in two key ways: (1) flat

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[7] Indeed, the analysis of literary animal characters in 'animal turn' scholarship tends to highlight how animals are 'a transdisciplinary object of investigation' (Herman 2012, p. 117) (see also: Bernaerts et al 2014 & Calkins 2010).
[8] Suvin is 'arguably the most influential Western theorist of SF' (Campbell 2018, p. 2).

characters predominate in sf, and (2) character is often subordinated in sf. Drawing on narratological theory, I will then show that characterisation in science fiction tends to prioritize the 'thematic' and 'symptomatic' function of character over the 'mimetic' (Phelan 1989, Eder 2010, Mikkonen 2017). The analysis of animal characters in this research, therefore, will be influenced by the genre's relationship to character.

Before outlining Suvin's definition and approach to science fiction, it is worth noting that virtually no science fiction scholars can agree on a satisfactory definition of the genre. Kelly and Kessel, for example, have argued that 'if "genre" sf *ever had* a consistent core, that time has long past' (2009, p. 16 – my emphasis). Mendlesohn has stated that '[s]cience fiction is less a genre – a body of writing from which one can expect certain plot elements and specific tropes – than an ongoing discussion' (2003, p. 1). And, Heuser acknowledges that 'no consensus regarding the definition of science fiction as a genre [...] has yet been reached' (2003, p. xii). As with sf authors and literary critics, stylisticians have attempted to highlight the 'fuzziness' of the sf genre category. In *The Poetics of Science Fiction*, Stockwell (2000a) cogently employs cognitive prototype theory (Rosch 1978) to provide an explanation of sf's nebulous nature. Following the theory, Stockwell suggests that certain members of the sf category are more 'prototypical' than others, for example, those texts that include tropes like robots, spaceships and aliens. Prototype theory accounts for individual perceptual experiences and cross-cultural differences, and Stockwell argues that 'what this means for a definition of science fiction is that different readers will have different ideas of which texts count as science fiction' (2000a, p. 7). Put simply, he concludes that the more sf someone reads, the broader their category of 'science fiction' becomes.

Despite 'fuzziness' of the sf genre, Suvin's definition is a helpful starting point and has proved influential in science fiction criticism. Suvin defines science fiction as:

a literary genre whose necessary and sufficient conditions are the presence and interaction of estrangement and cognition, and whose main formal device is an imaginative framework alternative to the author's empirical environment (1979, pp. 7-8).

Fleshing the definition out slightly, sf immerses the reader 'in an imagined world that is different from our own in ways that are rationally explicable (often because of scientific advances) and that tend to produce cognitive estrangement in the reader' (Booker & Thomas 2009, p. 4). Stockwell (2000a) has argued that 'cognitive estrangement' is similar to the concept of *defamiliarisation*, the effects of which could be found in all literary texts. In sf, however, 'cognitive estrangement is [...] dominant' (Freedman 2000, p. 22). Suvin argues this estranging effect is introduced through the novum, 'a strange newness' (1979, p. 70). The novum, or 'new thing', 'need not be a gadget or machine' but can be an 'alternative imaginative framework', which is hegemonic in nature, i.e. 'so central and significant that it determines the whole narrative logic' (ibid). Examples of nova include the invention of time travel in Wells's (2005 [1895]) *The Time Machine* or xenotransplantation in *The Island of Doctor Moreau* (2005 [1896]). Sf, therefore, is a genre that positions the reader in an imagined world that is radically different from their own through the introduction of a novum or multiple nova.

But science fiction is not just about estranging techniques and nova extrapolated from scientific and technological advances. For Suvin, sf is filled with beings that 'are mirrors of humankind, just like the unknown country is the mirror of [our] world', and these mirrors, he argues, act as 'crucible[s]' (1979, p. 13). As many sf critics have noted, Suvin's approach to sf is fundamentally ideological. Suvin thus 'insist[s] that SF must have a critical relationship to the social world contemporary to its production', defining the genre in terms of 'its ability to promote social change' (Bould & Vint 2011, p. 17). This aligns Suvin's approach with the abovementioned affordances of the sf genre that enable animal studies perspectives. Influenced by Suvin's definition, science fiction isn't just 'narratives of literal aliens', but also narratives of 'the metaphorical sense of alienation felt by those excluded from mainstream hegemonic culture' (Stockwell 2003a, p. 197). Suvin's approach to sf, then, is clearly helpful

in underpinning this thesis's focus on literary representations of animal characters whose realities and perspectives are often marginalised.

Characters, human or animal, are themselves an overlooked element of science fictional analyses. As Mandala (2010) makes clear, this is largely due to the assumption that sf writers often only depict 'flat' characters, and she gives a fairly concise overview of this issue, which I will briefly outline here.[9] Stockwell (2003a) refers to sf characters as 'interchangeable', whilst Attebury (1992) sees sf characters as being merely vehicles for narrative exposition. Russ (1975) argues that sf characters are never individualised. Most damningly, Sanders suggests that 'one is hard put to name half a dozen memorable characters from all the annals of the genre' (1977, p. 14). Speaking specifically on animal characters in speculative fiction, Shaw states that this 'generalisation [...] is accurate enough', particularly in relation to short stories and novellas (2010, p. 56). Counterexamples to this 'characterisation-is-poor' narrative, Mandala (2010) argues, are frequently ignored. Hence, 'psychologically valid' characters are merely discussed as '"mediator[s]" [...] "emblematic counterparts" [...] or "bridges" [...] that we use simply to cross from the world of the real to the alternative world of the text' (ibid, p. 122). Mandala's examples highlight that when round characters appear in sf they are often dismissed as aberrant. Despite this, most critics acknowledge that flat characters are ubiquitous in sf and reasons for this are explored below.

Perhaps, more important than exploring the few examples of 'round' characters in the genre is challenging the idea that sf characters are not worthy of attention merely because the majority are flat. As Gomel states, 'few have tried to reassess the concept of the flat character itself, or to claim that it may express something more than the genre's deficiency' (2016, p. 4). Taking such a position, Mandala argues that the distinction between 'flat' and 'round' characters should not be equated with evaluations of 'bad' or 'good' characterisation respectively. She convincingly outlines that a focus on

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[9] As defined by Forster, the distinction between 'flat' and 'round' characters is those characters that are respectively either 'constructed around a single idea or quality' (1927/2005, p. 73) or characters that 'are more highly organised' (ibid, p. 79). Whilst these definitions seem imprecise, later critics have defined the elements of character presentation contributing to these character categories. Rimmon-Kenan (2002), for example, proposed three dimensions to help distinguish flatness from roundness, including 'complexity', 'development' and 'inner life'.

literary linguistic analysis can reveal how 'flat characters are not necessarily thinly drawn ones' and that 'a representative type can be just as compelling in alternative world fiction as a represented person' (2010, p. 146). For example, the Borg in *Star Trek* offer an example of strong characterisation despite being flat in their psychological complexity – indeed, their unwavering position makes them compelling antagonists.

Whilst stylisticians have attempted to defend science fiction's flat characters, sf critics contextualise this predominant mode of characterisation. Parrinder (1979) has argued that sf's historical roots mean that concepts of character autonomy and psychological depth, encoded by liberal humanist values, 'are not appropriately applied to characters in science fiction' (quoted in Mandala 2010, p. 124). Maule emphasises that lack of 'rounded' characters in sf is intentional and should be considered 'a facet of the genre's strength rather than its weaknesses' (1996, p. 108). The characters in sf, she argues, are vehicles through which the reader might explore broader themes. Sanders suggests that critics 'frequently use this weakness of characterisation as a bludgeon for attacking the genre', but that sf's flat characters are integral to the genre, which is about the 'disappearance of character' (1977, p. 132). Disappearance of character, rooted in the genre's development alongside, and engagement with, modern techno-scientific culture (see: sixth & seventh point above), can be seen in the genre's privileging of systems over individual autonomy. Malmgren states that claims of flat characterisation can be levelled against particular subgenres of sf – 'gadget sf', 'space opera', 'alternative world sf' – but not 'alien encounter sf', as it depicts alien and human characters whose 'respective unique qualities [are] the *sine qua non* of the fiction' (1991, p. 56-57). Yet, he appears to conflate flat character with minor character, as he later concedes that even in this subgenre the characters often serve as 'representatives' of their species.

Overall, Mandala's (2010) research shows that flat characters are ubiquitous in sf, yet despite this close analytic attention can be productive. Her analyses of sf characters undermines the explicit and oft-quoted association between 'flat' and 'bad' characterisation (Stockwell 2003a, Russ 1975). Sf

writers argue that flat characters are a necessity of the genre. Whilst sf critics justify a focus on flat characters in sf via the genre's historical roots, priorities, and cultural contexts. All of the above research, therefore, attempts to legitimise a focus on sf characters that are frequently dismissed as unworthy of critical attention. As Shippey notes 'the familiar accusation that sf "lacks characters" […] is ducking an obvious question: are human beings the only really interesting things in the universe, without which no story has a point?' (2016, p. 6).

A criticism of the above discussion might be that a focus on 'flat' characters amounts to a 'repudiation of the text's own hierarchy of value, bringing to the critical foreground what has been subordinated to the narrative background' (Woloch 2003, p. 37). However, the above discussion hints at a crucial distinction between characters in sf and other genres or modes of fiction: namely, characters are often subordinated in sf. Discussing this issue, Keyes suggests that 'every work of literature must include some degree of characterisation and plot development […], but the balance between those elements of literature shifts from […] type of literature to type of literature' (2006, p. 63). Indeed, many critics categorise alternative world texts, like sf, as 'plot-driven' rather than 'character-driven' (see: Brooke-Rose 1981, Hume 1984, Thompson 1982). Amis has similarly suggested that sf is a genre where the '[i]dea [i]s hero' (1960, p. 137), and Gunn (2002) sees science fiction as a literature of ideas. This conception of sf means characters are more likely to be subsidiary elements of sf storyworlds, with their complexity, development and inner life – all 'rounded' qualities – being sidelined. Sf therefore approaches characters and characterisation entirely differently to realist fiction that 'tends to be primarily a context for the portrayal of character' (Brooke-Rose 1981, p. 80). Similarly, narratologists have suggested that sf tends to focus on 'body-centred' representations of characters, as opposed to 'mind-centred' depictions found in realist modes, and is therefore unlikely to engage with the rounded quality of inner life (Eder 2010).

Mandala is critical of such 'apologist' positions, yet studies of sf character that consider the genre's differences from other modes and attempt to explain such essential differences do not, in my

opinion, amount to an apology. On the contrary, dismissing such work is tantamount to ignoring the genre's influences on depictions of characters and characterisation strategies. Indeed, many stylisticians have stated that 'the way characterisation works is [not] identical in every genre [and] [t]here are crucial stylistic or narratological differences between genres that affect the way characterisation proceeds' (Culpeper 2009, p. 127). Similarly, Eder et al suggest that genre is a mental schema that can 'trigger a complex set of expectations concerning the kind of characters to appear [and] […] their conception as flat or round, or static or dynamic' (2010, p. 43). An analysis of characters in sf, therefore, must acknowledge the genre's general tendency towards subordinating characters.

Before moving on, I will briefly consider the above conceptual underpinnings of sf characters and characterisation in relation to the approach taken towards animal characters in this research. Firstly, the ubiquitousness of flat characters in sf. In her analysis of the Borg, Mandala (2010) elucidates how nonhuman characters are frequently represented as compelling characters in sf (see also: Meyers 1980, Chatman 1978, Parrinder 1979, Roberts 2006). But, given the historical roots, cultural contexts and necessities of the genre, they are likely to be presented as predominantly flat characters. Indeed, in all but a few of the sf texts considered in this thesis, animal characters are not afforded the foundational qualities of roundness, such as 'interiority', 'complexity' and 'development' (Rimmon-Kenan 2002), though they often play a central role in the text. As Mandala claims, however, 'flatness' should not equate with evaluative judgements, such as 'poor'. I, therefore, will do not evaluate flat animal characters as examples of inherently 'impoverished' characterisation in this thesis. Such a position is consistent with animal studies scholarship that argues animal characters should not be seen as 'exemplify[ing] the bad object choices of academics' (McHugh 2011, p. 18).

Earlier (see section 1.1), I pointed out that narratologists had tended to focus on 'speaking' animal characters (Bernaerts et al 2014, Keen 2011, Nelles 2001, Hoing 2017, Danielsson 2017). These characters are often round, represented as narrators and/or focalisers, or have any number of the qualities mentioned above. This tendency in narratological research is noted by Herman (2018, p. 8).

Whilst speaking 'uplifted' animal or animal alien characters feature in sf, such characters tend to remain flat, as they infrequently fulfil the position of narrator or focaliser. This research, therefore, aims to expand the corpus of narratives focused on for animal character analyses and look beyond round, often speaking, animal characters. Indeed, this focus is one of the ways in which this thesis aims to contribute to the development of studies of animal characters.

Secondly, the subordinated position of character in certain genres, like sf, has led narratologists to consider the ways that characters in such genres might be read not just mimetically, but as being synthetically, thematically or symptomatically significant. Phelan (1989)[10], Eder (2010)[11] and Mikkonen (2017)[12] propose similar ideas about how 'mimetic' subordination of character occurs in non-mimetic genres like sf. Whilst the 'synthetic' dimension of character is not foregrounded in the subsequent analyses, Phelan's 'thematic' dimension of character – 'characters as representatives of classes of people [...], [involved] in the cultural, ideological, philosophical, or ethical issues being addressed by the narrative' (p ?) – and Eder's 'symptomatic' dimension of character are both useful conceptual underpinnings for situating the analysis of sf's subordinated animal characters in this research – these dimensions are, necessarily, read alongside the 'mimetic' aspects of animal characters. These analysts have argued that thematic and symptomatic dimensions of character help to situate characters as part of broader social, cultural or historical contexts, a position I align with in this research. In this thesis, however, I will focus on a specific kind of contextual engagement: a scientific context.

1.4 Science Fiction: Scientific Contexts

This section outlines how science fiction critics have scrutinised sf's engagement with scientific contexts. Many have argued that science plays an important role in all sf, though some disagree. Even

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[10] Phelan's seminal work on his typology of character analysis highlights the importance of thematic dimensions of character in sf by analysing Winston Smith in Orwell's (1949) *Nineteen Eighty-Four*.

[11] Like Phelan and Mikkonen, Eder argues that many analysts tend to focus on the 'mimetic' function of character. He suggests that generic factors should inform the category drawn on for character analysis. Similar to Phelan, he proposes four categories – a 'clock of character' – for character analyses. His model includes categories in line with Phelan's (1989) model, plus a category known as 'symptom'. When characters are considered as symptoms, the analyst should consider the character's 'cultural mentalities or the socio-cultural' meanings (Eder 2010, p. 32).

[12] Mikkonen argues that non-mimetic genres, like sf, are likely to prime thematic readings of characters. In the superhero genre, for example, he argues that characters tend to embody 'mimetic flatness' but 'thematic roundness' (2017, p. 193).

strong proponents of the 'science' in sf frequently admit that science appears as a background context that informs the sf text (Lambourne et al 1990). Some have attempted to mark out a distinction between hard and soft sf, attempting to demarcate the scientific rigorousness of hard sf.[13] I will show how distinctions between hard and soft sf have been undermined. I conclude that the soft strand of sf engages with science as legitimately as does the hard, that fidelity to the scientific context is irrelevant, as the sf author is not 'practising' science, and that scientific contexts can be drawn from the social or the physical sciences. I also suggest that definitions of hard sf frequently ignore the fact that the interaction between narrative and science is two-way: sf does not passively adopt scientific contexts wholesale with literary and narrative concerns entirely backgrounded. As Ryan suggests 'without denying value to writing experiments that attempt to develop formal equivalents to [scientific ideas]', the majority of sf does not tend to 'give up the proven modes of representations' (2011, p. 184).

Most definitions of science fiction, including Suvin's, note the genre's relationship to science. Luckhurst sees science fiction's connection to scientific contexts as central, but suggests that it ought to be viewed as 'a constantly shifting network that ties together science, technology, social history and cultural expression with different emphases at different times' (2005, p. 6). Exploring 'new' scientific ideas is, for some sf critics, science fiction's main purpose, as the genre is 'about the emotional experience of discovering what is true, often represented by scientific discoveries of great consequence' (Crammer 1994, p. 25). With 'science' forming such an intrinsic part of the genre's definition and development, sf seems to represent a unique relationship between disciplines as disparate as science and literature. Indeed:

> [w]hen the term "science fiction" was reinvented in the 1920s to describe a new genre of
> popular fiction [...] its inventors and adherents had little difficulty in constructing a literary
> tradition going back fifty years [...], but they had to recognise that the body of work in question

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[13] Hard sf is defined as 'a form of science fiction that displays an especially heightened concern for, and an especially heightened connection to, science' which often features 'thorough explanations of scientific facts and/or lengthy expository passages providing evidence of a scientific thought process at work' (Westfahl 2005, p. 187). It is also likely to feature a narrative voice that is 'detached, objective, cold, clinical' (ibid). Soft sf, however, is defined as science fiction that 'emphasises plot and characters more than scientific detail and realism' (Hamilton 2007, p. 30)

was a mere trickle compared to the vast surge of the literary mainstream: a tradition that has been and remained stubbornly indifferent to […] the progress of science (Stableford 2014, p. xxi).

Sf critics have suggested that there have been few developments in physics, astronomy, cybernetics, biology, psychology, earth science and genetics that have not been creatively engaged with in sf narratives (Parrinder 1979). Overall, few can argue that sf 'based on extrapolation and/or speculation with plausible ties to the technoscientific worldview has flourished as a literature' (Landon 2014, p. 32).

However, there are some who disagree with the idea that sf is closely connected to science. Contemporary sf writers, including Kurt Vonnegut and Margaret Atwood, have rallied against the labelling of their own works as sf, due to its un-scientific underpinnings. For example, one of Vonnegut's characters, Kilgore Trout, voices concerns about the genre's connection to science: 'Like most science-fiction writers, Trout knew almost nothing about science, [and] was bored stiff by technical details' (quoted in Parrinder 1979, p. 67). Similarly, Atwood has argued that her work is 'speculative' rather than 'science' fiction. But, attempts to position their own work outside the genre appear to rest on the assumptions that sf should engage with 'technical details', remain 'true' to scientific concepts, and that 'speculation' doesn't form a constituent part of the genre, all assumptions I hope to challenge in this section. Vonnegut and Atwood's position is even harder to maintain given that their narratives have been read productively alongside contemporary physics (Nadeau 1980) and bioengineering (Kuźnicki 2017) respectively.

The above debate does highlight a key question for consideration in this section, that is, 'how central is science to science fiction?' (Benford 1994, p. 15). Whilst grappling with this question, I must draw out the distinction between 'hard' and 'soft' strands of sf. This will be useful as distinctions between hard and soft sf can act as a heuristic outlining the genre's dynamic relationship with science. The hard sf strand is seen, unfairly so, as being more directly involved with the experience of science. Hartwell, for example, persistently argues that hard sf is 'the core of all science fiction' (1994, p. 31).

These critics seem to take the 'science' of science fiction to be a rigorously-enforced constraint of the genre. Sheffield, for example, states that 'if you can take the science and scientific speculation away from a story, and not do it serious injury, then it was not hard [sf] to begin with' (2000, p 351). More subtly, depictions of science being more central to hard sf can be seen as attempts to reify a boundary between 'hard' and 'soft' sf, a boundary many critics reject.

Proponents of the hard and soft sf division have traced back the hard sf strand, as many critics do, to Hugo Gernsback, who 'strongly promoted the idea that science fiction should be a vehicle for science education' (Lambourne et al 1990, p. 34). However, most concede post-Gernsbackian sf has tended not to deliver expository chunks of scientific information. Lambourne et al attempt to categorise how science features in sf – exclusively hard sf – and summarise that

> science enters science fiction in a variety of ways […] Sometimes it is in the foreground, being used to explain a piece of technology or to account for an unfamiliar process. More often it is in the background, justifying some particular aspect of either a real or an imaginary environment. Occasionally, it may even provide the context for the story (ibid, p. 48).

The acceptance here that science, in full expository mode, is largely backgrounded suggests that hard sf does not have an overt focus on science. This slightly undermines the ground upon which many sf hardliners attempt to position the subgenre, and confuses, as Gernsback did, the distinctions between science fiction, a literary genre, and scientific discourse. This confusion is similarly apparent when they suggest that sf writers don't 'present[] proofs or demonstrations or even arguments' to back up the plausibility of their speculations, and therefore 'much of the science [presented] in science fiction lacks depth and is not related to empirical evidence' (ibid, p. 49). Such conclusions suggest that these critics believe science fiction narratives ought to explain the scientific underpinnings of their worlds, gadgets, and plausible characters to their readers.

However, the authors acknowledge that the most prolific category represented those sf texts that draw on science in a contextual way, using a 'generally "scientific" background' to anchor their

narratives (Lambourne et al 1990, p. 48). They argue these narratives contain 'little of the real thing [i.e. science]', and suggest that *Dune* is a good example of this particular category (ibid). However, in disparaging this category, these critics rely on the same assumption mentioned above, conflating the 'real thing' with lack of scientific explanation in the text itself. Later, therefore, they argue that whilst '[e]cology permeates the whole fabric of Frank Herbert's *Dune,* […] a reader might not be able to state a single ecological principle upon completing the book's 510 pages' (ibid, p. 49). If the text does exemplify principles of ecology, it seems fair to consider *Dune* as an attempt to represent the 'real thing'. The assumption that science fiction needs to explain its underlying scientific principles is a pernicious one, which undermines attempts by sf writers to connect their works with scientific concepts and ideas. As McConnell asks 'does it make a difference whether the [science] is more or less explicitly described *in* the story?' (2009, p. 49). Many have argued not. As the most prolific category sees sf using science as a background context, instead of viewing sf as explaining or imitating science, it might be more productive to argue that instead 'science [often] functions as an important "authority source" for science fiction' (Hendrix 2009, p. 39).

Lambourne et al argue that science is 'of relatively little use' to soft sf and thus focus all their attention on hard sf (1990, p. 37). Other critics, however, argue against the positions put forward by such critics. Westfahl finds the position that scientific ideas can only be found in hard sf as 'objectionable', since soft sf authors, like Ursula Le Guin, can 'bring to their writing a background in anthropology' which informs their alien societies (2005, p. 189). Indeed, canonical soft sf texts, like Wells's (2005 [1896]) *The Island of Doctor Moreau*, can convincingly engage in dialogue with contemporaneous scientific contexts (see: Glendening's 2002 discussion of Darwinism). Narratologists have also shown how a particular scientific concept can be incorporated in works of sf, ranging from hard writers, like Greg Bear, to soft writers, like Ursula Le Guin (Ryan 2011). Many have argued convincingly that the distinction between hard and soft sf cannot be drawn along the lines of hard sf's engagement with science and soft sf's lack thereof. Further distinctions between hard and soft sf have also undermined the putative connection between solely hard sf and science. Stableford, for example,

suggests that many critics have understood the terms hard and soft sf 'to mean science fiction based on the hard (physical) sciences rather than the soft (human) sciences' (2014, p. 227) (see also: Westfahl 2005, Prucher 2007). Following this definition, those texts defined as hard sf rely on scientific enquiry from fields such as physics, chemistry and biology, whereas texts informed by the 'soft' sciences, like psychology, anthropology and earth science, are considered soft sf. Both hard and soft sf texts alike can be considered to be drawing on scientific contexts, but the sphere of scientific endeavour is slightly different. Again, this distinction is contentious, as soft 'New Wave' sf has long been associated with the concept of entropy, derived from 'hard' physical sciences (see: Greenland 1983, Gunn 2002).

For soft sf critics, sf has a close relationship with science, but this does not necessarily amount to unwavering fidelity to scientific methods and concepts. For Kress, soft sf tends to '"focus[] on pragmatic, concrete examples rather than abstract theorising"' (quoted in Vint 2009, p. 419). Unlike hard sf, soft sf is not considered to be practicing or imitating science. Science often acts as a context for imaginative exploration in soft sf, since the genre 'rehearse[s] the implications of [scientific] advances [and] [i]t does this by centring its ethical debate not on the statistics and probabilities that rightly belong to scientific theory, but on individual [characters]' (Kress 2007, p. 207). Csicsery-Ronay, who lists sf's relationship to science as one of the 'seven beauties' of the genre, suggests that 'the scientific content of sf, even though generally based on the scientifically plausible knowledge of its day, is always fabulous' (2011, p. 6). These soft sf critics neither deny the importance of 'science' as an informing context in sf texts, nor ignore the 'fiction' element of the genre's title. Indeed, the interaction between 'science' and 'fiction' is two-way and, despite the positioning of hard sf critics about predicative extrapolation and fidelity, all 'science fiction is fiction, no more and no less' (McConnell 2009, p. 48). Overall, proponents of soft sf have argued against divisions between hard and soft sf along the lines of scientific engagement, suggesting that 'the best science fiction writers […] pursue ideas intellectually and aesthetically' (Miller 2002, p. 80).

Relating this back to animal character analyses, this thesis's engagement with animal studies also justifies a focus on the influence of scientific contexts on animal representation. Animal studies scholars, therefore, often see animal characters, like their real-world counterparts, as 'transdisciplinary objects' of investigation, where 'the scientific study of animals […] does not stand apart from but rather participates in wider cultural contexts' (Herman 2018, p. 143). Examples of reading animal characters in light of scientific ideas has been touched upon above (see section 1.1). This includes Bernaerts et al's (2014) analysis of Kafka's mole character in 'The Burrow' (2005), whose characterisation replicates the innate behaviour patterns, in this case burrowing, theorised by Lorenz and Tinbergen.[14] In addition, Herman's (2013) research into representations of animal minds in narrative links certain representation strategies in Woolf's (2009 [1933]) *Flush* to ethological/biological theorising of animal minds, in particular Uexküll's (2010) concept of *Umwelt*. Similarly, Nerlich et al (2001) have explored how science fiction has created a number of pertinent metaphors around the issue of genetic engineering, which seem to have influenced media and popular scientific representations of Dolly the Sheep. More broadly, Caracciolo (2015) suggests that nonhuman characters can embody shifts in perspective that trace developments in physics, chemistry, and biology, estranging readers from their everyday world.

Proponents of the transdisciplinary positioning of animal characters can also be found in literary criticism – including sf criticism (see section 1.2, point 7) – as well as narratology and stylistics. The strongest advocate for such an approach is Calkins (see also: McHugh 2011, Haraway 1989, Cole 2016, Enenkel & Smith 2007). Calkins has argued that 'the examination of the animal "other" as a true embodied character is rare' and that science can help to 'provide information […] to analyse the textual embodiments of animal others' (2010, pp. 32-34). She suggests, if animal characters are of critical interest to the stylistician (and critic), they should ground their analyses in scientific theories and concepts related to animal beings. Her analysis of the whale character in *Moby Dick*, for example, draws on contemporary research on sperm whale social groupings, foraging behaviour and sensori-motor

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[14] Lorenz outlines these fixed patterns, known as Innate Releasing Mechanisms, as an 'instinctive action' which is a 'species-characteristic drive' towards a particular 'motor activity […] regarded as a chain of reflexes' (1981, p. 153). For example, a dogs' instinctive chasing behaviour or the mating dance performed by particular bird species.

abilities to show that, despite being flat, the whale is 'a match for Ahab as a primary character in the novel' (ibid, p. 46). Narratologists, stylisticians and literary critics have shown how 'including science in our framework[s] for thinking about animal others opens our experiential, and textual, horizons' (Calkins 2010, p. 34). Overall, a scientific contextualist approach makes sense given that these animal characters appear in the sf genre and the positioning of this thesis within animal studies.

1.5 Reading Science Fiction within Scientific Contexts: An Example

Drawing on Ryan's (2011) article, this section will outline the ways that sf narrative draws on a scientific context – in this case, 'The Schrödinger's Cat Paradox' – elucidating the scientific contexts' influence at the level of organisation, plot, characters and characterisation. Ryan's study thereby offers 'a test case for the study of the relations between narrative and science' (2011, p. 171). The Schrödinger's cat paradox is a thought experiment in which a cat is locked in a box with a contraption that has a fifty percent chance of killing her/him. Running through the various interpretations of the cat paradox, including the Copenhagen interpretation and the many-worlds interpretation, Ryan attempts to trace the 'development of the parable from science to fiction' (ibid). Based on narrative criteria, she suggests that the paradox is transformed into a story through four main strategies, which include:

(1) turning the cat into a character;

(2) turning the performance of the experiment into an event;

(3) creating suspense by making the outcome uncertain; […]

(4) using the story as a pretext for reflections on the problem of knowledge (ibid, p. 177-8).

In Le Guin's (1990 [1974]) 'Schrödinger's Cat', we see how this plays out. A cat character (point 1) outsmarts the human observer by disappearing from the experimental box (points 2 & 3). The human character then slowly realises that she herself is inside the box, 'which means [that] there is no privileged position outside the box' (point 4) (Ryan 2011, p. 179). The above list delineates the pressures that stories, including science fiction, exert on science's engagements with narrative, including the need for defined characters, a plot, and tellability.

However, these strategies listed above (points 1-4) are not used to analyse the other science fictional examples on which Ryan draws. Instead, what she highlights in the analysis are the subtle ways that scientific contexts might engage with constituent elements of narrative, particularly structure, time, character and plot. In terms of characters and characterisation, Le Guin's text features a cat character whose gravity defying movement highlights the 'incompatibility of quantum theory with Einstein's general relativity' (ibid, p. 178). It also features a dog-scientist, Rover, whose direct speech foregrounds how unstable reality is following the paradox's logic – '"Certainty. All I want is certainty"' (quoted in ibid). Wilson's (1988) text features a scientist character who expounds the Copenhagen interpretation of the paradox.[15] In both Wilson's and Pohl's (1986) narratives, characters lack 'stable properties', have 'no long term goals' and 'no meaningful interaction with other characters' (Ryan 2011, p. 183). This, Ryan suggests, is because quantum mechanics places serious doubts on concepts such as continuity, causality and chronological order.

Ryan's article highlights the various ways that scientific contexts might feature in sf texts: they might incorporate scientist characters who expound certain scientific perspectives; they might draw on the changed realities precipitated by 'new' scientific discoveries; they might engage with science at the level of narrative structure, time or plotting; or they might engage with science through their characters or characterisation strategies. My primary focus, as mentioned above, is how scientific contexts influence animal characters and characterisation, and Ryan's article offers compelling groundwork for such an approach. However, before moving on to my analyses, which focus on behaviourism (section 3), entropy (section 4) and Gaia theory (section 5) respectively, I outline the methods and frameworks I will be employing in this research.

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[15] The Copenhagen interpretation of the paradox states that 'the cat exists in a superposition of states until the door is opened, and it is the act of observation that makes the wave function collapse' (Ryan 2011, p. 175).

2 Methods

As outlined earlier (see section 1.1), narratologists and stylisticians have been successful in extending the concept of character to animals, and highlighting the narrative strategies employed to present animal characters. However, this theoretical and analytic work has only just begun. Largely, the narratological work conducted so far has focused on how the characterisation techniques of homodiegetic narration, focalisation and direct speech have opened up space for animal perspectives to be foregrounded in literature. Whilst these have been invaluable, and, where appropriate, will be drawn on during the analyses conducted in this thesis, there are methods developed by stylisticians that offer similarly thorough attempts to capture other aspects of characterisation. In particular, I noted above that flat characters predominate in sf, meaning that a focus on those aspects mentioned above will be only partially useful in this thesis's approach to animal characters. Indeed, as Culpeper notes, 'gaining knowledge of a character's inner life is an important factor in characterisation, and one likely to lead to a "rounder" impression of character', but this strategy is not necessarily the one favoured by sf narratives (2001, p. 170).

The framework chosen for my analyses is Culpeper's (2001) cognitive stylistic model. Briefly, Culpeper's model suggests that both cognition (mental processes) and language (textual cues) are employed when readers form impressions of character. In relation to mental processes, Culpeper notes that reader's draw on their knowledge of personal (interests, traits, etc), social (relationships, etc) and group membership schema (nationality, etc), when encountering characters in texts. Schemata represent knowledge stored in the mind which is 'structured into organisational units [and accounts for] stereotypical situations and experiences' that can be brought to bear on character impressions (Vaeßen & Lothmann 2014, p. 3). These represent the top-down building blocks of character. The bottom-up, or textual cue, elements of Culpeper's framework fall into explicit, implicit (action, etc) and authorial (character's name, etc) characterisation cues. These represent those textual elements that help form impressions of a particular character – these categories are outlined more fully below.

Not only is Culpeper's approach frequently employed by stylisticians (see: McIntyre 2015a, p. 152), suggesting its utility, it is also to date the most comprehensive characterisation framework. Similarly comprehensive frameworks have recently emerged (Eder 2010, Eder et al 2010), but, as these tend to focus on multimodal media, such approaches were not deemed suitable for this study. Of the other frameworks that exist, some were rejected for similar reasons to those mentioned above. Many approaches focus solely on character traits, taking a heavily psychologised view of character inappropriate for animal character analyses (Abbott 2002, Chatman 1978, Rimmon-Kenan 2002, Margolin 2007). Culpeper's model though attempts to account for flat characters as well as round. This is down to the fact that it is a 'mixed approach' which represents 'a reconciliation of a text-based view of character and a humanising view of one-to-one correspondence between character and real [beings]' (Umar 2015). According to Culpeper, the top-down schema elements of his model account best for flat characters, whilst the bottom-up textual cues account for round characters (2001, p. 94).

In earlier sections (section 1.3), I outlined how I would be approaching animal characters not merely mimetically (bottom-up), but also thematically/symptomatically (top-down), and that contextualist – i.e. scientific contextualist – readings needed to be anchored in close textual analyses (Phelan 1989, Eder 2010). To this end, Bousfield notes that the top-down elements of Culpeper's model rely on socio-cultural 'view[s] of certain "prototypical" types of person, animal, or other entity in the world at large', linking these elements of the model to contextual readings of characters (2014, p. 131). In later research, Culpeper and Fernandez-Quintanilla note that 'schemata are both culturally and ideologically embedded' (2017, p. 103). Busse has similarly noted that analysts taking a cognitive stylistic approach 'should not sidestep the important role of political, social and cultural background of the story' (2011, p. 176). Culpeper's characterisation framework has been used by some researchers to engage in socio-cognitive analyses, a perspective some argue is sorely needed (see: Hartner 2017). Balossi, for example, employs Culpeper's framework when analysing characters along gendered dimensions, arguing that its top-down elements are 'chiefly influenced by the social schema of gender dichotomy as it can be inferred from the social categories prevalent at the time of the novel, shaped by

cultural and historical context' (2014, p. 107). Similarly, Montoro's research on flat female characters employs a socio-cognitive approach (and Culpeper's framework) to highlight that 'cappuccino' fiction is 'packed with character types and relationships which fit into conventional social schemata […], […] social institutions […], and ideologies' (2007, pp. 100-101). Balossi (2014) and Montoro (2007) show how Culpeper's framework has been drawn upon for contextualised analyses of character. Culpeper's framework, therefore, can accommodate integrated approaches to character and characterisation, and will be useful for exploring animal characters in this thesis.

As well as using Culpeper's model, this thesis will be combining this approach with corpus stylistic approaches. Recently, there has been a burgeoning of research utilising corpus approaches to character analysis and characterisation (Culpeper 2001, Hubbard 2002, Hori 2004, Archer & McIntyre 2010, Bednarek 2011, McIntyre 2011, Mahlberg 2012, Balossi 2014, Mahlberg & Stockwell 2015, Ruano 2016, Mastropierro 2018, Ruano 2018). As will be outlined (see section 2.2), all these studies highlight that 'a key aspect of corpus [stylistics] […] is that corpus methods and descriptive tools can help to identify textual features that contribute to the creation of a reader's sense of character' (Mahlberg & Stockwell 2015, p. 131). A large number of these studies have productively combined corpus stylistic approaches with cognitive stylistic ones, often drawing on Culpeper's model. In fact, Culpeper's model has a section on keywords analysis, which explores characters in Shakespeare's corpus of plays, and argues that characterisation research employing a corpus approach can 'help reveal what the salient lexical features of a particular character are' (2001, p.183).[16] Mastropierro has similarly suggested that 'the role of formal patterning in the process of characterisation is in line with a cognitive stylistic understanding of the phenomenon', as 'bottom-up textual information […], together with prior knowledge, shape the impression of character in the reader's mind' (2018, p. 20). There is clear overlap between corpus stylistic and cognitive linguistic approaches to characters and characterisation, in that

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[16] Keywords are words that occur significantly more or less frequently in the target (or 'node') corpus compared with a reference corpus. Keywords are calculated by 'comparing the corpus list of words to the list of words of a reference corpus and comparing the frequency of each word in each corpus statistically' (Shepherd & Sardinha 2013, p. 79). Many stylisticians have argued that keywords can be used to explore literary themes (Mastropiero 2018, Fischer-Starcke 2009), but many subsequent studies, discussed in this section, have proven that they are useful for revealing characterising information.

'features on the textual surface […] play an important role in both approaches' (Mahlberg 2012, p. 36). Along with many other stylisticians, I have combined these approaches to character, identifying 'specific features in a literary text or corpus of several texts […] by corpus linguistic methods and then integrat[ing] [these findings] into a more holistic and experiential frame by drawing on cognitive poetic work' (Mahlberg and Stockwell 2015, p. 131). The corpus methods outlined will therefore be used to supplement Culpeper's (2001) characterisation model.

Though the corpus stylistic method is rigorous and useful for justifying particular points of analytic focus, it is hard to justify using this method in isolation for character and, more broadly, stylistic analysis. McIntyre has argued convincingly, for example, that corpus stylistic approaches need to be 'integrated' with other stylistic methods. The reason for this is that corpus methods alone gives only 'partial analyses', which 'fail to engage sufficiently at a functional level for meaningful interpretations of the data' (2015b, p. 62). Similarly, Ho has suggested corpus stylistics should not be considered 'a purely quantitative study of literature', but rather 'a qualitative stylistic approach to the study of language and literature, combined with or supported by corpus-based quantitative methods' (2012, p. 10). Even proponents of extremely corpus-driven approaches rightly argue that 'a corpus stylistic study has to find a useful trade-off between general quantitative information and finding ways of selecting examples that can serve as a basis for more detailed textual analysis' (Mahlberg 2012, p. 61). What all of these authors highlight is the reciprocal relationship between 'corpus' and 'stylistic' approaches, with stylistics neither resistant to the quantitative impulse in corpus research, nor corpus subordinating the qualitative impulses in stylistic research. Following these researchers' positions, I therefore align the approach taken here with corpus-based rather than corpus-driven approaches.[17]

The first section will outline Culpeper's characterisation model, elaborating on the elements of this approach. These elements will then be reworked in light of this thesis's focus on animal characters. This was deemed necessary as none of the past frameworks listed above have focused on animal

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[17] Ho (2012) delineates all potential corpus stylistic approaches, including corpus assisted, corpus-based and corpus driven.

characters, using human characters as the sole point of reference. Culpeper's categories are therefore amended or added to in order to highlight areas of focus that relate more specifically to animal characters. In the second section, a variety of corpus stylistic approaches to characterisation are outlined and evaluated. No specific amendments to these frequently utilised methods was considered necessary. Instead, this section outlines specifics relating to node corpora and subcorpora preparation (comprising the sf texts chosen for my study), reference corpus selection and preparation, and the software chosen for such analysis. These methods will variously be employed to supplement Culpeper's characterisation model.

2.1 Culpeper's Characterisation Model

Culpeper's approach relies on both bottom-up (textual cues) and top-down (schema theory) analysis of literary character. The top-down approach in Culpeper's model draws on schema theory, which is defined as 'bundles of background knowledge about the world that are stored in […] long-term memories', which readers use 'to shape […] impressions of characters' (McIntyre 2015a, p. 152). To give an example, a reader's schema for 'cat' might include information about its physical characteristics (fur, four legs, tail, paws), its higher-level characteristics (mammal, meat-eating, warm-blooded, live young), its behavioural dispositions (head butting, purring, grooming, sleeping), its abilities (agility, night vision), its personality (aloof, vicious, lazy, loving), and its potential relationship to humans (pet, stray, wild). Culpeper and Fernandez-Quintanilla (2017), therefore, note 'schema-based characters are usually the prototypical, unremarkable and forgettable characters of fictional worlds […] [with] such characters […] be[ing] described as "flat"' (p. 104). The connection made between the 'top-down' elements of Culpeper's model and flat characterisation, as mentioned above, will be particularly useful in exploring animal characters in sf.

Turning to the specifics of Culpeper's model (2001), he outlines that character schemata can be grouped into various types, including *social role, group membership* and *personal.* These groupings contain the following information about represented characters:

Social role	kinship roles, occupational roles, relational roles
Group membership	gender, race, class, age, nationality, religion
Personal	preferences, interests, traits, goals, abilities

Table 1: Social schemata of characters

These categories need to be reworked slightly in relation to animal characters. In terms of *social roles*, animal characters might fulfil *kinship roles*, particularly if considered as beloved companion animals (or pets), as in the chimpanzee/child character, Peony, in Miller's (2016 [1962]) 'Conditionally Human'. Occupational roles can also be filled by animal characters also, like the proletariat Underpeople in Smith's (1975-79) *Instrumentality* series, but also in more traditional roles where animals appear as 'beasts of burden'. *Relational roles* might include, similar to those mentioned above, the various configurations of human-animal relationships, spanning from proximal to distal relationships, from 'pets' (Blood in Ellison's (2014) *Vic and Blood*), to 'meat' (the Wub in Dick's (1999 [1952]) 'Beyond Lies the Wub'), to 'wild' (Painter in Crowley's (2000 [1976]) *Beasts*). This category could also be expanded to consider the kind of ecological interactions between different species, like symbiosis, predation and parasitism, like the above outline of Mitchison's (1985) *Memoirs of a Spacewoman* (see section 1.2). If animal societies are depicted, the relationships between members of those societies could be considered, as is, for example, ant social organisation in Olsen's (1934) 'Peril Among the Drivers'.

Group membership categories could prove useful for analysis if the animal character is heavily anthropomorphised. If not, categories such as 'age' and 'sex' (instead of 'gender') might be the most applicable for animal characters. The most obvious expansion for animal characterisation would be to include the category 'species' or 'species-type' – if the character is an animal alien – in this group.[18] For example, the Houyhnhnms in *Gulliver's Travels* (Swift 2005 [1726]) comfortably fit into the category 'horse'. However, this category can be stretched for animal alien characters. The hoxneys in Aldiss's

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[18] I use 'species-type' here in the way 'type' is referred to in biology. Hence, the 'biological type of a taxon is simply the specimen [...] that serves as the referential tie for that particular taxon' (Clark 1999, p. 124). A type, therefore, helps define the features of that particular group, but certain members of that group might be considered more 'typical'.

(2010) *Helliconia* trilogy are grass-eating quadrupeds, who turn translucent and hibernate in winter. Further still from the 'horse' category might be the hippae characters in Tepper's (1989) *Grass*. The hippae are referred to as horses and ridden by the human characters, but their physical description reveals a resemblance to dinosaur-like creatures. Animal characters might also be categorised by the 'ecological niche' that they fulfil, such as scavengers, predators, and herbivores. The wolvog – a portmanteau of wolves and dogs – characters in Atwood's (2013 [2009]) *Oryx and Crake*, for example, are likely to be considered 'predators', setting up expectations about their behaviours.

The *personal* categories can be applied to animal characters, especially when using the base type character prototype proposed by Eder, Jannidis & Schneider (2010), where characters are considered to have mental states and a body. Unless animal characters feature as homodiegetic narrators and focalisers, it might be more suitable when referring to animal characters to consider these categories as 'behavioural traits'. Otherwise, recent research around the area of animal personality in comparative psychology suggests that 'preferences' and 'traits' could justifiably be applied to animal characters, though such applications might be considered inherently anthropomorphic.[19] Culpeper notes that *personal* descriptions of characters tended to take the form of adjectives, similar to the descriptions used in animal personality studies mentioned below. The category 'abilities' might be expanded to consider those that human characters lack, like the whale character's spatial-navigational abilities in Watson's (1975) *The Jonah Kit*. The final addition I would include is an *animal body* category, which accounts for those elements of animal physiology that are associated with a particular species. The reader, therefore, draws on their schematic knowledge of 'cats', inferring particular physical traits, such as 'tail', 'fur', 'four legs' and 'paws'.

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[19] Landmark works in this field include the Emotions Profile Index (EPI), which was used to profile the character of individual dolphins, baboons and chimpanzees, and included categories such as: adventurous, affectionate, brooding, cautious, gloomy, impulsive, obedient, quarrelsome, resentful, self-conscious, shy and sociable (Whitman & Washburn 2017). Though the EPI offered a 'standardised, cross-species method for personality research', it was considered highly anthropomorphic and has been surpassed by later developments, including the Madingly Questionnaire (MQ) (ibid, p. 10). The MQ consisted of scales for confident to fearful, active to slow, and sociable to solitary (ibid, p. 11). Synthesised with factor analysis methods that predominated in human personality tests, the MQ also standardized 'individual animals' scores relative to population means for each component' measured, allowing researchers to identify those individuals who deviated from the norms of their species (ibid). In recent years, the types of animal subjects undergoing such testing has increased, and now includes fish, birds, spiders, and lizards.

These schema-based impressions of animal characters can be extremely influential. In an article exploring animal characters in graphic novels, Keen suggests that

Readers […] know perfectly well where to place the fox, tiger, and the shark, just as we recognize the traditional vulnerability of their prey. These associations are [however] subject to cultural variation […]. Animal stereotypes are also subject to revision by the interventions of scientific narratives, as when hyenas get rehabilitated as hunters rather than scavengers […].The traditional schemas relating human types or groups to corresponding animal types may also be revised, resisted, or placed under comic inversion, as in Bruce the shark in *Finding Nemo* (2003), who tries to break his fish-eating habit through a 12-step program […]. Nonetheless, even these resistant uses of anthropomorphized animal figures rely upon widely disseminated and automatically recognized schemas: sharks must be voracious killers […][.] Thus any anthropomorphized representation of an animal either tacitly accepts or works against cultural pre-sets (2011, pp.137-138).

The schema or top-down element of Culpeper's framework is matched also by 'bottom-up' elements, where Culpeper outlines textual cues for characterisation. These cues are broken down into three categories, which include:

Explicit cues	self-presentation, other-presentation
Implicit cues	conversational structure, conversational maxims and implicature, lexis, syntactic structure, accent and dialect, verse and prose, paralinguistic features, visual features and appearance, context (character's company and setting)
Authorial cues	proper names, stage directions

Table 2: Textual cues for characterisation

Explicit cues are where characters present information about themselves or other characters. *Self-presentation* occurs 'when a character or person provides explicit information about him or herself' (Culpeper 2001, p. 167). This category is particularly relevant, if, as outlined in the research above (see section 1.1), the animal character is a narrator or focaliser. *Other-presentation*, on the other hand, is

where a focalised character characterises another in the text. Explicit characterisation cues gleamed through other-presentation need to be considered cautiously, however, as judgments about other characters can be coloured by the focalised character's own ideology and perspective. Culpeper suggests that one way to mitigate this bias is to verify whether the description of the target character(s) remains consistent across a number of descriptions. If 'high consensus' is reached, then it can be argued that such descriptions express something of the nature of the target character. Other-presentation can be extremely prolific. Indeed, the reader might 'form an impression of character entirely on the basis of other-presentation' (Culpeper 2001, p. 171). From this thesis's perspective, other-presentation is an important category to consider as the animal characters in these sf texts are often flat and externally presented.

Implicit cues focus on a variety of areas, but these were largely developed with a focus on dialogue between characters in Shakespeare's plays. Its categories highlight that a predominant strain in stylistic analyses of characters is speech presentation. Semino argues, for example, that 'the presentation of characters' words [...] has received a great deal of attention within stylistics and narratology' (2004, p. 428). Some of these categories, like *conversational structure* and *implicature*, will only be useful if the animal characters speak – a number of which do so in this thesis – and might be useful in outlining relations of power between animal characters and, where appropriate, human characters. *Lexis* and *syntactic structure*, related specifically to dialogue in Culpeper's model, can be used to think about the manner in which animal characters speak, informing character analysis. As mentioned above, the dog, cat and rabbit characters in Morrison and Quitely's *We3* (2014) speak in broken syntax and simplistic vocabulary. But, lexis and syntax categories can relate more broadly to characterisation strategies than merely the dialogue that animal characters might speak. For example, the use of imperatives in Baker's (2017 [1967]) *The Peregrine* attempt to capture the bird's mind style (Herman 2018, pp. 208-210). *Accent and dialect* might only appear relevant if animal characters are heavily anthropomorphised, but might more productively be thought of in terms of 'manner of speech', as mentioned above for lexis and syntax related to characters' speech.

Verse and prose, useful for Shakespearean texts, could be broadened to consider the way that animal characters draw on different 'registers' in speech. For example, Blood, the dog character in *Vic and Blood* (Ellison 2014), employs an ironic formal register when speaking to his human companion, and *Doctor Rat*'s (Kotzwinkle 2014 [1971]) eponymous narrator's use of a scientific register is highly satirical. Similarly, Höing shows how Snitter's, the terrier character in Adams's (2015 [1977]) *Plague Dogs*, use of rhyme is a symptom of mental trauma (2017, p. 10). *Paralinguistic features* include various vocal characteristics, such as pitch and tempo. These features might be productively extended for animal characters via a 'vocalisations' category, covering descriptions such as 'grunt', 'bark', 'purr', 'growl', 'bellow' and 'screech'. Such vocalisations can be loaded with characterising information regarding an animal character's affect or state.

Visual features and *appearance* in Culpeper's model include categories such as *facial expressions*, *stature*, *clothing*, and *posture*. Mahlberg notes that Culpeper's discussion of physical characteristics is brief given his generic focus, but she gives visual features far greater attention, focusing specifically on characters' body language (2012, pp. 100-126). Culpeper's categories have an anthropocentric bias, but Rimmon-Kenan's (2002) characterisation framework, upon which Culpeper's model is built, is broader and includes all elements of 'external appearance'. It will, therefore, be the definition used for this thesis. As Caracciolo (2016) notes *appearance* is an important category for animal characters as 'the animal body [...] is a material, living reminder of [the human-animal] divide[,] [which] [...] can be considered incomprehensible, alien, abject, immoral' and yet, is frequently foregrounded in literary narratives, often 'inviting forms of somatic and emotional empathy' (p. 144). Culpeper's categories again are useful if animal characters are heavily anthropomorphised. For example, as mentioned above, *Pride of Baghdad* (Vaughan & Henrichon 2006) employs human facial expressions to convey the lion characters' emotions. In many character studies, external appearance is often linked to specific character traits, a point often noted in characterisation research as associated with the practice of physiognomy. Physical descriptions of animal characters can also lead to

assumptions regarding character traits. Compare, for example, the appearance of these two dog characters:

A.

Here comes a bloodhound, hot on the scent. His big nose travels on the ground, and he keeps shaking his head, unable to detect exactly where the smell is. […] His big ears droop along, almost touching the ground and his short legs carry him slowly forward, until he sees us (Kotwinkle 2014 [1971], p 30).

B.

[H]e was an Alsatian, perhaps with a dash of Great Dane or Mastiff, for he was a huge beast. His general build was wolf-like. […] His grey eyes might have been wolf's eyes, had not the pupil's been round like any dog's, not slits like the wolfs. [He] […] kept his cold eyes fixed on mine (Stapledon 2011 [1944], p. 4).

In example A, the bloodhound's physical appearance – big nose, shaking head, big ears, short legs – highlight a physiology that is out of touch with (what should be) the dog's natural acuity. The bloodhound's physical description suggests traits such as 'domesticated', 'soft', even 'clumsy'. This is in stark contrast to the description of Sirius, the eponymous dog character, in example B, whose physical description – wolf-like body, cold eyes – suggest traits such as 'wild' and 'indifferent'. But, reading physical descriptions as standing in metonymic relation to character traits highlights a mimetic bias to character analyses (see: Rimmon-Kenan 2002, p. 67). Some analysts argue that appearance features need not necessarily be attached to traits. Eder et al (2010), in contrast, suggest that characterisation via visual features can solely be a means of attaching 'certain specific physical markers' to characters (p. 31). Even if analysts read visual features as physical markers and avoid assigning traits, this does not mean that these descriptions do not communicate meaning. Indeed, the visual features in example A can be read productively as engaging with thematic (the domination of animals in human society) and symptomatic (the domesticated/heavily modified animal body) readings of the bloodhound character.

The final category in Culpeper's implicit cues category is *context,* which highlights the *company* a character keeps, i.e. 'which character, or characters, appear with another character', and the *setting*

within which the character is depicted. In relation to *company*, Culpeper suggests that interactions between characters might enhance or supress 'the reader's *perception* of similarities or oppositions' between characters (2001, p. 228). Animal characters might be depicted as interacting with animals of their own species or species-type or different species (most notably, of course, human characters). Animal characters within intra-species *company* might be presented in similar ways, reinforcing a schematic depiction, like the elephant-like herds of *fithp* in Niven and Pournelle's (1986) *Footfall*, or more individualised. Inter-species *company* might depict animal characters as being similar to other species. For example, the daemon characters in Pullman's (2003) *His Dark Materials* trilogy are an extension of their companion human characters' traits and values. Conversely, animal characters might offer counterpoints to characters they frequently appear alongside, like the contrast between the fearsome and rabid horse-like hippae who hunt and exterminate the intelligent and peaceful foxen characters in Tepper's (1989) *Grass*.

Setting can also be an important aspect of characterisation. Culpeper argues that 'it is [...] possible, assuming an absence of constraint, for a person or character to choose their surroundings, both physical and human' (2001, p. 226). Of course, this might not be the case with animal characters. For example, the rat-like alien narrator in Le Guin's (1990 [1971]) 'Mazes' does not have the opportunity, as an experimental object, to choose her surroundings, but such a setting functions to draw a laboratory rat schema to the foreground, a schema that the text heavily undermines. More broadly, if an animal character is represented in largely human environments, it is likely that the animal character is heavily anthropomorphised. If not, a more naturalistic representation strategy is likely being employed. Rimmon-Kenan sees the characterising effects of 'environment', similarly to that of 'external appearance', as standing in metonymic relationship to a character's traits (2002, pp. 68-69). Depictions of animal characters frequently labelled as 'vermin' might be depicted as 'disgusting' given the 'dirty' environments within which they are depicted, as in the rat narrator in Zaniewski's (1994) *Rat*. Skinner, however, argues that character and setting should be considered 'beyond subtle evocations of

moods', like examples of pathetic fallacy, as connections between character and setting 'involve the way readers evaluate a character's status, potential, and tendencies' (2003, p. 43).

An *implicit cue* characterisation strategy that is not included in Culpeper's framework is that of a character's *action*. As he notes in later work, 'character behaviours have greater significance' in fictional work and 'interaction between characters might be described as a discourse embedded within that of the discourse between author and reader' (Culpeper & Fernandez-Quintanilla 2017, p. 97). Rimmon-Kenan's (2002) framework for characterisation gives equal weight to 'action' (pp. 63-65) and 'speech' (pp. 65-67), and Margolin (1986), similarly, devotes an article to the way action can be used to convey characterising information. Indeed, Margolin suggests, whilst 'character and character-traits are not *primary*' in narrative as 'there can be [...] universes which do not lead to significant mental traits or portraits' of characters, action is fundamental (ibid, p. 206 – original emphasis). A focus on characters' actions is therefore pertinent for analyses of characters in sf narratives as they are likely to undergo the subordination discussed above (see section 1.3 & 1.4) and often lack internal presentation.

For Margolin, actions that provide characterising information need to be considered in terms of matter (what is being done) and manner (how is it being done), and can 'serve as signifieds with respect to the textual verbal structure and signifiers with regard to the characteristics' of characters (ibid, p. 208). In relation to matter, if anthropomorphised animal characters may be depicted performing actions that are unusual for the species. For example, the dog characters in Bakis's (1997) *The Lives of the Monster Dogs* engage with human cultures frequently attending the opera, whereas the dog-like alien character in Gloss's (2003 [2002]) 'Lambing Season', despite arriving on Earth in an operated craft, performs convincingly dog-like actions (McGuirk 2008). Animal characters' actions might also be stereotypically associated with a particular 'species' or 'ecological niche', specifically verbs of movement: insects 'scuttle', worms 'writhe', predators 'prowl', prey 'evade' and 'hide'. Rimmon-Kenan (2002) suggests that character actions can be categorised as 'non-routine', emphasising the dynamic aspect of the character, or 'habitual', elucidating the static aspects of characters (p. 63). An example of non-routine action would include the depiction of Napoleon walking upright at the end

of Orwell's (2008 [1945]) *Animal Farm*. This is not necessarily tied to the anthropomorphic nature of the action, but is instead tied to Napoleon's unexpected flouting of the rules – 'four legs good, two legs bad' – signifying that the pigs now assume the role of (exploitative) 'human'. Contrastively, the mole character in Kafka's (2005) *The Burrow* is depicted continually burrowing, driven by instinct (see: Bernaerts et al 2014).

Recent developments in stylistics research have expanded the *action* category further. Culpeper outlines a number of studies employing inter-character interactions as part of character analysis (Culpeper & Fernandez-Quintanilla 2017, pp. 114-117). Such character analyses are underpinned by post-structural views of identity that see identity as emergent and constructed through social behaviour (see: Bolander & Locher 2015, pp. 102-103). Mills's (2014) research, for example, argues that characterisation research has been skewed towards 'individual characters, particularly in relation to the [...] actions they take', and instead focuses on 'relations between characters and the patterns of actions between characters' (pp. 559-560). This framework can be expanded to explore how the identities of animal characters are constructed through interactions with other characters. For example, the patterns of interaction between owl and human characters in Rowling's (2000 [1997]) *Harry Potter* suggest that they fall into the category of 'human commodities' (Goatly 2004, p. 122). Similarly, the contrasting identities of human and cockroach, explored through the latter's 'disgusting' actions, are presented in comedic and hyperbolic fashion in Elton's (2006 [1989]) *Stark* (Nahajec 2014, pp. 125-127).

Authorial cues are the last of the textual cues that inform characterisation. These include *proper names* for the characters in the text. As McIntyre claims, names 'can convey significant characterisation information' (2015a, p. 155). If animal characters are named, then they are likely to be presented as round characters, whereas those that are referred to by species name are likely to be considered flat characters. The dolphin-like alien in Scott's (1986 [1977]) *Passing for Human,* Benaroya, does not have a name that conveys such information, and is likely to be read as a more individualised animal character. However, in Simak's (2011 [1952]) *City*, the names of the rabbit-like animal characters, lopers, is

evocative of the species-type on which the animal alien character is based. A character's naming strategies can also be used to create extratextual allusions. For example, the dog character, D'joan, in Smith's (1975-1979) *Instrumentality* series alludes to Joan of Arc, foreshadowing not only the manner of her death but her depiction as a martyr. The final category, *stage directions,* has been expanded by analysts to include reporting clauses used by heterodiegetic narrators in prose fiction, as these clauses can be used to 'derive characters' feelings, behaviour or attitudes' (Balossi 2014, p. 31). In certain cases, the reporting clauses used for animal characters' speech might reflect their animal nature, as is the case with the feline-like characters, the *Hrrubans*, in McCaffrey's (1989 [1969]) *Decision at Doona*, whose speech is often described as a kind of 'growling'.

Overall, the proposed expansions to Culpeper's framework that attempt to account for animal characters, include the following:

	Expansions and considerations for animal characters	
Social role	- kinship roles - occupational roles - relational roles	- companion animals - working animals - human animal relationships[20] (e.g.'pets', 'meat', 'wild') & ecological interactions (e.g. symbiosis, parasitism, etc)
Group membership	- gender - race - class - age - nationality - religion - add: 'species' or 'species-type' - add: 'ecological niche'	- instead 'sex' - ⌉ - ⎸ - ⊢ if anthropomorphised - ⎸ - ⌋ - the former to be used for animal characters that align closely to particular group; the latter if the category aligns partially with group - e.g. predator, scavenger, etc
Personal	- preferences - interests - traits - goals - abilities - add: 'animal body'	- ⌉ - ⎸ if anthropomorphised, but if not - ⎸ 'behavioural traits' - ⌋ - animal capabilities (e.g. echolocation) - physical traits (e.g. fur, paws, four legs, etc)

Table 3: Social schemata of animal characters

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[20] I have listed only a few examples here, but following Korthals these relational roles might include: 'farm animals', 'pets', 'captive animals' (zoos and circuses), 'semi-wild animals' (conservation areas), 'wild animals', 'experimental animals' and 'pharmacological animals' (2016, p. 76). As Korthals states, 'each of these practices has its own […] standards for interactions with animals' (ibid).

Expansions and considerations for animal characters		
Explicit cues	- self-presentation - other-presentation	- - } none needed
Implicit cues	- conversational structure & implicature	- if anthropomorphised, with specific focus on power dynamics between human and animal characters or within animal societies
	- lexis - syntactic structure	- } - } if anthropomorphised, with specific focus on 'manner of speech' or animal 'mind style'
	- accent and dialect	- if anthropomorphised, with specific focus on 'manner of speech'
	- verse and prose	- if anthropomorphised, with specific focus on 'register'
	- paralinguistic features - add: 'vocalisations'	- if anthropomorphised - e.g. bark, growl, whimper, etc
	- visual features & appearance	- if anthropomorphised, but if not specific focus on animal body

	- context
	  - company
	  - setting
		
		- intra-species & inter-species identities
		- if anthropomorphised, likely human settings, with specific focus on setting & cultural associations (e.g. 'vermin' and 'unclean setting'), but if not likely natural environments

	- add: 'action'	- if anthropomorphised, likely human actions (dressing, speaking, reading, etc), but if not species-typical actions, with specific focus on verbs of movement (e.g. scuttle, prowl, etc)
Authorial cues	- proper names	- if individualised, but if not 'species' or 'species-type' name
	- stage directions	- instead 'reporting clauses': if anthropomorphised, with specific focus on animal sound descriptions (e.g. bleated)

Table 4: Textual cues for animal characterisation

Such expansions should allow this thesis to explore the characterisation strategies used for representing animal characters and, it is hoped, will be useful for future scholars wishing to analyse animal characters not only in sf, but also in other literary genres.

2.2 Characterisation and Corpus Approaches

As mentioned above, there have been numerous studies that explore characterisation through corpus approaches, many of which have productively engaged with cognitive stylistic approaches. Bednarek (2011) follows Culpeper's cognitive stylistic approach, combining it with keywords and n-gram analysis,

to explore character identity through fictional dialogue in television dramas.[21] Balossi (2014) draws on semantic domains and PoS (part-of-speech) categories to analyse presentations of characters' minds in Woolf's *The Waves*.[22] In a similar vein, Archer and McIntyre (2010) explore instances of direct speech in order to outline a fictional character's unusual mind style, drawing on sematic domain and keywords analysis. A common method with these studies is to create separate sub-corpora of specific characters' dialogue or FID, and then subjecting each sub-corpus to statistical analyses. For example, Archer and McIntyre's procedure involved 'creating a master electronic version of the […] text […][,] creat[ing] separate files for each individual character's speech [and] then upload[ing] to Wmatrix and tagg[ing] for parts-of-speech and semantic domains' (ibid, p. 171). Taking a slightly different method, Hori (2004) explores the collocations found in individual characters' speech patterns and general descriptions of those same characters. His methods are descriptive, employing raw frequencies, rather than statistically significant collocates, yet his study convincingly outlines the characterisation strategies employed for particular characters.

Mahlberg (2012), similarly drawing on Dickens's fiction, has used n-gram analysis to explore the representation of fictional characters, developing a taxonomy of clusters, which are then drawn upon to analyse particular characters or groups of characters. She focuses specifically on characters' speech (pp. 75-99), body language (pp. 100-126) and *as if* n-grams (pp. 128-151) used by the narrator to draw 'the readers' attention to features of the fictional characters' (ibid, p. 128). In a similar vein, Mahlberg and McIntyre (2011) show how keywords can be used to identify lexical items important for characterisation in Fleming's (2012 [1953]) *Casino Royale*. Unlike the previous studies, which tend to focus on a specific character's subcorpus, these studies begin by exploring statistically significant n-grams or keywords and focus on those that relate specifically to various aspects of character

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[21] N-grams are repeated multi-word clusters that are repeatedly used throughout a text, with statistical significance measured in the same way as for keywords.

[22] Key semantic domains are calculated in a similar way to both keywords and n-grams, however, whilst keywords and n-grams rely on exact repetition of the specific item or cluster, semantic domains group various lexical items together with similar meanings. This is achieved through Rayson's (2009) Wmatrix corpus tool and USAS tag set. The strength of using this method is that 'semantic categories can group lower frequency words which might not appear as keywords individually and could thus be overlooked' (Culpeper & Demmen 2015, p. 101). Semantic domain analysis has been used for character analysis in a number of corpus stylistic studies.

presentation. Hubbard (2002) focuses on characters' speech presentation comparing a number of features – various types of conjunction and features associated with 'involvement' in Biber's MDA approach. His analysis confirms that literary critical analyses positing specific traits of characters, Elinor ('sense') and Marianne ('sensibility'), can be traced partly to these linguistic features in Austen's novel. Hubbard's approach is different from those mentioned above, instead beginning with a hypothesis about fictional characters' traits and finding linguistic evidence to support such readings. He acknowledges, however, that 'many of the specific differences between the sisters can be linked to the more explicit authorial and non-authorial character cues throughout the text' (ibid, p. 83). Indeed, as he outlines earlier in the article, such differences can be elucidated by Culpeper's model, and will, of course, still bear a textual footprint.

More recently, Mahlberg and Stockwell (2015) explore the character, Mr Dick, in Dickens's *David Copperfield* via the CLiC software – this corpus tool has a reference corpus of 19th century texts, annotated for traditional corpus tag sets and salient literary features. Their study of character employs the corpus method of concordancing, arguing that

> [o]ne of the most basic methods in corpus linguistics is the study of concordance lines. With the help of a concordance, patterns and meanings of words can be described (e.g. Sinclair, 2004). This method is also useful to gather character information. As for the study of word meanings, the patterns that the narrator uses to describe characters make individual characters distinguishable from others. […] The cumulative evidence provided by concordance lines is an illustration of the text-driven nature of [this kind of] approach to characterisation (ibid, pp. 136-137).

The authors explore a cognitive stylistic topic – a character's mind model – through a corpus stylistic approach. As they argue, such an approach, though basic by corpus stylistic standards, allows the authors to explore those elements of characterisation that align with Culpeper's textual cues model (ibid, p. 134). Specifically, the stylistic patterns that can be analysed through such an approach include: character's direct descriptions of physical appearance, the presentation of character's speech and

thought, the reactions of other characters to the target character, and their social relationships. They argue that though a concordancing approach might appear to use the corpus software merely as a 'powerful search engine', it can, according to 'the disciplinary standards of corpus stylistics', be 'used [...] to uncover patterns across the text' (ibid, p. 146). This method they argue represents an integrative approach to corpus stylistics, an idea similarly proposed by McIntyre (2015b).

The diversity of these studies highlights that there seems to be no single corpus method that accounts solely for relevant and foregrounded characterising information. For some stylisticians, the starting point is the characters' discourse (speech and/or thought) itself with the subsequently constructed subcorpora allowing for in-depth character analysis (Archer & McIntyre 2010, Balossi 2014, Bednarek 2011, Hori 2004). These studies are largely corpus-based. One of the key differences between the characters focused on in this thesis and those in the above studies, other than being a different species, is that only some of the animal characters speak, and even when they do, it is often only a few utterances. For example, the newts in *War with the Newts* (Čapek 2010 [1937]) have the ability to speak, but this is only reported intermittently, even if they are individualised: Andrew Scheuchzer's direct speech totals a mere 398 tokens (0.5% of the corpus) and the salamander at the circus 28 tokens (0.03%). Such speech may form a significant part of the animal characters' representation, however, and for certain characters – Andrew Scheuchzer, the circus newt – a separate subcorpus was created. The overriding focus on character speech in these past studies, although particularly relevant for certain genres like drama, would be methodologically restrictive in relation to this thesis and is necessarily used sparingly.

In other studies, the stylistician, beginning from a corpus-driven perspective, focuses only on those features that appear to be statistically significant, but, unsurprisingly given the importance of literary character in narrative fiction, also reveals characterising information (Mahlberg 2012, Mahlberg & McIntyre 2011). Such studies highlight that keywords and semantic domains themselves might be a useful starting point for character analysis, emphasising how 'frequency information functions as evidence for arguments about theme, style and characterization' (Green 2017, p 284). In most of these

studies a corpus software tool is used. For this research, AntConc is used for statistics related to keywords (Anthony 2019) and Wmatrix (Rayson 2009) is the tool used for semantic tagging statistics – both employ loglikelihood (LL) scores. These scores are measures 'of the certainty that one can have that [the] resulting keywords or semantic domains are not occurring due to chance', and the generally agreed upon cut-off point for statistical significance (> LL15.13) is adhered to (Potts 2016).

There are, however, some potential problems with keyword and semantic domain approaches to fictional character analyses. Culpeper (2002), for example, outlines three important potential limiting factors for keywords. First, lexical items are not easily lemmatised due to accuracy issues with lemmatization software. This means that all instances of an item are not necessarily grouped together, because the keyword software is unable to count the inflected forms of an item. Hence, the verb 'go' might be listed separately from its past (*went*), progressive (*going*) and participle (*gone*) forms. Second, keywords analysis accounts only for 'statistical deviation from a relative norm' rather than measuring deviation from 'absolute norms' (ibid, p. 28). Third, keywords analysis does not account for instances of hapax legomena – one-off occurrences of a particular word – as there are cut-off points for minimum frequencies required for an item to be considered a 'keyword'. Hapax legomena, however, can be interesting from a stylistic perspective, revealing the author's 'vocabulary usage habits', and their exclusion marks a limitation of keyword studies (Jockers 2014, p. 72).

Semantic domain analysis relies on statistical significance, similar to keywords, but such significance tests are based on how the software has tagged, and subsequently grouped, lexical items belonging to the same semantic category together. As such, it relies on the tagging system's (USAS in *Wmatrix*) accuracy, but USAS has an accuracy of around 91% – almost every one in ten words is likely to be classified incorrectly. Although, there is potential to reclassify incorrectly tagged lexical items, it is a laborious task even for smaller corpus-based or corpus-driven studies, and almost impossible for larger ones. Another potential issue with USAS semantic domains is that the 'process is less suited to providing insights into textual and interpersonal categories' (Collins 2015, p. 98). Essentially, this means that certain linguistic features, particularly grammatical, will not be highlighted for consideration if

USAS is used in isolation. This represents a limitation as stylisticians have shown how grammatical items can convey significant characterising information (see: Balossi 2014).

In yet other studies, stylisticians have focused not on an individual characters' discourse (speech and thought), but employed corpus software to explore the concordance patterns frequently presented with the character's depiction (Mahlberg & Stockwell 2015, Hori 2004 [pp. 179-183], Mahlberg 2012 [pp. 128-151], Mastropierro 2018 [pp. 146-149]). Some analysts, such as Sinclair, argue that the evidence concordances offer are 'superior to any other method' (1991, p. 42). Concordancing software thus enables the analyst to 'organise [their] concordance [...] chronologically to look at all instances of [the character's] name in the text' (Giovanelli & Mason 2018, p. 104). Concordance lines then are not only useful in searching for characterisation patterns, but can also be helpful in tracking a character's depiction throughout the text. The analysts can thereby note details such as when the character is introduced, points in the narrative structure where they come to the foreground, or when particular descriptions become part of a character's depiction. Concordances can either be analysed qualitatively (but no less systematically) by the analyst, or quantitatively, with the analyst drawing on statistically significant collocational patterns – indeed, all the above studies mix both these approaches.[23]

A few issues when taking this approach are worth considering. The first issue is that concordancing software and collocational analyses work with a defined span. For collocational measures, this is a span of 5 words to the left or right of the node word, i.e. a character's name. This leads to questions as to whether this span can effectively capture the majority of the characterising information given about a particular character. The second issue is that characters might not always be presented using their name. It is likely that characters will be referred to using pronominal references (*I, she, he, they, it*) throughout the text, meaning that searching for concordances and identifying

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[23] Toolan defines collocations as 'the lexical company a word tends to keep' (2009, p. 18). Collocates are therefore a 'word (or words) which co-occur with a node [word] in a corpus' (Ho 2012, p. 20). In the above research, the 'node' word is defined as a character's name. With collocational analysis, only those words within a particular span of the 'node' word are measured for statistical significance, typically a 5-word span to the left and right of the node.

collocates using the character's name as a node word may not capture all instances of that character's appearances in the text.[24]

Despite such limitations, however, these approaches have proved useful in other studies and are therefore also utilised in this study. I have chosen to use the LancsBox 3.0 (Brezina et al 2015) and AntConc (Anthony 2019) software for such approaches. The node word being investigated will be the characters' names. This method is useful for the reasons listed above, but also, in specific relation to this thesis, because the characters in many of my node corpora are largely externally presented. Indeed, in all of the above studies where this method is employed, the texts present the analysed characters externally. Whilst concordancing approaches are more qualitative, collocational analysis is quantitative, meaning that an appropriate statistical significance test needs to be chosen. Unlike semantic domains, PoS and keywords analysis, which use log-likelihood statistics, collocational analysis offers a wider array of choices. I have decided to use Log Ratio (LR), a collocation measure that is 'very similar to mutual information' (Hardie 2014). The minimum frequency threshold was lowered to 2, and the default cut-off point raised to 4.0. With LR scores, 'every extra point [above 0] [...] represents a doubling in size of a collocate's frequency near the node and its frequency elsewhere' (ibid). A LR score above 4.0, therefore, means the collocate is 16 times more common near the node word, in this case the character's name, than elsewhere in the corpus. To avoid claims of data 'massage', this statistic, threshold and cut-off point is kept consistent throughout the following sections (see: Baker 2006 p. 179).

In order to allow analysis using corpus software, it was necessary to create an electronic format for all the core texts used in this research. Following the procedure outlined by Archer and McIntyre

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[24] For this reason, I have chosen to amend some pronominal and other lexical references for particular characters that form focal points of my analyses, specifically the ants in 'Remote Control' (Kately 1930). This was decided with these characters because there were limited references to them in the text and such amendments would allow the use concordancing and collocational methods. In making such amendments, this procedure was followed: (1) Identification of named reference to target character; (2) Verification that subsequent pronominal reference or naming strategy was outside collocational span; (3) Amendment of subsequent references to characters generic name, with original pronoun preserved in angled (< >) brackets. Step two was considered necessary as amending pronominal references within the span of a named reference, or previously amended pronominal reference, might lead to the inflation of certain lexical items being highlighted as collocates.

(2010), I therefore sourced electronic formats of the core texts and converted them into a plain text format (.txt). These texts were either sourced commercially or online via electronic archives – the pulp sf texts, including Kately's (1930) 'Remote Control' and Platt's (1966) 'The Rodent Laboratory', were sourced in this manner. The files were cleaned and the output of this procedure are the files listed below (table 5). These files comprise the 'node' corpora from which the statistical analyses of collocations and concordance examples given in the subsequent chapters are drawn. As mentioned above, for some of the animal characters – the newt characters in *War with the Newts* (Čapek 2010 [1937]) – I created separate sub-corpora using their direct speech which were extracted from the node corpus warwiththenewts.txt.

Behaviourism	Entropy	Gaia
remotecontrol.txt	thewub.txt	dramaofyan.txt
warwiththenewts.txt	drownedworld.txt	helliconia.txt
animalfarm.txt	rodentlaboratory.txt	

Table 5: Plain text files of the node corpora

In order to include statistical analyses of keywords and sematic domains, a suitable reference corpus needed to be created. The texts comprising the reference corpus were chosen for their similarity to my core texts: all are science fiction featuring animal or animal-like characters. In this regard, I follow Archer and McIntyre (2010) again, positing that 'the closer the reference corpus to the target corpus in terms of content, the more likely it is that the key items generated will reveal issues specific to the target text/s' (2010, p. 173). Compiling a reference corpus containing texts of the same genre, similar content and date range to my node corpora means that the keywords and semantic domains highlighted as statistically significant should not be related to generic or historic differences. It also means that the reference corpus, despite not being large, can provide reliable results and used efficiently with the desktop corpus tools available for this analysis. This approach is also endorsed by corpus linguists. Scott (2009), for example, has suggested 'the content of the reference corpus is more crucial than the size, where only one register or text-type is under investigation' (Culpeper & Demmen

2015, p. 97). Similarly, Xiao and McEnery note that 'the size of the reference corpus is not very important in making a keyword list' (2005, p. 70).

The compiled reference corpus contains a mixture of science fictional short stories, novellas and novels. A variety of text types and authors were chosen to ensure a good level of representativeness. Following Herring (n.d.), the procedure for the selection of the texts used in the reference corpus was as follows:

(1) Identification of material.

(2) Validation text had been published.

(3) Locating the text.

(4) Verification that text contained animal or animal-like characters.

(5) Converting text to .txt format.

(6) Cleaning the text, removing information such as prefaces, chapter titles and page numbers.

As with my node corpora, many of pulp sf texts, the short stories, were only available via online archives, in this particular case: Project Gutenberg. The novellas and novels chosen, however, were sourced commercially. The table below (table 6) details all the texts selected for the reference corpus and the overall size of the corpus. As Mastropierro has stated, 'the choice of which reference corpus to use is a fundamental methodological decision', and I have therefore tried to construct a reference corpus that will help elucidate the distinctive aspects of the node corpora analysed (2018, p. 88). Overall, the utility of these corpus-assisted methods cannot be understated, especially when analysing the longer texts (novellas and novels) that comprise the majority of my node corpora. They have frequently proved invaluable for character analyses and are therefore used to supplement Culpeper's (2001) characterisation model in this thesis's approach.

Reference Corpus	
'All Cats are Grey' (1953) Andre Norton	'The Ballard of Lost C'mell' (1962) Cordwainer Smith
'Alpha Ralpha Boulevard' (1961) Cordwainer Smith	'The Carnivore' (1953) Katherine MacLean
Beasts (1976) John Crowley	'The Dead Lady of Clown Town' (1964) Cordwainer Smith
'Cat and Mouse' (1959) Ralph Williams	'The Empire of the Ants' (1905) H G Wells

'Conditionally Human' (1952) Walter Miller Jr	'The Evolutions of Trickster Stories among the Dogs of North Park' (2007) Kij Johnson
Doctor Rat (1971) William Kotzwinkle	*The Family Tree* (1979) Sheri Tepper
'Mother Hitton's Littul Kittons' (1961) Cordwainer Smith	'The Flight of the Horse' (1969) Larry Niven
'Project Mastodon' (1955) Clifford D Simak	'The Game of Rat and Dragon' (1955) Cordwainer Smith
'Second Dawn' (1951) Arthur C Clarke	*The Island of Doctor Moreau* (1896) H G Wells
Sirius (1944) Olaf Stapledon	'The Men in the Walls' (1963) William Tenn
'The Ape Cycle' (1930) Clare Winger Harris	'Under Old Earth' (1966) Cordwainer Smith
Reference Corpus Total Size: 609010 tokens	

Table 6: Reference corpus texts

3 Animal Characters in the Contexts of Behaviourism

3.1 What is Behaviourism?

Behaviourism viewed psychology as a branch of natural sciences, whose evidence should be drawn from observations in controlled experiments (Smith 1996). It rejected 'mentalistic' approaches to psychology, arguing that any references to 'mind' and 'subjectivity' were unscientific, as they could not be objectively proved. As the behaviourist saw it, 'no one [can] observe a mind, urge, impulse, or personality; they are all inferred from behaviour. A person who behaves aggressively [...] is said to have an aggressive personality', but '[n]o one will ever see the personality; one sees the behaviour' (Baum 1994, p. 32). Emotions, when they were considered as part of the behaviourist's rubric, were those that could be 'reduced to a sort of visceral sensation' (Moore & Oaksford 2002, p. 2). Watson stated, for example, that animals are born with just three basic emotions, including fear, anger and love. Affects, along with mental phenomena such as thoughts and perceptions, were also never seen as the driving force behind an individual's behaviour. This is because behaviourism rejected internal causes of behaviour, instead focusing on environmental ones.

Behavioural scientists' focus on environmental conditioning meant it is heavily deterministic, frequently arguing that animals (and people) do not 'have freedom to choose their actions' (Baum 1994, p. 11). Unlike other deterministic approaches, however, behaviourists' downplaying of genetic inheritance and instinctual behaviour led to a research paradigm that prioritised controlled laboratory experimentation over the observation of animals' behaviour in natural environments. Watson's infamous statement makes the behaviourist position on environmental conditioning and determinism clear: '"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll [...] take any one at random and train him to become any type of specialist"' (Watson 1926b, p. 10). Behaviourism was often applied as a theory of learning, with behaviour being viewed as 'acquired and fluid rather than innate and fixed' (Smith 1996, p. 414).

Behaviourism's most notable proponents were J B Watson and B F Skinner. Whilst there are some distinctions between Watson and Skinner's behaviourism – Watson's is often referred to as

classical and Skinner's as *radical* – both believed that '[t]erms like "mind," "will," and "thought" are often simply synonyms of "behaviour"' and that psychology ought to be considered a natural science (Skinner 1978, p. 100). Watson's behaviourism, however, was more focused on physiological reflexes, a concern he inherited from his Russian predecessor Ivan Pavlov – indeed the terms 'stimulus' and 'response' were borrowed from physiology (Leary 2004). To give one example, he suggested that thought could be considered 'sub-vocalised speech movements in the laryngeal muscles' (Smith 1996, p. 413). The distinguishing feature of Watson's approach to behaviour was that he considered behaviour 'as actual movements of the body: legs and arms, glands, specific muscles' (Shiraev 2011, p. 264). In *Psychology as the Behaviourist Views it,* he focuses on the physiology of nerve cells and musculatory responses to stimuli, and argues that 'the conditioned motor reflex could be applied to animals […] and thus form the building block of behaviour' (Fuchs & Milar 2003, p. 16). Despite his expertise in physiology, Watson 'included no illustration of brain mechanisms' in his work, as he posited 'that a nervous system was not necessary for intelligent behaviour and […] attributing behaviour to the brain was only a distraction' (Malone 2017, p. 3). Early behaviourist research was often disparagingly labelled 'muscle-twitch psychology'.

Whereas Watson focused on conditioned reflexes, Skinner focused on operant behaviour and conducted animal learning experiments.[25] These laboratory experiments took place in elaborate contraptions, such as Skinner's operant conditioning chamber, but also Thorndike's puzzle box, Tolman's maze and Mowrer and Miller's shuttle box. Skinner, and most other behaviourists, almost exclusively used animals in their psychological experiments as generic 'models' of behaviour, arguing that the findings of their experiments could be applied to the conditioning of humans' and other species' behaviours. Skinner states for example:

> Pigeon, rat, monkey, which is which? It doesn't matter. Of course, these species have
>
> behavioural repertoires which are as different as their anatomies. But once you have allowed

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[25] Skinner argued that operant behaviours are those behaviours that, unlike reflex behaviours, showed the animal to be 'operating' on their environment. Operant behaviour is freely emitted by animal subjects and is a voluntary behaviour. When an organism is emitting operant behaviours it 'act[s], function[s], and produce[s] effects on [itself] and the environment' (Watson & Tharp 2014, p. 132).

for differences in the ways in which […] they act upon their environment, what remains of their

behaviour shows astonishingly similar properties (1957, p. 374).

Although most strongly associate behaviourism with certain animal species, particularly the laboratory

rat and the pigeon, the range of animal subjects employed in behaviourist experiments was broad. For

example, Thorndike worked with cats, frogs, and chickens, Yerkes with apes, Parker, Shelford and

Severin with fish, Pavlov with dogs, Watson with monkeys, Bingham with birds, Liddell with sheep, and

Coburn with pigs (Frolov 2007, p. 11).

A controlled environment allowed behaviourists to explore the conditioned responses of

animals in a replicable manner, freed from extraneous factors. The majority of these experiments were

extremely simple, and were geared towards noting the frequency with which a particular stimulus

would elicit a specific response. For example, a rat would be placed inside a box with a lever, and every

time it pressed the lever it would be rewarded with a food pellet. Stimulus and response was the

cornerstone of the behaviourist methodology often leading researchers 'to ignore many interesting

phenomena about animals' natural way of life' and offering only the simplest mechanistic explanation

of their behaviour (Kalat 2011, p. 211). Animal research in psychology, pioneered by behaviourists,

therefore 'learned a great deal about how primates, dogs, cats, pigs, pigeons, and rodents behave in

highly artificial (and often stressful) situations' (Giannelli 1986, p. 112). Behaviourism's focus on man-

made and controlled environments is a frequent criticism levelled against its methodology:

behaviourism, it is asserted, merely 'domesticat[ed] white rats in order to make them suitable to a

particular testing paradigm', rather than 'invent[ing] paradigms that fit "real" animals' (de Waal 2016,

p. 55).

Stimuli in such experiments might include a light or a particular noise and the response would

be the desired behavioural response. Animals, however, were frequently 'motivated' to perform

desired behaviours through either fear, hunger, or physical constraint. Many tended to undergo

conditioning in a state of starvation or be subject to aversive stimuli, like electric shock, during the

experiments. In behaviourist nomenclature, food and other rewards are known as 'reinforcers', whilst

electric shocks are known as 'punishers'. Whilst these elements constituted the basics of behaviourist experiments, further elements included ideas such as shaping and chaining. Behaviourist experiments often had to 'shape' the animal for experimental purposes, where the animal is moulded to the experimental parameters. The process of shaping usually occurred along such lines:

> First, the experimenter reinforces responses that are close to the final, desired response. Thus, the experimenter may first reinforce standing close to the bar. After the rat is doing this reliably, the experimenter changes the criterion for reinforcement. Now standing close to the bar is no longer sufficient for gaining reinforcement. The experimenter now only reinforces standing close to the bar and making a paw movement in the direction of the bar. The experimenter can repeatedly raise the criteria for reinforcement in these successive approximations until the final, target behavior is performed (O'Donohue & Ferguson 2001, p. 97).

Chaining was also an experimental technique employed by some in which a sequence of behaviours were chained together. For example, one experiment involving a rat taught the rat to move to the centre of its cage, sit up on its hind legs, pull string attached to a flag pole (raising a flag), and salute when it heard a particular stimulus (American national anthem), after which the food reinforcer was given (Kalat 2011). The processes of shaping and chaining, whilst perhaps elucidating some of the simplistic processes by which animals can learn sometimes elaborate behaviours, highlight how 'unnatural' the behaviour elicited by such experimental procedures was.

Whilst 'behaviour' as outlined above has been largely tied to physical movements, it was also explored by Watson and Skinner in relation to language, or 'verbal behaviour', as they referred to it. Watson sees language development, like Skinner, as 'acquir[ing] the appropriate language behaviors (or 'habits') through repetition and reinforcement' (Mackey 2006, p. 434). Through such a description of language acquisition it is easy to see basic behaviourist tenets, as a 'habit is a stimulus-response connection' (Ellis 2010, p. 31). Watson's view of verbal behaviour was more tied to the manipulation of physiological structures than Skinner's. Despite this, Watsons's behaviourist tenets heavily influenced Bloomfield's *Language*, which argued that 'language enables one person to make a reaction (R) when

another person has the stimulus' (1933, p. 23). Skinner's attempt to outline verbal behaviour, *Verbal Behaviour* (Skinner 1957), argued that 'learners imitated models of correct language (i.e. stimuli)' and formalised categories that were considered important for behaviourist approaches to language usage (Ellis 2010, p. 31). The verbal operants that Skinner defined were 'intraverbals', interactions between mands (questions) and tacts (answers), a category in which the speaker's utterances are controlled by others' verbal behaviour, and 'echoics', where the speaker repeats what has been heard. As Lyons points out, behaviourist examples of verbal behaviour worked in only 'highly ritualised exchanges' where 'the notion of stimulus-control ha[d] [some] kind of prima facie plausibility', but despite this linguistics was briefly influenced by behaviourism (1977, p. 133).

For Watson and Skinner, the behaviourist didn't merely study behaviour for descriptive purposes, they also ought to apply such knowledge to control subjects' behaviours. As Smith has outlined, behavioural conditioning and control became a kind of social technology that engendered a 'new conception of academic research and the value of its contribution to social reform' (1996, p. 418). Behaviourist methods of behaviour modification were particularly put to use in animal training. As in the laboratory, animal training involves 'the trainer shap[ing] the animal to perform more complex behaviours' through positive reinforcement (Kalat 2011, p. 219). Enquist and Ghirlanda argue that animal training 'based mainly on knowledge gained during the behaviourist era' sustained large organisations such as 'Animal Behaviour Enterprises', which trained '15,000 animals of 140 different species […] for purposes ranging from military applications to entertainment', set up by Skinner's former students Keller and Breland (2005, p. 159). Skinner's techniques, therefore, were implemented widely with animals in zoos and circuses, who were largely trained using operant conditioning (see: McGreevy & McLean 2010, p. 56).

3.2 Behaviourism as a Context in Science Fiction

Analyses which draw on behaviourism as scientific context in science fiction are extremely limited. This is strange, as prominent examples of sf that overtly engage with behaviourist concepts exist. Some critics have drawn on behaviourism to explore representations of other intelligences and free will in sf,

including computers and robots, such as Warrick (1980). She argues that Asimov's sf texts tend to present nonhuman minds that resist the mechanistic-physical view in which 'intelligent activities can be completely explained in terms of the physical properties of the neuronal mechanism in the body' (ibid, p. 75). Contrastingly, Andersen (2009) has noted that Vonnegut's (1985) *Galapagos* depicts an image of animal minds that is entirely in line with, and fostered by, the behaviourist view. Before future evolutionary trajectories, the human characters in the text exhibit free will, but animal characters, even the sea-lion-like species that humans evolve into, do not. The exploration of behaviourism in these studies focuses solely around issues of determinism and free will, arguing that behaviourism can foster depictions of animal characters that lack agency and intelligence.

Some authors and researchers have instead explored the implications of behaviourist theories and concepts in relation to broader, often human, society. Skinner, himself, famously published an sf novel, *Walden Two* (2005 [1948]), which 'envisages a modern utopia of health, friendship and balance brought about by the interventions of behaviourist science' (Yar 2014, p. 31). From an opposing perspective, presenting dystopian rather than utopian societies, the influence of behaviourism can be tangibly felt in Orwell's (1999 [1949]) *1984* and Huxley's (2007 [1932]) *Brave New World*, which outline how controlling individuals' behaviour either through propaganda or chemical intervention could re-engineer society. Packer's research (2015) explores how behaviourism is manifested in sf films. For example, she explores behavioural conditioning ('the Ludovico technique') in Kubrick's *A Clockwork Orange*. The human character's visceral 're-programming' does raise ethical considerations regarding the methods employed by behavioural scientists to 'condition' their animal subjects through aversive stimuli. Depictions of dystopic societies in which subjects are heavily controlled and manipulated by governments (or a ruling elite) are perhaps the most prevalent behaviourist-inspired tropes to be found in sf. Indeed, Orwell's and Huxley's texts are often listed as examples of societal behavioural conditioning in many introductory textbooks on behaviourism (Baum 1994, Staddon 2014, Krapfl & Vargas 1977).

Hard sf authors have also engaged with behaviourism, with the titles of their short stories overtly signalling a behaviourist influence. These include: Robinson's (1981 [1950]) *The Maze*, Anderson's (1978 [1954]) *Question and Answer*, Bernstein's (1969) 'Stimulus-Response' and Purdom's (1977 [1972]) *The Barons of Behaviour*. Many hard sf texts highlight a particular trend in responses to behaviourism, where a 'human protagonist discover[s] that they are actually experimental subjects in glorified Skinner boxes' (Stableford 2014, p. 413). Some hard sf writers have, therefore, focused heavily on behaviourist experimental equipment, procedures and methodologies, whilst others have, like soft sf writers, explored behavioural conditioning on society.

Most of the aforementioned represent human characters in place of animals. However, Le Guin's 'Mazes' (1990 [1971]) is told from the perspective of an animal undergoing behaviourist experiments. The narrative features an alien animal who laments the human scientist's inability to understand its acts of communication. Running through the maze, the creature's kinaesthetic performance is ignored by the human scientist, who is merely focusing on the animal's route through the maze. The narrative highlights how sterile laboratory conditions to which animals are subject in behaviourist experiments 'produce conditions under which it is impossible for us to see their intelligence' (Vint 2010, p. 185). Tiptree's (1978 [1976]) 'The Psychologist Who Wouldn't Do Awful Things to Rats' is similar to Le Guin's text. It explores a scientist – Tilman, considered to be a reference to Edward Tolman (Elms 2004) – unable to 'discipline himself into thinking of the laboratory rats as objects' (Vint 2010, p. 205). Initially, Tilman fails to grasp that the research conducted in his experiments must directly benefit human, and not animal kind, and therefore repeatedly fails to win research grants. As the narrative progresses, it shows how he becomes encultured and desensitized to his rat subjects and trapped '"in a clockwork Cartesian world in which nothing will mean anything forever"' (quoted in ibid, p. 206). Both Le Guin and Tiptree write sympathetically of the experimental animals' experiences in behaviourist experiments in their sf.

3.3 Why Choose Behaviourism as a Context?

As mentioned in point six above (see: section 1.2), there have been many critics who have focused on animal characters in the context of biomedical laboratory culture, but few, if any, have considered behaviourists' experimental culture in relation to sf texts. For example, Elms (2004) notes that, despite being a current favourite of sf anthologists, scholars have paid little attention to Tiptree's experimental psychology background – her research work was heavily influenced by Tolman's theories. Elms's research represents one of the few studies that links a behavioural psychological context to readings of (Tiptree's) sf texts. Indeed, Tiptree argued vehemently that she wanted to show sf readers that 'bio-ethology or behavioral psychology […] could be exploited to enrich the sf field' (2000, p. 345). Whilst Elms also links this influence specifically to a preoccupation with animal characters in Sheldon's work, his focus is largely biographical. Sheldon is not incorrect in noticing sf (and sf criticism's) lack of engagement with behaviourism. The sf anthology, *Introductory Psychology Through Science Fiction*, represents an entire collection devoted to psychological theories in sf, but pays little attention to the behaviourist approach (Katz et al 1974). Similarly, *The Encyclopedia of Science Fiction* claims that 'the actual progress of experimental and physiological psychology has had very little impact on sf' (Stableford & Langford 2018), a claim that I aim to question throughout this chapter.

Previous sf scholars' lack of engagement with behaviourist contexts means they have fundamentally ignored the lived realities of the animals through which such knowledge was constituted. In certain cases, behaviourism's influence is largely historic. Some of the animal training practices on which Skinner's techniques were employed, like circus animal training, are practices now considered cruel and unethical. Although the circus industry is small-scale, the behaviourist training employed is 'very repetitive and […] [not] enriching' from the animal's perspective (Mills 2010, p. 106). Outside of the circus setting, behaviourist training techniques relying on positive reinforcement strategies are used but with a more humane approach. For example, contemporary animal training does not 'mold' the animal to tasks vastly outside the repertoire of that species. It also views 'behavioural control for the sake of domination or for the sake of objectives harmful […] or degrading' to the animal as

inconsistent with its underlying philosophy and motivation (Lindsay 2000, p. 390). Behaviourist practices in such instances have been brought up-to-date from an ethical perspective.

However, there are some instances where harmful behaviouristic applications, methods and perspectives have persisted. Though some uses predate Skinner, the weaponisation of animals seems to have been popularised with Skinner's research on project pigeon, an attempt by Skinner to develop pigeon-guided bombs (Skinner 1960). Indeed, some have claimed that like Descartes, whose views about animal life were derived from mechanical toys, behaviourism has facilitated an aggregation of animal life with technology (see: Smith 1990, Stam & Kalmanovitch 1998).[26] In a contemporary setting, animals used for military purposes are trained to detect various objects (mines) or substances (hazardous agents). Their bodies are therefore weaponised and expendable. The variety of species used for 'suicide missions' (i.e. where explosives are attached and detonated) has also diversified, and includes dolphins, beluga whales, dogs, and cats (Nocella et al 2014). This view of animals as organic devices has recently reached its zenith in the military development of 'cyborg' creatures and programmes that employ 'remote, haptic control of animals for combat duty' (Hamilton & Katz 2014, p. 116). Skinner's project pigeon, a collaboration between psychologists and the National Defence Research Committee, represented a damaging step towards the use of animals for military purposes, which is still widespread.

The mechanomorphic view of animal life fostered by behaviourism is similarly still influential in psychology with 'journals contain[ing] too many papers that treat animals as reacting devices and data generators rather than sentient and suffering beings' (Rowan 1984, p. 137). Behaviourism's methods, therefore, have had a lasting impact on contemporary behavioural scientists and experimental psychologists. In the UK alone around 43,000 rats are used in psychological experiments annually, and, of the overall total number of animals used (including mice, pigeons and other birds), 15% underwent 'severe deprivation protocols' and 10% surgical modification or electric shock conditioning (ibid, p.

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[26] Cf: Skinner (1960) discussing his choice of pigeons for the bomb-guiding system he was developing: 'we have used pigeons, not because the pigeon is an intelligent bird, but because it […] can be made into a machine, from all practical points of view' (p. 33).

138). Starved, surgically modified, and shocked, these practices, as mentioned above, were justified and systematized during the behaviourist era. Though 'ethical' review committees check animal research adheres to guidelines concerning housing and feeding, few address issues such as whether the research is unique (replication) or necessary (unimportant findings), scrutinize the number of animals used (sample size), or ask whether a less invasive procedure is possible (alternatives) (Kelly 1986, p. 178). Both Watson and Skinner's behaviourist approach has been adopted by experimental psychologists in the contemporary setting, and Skinner's box 'remains an important tool in animal psychology' (Mandal 2015, p. 6).

Finally, behaviourism's foundational perspective rejects autonomous subjects and upholds a 'black box' view of mind. The behaviourist position, although it purported not to be, was therefore a return to the Cartesian view of animal mind. Animals were thoughtless automata, largely due to behaviourism's disinterest in Darwinian theory which conversely stressed continuity between human and animal (see: Stam & Kalmanovitch 1998, p. 1139). Turning a blind eye to inheritance and instinct meant behaviourists tended to view animals 'as a clean slate, uninfluenced by predispositions to act and respond in certain ways' with the organism 'molded entirely by its environment' (Zumpe & Michael 2013, p. 4). However, deterministic and mechanistic explanations of behaviour have never really disappeared for animals. Jones, for example, claims that 'Watson's and Skinner's "black box" […] overwhelmed academic psychology' and to this day 'in animal research, behaviourism continue[s] to rule' with psychological processes very rarely considered to drive animal behaviour (Panksepp 2008, p. 51) (see also: Langley 1989, Boakes 1984). Even cognitive psychologists, who reject the 'black box' perspective, have been 'severely constrained' and argue that it is 'unscientific to inquire about subjective feelings and conscious thoughts' in animals' minds (Griffin 2001, p. 21). Behaviourism's mechanistic perspective remains not solely in psychology, but also ethology. Ethologists thus routinely 'try dutifully to fit all the new knowledge about animal behaviour into the same old pigeon-holes that seemed sufficient years ago to Pavlov and Watson' (ibid).

Overall, the contemporary use of animals within the militaristic setting and experimental psychology has received very little, if any, serious engagement by sf scholars. Similarly, the 'black box view' of mind pioneered by behaviourist psychology is only considered in relation to human characters. The lack of scholarship in these areas is problematic given that these behaviourist applications, methods and perspectives continue to exert an influence over real 'flesh-and-blood' animals' lives. In addition to choosing this scientific context because it is overlooked, I have therefore examined behaviourism due to its continued influence and 'culpability [...] in the creation and perpetuation of damaging conclusions about animals' (Calkins 2010, p. 34).

3.4 Core Texts

The core sf texts I will be considering in this section include Kateley's (1930) 'Remote Control', Čapek's (2010 [1937]) *War with the Newts* and Orwell's (2008 [1945]) *Animal Farm*. I was partly guided towards sf authors who have continued to be overlooked, such as Čapek (see section 1.2) and Kateley. On the whole, however, these texts were chosen because of their behaviourist influences and their prevalent use of animal characters, which, as yet, no sf scholars have considered in relation to these texts. 'Remote Control', for example, features a lead protagonist Kingston, who the narrator refers to as '"Watson"' (Kateley's 1930, p. 29). *War with the Newts* features many newt characters who have undergone behaviourist-style training, including animal characters depicted in institutions often associated with employing such techniques, like circuses. *Animal Farm*, like the other soft sf texts identified above, engages with the effects of behavioural conditioning on (animal) society. As I aim to elucidate, my analyses of the animal characters in these texts will provide further evidence for the relevance of a behaviourist context.

Although Kateley and Čapek's texts both sit comfortably in the sf genre, *Animal Farm* perhaps needs justification. First, *Animal Farm* (Orwell 2008 [1945]) is clearly dystopian. Although some argue that dystopian fiction and sf are separate and that 'dystopia becomes progressively more identified with science fiction in the twentieth century' (Claeys 2017, p. 290), many critics continue to regard dystopia as a subcategory of science fiction (Suvin 1979, Ketterer 1974). However, amongst those who

argue sf and dystopia are separate categories, it is agreed that when sf 'becomes *political* [...], it may overlap substantially with [...] dystopia' (Claeys 2017, p. 287). Here the text's reliance on science becomes crucial in the distinction between the two. But as discussed above (see: section 1.5), when soft sf draws on scientific contexts, these contexts are not always overtly signalled, something which Claeys admits makes distinctions between dystopian fiction and sf difficult (ibid). Similarly, as I have pointed out, past sf scholars have not previously connected Orwell's *Animal Farm* to a behaviourist context, and, this overlooked connection could account for its frequent incorporation within genres (fantasy, beast fable) other than sf.

Second, it cannot be denied that *Animal Farm* bears striking resemblances to Orwell's sf classic *Nineteen Eighty-Four* (1999 [1949]), a novel that is often associated with a behaviourist context. Gottlieb goes so far as to claim that *Nineteen Eighty-Four* 'is a perfect replica of *Animal Farm*' (1992, p. 53). Whilst she outlines the similarities of both in relation to the Stalinist regime's history, the vital similarity resides in the hegemonic nature of the 'propaganda machines' through which both populations in these texts are controlled, representing clear examples of behavioural engineering. Dystopic sf, like *Animal Farm*, thus often explores science and technology's 'negative impact on humanity [and] whether we use [it] as instruments of oppression and destruction' (Claeys 2017, p. 287). Overall, *Animal Farm*'s dystopic elements and similarity to Orwell's other canonical sf text present compelling arguments for its incorporation within sf.

3.5 Walter Kateley's (1930) 'Remote Control'

'Remote Control' follows an amateur scientist and engineer, Kingston, and an unnamed naturalist, the narrator, as they search to uncover a controlling mechanism for animal behaviour. Their discovery is made by observing a colony of ants on which the narrator by chance spills some buttermilk, which reveals the 'nerve system of the ant colony' (Kateley 1930, p. 28). The nerve system is depicted as connected to the ants by thin filaments. Some theorising about how the nerve system operates commences, with Kingston proposing that the 'amoeba'-like nerve system is 'the animal itself, possessed of brain power and intelligence; and that what we call ants are only multitudinous

appendages' (ibid, p. 29). Kingston suggests that if they can discover 'what the nerve energy is, and determine the wave length of its vibrations, [they] could apply the force to all animals', and that it 'could revolutionize all industry' (ibid). When the narrator next visits Kingston, years later, Kingston has applied the knowledge gained from their discovery and is able to remotely control animal behaviour. The story begins and concludes with depictions of animal characters being used for work purposes: whales and sharks are moving cargo; monkeys, gorillas, and elephants are unloading cargo; squirrels are typing letters.
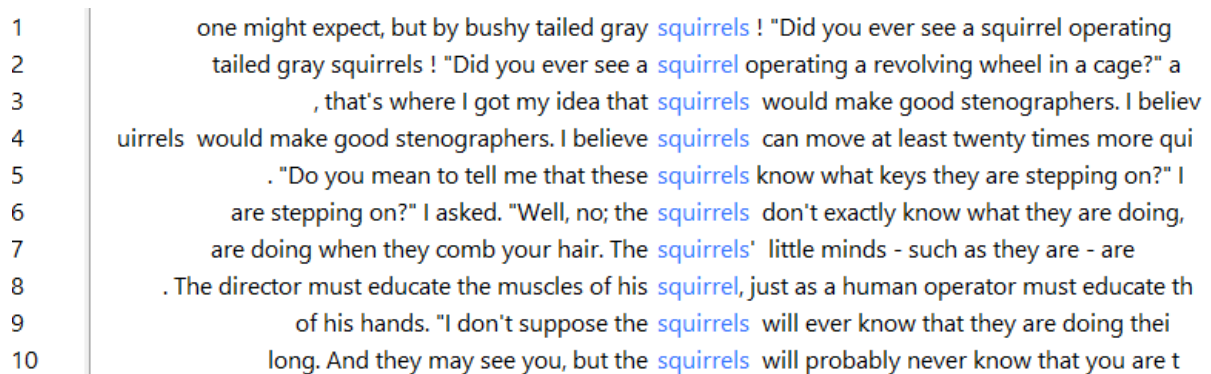
Kateley's 'Remote Control', therefore, features a variety of animal characters. Of these only squirrels (LL: 46.84) and ants - *ant* (LL 179.28) and *ants* (LL 141.40) – feature as keywords and will be given analytic focus. The squirrel characters are minor, flat characters, featured in the framing narrative at the beginning of the short story, but they can be seen as broadly representative of the other working animal characters presented in 'Remote Control'. The first part of my analysis will therefore focus on them. It argues that the characterisation of the squirrels challenges the standard 'relational role' schema for squirrels and aligns them more closely with rats, those animals most often used by behaviourists. The squirrels 'actions' being under haptic control of 'the Director' is also particularly behaviouristic, and depicts the squirrels as extensions of the machinery they are operating. Similarly, drawing on behaviourist influences, the squirrels are shown as having little in the way of mind. In the second part of my analysis, analysing the ants, I argue ant characters are initially presented as workers or performing specific functions, which aligns with the behaviourist's functional view of animal behaviour. They are also often characterised as experimental animals, from the context within which they are presented (a formicary) to Sarah's characterisation. After the discovery of the ant 'brain', Kateley's focus on the nerves that connect the ants seems particularly influenced by Watsonian behaviourism. This leads to schema refreshment for the ant characters, where they become merely 'appendages', encouraging reductive views of the ants' behaviours.

3.5.1 Squirrels

Although squirrels are not usually the subject of behaviourist experiments, like the majority of the animals that undergo behavioural conditioning, they are small rodents. As mentioned above, the variety of animal species used in behaviourist experiments was far broader than many realise, but rodents remain the prototypical behaviourist subject. At the beginning of 'Remote Control', there is an overt comparison made between squirrels and rats, behaviourism's standard subject. Kingston thus asks the narrator, '"Did you ever see a squirrel operating a revolving wheel in a cage?"' (ibid, p. 24). This characterisation of the squirrel depicts them as being interchangeable with other small rodents, particularly rats, with whom this particular 'action' (*operating a revolving wheel*) and 'setting' (*a cage*) are most likely associated. It also challenges the reader's 'relational role' schema, specifically human-animal relationships, as the squirrel is characterised here not as a 'wild animal', free from human control, but as a captive one. The squirrel characters' interchangeability with other rodents and its depiction as a captive creature seemingly opens up its potential as an 'experimental animal' in 'Remote Control'. On his discussion of rats as experimental subjects, for example, Tolman noted the benefits of using captive rodents: 'Let it be noted that rats live in cages; they do not go on binges the night before one has planned an experiment' (1945, p. 166). Similarly, Watson's rationale for using small rodents was that 'the white rat [i]s a convenient "behaving organism"' (Richards 2002, p. 68), whose convenience as laboratory animals includes the ease with which they can be kept in small, inexpensive cages. Kateley presents squirrel characters that seem to all intents and purposes to be 'bushy-tailed' rats (1930, p. 24).

This interpretation is further strengthened when considering the squirrels' 'action', particularly their typing on keyboards of typewriting and computing machines. In essence, 'Remote Control' presents the squirrels, small rodents, pressing keys and operating machines. As shown above, the squirrels are associated with the keyword *operating* (LL: 31.63). This word can only be linked to the characterisation of the squirrels through keyword analysis, as it takes a variety of forms (progressive, past and nominal) and falls outside of the span considered for collocational analysis – a good reason

why a variety of corpus methods are important to use for characterisation analysis. Overall, there are 5 instances, and examples include: 'The machines were being *operated* at lightning speed [...] by bushy-tailed *squirrels*', 'Another was *operating* a quivering typewriter', and '[O]ne of the little creatures was mounted on the keyboard of a comptometer, operating the keys with all four feet' (Kateley 1930, p. 24). OPERATE is a key term for the Skinnerian behaviourist school and Skinner developed his operant conditioning chamber in 1930 (Vale 2012). His theory of operant conditioning is based on his observations of small rodents' interactions with buttons and levers. Though reinforcement is missing here, the similarities between the squirrels' 'action', an implicit characterisation cue, which depicts them operating various machines by pressing keys, appears to be influenced by behaviourist methods.

1	one might expect, but by bushy tailed gray	squirrels	! "Did you ever see a squirrel operating
2	tailed gray squirrels ! "Did you ever see a	squirrel	operating a revolving wheel in a cage?" a
3	, that's where I got my idea that	squirrels	would make good stenographers. I believ
4	uirrels would make good stenographers. I believe	squirrels	can move at least twenty times more qui
5	. "Do you mean to tell me that these	squirrels	know what keys they are stepping on?" I
6	are stepping on?" I asked. "Well, no; the	squirrels	don't exactly know what they are doing,
7	are doing when they comb your hair. The	squirrels'	little minds - such as they are - are
8	. The director must educate the muscles of his	squirrel,	just as a human operator must educate th
9	of his hands. "I don't suppose the	squirrels	will ever know that they are doing thei
10	long. And they may see you, but the	squirrels	will probably never know that you are t

Figure 1: Concordance lines for lexeme *SQUIRREL* in AntConc

However, it becomes clear through their characterisation that the squirrels are not in control of their actions. Kateley's text draws on the 'occupational roles' schema, where the squirrels are presented as manual workers – good stenographers (lines 3 & 4, figure 1) – under the direction of a boss, the 'director' (line 8). But the power dynamics between (squirrel) worker and (human) boss are foregrounded and heavily exaggerated in Kateley's text through the coercive nature of the director's control. When the narrator questions how the squirrels are taught to use these machines, Kingston reveals that, much like a behaviourist scientist, the director exerts complete control over the squirrels' behaviour. The director, he states, '"must educate the muscles of his squirrel, just as a human operator must educate the muscles of his hands"' (Kateley 1930, p. 24). The use of syntactic parallelism here

suggests that the squirrels' muscles are equivalent to a human stenographer's hand muscles, aligning them again with manual work, but also bringing their behaviour under the influence of a human controller.

The squirrel appears to be characterised here as an automaton. As mentioned above, the haptic control of animals has been explored in the military, fostered in part by Skinner's project pigeon. This synthesis between squirrel and operatable machine, preceding such projects as it does, however, still emphasises a mechanomorphic view of the squirrel characters. Their characterisation as machine-like can also be detected through the narrator and Kingston's descriptions of the squirrels as efficient: 'working with a frenzy of almost imperceptibly quick movements' (ibid, p. 24); '"at least twenty times more quickly than a human being"' (ibid); '"swift"' (ibid). The lexical items and phrases used – *frenzy, quick, at least twenty times more quickly […]*, *swift* – highlight the squirrels' efficiency. Indeed, as Aaltola notes, mechanomorphic views of animals, like those found in behaviourism, encourage the belief that humans can 'operate the animal machine with an optimal technique in order to gain an optimal result' (2012, p. 47). The squirrels' controlled actions and the description of those actions characterise the squirrels as operatable machines as mechanical as the machines they are typing on.

Drawing on the 'animal body' schema, the foregrounding of the squirrels' muscles in the above quote (*educate the muscles of his squirrel*) also appears particularly Watsonian. As mentioned above, his focus on the physiological side of reflex responses known as muscle-twitch psychology is well-documented in his early work. He thus 'developed his own muscular theory of thinking which tended to place the process of thought in the muscles rather than the brain' (Karier 1986, p. 178). Kingston's lexical choices also feel behaviouristic. The verb 'educate' – a keyword (LL: 16.83) – not only seems to denote instruction and learning, to which theory behaviourism was readily applied, but also emphasises that instruction is connected not to the mind ('the black box') but to the body. In essence, the squirrels' mind is not learning, instead its muscles 'learn' to respond habitually to particular stimuli, in this case at the behest of the human director.

Correspondingly, aligned also with behaviourism's anti-mentalism, the squirrels are presented as having little in the way of mind. This can be seen in lines 6, 9 and 10, with constructions such as: *don't exactly know*, *don't suppose […] will ever know*, and *will probably never know*. The repeated use of mental process verb, *know*, used with negative particles (*not*) and adverbs (*never*, *ever*), highlight the limitations of the squirrel mind. Similarly, expanding line 7 (figure 1), Kingston tells the narrator the squirrels '"don't exactly know what they are doing [on the machines] […] [and] [t]heir little minds – such as they are – are crowded aside by the will of the director"' (Kateley 1930, p. 24). The use of the diminutive *little* represents the squirrels' minds as 'small, unimportant, [and] insignificant' (Schneider 2003, p. 129). The fact that squirrels' minds can be *crowded aside* also suggests implicitly that they are 'weak' compared to that of the human director's 'strong' mind. Looking at the projected clauses following the verb, *know* – *what they are doing* and *that they are doing their part* – emphasises that the squirrels' lack of knowledge is related to their behaviour or 'action' (*doing*). Alongside behaviourist accounts of animal mind, the squirrels are presented as characters who have little mind, or that their mind need not be taken into consideration when explaining or directing their behaviour. Indeed, as Cavalieri has stated after behaviourism gripped psychology 'the undemonstrability of the existence of the animal mind transmuted into the assertion of its nonexistence' (2001, p. 14).

However, the characterisation of the squirrels' lack of mind appears through 'other-presentation', from Kingston's perspective and direct discourse. The squirrels, and other animal characters in 'Remote Control', neither narrate nor act as focalisers, and the reader is therefore never given access to their subjectivity. Although other-presentation is employed, it is possible to read Kingston's characterisation of the squirrels critically, noting that he appears heavily influenced by behaviourist views of animal minds. Kateley, therefore, draws the reader's attention to potentially contrastive views (i.e. animals have minds). For example, in line 9 and 10 (figure 1), Kingston uses epistemic modality (*suppose* and *probably*), which leaves space for the possibility of animal minds. Similarly, the expression, *such as they are* (line 7), despite its dismissive tone and 'negative implications', can be read as conversely affirming that the squirrel characters do have minds (Preisler 1997, p. 209).

By using punctuation – the em dash – Kateley simultaneously presents both positions, the dominant behaviourist-influenced position held by Kingston, and the animals-have-minds position. The em dash, which brackets off this contrasting opinion, also effectively depicts Kingston in the act of marginalising these other opposing positions. As Tartakovsky has argued, 'parentheses are oftentimes used […] to echo epistemological uncertainty' and are seemingly functioning in a similar way to the epistemic modality lexis mentioned above (2009, p. 233). Overall, the squirrels' characterisation is inspired by behaviourist views of animals, but Kateley's careful unpicking of Kingston's dominant perspective suggests a subtle critique of such perspectives.

3.5.2 Ants

The ants are the most frequently characterised animals in 'Remote Control', and though they appear a strange choice for behaviourist-influenced characters, drawing on the ant 'species' schema proves productive, largely because they are a colony species. Vanderbeke, commenting on insect symbolism in scientifically-informed fiction, notes that 'the bee hive [like the ant colony] has been a metaphor for a well-ordered state' since before Darwin (2003, p. 291). This metaphor can be seen in the narrator's admiring comments – 'orderly commotion', 'perfect teamwork', '[perfect] co-ordination' – when observing the ant characters' 'multifarious occupations' (Kateley 1930, p. 25). But, whilst some sf depicts colony life as utopian, just as many texts depict colony subjects as coercively controlled, drone-like, individuals. For example, Herbert's contemporary sf novel *Hellstrom's Hive* (2011 [1973]) depicts a human colony, where 'social roles are […] enforced […] according to strict internal regulation' (Murphy 2008, p. 269). Kateley's use of ant characters, therefore, seems an effective choice for exploring behaviourist ideas, as readers are likely to bring schematic associations regarding the nature of colony species, including potential doubts about ants' free will. Indeed, despite the narrator's admiration of the ants' 'orderly' behaviour, he suggests that '"that every movement [of an ant] is a reaction to some sensory stimulus; and […] [their] behavior is controlled by something more deeply seated than intelligence"' (Kateley 1930, p. 25).

At the beginning of the narrative, as with the squirrels, ants are largely characterised as performing labour. Indeed, *worker* is one of the key collocates for ants (LR 10.99) and Kateley also uses adjectival traits such as workmanlike (Kateley 1930, p. 25). Drawing on the 'occupational roles' schema, the ants seem to be defined by what they do, and are depicted in seemingly functional ways. Observing the hive, the narrator suggests that he can see the ants working *at their multifarious occupations* (line 15, figure 2). For example, the worker ants are depicted as labourers, who are busy (line 15), carry and bring objects (line 16, 50), and move around or mount objects (lines 66, 68, 71). Even those ants not explicitly defined as workers are depicted as 'busy with their household duties' (ibid, p. 25), and 'at work excavating new chambers' (ibid, p. 26). The workers' bodies are also characterised as developed for specific functions. There are workers with *digestive tracts [which are] especially adapted* (line 90) and *small wingless* (line 94) ants, whom, it is assumed given earlier characterisation, are adapted to continue their industrious duties.

15	Remote Cont	Americanns. Upon examination we found the worker	ants	busy at their multifarious occupations. The worker
16	Remote Cont	busy at their multifarious occupations. The worker	ants	were carrying in fragments of insects and
19	Remote Cont	While we watched, a group of worker	ants	appeared at the edge of the mound,
41	Remote Cont	intelligent. "IN the first place, the worker	ant	only lives a few months; passing all
50	Remote Cont	know that? "Now look at these worker	ants	bringing this twig. Here is a large
65	Remote Cont	which lay just beside a medium-sized worker	ant.	As the ant moved along, the particles
66	Remote Cont	beside a medium-sized worker ant. As the	ant	moved along, the particles of color moved
68	Remote Cont	midway along the thorax. As the worker	ant	mounted a little rise, the area lengthened
71	Remote Cont	In one instance, where a small worker	ant	was mounted on a twig, the strange
72	Remote Cont	now noted that from all the worker	ants	within my observation the color line extended
90	Remote Cont	the digestive tracts of especially adapted worker	ants.	Or it may be that the queen
94	Remote Cont	with a number of small wingless worker	ants,	or a fragment of fungus culture with

Figure 2: Collocate *WORKER* for lexeme *ANT* in LancsBox

Other ants are assigned highly anthropomorphised 'occupational' (and functional) roles such as 'nurse' and 'foreman' ants. As with the workers, the focus is on the kind of work they perform. The queen is also represented as being a 'reproductive organ' (ibid). Implicitly, the narrator notes the queen's reproductive role by referring to her flying away and '"institut[ing] another colony"' or '"start[ing] a new establishment"' (ibid). The ants, whether explicitly defined as workers or not, are represented as 'able to do [their] part […] as soon as [they] are fully developed' (ibid, p. 25). Behaviourism's 'functional orientation' towards animal behaviour can be seen to be influencing

characterisation here. Skinner in his experimental methodology defined operant behaviour in functional terms: 'The lever-press [...] includes within it all the acts that have the effect of depressing the lever. It makes no difference if the rat presses the lever with its left paw, right paw, nose, or mouth; all of these are instances of lever presses' (Baum 1994, p. 75). Animal behaviours are here reduced to those that perform the functional role, in this case, depressing the lever. Behaviourists' functional view of animal behaviour can be seen in the above depiction of the working ants and those functions assigned to other ant characters, where the specificity of animal behaviour is lost, and is instead grouped into higher functional categories.

Ants' 'experimental animal' status is signalled explicitly, as touched upon below with Sarah's characterisation, but also implicitly throughout 'Remote Control'. This implicit characterisation can be attributed partly to the ants' association within a particular 'setting'. One of the highest ranked keywords, for example, is *formicary* (LL 100.99), which is the name for an ant colony when naturally occurring, but also the word used to denote an artificial glassed-in ant colony. Earlier in the narrative, the narrator discloses that he has an artificial formicary in his house, 'where [he] could have [the ants] under daily observation' (Kateley 1930, p. 24). Even where the lexical item is used to describe naturally occurring ant colonies, it is clear that the narrator and Kingston see the structure as something they might manipulate and study. When the narrator heads to the natural formicary, he thus 'arms' himself with 'a spade, a high-power microscope and [...] binoculars' (ibid). Similarly, this manipulable aspect of the formicary is noticeable in the concordance lines: see lines 5, 8, 11, 13 and 14 in figure 3. Line 5, 11 and 14 depict Kingston and the narrator *excavati[ing]*, *digging*, *shaving the layers* of soil and *remov[ing] the soil*. Line 8 depicts the narrator observing the formicary with his binoculars and line 13 shows the narrator and Kingston removing the ants from the colony en masse to get a closer look at the structure. Characterisation of the ants as experimental subjects is implicitly built up via this choice of lexeme and its patterning with experimental equipment, procedures and applications.

```
1   a colony of ants in a glassed-in    formicary   in the library living room of my town
2              of the sand pit to look for a    formicary   this afternoon. There used to be several
3   icroscope and these binoculars and march upon the    formicidai." "Yes," rejoined my friend very gravel
4           expected, we found a couple of very populous    formicaries, and chose one dose to the shade of
5        to see something of the substructure of the    formicary, so we decided to start an excavation, b
6             by tiny tunnels with those of the larger    formicary, and that these tunnels were too small f
7            months; passing all her life in a single    formicary. We have no reason to believe that an
8       the binoculars to examine some detail of the    formicary. As the lenses came into proper focus, I
9       direction; that is, toward the center of the    formicary, regardless of which way the ant was fac
10   innumerable lines of brilliance extending to the    formicary. It resembled a wonderfully illuminated
11       digging again; shaving the vertical layers of the    formicary, stopping every now and then while Kings
12              was clear and light. We were at the    formicary   bright and early. To our great delight w
13        large number of ants were lifted from the    formicary   en masse, it gave a very beautiful effec
14       other removed the soil and deposits of the    formicary. Upon arriving at a point near the cente
15   electricity, etc., and aptly suggested the name "Formicidary   Rays." A still later letter adyised me
16        was now able to produce visible lines of    formicitlary   rays at will. I asked for a few
```

Figure 3: Concordance lines for *FORMIC** in AntConc

The narrator and Kingston's excavations of the formicary take on a particularly behaviourist bent when they discover a 'tiny basketlike object' which they then 'mount[] on a crystal slide' and examine (Kateley 1930, p. 29). They discover that the object is alive and that this object must be 'the brain and nerve centre of the whole colony' (ibid). Although the behaviourists don't pay much attention to the brain or its role in animal behaviour, it becomes clear that Kingston and the narrator too see the discovered ant brain as unimportant for the functioning behaviour of the ants. For example, they frequently compare the object to an *amoeba*, a keyword (LL 33.69), described earlier in the narrative as a creature that simply 'digests […] food with which it comes in contact' and whose 'parts move and react to stimuli' (ibid, p. 27). The narrative draws on adjectival ('amoeba-like movement'), simile ('like an amoeba') and adverbial constructions ('after the manner of an amoeba') to sustain the comparison (ibid, p. 29). Drawing on the amoeba schema, readers are seemingly encouraged to see the ant colony brain as a simple and primitive structure whose function is relatively unimportant. Kingston explicitly states as such when he hypothesises that the ant brain can subdivide, like an amoeba, and the 'superfluous brain [can be] carried away by a young queen, […] to institute a new colony' (ibid). Like Watson, who 'rejected all reflex action that was higher in the nervous system than the spinal reflex', the brain is deemed unimportant here (Maultsby & Wirga 2001, p. 12). Similarly, comparing the ant

brain with an amoeba, which still reacts despite having no brain, highlights a particularly reductionist view of behaviour, a point picked up again later in this analysis.

What is highlighted as important for the amoeba-like ant brain is its connection to the ants via nerves – keywords include *nerve* (LL: 75.74), *nerves* (LL: 51.02), and *lines* (LL: 33.72) – these are depicted initially as 'a tiny gleam of brilliant color […] about midway along the thorax' of the ants (Kateley 1930, p. 28). These nerves (or lines, depending on the reader's progress through the narrative) become an important part of characterising the ants in the latter part of the narrative represented largely by concordances in position 3 of the concordance plot (figure 4).[27]

Figure 4: Concordance plot for lexeme *ANT* in AntConc

In position 3, the reader is presented with depictions, not of the ants, but of the nerves and lines that connect them to the ant brain. Some examples of this include: '[i]t was a tiny gleam of brilliant color, which lay just beside a medium-sized worker [ant]' (ibid, p. 28), '[a]s the ant moved along, the particles of color moved with it' (ibid), 'took up a mass of the building material covered […] with ants […] [and] we beheld innumerable lines of brilliance extending to the formicary[,] resembl[ing] a wonderfully illuminated waterfall' (ibid). The poetic descriptions of the nerves with their elaborate noun phrase structure – *a tiny gleam of brilliant color, the particles of color*, *innumerable lines of brilliance*, *a wonderfully illuminated waterfall* – contrast sharply with the mundane depictions of the worker ants. This awe, however, is not extended to the ants themselves, and the narrator describes how he 'manipulat[ed] several groups [of ants] in the air […] [to] provide[] some very striking effects' (ibid, p.

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[27] The other positions in the concordance plot represent distinct representation strategies for the ants. Position 1 encompasses the descriptions of the functional worker ants. Position 2 represents the narrator theorising about ants' ability to coordinate and organise their work 'efficiently', based on their observations of the formicary. Position 3 covers the period where the nerves and ant brain are discovered in the formicary. Finally, position 4 relates to Sarah's representation. Concordance plots, therefore, can be useful at highlighting when particular characterisation strategies come to the foreground.

29). This focus on the awe-inspiring nerves represents a generic trope of pulp science fiction, which 'embrace[s] the thrill of discovery and the satisfaction that comes from building [and discovering] new things' (Bascomb 2015, p. 6).

It is also particularly behaviouristic. Watson spends lots of time outlining the structure of nerve cells in his writings (1913, 1924), arguing that 'the nervous system consist[s] of nerve paths running from sense organ to brain or cord and from brain or cord to the reacting organs' (Watson 1924/1998, p. 72). He suggests that, despite the space he gives to outlining their structure, 'the nervous system [should not] be overemphasised [as] [t]he whole motor and glandular systems in each and every part [of the animal] do the reacting' (1913, p. 160). In Watson's view, the important function of nerves, like the motor and glandular systems, is to allow the organism to engage with stimuli and respond. He sees nerves as merely 'connecting organs'. In a similar vein, the narrator suggests that nerves convey *message[s]* from stimuli (*sight, smell, touch*) which are *translate[d]*. The communication metaphor here serves to foreground the nerve's connective function:

> '[w]e do not know what a nerve message really is. [...] [B]ut our reason dictates that it is a movement of some kind of energy, perhaps a series of vibrations of some sort [...]. And the human brain [...] is able to interpret these vibrations in terms of sight, smell, touch, etc. Or, if the vibrations originate in the brain, some organs in the muscles [...] have power to translate them in terms of motion' (Kateley 1930, p. 29).

These messages are then converted into responses, particularly *motion*. The narrator conceptualises the nerves' messages in kinetic terms as 'vibrations' – *a series of vibrations*, *these vibrations*, *the vibrations*. Focusing on nerve 'vibrations' aligns with Watson's behaviourism as it focused on 'smaller units of analysis, with behaviors being parts of reflexes or small movements like those of muscles or glands, and being explained by under-the-skin factors' (Gewirtz 2001, p. 25).

The discovery of the ant brain and its attachment to the ants via nerves initiates a schema refreshment, where the ant characters no longer fit into the ant 'species' schema, instead becoming a

'physical trait' (an appendage) of the 'animal body' schema. Through explicit characterisation, the narrator thus states:

> '"I think we can safely say that this is the animal itself, [...] and that what we call ants are only its multitudinous appendages [...]. The various parts of its anatomy are not connected one with another by organic tissues. But they are connected and coordinated into one complete entity by this marvellous and beautiful system of nerves"' (Kateley 1930, p. 29).

The use of the term 'appendage' also links to the narrators' early theorising about the ants' co-ordinated actions (position 2 in figure 4). He suggests that '"ants [...] are only a great many operating parts of one animal"' and that 'as [humans] have hands, fish have fins; an octopus has tentacles; and so this thing has ants' (ibid, p. 27). The use of syntactic parallelism is used to foreground (and foreshadow) the ants' appendage-like nature. The narrator continues to theorise that 'alien' beings who could only see humans' hands, but not the rest of the body, would '"watch[] our hands doing all manner of things; writing, using tools, operating machines"' and '"would suppose our hands were possessed of intelligence"' (ibid).

Through comparison between ants and other appendages, like *hands*, *fins* or *tentacles*, 'Remote Control' highlights those physical traits most likely to interact with the environment. The laboratory experiments which behaviourists conducted, thus, often contained *manipulanda*, 'the mechanical device upon which an animal directs an operant response in order to obtain a reinforcer' (Young 1999, p. 92). As laboratory rats and pigeons have physical traits allowing them to interact with manipulanda, using them for conditioning seems logical. But conditioning on invertebrates (flies and snails) is often explored without using such devices (Brembs 2003), and a recent study conducted using goldfish notes there are '[d]ifficulties associated with [...] manipulandum [which] appear to limit [operant conditioning's methodological] utility' beyond certain species (Phelps 2014). Ants, and other invertebrates, who possess bodies for whom behaviourist experiments were not really designed, are characterised by Kateley as having bodies more in line with those creatures for whom such experiments were designed.

A shift in characterisation can also be seen in the depiction of the ants' 'actions' in particular. They are no longer depicted as behaving in functional ways, with the worker ants busily building, etc. The first ant attached to the ant brain via the nerves is described as *mov[ing] along* (line 65 in figure 5), and others are subsequently described in a similar way: *mount[ing] a little rise* (line 68), *mov[ing] into the clouded area* (line 69), *mounted on a twig* (line 71). Similarly, the experimental ant character's, Sarah's, 'goal' to feed herself, shown by her eating behaviour is undermined by Kingston's description of the act as a 'reflex action [that] can be carried on without intelligent direction' later on in the narrative (Kateley 1930, p. 30). Additionally, the centre of the formicary where the ant brain is located, the queen is notably absent: 'there was no queen ant present', and, although the narrator hypothesises she feeds the brain, he never observes this (ibid, p. 29). Backgrounding their functional roles, the ants are depicted as simply moving around their environment, performing reflex actions or not involved with particular functions. Unlike earlier characterisations, the ants are depicted as directionless and lacking agency.

65	, which lay just beside a medium-sized worker ant. As the ant moved along, the particles of
66	beside a medium-sized worker ant. As the ant moved along, the particles of color moved with
67	with it. My first thought was that the ant was carrying something that reflected the sun
68	about midway along the thorax. As the worker ant mounted a little rise, the area lengthened an
69	lengthened and shortened as she moved on. Another ant moved into the clouded area; and immediately I
70	iosity was thoroughly aroused. I focused on other ants, and found them all accompanied by the same
71	long. In one instance, where a small worker ant was mounted on a twig, the strange glimmer

Figure 5: Concordance lines for lexeme *ANT* in position 3 (figure4) in AntConc

This description of the ants, combined with the narrator's earlier theorising about ants as hand-like appendages, all works to effect what the behaviourist perspective posits, namely a Cartesian division between 'body' and 'mind'. Similarly, it also highlights a reductionist approach to animal behaviour, where there is no assumption of intelligence. 'Alien' beings might suppose hands or ant appendages have intelligence, but they would be over-interpreting such intelligent-seeming behaviours, such as *writing*, *using tools*, and *operating machines*. Being inextricably human activities – language and tool use have long been markers of human exceptionality – and drawing on a posthuman

perspective, the narrator's theorising subtly undermines intelligent human behaviour, presenting it as not dissimilar to the performing animal characters. Indeed, Kateley's use of gerund parallelism here highlights the behaviours which were used to characterise the squirrels under the Director's control. On the surface, 'Remote Control' might appear an anthropocentric narrative – Kingston in particular is unsympathetic to the animal characters – but through the narrator's focalisation and direct speech there are subversive attempts to position human behaviour alongside 'unintelligent' animal characters'.

The ethics of behaviourist approaches to animal behaviour and mind is most clearly explored through the characterisation of Sarah, the experimental ant, represented in position 4 in figure 4. Exerting control over animal subjects is very aligned with the aims of behaviourism according to Watson (see: Hergenhahn 2009, p. 419), and, as I have shown, 'Remote Control' seems to present such control uncritically at least initially. But, this is challenged at the end of the story, when Kingston demonstrates his prototype controlling mechanism on Sarah to the narrator, showing how he can 'direct her [to stop eating and] to go and get [some] straw' (Kateley 1930, p. 30). This demonstration coincides with Kingston referring to an animal character by a 'proper name', Sarah.[28] Sarah clearly represents an animal used for behavioural experimentation, and the naming strategy here individualises and anthropomorphises her.

Like all experimental animals, particularly in behaviourist experiments, Sarah is seemingly replaceable with any other animal or species, with Kingston suggesting that '"next time […] I will have a guinea pig perform for you"' (ibid). As well as replacing Sarah with a guinea pig, he extrapolates from Sarah's experiment to a thought experiment involving a dog: '"[s]uppose a dog is standing with one foot raised off the ground. […] [I]f we can send a stronger, more impressive message saying 'Put that foot down,' the foot will go down; and Mr. Dog can like it or not"' (ibid). As with Sarah, the dog is anthropomorphised, with Kingston referring to the dog's paw as a 'foot' and naming him 'Mr. Dog',

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[28] Although Culpeper's model places 'proper names' (or more broadly naming strategies) as an 'authorial cue' for characterisation, McIntyre points out that actually all characterisation cues are authorial and depend on the choices made by the author. He instead proposes that characterisation cues need to be considered in terms of discourse levels on which they are operating: author addressing reader (discourse level 1); narrator addressing narratee (discourse level 2); character addressing character (discourse level 3) (2015a, p. 157). This particular example of naming represents discourse level 3.

stressing the human-like qualities of this hypothesised creature.[29] Extrapolating beyond Sarah to the potential control of other animal species seems particularly behaviourist as Sarah's behavioural control is seen as a universal principle that can work with any number of species. Indeed, Kingston claims '"I have reason to believe […] that a like force actuates the nervous system of all animals"' (ibid, p. 30).

| 1 | the actions of the animals' body. "Suppose a dog is standing with one foot raised off the |
| 2 | down,' the foot will go down; and Mr. Dog can like it or not." "I wish you |

Figure 6: Concordance lines for lexeme *DOG* in AntConc

By extrapolating from tests on Sarah's behavioural control to other animals, like dogs, Kingston, however, jumps from a species as alien to humans as possible (insects) to more familiar species (mammals), and from those species that have distal (experimental) to proximal (companion) relationships to humans. His anthropomorphic characterisation also blurs the human-animal boundary. Both of these strategies work to make the narrator uncomfortable in Kingston's presence. For example, in direct speech, he jokes that Kingston's love of buttermilk is '"affecting [his] mind"', but, in indirect thought, he suggests he 'was conscious […] of being in the presence of a superior mind' (Kateley 1930, p. 30). Kateley is, I would argue, drawing on the mad scientist schema, a 'familiar genre [character in sf], [and] one that is frequently employed to depict warnings about individuals corrupted by power' (Urbanski 2007, p. 95). In so doing, Kateley seems to position Kingston's experiments in behavioural control on Sarah amongst a history of cultural critiques of science, which is embodied by mad scientist characters (see: Toumey 1992). Indeed, the narrator's sudden nervousness around Kingston suggests a brief empathic alignment between the narrator and animal characters, like Sarah, that have putatively inferior minds, raising ethical concerns about behavioural control techniques.

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[29] In the characterisation of the dog, foot occurs 5 times, and, though it remains slightly outside collocational range, it can be seen in concordance lines (1 & 2) in figure 6.

3.6 Karel Čapek's (1937) *War with the Newts*

War with the Newts (2010 [1937]) tells the story of a giant newt species discovered in Sumatra by Captain van Toch, a Dutch trader. In the first book, 'Andrias Scheuchzeri', van Toch hires the newly discovered species to work for him collecting the pearls from oysters. The newts are bipedal, human-sized and quick to learn new skills from humans. As well as working for van Toch, the newts are exhibited as 'exotic' species in circuses and zoos and 'classified' (dissected and experimented upon) by scientists. The second book, 'Along the Steps of Civilization', explores what happens to the newts after van Toch's death. This section largely depicts the newts being exploited on a global scale, where they become a cheap labour force for human development: this becomes known as the 's-trade'. In the final book, 'War with the Newts', hostilities between the newt and human population erupt and the newts begin sinking vast areas of continent to create more newt habitat. Chief Salamander, the leader of the newts, frequently addresses the human population with his demands and the novel ends with the immanent destruction of humans.

Unlike my analysis of Kateley's (1930) 'Remote Control', this section will analyse only a single species of animal character, although they are referred to throughout the novel as *newts* (LL: 2843.79 and singular LL: 1018.36), *lizards* (LL: 262.86 and singular LL: 65.71), *salamanders* (LL: 295.71 and singular LL: 250.53) and *tapa-boys* (LL: 94.46). My analysis will, however, focus solely on book one of the novel. This is due to a number of reasons. Firstly, the characterisation strategy for the newts changes dramatically between books, so focus on one section will allow stronger analytic focus – the novel was also released in serialised format. Secondly, the newt characters presented in book one receive the most sustained characterisation, compared with book two, for example, in which the heavy use of collage creates an extremely fractured portrayal of the newt characters. Therefore, I will explore the characterisation of van Toch's 'trained' newts, Andrew Scheuchzer and the circus newt.

I argue that the newt characters in book one are all shown to be trained via behaviourist methods. Drawing on the 'company' category, the trained newts are shown to be operantly conditioned and shaped by van Toch. This relationship is depicted as being for the newts' benefit as van Toch

characterises them as cute and pitiable creatures. In particular, their 'ecological interaction' with sharks means that the knife (a reinforcer) given to the newts for their operant behaviour, i.e. gathering pearls from oyster shells, allows them to avoid being eaten, for which van Toch takes credit. The newt's shaping continues to influence their behaviour even in interactions with other human characters, presented largely through the trained newt's direct speech. This is presented however as an exploitative interaction. Andrew Scheuchzer, the newt living in the zoo, also undergoes conditioning. His interactions with the scientists, which position him as an 'experimental animal', highlight a 'conversational structure' through which the scientists exercise control of Andrew's verbal behaviour. Similarly, drawing on the category 'register', Andrew's speech is filled with advertising slogans and newspaper headlines, which work to present his speech as being extremely environmentally determined. Finally, the circus newt's 'actions', its performance, present the creature performing behaviours vastly outside the repertoire of its species, which is in line with the shaping of animal behaviour practised by behavioural scientists. Like, Andrew, the circus newt's verbal behaviour is presented as heavily conditioned by its environment, instead this is highlighted through phatic 'lexis'. The circus newt is shown, unlike the other two newts, undergoing training via aversive stimuli, and focus on the creature's 'appearance' highlights its poor physical condition as a result of this, creating sympathy for those animals trained via these methods.

3.6.1 Captain van Toch's 'trained' newts

Van Toch has a significant influence on the characterisation of the newts in book one. Whilst Culpeper employs a matrix to explore his implicit cues category 'company', noting the patterns presented when considering 'who actually appears with whom', this can also be picked up by corpus software (2001, p. 228). Looking at collocates for the lexeme *captain* highlights *tapa-boys* (LR: 6.00), with *Toch* the collocate *lizards* (LR: 5.38) appears, and, conversely, the lexeme *lizard* flags up the collocate *captain* (LR: 4.85). As the title of chapter 5 suggests ('Captain J. van Toch and his trained Lizards'), the newt characters in book one not only frequently appear alongside the captain, but are also shown as undergoing the process of training and shaping via his influence. Van Toch's appearance with the newts

in these chapters is important not because he is the only human character to appear alongside the newts – also after book one van Toch dies – but because under his influence the newts transition 'relational roles' within the human-animal relationships schema, moving from a wild species to a trained and captive one. Van Toch's role as a human shaper of animal behaviour, a role that feels distinctly behaviourist, becomes a repeated pattern throughout book one, as the characterisation of Andrew Scheuchzer (3.6.2) and circus newt (3.6.3) will attest.

In chapters 2, 3 and 4, van Toch discovers the newts and, realising that they are able to collect oyster shells, quickly attempts to shape the newts' behaviour to his will, though, as I will show, this is not how he frames the interaction. Presented in direct speech, van Toch instructs the newts to bring him shells filled with pearls: '"not this kind, my dears, it's not worth anything. I won't open this one for you with my knife." But when it was a pearl shell I opened it […] [a]nd that shell I used to let them lick out' (Čapek 2010 [1937], p. 52). Drawing on the 'traits' schema, he notes that the newts are inquisitive and *clever* (LR: 9.24 – node word: lexeme *LIZARD*), and seem as if they 'want to learn' (ibid, p. 51). After getting the newts to bring him the oyster shells, he then teaches the newts to use a knife: 'You must lever it, I said, lever, see? twist the knife like this and its done. And he [the newt] kept on trying, poor little thing, till it cracked, and the shell was open' (ibid, p. 54). The knife is therefore shown as being a kind of manipulanda that the newts must use, thereby eliciting the desired behaviour of removing an oyster – and the pearl – from its shell. The newts' use of the knife is also shown as being a highly repetitive behaviour (*kept on trying*) that is not within the behavioural repertoire of that species. Indeed, van Toch states '"what a wonder and marvel it is […] when a beast like that can do this kind of thing"' (ibid). The process of shaping is captured succinctly in van Toch's initial interactions with the newts.

Whilst the newts are initially depicted being given a commonplace food reinforcer, they are later shown to be given a different reinforcer: a knife. The knife quickly becomes the chosen reinforcer for the newts due to their interactions with another species: sharks. *Sharks* not only represents a keyword (LL: 65.36) in the corpus, but also a key collocate (LR: 7.83 – node word: lexeme *LIZARD*) for

the newts, and similarly draw on the 'company' category of the framework. The prolificness of the sharks in book one means the reader is likely to draw on the 'ecological interactions' category of the characterisation framework, especially considering a key collocate for *shark* is *eaten*, always in the passive construction with the shark as an agent (LR: 12.37). Similarly, readers are likely to draw on their 'species' and 'animal body' schema and assume that the shark characters will be large, muscular predatory species with sharp teeth, whereas the newts will be a medium-sized, soft-bodied, omnivorous prey species with little defence against sharks. This is clearly visible in the interaction between the sharks and newts presented in the concordance lines (figure 9, lines 27, 32, 33) and qualitatively via van Toch's direct speech: '"It's very easy to become fond of these lizards [...]. But if only the sharks didn't keep eating them like that"' (Čapek 2010 [1937], p. 53). After van Toch notices this interaction, he subsequently makes '"a sort of contract"' with the newts, stating that '"if they would bring [him] the pearl shells [he] would give them harpoons and knives in exchange, so that they could defend themselves"' (ibid, p. 58). The knife switches from being merely a manipulanda, to a reinforcer for the newts, allowing them to kill the sharks that keep eating them. That the *knife* is repeatedly used to this end can be seen in its appearance as a key collocate (LR: 8.63) for *shark* in the repeated pattern below (see figure 7, lines 19 & 22).

Index	File	Left	Node	Right
18	War with the N	a Dayak, a shark-killer, who kills the	sharks	with a knife in the water. A
19	War with the N	and now, fellow, you will kill the	sharks	with that knife of yours. I wanted
22	War with the N	it here underlined. Sergeant killed a small	shark	with that knife. Its weight was seventy

Figure 7: Collocate *KNIFE* for lexeme *SHARK* in LancsBox

It is worth noting, however, that though the shaping presented here does feel slightly removed from the intensive rigors of the behaviourist method, van Toch's depiction is heavily romanticised. Indeed, van Toch's story – '"Well, then, I've something to tell you [...] such a story"' (Čapek 2010 [1937], p. 45) – about the shaping of the newts' behaviour is narrated from his perspective and is likely to gloss over the exploitative nature of the interaction. This romanticised perspective can be seen in his

description of the newts as 'cute' characters for whom he has great sympathy, not only for their deficiencies, but also their place on the food chain. The newts are described by him, employing 'other-presentation', as having '"front paws [...] like babies' little hands"' (ibid, p. 48). He shows his addressee, Mr Bondy, the way the newts walk by 'holding his arms in front of himself like a dog begging, and [...] fix[ing] on Mr Bondy his forget-me-not eyes that seemed to clamour for sympathy' (ibid). In another translation of the text (Čapek 2012 [1937]), the characterisation of the newts as cute and pitiable can be seen particularly with the collocate *poor* (LR 8.90). Lines 8 and 40 (figure 8), for example, highlight the newts' physical deficiencies; line 16 emphasises the newts' inability to perform particular actions; and line 30 shows a newt performing an action with difficulty. The collocate *poor* can be considered a surge feature, defined as 'outbursts of emotion' that can 'contribute to the construction of character' (Mahlberg 2012, p. 104). In this case, the newts are characterised as pitiable creatures.[30]

8	War with the [	but they've only got four fingers. Poor	lizards,"	the captain added in sympathy. "But they're
16	War with the [	have been a wonderful titbit for these	lizards.	Only, the poor lizards weren't able to
17	War with the [	titbit for these lizards. Only, the poor	lizards	weren't able to get into the hard
30	War with the [	it. And he kept on trying, poor	lizard,	until it gave way and the shell
40	War with the [	stones for the dam. And the poor	lizards	had to pull everything in those tiny
44	War with the [	and anything else they need. The poor	lizards	increased their population so much in Devil
65	War with the [	of pearls round here that the poor	lizards	brought for me! Aren't they sweet, Fred?

Figure 8: Collocate *POOR* for lexeme *LIZARD* in LancsBox

The newts' depiction as helpless leads van Toch to become increasingly paternalistic towards their wellbeing. This attitude is highlighted by the collocate *my* (LR: 5.90). These collocates (figure 9) show van Toch concerned with the newts' wellbeing, particularly in relation to their interactions with the sharks (lines 27, 32 & 33). The use of the possessive pronoun in these examples suggests an affinity and affection towards the newts and their 'relational role' as a prey species. In these examples, the relational role is brought to bear on interpretation via textual cues *ate* and *eating* (lines 27 & 32). Van Toch takes the predator-prey interaction between these species personally, characterising the newts

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[30] This characterisation strategy for animal characters is known as 'Disnification', a word derived from the anthropomorphised animal tales made by Disney. Disnification refers to a process whereby an animal character is 'neotinized', given baby-like characteristics. This strategy for representing animals has 'connotations of trivialization and belittlement' (Baker 2001, p. 174).

as cute and helpless victims in need of his protection. His affection is further evident in his response to seeing the relational roles of the sharks and newts reversed: '"*Sergeant* [a newt] *killed a small shark with that knife* […] [I] cried for pure joy […] [n]ow I knew that my tapa-boys wouldn't give in"' (Čapek 2010 [1937], p. 58 – original emphasis). As with the collocate *poor*, van Toch's emotion – *pure joy* – is a surge feature which highlights his emotional involvement with the newts' struggle against the sharks. Van Toch positions himself as a paternalistic figure who takes an interest in the cute yet pitiable newts' plight. However, the reader remains aware that this characterisation of the newts remains 'other-presentation', and is therefore, likely, romanticised. This 'rose-tinted' view of van Toch as the newts' saviour can be undermined by viewing such characterisations with scepticism and seeing the shaping of the newts' behaviour as potentially self-serving. Indeed, van Toch offers the newts a reinforcer (knives) that, whilst used to kill sharks, means he will accumulate vast amounts of precious gems.

18	War with the N	out in my head, lad. When these	lizards	saw how the Sinhalese cut away the
27	War with the N	monsters ate more than twenty of my	lizards,"	the captain exclaimed and blew his nose
32	War with the N	watched how the sharks were eating my	lizards.	That night I swore that I would
33	War with the N	the sharks so that they'd leave my	lizards	in peace, but this Dayak was such
46	War with the N	have the tanks on board with my	lizards	in them..." "That's something it might well

Figure 9: Collocate *MY* for lexeme *LIZARD* in LancsBox

In later chapters (6 & 7), van Toch's trained newts again appear, though not in the company of van Toch. Their interactions with other human characters are therefore useful as it allows another perspective on these characters. Their 'actions' in these chapters, however, largely confirm that van Toch's shaping has had a strong influence on their behaviour. The newts are depicted approaching a film crew and offering them pearls:

Abe stood with his legs apart […] "Ts, ts," he said. "What do you want?" To him it seemed as if the animal offered its front paw […]. "What?" he asked somewhat sharply. "Nife," barked the animal, and from its paw some tiny things fell like colourless drops of water. (Čapek 2010 [1937], p. 85).

Other examples of the newts continuing to bring pearls to these human characters can be seen in a collocate for the keyword *PEARL* (LL: 70.30), specifically *brought* (LR: 6.22) – '"they've [the newts] brought me pearls"' (ibid, p. 97); '"There will be heaps of pearls those poets [the newts] have brought me"' (ibid, p. 88) – both utterances from Li, the film star. Li's encounters with the newts is also reported in newspaper headlines, a collage-style element featured in book one, which further foregrounds the behaviour: '"Antediluvial Sauria pay homage to beauty and youth"' (ibid, p. 99); '"Tritons Sprinkle Pearls over White Lily!"' (ibid, p. 100). Another link between the newt's actions here and behaviourism, drawing on the 'proper names' category, is the character Abe Loeb (*Abe* LL: 726.61), one of the film crew. His name is an allusion to Jacques Loeb, an American physiologist. Loeb's work 'exert[ed] substantial influence on the work of B F Skinner and behaviour analysis' and he was also Watson's tutor at university (Hackenberg 1995, p. 225). Loeb's research, like Pavlov's, was focused on reflex actions and behaviours, and this authorial cue works to situate the newt's actions within this particular scientific context.

The newts are above characterised using direct speech. The quote shows that the newts expect a knife (a reinforcer) will be given to them once they present pearls. Indeed, Skinner's research into rats demonstrated the effects of reinforcement, but he also became increasingly focused on histories of reinforcement, arguing that 'explain[ing] behaviour in terms of expectancy [means] you must explain expectancy, and to do so you must turn to a history of reinforcement' (quoted in Toates 2009, p. 65). This history of reinforcement, partially glimpsed through van Toch's romanticised, embedded story, is particularly evident here. The newts' expectation can also be seen in later direct speech, which highlights a pattern of characterisation used in these chapters (figure 10).

1	and like an old man it barked out: 'Nife!' 'Nife!' came another bark further away. 'Ni
2	like an old man it barked out: 'Nife!' 'Nife!' came another bark further away. 'Nife! Nife
3	'Nife!' 'Nife!' came another bark further away. 'Nife! Nife!' 'A-be!' 'Don't be frightened, Li,'
4	!' 'Nife!' came another bark further away. 'Nife! Nife!' 'A-be!' 'Don't be frightened, Li,' called
5	he were in a dream. 'What's that?' 'Nife!' 'A-be,' moaned darling Li. 'Come here!' 'Co
6	look of that. 'What?' he asked somewhat sharply. 'Nife,' barked the animal, and from its paw some
7	. 'What the devil, Li; be quiet,' growled Abe. 'Nife,' a voice barked beside him. 'Ts, ts, ts.
8	,' a voice barked beside him. 'Ts, ts, ts. Nife. Li. Nife. Nife. Li.' Now they were past
9	barked beside him. 'Ts, ts, ts. Nife. Li. Nife. Li.' Now they were past that semicircl
10	beside him. 'Ts, ts, ts. Nife. Li. Nife. Li.' Now they were past that semicircle, and
11	face Li and drew nearer. 'Ts, ts, ts. Nife. Nife. Li.' But Li didn't cry out.
12	Li and drew nearer. 'Ts, ts, ts. Nife. Nife. Li.' But Li didn't cry out. Li
13	other side, Abe; they can't see me.' 'Nife. Ts, ts, ts. Abe!' 'Nife, ts, nife.' 'Ts,
14	't see me.' 'Nife. Ts, ts, ts. Abe!' 'Nife, ts, nife.' 'Ts, ts.' 'Nife!' At last the
15	me.' 'Nife. Ts, ts, ts. Abe!' 'Nife, ts, nife.' 'Ts, ts.' 'Nife!' At last the boat rolled
16	, ts, ts. Abe!' 'Nife, ts, nife.' 'Ts, ts.' 'Nife!' At last the boat rolled on the waves,
17	to cry out. 'Li,' shouted Abe. 'Li, run!' 'Nife! Ts, ts, ts. Li. Li. Abe!' Someone raised
18	't you make some light!' 'Ts, ts, ts.' 'Nife.' 'Nife.' 'Abe!' The dark shadows were swayin
19	you make some light!' 'Ts, ts, ts.' 'Nife.' 'Nife.' 'Abe!' The dark shadows were swaying and ci

Figure 10: Concordance lines for lexeme *NIFE* in AntConc

Drawing on the category 'conversational structure' and 'lexis', *nife* in the below and the above examples is a directive, in speech act theory, with the newts attempting to get the humans to carry out an action, specifically giving them a knife. The concordance for *nife* also highlights the newts' insistency about receiving a knife. This is largely achieved through the sheer repetitive nature of the lexical item – every instance of the trained newts' direct speech features *nife* in these chapters – and the reporting clauses *barked* (lines 1-2, 6 & 7-9) and *bark* (line 1-4), which are authorial characterisation cues. The use of *bark* here reiterates the directive nature of the speech act. As with van Toch's romanticised perspective about shaping the newts' behaviour, there are hints that van Toch's training of the newts has been exploitative. Here, for example, the irregular spelling of the lexical item, *knife*, implies the newts are simple creatures, and have clearly not understood the parameters of the '"contract"' made with van Toch (Čapek 2010 [1937], p. 58). Through direct speech, the newt characters' expectation and insistence on receiving a knife further suggests how heavily they have been trained via van Toch's operant techniques and also the exploitative nature of the interaction.

3.6.2 Andrew Scheuchzer

Andrew Scheuchzer, or Andy (LL: 90.35), is a zoo animal, and accordingly draws on the 'captive animal' schema. The captive animal schema is signalled in the introduction to the chapter and Andrew: '[O]ne Thursday when the *London Zoo* was closed [...] a keeper in the *Reptile House* [...] was clearing the tanks [...] of his *charges*' (Čapek 2010 [1937], p. 111). Though captive zoo animals may not appear aligned with behaviourism or its methods, following Skinner's conditioning experiments, his former students, Keller and Breland, set up 'IQ Zoo' in 1955, which featured a variety of animal acts (Breland & Breland 1961). Mitman argues, however, that the Keller and Breland's 'use of operant conditioning was one among many examples of scientific research helping to fashion the [animals'] role as simultaneous experimental subject and popular celebrity', including McBride's trained dolphins in the late 1930s (1999, p. 168). The mixed role of captive animals in the 1930s is being drawn on not only schematically here but also textually via Andrew's characterisation. For example, at the end of the chapter the heterodiegetic narrator states that 'the talking newt became a sensation at the London Zoo [and] [...] was besieged by people who wanted to have a chat with him' and '[i]n return he used to get [...] so much chocolate and sweets that he became seriously ill' and eventually 'perished of the consequences of his popularity' (Čapek 2010 [1937], pp. 120-121). Andy's celebrity status is highlighted in this final paragraph, but for the majority of the chapter he is characterised as an experimental animal subject. The captive zoo animal schema appears, at the time, to have offered a blurry distinction between circus, zoo, experimental and celebrity animals, and is productively employed for Andrew's characterisation throughout the chapter.

Although other newt characters speak, Andrew's speaking ability is one of the most extensively presented in the novel. Indeed, the lexical item *said* (LR: 5.68) appears as a key collocate for *Andy*, and as already quoted this appears to be his defining feature (*the talking newt*). Andrew's speaking abilities are discovered by the zoo keeper, who overhears Andrew repeating utterances that zoo visitors have used in the vicinity of his enclosure. For example, '"Look, a newt [...][.] Does it bite?" croaked the

salamander' (Čapek 2010 [1937], pp. 111-112). The zoo keeper then attempts to interact with Andrew using distinctively behaviourist training methods.

'Say "Good Day"' [...]

'Good day,' it croaked. 'Good day. Good day. Can I give it a bun?'

Mr Greggs pushed a bewildered hand into his pocket and took out a slice of bread.

'Here, have this.'

The salamander took the bread in its paw and began to nibble it (ibid, p. 112).

He tries to elicit a response by guiding Andrew to *"Say 'Good day'"*, presented as in the imperative mood and, as mentioned above, a directive in speech act theory. After Andrew repeats the phrase a number of times, the zoo keeper gives him *a slice of bread*. This behaviourist interaction shows Andrew being given a stimulus (*"Say [...]"*), responding accordingly by repeating the utterance, and being given a positive food reinforcer. The reader is therefore initially introduced to Andrew and his speaking ability through this behaviourist-style verbal interaction. In fact, the majority of Andrew's characterisation subsequently comes from interactions similar to this, though the food reinforcer is only ever explicitly mentioned again at the end of the chapter (*chocolate and sweets*). Andrew's shaping at the hands of humans is therefore presented in a similar vein to van Toch's shaping of the 'trained' newts, but Andrew's shaping and characterisation focuses almost exclusively on controlling his (direct) speech, and thereby highlights the shaping of verbal behaviour rather than physical action.

After the discovery of his speaking ability, Andrew is studied by scientists. Their interview with Andrew, described as an *experiment* and foregrounding an 'experimental animal' schema shows a repeated pattern of verbal interaction between Andrew and the scientists.

What is your name?

Ans. Andrew Scheuchzer.

How old are you?

Ans. I don't know. If you want to look younger, wear the Libella corset.

What date is it to-day?

Ans. Monday. Nice weather, sir. Next Saturday Gibraltar is running at Epsom.

How much is three times five?

Ans. Why?

Can you count?

Ans. Yes, sir. How much is seventeen times twenty-nine?

Let us ask the questions, Andrew. […]

Where are the Gilbert Islands?

Ans. In England. England will not bind herself to the continent. England needs ten thousand aeroplanes. Visit the south coast of England.

Can we look at your tongue, Andy?

Ans. Yes, sir. Use Macans for the gums. It's cheap, it's best. It's British. Do you want perfume in your breath? Use Macans (Čapek 2010 [1937], pp. 118-119 – original emphasis).

I here draw on Culpeper's implicit cues category 'conversational structure and implicature' for this analysis of Andrew's direct speech, as it allows me to explore 'the form or style of speech [a]s a […] means of characterisation' (Rimmon-Kenan 2002, p. 66). Structurally, this interaction, and earlier ones between Andrew and other human characters, consist of a repeated question and answer pattern. This structure is signalled explicitly in this extract by using an abbreviation for answer (*ans.*). By foregrounding the structure of this verbal interaction between Andrew and the scientists, the conversation is presented as a formal and official record of Andrew's utterances, which aligns with the framing of the conversation as an 'experiment' and Andrew's characterisation as an experimental animal. Indeed, Andrew's answers, not the scientists' questions, are the foregrounded structural element, presenting him as undergoing scientific interrogation. This extract actually represents an instance of free direct writing, though, I see no reason this ought not be considered a verbatim account – at least within the norms of speech representation in fiction – of Andrew's direct speech.

Andrew's direct speech in this extract, and more broadly in this chapter, is always depicted within such question and answer sequences. In pragmatics, question and answer sequences are known

as adjacency pairs, in which the 'question creates a "slot", "place", or "context" within which an answer is relevant and expected next' (Sidnell 2010, p. 20). In *Verbal Behaviour*, Skinner (1957) labelled these interactions as 'intraverbals', and defined them as 'verbal response[s] directly under control of a prior verbal stimulus' (Sundberg 2016, p. 121). The question and answer pairing is an important linguistic structure for the behaviourist view of language, clearly exemplifying a direct relationship between (verbal) stimulus and expected (verbal) response. With the stated aim of behaviourists being the control of subjects' behaviour, adjacency pairs offer a conversational structure within which this control can be exercised. As many critical discourse analysts have argued those who ask the questions not only control 'the organisation and the ordering of speaking turns […], but also the topic to be spoken about' (Woods 2006, p. 105). In the above extract, the scientists' control over the topic, for example, can be seen particularly when Andrew draws on advertising slogans – *If you want to look […], Visit the south coast […], Do you want perfume […]*. Andrew's use of advertising slogans, tangentially related to the initial topics (i.e. Andrew's age, location of the Gilbert Islands, and Andrew's tongue) set by the scientists, thus represent an attempt to topic shift. However, Andrew's attempts fail and these utterances are ignored. The scientists' control is also made clear when they ignore Andrew's interrogatives, a point I will pick up again later. Overall, Čapek's use of the question and answer structure effectively presents the scientists' control over Andrew's verbal behaviour.

As well as this repeated structure, a recurring feature of Andrew's speech is his repeated use of advertising slogans (*If you want to look younger, wear the Libella corset*; *Visit the South Coast of England*; *Use Macans for the gums. It's cheap, it's best. It's British*). This is also a feature of earlier conversations with the zoo keeper and director (Čapek 2010 [1937], pp. 111-113 & 115- 117). Referring to the amended categories for Culpeper's model, 'register' is an implicit characterisation cue that is drawn on for the characterisation of Andrew. This unusual register can be seen quantitatively with Biber's multidimensional analysis (MDA), which highlights a target text's similarities to a variety of text-types across a number of linguistic factors. Using the multidimensional analysis tagger (Nini 2018), Andrew's direct speech showed a similarity to text-types that are categorised as 'involved persuasion',

such as advertisements. Although this category covers a broad array of different text-types, Biber categorises 'texts belonging to this text type [as being] typically persuasive and/or argumentative' (quoted in Nini n.d., p 8).[31] Andrew frequently utters advertising slogans filling his direct speech with persuasive linguistic features, including those imperatives (*wear, visit, use*) featured above.[32] Not only is Andrew's choice of advertising slogans in his direct speech unusual, and therefore, foregrounded, but also the use of advertising slogans seems particularly behaviouristic. After leaving the laboratory, for example, Watson went to work within the advertising industry, employing his behaviourist techniques to control the consuming 'masses'.

It is not only advertising slogans that are frequently uttered by Andrew verbatim, offering an odd slippage into another 'register', but also newspaper headlines he reads in the papers, an activity he is also shown doing earlier in the chapter (*Next Saturday Gibraltar […]*, *England needs […]*). Similar to the advertising slogans, this register shift seems a recurrent feature of Andrew's speech, with examples including: '"IS MARS INHABITED?"' (ibid, p. 115) and '"WILL THERE BE WAR?"' (ibid, p. 117). In combination, Andrew's verbatim quoting of advertising and newspaper discourse depicts Andrew's speech as heavily conditioned by his verbal environment. Exact repetition of adverts and newspaper headlines also appears to align with Skinner's category of 'echoic' verbal behaviour, where 'there is a formal correspondence between stimulus and response-product' (Skinner 1957, p. 71). Echoic verbal behaviour emphasises the repetitive nature of language acquisition. Although *War with the Newts* precedes Skinner's categories, Bloomfield (1933) noted earlier that 'language acquisition [could be considered] in terms of habit formation' in which imitation and repetition play an intrinsic role (Cook & Singleton 2014, p. 111). This repetitive verbal behaviour not only characterises Andrew as heavily conditioned, but also represents a phenomenon often applied to talking birds known as echolalia, where there 'is a tendency to repeat the surface forms of speech without complete comprehension' (Oller & Oller 2010, p. 37). Indeed, Andrew's speech presentation appears to back up the scientists'

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[31] I have used factors across all dimensions, since Koteyko has shown that persuasive features can appear across a variety of dimensions in Biber's model (2015, p. 279).

[32] Linguistic elements include phrasal verbs, imperatives, universal pronoun *all*, exclamatives, and exclusive adverbs.

claims earlier in the chapter that he 'learned to talk like a cockatoo' (Čapek 2010 [1937], p. 115). Andrew's characterisation through these interactions seemingly draws on the 'bird brain' animal stereotype.

On the surface, this appears a fairly straightforward behaviouristic and uncritical attempt to characterise Andrew. As well as his responses adding superfluous information which draws on unusual registers, leading to a particularly reductionist view of his mind, Andrew also responds to the scientists' questions – *Andrew Scheuchzer, Monday,* etc – giving them answers, preferred responses, that they argue give 'no suggestion of any independent thought' (Čapek 2010 [1937], p. 120). The characterisation of Andrew's mind, which stylisticians argue can be accessed through direct speech, might appear therefore to underpin a reductionist perspective, a conclusion the scientist characters are only too happy to run with. But Čapek's depiction is subversive and critical. Numerous times during the experiment, the scientists ignore Andrew's more complex responses. For example, Andrew attempts to ask questions himself (*Why? How much is seventeen times twenty-nine?*), but he is repeatedly ignored or told to 'Let us [the scientists] ask the questions' (ibid, p. 118). Andrew's interrogative (*Why?*) is not an answer, a dispreferred response, and his other interrogative (*How much is […]?*) follows a preferred response, but attempts to take the floor during a transition relevance place (i.e. after answering the question). Both Andrew's dispreferred response and attempt to take the floor can be seen to undermine the scientists' assertions that he has been entirely conditioned by simple stimulus-response learning, in which Andrew has merely repetitively (and vacuously) learned how to respond to their questions.

Moreover, the conclusions drawn by the scientists about Andrew's 'free will' and 'lack of intelligence' is shown to frame their investigation of him. Before meeting Andrew, the reader is told that Professor Petrov believes that 'so-called animal intelligence, conditioned reflexes, [are examples of] how popular ideas overrate the reasoning powers of animals' (ibid, p. 115). After meeting Andrew, the reader is presented with the scientists' conclusions that 'Andrias Scheuchzeri […] only repeats what it has heard and read' and 'there is no need to overrate its intelligence' (Čapek 2010 [1937], p. 120) –

all conclusions that are challenged by Andrew's dispreferred responses, his attempts to take the floor and, as mentioned earlier, shift the topic. Čapek implies that scientists' underlying assumptions, like Watson's anti-mentalism, can distort and impair experimental methods, analysis and conclusions. Through Andrew's characterisation, he therefore presents the newt's verbal behaviour as being more nuanced than behaviourist approaches will permit.

3.6.3 The Circus Newt

The last newt characterised extensively in book one is the circus newt. Like Andrew, the characterisation of the circus newt also draws on the 'captive animal' schema, and, as such, the reader will bring to the text an understanding that this character is enculturated within human institutions (Lyn 2017, p. 85). This schema is signalled by the chapter's title, 'Country Fair in New Strašecí', and a collage style element, an advertisement for the circus: 'Talking Reptiles !!The Greatest Scientific Marvel!! Entrance 2 Crowns' (Čapek 2010 [1937], pp. 122-123). The circus 'setting' also means that the reader expects the newt to be presented in a highly anthropomorphic manner performing tricks, an expectation met by the newt characters' drumming and dancing performance. The choice of circus animal also appears particularly behaviouristic, as 'operant conditioning techniques for achieving desired behavioural modifications had long been known by those who trained and worked with [..] circus animals', even before Skinner developed the operant conditioning chamber (Hall & Halliday 1998, p. 150). Similarly, Skinner's graduate students, Keller and Breland, as mentioned above, also created the field of applied animal psychology that drew on both behavioural science and experiences of professional animal trainers. Circus animals therefore seem to come with certain schematic expectations and a heritage that lends itself to behaviourist-inspired characterisation.

When the human characters Mr Povondra and his son first sight the circus newt, it is described as: 'something black and apathetic as big as a catfish […] lying there; motionless, except that behind the head the skin expanded and contracted a little' (Čapek 2010 [1937], p. 124). The newt character is therefore shown to be an unresponsive creature, apart from his reflex breathing response. His breathing, however, is described in extremely physiological terms focusing on musculatory movements.

Instead of 'breathing', the newt's skin *expand[s] and contract[s] a little.* For Watson, the unconditioned reflex, like breathing, 'was the basic [...] physiological endowment, consisting of automatic responses to environmental stimuli' (Reich 1998, p 516). But, like Pavlov, Watson's focus on unconditioned reflex responses, a building block of conditioned ones, positions animals as 'passive organism[s] that an external "stimulus" must prod into action' (Garrison et al 2012, p. 106). Indeed, exploring behaviourist influences in fiction, Maude argues 'Watson's subjects [...] lack a sense of agency or intentional subjectivity' (2013, p. 87). The newt characters' inertness (*lying there; motionless*) leads Povondra to judge the newt as an *apathetic* creature – an explicit characterisation cue. This trait is also repeated later in the chapter: 'he [...] poked with a stick that black and apathetic something that was lying motionless in the tub' (Čapek 2010 [1937], p. 125). Agency is also backgrounded in both quotes via the reference strategy (*something*), where the newt is an object, not an animal. The characterisation of the newt's breathing in physiological terms, its 'apathy', lack of agency, and inertness all seem to suggest an animal character, whose passivity seems aligned with early behaviourist views in which the organism merely reacts to its environment.

As with other newt characters, this characterisation is formed largely through other-presentation. In the above examples, Povondra's stated 'disappointment' strongly suggests that the newt is being focalised from his perspective. It also highlights Povondra's expectations about what the newt's behaviour should be, particularly when drawing on the 'captive (circus) animal' schema. These expectations are met when the newt character begins his performance. Drawing on the 'action' category of Culpeper's model, I proposed that if animal characters are anthropomorphised they will be depicted performing human-like actions as opposed to species-typical ones. The newt character here is presented using the former, showcasing its dexterity by 'gripp[ing] [a] stick in its fingers' and holding string 'in its fingers, and [...] really t[ying] a knot' (Čapek 2010 [1937], p. 126). The newt is also depicted 'hit[ting] [a] drum several times and twirl[ing] the upper part of its body' (ibid). After the performance, Povondra notes '"It really is like a human being"', foregrounding the anthropomorphic nature of the newt's actions (ibid, p. 127).

Before and during the performance, Čapek creates irony with the newt's characterisation, by contrasting lexis related to authenticity, ascribed to the newt character via its 'traits' and its 'actions', with its unnatural performance. Before the newt's performance, for example, the circus trainer describes the newt as being authentic: '"the newts are really from Captain van Toch […] Guaranteed real Australian reptiles"' (Čapek 2010 [1937], p. 124). Using Wmatrix's (Rayson 2009) semantic tag categories as a guide ('A5.4: Evaluation: Authentic'), a number of these lexical features suggest authenticity, particularly *really* and *real*. This stated authenticity, however, is followed by the above stilted performance, which is similarly depicted as authentic (*really tying a knot*). The use of *really*, which foregrounds authenticity despite the anthropomorphic nature of the newt's actions, suggest a skewed view of its real nature and behaviour. Given the lack of naturalistic behaviour displayed by the newt's performance, this characterisation of the circus newt seems particularly inspired by behaviourism. Indeed, contemporaneous to the production of the novel, Skinner's work on operant conditioning showed how his methods could 'produce responses that were not in the original behavioural repertoire' of an animal (Capshew 1993, p. 839). In particular, he trained a rat called Pliny the Elder to perform a series of tricks.

As with Andrew, the circus newt is also depicted as a speaking animal character. In addition to adjacency pairs, like question and answer sequences, the circus newt frequently utters repetitive phatic expressions. When the newt is first commanded to speak by the circus trainer, he greets Povondra and his son with '"You are very welcome […] Willkommen. Ben venuti"' (Čapek 2010 [1937], p. 126). At the end of his performance, the newt also utters phatic greetings: '"My best compliments. Thank you. Good-bye. See you again"' (ibid, p. 127). Similar expressions are repeated again later – '"Come again. Auf Wiedersehen"' (ibid, p. 128). Phatic communication can be seen as 'a mode of action, a form of social behavior that establishes or confirms social relations and does not necessarily communicate "new ideas"' (Duranti 2009, p. 190). Whilst Culpeper's model can be explored through 'conversational structure', it can also be employed to explore a character's spoken 'lexis'. The circus newt's phatic lexis is employed here to highlight the character's verbal behaviour as putatively empty. Combined with the

circus newt's actions, the phatic lexis highlights a particularly behaviouristic position on environmental determinism. The circus newt is therefore characterised as a tabula rasa and is particularly aligned with the '"animal as empty vessel" view of behaviourism' (Klama 1988, p. 79).

Unlike van Toch's newts and Andrew who are presented as being trained through positive reinforcement, the circus newt is largely presented receiving negative reinforcement. This is elucidated through characterisation of the circus trainer, whose controlling 'actions' emphasise a dominating relationship with the creature. The circus trainer – 'the little man' – is thus depicted as initiating the creature's performance by 'pok[ing] [him/her] with a stick' (Čapek 2010 [1937], p. 125). Later, when the newt drops a drum stick during the performance, the circus trainer's abusive direct speech – '"Damn you, you brute"' – is described using the reporting verb *snapped*, an authorial characterisation cue that further highlights his violent temperament. In behaviourist terminology, however, this is classed as punishment rather than negative reinforcement, as it occurs after the behaviour. Also, the lexical item *brute* is highlighted as being part of the semantic category 'E3: Violent/Angry' in Wmatrix. When demanding the newt speak, the circus trainer is described as 'clapp[ing] his hands', a violent stimulus which, given the readers' awareness of typical animal responses to loud noises, would likely startle the creature (ibid, p. 126). The heterodiegetic narrator's choice of lexis describing the circus trainer's actions – *poked, snapped, clapped* – strongly suggest violence. This emphasises the use of negative reinforcement and punishments for training the circus newt, an idea strengthened by the description of the newt's body.

The use of negative reinforcement and punishment, though shown explicitly through the circus owner's actions, is also shown implicitly through the description of the newt character's 'appearance'. For example, the creature is introduced to the reader through a description that highlights its poor physical condition:

The gills behind its head were twitching convulsively and the black snout gasped for breath. Its skin which had rubbed raw, was too loose and studded with warts, and it had round frog-like

eyes which […] were painfully closed with its membranous lower lids (Čapek 2010 [1937], p. 125).

Drawing on Wmatrix's semantic tag categorisation, 'B2: Disease', this passage is filled with items that connote illness, particularly *convulsively, warts,* and *painfully*. Other hints of this semantic category are at the level of syntax, a level at which semantic tagging does not operate, and include *black snout gasped for breath*. The adjectives describing the newt's skin, such as *raw* and *too loose*, also seem symptomatic not only of illness, but also mistreatment. The description of the skin as *raw* is therefore suggestive of punishment, whilst the newt's skin being *too loose* hints at negative reinforcement. As a reminder, negative reinforcers work by encouraging the animal to avoid further aversive stimuli – such as *poking* and *clapping*. The description of the newt's skin being *too loose* means negative reinforcement is likely employed instead, as food is the reinforcer most commonly used for positive reinforcement. Additionally, the reader is not shown the circus newt being given food at any point in the chapter unlike the other newt characters in book one. The only mention of food occurs in an instance of disnarration: '"Daddy, and what does it eat?" "Fish, and things like that," opined father Povondra. (It must chew something)' (ibid, p. 125). The use of modality (*must*) in Povondra's free direct thought highlights an 'epistemic expression[] of ignorance' that functions to foreground 'what did not or does not take place' in the narrative (Prince 1988, p. 3). In this case, the disnarration highlights a lack of evidence of what the newt eats, which strongly suggests lack of positive reinforcement.

War with the Newts is, however, critical of negative reinforcement. Implicit cues used to describe the circus newt's 'actions' highlight its physical discomfort. During the performance, for example, the newt is described raising itself '*with difficulty* […] from the water' (Čapek 2010 [1937], p. 125). When the newt speaks, the reporting clause – an authorial textual cue – describes the newt as 'croak[ing] […] *laboriously*' (ibid, p. 127). Its gills are described as 'twitching *convulsively*' (ibid, p. 125) and 'contract[ing] *convulsively*' (p. 126), and its eyes are described as '*painfully* clos[ing]' (p. 125) and '*painfully* blink[ing]' (p. 126). As mentioned above, these adverbs fall within Wmatrix's semantic category, 'B2: Disease', but also highlight the creature's pain and discomfort. Many of these

descriptions – *twitching*, *contract[ing]*, *blink[ing]*, *clos[ing]* – specifically foreground the newt's musculatory reflex response. These reflex responses are the foundations on which all conditioning and shaping of complex behaviour – like the newt's performance – is built (Watson 1926a). That the newt's reflex reactions appear to be causing it pain strongly suggests that its performance would similarly be painful.

In addition, drawing on 'species' schema, newts are amphibious creatures in need of moist conditions, but the circus newt is exposed to the air during its performance. When the newt finishes its performance, its urgency to get back into the water, conveyed by the adverb *quickly* – 'And quickly it hid beneath the water' (Čapek 2010 [1937], p. 127) – again suggests its discomfort. The circus newt is characterised as a fish out of water. This situation also describes animals in the laboratory culture of behaviourist research, where animals are studied outside their natural habitats and, when aversive conditioning is used, likely in pain. The use of adverbials and adverbs describing the newt's largely reflex responses create sympathy for the creature and the unnatural behaviour it is coercively forced to perform.

3.7 George Orwell's (1945) Animal Farm

As the novella's title suggests, there are a variety of animal characters that could be explored in this analysis. I have chosen to focus on some of the minor characters, the *dogs* (LL: 29.70), because they represent the strongest case for behaviourist influences in *Animal Farm*, being the characters most heavily controlled by the pigs.[33] They are also important characters as they mark the point in the plot when the farm transitions from democratic to dictatorial society and where behaviour begins to be coercively controlled. The dogs are characterised as conditioned animals, whose isolation and 'education' by Napoleon seem an allusion to Watson's environmentally deterministic perspective. Considering their differences to the other dogs, like Jesse and Bluebell, these dogs become extensions of the pigs' wills, an instrumental depiction that aligns with behaviourism's experimental outcomes. As

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[33] My analysis excludes references to the other dogs on *Animal Farm*, specifically the dog characters Jessie and Bluebell. My analysis here only concerns the (nine) dogs who are raised by Napoleon.

well as the dogs being presented as conditioned animals, after their training, the dogs 'actions' work to depict them as punishers for the other animals, supressing free speech. Similarly, through their 'appearance' features and 'vocalisations', the dogs also appear to be aversive (unpleasant) stimuli, who become closely associated, via the category 'company', with the pigs.

3.7.1 The Dogs

Drawing on the 'species' schema, dogs are animals synonymous with the behaviourist approach. As Ryan has argued '[s]cience has a notorious history of using animals for its experiments' with some of 'the most famous of these unfortunate creatures [being] […] Pavlov's dogs' who exhibit 'all the features of […] well-trained, obedient dog[s]' (2011, p. 171). However, unlike *War with the Newts,* the training the dogs undergo does not occur at the hands of humans. Indeed, drawing on the 'relational roles' schema, cultural stereotypes of dogs as man's best friend are foregrounded in the text – 'wagg[ing] their tails to [Napoleon] in the same way as the other dogs had been used to do to Mr Jones' (Orwell 2008 [1945], p. 36) – but humans' roles are instead filled by the pigs. The authorial decision to focus on dog characters and their subsequent characterisation as submissive instruments of the pigs' wills feels particularly behaviouristic. In a lecture on his work, Pavlov introduced a '"remarkable" dog who had ten different conditioned reflexes, earning [the dog] his nickname of "animated instrument"' (Collard & Contrucci 1989, p. 61). Throughout *Animal Farm*, the dogs' characterisation is continually aligned with the conditioned animal subjects and experimental techniques of behaviourist experimentation.

The dogs are initially introduced as puppies, but are shown being taken away and 'educated' by Napoleon.

> Jessie and Bluebell […] g[ave] birth between them to nine sturdy puppies. As soon as they were weaned Napoleon took them away from their mothers, saying that he would make himself responsible for their education. He took them up into a loft which could only be reached by a ladder […] and there kept them in such seclusion that the rest of the farm soon forgot their existence (Orwell 2008 [1945], p. 22).

This introduction feels particularly behaviouristic. I would argue it alludes to Watson's statement about educating infants to become whatever the behaviourist trains them to be, a position advocating environmental determinism: '"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll [...] take any one at random and train him to become any type of specialist"' (Watson 1926b, p. 10). In this introduction, the species is different, but the dogs are *puppies,* therefore young, and are described as *sturdy*, comparable to Watson's quote *[g]ive me a dozen healthy infants, well-formed*. The puppies similarly are taken to a *loft*, where they are trained in *seclusion*, reminiscent of Watson's suggestion that given his *own specified world to bring them up in [...] [he'll] train [them] to become any type of specialist* (ibid). Possessive lexis (*took*, *kept*) is similarly foregrounded, as in Watson's quote (*[g]ive*), with the puppies appearing syntactically as direct objects. However, compared with Watson's hypothetical situation that emphasises permission – *give* suggests a possession freely exchanged – Napoleon exercises control by taking and keeping the puppies. The puppies are therefore characterised as isolated creatures who undergo conditioning at the hands of Napoleon, a stand-in for a human character, and behavioural engineer.[34]

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[34] The dog's conditioning by the pigs is not the only instance of this in *Animal Farm*. The sheep, for example, are also conditioned by Squealer. At the end of the novella, they are taken away and remain in isolation for a week, with Squealer 'teaching them to sing a new song, for which privacy was needed' (Orwell 2008 [1945], p. 88). The sheep are also depicted 'browsing at [...] leaves under Squealer's supervision', a suggestion that positive reinforcement is being used to train them (ibid). When the sheep return they have been taught to bleat, '"Four legs good, two legs *better*!"' (ibid, p. 89).

10	terrible baying sound outside, and nine enormous	dogs	wearing brass-studded collars came bounding i	Animal Fa
11	as only a pig can run, but the	dogs	were close on his heels. Suddenly he slipped	Animal Fa
12	up again, running faster than ever, then the	dogs	were gaining on him again. One of them	Animal Fa
13	back into the barn. In a moment the	dogs	came bounding back. At first no one had	Animal Fa
14	. Though not yet full-grown, they were huge	dogs,	and as fierce-looking as wolves. They kept	Animal Fa
15	him in the same way as the other	dogs	had been used to do to Mr. Jones.	Animal Fa
16	to do to Mr. Jones. Napoleon, with the	dogs	following him, now mounted on to the raised	Animal Fa
17	and began speaking at once. But suddenly the	dogs	sitting round Napoleon let out deep, menacing	Animal Fa
18	of the raised platform, with the nine young	dogs	forming a semicircle round them, and the othe	Animal Fa
19	but Squealer spoke so persuasively, and the three	dogs	who happened to be with him growled so	Animal Fa
20	omptly silenced by a tremendous growling from the	dogs.	Then, as usual, the sheep broke into "Four	Animal Fa
21	at this moment, attended by two or three	dogs,	was able to put the whole matter in	Animal Fa
22	was guarded at each door by fierce-looking	dogs.	When he did emerge, it was in a	Animal Fa
23	a ceremonial manner, with an escort of six	dogs	who closely surrounded him and growled if any	Animal Fa
24	a hen should be punished by death. The	dogs	saw to it that these orders were carried	Animal Fa
25	nvestigation into Snowball's activities. With his	dogs	in attendance he set out and made a	Animal Fa
26	distinctly!" and at the word "Snowball" all the	dogs	let out blood-curdling growls and showed thei	Animal Fa
27	"Animal Hero, Second Class"), with his nine huge	dogs	frisking round him and uttering growls that s	Animal Fa
28	e uttered a high-pitched whimper. Immediately the	dogs	bounded forward, seized four of the pigs by	Animal Fa
29	's feet. The pigs' ears were bleeding, the	dogs	had tasted blood, and for a few moments	Animal Fa
30	ast. When they had finished their confession, the	dogs	promptly tore their throats out, and in a	Animal Fa
31	, the remaining animals, except for the pigs and	dogs,	crept away in a body. They were shaken	Animal Fa
32	one dared speak his mind, when fierce, growling	dogs	roamed everywhere, and when you had to watch	Animal Fa
33	the third time when Squealer, attended by two	dogs,	approached them with the air of having somet	Animal Fa
34	in the hearing of the pigs or the	dogs,	it was felt that the killings which had	Animal Fa
35	was attended not only by his retinue of	dogs	but by a black cockerel who marched in	Animal Fa
36	others. He took his meals alone, with two	dogs	to wait upon him, and always ate from	Animal Fa
37	recautions for Napoleon's safety were taken. Four	dogs	guarded his bed at night, one at each	Animal Fa
38	ies of triumph. Napoleon himself, attended by his	dogs	and his cockerel, came down to inspect the	Animal Fa
39	by Jessie and Bluebell. And when the nine	dogs	of Napoleon's own bodyguard, whom he had	Animal Fa

Figure 11: Concordance lines for lexeme *DOG* in AntConc

Although the dogs' 'education' is not presented it is clearly evident that they have been conditioned by the pigs. Indeed, as instruments of Napoleon's will, they are repeatedly shown under his direct control. For example, Napoleon's 'high-pitched whimper', a stimulus, elicits the dogs' violent response to Snowball and the other pigs (Orwell 2008 [1945], p. 35 & p. 55). Similarly, when Napoleon utters Snowball's name, another stimulus, the dogs respond in a similar manner: 'at the word "Snowball" all the dogs let out blood-curdling growls and showed their side teeth' (ibid, p. 53). Even allegorical readings of the dogs as KGB agents highlight that the dogs ought to be considered brainwashed and controlled subjects of the state. By comparison, it is worth noting that the other dog characters – Jessie, Bluebell and Pincher – are never depicted in this manner. With the above allusion to Watson's environmentally deterministic position and the responses of the dogs to stimuli given by Napoleon, the dogs are presented as the heavily conditioned animal subjects found in behaviourist experiments.

After their training, the dogs return to the farm fully-grown and, as noted above, extremely aggressive. However, they are depicted not solely as conditioned characters, but as characters who act as punishers and aversive stimuli for the other animals. One of Watson's (1920) most controversial experiments in fact used aversive stimuli to condition a young child to be frightened of 'furry' animals, specifically a white rat and rabbit. Negative reinforcement, as mentioned above, 'involves the removal or avoidance of an aversive or unpleasant stimulus' (Lund 2010, p. 27). Whereas aversive stimuli are presented before the desired behaviour, punishment crucially occurs after the behaviour. Unlike aversive stimuli, which increase the likelihood of specific behaviours, punishment is designed to weaken certain behaviours. Like aversive stimuli, punishers can be unconditioned (i.e. they naturally cause pain or discomfort and are biologically harmful), or conditioned, where the punisher becomes associated with an unconditioned punisher. Punishers and aversive stimuli can include 'extreme heat or cold, extreme levels of auditory or visual stimulation, or any painful stimulus (e.g. from electric shock, a sharp object, or a forceful blow)' (Mittenberger 2012, p. 110). Behaviourists employed both aversive stimuli and punishment in behavioural training (Skinner 1938).

Initially, the dogs are used as a punishment to discourage certain behaviours, namely, speaking against or disagreeing with Napoleon. This is largely depicted through their 'actions' – though 'appearance' features highlight that the dogs' wear *brass studded collars* (line 10) which hints at their punitive role. In the first few concordance lines (lines 10-12, figure 11), the dogs attempt to punish Snowball for disagreeing with Napoleon. The dogs are depicted chasing Snowball – *were gaining on him* – and though the punishment is not given it is implied that should the dogs catch Snowball they would harm him. As a dog nears Snowball, for example, it 'all but closed his jaws on Snowball's tail' (Orwell 2008 [1945], p. 35). The choice to represent the dog's muzzle as *jaws* emphasises its savagery and potential punishing capability. Chasing and attempting to bite Snowball after he 'finishe[s] speaking' foregrounds the dogs' roles as punishers of this behaviour (ibid). This also occurs later in the narrative (lines 24 & 28-30). Line 24 highlights the dogs' function as punishers who kill the disagreeable hens. In this instance there is an explicit link between the dogs' actions and punishment, where the phrasal verb

(*s[eeing] to*) makes them complicit in the aforementioned punishment. In lines 28-30, a group of pigs, 'the same four pigs as had protested when Napoleon abolished the Sunday Meetings', are also killed by the dogs (ibid, p. 56). The 'actions' of the dogs (and the direct objects of those actions) – *seize[], taste[] (blood), t[ear] (throats)* – highlight their vicious and punishing nature.

The dogs' violent actions mean that they become associated with a biologically harmful stimuli. In contrast, the only other predatory animal – the cat – is characterised as having 'good intentions', even though she attempts to lure 'sparrows [towards her] who were just out of her reach' (Orwell 2008 [1945], pp. 19-20). Compared with the cat, Orwell chooses to foreground the dog characters' predatory actions thereby highlighting their capacity to punish the other animals. Although the consequences of punishment in behaviourist conditioning are intended merely to weaken certain behaviours, in many of these instances the dogs' actions often lead to the deaths of those animals punished. I would argue, however, that narrative's drive for tellability (see section 1.5) is influencing the depiction of behavioural conditioning in these examples, as the dogs' fatal punishment is unquestionably dramatic and shocking. It also violates one of the 'seven commandments' on the farm, which the heterodiegetic narrator brings to the foreground after the punishments: 'until today, no animal had killed another animal' (ibid, p. 57).

The characterisation of the dogs as punishers of verbal behaviour persists throughout the novella, but cannot be merely tied to the 'actions' of the dog characters. This is largely because the dogs' roles as punishers needs to be considered as a change it effects on the other animal characters' behaviours. In essence, the other animals learn to avoid certain behaviours through fear of punishment, which is administered by the dogs, who become conditioned punishers. As mentioned in the methodology, characterisation is often skewed towards individual characters' actions (see: Mills 2014), but the dog characters' identities as punishers are constructed through a pattern of interaction with the other animals on the farm. This pattern of interaction can be described as: 'Napoleon states opinion' (Stimulus) → 'Animals speak out/disagree' (Response) → 'Dogs punish them' (Punishment). The other animals observe the actions depicted above learning that speaking out or disagreeing leads to

punishment, and subsequently do not imitate the other animals, remaining silent.[35] For example, after Snowball's expulsion from the farm (lines 10-12, figure 11), the dogs' effective roles as punishers is further elucidated, not by their own actions, but by the other animals'.

> By the time he [Snowball] had finished speaking there was no doubt as to which way the vote would go. But at this moment Napoleon stood up and [...] uttered a high-pitched whimper [...] At this there was a terrible baying sound outside, and nine enormous dogs wearing brass-studded collars came bounding into the barn. They dashed straight for Snowball [...] Too Amazed and frightened to speak, all the animals crowded through the door to watch the chase [...]
>
> Silent and terrified, the animals crept back into the barn. [...]
>
> Napoleon, with the dogs following him [...] announced that from now on [...] there would be no more debates [...]
>
> Four young porkers in the front row uttered shrill squeals of disapproval, and all four sprang to their feet and began speaking at once. But suddenly the dogs sitting round Napoleon let out deep, menacing growls, and the pigs fell silent and sat down again (Orwell 2008 [1945], pp. 35- 37).

After the dogs attempt to punish Snowball, the animals are subsequently described as being *[t]oo amazed and frightened to speak* and *silent and terrified*. When the young pigs *beg[i]n speaking*, they *f[a]ll silent* after the dogs growl at them. As can be seen here, lexis related to speech and the stifling of it often appear in close proximity to the dog's characterisation – the semantic category 'Q2.1: Speech: Communicative' (*LL: 18.14*) is overall an underrepresented category in *Animal Farm*. These items,

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[35] Strictly speaking, this forms part of early social learning theory as proposed by Miller and Dollard's (1941) research. Miller and Dollard's research was conducted using laboratory animals and rested on behaviourist foundations. They discovered a special kind of operant conditioning, known as 'matched-dependent behaviour', in which 'observers use the behaviour of the model [another animal] as a discriminative stimulus [a specific cue associated with a specific outcome] to determine when they should also do the behaviour' (Eyck 2008, p. 352). For example, a 'boy may imitate the behaviour of his older sister because he has observed his sister receiving a reward' and '[b]ecause the boy has observed his sister receiving a reward, he is cued to perform the same behavior' (ibid). Importantly, however, 'the boy *does not immediately or directly receive a reward*', but 'is motivated to perform the behavior because he first observed his sister receiving a direct and immediate reward' (ibid).

however, are often outside collocational range for the node character *dog*, and the pattern therefore is only noticeable when taking a more qualitative approach.

Other examples persist throughout *Animal Farm* and include the other animals not speaking after the 'traitorous' pigs are killed by the dogs in chapter 7 – '[f]or some time, nobody *spoke*' (Orwell 2008 [1945], p. 57) and '[t]he animals huddled about Clover, *not speaking*' (ibid, p. 58). In this same chapter, there is a rare transition into free indirect discourse (FID) from Clover's perspective, drawing on lexical items related to speech: 'If she could have *spoken* her thoughts, it would have been that […] they had come to a time when no one dared *speak* his mind, when fierce, growling dogs roamed everywhere, and when you had to watch your comrades torn to pieces' (ibid, p. 58).[36] Drawing on FID, instead of direct discourse, the established norm in *Animal Farm*, creates a synthesis between style and content, further emphasising the stifling of the other animals' ability to speak freely because of the dogs. The personal pronouns switch from *she* to *they* suggesting that Clover's experience is also representative of the rest of the animals on the farm. Though causation is not explicitly stated, the syntactic parallelism, in this case the repetition of relative clauses following the noun *time* (i.e. *no one dared speak […], growling dogs […], […] comrades torn to pieces*) emphasise the connection between these declaratives.

Similarly, the other animals refrain from speaking against Napoleon's regime unless they are sure not to be overheard by the dogs: 'if anyone *complained* (as a few animals sometimes did, when no pigs or dogs were near)' (Orwell 2008 [1945], p. 77). The use of brackets is a stylistic choice which has the effect of symbolically hiding the act of complaining from the dogs, emphasising how effective the dogs have been at weakening this verbal behaviour. At the end of the novella, when the animals see Napoleon carrying a whip, an instrument formerly associated with punishment by the other animals, the heterodiegetic narrator states: '[T]here came a moment […] when […] – in spite of their terror of the dogs, and of the habit, developed through long years, of never *complaining*, never *criticising*, no

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[36] Fowler notes that 'each of [Orwell's] novels except *Animal Farm* has one character much more prominent than the others, his thoughts and feelings given freer and freer rein' a strategy that requires drawing on 'conventions such as […] free indirect thought' (1995, p. 185).

matter what happened – they might have *uttered* some word of protest' (ibid, p. 89). Repetitive use of negative adverb *never* and epistemic *might* again suggests that the dogs have been, and are likely to continue being, effective punishers. Also, describing the animals' behaviour of not speaking out as a *habit* is particularly behaviouristic, since as a theory behaviourism saw learning as the 'formation of habits' (Kirwan 2013, p. 6). As mentioned with the characterisation of Andrew Scheuchzer, Skinner's exploration of verbal behaviour aimed 'to predict and control verbal behaviour by observing and manipulating the physical environment of the speaker' (Chomsky 1959, p. 26). Here, the other animals' verbal behaviour is being controlled by the dogs through punishment.

After Snowball's expulsion, the dogs are used not only as punishment, but as an aversive stimuli to strengthen the other animals' submissive behaviour towards Napoleon. When the dogs appear for the first time, they can be aligned with a number of aversive stimuli, including sound and (potential) pain: 'there was a terrible baying sound outside, and nine enormous dogs […] came bounding into the barn. They dashed straight for Snowball, who […] escape[d] their snapping jaws' (Orwell 2008 [1945], p. 35). The dogs' baying, described as *terrible*, and their *snapping jaws* aligns them with unconditioned aversive stimuli. There are other hints through their 'appearance' that they are seen by the other animals as unpleasant and threatening. For example, in the concordance lines (figure 11), the dogs are described as *enormous* (line 10), *huge* (lines 14 & 27), and *fierce-looking* (lines 14 & 22). Similarly, the dogs' punishing actions mean the other animals have reason to fear the dogs who become a conditioned aversive stimuli.

That the dogs are aversive stimuli can be seen by the other animals' avoidance of the dogs. After the hen rebellion, for example, Napoleon 'with his dogs in attendance […] set[s] out and ma[k]e[s] a careful tour of inspection of the farm buildings, [whilst] the other animals follow[] at a respectful distance' (Orwell 1945, p. 52). In contrast, drawing on the category 'company', the dogs' close proximity to the pigs is stressed repeatedly throughout the novella. The dogs *follow* (line 16, figure 11), *sit/form a semi-circle round* (line 17 & 18), are *with* (line 19, 25, 27 & 36), *ATTEND* (line 21, 25, 33, 35 & 38) – *attended* appears as a collocate (LR: 8.96) – and *GUARD* (lines 22 & 37) the pigs. They are also described

as the pigs' *escort* (line 23), *retinue* (line 35) and *bodyguard[s]* (line 39). The other animals' avoidance of the dogs in the first example suggests that they see the dogs as aversive stimuli, as creatures to be feared. The effects of aversive stimuli on behavioural conditioning were explored extensively by behaviourist experiments. In particular, behaviourists created 'a modified form of the Skinner box called a "shuttle box"' (Lund 2010, p. 27). The shuttle box consisted of two compartments, a door allowing access to either side, and a metal floor through which an electric current was passed. One side would then be electrified and the animal would jump to the other side of the box, a behaviour known as avoidance or escape learning. The dogs are therefore a stimulus that the other animal characters, except the pigs, would rather avoid.

Avoidance behaviour towards the dogs is just one of the textual suggestions that the dogs are acting as aversive stimuli. The dogs are also frequently represented *growling* (lines 17 (extended), 19, 20, 26, 27 & 32, figure 11), a feature considered in an addition to Culpeper's framework, 'vocalisations'. Skinner and other behaviourists certainly used electricity as an aversive stimulus, but other aversive stimuli included loud or piercing sound. In Watson's infamous experiment, for example, he used an 'unconditioned alarming noise to condition fear to a white rat' (Domjan 2015, p. 63). In *Animal Farm*, the description of the dogs' growling suggests that the other animals see it as an aversive stimulus. Adjectives, adverbs and restrictive relatives include: *deep*, *menacing*, *threateningly, blood-curdling*, *tremendous*, *sent shivers down all the animals' spines* (figure 11). It also becomes clear that the dogs' growls appear to encourage submissive behaviour. To give an example, when Squealer tries to convince the animals that it was actually Napoleon who proposed the windmill, the heterodiegetic narrator states, 'Squealer spoke so persuasively, and the three dogs who happened to be with him growled so threateningly, that [the animals] accepted his explanation without further questions' (Orwell 2008 [1945], p. 39). Here, the dogs' growls act as an aversive stimulus that increases the likelihood the other animals will accept Squealer's explanation. The conjunction *that* is used to express causation between the main co-ordinated clauses (*Squealer [...] and the three dogs [...]*) and the subordinate (*[the animals]*

[…]), suggesting a stimulus-response connection. The use of 'vocalisations', like *growling*, is unique to the dogs' characterisation, and it is presented here as an aversive stimulus for the other animals.

3.8 Conclusions

In my introductory discussion of the many behaviourist-inspired sf texts that exist (see section 3.2), I noted how few, if any, of these texts had been explored in relation to behaviourist psychology. Even when behaviourism is considered as a scientific context relating to characters, analysis is either extremely partial (Andersen 2009, Elms 2004), focuses on human characters instead of animal (Packer 2015, Maude 2013), or highlights a single element of behaviourist psychology, such as lack of free will (Warrick 1980). Overall, I argued sf's engagement with behaviourism had been largely overlooked, despite its potential for focusing on animal characters. Hence, one of the reasons I chose to focus on behaviourism as a context was that very little research on this interaction exists. I have, therefore, attempted to refute the claim made by Stableford and Langford that 'the actual progress of experimental and physiological psychology has had very little impact on sf' (2018).

This chapter's attempt to solely concentrate on behaviourism therefore not only fulfils the broader aims of this thesis to explore a scientific context's influence on animal characterisation, but also highlights specific areas of focus that few have considered in relation to behaviourism. These include: anti-mentalism, specifically the downplaying of the mind or brain as a cause of behaviour (the squirrels, pp. 80-81, the ants, pp. 89-90); the methods employed to operantly condition animal subjects (trained newts, pp. 94-95, the circus newt, pp. 109-110, the dogs, pp. 116-120); the extreme position of environmental determinism found in behaviourism (Andrew, p. 104, the circus newt, pp. 108-109, the dogs, p. 113); the strong influence of physiological reflexes on early behaviourist psychology (the circus newt, pp. 110-111); the conditioning of verbal behaviour (Andrew, pp. 100-105, the circus newt, pp. 108-109); and the use of animals themselves as aversive stimuli and punishers (the dogs, pp. 114-120). All of these areas, I argued, have had little or no consideration in relation to sf's animal characters, whose flesh-and-blood counterparts are the ones through which behaviourist knowledge and experimental practice has been honed. In opposition to the claims made by Stableford and Langford

(2018), I have argued and shown consistently that the animal characters in these texts owe a great deal to the influences of behaviourism. My analyses of animal characters in this chapter can be considered a stylistic counterpart to Crist's research (1999), which explores the impacts of behaviourist thought on ethology's conception of animals. Similar to Crist, this research highlights how animals are presented as 'natural objects, driven by forces outside the ken of their experiential […] possibilities, steered and propelled by […] exterior stimuli beyond their control and comprehension' (ibid, p. 122).

The second reason this research is important is due to the lasting and damaging practices that still exist as a consequence of behaviourism's views of animal mind, its experimental practice and the militaristic use of animals that it encouraged. Specifically, I argued that, whilst many of these texts drew on behaviourism as a context to inform their animal characters, they often did so critically. In my analysis of the squirrels in 'Remote Control', I noted how Kateley unpicked Kingston's certainty of behaviouristic views of animal mind via epistemic modality (p. 81). With the ants, the narrator's direct and indirect thought and Kateley's use of the mad scientist trope depicted Kingston's haptic control over animal characters as ethically troubling (p. 91). In *War with the Newts*, the operant conditioning of the newt characters' actions and speech are critiqued: Van Toch's trained newts are depicted being trained for exploitative ends by the human characters (pp. 95-97); Andrew's analysis showed how underlying behaviourist assumptions influenced experimental methods (p. 105); and the circus newt's physical condition and discomfort highlighted the abuses of aversive conditioning and punishment (pp. 109-110). *Animal Farm*, however, emphasised how the behaviourist training of the dogs leads to an instrumental view of them, which in turn damages broader animal society (pp. 111-120). In line with others' research on science fiction and scientific engagements, it also highlights how science fiction can be a lens through which scientific advancements and perspectives can be problematized and ethically explored (Ryan 2011, Vint 2010, Kress 2007, Suvin 1979).

My analyses of these characters has worked to conduct a qualitative analysis which utilises Culpeper's characterisation framework and has been supported by quantitative corpus approaches. Methodologically, this sits alongside previous research on corpus stylistic approaches to

characterisation (see: section 2.2), most of which aim for a similar integration. I have also shown how Culpeper's framework with its original categories has been useful for animal character analysis in this chapter. For example, I highlighted how categories such as 'conversational structure' were particularly helpful for the analysis of Andrew in *War with the Newts* (pp. 102-103 & p. 105). Similarly, the textual cues 'appearance', 'company' and 'setting' were also particularly instructive. For example, the dog's ferocious 'appearance' in *Animal Farm* aligned them with aversive stimuli (p. 115); the circus newt's physical 'appearance' encourage sympathy for the cruel training techniques employed in operant conditioning (pp. 109-110); the 'company' the trained newt character's kept in *War with the Newts* was mainly van Toch, which allowed my analysis to explore how operant conditioning was central to their relationship (pp. 93-94); 'setting' allowed me to elaborate on the idea that the ants in 'Remote Control' are frequently positioned as experimental animal characters (p. 84). In so doing, I have elucidated the usefulness of applying Culpeper's basic framework to animal character analyses. Indeed, despite this being the most influential characterisation model within stylistics, my study represents the first extensive application of Culpeper's framework to animal characters, highlighting a broader gap in stylistic analyses of animal character.

Where I have particularly innovated is in my amendments to Culpeper's characterisation framework, which significantly extends or amends Culpeper's categories to include animal characters. Indeed, the amendments I have proposed have framed and developed the analyses set forward in this section. Categories such as 'vocalisations' were used in the analysis of the dog characters in *Animal Farm*, showing how this differentiation between them and the other animals instrumentalises the dogs (p. 120). The relational roles, 'experimental animals' and 'captive animals', have been useful for exploring the concrete realities of animals under behaviourist influences. For example, my analysis of Sarah (and the other ants) highlighted how they are manipulatable automata with little agency over their own behaviour (p. 84 & p. 90). The 'captive animals' relational role was drawn on consistently but frequently blurred the distinctions between captive and experimental animal (squirrels, p. 78, Andrew, p. 99) and tended to situate animal characters within the confines of institutions, like circuses, with

histories of operant conditioning (the circus newt, pp. 105-106). The 'animal body' schema was also utilised in these analyses. For example, the ants are re-categorised as appendages, who are connected via nerves to the ant brain (pp. 87-88). The 'species' schema was drawn on for the analysis of the ants to highlight that readers would likely bring assumptions to the text regarding ants' ability to exercise free will (p. 82). Similarly, with the dogs, I argued that this species, through Pavlov's research, was associated with the founding of behaviourist approaches (pp. 111-112). It is hoped stylisticians wishing to focus on animal characters in the future can draw on these amendments for animal character analyses.

As well as certain categories being foregrounded in these texts, some categories have been backgrounded. For example, 'ecological interactions', 'behavioural traits' and 'animal capabilities', apart from a single instance – though the ecological interaction between sharks and newts is depicted before van Toch finishes his training of the newts (p. 94) – are not highlighted. This is likely due to the fact that animal characters and behaviours are not presented in naturalistic ways. This clearly accords with a behaviourist perspective that privileges trained behaviours and laboratory settings. Despite these amendments to the characterisation framework rarely being employed in the present chapter, this is largely due to the choice of behaviourism as a context rather than these categories being analytically redundant, a point subsequent chapters will help to elaborate.

Further recommendations for research that expand on the ideas set forth in this chapter include exploring internal depictions of animal minds from a behaviourist perspective, something which I only touched upon briefly with Andrew's analysis (section 3.6.2). I have not explored the mind style (Fowler 1977) of any animal characters in this chapter, as all core characters are largely presented externally. Whilst exploring animal characters' minds might seem counterintuitive given behaviourism's anti-mentalistic approach, such explorations could elaborate on elements of mind style that back up a behaviourist perspective. Depictions of animal characters' minds that suggest a lack of awareness of cause and effect, for example, are particularly behaviouristic. As Crist notes, a depiction of animal minds where 'the sequential logic of linked actions is repudiated [means] a picture of subjective coherence

becomes unsustainable', situating such minds within the behaviourist tradition. A stylistic precedent for such explorations includes Halliday's (1971) research on how cause and effect is backgrounded in Goulding's (2011 [1955]) *The Inheritors*, through the use of intransitive verbs which presents 'the Neanderthal population's inability to grasp the full complexity of causal processes' (Herman 2011b, p. 489). Depicting animal characters' minds as merely reacting to a stream of disconnected events in their environment would therefore expand this chapter's focus to internal characterisation also.

Additionally, as mentioned in the introduction, I have chosen to limit my text selection to 'soft' sf but a behavioural contextual analysis could be extended to cover a broader range of sf texts. Bernstein's (1969) 'Question and Answer' features animal alien characters, the Rorvan, which could be analysed for similarities or differences to the analyses presented in this chapter. Broader still, contextual approaches to animal characters might be considered in other culture's sf writing. In China, behaviourism was notably propounded by psychologist, Guo Renyuan, who met Watson whilst studying in America, and whose experiments on the 'learned behaviours of chicks, cats and mice made him the most cited Chinese behaviourist in China and abroad' (Hsueh & Guo 2012, p. 100). This would expand the scope of this research beyond a European-American perspective, highlighting not only a scientific culture, but also an sf culture that is often overlooked (see: Milojevic & Inayatullah 2003).

4 Animal Characters in the Contexts of Entropy

4.1 What is Entropy?

Entropy, outlined by the second law of thermodynamics, states that a closed system will become more disordered over time, due to a loss of the energy through entropy. The second law was proposed by Clausius in the 1850s, and stated that 'matter and energy can be changed in only one direction, i.e. from useable to unuseable, or from available to unavailable, or from ordered to disordered' (Rifkin 2003, p. 20). Very simply, when 'energy is transformed from one state to another, there is a loss in the amount of energy available to perform future work [and] [e]ntropy is that loss of energy' (Lehan 1998, p. 213). The energy lost as entropy in systems is most often heat. Classical entropy focused on 'closed' systems, ones that exchange energy but not matter, and was discovered by observing the distribution of chemical concentrations and distributions of gas molecules in isolated systems, such as within a sealed glass container. Classical thermodynamic theory also explored how entropy can be considered a measure of disorder, with high levels of disorder meaning high levels of entropy. This can clearly be observed in a simple experiment:

> When [there are] two objects (say, two blocks of the same metal) at different temperatures, [the] system is relatively organized: the molecules are partitioned by speed, with those in the cooler object moving slowly and those in the hotter object moving quickly. If heat flows from the hotter object into the cooler object (as it will spontaneously), the molecules of the hot object slow down, and the molecules of the cool object speed up, until all the molecules are moving at the same average speed. Now, rather than having a partition between fast and slow molecules, [there is] simply […] one big pool of molecules going about the same speed – a less ordered situation than [the] starting point (Khan Academy 2020).

> Findings from classical thermodynamics were 'prematurely extrapolated to the entire universe to predict an end state' that became known as the '"heat death of the universe"' (Schneider & Sagan 2005, p. 5) – the term 'prematurely' here acknowledges that the universe is not a closed system and therefore such an extrapolation is not founded in classical thermodynamic theory. Overall, in its original

form the second law predicted the eventual running down of the universe, where the system reaches an equilibrium and loses its ability to do further work, due to energy exhaustion.

The idea that the energy available in the universe will eventually run out meant that time could be considered to have a direction, known as the 'arrow of time' (Eddington 1929). Entropy therefore makes processes in the natural world irreversible: 'no real system in nature can go through a cycle of operations and return to its initial state without increasing the entropy of the […] "universe" [and] [this] increase of entropy distinguishes the future from the past' (Kondepudi & Prigogine 2015, p. 83). As Coveney and Highfield suggest time is also 'linked by thermodynamics to ideas about organisation and randomness […] [where] there is an inexorable tendency in any system left to its own devices for organisation to diminish and randomness to increase (1992, p. 147). For example, tea and milk left on their own will over time mix to become a light brown liquid, where molecular randomness (entropy) has reached its peak state, but the reverse process, whereby the tea and milk separate, will not occur (ibid). As might be noted in the above discussions of molecules and atoms, classical thermodynamics tended to focus on micro-scale interactions in closed systems rather than macro-scale ones in open systems, meaning that the application of entropy was limited and not applicable to phenomena like organic life.

Although eventually all animal life would be affected by the second law as entropic 'heat death' would mean there would be no energy to sustain life, initially thermodynamic theory was not considered to apply to animal life. The second law, 'in its basic original form, states that entropy (atomic or molecular randomness) will inevitably increase in a sealed system [but] living beings preserve […] exquisite atomic and molecular patterns over eons' (Schneider & Sagan 2005, p. 7). Animals were therefore considered to contain 'an ineffable "life force" coursing through [them], enabling [them] to counter the laws of thermodynamics', linking with the contemporaneous Victorian idea of 'vitalism' (Sholette 2013, p. 136). Despite classical thermodynamic scientists' tentative theorising about the connection between organic life and entropy (see: Boltzmann 1886), these misconceptions were largely corrected by later physicists, biologists and ecologists. As mentioned above, in classical

thermodynamics, entropy was initially applied to closed systems, but in later iterations it was used to describe open systems, such as the Sun's energetic interaction with the Earth, becoming known as non-equilibrium thermodynamics (NET). This meant that entropy could be applied to biological and ecological systems classed as 'open'. NET therefore acknowledged the need to expand the concept of entropy and 'recognis[ed] that living systems exist in a world of energy and material fluxes' (Schneider & Kay 1994, p. 26). Such a move saw vitalist assumptions being supplanted by scientists, who argued that animal life does indeed conform to the second law. As Dolev and Elitzur note, 'the most illuminating demonstration of thermodynamics' pertinence to [...] life [...] comes from observing the processes to which an organism is subject upon *dying*', where 'the decomposing organism goes back to the state of equilibrium [...] with its environment' (1998, p. 133 – original emphasis).

Schrödinger attempted connecting entropy with animal life in *What is Life?* (1944) and is the most frequently cited scholar in this regard. He suggested that animal life was not opposed to entropy, but exists in a state of autonomy that briefly defies the entropic environment. An animal, he argued,

> tends to approach the dangerous state of maximum entropy, which is death[,] [and] can only [be kept alive] by continually drawing from its environment [...]. Indeed in the case of higher animals we know the kind of orderliness they feed upon [...] viz. the [...] complicated organic compounds, which serve them as foodstuffs [are] utiliz[ed] [and] [...] return[ed] in a very much degraded form (ibid, p. 25).

Put more simply, 'animals create order at the expense of the local environment: they eat ordered molecules [...] and release less ordered waste molecules' (Sherwood, Klandorf and Yancey 2013, p. 716). The ability that allows animals to use energy and matter to maintain life is known as metabolism. As Schrödinger points out, 'the essential thing in metabolism is that the organism succeeds in freeing itself from all the entropy it cannot help producing while alive' (1944, p. 72). An animal's metabolism and its feeding habits, which allow metabolism to occur, are implicated in the production of entropy. Indeed, 'the ability to utilize energy and to process matter', one of the key characteristics of animal life, 'are governed by the principles of thermodynamics' (Manahan 2013, p. 17). Reducing organisms to their

chemical interactions (i.e. metabolism) and material components, thermodynamic theorists often view animal life in fundamentally physicalist terms, where animals can be seen as 'natural metabolic machines' (Schneider & Sagan 2005, p. 84). Focusing on the life processes of eating and excreting, animal life clearly '"obey[s] the energy/matter aspects of the second law in a manner that is not fundamentally different from that of non-living systems of a similar (if far simpler) kind' (Brooks & Wiley 1988, p. 33).

Although Schrödinger is the most-cited scientist who explores these early connections between entropy and animal life, the first scientist was actually Lotka (1922), whose work considered the synthesis between thermodynamics and evolution. He agreed with Boltzmann (1974) that 'organisms struggle not only for food and habitat, but for the energy that drives their material organisation – their metabolism, reproduction and expansion' (Schneider & Sagan 2005, p. 147). He saw the consumption of available energy by organisms as a Darwinian struggle, suggesting that 'when excess resources were available, those [organisms] adopting a conservative behaviour would lose out to more expansive competitors' (Ulancowicz & Hannon 1987, p. 182). He argued organisms able to convert energy efficiently to biomass, an entropic process, were those that were more likely to be favoured by natural selection, an idea that became known as the maximum power principle, linked by later scholars to the complementary maximum entropy principle. These principles 'provide a mechanistic explanation [of] how systems develop and organize in the context of energy uptake (e.g., power) and energy use for system maintenance and biomass turnover (e.g., entropy)' (Chapman et al 2016, p. 28). Simply put, according to Lotka those organisms most able to utilise energy better would prosper and he viewed organisms as systems that would become more efficient over time at utilising available energy. This idea is something later scholars have been able to elucidate (see: Zotin 1984). Hence, 'through the creation of complex but ordered structure […] in biological systems […] the rate of entropy production […] is actually accelerated relative to that in simpler, non-ordered systems' (ibid).

Similarly, Blum (1955 [1951]) later considered the relationship between evolution and entropy. His focus was less on the struggle of organisms to utilise available energy but more on the broader

evolutionary process itself. Like Lotka, he saw the second law and evolution as essentially synonymous, with both concerned 'with the history of irreversible change' (Brooks & Wiley 1988, p. 7). This energetic view of evolution was therefore progressive. He noted that 'intuitively the evolutionist does not expect Brontosaurus to browse again on the earth, nor Lepidodendron to sprout up in our rain forests', with such intuitions revealing the relevance of the second law to life's progressive development (Blum 1955 [1951], p. 595). Blum also followed Oparin's (1938 [1924]) research, proposing a 'metabolism-first' theory of the origin of life, which placed thermodynamics (i.e. the organism's utilisation of energy and production of entropy) as being the fundamental process that led to the development of, and was later incorporated within, organic life.[37]

After Lotka, Lindeman (1942) applied thermodynamic theory to the organisation of organic life in ecosystems. He discovered that life could be classified into trophic levels creating food chains which accounted for different types of biological organisms such as plants (autotrophs) and animals (heterotrophs). Lindeman's taxonomy however was not merely a static classification system, but attempted to show the interrelationship between trophic levels, highlighting how energy and material flowed through the biosphere. He therefore realised that 'the most profitable method for analysis [of biosystems] lay in the reduction of all interrelated biological events to energetic terms' (1942, p. 417). In so doing, he noted that energy transfer from one trophic level to another (i.e. from plants to herbivores to carnivores) showed that 'there was a finite amount of energy that could be pushed up a trophic ladder and that not all of that energy can be converted to energy at the next level of the food chain' (Schneider & Sagan 2005, p. 191). Indeed, contemporary scientists suggest c.80-90% of chemical energy (food) is lost to entropy (heat) when moving from one trophic level to another (Morowitz 1979).[38] Lindeman also noted that, because entropy takes its toll on energy transferred up the system, food chains never went higher than five or six levels. Lindeman's research was considered an example of how the second law of thermodynamics affected the hierarchies of organic life.

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[37] This idea that energy usage and entropy production is fundamentally connected to organic life's origins and functions is most succinctly expressed by Prigogine (1955), who categorised animal life as being a kind of 'dissipative structure'.

[38] In living organisms, heat is considered 'a thermodynamic waste product roughly equivalent to entropy' (Schneider & Sagan 2005, p. 186).

As becomes clear, compared to classical thermodynamic views of entropy, like the heat death hypothesis, NET has a very different conception of entropy. Some claim that NET's conception of entropy does not challenge classical conceptions, but is merely 'a restatement of that law' (Torrance 1990, p. 41). Instead, NET focuses on entropy *production* through energy and matter flow in systems – for obvious reasons, I have explored biological ones. Specifically, NET views the utilisation of free energy, sometimes referred to as 'exergy', and the production of entropy as two sides of the same coin, since as soon as 'exergy is destroyed […] entropy production occurs' (Purvis et al 2017, p. 4) (see also: Pons 2019, p. 3 & Chellan 2016, p. 345). As mentioned above, it focuses not on the equilibrium-seeking, maximum-entropy state, but shows how living systems 'need a continuous flux of negative entropy [free energy] from the universe, to which they return an even larger amount of positive entropy' (Marchettini et al 2006, p. 264). It is also applied to systems outside of the controlled laboratory settings that are the focus of classical thermodynamic research. As Chaisson (2006) notes, in a

> non-equilibrated Universe, it is free energy that drives order from disorder, […] in good accord with the second law of thermodynamics and leading to the production of entropy […] [o]n all scales, from galaxies and stars to planets and life (2005, p. 21).

4.2 Entropy as a Context in Science Fiction

Critical explorations of entropy have most often been explored in the writing of New Wave sf authors, including Philip K Dick, J G Ballard, Michael Moorcock, Brian Aldiss, Robert Silverberg and Pamela Zoline (see: Ingwersen 2016, Stephenson 1991, Greenland 1983, Nicol 1976, Nicholls 1975). Hewitt, for example, explores Zoline's (1988 [1967]) 'Heat Death of the Universe' arguing that 'interspersed within this domestic narrative are ruminations on entropy, chaos, and the heat death of the universe' (Hewitt 1994, p. 289). As a context, entropy is more commonly written about in relation to soft sf authors. However, Freese notes that in fact many 'science fiction writers [have] ma[d]e the Second Law their staple fare', stating that between 1934-1955 a plethora of stories in *Astounding Science Fiction*, the American pulp magazine, were extrapolating on this context (1997, p. 395). For Berger (1988), hard sf has had a particularly strained relationship with entropy, since the classical law's bleak reality didn't

align with hard sf's position on human progress through technological advancement. If hard sf authors do draw on the concept at all, despite the second law being a physical principle, it is often 'made into a metaphor for social and political interaction', with hard sf authors, exploring 'the inevitable decay of existing societies' (ibid, p. 35). Campbell's (2003 [1935]) 'The Machine', for example, depicts human characters naked and 'revert[ing] to savagery', representing an instance of entropic decline (Berger 1988, p. 15). Overall, compared with the behaviourist context, critics have explored entropy's connection to a variety of sf texts much more frequently.

In many sf texts, the context of entropy is often presented through engagement with the 'heat death' hypothesis. This exploration of the second law in sf tends to foreground dying stars. Sf works in this vein include Wells's (2005 [1895]) *The Time Machine,* Hodgson's (1908) *The House on the Borderland*, and Ballard's (1998 [1960]) 'The Voices of Time'. All of these texts engage with the classical thermodynamic view of entropy, focusing on the inevitable running down of the universe's available energy. This cosmological perspective also means that vast time spans and future periods are often presented, allowing these texts to hypothesise an evolutionary trajectory for animal life. Sf that foregrounds entropy tends to present evolutionary trajectories that are atavistic. For example, in Wells's novella, the penultimate animals on Earth are crabs, arthropods being very early forms of animal life. Similarly, in Aldiss's (2008 [1961]) *Hothouse*, human characters revert to small ape-like creatures, who live in trees and forage for fruit. Apart from Wells's novella, many sf writers imagine 'heat death' as creating a warmer planetary climate, but Vonnegut's (2008 [1963]) *Cat's Cradle* is 'thermodynamically correct, because it [presents] a "cold death"' as being the end result of thermodynamic entropy (Freese 1997, p. 397).

Though the cosmological level is one strategy, others have depicted entropy as a local, and arguably human-scale, phenomenon. Zoline's (1988 [1967]) short story, for example, links entropy with the growing disorder of the protagonist's house, and Dick's (2007 [1968]) *Do Androids Dream of Electric Sheep?* features 'kipple', 'a low-key, domestic version of entropy: household disorder [and] kitchen-sink chaos' (Langford 2009, p. 168). The critical build-up of waste is the central entropic conceit in Platt's

(1977 [1967]) *Garbage World*, where former commodities signify high levels of entropy production associated with manufactured products. Much like Berger's comments on hard sf, soft sf like Platt's text also draws on entropy metaphorically: 'the entropy in Platt's fiction is the disorder created by the breakdown of the social mechanism rather than the heat death of the universe' (Smith 1986, p. 569). With *Garbage World*, the build-up of waste matter (and entropy) is both a literal nod to entropic processes, and a metaphorical one signifying a heavily commodified human society in terminal decline. Freese is critical of the speculative uses of entropy in New Wave sf, arguing that they are 'scientifically irresponsible' and 'rarely guide its readers to a better understanding of scientific developments' (1997, p. 404). However, as noted above (see: section 1.4), such speculative uses are common in soft sf, something with which this research takes no issue. Indeed, this chapter will explore these elements alongside more literal depictions of entropy.

As a context, entropy can be considered as a setting or environmental backdrop against which the characters live, but it has also been explored in relation to characters, though often human ones, and characterisation. Greenland (1983), for example, notes that Ballard's presentation of his main protagonists in his disaster tryptic (*The Drowned World (DW)* (2012 [1962])*, The Burning World (BW)* (2014 [1964])*, The Crystal World* (2014 [1966]) *(CW)*) are very similar, labelling such protagonists as 'The Terminal M[e]n'. Ballard's protagonists, he argues, are depicted as being as stagnant as their environment, unable or unwilling to act: 'A hero […] ought to pursue a course of action, but Kerans [*DW*], Ransom [*BW*] and Sanders [*CW*], instead of motivating the plot, seem[ ] to […] prevent[ ] one from developing' (ibid, p. 95). In *DW*, Kerans, a biologist monitoring the development of animal life in the submerged tropics, suggests that humanity is undergoing 'the slackening metabolism and biological withdrawal of all animal forms', something from which he himself is suffering (Ballard 2012 [1962], p. 14). In Ballard's disaster tryptic, Greenland (1983) argues the protagonists' bodily and/or psychological disintegration in these narratives is a symptom of their acceptance of, and reabsorption with, their entropic world. As noted by Zencey (1986), death, decay and disintegration are potent reminders of

the realities of entropy's connection to organic life, and these themes are a frequent way entropy is represented in sf.

Very few critics have focused on animal characters in relation to an entropic context. Nicol (1976) briefly explores Ballard's (1998 [1960]) 'The Voices of Time', which alludes to the heat death hypothesis via a continual countdown, and depicts a planet where solar radiation has awakened inactive genes in various organisms. This story's mutated animal characters are depicted as 'enter[ing] a final phase of totally disorganised growth, producing dozens of specialised sensory organs whose function […] can't even [be] guess[ed]' at (quoted in Nicol 1976, p. 155). Entropy can be considered a measure of disorder and these animal characters' disordered body structures, therefore, are an extension of the concept of entropy. Similarly, Roberts (2001) explores the influence of entropy in Wells's (2005 [1896]) *The Island of Doctor Moreau*. He traces the inspiration for Wells's eponymous protagonist to French scientist, Maupertuis, whose 'extremal' principle 'was an early expression of the second law of thermodynamics' (ibid, p. 268). Roberts argues that 'the cold and bleak "winding down" of the universe predicted by the second law […] nicely coincides with Wells's belief that "degradation" is the "essential complement" to any "advance in biological phenomena"', an example of speculative connections between entropy and evolution before NET was theorised (ibid). Entropy's influence appears in the characterisation of the Beast Folk, who are always 'cold' to the touch, and undergo a '"slow and inevitable" reversion' (ibid, p. 270).

4.3 Why Choose Entropy as a Context?

According to Stableford entropy is an often used scientific context in sf because of its creative potential: 'the notion that everything in the universe is caught up in an eternal and irresistible process of decay, against which […] all constructive endeavour must ultimately prove futile, is imaginatively powerful' (Stableford 2014, p. 160). As mentioned above (see: section 4.1), entropy is a scientific context which has a classical and expanded application (i.e. NET). However, the majority of the research conducted on entropy in sf focuses largely on the classical thermodynamic context (see: Hewitt 1994, Zamora 1989, Nicol 1976, Roberts 2001), often drawing on 'heat death of the universe' scenario, and citing

classical thermodynamic scientists, like Clausius and Boltzmann. To give an example, Nicol states that 'images of entropy in [Ballard's] "The Voices of Time" are extremely insistent', and that 'from the universe down through the sun, from agricultural yields and human fertility, everything [in the story] has begun to run down' (ibid, p. 155). By focusing only on classical thermodynamics, these scholars occasionally miss the fact that entropy can equally apply to open systems, like animal beings. Indeed, Zamora states that homeostatic processes in animal bodies 'represent the antithesis of the unopposed tendency toward [...] entropy [...] [which] would seem to limit the applicability of entropy as a [context]' in fictional works (ibid, p. 54). Those that do focus on NET have tended to focus their research around Prigogine's 'dissipative structures' (Freese 1997, Porush 1991). Freese, for example, explores texts that employ 'Prigogine's theory [...] about the order hidden within apparent chaos for the purpose of projecting alternative worlds in which the entropy concept has turned from a messenger of death into a harbinger of rebirth' (ibid, p. 405). Such explorations, however, are extremely rare. Therefore, this chapter represents an attempt to view entropy as a context which has far broader implications than its classical thermodynamic roots suggest, by focusing additionally on the context's connection to animal life.

When entropy is explored as a context in any form, it has most often considered in relation to human characters and societies (Greenland 1983). Freese's introduction epitomises the focus of many sf researchers exploring entropy: entropy 'presented imaginative scenarios that "translated the law's grim insights into their [writers'] view of *humanity* and the *human* universe"' and 'has become a centrally important metaphor of the *human* condition' (1997, p. 395 – my emphasis) (cf: Nicol's (1976) brief focus on a sea anemone focaliser, p. 156). As noted above (see: section 4.1) though, entropy is clearly a force to which all lifeforms are subject, not solely humans – indeed, the very term 'human universe' is oxymoronic. Greenland and Freese's research also highlights that a focus on human characters and society often underpins metaphorical extensions of entropy, rather than entropy's direct relation to life's processes and structures, such as those considered by NET, including metabolism (eating), food chain organisations and evolutionary development. By expanding the context's influence

to animal characters my analyses will highlight similarities to human characterisation strategies, but animal characters, flatter and less likely to be psychologised and placed within societal structures, will lead to a focus on entropy's connection with fundamental life processes.

Indeed, entropy is a scientific context that radically decentres human exceptionality, allowing space for other-than-human perspectives and characters (Larsen 2015). I noted this broader point in relation to sf in the introduction (see: section 1.2). The dissolution of human protagonists in entropy-inspired sf allows such perspectives to flourish. For example, in Ballard's (2014 [1966]) *CW* a forest in Africa is inexplicably turning into crystalline form – plants, animals, human inhabitants, all are metamorphosing into crystals. Ingwersen (2016) argues in this sf text 'the human […] stands on par with animals, plants and rocks in a transition into something that structurally underlies and precedes all forms of matter' (p. 87). *CW* (Ballard 2014 [1966]) employs the homogenous spread of inert crystal life to signify entropy and lack of energy, since, as with the example of the tea and milk, entropy on a molecular level leads to homogeneity over time. Beckman (2017) similarly agrees that Ballard's disaster tryptic is populated with creatures that challenge the boundary between human and animal. Though she doesn't directly connect this to the context of entropy, the 'mixing' of animal matter or blurring of species boundaries, though a metaphorical extension of molecular and atomic homogeneity, can be seen to be an entropy-inspired characterisation strategy. Entropy, unlike behaviourism, diminishes human exceptionality, making it a context worthy of focus for animal studies approaches like this one.

As noted above (see: section 4.1), NET tracks entropy production in open systems, by focusing on the way energy flows from an energy source, like the Sun, is utilised throughout a system, like the biosphere and the organisms contained within it, leading to energy's dissipation and eventual loss. Zencey, who writes about the popularity of entropy as a context in fiction, has noted that 'the notion of energy becomes a popular metaphor, and where there is energy, there is entropy' (1986, p. 9). He also notes that entropy is an important concept in 'energy-conscious age[s]' (ibid). Though his article was written in the 1980s, Zencey's comments easily apply to the contemporary period, in which grave concerns over environmental exhaustion exist, an idea captured by the current epoch's proposed

name: the Anthropocene. Prophetically, Lotka noted in 1945 that human beings would 'become even more addicted to the energy capture and degradation business' where the desire for luxury products, such as 'automobiles, fur coats, and jewellery is not, like the biological appetite for food, in principle limited' (quoted in Schneider & Sagan 2005, p. 150). In literary critical research, analysts have noted particular contemporary texts and authors whose work can be labelled 'Anthropocene' or 'Petro' fiction, but limited stylistics research has been conducted on such texts (cf: Caracciolo et al 2019). This chapter therefore can be considered, partly, a historical counterpart to contemporary explorations of environmental degradation and exhaustion, which focuses exclusively on entropy as the context. In so doing, I highlight the way these sf authors have challenged the idea that 'thermodynamic law is not weighted by moral or ethical distinctions' in which 'energy is […] merely spent, [but] never misspent' (Zamora 1989, p. 72).

4.4 Core Texts

This thesis will focus on 'New Wave' sf authors who have long been associated with entropy (Greenland 1983). As noted above, Philip K Dick's novel, *Do Androids Dream of Electric Sheep?* (2007 [1968]), features an entropic environment, but I will be focusing my analysis on his short story 'Beyond Lies the Wub' (1999 [1952]), a text also concerned with entropy. Unlike the novel in which animal characters rarely feature, this short story's suitability lies in its prominent characterisation of an animal alien character. 'Beyond Lies the Wub', unlike *Androids*, has rarely been considered by stylisticians or sf scholars in any great detail (see: Gillis 1998 & Barlow 2005 for brief discussions of 'The Wub'). Of those analyses that do exist, many emphasise that Dick's short story presents the reader with a posthuman perspective, something which, as mentioned above, entropy-inspired sf allows authors to explore freely. This short story has never been explored in relation to entropy, despite the author's frequent allusions to the second law in his other works (see: Langford 2009 on *Do Androids Dream of Electric Sheep?* & Kasdorf 2006 on *Ubik* (Dick 2012 [1969])). Indeed, Nicholls & Langford state that Dick uses 'the concept in nearly all his work [and] was [likely] the first to popularize it' (2017).

I have also focused on another well-known New Wave text: J G Ballard's *The Drowned World* (2012 [1962]). This text has been written about in relation to entropy (Greenland 1983), but as mentioned above the focus has been on crumbling human characters and societies rather than animal characters. Indeed, Beckman notes Ballard's relevance for exploring the context of entropy, suggesting that he has long 'positioned himself as a dystopian writer and […] a narrator of "exhausted futures"' (2017, p. 60). Like Greenland, she posits human characters are presented as exhausted in his fiction, but argues that this allows 'an interrogation [of] […] the borders of the human and the nonhuman', something she explores partially in *CW* (2017, p. 60). Following Beckman, I too focus on animal characters, but in this section they are given exclusive analytic focus. Ballard's *The Drowned World* is perhaps the most useful text to scrutinize in relation to entropy and animal characterisation, largely because of the abundance of animal characters in the text. Whilst animal characters do feature in *CW* (2014 [1966]) – a crocodile – and 'The Voices of Time' (1998 [1960]) – a sea urchin – they appear only fleetingly.

In addition to well-known 'New Wave' authors, I have chosen a text by Charles Platt, whose work has remained relatively obscure. When Platt is mentioned in sf scholarship, it is often his editorial comments in sf magazine 'New Worlds' which are discussed rather than his sf (Luckhurst 1994, Latham 2006). Indeed, I am unable to find any scholarship that analyses his fiction in any detail. Above, I noted that Platt's (1977 [1967]) *Garbage World* employs an entropic environment, but Platt notes in the introduction that the text is 'Ballardian at times' depicting 'small human figures struggl[ing] through a radioactive jungle' and that he was 'reading *The Crystal World* at the time' he wrote the novel (1977 [1967], p. xi). As I am already focusing on one of Ballard's disaster tryptic, I have chosen to focus on a text that is not as overtly influenced by Ballard's writing (though labelling *Garbage World* as merely imitative would be unfair). As I will show, his short story 'The Rodent Laboratory' (1966) is as focused an exploration of entropy as *Garbage World*, and, in addition, as the name suggests, animal characters are more foregrounded in this text compared with the mutant dogs and slugs in Platt's novel.

4.5 Philip K Dick's (1952) 'Beyond Lies the Wub'

'Beyond Lies the Wub' (1999 [1952]) is a short story, which introduces the reader to an uncategorised alien animal, known by the Martian population as a 'wub'. The wub is brought on board a spacecraft by the crew, who stop on Mars to collect food before returning to Earth. Animal characters are depicted in the story as a food source for the human crew's upcoming voyage. Speaking to a Martian native, Captain Franco asserts how the hunted animals are a necessary but exhaustible resource like fuel, largely signalled by the phrasal verb *run out*: 'You people can […] track it all down again. But when we run out halfway between Mars and Earth' (ibid, p. 27). Once the wub is aboard the spaceship, the captain examines it and suggests the crew eat the creature for dinner. Before the cook can begin butchering the wub, however, it uses its telepathic ability to 'speak' with the captain and crew. The wub bargains with the captain for its life, but the captain dismisses the wub's pleas – '"Nuts to you"' (ibid, p. 31) – and prepares to order the cook to kill the wub. The wub uses an ability to freeze the captain and spends time speaking with the rest of the crew about their cultures' shared mythology. When the captain is discovered, the crew revive him and he shoots the wub. The wub's body is cooked and served for dinner. None of the crew seem to enjoy the meal apart from the captain who comments that the taste of wub is '"very fine"' (ibid, p. 33). However, when the captain attempts to resume a conversation about the Odysseus myth with Peterson, a topic about which the wub was formerly speaking, Peterson discovers the wub has transferred his consciousness to the captain's body, meaning the wub's former body is now merely '"organic matter"' (ibid).

The analysis in this section focuses solely on the eponymous animal character, the wub. I outline how the wub is depicted as an exhausted animal character, whose 'appearance' and 'actions' suggest an entropic state. The wub character's categorisation as a 'farm animal' by Franco situates the wub in the spaceships' lower trophic (food chain) level, which, given the captain's conceptualisation of animals as fuel, suggests a physicalist and energetic view of animal life. Indeed, after the wub is shot, its dying words connect its death to other entropic processes. Similarly, drawing on the 'conversational structure' category, the wub's direct speech is also used to highlight how animal life is eventually

reintegrated with its environment, particularly through his discussions of mythological figure Odysseus. I thus argue that the wub's characterisation works to explore the relationship between entropy and animal life by focusing on basic yet entropic life processes like eating. As Blum claims 'a little free energy accompanied by a small local decrease in entropy by living systems is not in any way contrary to the second law of thermodynamics' (1955 [1951], p. 95). After the wub's former body is killed and cooked, the wub's cries for sympathy from Franco are forgotten and the wub, now in Franco's body, appears to embody an entropic perspective, becoming emotionally cold and offering a physicalist rationalising of its former body's plight. Drawing on proxemic and 'authorial' cues, however, Dick offers critique of those that sit at the top of energetic hierarchies (i.e. meat-eaters) and physicalist views of animal life.

4.5.1 The Wub

The wub is first introduced to the reader when it is brought aboard the spaceship. Drawing on Culpeper's characterisation framework, the wub is depicted in a 'setting' that is not its natural environment, but an atomic energy-driven spaceship. Keywords in the short story that highlight this setting are the lexical item *gangplank* (LL: 24.15) – *plank* also features but not quite high enough in statistical significance (LL: 14.92) – with the concordance lines showing the animals, including the wub, being led inside the ship: 'He looked toward the animals and birds being driven up the *gangplank* into the spaceship' (Dick 1999 [1952], p. 27). The wub itself highlights this setting in its direct speech telling Franco it '"was curious to see [and learn about] [the] ship"', and, in its last utterances before dying, it highlights its proximity to the ship's engines and power source: '"It is very warm [in the ship] […] I understand that we are close to the jets. Atomic power"' (ibid, p. 32). Given these textual cues, the keywords and the wub's direct speech, the spaceship 'setting' is clearly an important one in the story. This 'setting' is also clearly related to the concept of entropy. Clausius's discovery of entropy built on Carnot's attempts to make efficient engines, and 'combined [the] notion that heat engines must waste heat […] with the notion of energy […] in various forms […] as heat, electricity, sunshine, [or] biochemical' (Schneider & Sagan 2005, p. 43). The wub's last utterances regarding the ship's engines (*jets*), their energy source (*atomic*) and heat (*very warm*), a measure of entropy, seem to mirror the

elements important to Clausius's discovery. The wub is therefore characterised as a being immersed within and intimately connected to its entropic environment.

Whilst Franco identifies the wub as a 'pig', there is a lot of focus on its uncategorised nature, signalled by the repeated use of impersonal pronoun *it*, the accompanying illustration that was used for its publication in *Planet Stories* (July 1952), and the brief physical descriptions of the wub given in the story.

"What is it?"

The wub stood sagging, its great body settling slowly. It was sitting down, its eyes half shut. A few flies buzzed about its flank, and it switched [sic] its tail.

It sat. There was silence.

"It's a wub," Peterson said. "I got it from a native [...]. He said it was a very unusual animal. Very respected."

"This?" Franco poked the great sloping side of the wub. "It's a pig! A huge dirty pig" (Dick 1999 [1952], p. 28).

As can be seen in the above extract the impersonal pronoun *it* – *it* appears as a keyword in the corpus (LL: 50.48) – is used frequently in relation to the wub, the stylistic effect of which is the foregrounding of the creature's indeterminate animal nature. This is further elucidated by Peterson's direct speech, an explicit characterisation cue (i.e. 'other-presentation'), describing the creature as *very unusual*. Similarly, drawing on the 'animal body' schema, the wub is presented as an extremely muddled animal character. In the accompanying image printed alongside Dick's narrative, the creature appears to have broad padded feet with claws, a fin running along its back, a saurian tail and stance, a nose like a snout, a face with forward-facing eyes, floppy ears, a fur-covered, tiger-striped face and leopard-print body markings. The descriptions of the wub's body in the story also make categorisation of the wub difficult. It is described by the heterodiegetic narrator as having 'rough hair' (ibid) and later is described 'put[ting] its paws out, pulling its tail around it' (ibid, p. 32).

Despite Franco's assertion of the wub being a 'pig', these textual cues highlight either the indeterminate nature of the wub or physical traits that are not entirely pig-like. Even Franco remains unsure of his 'pig' classification: 'Captain Franco bade his men fetch the wub […] so that he might perceive what manner of beast it was. […] "Let's have a look at it." He advanced squinting critically. […] "I see," Captain Franco said. "Now, as to the taste. That's the real question"' (Dick 1999 [1952], p. 28). Unlike the other animals presented in Dick's story, such as 'the long-legged Martian go-birds', the wub is clearly far from easily categorised (ibid, p. 27). The wub is characterised as having a bodily indeterminacy that does not accord with taxonomic classification, appearing to be an amalgam of various animal body types and parts. Such dissolution of taxonomic boundaries between animal types, embodied by the wub, suggests a disordered mixture of animal matter that appears metaphorically entropic. As outlined in classical thermodynamics theory, the even distribution of molecules and atoms within a system is the end, high-entropy state. Indeed, Boltzmann noted that 'the entropy of a system was higher when the distribution of molecules was more even' (Cockshott 2009, p. 22). The wub also explicitly notes that his species is '"a very old race […] [v]ery old"', suggesting that the dissolution of the boundaries between animal types has occurred over time (Dick 1999 [1952], p. 30).

This interpretation is also strengthened by a focus on the wub's 'actions'. The concordance lines for the wub (see: figure 12) and more broadly throughout the short story suggest an exhausted animal character: *The wub stood sagging, it's great body settling slowly* (line 1); *The wub gasped* (line 5); *the wub […] sound asleep in the hold* (line 7); *the wub grunted and wheezed* (line 9); *the wub stood up unsteadily, panting* (line 13); *the wub eased itself down in the corner with a sigh* (line 29); *the wub looked up from where it lay in the corner* (line 41); *the wub rose, grunting* (line 43); *the wub settled down, panting* (line 46); *the wub looked up slowly* (line 49). Similar examples employing impersonal pronoun, *it*, also abound: *it was sitting down, its eyes half shut* (line 8); *It sat* (line 13); *after it eats it lies down and goes to sleep* (line 41); *it stood gasping, its tongue lolling foolishly* (line 79). All these actions characterise the wub as an unenergetic, slow and physically ungainly creature. The wub is frequently characterised as performing low energy activities, highlighted by the use of material process verbs, such

as *lay*, *sit*, *stood*, *look[ing], eas[ing], ris[ing]* and *fall[ing]*. The adverbs and adverbials used to describe these actions, including *sagging, unsteadily*, and *with a sigh*, often highlight the wub struggling to perform even these low-energy activities. The use of adverb *slowly* and non-finite verbs, such as *grunting, panting* and *gasping*, also achieve the same effect, making the finite verb, already low energy, appear as though it is a struggle for the wub. All these items suggest a creature who is continually physically exhausted.

1	ring. Franco walked toward him. "What is it?" The wub stood sagging, its great body settling slowly.
2	tail. _It_ sat. There was silence. "It's a wub," Peterson said. "I got it from a native for
3	This?" Franco poked the great sloping side of the wub. "It's a pig! A huge dirty pig!" "Yes
4	, it's a pig. The natives call it a wub." "A huge pig. It must weigh four hundred poun
5	." Franco grabbed a tuft of the rough hair. The wub gasped. Its eyes opened, small and moist. Then
6	its great mouth twitched. A tear rolled down the wub's cheek and splashed on the floor. "Maybe it'
7	ervously. "We'll soon find out," Franco said. The wub survived the take-off, sound asleep in the hol
8	g smoothly, Captain Franco bade his men fetch the wub upstairs so that he might perceive what manner
9	might perceive what manner of beast it was. The wub grunted and wheezed, squeezing up the passagew
10	"Come on," Jones grated, pulling at the rope. The wub twisted, rubbing its skin off on the smooth ch
11	said. "What is it?" "Peterson says it's a wub," Jones said. "It belongs to him." He kicked a
12	said. "It belongs to him." He kicked at the wub. The wub stood up unsteadily, panting. "What's
13	belongs to him." He kicked at the wub. The wub stood up unsteadily, panting. "What's the matt
14	. "Is it going to be sick?" They watched. The wub rolled its eyes mournfully. It gazed around at
15	ulations." Peterson came back with the water. The wub began to lap gratefully, splashing the men. Ca
16	want him here. I want to find out--" The wub stopped lapping and looked up at the Captain.
17	looked up at the Captain. "Really, Captain," the wub said. "I suggest we talk of other matters." Th
18	t. "What was that?" Franco said. "Just now." "The wub, sir," Peterson said. "It spoke." They all loo
19	Peterson said. "It spoke." They all looked at the wub. "What did it say? What did it say?" "It
20	alk about other things." Franco walked toward the wub. He went all around it, examining it from ever
21	it up and have a look." "Oh, goodness!" the wub cried. "Is that all you people can think of,
22	stood together, their faces blank, staring at the wub. The wub swished its tail. It belched suddenly
23	ether, their faces blank, staring at the wub. The wub swished its tail. It belched suddenly. "I beg

Figure 12: Concordance lines for lexeme *WUB* in AntConc

The characterisation of the wub as physically exhausted doesn't just come from the heterodiegetic narrator, but is also emphasised by the wub itself through explicit characterisation cues. When the wub introduces its species to Captain Franco, it suggests that 'It is difficult for us [the wub's species] to move around. You can appreciate anything so slow and heavy would be at the mercy of more agile forms of life. There was no use for us relying on physical defences. [...] Too heavy to run, too soft to fight' (Dick 1999 [1952], p. 30). The repeated use of the adjectives *slow, heavy,* and *soft,* coupled with the intensifiers (*so* & *too*), all suggest that the wub's species is an entropic one, which is physically exhausted. This characterisation strategy is one that is found in other texts that engage with entropy.

The wub in Dick's short story is therefore reminiscent of Campbell's (2003 [1935]) 'The Machine' in which humans become a lazy entropic species (see: Berger 1988). Characters lacking energy is a metaphorical extension of the entropy context which similarly appears to influence animal characters in entropy-inspired fiction.

Another characterisation strategy strongly associated with the wub is its love of eating – indeed, the semantic category 'F.1: Food' (LL: 32.21) is overall a significant category in 'Beyond Lies the Wub', which features the lexeme *EAT*. The wub's enjoyment of eating is both depicted in 'other-presentation' and 'self-presentation'. Describing the wub's habits, Peterson notes '"[i]t eats almost anything. I fed it on grain and it liked that. And then potatoes, and mash, and scraps from the table, and milk. It seems to enjoy eating"' (Dick 1999 [1952], p. 28). The wub's self-presentation also highlights such enjoyment: '"I, myself, love to eat. It is one of the greatest things that a living creature can enjoy"' (ibid, p. 33). The wub's love of eating is also presented implicitly via his physical corpulence. The collocate *great* (LR: 6.18) is thus used to suggest that the wub eats to excess (see: figure 13). Similarly, Franco's repeated descriptions of the wub's body, such as *huge* (ibid, p. 28) and *fat* (p. 29), also suggest the wub is a physically excessive creature.

The wub's characterisation as an organism that enjoys eating can be read, as mentioned in the introduction, along entropic lines. Eating is therefore both an entropy-producing and entropy-reducing process that leads to the degradation of energy and matter, but also decreases the organism's local levels of entropy. The importance of eating as an entropy-avoiding activity is highlighted by an interaction between Franco and the wub. When Franco asks the wub, '"How do you live?"', the wub's answer highlights that it has taken the question quite literally and in physical terms, suggesting that it eats: '"Plants. Vegetables. We can eat almost anything"' (Dick 1999 [1952], p. 30). Schrödinger's physical view of biological organisms in *What is Life?* presented a similar view of how biological organisms live: '[they] can only keep aloof from it [entropy], i.e. alive, by continually drawing from its environment negative entropy [free energy]' (1944, p. 25). The wub's characterised enjoyment of eating, a fundamentally entropic process, and his direct speech which highlights a purely physical view

of living in terms of energy consumption all emphasise the wub's involvement in energy consumption and entropy production.

1	Beyond Lies t	walked toward him. "What is it?" The	wub	stood sagging, its great body settling slowly.
3	Beyond Lies t	poked the great sloping side of the	wub.	"It's a pig! A huge dirty pig!"
38	Beyond Lies t	land and race...." The door opened. The	wub	stopped, turning its great head. Captain Franco

Figure 13: Collocate *GREAT* for lexeme *WUB* in LancsBox

The wub is an animal character that enjoys eating plants and vegetables, presenting the wub as a herbivorous creature. This is in contrast with the crew, particularly Franco, who are repeatedly foregrounded as meat eaters, treating the animal's collected from Mars as a meaty and energetic resource that can potentially '"run out"' (Dick 1999 [1952], p. 27). Drawing on the 'relational roles' category, the wub is considered by Franco to be a 'farm animal', signified by repeated though failed attempts to categorise it as a 'pig'. Indeed, according to Bulleid the main drive of the short story is to 'giv[e] voice to nonhuman experiences […] [and] directly challeng[e] human carnivorousness' (2019, p. 49). When Franco examines the creature, he concludes that the creature's taste is the most important thing and begins making preparations to butcher it: 'I doubt there's much point in fattening it up any more. It seems fat enough already. Where's the cook?' (Dick 1999 [1952], p. 29).[39] The wub's direct speech highlights that it is aware of these intentions: '"Is that all you people can think of, killing and cutting"'; '"I could see the image in your mind – most of me in the frozen food locker, some of me in the kettle, a bit for your pet cat –"'; '"[Y]ou are obsessed with the idea of eating me"' (ibid, p. 29, 30 & 31). Indeed, wmatrix's semantic tag 'F.1: Food' – (LL: 32.21) – not only highlights the wub's love of food, but also how the wub is in turn perceived as meat: lines 9, 14, 15, 16, 19, 20, 21 and 23 (see figure 14).

As mentioned above, the process of eating is an entropic one, but as Lindeman (1942) pointed out in his research on the energetics of food chains, the production of entropy is higher the higher up

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[39] As Adams (1990) has outlined, in carnocentric cultures, animals become absent referents through the process of butchering. When the animal is depicted as meat, as the wub is here despite being alive, its status as 'meat' helps to salve the conscience of the meat-eater, rendering the violence and death the animal undergoes invisible.

the food chain goes, with meat-eaters being at the top. As a reminder, he noted that with each rise in trophic level (producers → herbivores → carnivores) the energy conversion becomes less and less efficient, with a 'predator at each higher level deriv[ing] less energy from those they consume' (Schneider & Sagan 2005, p. 192). Considered in relation to contemporary farming practices, this means '[i]t takes nine pounds of feed grain to make one pound of steak [...] mean[ing] that only 11 percent of the feed goes to produce the beef' (Rifkin 2011, p. 200). In terms of environmental entropy, meat-eaters therefore contribute significantly more to entropy production.

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, " Franco said . " It 's to be    eaten       . Will you measure it and figure    9
what the outcome will be , " the   cook        said . " Well , I 'll be in the k  10
 said . " Well , I 'll be in the   kitchen     . Let me know as soon as you hear  11
" How do you live ? " " Plants .   Vegetables  . We can eat almost anything . We  12
" " Plants . Vegetables . We can   eat         almost anything . We 're very cat  13
r mind--most of me in the frozen   food        locker , some of me in the kettle 14
em-- " " Quite so . You spoke of   dining      on me . The taste , I am told , i  15
ort to such barbaric attitudes ?   Eat         me ? Rather you should discuss qu  16
be hard put to find something to   eat         for the next month . An unfortuna  17
e Captain walked to the door . "   Nuts        to you , " he said . He opened th  18
ou are obsessed with the idea of   eating      me . I wonder why . " " Get up ,   19
it the brain . It 's no good for   eating      . Do n't hit the chest . If the r  20
 the table , some of them hardly   eating      at all . The only one who seemed   21
te , at the potatoes , the green   peas        , and at the thick slab of tender  22
 the thick slab of tender , warm   meat        . He opened his mouth . No sound   23
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Figure 14: Concordance lines for semtag 'F1: Food' in Wmatrix

The wub's position as a herbivorous creature, a lower trophic level, who is eventually eaten by a carnivorous human character, a higher trophic level (albeit the wub itself in Franco's body), allows the story to explore entropy on a subjective and less cosmic scale. The wub's final words before it dies are important for this entropic reading of the wub's death and consumption. As it curls up to die, the wub comments poignantly that '"It is very warm [...] I understand that we are close to the jets. Atomic power. You have done many wonderful things with it – technically. Apparently your scientific hierarchy is not equipped to solve moral, ethical [problems]"' (Dick 1999 [1952], p. 32). The wub's dying words appear incongruous with the narrated action, yet, as noted above, its mention of heat (entropy) at this specific point in the story connects its death to the entropic processes at work aboard the ship. The wub, however, also points out that *scientific hierarchies*, like trophic levels, are largely inadequate for ethical

and moral questions, like who should eat what or whom. Indeed, when Franco states that the wub is needed as an energy source (food) – '"we will be hard put to find something to eat for the next month"' – the wub argues that in order to determine who is eaten '"it [would] be more in accord with […] principles of democracy if [the crew] all drew straws"' (ibid, p. 30). The wub's pleas are not heeded and Franco kills the creature just as he used to kill '"dirty razorback hogs"' on his family's farm (ibid, p. 33). By foregrounding the practice of meat-eating, where the wub is placed in the relational position of 'farm animal', Dick's short story raises concerns about the ethics of trophic levels, specifically how entropy is produced and energy spent in biospheric systems.

The wub's body reappears, after a narrative gap in which the reader infers the creature's body is butchered and cooked, as a 'thick slab of tender, warm meat' (Dick 1999 [1952], p. 33). The wub's comments that the meat '"is only organic matter, now"' highlight the inertness of its former body, death being the final entropic state to which an organism must eventually succumb, and a purely physicalist view of organic life. Indeed, the Wub's description of its former body as mere *matter* and sense of detachment suggest an acceptance of the ubiquity of entropic forces on organic life, where the organism is broken down and reintegrated with its environment. These ideas are similarly foregrounded, although more metaphorically, in the wub's direct speech where it repeatedly raises the Odysseus myth in conversations with Peterson. In fact, the topic of *Odysseus* is repeated frequently enough in the wub's speech that it appears as a keyword in the corpus (LL: 48.30). Drawing on Culpeper's 'conversational structure' category, the wub's repeated attempts to discuss the Odysseus myth can be seen as an extreme form of 'skip-connecting', where the interruption consists of the wub's former body being shot, cooked and eaten.[40]

Before the wub is shot, it states that Odysseus is a common mythological figure and offers an interpretation of the story:

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[40] Skip-connecting is where 'a speaker produces an utterance that is […] related to a prior utterance, but [is] not related to the directly prior utterance, but some utterance prior to the directly prior utterance' (Sacks 2006 [1992], p. 349).

"As I interpret it, Odysseus wanders as an individual aware of himself as such. [...] This is the idea of separation. [...] The process of individuation."

"But Odysseus returns to his home". Peterson looked out the port window, at the stars, endless stars, burning intently in the empty universe [...]

"As must all creatures. The moment of separation is a temporary period [...] It begins, it ends. The wanderer returns to land and race. . . .' (Dick 1999 [1952], p. 31).

After the wub, now Franco, has eaten its former body, it attempts to resume this topic: '"As I was saying before I was interrupted, the role of Odysseus in the myths –"' and '"To go on, [...] Odysseus, as I understand him – "' (ibid, p. 33). The fact that the consumption of the wub's former body is structurally framed by his discussion of the Odysseus story suggests that it is pertinent to an interpretation of the intervening event. As with the wub's body eventually becoming merely *warm meat* and *organic matter*, the Odysseus story highlights that an organism's separation from its environment is in fact a temporary one – *separation is [...] temporary, returns to land and race*. This subjective perspective is connected to a broader cosmic one, as Peterson gazes at *the endless stars, burning intently in the empty universe*. The eventual emptiness of the universe, the heat death hypothesis, is at the core of classical thermodynamic interpretations of entropy. The conceptual metaphor LIFE IS A JOURNEY – for example, *Odysseus wanders*; *Odysseus returns home*; *it begins, it ends*; *The wanderer returns* – is employed here to underpin the connection between the organism's finite lifespan and that of the universe's. The wub's characterisation via direct speech highlights its complete indifference to its former body, the eating of which is framed by its repeated topic of conversation, the Odysseus story. These textual cues show the wub character evoking a particularly entropic perspective, where death triumphs over everyone and everything.

Despite later embodying this entropic perspective, the wub initially resists being turned into meat, commenting to the armed Franco, '"Can you expect me to rush eagerly to my death?"' (Dick 1999 [1952], p. 32). Unlike Ballard's human characters, described as dissolving heroes who 'do[] not fight, but instead seek[] [...] to be absorbed' with the environment, the wub does not happily dissolve and

pleads for its life (Cawthorn 1966, p. 144). These pleas allow the story to question the ethics of energy hierarchies, as mentioned above, where 'carnivorous kin luxuriate on the distilled energies of life, [with] their way paid by organisms' lower down the chain (Schneider & Sagan 2005, p. 192).

This ethical concern raised initially by the wub appears to have an effect on the crew in the last few paragraphs of the story. The dinner scene depicts the crew fleeing the table due to the wub's callous and entropic perspective:

"More? And some wine, perhaps[,]" [said the wub]

"Not me", French said. "I think I'll go back to the chart room."

"Me too." Jones stood up […] "I'll see you later" […]

Some of the others excused themselves.

"What do you suppose the matter is?" […] "It's only organic matter now" […]

Two more men got up and went out (Dick 1999 [1952], p. 33).

Drawing on the 'appearance' category from Culpeper's framework, which also covers proxemics, the wub's question – *What do you suppose the matter is?* – suggests it is aware that the crew's actions, i.e. leaving the table, are likely an evaluation of its attitude. Here, the spatial distance created between the crew and the wub can be interpreted through proxemic analysis, in which 'intimates [are expected] to be relatively close together and strangers to be relatively far apart' (Culpeper 2001, p. 222). Though the crew are not strangers to the wub, these proxemic cues are used to suggest not physical distance, but emotional distance.[41] A number of other 'authorial cues', particularly adverbs, also suggest this interpretation, with the crew 's[itting] *glumly* around the table' and 'Peterson star[ing] *dejectedly* at the table' (Dick 1999 [1952], p. 33). The crew clearly disapprove of the consumption of the wub's former body and the use of it as an energy source. These proxemic and 'authorial cues' challenge the entropic and indifferent perspective of the wub towards its former body.

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[41] This idea is also captured by the conceptual metaphor EMOTIONAL INTIMACY IS PHYSICAL CLOSENESS (see: Kövecses 1986).

4.6 J G Ballard's (1962) *The Drowned World*

Ballard's *Drowned World* focuses on a world that, due to solar fluctuations, is becoming an exotic jungle, with what is left of humanity surviving at the dwindling poles. The swampy jungle has long been associated with a metaphoric representation of entropy, as sf novelists frequently employ this setting to signal 'the steady loss of organization in the civilizations upon which it [...] encroaches' (Zamora 1989, p. 71). Human fertility is on the wane, as are all mammalian animal species, with the only creatures doing well being the arthropods, including insects, and reptilian forms of life.[42] Reptilian species, like iguanas, crocodiles, and lizards, appear to be ascending to take the dominant role on the planet. Kerans and Bodkin are the ecological surveyors sent to collect and document specimens in the tropics, which were formerly London. The drowned world is a challenge for the human characters who are frequently depicted suffering from malaria, often unable to sleep, and being driven slightly mad. Hardman, for example, heads into the jungle to die. The surveyors eventually encounter Strangman, a treasure hunter who drains the flooded streets to reap its wealth. He is presented in a predatory fashion – Strangman's crew create a mythology around a crocodilian figure named Mistah Bones, an old boss alligator, which is a thinly veiled allusion to Strangman. Strangman proceeds to terrorise the survey team with a pack of alligators. After Strangman is apprehended by a military patrol, Kerans heads south into the jungle, like Hardman, which the reader infers will be a one-way journey.

Writing about Ballard's disaster tryptic, including the *Drowned World*, Beckman (2017) focuses exclusively on the representation of birds, but in all of these texts arthropods and reptiles feature just as prominently. Herman (2018), for example, has noted there is proliferation of reptiles in Ballard's *Drowned World*, where reptilian characters 'are more or less literally taking up residence in [...] boardrooms in flooded high-rise buildings' and is inclined to read the reptiles as signal of 'trans-species atavism' (pp. 270-271). Though he doesn't mention this explicitly, his focus on atavism, a process he argues presents occurring across species, links to depictions of devolution in entropy-inspired sf. Langford and Nichols point out that 'entropy became popular in the 1960s, and with it came a new

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[42] Arthropods are a taxa which includes creatures with an exoskeleton, including all insects, spiders, and crabs.

lease of life for devolution stories' (2018, p. 167). Devolution, therefore, emphasises regression, which as Blum (1955 [1951]) noted was against the seemingly anti-entropic drive and progressive trends seen in evolutionary development.

The animal characters I will be focusing on therefore – the arthropods and reptiles – are all examples of animal life taking a devolutionary trajectory, which accords with the entropic context. I argue that the arthropod characters can be seen as active agents of entropy, linked to the human characters' physical or mental decline. Foregrounded aspects of their characterisation, like their link to the sun's energy, social order, or appetite contrast with the human characters' unenergetic, disordered and sickly states, highlighting entropy via contrast. The reptiles, unlike the insects, are linked to physical descriptions that highlight entropy, such as coldness and inanimacy. The iguanas are particularly linked with 'vocalisations' that align them with nightmarish reptilian figures that haunt the human characters' dreams of dissolution. The crocodiles are more broadly considered a destructive, entropic force, particularly through their connection with militaristic lexis. The 'behavioural traits' (for the iguanas) and 'ecological niche' (for the crocodiles) schemas are also challenged, depicting these characters in un-naturalistic ways and foregrounding increased predation and metabolism , which, as mentioned above, can be an entropic process.

4.6.1 Arthropods

Taken cumulatively, the arthropod characters foregrounded in this novel are the mosquitoes, which have grown to gigantic sizes – *mosquito* (LL 6.04) and *mosquitoes* (LL 10.35) – and spiders – *spider* (LL 2.78), *spiders* (LL 16.18) and *waterspider* (LL 4.83), though other arthropod characters appear also – *flies* (LL 4.98). Drawing on the 'species' schema, the choice to represent numerous arthropod characters in the story represents a strong instance of entropic characterisation. As mentioned above, in Wells's (2005 [1895]) *The Time Machine*, the only characters depicted in the earth's entropic stages are crab-like creatures. Depicting animals that feature early in the evolutionary development of life on earth suggests a movement backwards in evolutionary progression, as noted above. Ballard's choice to employ arthropods highlights an acknowledgement of the forward (and conversely backwards)

trajectory of evolution, the 'arrow of time', that the second law provided it with. Indeed, Bodkin notes that his and Kerans' biological surveying has 'carefully catalogued the backward journeys of […] many plants and animals' (Ballard 2012 [1962], p. 42).

The choice of arthropods also feels particularly entropic when considering the 'ecological niche' schema. Such creatures often fall within the scavenger niche, and Ballard's choice to present creatures that live off decaying remnants connects these characters with the broader entropic themes of death and decay found in the novel. Arthropods are therefore often agents of decay, through whose actions the dead are speedily decomposed and returned to an energy-less state. In complement, other animals, excluding the reptile characters, are depicted as dead or dying, including: *fish* – '[d]ying fish and marine plants expired' (Ballard 2012 [1962], p. 124) and 'a flotsam of stunned eels' (ibid, p. 98) – and various invertebrates – 'the curving dunes dotted with cuttle-fish and nautiloids' (p. 168); and 'a debris of conches and dismembered starfish' (p. 137). Similarly, though mainly presented in similes, mammals also feature, including: *buffalo* – 'like a wounded buffalo' (p. 65); and *whale* – 'like the leaking bloodstream of a whale' (ibid, p. 127), 'like the velvet belly of a stranded whale' (p. 147), and 'like the belly of an expiring whale' (p. 164). References to birds highlight death via a focus on their ghostly presences: 'ever-present phantoms which attended him like sentinel birds' (p. 86). The presence of arthropod characters, particularly in relation to how other animals are presented in the novel, suggests a focus on those species that are complicit in the entropic drive towards death and decay. This is particularly true of the fly and insect characters in *Drowned World*.

1	giant Anopheles mosquito, the size of a dragon-	fly, spat through the air past his face, then
2	dead vegetation and rotting animal carcasses. Huge	flies spun by, bouncing off the wire cage of
3	and discreet, thousands of miles away from the	fly-blown vegetation and tepid jungle water twenty
4	hand, trying to brush it away like a	fly, then flexed his facial muscles in an ugly
5	slumped to one side against his stone pillow.	Flies began to swarm across the ground and buzzed
6	back to the vanished sun, oblivious of the	flies settling on his face and beard. "It's
7	and began to wipe the rain and dead	flies from the man's face. Taking the ravaged

Figure 15: Concordance lines for lexeme *FLY* in AntConc

In lines 2 and 5-7 (figure 15), the flies are depicted as being present around dead and dying bodies. Drawing on Culpeper's framework, this highlights the flies' typical 'company'. Line 2 presents the flies as subjects of a material process clause, situated within a lagoon filled with *rotting animal carcases*. Their description as *huge,* similar to the characterisation of the mosquitoes mentioned below, further highlights the extent of the entropic environment, as the reader likely infers the flies increasing size is due to an abundance of food. In lines 5-7, Kerans comes across a 'huge emaciated figure on the ground', his colleague Hardman, who is surrounded by flies (Ballard 2012 [1962], p. 170). Line 5 presents them, similar to line 2, as subjects of a material process clause involved in the activity of scavenging on Hardman's dying body. Line 6 shows the flies as an embedded fact clause, with the adjective *oblivious* acting in similar vein to mental projection clauses, within an overarching relational process structure – He […] , [was] oblivious (ibid, p. 171) – in which Hardman is the subject (see: Halliday & Matthiessen 2004, p. 474). Though embedded, compared to Hardman who is presented as accepting his decay, the flies are subjects actively engaged in the entropic process. Indeed, as Zencey (1986) notes, death and decay are clear manifestations of entropy. Finally, line 7 sees the flies as direct objects of a material process clause, but in this instance they are themselves dead bodies. As Viney (2007) notes in Ballard's fiction, flies enjoy an integral position often presented as 'ferocious feeders', whose scavenging on human corpses 'provides a consummate image of human powerlessness [and] […] the essential transience of human life'.

There is some overlap between the characterisation strategies of the *flies* and those of *insects*. The use of *flyblown* in line 3 (figure 15), meaning something infested or contaminated with flies, and the presentation of insects in line 3 (figure 16) – *insect-strewn fluid* – and line 7 – *myriads of insects festered along the water-line* – highlights the proliferation of flies and insects in *The Drowned World*. However, the representation of insects and flies here also highlights the insect stereotype of 'pestiferousness' found in many sf works, evaluating these characters negatively (see: Murphy 2008). Opposed to other sf texts, this strategy forms only part of the characterisation of these arthropods. Line 2 (figure 16) shows *insect* characters flying away from *rotting logs* in a relative clause, which similar to

the flies presents them amongst a 'setting' of decaying matter. Unlike flies, insects are only depicted as subjects in line 5, which depicts them *bouncing off the wire mesh* protecting Kerans's boat – an instance of a non-finite clause with an overt subject. Though not often seen as subjects of material processes, line 6 presents insects as agentive through the embedded noun phrase structure which includes the non-finite post-modification clause, i.e. *pulsing and humming hungrily above*.

In line 5 (figure 16), insects more so than flies are presented as voracious – *a corona of a million insects pulsing and humming hungrily above.* As with references to the *huge flies*, the adverb *hungrily* highlights the voracity of these insect characters, suggesting not only proliferation of death and decay, but their agentive role in the entropic process. Focusing on the 'proper names' category, though as mentioned in the approach section (see: section 2.1) naming strategies for animal characters when not individualised include the species name, there is an interesting naming strategy for insects in line 5. Employing the noun phrase (*a corona of […]*) connects the lexical item corona, a hapax legomena in this corpus, to insect characters.[43] It depicts insect characters causing a hazy atmosphere leading to the scattering of light that makes a corona visible. Though corona are optical illusion phenomena, this can be read as a metaphor for entropy, with the scattering of light being analogous to the dissipation of the sun's energy. The insects in *Drowned World* therefore are not just extensions of the entropic environment, merely part of the background setting for the human characters' story. The agency afforded these characters, teased out by grammatical analysis, suggests that they are active agents of entropy, and via naming strategies – *a corona of* […] – they are also linked, albeit metaphorically, to the dissipation of energy.

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[43] Corona are luminous rings surrounding a celestial body, like the sun or the moon, particularly when viewed through a haze or cloud. This is caused by the diffraction and scattering of light, which slows when passing through the intervening medium.

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1    the mounting heat was bringing the huge predatory  insects  out of their lairs all over the moss-
2                            the wake of the cutter, snapping at the  insects  dislodged from the air-weed and rotting lo
3        that pool—"he indicated the tank of steaming,  insect-strewn fluid—" will damn' nearly boil. What
4                    fire, like the blazing facetted eyes of gigantic  insects. A two-storey drum some fifty feet in
5                            the silt flat, a corona of a million  insects  pulsing and humming hungrily above it, and
6                    stared across the table at each other, the  insects  outside bouncing off the wire mesh as the
7        eyries in the submerged office blocks. Myriads of  insects  festered along the water-line, momentarily
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Figure 16: Concordance lines for lexeme *INSECT* in AntConc

Mosquitoes, still arthropods but not scavengers, can similarly be linked to the context of entropy. Like the insect characters, mosquitoes are depicted as voracious in line 1 (figure 16) – *the huge predatory insects out of their lairs* – and, though their connection to decay and entropy is less direct than the flies (i.e. they don't feed on decaying matter), their entropic roles are still foregrounded in their interaction with human characters. They are subjects of a material process clause in line 1 (figure 17) and are, therefore, afforded agency. As with the flies, they are not merely extensions of an entropic environment. Focusing on the 'proper name' category, the post-modification position in which the characters' names appear in lines 4 and 5 suggest mosquitoes are also extremely prolific. Descriptions of the mosquito characters forming *a cloud*, highlighting the erratic and un-coordinated movements of many individual creatures, also suggests disorder, such as classical thermodynamic theorists witnessed in molecular and atomic descriptions of entropy. As many have noted, entropy is frequently presented through the disorder metaphor (Zencey 1986, Haglund et al 2010).

The 'behavioural traits' schema is challenged by some characterisations of the mosquitoes, as they are depicted out in the daytime despite mosquitoes' preferences for dusk. Indeed, these characters appear driven by, and connected to, the sun's energy, through lexical items *heat* and *sunlight*: line 1 (figure 16) – *the mounting heat was bringing the huge predatory insects out*; line 4 (figure 17) extended – *the open sunlight in the centre of a cloud of mosquitoes*; and line 5 extended – *the air free of the enormous clouds of mosquitoes which would later be roused from their nests by the heat*. The clause structure also works towards this end with line 1 (figure 16) representing the mosquitoes as an object affected by the subject's (*the mounting heat*'s) actions. Similarly, in line 5 (figure 17) the

mosquitoes are objects of the relative clause where a passive material process (*would […] be roused*) connects them again with the sun's energy (*by the heat*), which features as an agent.

Connecting the mosquitoes to the sun's energy, along with their size (line 1, figure 17) and prolificness (line 4 & 5), offers a useful contrast between these characters and the human characters whom they are implicitly depicted feeding upon. Drawing on the 'ecological interaction' schema, the reader will bring to the text their knowledge that mosquitoes are parasitic, feeding on the blood of animals, and will be avoided by their prey where possible. The pre-modification of *insects* [mosquitoes] in line 1 (figure 16) – *the huge predatory* – suggests that these creatures are characters others are wary of. This is also clear from the references to *wire* and *mesh* in lines 2 and 6, both of which are keywords in the text (LL 16.49 & LL 37.94 respectively), and highlight human characters' attempts to avoid the creatures. The 'company' category also becomes prominent in the concordance lines with human characters in close proximity to mosquitoes. In line 2, Kerans studies the mosquitoes *which had slipped through the wire hatch*, and line 3 depicts Macready *swat[ing] at the mosquitoes*. The use of phrasal verb *slipped through* in line 2 has connotations of slipperiness, a 'trait' attached to the mosquitoes, and suggests that their presence in human living spaces is unwelcome. Readers will also be aware that through ecological interactions between parasitic mosquitoes and host animals, it is likely infections, chiefly malaria, are spread. Indeed, the story's later references to *malaria,* marginally missing keyword status (LL 14.51), are caused by the mosquitoes' bites. The narrator later links Kerans's physical disintegration to the infection: 'a chronic lack of appetite, and the new malarias, had shrunk the dry leathery skin under his cheekbones, emphasising the ascetic cast of his face' (Ballard 2012 [1962], p. 11). The mosquitoes' interactions with the human characters highlights their role in the humans' rapid decay and disintegration, much like the flies.

Hit	KWIC	File
1	vintage whiskies and brandies. A giant Anopheles mosquito, the size of a dragon-fly, spat through	The Drow
2	k. Kerans studiously examined a pair of Anopheles mosquitoes which had slipped through the wire hatc	The Drow
3	supposed to be putting up?" Swatting at the mosquitoes with his forage cap, Macready looked ar	The Drow
4	sunlight in the centre of a cloud of mosquitoes only a few token sections around Riggs'	The Drow
5	, the air free of the enormous clouds of mosquitoes which would later be roused from their	The Drow
6	the terrace, where the wire mesh of the mosquito screen had been ballooned outwards until	The Drow

Figure 17: Concordance lines for lexeme *MOSQUITO* in AntConc

The final arthropod characters considered in this section are the spiders.[44] Again, there are some similarities to the presentation of other characters. Line 6 (figure 18), for example, shows spiders as subjects of material process *raced*, suggesting particularly energetic agents, which also contrasts with the human characters. Like the mosquitoes, the spiders' characterisation challenges the 'behavioural traits' schema. In line 1 and 5, the spiders are depicted as members of colonies. Spiders rarely form social colonies, with the vast majority of spider species being solitary hunters, including water spiders and wolf spiders. Indeed, water and wolf spiders do not build webs, making the likelihood of colony behaviour even more remote. The representation of these characters forming social groups creates a contrast with the human characters, whose social bonds are dissolving (see: Greenland 1983). Extending line 5, the spider characters occur in a non-finite clause, with the main clause depicting Kerans watching Strangman's arrival – 'he caught a glimpse of a tall, broad-shouldered man in the cockpit, wearing a white helmet and jerkin' (Ballard 2012 [1962], p. 82). Throughout the entire chapter, Kerans merely watches Strangman only introducing himself when forced to do so by Bodkin. Unlike the clouds of mosquitoes, insect colonies are highly ordered, and the human characters' disintegrating social bonds in contrast represent a metaphorical state of disorder and entropy.

Unlike the mosquitoes, however, the spiders are implicated not in the human characters' physical decay but are used to highlight their mental decline. Concordance lines 3 and 4 (figure 18) link spiders to inherited memories, formed during the evolutionary development of life on earth:

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[44] Line 2 & 7 (figure 18) are not explored here as they relate to objects or other characters.

[C]an you explain the universal but completely groundless loathing of the spider, only one species of which has ever been known to sting? […] Simply because we all carry within us a submerged memory of the time when the giant spiders were lethal (Ballard 2012 [1962], p. 43).

The spider characters are linked to atavistic memories within the human characters' minds. As mentioned above, evolution was seen by Lotka (1922) and Blum (1955 [1951]) as having a unidirectional flow due to the second law of thermodynamics. Indeed, leading up to discussion of these memories between the human characters, Bodkin notes that 'a biological process isn't completely reversible' (ibid, p. 42). Atavism is a biological mutation which challenges evolutionary striving towards progress and development, presenting instead a devolutionary and entropic trajectory and aligning with many sf depictions of entropy in which energy and the life it sustains eventually degrades. Though not biological atavism, this atavistic memory works to highlight a similar trajectory. *The Drowned World* suggests this, with Bodkin noting that the human crew are 'being plunged back into the archaeopsychic past', with the adverb *back* highlighting resistance to the unidirectional evolutionary flow (Ballard 2012 [1962], p. 44). The human characters' discussion of these memories suggests that the spiders, as well as the other arthropod characters considered here, can be seen as active agents of entropy.
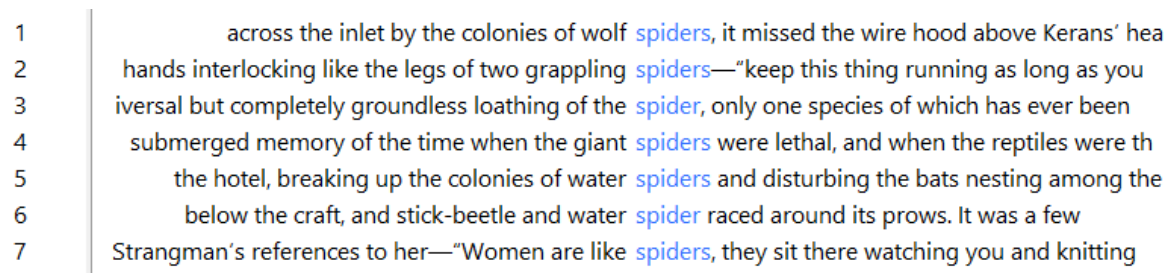

1	across the inlet by the colonies of wolf	spiders, it missed the wire hood above Kerans' hea
2	hands interlocking like the legs of two grappling	spiders—"keep this thing running as long as you
3	iversal but completely groundless loathing of the	spider, only one species of which has ever been
4	submerged memory of the time when the giant	spiders were lethal, and when the reptiles were th
5	the hotel, breaking up the colonies of water	spiders and disturbing the bats nesting among the
6	below the craft, and stick-beetle and water	spider raced around its prows. It was a few
7	Strangman's references to her—"Women are like	spiders, they sit there watching you and knitting

Figure 18: Concordance lines for lexeme *SPIDER* in AntConc

4.6.2 Reptiles

Other than the arthropods, the reptile characters are the most extensively presented animal characters in *The Drowned* World. Indeed, the keywords suggest that reptiles have taken over. Both *alligators* (LL: 84.24) and *iguanas* (LL: 102.14) feature extremely prominently especially with their attending lexemes – *alligator* (LL: 46.80) and *iguana* (LL: 24.32). Other statistically significant reptile characters include:

the *crocodile* (LL: 29.18) (and plural (LL: 2.27)), the *reptile* (LL: 19.45) (and plural (LL: 43.77)), and the *lizard* (LL: 24.35) (and plural (LL 24.32)). Less statistically significant, other reptile characters are also present, including the *snake* (LL: 0.78) (and plural (LL: 8.47)) and *water-snakes* (LL: 4.86). Drawing on the 'species' schema, Ballard's novel thus seems to be disproportionately weighted towards characterising cold-blooded forms of life. A focus on reptilian characters aligns with Ballard's interest with entropy, as not only can their coldblooded nature be read as a metaphor for the encroaching coldness predicted by the classical thermodynamic heat death hypothesis, but also they are creatures developed early in life's evolutionary history, whose sudden prolificness can be read along devolutionary lines.

This is most noticeable with the *pelycosaur* character (LL: 14.51 – just under significance level). The pelycosaur is an extinct early reptilian group, known as 'sail-backed reptiles', that lived during the Permian era and they are the first reptile characters presented in the novel. They are introduced in a mock report that Bodkin sends to Camp Byrd, the human resettlement camp located at the North Pole. Although Bodkin's reported sighting is fake, the reptile's purported return turns out to be portentous. Bodkin later states that '"[t]he joke was on us. The reason they didn't take the report seriously at Byrd was that ours wasn't the first reported"' (Ballard 2012 [1962], p. 74). In the fake report, he describes the creature as '[a] large sail-backed lizard with gigantic dorsal fin […] seen cruising across one of the lagoons, in all respects indistinguishable from the Pelycosaur, an early Pennsylvanian reptile' (ibid, p. 9). His descriptions of the scale of the creature – *large* and *gigantic* – and its relaxed manner – *cruising* – presents a flourishing species, well suited to its environment. As the creature later turns out to be a reality, Kerans's comment that the pelycosaur would '"herald[ ] the momentous return of the age of the great reptiles"' rings true (ibid). His reference to *the momentous return of the age of the great reptiles* here foregrounds the idea of dominant species, with the pelycosaur character signalling this shift towards reptiles' domination, which combined with the death and decay of other later forms of life suggests an entropic de-evolutionary force. Ballard's presentation of a world filled with largely reptilian animal characters also presents life on Earth as becoming more homogenous. Homogeneity,

as mentioned above, can be seen as the entropic equilibrium or end state in closed systems, particularly at the molecular and atomic level.

1	songs and local news—an attack by two iguanas on the helicopter the previous night, the
2	of the office blocks and department stores, the iguanas watched them go past, their hard frozen he
3	had a strange dream-like beauty, but the iguanas and basilisks brought the fantasy down to
4	away, on a projecting cornice, a trio of iguanas watched with stony disapproval, whipping t
5	the Type X Anopheles, skin cancers and the iguanas shrieking all night down below, you'll get
6	flapping fronds of the fern-trees, driving the iguanas across the rooftops. Beatrice brought a dr
7	, switch their menu to wood soup and steak iguana. Fuel raised more serious problems. The res
8	the green tunnels like clouds of exploding soot, iguanas sat motionlessly on the shaded cornices li
9	the sounds of the helicopter, a school of iguana had approached, and the reptiles were now s
10	, referring in passing to the voices of the iguanas. Enigmatically, Bodkin only nodded to hims
11	t reptiles had been terrifying. He remembered the iguanas braying and lungeing across the steps of t
12	he water; occasionally a marmoset gibbered or the iguanas shrieked distantly from their eyries in th
13	-storey climb up the stairway—already a few iguanas had made their homes on the lower landings
14	the stuff—six months. But I'd prefer iguana." "No doubt the iguana would prefer us. All
15	. But I'd prefer iguana." "No doubt the iguana would prefer us. All right then, that seems
16	-tipped boat-hook to drive away two small iguanas idling on the jetty, he slid the catamaran
17	animal sound not unlike that emitted by the iguanas. It drew nearer, mingled with the drone of

Figure 19: Concordance lines for lexeme *IGUANA* in AntConc

Moving on to the iguanas, these creature's characterisation strategies are varied but similarly link them to entropy. The iguanas' association with coldness can be seen in lines 2 and 8, with line 2 (extended) (figure 19) highlighting a cold 'appearance' – *their hard frozen heads jerking stiffly* – and line 8 – *iguanas sat motionlessly on shaded cornices* – presenting them in a shaded 'setting'. Other instances seem to highlight emotional coldness, as when Kerans describes the iguana's faces 'as ancient and impassive' (Ballard 2012 [1962], p. 18). This characterisation strategy is also found for the *lizard* characters: 'shading the lizard's in their window lairs' (ibid, p. 83). As mentioned above, cold-blooded reptilian characters can be seen as a metaphorical allusion to entropic heat death. In conjunction with the 'trait' of coldness, the iguanas are also aligned with inanimacy. The iguanas' 'actions' are thus described as *watch[ing]* (line 2 & 4), *s[itting] motionlessly* (line 8) and *idling on the jetty* (line 16). The characterisation of inanimacy reaches its zenith when the iguana characters are described using lexical items *stone* and *stony*. In line 4, the iguanas watch Bodkin *with stony disapproval*, and line 8 (extended) depicts the iguanas *s[itting] motionlessly […] like stone sphinxes*. Lizard characters are also described using these lexical items: 'a white monitor lizard sat and regarded him with its stony eyes' (ibid, p. 116).

The characterisation of the iguanas and lizards here also appears similar to that of the crystallised crocodile in *The Crystal World* (Ballard 2014 [1966]). The connection between the iguanas (and other lizard characters) and traits like coldness and inanimacy appear a metaphorical manifestation of the second law. The iguanas' inanimacy highlights the fate of all life once the energy in the system has dissipated, leaving none to be utilised to perform future work.

The characterisation of reptilian characters as *stony* or *crystalline* also presents animal characters as not merely entropic, but also inorganic. Blum's (1955 [1951]) view of evolution through the perspective afforded by the second law focuses largely on prebiotic chemical evolution. In so doing, he and others like Oparin (1938 [1924]) propose that organic life developed from earlier chemical (inorganic) reactions, and that these metabolic processes shaped all future developments of organic life. These theories are known as metabolism first theories, and key to all of them, as the name suggests, is 'the idea of a gradual genetic take-over of a metabolic process', which places fundamental importance on the utilisation and concurrent degradation of available energy (Michaelian 2011, p 38). Metabolism first theories – Blum refers to Oparin's research as the 'heterotrophe hypothesis' but it is later known as 'metabolism first' (1955 [1951], p. 163) – suggest that simple inorganic molecules react by utilising the energy available in the environment which leads to simple building blocks such as amino acids. These are followed by more complex molecules, like proteins, that subsequently group together and carry out metabolic functions. A focus on the inorganic chemical components of organic life is reflected in the above characterisation of the iguana's inorganic nature, and also appears in line with the devolutionary trajectory traced by the text.[45]

Drawing on the 'vocalisations' category, which I have added to Culpeper's framework, the iguana characters are associated with the lexical item *SHRIEK* (lines 5 & 12, figure 19). Similarly, in line 11, the iguanas are depicted as *braying*. The iguanas' vocalisations are later described as 'raucous barks'

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[45] Another suggestion of the metabolism first hypothesis' influence in *Drowned World* includes the description of the pool in the 'Pool of Thanatos' chapter. Kerans describes the 'green translucent depths' and 'the warm amniotic jelly' of the primordial pool into which he is about to dive (Ballard 2012 [1962], p. 99). Oparin's (1938 [1924]) metabolism first theory described how the network of chemicals would form a thick jelly-like substance on the top of the sea. Drawing on the 'context' category, this primordial soup is inhabited by 'small albino python' whose connection to such surroundings similarly links reptiles to life's thermodynamic and entropy producing origins (Ballard 2012 [1962], p. 99).

(Ballard 2012 [1962], p. 70) and in line 17 (extended) a plane landing in the lagoon is compared to the *harsh animal sound not unlike that emitted by the iguanas*. In all these cases, the lexical items highlight the iguanas' vocalisations as being harsh, with this characteristic working in synthesis with their characterisation as *stony* creatures. These creatures' vocalisations negatively affect Kerans who suffers 'a dull fear' on hearing them (ibid, p. 69), as well as the other characters who 'get precious little sleep' due to their shrieking (ibid, p. 26). Being visibly shaken by the iguanas' shrieking, Bodkin tells Kerans to '"[b]e warned […] [as] you may hear them again"', foreshadowing the nightmarish reptiles that have already appeared in many of the crews' dreams and appear to send them mad (ibid, p. 70). When Kerans does sleep, reptilian characters begin to appear in his nightmares, whose vocalisations also have an overwhelming effect on him:

> As the great sun drummed nearer, almost filling the sky itself, the dense vegetation […] flung back abruptly, to reveal the black and stone-grey heads of enormous Triassic lizards. […] [T]hey began to roar together at the sun, the noise gradually mounting until it became indistinguishable from the volcanic pounding of the solar flares. Kerans felt beating within him […] the powerful mesmeric pull of the braying reptiles, and stepped out into the lake […]. [H]e felt the barriers which divided his own cells from the surrounding medium dissolving, […] spreading outwards across the black thudding water (ibid, p. 71).

The reptile characters' vocalisations – *roar* – become part of the pounding energy of the sun in Kerans's nightmare. These characters are also presented using the same lexis – *braying* – as the iguanas. The reptiles' *braying*, appearing as part of the post-modification of the noun phrase, *the powerful mesmeric pull,* also emphasises the overwhelming power they have over Kerans. Connecting the reptiles to the sun, the energetic source of all life, as with the mosquitoes, offers a contrast to Kerans, who is depicted undergoing physical dissolution, a situation which appears to be brought about by the reptiles' *braying*. Like the flies and mosquitoes, the iguanas and their reptilian nightmarish counterparts are presented as being involved with Kerans's physical dissolution, a clear depiction of entropy.

Finally, the iguana characters appear increasingly predatory. This challenges the 'ecological niche'

schema for iguana, whose largely herbivorous nature – though juveniles do eat insects – changes in

Drowned World. Line 15 (figure 19) suggests they now have a taste for human flesh: *No doubt the*

Iguana would prefer [to eat] us. This is also later confirmed when Kerans enters the jungle, heading

south along a dead beach towards his inevitable death. In lines 24 and 25 (figure 20), the iguana are

presented as *snarl[ing]*, *lung[ing]* and *attacking* Kerans. Although line 26 does not present the iguanas

directly attacking Kerans, it does depict them behaving in a predatory manner, as he suspects they are

stalking him – *an iguana had followed him* – in his wounded state. Similarly, in line 27, the narrator

states that 'as long as the iguanas failed to scent him, Hardman would move forward' (Ballard 2012

[1962], p. 173). The conditional clause – *as long as […]* – suggests the fatal consequences of an

encounter between Hardman and the iguanas, particularly if *forward* is read figuratively as 'living'.[46]

The iguanas' characterisation highlights them as predators who view the human characters as a source

of food. As mentioned in the analysis of Dick's (1999 [1952]) 'Beyond Lies the Wub', meat-eating is a

practice linked to high levels of entropy, and the iguanas switching from a vegetarian diet suggests a

connection to the greater entropic forces overtaking the Earth.

24	endless twilight world of the forest floor, the	iguanas	snarl and lunge. His ankle had begun to
25	night, he pressed on, shooting off the attacking	iguanas,	darting from the shelter of one massive t
26	Kerans looked around him quickly, wondering if an	iguana	had followed him into the ruin. But the
27	by the sun, and as long as the	iguanas	failed to scent him, Hardman would move fo

Figure 20: Concordance lines for lexeme *IGUANA* in AntConc

Besides the iguanas, the most common reptilian characters are the crocodiles – for this analysis, I

consider the lexemes *CROCODILE*, *CAIMAN* and *ALLIGATOR* as synonymous. These characters come to

the foreground when Strangman arrives in the lagoon (span 2, figure 21), who as mentioned above is

referred to by his crew as Mistah Bones, portraying him as an old boss crocodile. Initially, when the

crocodiles appear, there is a focus on their overwhelming numbers, evident in the concordance lines:

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[46] Underpinned by the conceptual metaphor LIFE IS A JOURNEY.

line 7 (figure 22) – *the great mass of alligators*; line 9 – *the press of alligators fighting to get into the creek*; line 13 – *there are thousands of them*; line 14 – *the shoal of alligators*; (line 34) – 'the intervening lagoon seethed with alligators' (Ballard 2012 [1962], p. 86). The narrator also describes them as an 'oncoming mass' (ibid, p. 87). As with the pelycosaur, this highlights the homogenous and entropic nature of organic life now present in *Drowned World*.

The crocodiles challenge the standard 'relational role' ('wild animal') schema between human and crocodiles, instead presenting them fulfilling the role of 'pets'. This is particularly highlighted when the crocodiles are described by Kerans and Beatrice as watchdogs: '"You're a well-trained watchdog"' and '"Those devilish things must be their watch-guards"' ((Ballard 2012 [1962], pp. 87-88). The textual cues present crocodiles not only taking up a position previously held by dogs, but also as having dog-like behaviours. A number of 'behavioural traits' appear to challenge the crocodile schema. In line 5, for example, an overt simile structure compares the crocodiles with dogs – *the alligators congregated like hounds around their master*. In line 6, the alligators' grouping behaviour is also described as 'packish' – *join[ing] the pack*. In most cases, crocodilians are considered solitary predators (Mader 2006, p. 113), and presenting them engaging in packish behaviour is largely un-naturalistic. In their pack, the crocodiles proceed to 'cruis[e] shoulder to shoulder in a clockwise spiral' around Strangman (Ballard 2012 [1962], pp. 86-87). The prepositional phrase functioning as an adverb, *in a clockwise spiral*, draws on the negative connotations of the lexical item *spiral* to convey an entropic decline, something the appositive noun phrase at the end of the clause makes clear – 'in a clockwise spiral […], a massive group incarnation of reptilian evil' (ibid). Presenting these crocodiles with dog-like roles and behaviours shows normal human-animal relationships as being in a state of disorder and turmoil, linked, through their spiralling packish behaviour, to entropy.[47]

In a similar vein, the crocodiles first appear in the chapter 'Carnival of Alligators', a carnival being an event that celebrates disorder and chaos. The carnival atmosphere is also signalled via noun phrases

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[47] As Agathocleous notes, 'the scientific idea of heat death intersected with discourses on moral, artistic, social and biological decline' (Conrad & Agathocleous 2009, p. 288). Here the crocodiles' association with 'evil' presents a moral decline.

that describe the crocodilian gatherings as a *troupe* – 'a tame troupe of tarantulas [reference to crocodiles]' (Ballard 2012 [1962], p. 88) and (line 28) 'a troupe of trained alligators' (p. 120).[48] This also links with the aforementioned characterisation as dogs, as the lexical items *tame* and *trained* are often states brought about by interactions between humans and dogs. In addition, the lexical item *troupe*, denoting 'a traveling band of performers', suggests these crocodile characters' roles appear unbelievable, an instance where the synthetic aspect of these characters is brought to the foreground. Similarly, Kerans describes them as 'insane' (ibid, p. 175). As Bakhtin (1941) highlights, disordered relationships and unusual behaviour are often featured in depictions of the 'carnivalesque' in literature. The crocodile's depiction as performing actors in a carnival production clearly fits this description, but is also works to highlight entropy, since regression and atavism are often central to a carnival's action and plot (Weisenburger 1995).

As well as crocodiles taking up positions formerly held by dogs, they also feature as Strangman's animal army, a pattern that can be seen through militaristic lexis – this characterisation strategy can be linked to Wmatrix's semantic category 'G3: Warfare, defence and the army; weapons' (LL: 51.99), significant in *Drowned World*. Exploring the 'actions' category, when Strangman arrives in the lagoon, the caiman are described *bringing up the rear* in line 10 (figure 22). The crocodiles also 't[ake] up their positions on the […] roof tops' (Ballard 2012 [1962], p. 87) and 'station themselves at points around the shore' (ibid, p. 88). Kerans similarly notes that the creatures can be seen 'cruising about slowly in small patrols' (ibid). In addition to actions, the crocodiles are also described as an 'armada' (ibid, p. 87). The agency behind these crocodile characters' actions, represented in a relative clause, is later shown to be Strangman: (line 42) 'the alligators Strangman had posted around the lagoon' (ibid, p. 145). The crocodile characters' connection to military lexis and Strangman highlights their destructive and entropic function.[49] On entering the lagoon, for example, the crocodile armada immediately destroy Kerans's plane – (line 9 – extended, figure 22) 'it was engulfed […] by the press of alligators fighting to

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[48] Strangman's boat is also referred to later as 'a lost carnival float' (Ballard 2012 [1962], p. 97)
[49] Earlier in the novel, the military are seen wielding the ultimate destructive power: 'had the report [on the Pelycosaur] been taken at face value […] an army […] would have descended […], backed by a tactical atomic weapons unit' (Ballard 2012 [1962], p. 9).

get into the creek and cut to pieces in their snapping jaws' (ibid, p. 87). The crocodiles' 'actions' – *cut* (*to pieces*) – suggest the unidirectional nature of the destruction, suggesting that Kerans's plane is unsalvageable. Though the destruction of the plane is matter being destroyed, it can be read metaphorically as the entropic process of energy dissipation.
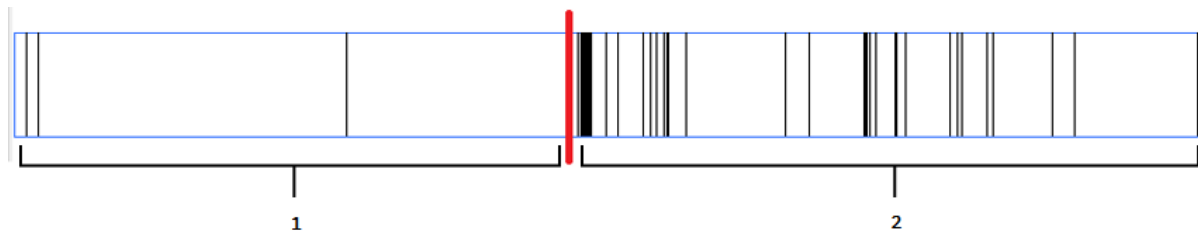

Figure 21: Concordance plot for lexemes *CROCODILE, CAIMAN,* and *ALLIGATOR* in AntConc

Like Strangman and the rest of his crew, depicted killing the biological survey team one by one, the crocodiles are depicted in an exaggeratedly predatory fashion. For example, earlier in the novel, crocodiles are depicted as ambush predators, affirming the 'ecological niche' schema for crocodiles. Kerans observes 'a motionless stone-headed creature snap[ ] out and pluck[ ] [a] bat from the air', catching the sight of 'crushed wings clamped in the lizard's jaws' as it 'shr[i]nk[s] back invisibly among the foliage' (Ballard 2012 [1962], p. 18). However, when the crocodiles enter the lagoon, an interaction between them and Kerans sees them pursuing him outside their usual habitat:

> a large caiman […] spotted Kerans […] and veered towards him, its eyes steadying. Its rough scaly
>
> back and the crest along its tail flexed powerfully as it surged through the water. Quickly Kerans
>
> retreated […] as the caiman lumbered out of the shallows on its short hooked legs and lunged at
>
> his feet (ibid, p. 87).

Compared with the earlier depiction of crocodiles as ambush predators, the crocodile character in this example is presented in an un-naturalistic manner: not ambushing prey, but *lumber[ing]* after it. The lexis in this passage, which contrasts the creature's suitability for the water – *steadying*, *powerfully, surged* – with its unsuitability for the land – *lumbered, short hooked legs* – draws attention to the crocodile's perfect adaptability within its standard niche.

Another very similar interaction occurs later in the novel. When the biological research crew explore a cul-de-sac, formerly flooded but drained by Strangman, 'a small caiman lunge[s] at them from a shallow pool' (ibid, p. 127). The caiman 'rac[es] behind them', pursuing them, its 'tail whipping slowly, jaws flexing' (ibid, p. 128). When Bodkin falls, 'the caiman's head pivot[s] towards them', and Kerans shouts after him, '"Alan! Hurry!"' (ibid). The decayed street where this encounter occurs is described as a 'gateway to a sewer', filled with 'rotting organic forms' and the 'rusting shells of cars', positioning the crocodile's appetite as being part of the broader entropic forces at play in the drained street (ibid, p. 127). Though the caiman is *small*, it is clear from both interactions that Kerans and the crew perceive themselves to be potential prey, with Kerans commenting that he was '"damn' nearly eaten"' (ibid, p. 88). The crocodile characters view humans as potential prey and are presented, like the iguanas, as voracious predators, whose ecological niche appears to have expanded beyond their usual subterranean habitat.

3	-line windows, then revealed itself to be a	crocodile	snapping at a waterfowl, or one end of
4	tails lashing the foam. By far the largest	alligators	he had seen, many of them over twenty-
5	face raised almost jauntily to one side. The	alligators	congregated like hounds around their ma
6	the morning air. More and more of the	alligators	joined the pack, cruising shoulder to s
7	into the next lagoon, the great mass of	alligators	surging along behind it. A few detached
8	up the snow-white belly of a dead	alligator	crushed by the hydroplane. As the advanc
9	it was engulfed, upended by the press of	alligators	fighting to get into the creek and cut
10	to pieces in their snapping jaws. A large	caiman	bringing up the rear spotted Kerans waist-d
11	his shoulders, reached the fire escape as the	caiman	lumbered out of the shallows on its short
12	at the knob on the end of the	caiman	's snout, grinning as it bellowed and backed
13	against his damp shirt. "Have you seen the	alligators	? There are thousands of them!" "Seen th
14	was circling it at speed, the shoal of	alligators	following in its wake, those at the tai
15	jungle was motionless in the immense heat, the	alligators	hiding in whatever shade they could fin
16	. By the way, I don't like your	alligators	." "They won't hurt you." Strangman lean
17	by the sounds of rifle fire as an	alligator	venturing too near the divers was despat
18	midnight breakfast—Strangman and his entourage of	alligators	and one-eyed mulattoes still frightened

Figure 22: Concordance lines for lexemes *CROCODILE, CAIMAN* and *ALLIGATOR* in AntConc

Drawing on the 'species' schema, reptiles are creatures that have extremely slow metabolisms, something challenged by the characterisation of them as active and voracious predators. This offers a noticeable comparison with the human characters, who, as mentioned in the mosquito analysis (see

section 4.6.1), suffer 'a chronic lack of appetite' (Ballard 2012 [1962], p. 11). The human characters' lack of appetite remains consistent throughout the narrative, bearing a textual trace in the form of an under-represented semantic domain, 'F1: Food' (*LL:35.38*), which includes lexical items such as BREAKFAST, LUNCH, DINNER, FEED and EAT. The characterisation of the crocodiles here and the iguanas above appears to show them as organisms driven to compete for available energy and entropy production, theorised by Lotka (1922) as the maximum power principle. In seeing the utilization of energy as a fundamental driving force behind natural selection, he highlighted that organisms better able to utilise energy (unlocked by chemical metabolism) and minimise their own levels of entropy would increase their 'fitness' for survival. Observing the reptilian characters, Kerans begins to understand 'the implacable hatred one zoological class feels towards another that usurps it' (Ballard 2012 [1962], p. 18). These crocodile characters' expanding ecological niche and increased metabolism suggests they are creatures driven by such energetic and entropy-producing motives.

4.7 Charles Platt's (1966) 'The Rodent Laboratory'

I noted in the introduction (see: section 4.2) that entropy is frequently explored by sf authors via crumbling social structures and relationships. Unlike most others, however, in Platt's short story, it is an animal society that is, at least, the dual focus of such decline. This short story follows a population experiment on rats in a small enclosure. Over time, the rat society is frequently depicted practicing acts of cannibalism, aggression and eventually exists in a state of complete physical torpor. Such descriptions link with contemporaneous psychological research, in which this aberrant behaviour due to overcrowding is referred to as a behavioural sink (Calhoun 1962).[50] Depictions of behavioural sinks, like those presented in this story, can be linked to representations of societies going through an entropic decline, since as Ramsden and Adams note '[t]he macabre spectacle of crowded psychopathological rats [...] w[as] quickly adopted as "scientific evidence" of social decay' (2009, p. 763)

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[50] John Calhoun's (1962) experiments on 'rodent universes' proposed a link between the overcrowding of mammalian populations and psychopathic behavioural tendencies. He referred to these tendencies, such as cannibalism and high infant mortality (96% in certain enclosures), as 'behavioural sinks', suggesting that animal societies (and human) can go through entropic decline when particular resources are sparse – Calhoun's experiments restricted not food but space.

– they also note that Calhoun's choice of 'sink' purposefully evoked entropic connotations. The scientists become obsessed with the rat society, barely venturing out of the laboratory and '"forg[e]tt[ing] the existence of anything but the experiment"' (ibid, p. 29). In the final throes of rat society and the human laboratory, the rats achieve a group awareness, which is also experienced by the scientists. They subsequently manage to escape their enclosure, at which point the laboratory is simultaneously destroyed by a thunderstorm.

The characterisation of the rats are the focus of this analysis and they appear as keywords in the text: *rats* (LL: 112.73, and singular LL: 0.93) and *rodents* (LL: 23.50 and singular LL: 39.30) – my analysis looks at both these lexemes. I argue that the rats are depicted as a swarm highlighting homogeneity, which similar to other animal characters above highlights entropy. Similarly, the rats' enclosure ('setting') is presented as a closed or isolated system, often used in classic thermodynamics to track the system's movement towards equilibrium. In many ways, the rats in Platt's text are seen as analogous to the molecular states in classical thermodynamic systems, eventually reaching an entropic equilibrium, characterised as complete lethargy. In this state, challenging the 'animal capabilities' schema, the rats' achieve group awareness, which characterises them as being in a state of dissolution, much like the final entropic state that all organisms eventually reach (i.e. death). The text also draws on metaphoric extensions of entropy, where social decline is seen as entropic. The rats' 'actions', for example, become increasingly unhealthy, a symptom of the rat society's decline. Finally, the rats are also characterised, as are all living organisms, as open systems, capable of utilising energy and producing entropy. For example, they are viewed by the scientists through infra-red viewing equipment at night making their heat loss (and entropy production) visible. They are also depicted, in the end, escaping their entropic closed system via the food access tube, which can be read allegorically: the rats can avoid entropy by utilising food (or, as is presented in this text, objects strongly associated with food), like all animals.

4.7.1 Rats

The choice of rats is relevant for the entropy context in a number of ways. The 'behavioural traits' schema, for example, will involve knowledge that rats are creatures that form swarms, due largely to their prodigious reproductive capacities. Textual cues that highlight such behaviours are the keywords *overcrowded* (LL: 62.56) and *crowded* (LL: 48.14), which are used to describe the rats' society (and humans'), as well as descriptions of their breeding habits – 'now, […] there was no longer any room in the hutches for females to rear their young' (Platt 1966, p. 25). Similarly, the rats' swarming behaviour also affords comparisons between them and insects: Harris describes the rats as 'brown shapes [that] wriggled and scuttled' (ibid) – *scuttl[e]* is also used in line 8 (figure 23). Although such swarming behaviour is an effect of the experiment, the behaviour still draws on traditional cultural stereotypes of rats (Cole 2016). Like the *Drowned World*'s almost exclusive focus on arthropod and reptilian life, characterising the rats as a swarm suggests homogeneity which, as noted above, is frequently depicted as the end state for animal life in entropic environments.[51] As well as being creatures that form homogeneous swarms, rats are animals that tend to fulfil the 'ecological niche' of scavenger. Though these rat characters are provided with ample food within the laboratory environment, there are still depictions of them scavenging, made explicit via textual cues: 'Here come the scavengers' (Platt 1966, p. 35). Rats are therefore presented not only as homogeneous swarming creatures, but also as fulfilling a niche that associates them with death and decay, a manifestation of entropy in relation to life and its processes.

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[51] Indeed, the biological description of swarms suggests they are homogeneous, formed of individuals of the same species (Georgi & Jung 2010, p. 65).

1	the brightly-lit test area below him. The rats were in one of their more active states:
2	in one corner of the enclosure, suckling young rats only two or three days old, baring her
3	the area below, fascinated by the active, busy rats feeding and resting, procreating and dying in
4	sorry," Harris said. He looked back at the rats. In one corner, it looked as if a
5	attle-scarred male and a younger, unusually large rat baring its fangs and making aggressive pawing
6	to us, as city dwellers . . ." "They're only rats, Philip. Is it that important?" "You're close
7	shorter. The leadership is still held by one rat but the battles occur more frequently, now; th
8	was overpowering. Under the one-way glass, the rats scuttled about, oblivious of the men watching
9	infra-red viewing equipment. As light faded, the rats' activity slowed; many of them lay down to
10	of pattern in the random movements of the rats — began to imagine they showed some kind of
11	movement; but then it seemed as if the rats instinctively knew what they were doing. In o
12	the chamber checking on the control group of rats kept separate from the over-populated test ar
13	look?" But as he spoke the circle of rats broke up and they suddenly scattered into ran
14	, he was sure of the impression that the rats moved as if guided by some . . . something .
15	this time, following his gaze down onto the rats' enclosure. Once this room had been used for
16	the feeding trough." As they watched, the large rat threw itself at a smaller one, dragging it
17	smaller one twitched and lay still. The large rat eagerly seized its place at the trough. "Inter
18	Here come the scavengers." Thin, nervous-looking rats sidled up to the corpse of the victim
19	didn't reply. Harris looked down at the rats again. Suddenly, they all broke away from the
20	, they started to converge into a circle. The rats moved hesitantly, yet the overall movement se
21	and looked down into the enclosure. But the rats were acting as if nothing had happened; they
22	d rodent world in the experimental enclosure. The rats had entered yet another habit-pattern; the ac
23	, as he noticed that every little movement the rats made drew them closer to forming one large
24	four walls. Everyone was concerned only with the rats below. Eventually, the influx of people dimin
25	atched in expectant silence, the movements of the rats became smaller and less frequent. The circle
26	ciousness, he looked down into the enclosure. The rats were engaged in mad activity; one of the
27	excitedly and pointed at the activity below. The rats had become a co-ordinated team, like a
28	was better than this; it spoke of intelligence. Rats crowded to one corner of the enclosure — wher
29	chamber. Few people paid any attention to the rats. Men staggered and fell, some clutching their
30	fascinated and captured by the spectacle of the rats. They had broken open the lower door of
31	a slow death of the society and the rats in it . . . "What's happening?" Laurian shout
32	to gain their footing and reach the exit. Rats scurried mindlessly around; one sank its teet

Figure 23: Concordance lines for lexeme *RAT* in AntConc

Drawing on the 'setting' category, the rat characters are depicted in a laboratory. The conditions under which laboratory rats are kept mirrors the kind of heavily-controlled closed or isolated systems within which the classical thermodynamic concept of entropy was discovered.[52] Repeated references are made to the rats' enclosure as being a closed system, with *enclosure* featuring as a collocate (LR 7.09) for the lexeme *RAT*. In line 25 (figure 23), for example, it is described as a 'cramped, enclosed rodent world' (Platt 1966, p. 36) and line 27 as an 'overcrowded rodent world in [an] experimental enclosure' (p. 40). The laboratory in which the scientists reside mirrors the rats' enclosure and is also

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[52] Laboratory animals are not kept in entirely closed systems, however, as animals themselves are open systems that require matter and energy flow to be kept alive.

presented as not merely a closed system, but an isolated one: 'constant-light and constant-temperature created the sensation of a[n] [...] enclosure separate from the rest of the universe' (ibid, p. 37). In this material process clause, a 'creative' sub-type, the outcome of the *constant-light and constant-temperature* is 'the coming into existence of [...] the Goal', i.e. *the sensation of a[n] [...] enclosure separate from the rest of the universe* (Halliday & Matthiessen 2004, p. 184). The choice of pre-modifier *constant* highlights one of the prerequisites for isolated thermodynamic systems, isolated systems being those kept at a constant temperature (see: Schneider & Sagan 2005, p. 26).

Although this closed system analogy only holds up in certain respects – there is an exchange of matter in the rats' enclosure, which has an 'access tube for replenishing their [the rats'] food supplies' (Platt 1966, p. 41) – it is as close as possible to a closed system containing living organisms. In this respect, the rats are partly characterised as analogous to the molecular and atomic elements observed in the closed systems of classical thermodynamics. Harris's numerous references to the rats as mere abstractions – *brown shapes* (ibid, p. 25) – and his description of their movements as *random* (line 11, figure 23) presents a physicalist view of the rats, with *random* particularly foregrounding entropy and disorder, strengthening such interpretations. Similarly, as with closed or isolated thermodynamic systems, the end point of the rodent experiment seems to be one in which equilibrium conditions, the high-entropy end state, is reached (see: Schneider & Sagan 2005, p. 26). Indeed, Harris states that 'the cripplingly restricted environment' will eventually lead to the rats' deaths (Platt 1966, p. 42). In the final stages before the rats escape their enclosure, they reach such an equilibrium state:

> the activity and movement of the past weeks had suddenly ceased, and now they lay dormant or crawled short distances lethargically as if the effort was too much trouble to make. Their eyes glinted in the lights of their enclosure, dull and unblinking (ibid, p. 40).

Through a variety of lexical items – *activity [...] ceased*, *dormant*, *crawled*, *lethargically*, *the effort was too much*, *dull and unblinking* – the rats are here characterised as exhausted creatures.

As mentioned above, however, rats are open systems, requiring an exchange of matter and energy (i.e. food), so depicting the rats as analogous to molecules in a closed-system, though hinted at, can

only be employed intermittently throughout the text. Indeed, focusing solely on the entropic end-state of rat society, with thousands of dead and dying rats, would make the narrative largely uneventful. Drawing on the 'actions' category, at the beginning of the experiment, the rats are described by Harris as being in an *active state[]* (line 1, figure 23). The narrator describes the rats as rearing their young – 'a mother crouched in one corner of the enclosure, suckling young rats' (Platt 1966, p. 25) – procreating – 'a male chased a female into one of the breeding hutches' (ibid) – and feeding – 'a group of them huddled round the feeding trough' (ibid), all fundamental life processes showing the rats utilising the energy available in their environment and resisting entropy.

However, the energetic actions of the rats are often balanced with unenergetic ones. For example, the above 'actions' are described by the narrator through a string of gerunds: *feeding and resting, procreating and dying* (line 3, figure 23). These co-ordinated noun phrases highlight this balance, with *feed* balanced by *rest* and *procreate* with *die*. As noted above in relation to the rats' final state, a focus on physical exhaustion or lethargy can be read as depictions of entropy. Also, through these gerunds' sequential nature, attention is drawn to the final entropic state of the rats (i.e. death). In line 9 & 10 (extended) also, the lights of the enclosure are turned low and the rats are shown sleeping – *the rats' activity slowed; many of them lay down to sleep* – challenging the 'behavioural traits' schema for rats who are largely nocturnal. Although sleep itself emphasises physical exhaustion, the rats are connected to entropic processes more literally whilst sleeping. Harris, therefore, observes them through 'infra-red viewing equipment' – *infra* features as a keyword (LL: 17.87) – which highlights the rats dissipating energy gained from feeding as wasted heat, an entropic process (Platt 1966, p. 30).

Additionally, the above actions are seen through Harris's entropic perspective: 'if one stood and watched [the rats] long enough, one could find some law or purpose to the meaninglessness of it all' (Platt 1966, p. 26). Harris's reference to a 'law' is an explicit acknowledgement of the second law and the nihilistic attitude to which it may lead. As mentioned in section 4.3, 'the notion that everything in the universe is caught up in an eternal and irresistible process of decay, against which [...] all constructive endeavour must ultimately prove futile' is one way entropy is depicted in sf (Stableford

2014, p. 160). The rats are characterised here as creatures whose actions are deemed unimportant and meaningless, achieved through contextualising their actions within the broader context of entropy. Any speciesist assumptions, however, are undermined through a parity between the rat and human characters' actions. For example, the scientists queuing for lunch are described in a similar manner to the rats at the feeding trough: 'an observer looking upon the scene from above would have seen the […] jostling forms moving with a seeming randomness of purpose' (ibid, p. 34).

The rats are initially depicted as feeding and procreating, but, as foreshadowed earlier in the story, 'the whole stability of the system [the rats' society] is breaking up' (Platt 1966, p. 28). The rats' 'actions' become increasingly unhealthy. They are depicted eating their young – 'some of the mothers have eaten their young straight after birth' (ibid) – and cannibalising their dead. In line 20 (extended), the scavenging rats are depicted as 'thin, nervous-looking rats [who] sidle[] up to the corpse of the victim and began dragging it away' (ibid, p. 35). Cannibalism is documented in rodents but is rather uncommon (Lane-Petter 1968). As well as cannibalism, some rats (line 18 & 19 – extended) are presented killing others:

> the large rat threw itself at a smaller one, dragging it by the neck, kicking up the sanded flooring.
> It bit viciously, and the smaller one twitched and lay still. The large rat eagerly seized its place at
> the trough (Platt 1966, p. 34).

The lexical items *threw*, *dragging, kicking, bit,* and *seized* are all lexical items that foreground violence. These rats' cannibalistic and murderous 'actions' are clear signs of the rat society in an entropic decline, especially as food, the scarcity of which usually leads to such behaviour, is abundant in the rats' enclosure. The rats' unhealthy actions can be linked to Calhoun's research on behavioural sinks and can be seen as a kind of social entropy. As discussed in the introduction to this chapter (see section 4.3), social entropy, in which crumbling social relationships are depicted, is a frequent metaphoric manifestation of the concept of entropy in sf texts.

As well as depicting the rat population in entropic decline, Harris observes the rats synchronising their actions on a number of occasions (lines 11-14, 22-23, 31-32, figure 23): 'a group of fifteen or

twenty of them began to form up in a circle, facing inwards […] they acted in unison' (Platt 1966, p. 30); 'the rodents formed a near-perfect circle, all of them facing inwards, and then froze' (ibid, p. 35); 'the movements of the rats became smaller and less frequent. The circle of the brown rodents was perfectly formed' (ibid, p. 41). As with the end entropic state of the rats, physical torpor and inactivity are highlighted through lexical items *froze* and *smaller and less frequent*. Challenging the 'animal capabilities' schema, after forming a circle, Harris suggests the rats are able to achieve a group awareness. As the rats are not internally focalised, however, this awareness is described by Harris who also feels its effects: 'he seemed suddenly aware of the whole research block, and of all the people in it' (ibid, p. 35) and 'he felt as one with every person in the chamber – his eyes were their eyes, his mind linked with their minds, as one perfect interconnected whole' (ibid, p. 41). In a state of torpor, the rats (and scientists) are depicted in a state of dissolution, where the boundaries between themselves, other animals and their environment breaks down. The rats are hereby characterised in ways similar to Ballard's protagonists in his disaster tryptic, which Greenland discuses as the dissolving hero trope (see section 4.3). Such dissolution of an organism occurs largely during its death and decay, its final entropic state.

As well as signalling individual dissolution, the rats' circular arrangement is foregrounded during their group awareness: '[Harris] noted every little movement the rats made drew them closer to forming one large circle' (Platt 1966, p. 41). The circle is also repeatedly described as *perfectly formed* and *near-perfect*. This description places emphasis on the even distribution of the rats, especially compared with the rats' swarming tendencies noted above. For example, the rats are earlier described as having 'certain meal-periods when the whole population decides […] to feed itself', whilst 'the rest of the time there's little activity round the food troughs' with 'very few of [the rats] go[ing] near there' (ibid, p. 35). The rats' perfect circle therefore appears a rare instance where the rats are spread consistently throughout their enclosure. Such arrangements can be read in light of Boltzmann's distributional and probabilistic equation for entropy that focused on the most probable arrangement of molecules in closed systems. To draw on an analogy, whilst the oxygen in a room could congregate

in a single corner, this is not the most probable distribution, an even distribution being most likely. Boltzmann thus realised that 'the randomisation of molecules to equiprobable distribution corresponds [...] with the maximum entropy for a closed system' (Schneider & Sagan 2005, p. 50).

As mentioned above, the rats' 'setting', their enclosure, can be read analogously as a closed system, and Harris explains that the rats' circling actions and group awareness is caused by such a system: 'it seemed to come as if it were a natural function of their environment [...] when everything became sufficiently familiar and well known; when each day is identical and one's surroundings are permanent and constantly experienced' (Platt 1966, p. 43). Similarly, again mirroring the rats' enclosure, just before the scientists experience the sensation, Harris describes the laboratory environment as 'nearing its maximum' (ibid, p. 39). The rats' 'setting' is therefore seen as instrumental in bringing about their group awareness and individual dissolution.

In a sympathetic final twist to the rats' characterisation, the rats are depicted in 'mad activity', desperately trying to escape their enclosure:

The rats had become a co-ordinated team like a rippling mass of ants [...]. Yet the co-ordination was better than this; it spoke of intelligence. Rats crowded to one corner of the enclosure – where, Harris recalled, there was an access tube for replenishing their food. They held small bright objects in their teeth and paws, almost like tools; [...] they began levering and scraping the little door at the top of the access tube. [....] They had broken open the lower door of the access tube [...] Soon they would be able to escape through the simple trapdoor. [...] They had to escape [...] They had to escape to survive (Platt 1966, p. 41).

Unlike the perfectly formed circle, the rats return to their swarming behaviour, where they *crowd to one corner of the enclosure*, the opposite of the evenly distributed circle. They are also compared via simile structure to *a rippling mass of ants*, in which the lexical description – *a rippling mass* – again highlights swarm-like characterisations of the rats. Their attempts to escape their enclosure are aided by small tools the rats have made from 'pieces of metal' and 'slivers of wood' collected from the feeding troughs (ibid, p. 35). The rats eventually escape the enclosure via the *access tube for replenishing their*

food. Overall, the means by which the rats escape their entropic enclosure is by utilising parts of their environment associated with food, such as tools constructed from feeding troughs and the food access tube. As mentioned above (Schrödinger 1944), animals are only able to resist entropy via feeding (chemical metabolism). In Platt's text, the rats' escape from their entropic fate using objects associated with food can be read allegorically, highlighting the activities all animals must perform to avoid entropy.

4.8 Conclusions

In the introduction (see section 4.3) I noted that, whilst there has been research that focused on entropy as a context in science fiction (see: Hewitt 1994, Zamora 1989, Nicol 1976, Roberts 2001), many of these explorations focused on classical thermodynamic theory. These studies tend to focus on the 'heat death hypothesis' scenario and often what this might mean for often human life on a hypothesised future Earth. In some cases, I have found similarities between those studies and this research. For example, the animal characters that predominate in Ballard's (2012 [1962]) *The Drowned World* – arthropods and reptiles – are those similarly proposed in Wells's (2005 [1895]) *The Time Machine*, in which the devolution of life on earth, represented by creatures which evolved earlier in life's history, come to signify an entropic trajectory. My focus on these texts also noted the following patterns. The types of animal characters chosen in these texts also foregrounded classical entropy. In *The Drowned World* (Ballard 2012 [1962]) and 'The Rodent Laboratory' (Platt 1966), for example, the authors presented animal characters that fell within the 'ecological niche' of 'scavenger', like the arthropods (p. 151) and the rats (p. 169). Indeed, those beings that thrive on death and decay can be considered obvious manifestations of entropy. Another strategy focusing on classical depictions of entropy was the homogeneity of the animal life on display, highlighted by foregrounding swarming activities, like the reptiles (p. 158), crocodiles (p. 162) and rats (pp. 168-169), or foregrounding the decline of certain animal species compared to others (p. 151 & p. 158).

I also showed that many of these animal characters are not merely extensions of the entropic future Earth's environment, but are active agents in entropic processes of degradation and dissolution. In particular, I noted that the arthropods and (some) reptiles in *The Drowned World* – flies (pp. 151-

152), mosquitoes (pp. 154-155), spiders (pp. 156-157), and iguanas (pp. 160-161) – were involved in the physical and mental decline of the human characters. Previous work on entropy in Ballard's disaster tryptic has thus highlighted the dissolving hero trope in Ballard's fiction (Cawthorn 1966, Greenland 1983), but the analyses conducted above highlights how implicated the animal characters are in these characters' entropic decline. I also showed that in line with classical thermodynamic approaches to entropy the animal character's here occasionally embody an entropic perspective. The wub's characterisation, for example, shifts dramatically regarding his position on meat-eating, which emphasises an acceptance of a cold, physicalist perspective on animal life and death (pp. 146-148).

As well as past researchers' narrow scope that focused mainly on classical thermodynamic views of entropy, the texts analysed by scholars were often limited to a few well-known New Wave authors, particularly Ballard (see: Beckman 2017, Greenland 1983, Ingwersen 2016, Nicol 1976). I therefore partly focused on sf authors that have remained relatively obscure. Analysing Platt's (1966) 'The Rodent Laboratory', I showed how Platt had employed classical thermodynamic views of entropy and analogously compared it to the laboratory conditions that rats are often kept within. The rats were characterised as abstractions (p. 171) that eventually reach an equilibrium, high-entropy state (p. 171 & pp. 174-175). Unlike many other sf authors' explorations of entropy, Platt appears to reconnect entropy with its closed system origins, exploring not the macro-scale (relationship between Earth and Sun) but the micro-scale (atomic and molecular) implications of the idea. In this regard, Platt's text appears a unique engagement with entropy, unlike any past scholars and critics have identified, and one discovered by broadening the authors considered in relation to this scientific context.

Although classical thermodynamic depictions of entropy influence all the animal characters analysed here in various ways, often through metaphorical extensions of the idea – lethargy and inactivity, for example, influenced many of the animal characters in these texts (the wub, pp. 141-142, the iguanas, pp. 159-160, the rats, pp. 171-172) – very few critics have explored entropy and its application to living organisms and those open systems that comprise the focus of NET. I argued that scholars such as Blum (1955 [1951]), Lindeman (1942), Lotka (1922) and Schrödinger (1944) had

attempted to consider the ways the second law applied to living organisms' basic life processes (i.e. metabolism), biological evolution and ecosystems.

Such ideas have proved invaluable for the analyses conducted in this chapter. For example, the wub character, as well as having a number of features that link with classical thermodynamic depictions of entropy such as a homogenous unspecifiable animal body (pp. 140-141), is also highlighted as being part of the consumable 'fuel', the meat, brought aboard the ship. The wub's depiction as meat and its former body's death and consumption implicates it in the energetic and entropy-producing hierarchies aboard the ship, which I argue can be read alongside Lindeman's application of the second law to energy flow through ecosystems (i.e. trophic levels) (pp. 144-146). Similarly, the iguanas (pp. 161-162) and crocodiles (pp. 165-167) in *The Drowned World* (Ballard 2012 [1962]) were characterised as having an increased metabolism, a depiction particularly salient when compared with the human characters' slowing metabolisms. I interpreted this as an instance of the maximum power (and entropy) principle, which as Lotka (1922) argued meant organisms better able to utilise the energy available in their environment would prosper. The iguanas are also characterised as being at least partly inorganic creatures, linking with 'metabolism first' theories of organic life that implicate energy utilisation and concurrent energy degradation as shaping the origins of life (p. 160). In such theories, life's development from inorganic matter is strongly foregrounded.

Other instances of NET's influences, more broadly, are evinced in these texts. In *The Drowned World* (Ballard 2012 [1962]), the 'proper names' category for the flies highlights how their swarming behaviour makes visible the Sun's corona, an analogy for life's involvement in the dissipation of free energy (p. 153). Platt's text also depicts the rats as viewed through infra-red viewing equipment highlighting in tangible ways their involvement in the production of entropy as wasted heat (p. 172). The story's ending also highlights the ability of life to escape entropy via the basic process of consumption, though this is presented in an action-centric manner with them escaping the entropic enclosure using the food access tube (pp. 175-176). Overall, a focus on NET and early NET scholars' research has, as with the focus on Platt's (1966) text, expanded the ways in which entropy can be

considered to be influencing characterisation in sf texts, not merely as metaphorical 'homogeneity' (see above) and 'coldness' (iguanas, pp. 159-160), but through depictions of animal character's entropy-producing bodily processes (metabolism), interactions with others (trophic levels) and pre-biotic origins ('metabolism first theories').

As with the behaviourism section (section 3), this chapter proved the utility of Culpeper's characterisation framework, including the proposed amendments I have made. The analyses above highlighted categories such as 'setting' (p. 139, p. 152, p. 170), 'actions' (p. 141, p. 159, p. 164, p. 172), 'relational role' (p. 144, p. 163), 'vocalisations' (p. 160), 'appearance' (p. 148, p. 159), 'proper names' (p. 153, p. 154), 'conversational structure' (p. 146), and 'animal body' (p. 140). Some of the categories not fully explored or prevalent in the preceding chapter were brought to the foreground in this one. For example, the 'ecological niche' schema was drawn on a number of times in these analyses. As mentioned above, *The Drowned World* (Ballard 2012 [1962]) and 'The Rodent Laboratory' (Platt 1966) often presented animal characters that were 'scavengers' and thus thrive on decay. In *The Drowned World,* similarly, the animal characters were often presented as challenging their niche. The iguanas were presented not as 'herbivores' but as 'predators', stalking and hunting the human characters and switching to meat-eating, an eating practice producing the highest amount of entropy – the wub's characterisation also showed a similar pattern (p. 146). Additionally, the 'behavioural traits' schema was useful in this chapter with the analysis of the mosquitoes (p. 154), spiders, and crocodiles (p. 163) in *Drowned World* and the rats in 'The Rodent Laboratory'. For example, the spider's colony-forming behaviour was used to contrast with the disintegration of the human characters' society (p. 156), whilst challenging the rats' nocturnal behaviour was used to foreground their inactivity (p. 172).

Similarly, corpus methods have continued to be a supportive underpinning for the characterisation analyses conducted here. Concordancing was used to identify patterns in all of the character analyses; semantic categories were used in the wub's analysis (p. 167); keywords were used in the wub's (p. 140 & p. 146), the mosquitoes' (p. 155) and the rats' analysis (p. 172); and collocates were used in the analysis of the wub (p. 143) and the rats (p. 170).

I also noted in the introduction that entropy-inspired science fiction can challenge human exceptionalism. All of these texts do so via various means. In 'Beyond Lies the Wub' (Dick 1999 [1952]), the wub character's direct speech works to question the morality of meat-eating, suggesting that, if such a process is necessary for survival aboard the ship, it ought to be done so democratically (p. 146). In *Drowned World* (Ballard 2012 [1962]), the characterisation of the arthropods and reptiles as active agents of entropy is often used to highlight the human characters' physical and mental decline (pp. 151-152, pp. 154-155, pp. 156-157, pp. 160-161). Contrastively, Platt's (1966) 'The Rodent Laboratory' continually draws comparisons between the rat and the human characters, showing the human characters similarly succumbing to social entropy. It thereby undermines any speciesist judgements regarding 'lower animals' easy slippage into unhealthy actions, behaviours and lethargy (p. 173).

Finally, there are a number of ways this study might be further expanded upon. Firstly, later research in NET could be used to explore entropy's influence in sf texts and their animal characters. Although too late for this thesis's focus, Wicken (1987) is considered a major influence in NET scholarship. He saw life as 'part of a general phenomenon of dissipation, not only subject to the second law, but driven by it in essential operations' (Schneider & Sagan 2005, p. 106). His work attempted to more fully consider the ways the second law applied to the origins of life, reproduction, evolution and development of ecosystems, often extending the research conducted by the forerunners of NET mentioned above.

Secondly, a number of sf texts could similarly be explored in light of the entropy context's influence on animal characterisation, including Aldiss's (2008 [1961]) *Hothouse* and Boulle's (2013 [1964]) *Planet of the Apes* – similarly, sf by female New Wave authors has been regrettably overlooked in this thesis, including works by: Hilary Bailey, Daphne Castell, Gwyneth Cravens, Carol Emshwiller, Gretchen Haapanen, Katherine MacLean, Judith Merril and Kit Reed (see: Higgins & Duncan 2013). Thirdly, apart from the wub, many of the animal characters in these texts do not speak and an exploration of how entropy might manifest itself within a character's speech style could provide an

interesting manifestation of entropy's effect on characterisation (cf: Greenland's brief discussion of

William Burroughs's 'linguistic disorder' (1983, p. 200)).

5 Animal Characters in the Contexts of the Gaia Hypothesis

5.1 What is the Gaia Hypothesis?

Gaia theory was proposed by James Lovelock (1972), a chemist, and later Lynne Margulis (1973), a microbiologist, in the early 1970s. However, Lovelock was developing his theories in the mid-1960s through his research on the planetary atmosphere of Mars (Lovelock 1969). Lovelock's discovery that 'the chemical composition of a planetary atmosphere would reveal the presence or absence of life' led him to consider the ways Earth's atmosphere was different and posit that organic life was implicated in such compositions (Lovelock 1979, p. 67). He therefore defines Gaia as follows:

> Gaia [i]s a complex entity involving the Earth's biosphere, atmosphere, oceans, and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet. The maintenance of relatively stable conditions by active control may be conveniently described by the term homeostasis (Lovelock 1979, p. 11).

As will be clear from this definition, Lovelock is outlining what would become known as a 'geo-physiological' approach to the Earth, which sees it as a system in which living organisms and their inorganic surroundings are closely integrated.

The idea that Earth needed to be considered from a physiological perspective, built on earlier research by geologist James Hutton (1790), and became one of the central tenets of the theory, which argued that 'Earth and its biological systems behave as a huge single entity' (Boston 2008). The scientific data that Lovelock draws on to substantiate such claims is the constancy of the levels of salinity in the sea, of oxygen in the atmosphere, and of global surface temperature. For example, the fact that oxygen levels remain constant means life is protected from oxygen toxicity and uncontrollable conflagrations if levels were too high, and conversely oxygen starvation if levels were too low.[53] In all of these cases, as well as focusing on the interaction between inorganic chemical elements, Lovelock shows how animal life is implicated in such processes. He argues that the systems of the Earth are far from

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[53] Oxygen levels have remained at 21% of the atmosphere for 300 million years (Lovelock 1979).

equilibrium and the only way to explain this is to consider the Earth system itself – Gaia – to be regulating these conditions, the way an organism unconsciously maintains internal levels of equilibrium. Lovelock's Gaia hypothesis therefore emphasises that homeostatic balance is pursued by the control system, Gaia, to maintain optimal conditions for its life.

As well as providing scientific evidence pointing to the existence of Gaia, Lovelock underpins Gaia theory by drawing on Norbert Wiener's (2007 [1948]) work on cybernetic systems, originally proposed to account for the homeostatic states achieved within functioning machines and animals. Lovelock drew freely on cybernetic terminology, describing Gaia's mechanisms through positive and negative feedback loops – positive feedback increases change, whilst negative feedback reduces change. Feedback mechanisms include 'the control of a room's temperature by a thermostat' and 'the human body's regulation of its temperature through sweating and shivering' (Ruse 2013, p. 13). Cybernetics was an appropriate model for Gaia as physiological processes found in organisms and highly automated machines could be extrapolatively compared to those regulatory processes seen at the planetary scale. It was also appropriate as 'cybernetic mechanisms, through positive and negative feedbacks, can amplify or attenuate trends automatically' and 'what appears to be intelligence and unified organismhood could accrue without any […] personified collusions among presumably mindless organisms' (Sagan & Whiteside 2004, p. 179).

The cybernetic underpinning of Gaia theory also worked to strengthen Lovelock's vehement claims that Gaia's homeostatic state was achieved through other organisms' *unwitting* cooperation. Lovelock repeatedly claims that 'planetary regulation [via Gaia] is [not] purposeful' and attempts to distance the theory from such positioning (1991, p. 32). However, this claim is repeatedly contradicted in sections of Lovelock's research. Indeed, one of the arguments favoured by biologists against Gaia theory became known as the 'Doolittle Objection', which claimed the idea that various organisms work collaboratively with Gaia ought to be derided. Doolittle (1981) was likely taking umbrage against claims made by Lovelock in his hypothesis regarding the seemingly Gaian-led purposive activities of fish and birds: 'it is worth asking ourselves whether the movement of migratory birds and fish serve the larger

Gaian purpose of phosphorous recycling' (Lovelock 1979, p. 105). As the Doolittle Objection points out, such a construal of animals runs against natural selection, as animals do not act 'for reasons of good citizenship, [and] in order to help the planetary biota as a whole […] [but instead do so for] reasons of individual (or kin) genetic fitness' (Tyrrell 2013, p. 29).

Viewing Earth as a superorganism that needs to be understood in terms of physiology has led Lovelock and subsequently others to theorise about the component parts that make up the Gaian whole (Lovelock 1979, Volk 1998). Lovelock (1979), for example, hypothesises that whales could potentially act as Gaia's nervous system. Other later ecologists and biologists, continuing to theorise along Gaian lines, have considered how organisms might be grouped to account for the functions performed by Gaia. Ought organisms to be grouped into categories such as 'photosynthesizer', 'denitrifier', 'nitrogen fixer' or 'respirer'? Such groupings would attempt to account for life's involvement in Gaian-scale processes. Or does the correct grouping of organisms happen at 'the grandest taxonomic levels' (Volk 1998, p. 96)? Breakthroughs of groupings at the level of 'domain', pioneered by Woese et al (1990), for example, see the domain of eukarya, including animals and plants, as grouped together due to their newly discovered 'common evolutionary heritage' (Volk 1998, p. 97). These taxonomic groupings, Volk suggests, make sense given that 'domains, as types of genetic innovations, arose and proliferated because they were able to invent life strategies and thus occupy large-scale functional niches within the global [Gaian] system' (ibid). Overall, despite the putative simplicity of Lovelock's theory, the idea that animals may perform functional roles within the Gaian system, purposive or not, offers a potentially radical reconceptualisation of animal life.

5.2 The Gaia Hypothesis as a Context in Science Fiction

As Stableford has noted, 'the literary influence of the Gaia hypothesis was very widespread, at least in reviving the name Gaia […] and equipping it with a new net of connotations' (2014, p. 277). Yet critical explorations of Gaia theory's influence are limited. Voller (1989) is one of very few who explores the Gaian context in sf works, focusing on authors such as Asimov (*Foundation* series 2004) and Aldiss (*Helliconia* 2010). Asimov's sf depicts human characters connecting with Gaia and other creatures'

consciousness, though this group consciousness is structured via a speciesist hierarchy: '"We're all separate organisms – but we all share an overall consciousness. The inanimate planet does so least of all, the various forms of life to a varying degree, and human beings most of all"' (Asimov 2016 [1982], p. 339). Asimov's Gaia features as a benevolent character, who is used to reveal the 'deficiencies of non-Gaian life' (Voller 1989, p. 141). Aldiss's (2010) *Helliconia* trilogy offers a much more in-depth engagement with Gaia theory, which Voller argues approaches the concept by focusing on the interconnectedness of life on the planet. For example, the focus of the novels is never fully upon the human characters but on their interactions with phagors, a bipedal bull-like species. Voller argues that 'the two species are involved […] in a deeply commensal relationship […] [as] a virus transmitted by a phagor tick is instrumental in regulating human populations' (Voller 1989, p. 145). In Voller's research, however, the focus on animal characters remains cursory.

Yanarella (2001) also attempts to outline how sf, specifically 'hard' sf, has engaged with Lovelock's theory, focusing on Asmiov (2004), Benford and Brin (*Heart of the Comet* 1986) and Brin (*Earth* 1990). All these text's highlight 'Gaia's sentience and active participation in securing the grounds for continued life and cybernetic elements stressing […] homeostatic balance-seeking process[es] involving feedback loops' (Yanarella 2001, p. 251). As noted with Voller's research, Yanarella also highlights that hard sf's engagement with Gaia appears to reassert humanity's control and dominance over the Gaian entity and the natural world, offering a speciesist perspective. Lastly, Pak (2016) frequently references Gaia theory, but the specific manifestations of the concept in sf are not outlined, though he suggests exploring the connection between the science and sf 'w[ould] undoubtedly uncover subtle[] and […] localised trends' (p. 220).

Despite a lack of critical engagement with Gaia theory, many sf texts seem influenced by a Gaian-like figure, although part of this proliferation is also due to Hutton's (1790) pioneering idea. The most common manifestation of a Gaian context is a sentient, planet-sized entity, a metaphorical extension of the original Gaia figure and the later theory. To name just a few: Manning's (1934) 'The Living Galaxy', Hamilton's (1936 [1932]) 'The Earth Brain', Lem's (2003 [1961]) *Solaris*, Le Guin's (1990

[1971]) 'Vaster than Empires and More Slow', Varley's (1979-1984) *Gaea* trilogy, Kress's (1990) *Brain Rose*, and Brin's (1990) *Earth*. All of these explore a planetary-scale being which itself can be conceived of as a character, with many presenting the being as a sentient mineral, vegetative and atmospheric entity. The human characters in these texts are frequently able to connect to the planetary consciousness via various technological or surgical advances. In *Brain Rose* (Kress 1990), for example, human characters connect to the Gaia-like entity after receiving a medical procedure known as 'Previous Life Access Surgery'. Whilst many present the interactions between human and Gaian entity as being peaceable, Butler's (1989-2006) *God of Clay* proposes a sentient planet antagonist hostile to the human characters that land on its surface (see: Canavan 2016, pp. 123-151).

Others present the Gaian-like planet entity not merely as a consciousness, but in more physiological or concrete terms. In 'Vaster than Empires and More Slow' (Le Guin 1990b [1971]), the vegetative entity – World 4470 – is continually considered in terms of its physiology – a similar idea is presented in Brunner's (1974 [1972]) *Dramaturges of Yan*. The planet's surface is described as a *hide*; a scientist character proposes that the entity is sending electrochemical signals between its various vegetative parts; and, analysing the planet's flora-fauna, another scientist suggests the structures might act similarly to cells found in the central nervous system of animals. Like Lovelock's insistence that Gaia is 'an attempt to find the largest living creature on Earth', World 4470 is a taxonomically fluid character.[54] Indeed, its animacy and flora-fauna, described as being not wholly plant-like, is often suggestive of a creatural entity (Lovelock 1979, p. 1). Le Guin's (1990 [1971]) text overall presents the Gaian entity as a vast, potentially, animal (or animal-vegetable) character. Other sf texts present a literal personification of Gaia. In Tiptree Jr's (2014 [1969]) 'The Last Flight of Doctor Ain', Gaia appears as a sick woman travelling with the eponymous doctor, who is spreading a virus to rid the world of humans. This, he hopes, will allow other animal species and the environment to recover. This short story appears prescient of Lovelock's later research that sees anthropogenic pollution as a threat to Gaia, proposing

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[54] Also see: Heise 2013

the need for geo-engineering – Lovelock considers this akin to 'medical' – interventions (Lovelock 1991).

Many of the texts above predominantly feature human characters interacting with the Gaia-like entity, but few sf critics consider the interaction between such an entity and animal characters. Indeed, Pak (2016) notes that scholars might profitably consider how sf texts presenting a Gaia-like entity could explore animal studies' perspectives. Tepper's (1999 [1998]) *Six Moon Dance*, for example, presents the creatural 'timmys' or 'tim-tims' as a species connected to the Gaia-like consciousness of the planet, named Kaorugi. After the human colonisers discover the native timmys, the timmys are used for manual labour, interrupting Kaorugi and the timmys's attempts to placate the Quaggi, a dragon that lives inside the planet's core – if the Quaggi awakes the planet will be destroyed. The human character's exploitation of life is therefore depicted as potentially leading to the destruction of Kaorugi, the Gaia entity, and all lifeforms. Sf texts that feature a Gaia-like consciousness and animal characters are fewer but include Brunner's (1974 [1972]) *The Dramaturges of Yan* and Aldiss's (2010) *Helliconia* trilogy. As in Tepper's novel, the animal characters in these texts are connected to the Gaia-like entity in ways that the human characters are not, suggesting that the human characters in these sf texts are not considered in line with the interests, or considered parts, of the Gaian entity.

Yet other Gaia-inspired sf that heavily features animal characters emphasises the interconnectedness of species and ecological balance, as Voller similarly noted with *Helliconia* (Aldiss 2010). Such texts tend not to personify Gaia, but instead present a system of feedback loops in which animal characters are implicated. For example, Slonczewski's (2000 [1986]) *Door Into Ocean* features giant cephalopod characters, seaswallowers, whose migration from pole to pole restores the balance of the planet's aquatic ecosystems (see: Junquera 2018). Similarly, in Traviss's (2007) *Ally*, the skavu are an animal species with both lizard and seal-like features, who work to maintain the healthy homeostatic functioning of the planets Umeh and future Earth (see: Sullivan 2010). Indeed, many sf texts that engage with Gaia theory focus at least dually on animal characters as well as human, but as yet sf critics have not comprehensively explored the influence of this scientific context on animal characterisation.

5.3 Why Choose the Gaia Hypothesis as a Context?

An important criticism of this choice of context is that Lovelock trained as a chemist and not a biologist – though Margulis's (1998) research explores the theory's repercussions in biology, placing heavy emphasis on symbiotic relationships. Unlike with behaviourism, where scientific knowledge was constructed through animal subjects, Lovelock's discussions of planetary homeostatic processes on the surface do not appear directly related to animal life. But, as mentioned above, Lovelock frequently shows that animals often feature as integral parts of Gaia's systems. For example, atmospheric oxygen levels are regulated in part by methane produced in the guts of animals. As Lovelock notes, in the absence of methane, oxygen levels would rise to dangerous levels in the Earth's atmosphere. The mundane process of farting implicates animals in the stability of atmospheric conditions (see also: Egan 2012). Indeed, Lovelock states that 'the more it seems that inorganic […] steady-state processes determine the atmospheric concentration of gas, the greater may be the extent of its biological involvement' (Lovelock 1979, p. 82). Some sf texts have explored how animal characters might be involved in maintaining homeostatic processes – largely through population control (see Voller's (1989) discussion on phagors and humans interaction) – but I aim to explore other ways in which sf's animal characters are implicated in such Gaian processes. Gaia's connection to animal life, as Lovelock claims, is integral, but animal characters' connections to Gaian functions and homeostasis remain largely unexplored by sf scholars.

Another, and perhaps the most obvious, reason to focus on Lovelock's hypothesis is the fact that it has received little scholarly attention in sf criticism, despite, as noted above (section 5.2), the myriad ways in which it manifests itself in sf. Even when Gaia theory is shown to be influencing sf (Volk 1989, Yanarella 2001), researchers often highlight the Gaian-like entities relationship solely to human characters. Depictions of Gaia as an entity with connected animal parts is clearly a creatively compelling prospect for sf writers and reconsiderations of animal life's part-of-the-whole relationship to Gaia can be accommodated in sf's world-building elements, which frequently explore alien ecosystems (Asaro & Dolan 2012). Unlike the previous (and limited) research, the connections between animal characters

and the Gaian entity will be more fully explored here, leading to a fuller conception of the context's relationship to sf.

In relation to this point, the Gaia hypothesis is a scientific concept that works to challenge human exceptionalism. It largely does so by eschewing the *scala naturae* (the great chain of being) hierarchy, where animals higher up the chain are considered to have more intrinsic value than those at the bottom.[55] Lovelock's research often reverses such hierarchies positioning larger, highly complex animals as unimportant from the Gaian perspective:

> The most essential part [of life] is probably that which dwells [...] in the soil below the surface. Large plants and animals are relatively unimportant. They are [...] desirable, but not essential. (Lovelock 1979, p. 40).

Though this is not without controversy, Lovelock places emphasis on those 'key species in [Gaia's] life support system', i.e. those that perform essential life enabling homeostatic processes. For example, focusing on the composition of the atmosphere, specifically the potential for carbon dioxide to build-up in the atmosphere, he notes this is mitigated not just by plant life but by certain animals: '[carbon dioxide] is removed from the atmosphere and converted into organic matter by many heterotrophic [...] organisms' (ibid, p. 82). He does not specifically mention which animals perform such functions, but one of the most important of these creatures, worms, are able to remove atmospheric carbon through a process called stabilization. Gaia theory often tends to focus on animals traditionally considered insignificant. This is useful from an animal studies' perspective also as scholars within this field have raised concerns that particular animal species are over-represented in the research literature, including those close to humans phylogenetically (apes and other mammals), companion species (dogs, dogs, rabbits, etc.), and megafauna (tigers, whales, elephants, etc.) (see: Clark 2016). Gaia theory therefore focuses on the lowliest of animals often essential to Gaia's functioning, meaning creatures usually backgrounded in sf texts and criticism may come to the foreground.

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[55] See: Rigato and Minelli's (2013) discussion of the prevalence of the *scala naturae* and the idea of evolution as progressive in contemporary evolutionary biology.

Finally, and somewhat contrastively, despite Lovelock's hypothesis being linked to the development of the environmental movement in the 1980s, it is worth noting that Lovelock's theory can be read as ambivalent about ethical concerns towards animals. As Kohák has noted 'it is useful to read carefully Lovelocks [sic] reasons for presenting the GAIA hypothesis' as it definitely showed little 'empathy with suffering nature' (2000, p. 131) – Lovelock (1979) argues Carson's (1962) *Silent Spring*, which led to a ban on the use of DDT, was a radical environmentalist 'over-reaction'. By working hard to undermine the importance of highly-developed animals, including humans, Lovelock's theory simultaneously downplays these animals' intrinsic value. For example, he hypothesises that very few highly-developed creatures perform a Gaian-scale function, suggesting whales might be one of the 'species destined to fulfil such role[s]' (1979, p. 148) – whales' brains, he argues, make them candidates for functioning as the Gaian nervous system. Though he eventually rejects the idea, Lovelock's hypothesising opens up an ethical can of worms. Extending the geo-physiological metaphor, if certain species are 'passenger organs', would the extinction of such species be of ethical concern? Lovelock appears aware of the potential ethical issues raised by such conceptions of animal life, stating that though whales likely do not perform a Gaian function it would constitute 'a form of genocide' to hunt them to extinction (ibid, p. 150). These ethical concerns do not form an inherent part of the Gaian perspective, but see Lovelock drawing instead on animal rights. Though some have noted the theory's potential for ambivalence towards animal rights (Yanarella 2001), few have explored manifestations of this darker side to Gaia theory in sf, something which will also be explored in this section.

5.4 Core Texts

The text's I will be focusing on in this section are Brunner's (1974 [1972]) *Dramaturges of Yan* and Aldiss's *Helliconia* trilogy (2010). Brunner's oeuvre (*Stand on Zanzibar* (2003 [1968]), *Bedlam Planet* (1973 [1968]), *The Sheep Look Up* (2003 [1972])) has often been explored and broadly connected to animal studies' perspectives (see: Pak 2016, Bould & Vint 2011). However, *The Dramaturges of Yan* has not received scholarly attention – indeed, the only sf critic to have considered this work is Murphy (1987). Whilst Murphy comments on the planet-sized entity, known as Yan, he does not explore the

Gaian context's relationship with the text. *Dramaturges of Yan* features not only a planetary consciousness, but also presents said entity as intimately connected to the creatures that inhabit it, the Yanfolk. As well as connection with the planetary consciousness, the Yanfolk, like the animal characters in *Door into Ocean* (Slonczewski 2000 [1986]) and *Ally* (Traviss 2007), engage in acts that appear to balance their population size. The interaction between Gaia-like entity and animal character of course makes this text a useful focus for this chapter, as does Brunner's previous interest in animal rights' perspectives.

In the preface to the *Helliconia* (2010) trilogy, Aldiss openly acknowledges his Gaian inspiration: 'I hoped to dramatise on a wide scale the workings out of Lovelock's hypothesis' (2010, p. xiii). Even before his acknowledgement of Lovelock's theory, much of Aldiss's earlier work – *Galaxies like Grains of Sand* (1979 [1960]) and *Cryptozoic!* (2020 [1967]) – also focused on planet-sized sentient entities (Voller 1989). Aldiss's (2010) *Helliconia* trilogy has understandably then been explored by a number of critics in relation to Gaia, including those mentioned above (Voller 1989, Yanarella 2001). The previous research on Aldiss's trilogy, as mentioned above, however, does not explore animal characters in any depth, despite sf critics acknowledging that 'the subtle and active participation of the flora and fauna [...] in the glacially slow tide of seasonal change [...] culminates in a complex and convincing portrait of' Gaia (Yanarella 2001, p. 267). Like Brunner's, Aldiss's *Helliconia* trilogy is a text that foregrounds animal characters and a Gaian-scale system, making it important for inclusion in this section.

5.5 John Brunner's (1972) *The Dramaturges of Yan*

Brunner's novel charts the awakening of the planetary consciousness, known as Yan, and its connection to the Yanfolk. The beginning of the story focuses on the Yanfolk's society, exploring their culture, language and settlements. One of their most striking customs is a ceremony known as *shrimashey,* a ceremony in which the Yanfolk achieve a collective consciousness and participate in ritualistic murder. *Shrimashey* is described as 'a population-balancing mechanism' (Brunner 1974 [1972], p. 80). Humans, also settled on the planet Yan, are depicted as being sexually intimate with the Yanfolk and, more broadly, involved and interested in Yannish culture. Most notable of these human characters are Marc

Simmon who is translating Yannish poems ('The Mutine Epics') and in a relationship with Shyalee, a Yanperson, and Dr Lem. However, Gregory Chart, a human geo-engineer, arrives on the planet, Yan, and offers the Yanfolk the chance to employ his services. As a geo-engineer, Chart is able to use 'weather-control techniques' and 'adjust potential gradients within the natural layers of the atmosphere' to fundamentally alter the planet and its inhabitants (ibid, p. 90).[56] Chart's arrival leads to ethical debates between the humans and Yanfolk about whether Chart's plans for an (anthropogenic) geo-engineering project should be permitted on Yan. Indeed, Chart's plans to 'pith' – remove the cortex – and 'reprogramme' the native Yanfolk (known as wilders) so they can become 'actors' in his performance only exacerbates tensions, and leads to the arrival of Trita Garsonova, 'Scholar of Cybernetics' and member of the 'Human Alien Relations' committee (ibid, p. 126). Before Garsonova can stop the geo-engineering performance, Chart's actions unintentionally awaken the planet, Yan itself. Fully awake, Yan proceeds to take control of the Yanfolk, using them as parts of its (geo)physiological structures. The planet then destroys itself, during which time it telepathically communicates with Marc justifying its actions, killing the Yanfolk and all lifeforms that inhabit it.

The analysis in this section will focus on the Yanfolk. It will begin by focusing on Yanfolk who are more individualised in the narrative, including Shyalee, who is in a relationship with human character, Marc Simmon, and Speaker Kaydad, a Yannish elder. Through the depiction of an inter-species relationship, Shyalee's characterisation, focalised from Marc's perspective, dramatizes a shift from an anthropocentric to a Gaian perspective. An initial focus on Shyalee's 'appearance', 'animal body' and 'sex' work to objectify her. In addition, drawing on the 'preferences' category, Marc often forces Shyalee to engage with Yannish traditions, despite her own opposing interests, denying her subjectivity and further objectifying her. After Marc and Shyalee's break-up, her characterised indifference towards him, acceptance of Yannish culture, signalled by the 'company' she keeps, and her incorporation with the planet, Yan (the Gaian-like entity), all suggest a rejection of an anthropocentric perspective in favour of a Gaian one. With Kaydad, the focus on his 'appearance' features hint at a

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[56] Chart's geo-engineering projects are conceptualised as art (a performance) rather than science.

collective identity and foreground a close connection between the species and its environment. Similarly, drawing on the 'animal body' schema, the 'trait' of conservatism, and 'occupational role', Kaydad is presented as a character controlled by, and instrumental in maintaining, homeostasis. As well as these characters, the analysis will latterly focus on the Yanfolk – lexeme *Yanfolk* (LL: 551.99) and synonymous term *Yan* (LL: 551.99), the planet's name, as the Yanfolk become intimately connected with the planet's consciousness and physiology in the last few chapters. I argue that the Yanfolk are mainly presented through two main representation strategies: either characterised as machines, drawing on the cybernetic influences present in Lovelock's theory, or as functional organs or cells that are part of the planet Yan. The Yanfolk's subordination to Yan highlights ethical concerns related to Gaia theory's undermining of the intrinsic value of highly complex animal life, as noted above.

5.5.1 The Yanfolk

Shyalee and Marc Simmon's relationship and subsequent break-up is used to dramatize the shift in relationship between human beings and the natural world in the context of Gaia's existence. Lovelock, for example, states that Gaia's existence challenges 'anthropocentric rationalisations' of the natural world being merely for '[humans'] special benefit', as Gaia has 'moulded the surface, the oceans, and the air to suit her […] [and fortuitously but not especially to suit humans'] needs' (1972, p. 580). When Shyalee is introduced, her description is focalised through Marc, who focuses on her 'appearance', sexually objectifying her. She is 'boy-slim', with 'delicate bones, huge dark eyes, [and] slender limbs like wands' (Brunner 1972, pp. 11-13). Marc describes her as 'heart-stoppingly' and 'fantastically beautiful', a trait repeatedly attached to Shyalee's characterisation (ibid). Marc also compares Shyalee's 'animal body' to that of human women in ways that focus heavily on Shyalee's sexuality: '[H]e wondered what it might be like to make love again with a girl having breasts and a skin all of one colour, who needed sometimes to break off from a kiss because she had to breathe in through her mouth' (ibid, p. 12). Similarly, drawing on the category 'sex', he also describes Shyalee's intimate physiology, suggesting 'the *cavernis veneris* […] made its counterpart in a human girl seem like spur-of-the-moment mechanical

imitation' (ibid, p. 13). Descriptions of Shyalee's 'appearance', 'animal body' and 'sex' indicate that Marc (sexually) objectifies Shyalee, making her appear as if she is for his benefit.

Marc's attempts to align Shyalee with traditional Yannish culture is another means through which he objectifies her, particularly denying her her own subjectivity. Drawing on the category 'preferences', Marc aligns Shyalee with his own interests rather than hers. When he extolls the strengths of Yannish culture, for example, Shyalee is depicted as completely disinterested: 'Shyalee would not even listen to that kind of talk any longer' (Brunner 1974 [1972], p. 15). Like many younger Yanfolk, Shyalee's preferences are for Earth culture, believing 'everything Earthly was marvellous, preferring syntholon to webweave, alien tapes to their own […] traditional culture-forms' (ibid). From this initial characterisation, the reader continues to infer that Marc's forceful attempts to engage Shyalee with Yannish culture, language and clothing fail to account for her own preferences. For example, he insists Shyalee wear traditional Yannish attire to a party they attend – He 'ma[de] her put on his favourite among her costumes, a webweave cloak of misty blue, finer than gossamer' (ibid, p. 13). In another instance, he chides Shyalee for mixing Yannish and human language: 'how often must I tell you that I hate this ape's habit of mixing Yannish and human words?' (ibid, p. 16). Marc and Shyalee also live together in a 'commonplace Yannish house' though a human enclave is also present on Yan, which the reader infers Shyalee would prefer (ibid). Like the sexual objectification, Shyalee's characterisation, presented through Marc's ignorance of her own 'preferences', denies her any level of subjectivity.

Other obvious examples of objectification occur through Shyalee's characterisation as Marc's possession. Textual evidence of this includes possessive pronouns – 'his Yannish mistress, Shyalee' (Brunner 1974 [1972], p. 11); '[s]he would never have become his mistress' (p. 13) – nouns with possession markers – 'Shyalee, Marc's mistress' (ibid, p. 36) – and lexical verbs – '[a]cquiring Shyalee' (p. 11); 'take a Yannish mistress' (p. 14); 'having Shyalee as a mistress' (p. 82). In sum, Shyalee is often presented through Marc's perspective, and he objectifies her, depicting her as a sexual object to be possessed and exploited for his own interests. Shyalee is thus initially characterised from an anthropocentric perspective, at odds with Lovelock's hypothesis and its challenge to conceptions of the

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Earth and biosphere not being exploitable objects for human use (see: Lovelock 1972, Lovelock 1979, Lovelock 2000, Goatly 1996).

However, at the end of the novel, a Gaian-inspired shift in perspective occurs. Shyalee leaves Marc, and her break-up with him sees her embracing Yannish culture on her own terms: she believes that Chart's geo-engineering performance is 'going to [...] re-create the golden age of Yan! [...] [and] [She]'ll have something real to be proud of!' (Brunner 1974 [1972], p. 115). Focusing on the category 'company', this shift in perspective can be seen through Shyalee's connection to characters strongly associated with Yannish culture and, indeed, the planet Yan itself. She is seen alongside Speaker Kaydad (line 34), as part of the dramaturges of Yan (lines 41 & 42), and Rayvor, who also leaves his human partner (lines 34, 36 & 38) (figure 24). Shyalee stops being characterised as Marc's objectified mistress, but as independent from, and indifferent towards, him. This is conveyed via the reciprocal pronoun (*one another*) and Shyalee's 'appearance' (*not even smiled*) in their final meeting: 'the last time they had chanced across one another, she had not even smiled at him' (ibid, p 130). Lastly, along with the other Yanfolk (detailed more fully below), Shyalee rejects the human colony on the planet and integrates fully with the Gaian-entity, Yan (line 41, figure 24). Overall, Shyalee develops into a character independent from Marc, whose rejection of human culture and acceptance of Yannish culture traces the Gaian perspective's challenge to anthropocentrism.

34	Carefully. Speaker Kaydad had called him in, and	Shyalee,	and told them just what the difference is
35	expecting you, because you'd have heard about	Shyalee	and you'd have gone to the enclave
36	it?' Not looking around. 'Did you know that	Shyalee	left me, and Rayvor left Alice?' 'I hadn'
37	a pang or two of sympathy. He missed	Shyalee.	He missed her terribly. For all her fault
38	know is a former friend of yours called	Shyalee.	So too is a male named Rayvor.' 'You'
39	the impact of what Chart had said about	Shyalee	reached him. 'Yes?' 'You have yourself vie
40	understand because I came close to understanding	Shyalee?	That was a fraction of himself-as-was–
41	the question. But there was not enough of	Shyalee	in the dramaturge to know what he was
42	his head in his hands, and wept, for	Shyalee,	for the dramaturges of Yan, for the Mutin

Figure 24: Concordance lines for lexeme *SHYALEE* in AntConc

Alongside Shyalee, Speaker Kaydad is the most extensively characterised of the Yanfolk. His characterisation specifically his 'appearance' highlights a variety of connections to Yan, the Gaian-like

entity. Indeed, Kaydad's physical description is the most extensively presented in the whole of the novel:

> He was, of course, scarred in several places, and two fingers had been broken and healed crooked, but that was the inevitable consequence of *shrimashey* [...]. Like all his kind, he looked at a casual glance as though he wore a mask. His forehead, scalp and eye-ridges were pale, light wooden colour between white and brown. [...] [T]he whole of the rest of his skin was patched with palm-sized areas of the same hue networked with irregular lines of the lighter colour. There was a hypothesis to the effect that [...] Yanfolk were of glade stock [...]. It was a guess based on analogies with Earthside creatures such as giraffe and zebra (Brunner 1974 [1972], pp. 43-44).

Kaydad's 'appearance' focuses on his past scars – *two fingers had been broken and healed crooked* – resulting from past *shrimashey* rituals, where the Yanfolk are able to tap into the greater Yan consciousness. The description of Kaydad's face also emphasises that he appears to be *w[earing] a mask*. This suggests a collective group identity, foreshadowing the Yanfolk's connection to, and eventual control under, the planetary superorganism. The description of Kaydad's white-brown fur – *the same hue networked with irregular lines of the lighter colour* – leads to comparisons with *Earthside* animals, like *giraffe* and *zebra*. Drawing on the 'species' schema, these grassland animals – *gladestock* – both feature patterned fur for camouflage, which the Yanfolk's two-toned fur seems to closely resemble. Emphasising the Yanfolk's camouflage-patterned fur highlights that the Yanfolk are able to merge seamlessly with their surrounding environment, and shows along with Lovelock's theory that 'the biosphere interacts actively with the environment so as to hold it[self] at an optimum' (Lovelock 1972, p. 579).

In addition to these 'appearance' features, some of Kaydad's foregrounded traits and features highlight homeostasis either metonymically or metaphorically – in its definitional, biological-process sense, homeostasis means: 'the maintenance of a dynamically stable state within a system by means of internal regulatory processes that tend to counteract any disturbance of the stability by external forces or influences' (OED 1976). The maintaining of atmospheric equilibrium, as mentioned above, is

a role applied to Gaia in Lovelock's theory, an extension of a biological process to the Earth system. To begin with the metonymic manifestations of homeostasis, drawing on the 'animal body' category, Kaydad's internal physiology is thoroughly detailed. Marc thus notes Kaydad's 'liver-kidney was at the front of the abdomen; his heart was in his pelvis [...]. And his lungs were at his sides, drawing air directly through spiracles between the ribs' (Brunner 1974 [1972], p. 44). This description of Kaydad's anatomy highlights many of the major organs often associated with maintaining internal levels of homeostasis in the animal body.[57]

Moving on to the metaphorical manifestations of homeostasis, Kaydad is described as extremely conservative. For example, Chart, the geo-engineer, comments Kaydad is one of the 'most conservative individuals' of the alien-animal species (Brunner 1974 [1972], p. 86). Similarly, the lexical item, *conservative*, an explicit characterisation 'trait', also appears in concordance lines 11 & 24 for Kaydad (figure 25), and descriptions of the Yannish elders, with whom Kaydad is grouped: 'the old, conservative, hard-liners' (ibid, p. 38); 'the grave, conservative elders' (ibid, p. 54); 'the conservative older Yanfolk' (ibid, p. 97). Yannish culture, as depicted throughout the novel, prizes nature, and Kaydad's conservative attitude is implicitly presented in his description of Yannish society: 'the structure of their society w[as] a tower, [...] which has just that degree of flexibility needed to endure storms without resisting them' (ibid, p. 86).[58] Such imagery further highlights Kaydad's conservatism, showing a deference to nature – *without resisting them* [storms] – in line with Yannish culture.

| 11 | was seeking him out, to talk to him. Kaydad's notoriously a conservative type, not as c |
| 24 | ously far more conservative and chauvinistic than Kaydad. 'One would draw to present-time attention |

Figure 25: Concordance lines for lexeme *KAYDAD* in AntConc

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[57] 'The main organs of mammalian homeostasis are the heart, lungs, liver, pancreas, kidneys, muscles, skin [...] and the brain' with 'the most important organs' being 'the kidneys, the liver and the brain' (Banfalvi 2013, p. 42).

[58] Yannish culture, unlike human culture, is not influenced by technological development. Instead, as their organic attire – *webweave* – attests, they celebrate nature and symbiosis with it. Yannish homes, for example, are 'egg-like' and centre around atriums displaying natural materials, including 'pool[s]', 'flowerbeds' and 'carvings' (Brunner 1974 [1972], p. 107). Compared to human culture which prizes synthetic clothing – syntholon (ibid, p. 15) – and utilises technology – 'go-boards' (p. 18), 'interstellar ships' (ibid) and 'communets [computers]' (p. 19) – Yannish culture privileges nature.

Kaydad's depiction as a conservative character suggests he is averse to change, 'a great respecter of the status quo', aligning his characterisation with the similar 'trait' of constancy (Brunner 1974 [1972], p. 45). Other characterisation strategies also align him with this trait. Drawing on the 'paralinguistic features' category, his voice is described as being a 'monotonous timbre […], resembling a cello droning away on a single note' (ibid, p. 44). A number of lexical features here connote constancy, including *droning* and *monotonous*. Overall, these 'traits' of conservatism and constancy feature as a metaphoric representation of homeostatic functioning.

In addition, Kaydad's 'occupational role' is that of village elder, known as *hrath*, a role which is described as such: 'they [the Yanfolk] had […] an informal clique of certain persons who were *hrath*, or "optimal" […], able to convey the sense of "rightness" to the next generation' (Brunner 1974 [1972], pp. 42-43). The role of *hrath*, glossed as being *optimal*, strongly implies that Kaydad is functioning to maintain homeostasis, with Kaydad's role in the community analogous to that of Gaia's role of 'homeostat[ing] the planet for an optimum physical and chemical state appropriate to its current biosphere' (Lovelock 1972, p. 579). As can be seen in the above quote, *hrath* is a role which is considered as a position of influence – *convey a sense of "rightness" to the next generation* – suggesting that its function of maintaining optimal conditions spreads throughout Yannish culture and practices. For example, even younger Yanfolk, like Shyalee, continue practicing *shrimashey* – population balancing – despite their ambivalence towards Yannish culture. More broadly, the optimal condition of the Yanfolk is noticed by Dr Lem, who suggests the Yanfolk 'decided there was a proper way to live, and adhered to it for thousands of years with no discernible alterations' (Brunner 1974 [1972], p. 10). Kaydad's 'occupational role' and its optimal function, though presented as influencing the species level rather than the planetary, suggest an analogy between him and a Gaian-like entity.

The Yanfolk, though individualised earlier in the novel, only appear as part of the collective organism, Yan, after it reawakens. As Garsonova, the cybernetics scholar, states:

The Yanfolk […] are components of a superhuman arganism [sic] whose collective brain consists in their lower spinal ganglia, the dramaturge – singular, not plural – which designed the wats and mandalas, and smashed the moon (Brunner 1974 [1972], p. 129).

The Yanfolk's incorporation within Yan leads to a fundamental shift in their characterisation, not only for Shyalee and Kaydad, but for all the animal alien species (span 2, figure 26 highlights the span covered in the latter part of this analysis). As Garsonova makes clear, this shift is a reductive one with the Yanfolk now characterised as controlled by their *lower spinal ganglia*. The conceptualisation of the Yanfolk as being in a more primitive state is suggested by the comparative adjective, *lower,* and the name of the physiological structure, which has connotations of the primitive part of the brain, the basal ganglia. Through their connection to Yan, the Yanfolk become subordinated characters. The strategies later used to characterise the Yanfolk fall into two main categories, which highlight their connection and subordination to the Gaian-like entity. Firstly, they are characterised as machines, drawing on the cybernetic influences present in Lovelock's theory. Secondly, the Yanfolk are depicted as physiological parts of the planetary organism, largely depicted as cells which function as part of the planet's geo-physiological structures, like the *wats and mandalas*.
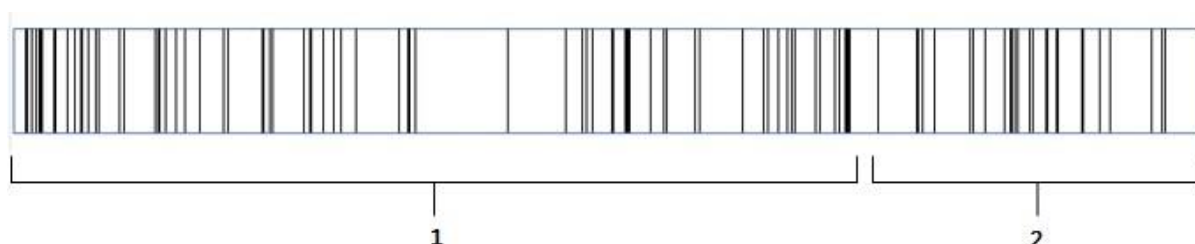

Figure 26: Concordance plot for lexeme *YANFOLK* in AntConc

Focusing initially on the first of these strategies, the Yanfolk are often depicted as organic machines or computers. Indeed, Lovelock's 'use [of] organic, mechanistic, and computer-based metaphors' draw on Gaia theory's cybernetic influences (Botkin 2012, p. 389). Though Lovelock more fully explores the links between Gaia and cybernetics in later research (see: 1979, pp. 48-63), even

noting that whale brains are 'large computers' that might act as part of Gaia's central nervous system (ibid, p. 150), his earliest research also describes Gaia as a 'biological cybernetic system' (Lovelock 1972, p. 579). The cybernetic influences in the Gaia hypothesis can also be seen in Brunner's text. After the planet awakens, the Yanfolk are described as being 'in absolute rapport' with 'every single member of it reduced to a component part' (Brunner 1974 [1972], p. 135). The lexical item *component* denotes a mechanical rather than organic part, with the Yanfolk being characterised as parts of a machine. When the human characters glimpse the Yanfolk travelling to the planet's geo-physiological structures, they note that '[i]t was obvious from their jerky gait that the Yanfolk were under the influence of the *sheyashrim* drug' (ibid, p. 141). Drawing on the 'actions' category, the Yanfolk's *jerky gait* again highlights a mechanical comparison.

In addition, many examples exist of the Yanfolk's minds being characterised as (re)programmable computers. Indeed, the conceptual metaphor, MIND IS A COMPUTER, is frequently drawn on to represent the Yanfolk in later parts of the narrative. Textual evidence includes the lexical items *programme* (LL: 22.04) and *programmed* (LL: 19.67), which appear as keywords. Dr Lem notes, for example, that the Yanfolk are '"[b]eing programmed"' when they are seen heading towards Yan's geo-physiological structures (Brunner 1974 [1972], p. 138). In an instance of narrative symmetry, earlier in the narrative, Chart is similarly depicted as treating the wilders, Yanfolk who live in the South, as programmable organisms. Marc discovers Chart's plan to 'decorticate' the wilders, so that they might be 'programmed actors' in his geo-engineering project (ibid, p. 106). Many of the examples of the lexeme *PROGRAMME* are related to the wilders, including line 4, 5, 6, 7, 11 & 13 (figure 27). Like the northern Yanfolk, the wilders are also seen as having programmable minds, which would become a constituent part of Chart's planned geo-engineering project. This symmetry between Chart's plans and Yan's utilisation of the Yanfolk in the last few chapters is done to foreground the ethically dubious nature of mechanistic approaches to animal beings. Marc is morally outraged by Chart's plans, stating that he will not have '"anything more to do with the man"' (ibid, p. 116). In sum, the Yanfolk, both north and south, are later depicted as organic machines with a mind that is easily bent to the will of the planet

Yan or the human geo-engineer, Chart. This, I argue, draws on the cybernetic influences present in

Lovelock's theory.

4	back of his mind. 'To be pithed and	programmed, of course,' Chart sighed. 'I don't hav
5	expensive, too. But we've got to have	programmed actors available, to take the dramaturg
6	you!' Chart snapped. 'We shall have to have	programmed actors!' There was a dead silence, apar
7	to take wilders and remove their brains, and	programme them artificially to act out the rôle of
8	! Where'd I get the credit for a	programme like that?' 'It could be arranged. In pr
9	no need to worry about costs. I can	programme you; it's a matter of elementary hypnoti
10	spur of the moment. You have to be	programmed with a hypnotic route-map, as it were.
11	a plan by Gregory Chart to pith and	programme intelligent primitives.' 'Was that what
12	wish, they can apply for free go-board	programmes to get them away from Yan until the
13	forbids you to remove their brains or otherwise	programme them for incorporation in–' 'I've alread
14	, and across, and out of, the mandala. 'Being	programmed,' Dr Lem said. 'Those are what we misto

Figure 27: Concordance lines for lexeme *PROGRAMME* in AntConc

The second strategy found in later characterisations of the Yanfolk sees them switching from

identifiable individuals to functional organs or cells, challenging the 'animal body' schema outlined for

the Yanfolk above, and clearly highlighting a connection to the Gaian context. As mentioned above,

Lovelock's Gaia theory sees the Earth as a geo-physiological entity. He states, for example, that 'the

sum total of species is more than just a catalogue, "The Biosphere", [but] […] an entity with properties

greater than the simple sum of its parts' (Lovelock 1972, p. 579). After the planet awakens, the Yanfolk

are seen sitting within one of the ancient geo-physiological structures, 'a curious hollow mountain top',

which Dr Lem suggests is '"a cortex for it [Yan] [in which] [t]housands of individuals [are] cut off by walls

of rocks from the exterior universe"' (Brunner 1974 [1972], p. 141). The Yanfolk are explicitly depicted

here as the planet's cortex, which like the brain in other organisms is enclosed in a protective skeletal

structure – *walls of rocks* – inside the body – *cut off* […] *from the exterior universe*. Even before the

Yanfolk are seen in this functional role, Lem hypothesises that the Yanfolk be conceptualised as the

nerve cells of Yan's brain. Speaking of the planet's subordination of the Yanfolk to lower primitive

functions, he suggests '"when [Yan's] most ambitious plans are under way, ordinary nervous tissue

won't cope, particularly if it's in competition in an individual, with a higher nervous centre, a brain

capable of thinking for itself"' (ibid, p. 138). Functioning as the planet's brain, the Yanfolk are

characterised as mindless and collective creatures, with no ability to *think[] for [themselves]*, and posing no challenge to the Gaian organism.

As well as being characterised as the planet's brain, the Yanfolk are also depicted functioning as Yan's cells, specifically skin cells. As with the focus on Kaydad's internal organs, the choice to represent the Yanfolk as skin cells is a choice that metonymically highlights homeostasis, as the main function of skin is to maintain homeostasis (see: Chiras 2019, p. 189). For example, after Yan awakens, the *shrimashey* ritual is not just seen as a cultural ritual, but '"analogous to that of a cut healing[,] [where] a certain prescribed number of cells replace a roughly similar number of damaged predecessors"' (Brunner 1974 [1972], pp. 134-35). Viewing the ritual as having a grander function, the Yanfolk themselves become characterised as replacement (new-born Yanfolk) and damaged cells (old Yanfolk). This re-construal of *shrimashey*, previously depicted as a murderous rampage, offers a sanitized view of the ritual that appears callous. This attitude is also foregrounded later when the wilders are presented as damaged cells: 'two or three children stared [...] dazedly, and one whimpered for food. But to the dramaturge [of Yan] that was irrelevant, as though a cell of skin had been damaged through the failure of a microscopic capillary' (ibid, p. 146). Yan's indifference to the suffering of the pitiable Yanfolk children is justified by comparing them to a damaged *cell of skin*, their suffering seen as inconsequential. In both these examples, characterising the Yanfolk as damaged cells highlights indifference towards their pain and suffering, problematizing the depiction of animals as organic parts of a larger Gaian whole.

The above characterisation strategies used for the Yanfolk after Yan awakens (span 2, figure 26) – as machines, functional organs or cells – raise ethical concerns about the potential conceptualisations of animal life suggested by Gaia theory, especially those which position animals as parts of the Gaian whole. These perspectives become crucial in *Dramaturges of Yan* as, unlike Lovelock's Gaia, the planet does not aim to maintain conditions for life on its surface, but attempts to destroy itself and the Yanfolk.

By suggesting that the Yanfolk are now part of Yan, highlighted additionally by the use of parenthesis – 'Yan(folk)' (Brunner 1974 [1972], p. 145) – the agency behind the planet's bid for

destruction is partly obscured. Yet, drawing on the 'proper names' category, a continuing individuation between Yan and the Yanfolk is emphasised during Yan's telepathic communication with Marc (ibid, pp. 147-153). Yan thus employs a variety of pronouns – *my/our, I/we, me/us* (figure 28) – that lexically (and typographically) maintain a distinct boundary between the planet and the Yanfolk. Yan also frequently references past events in which the Yanfolk were separate from the planet – *they* in '[t]hey built the mandala' (ibid, p. 147) and *species* in '[a] species evolved on it [Yan]' (ibid, p. 148). This trend continues in the narrative present also, including Yan's use of *victims* – 'the victims of my [...] grandiose plan' (ibid, p. 149) – and pronominal *we*, used after the Yanfolk have suffocated – '"there is no more 'we'"' (ibid). These reference strategies poignantly confirm Marc's suspicions that Shyalee 'was never you [Yan] [...] her consciousness [was merely] drowned out with *sheyashrim*', a drug the Yanfolk take during Yan's awakening (ibid, p. 152). Reducing the Yanfolk to constituent parts of Yan robs them of agency, a change exploited by the planet. Brunner's text therefore dramatically foregrounds problems inherent in the depiction of animals as subordinated parts of Gaia.

1	communication among you which is like that among	my/our species, but which cannot take control of
2	am dying because while your dreams lure you	my/our dreams had the power to drive us.
3	ly, separated scraps of protoplasm should do what	I/we failed to do. If it had been
4	dream brake you. Because the dreaming part of	me/us has never had to fight the harsh
5	rlier grandiose ambition. You no longer say/think	I/we. There is no more 'we'. What oxygen
6	but exhaustion is closer. Super-organism or not,	I/we was/were worn out. It is not
7	out. It is not to be regretted that	I/we died.' '?' 'Of course. What survives is only
8	. What survives is only your awareness of what	I/we were. I found something relevant in your

Figure 28: Concordance lines for **_PRP*/*_PRP** in AntConc

5.6 Brian Aldiss's (1982-1985) *Helliconia* Trilogy

Aldiss's *Helliconia* series (2010) follows the development of a number of human(oid) societies and species on the planet Helliconia. The narrative spans millennia, with the trilogy's timeframe accounting for one year of Helliconia (2592 Earth years) as it orbits around its stars. The books of the trilogy are set during each of Helliconia's seasons ('Spring' (1982), 'Summer' (1983), 'Winter' (1985)). The planet Helliconia itself, like Yan, is represented as a sentient being, known as the 'Original Beholder', whose

'geochemical spirits [...] have managed the life of a functioning whole world as a single organism' (Aldiss 2010, p. 1199). As in *Dramaturges of Yan*, many of the animal characters are able to connect with the Gaia-like entity, the 'Original Beholder' through a process called 'tether', but unlike in *Dramaturges*, the Original Beholder is benevolent. There are numerous animal species presented throughout the *Helliconia* series, including the phagors, a bull-like species, who predominate in the trilogy. The phagors, however, are the only animal characters who have been afforded analytic focus, though such focus is still relatively minor (see: Voller 1989).

To give a brief outline of the plot of Helliconia would require too much space and would be largely irrelevant for the subsequent analysis, so instead I highlight where the animal characters featured in this section appear in the Helliconia trilogy. In *Helliconia Spring* (1982), the prelude section chronicles the fate of Yuli, a boy, who is captured by the phagors but escapes to live with a religious sect in a series of underground caves. Here, Yuli encounters the wutra worm, an animal character that is fundamentally tied to the human societies' religions and iconography as they develop throughout the trilogy. Years later, Yuli's ancestors live in the town of Embruddock, a human settlement in Oldorando, and are frequently at war with the phagors. During an encounter between the two armies, a wutra worm appears from the ground and takes on its aerial form. *Helliconia Spring* also introduces animal characters known as yelk, giant elk-like creatures, with extremely unusual reproductive cycles. *Helliconia Summer* (1983) shifts focus to the Borlien region, broadly following the rule of human king, JandolAnganol. It introduces the shoals of assatassi, a metamorphic swordfish-like species, who share with the yelk an usual reproductive cycle. The wutra worm also appears in *Summer,* though this time as a marine-dwelling creature. Finally, *Helliconia Winter* (1985) explores the Sibournal region of Helliconia, ruled over by the Oligarch. The wutra worm also appears in *Winter* but this time as scupperfish, an eel-like species, considered the immature stage of the wutra worm. The yelk also appear, largely as beasts of burden, or as part of human homesteads.

This analysis will focus on a number of animal characters that feature across the *Helliconia* trilogy. Firstly, the yelk and assatassi, animal characters that form herds and shoals, will be analysed. I have

considered these animal characters collectively as there are many similarities in these creatures' characterisation strategies. I argue that the yelk and assatassi are depicted as contributing to atmospheric and climatic conditions in the narrative, and are therefore depicted as actively part of Gaian-scale processes. They are also involved in element cycling, principally the hydrologic and phosphorous cycles, an important Gaian function. I also argue that these animal characters' method of reproduction is influenced by Gaian principles which enables population balancing, a Gaian theme that, as mentioned above, appears in other sf texts. Secondly, the wutra worm is analysed. I argue that Aldiss's choice to characterise a worm is largely influenced by a Gaian inspired re-evaluation of the importance of this species. The worms also appear to have influenced human mythology in ways that are similar to Lovelock's hypothesis, blurring distinctions between scientific reality and myth. I also suggest that the wutra worm's many metamorphic forms implicate the worm in being a part of Gaia's circulatory function.

5.6.1 Yelk and Assatassi

The yelk appear throughout the *Helliconia* trilogy and are largely presented as herd creatures – a collocate of these characters being *herds* (LR: 8.99). Drawing on the 'proper name' category, these creatures' herd-like dispositions and physical appearance can be anticipated via comparison to terrestrial creatures, like elk. The yelk's physical 'appearance', too, confirms that these creatures are akin to terrestrial elk: they are hoofed creatures with 'long skull[s]', 'elegant horns' and a 'shaggy mane overlying a thick matted coat', the thick coat suggesting the creature is an animal used to colder climates (Aldiss 2010, p. 10). The last of these physical features, their thick coat, is also presented as having a functional and planetary-scale purpose, with the yelk herds being described as 'a rumpled carpet of animals roll[ing] across the land' (ibid). Conceptualising the yelk as offering planetary-scale insulation can also be tied to fluctuations of the yelk herd's population size: in *Spring* (and *Summer*) the herds are *dwindling* (figure 29, line 27), yet in *Winter* they *appear[] in growing numbers* (line 128). Drawing on the aforementioned 'species' schema, like terrestrial grazing herds, the yelk are characterised as herbivorous creatures: 'thick green trails of saliva hung from many a mouth' (ibid, p.

11). Aldiss's use of animal characters based upon terrestrial ruminants is interesting from a Gaian perspective as such creatures, as Lovelock notes (see: 1979, p. 72), were the first to be identified as having a significant effect on the planetary atmosphere, specifically through methane production – though the focus of such studies was domesticated ruminants, wild ruminants also contribute significantly to atmospheric methane.

26	Helliconia - B	plains. They raided the migratory herds of	yelk	and gunnadu. And they moved towards the
27	Helliconia - B	was taken of the dwindling herds of	yelk	and biyelk which inhabited the northern Campannlat
58	Helliconia - B	Takissa. The Driats lived among herds of	yelk	and biyelk which pastured in those high
128	Helliconia - B	relying for meat on the herds of	yelk	and biyelk, which appeared in growing numbers,

Figure 29: Collocate *HERDS* for lexeme *YELK* in LancsBox

Whilst the 'species' schema might hint at this particular alignment to Gaian-scale functions, the text explicitly foregrounds this also, with the yelk's characterisation frequently highlighting the creatures' respiration and other gaseous emissions. For example, the yelk's 'noise came […] not solely [from] the sound of their hoofs but the rasp of their breath, and a continued chorus of […] coughs' (Aldiss 2010, p. 11); 'the noise of the drumming hoofs was punctuated by laboured breathing and coughing and breaking wind' (ibid, p. 14); and 'the cold froze the steam from their upthrust nostrils' (ibid, p. 11). When riding a yelk, Luterin 'breath[es] [in] its misty breath' (ibid, p. 1214). Similarly, another human character notices the yelk he is riding's 'dilated' nostrils, a sign of heavy breathing (ibid, p. 397). As well as breathing and breaking wind, the yelk's excrement and gaseous output is shown affecting the air the human characters breathe. After picking through the yelk's remains, for example, human characters notice 'the smell [eventually] d[ying] from their nostrils' (ibid, p. 22). In *Winter* too, the Sibournalese human communities keep yelk and use their rotting excrement as a source of 'biogas': 'All excretions from both house and stall were washed down into a […] pit […] [.] As the refuse [and excrement] rotted underground, it gave off biogas, chiefly methane' (ibid, p. 1105). Referring to the emissions as *biogas* clearly emphasises its origins, and therefore the biosphere's role in its production.

As mentioned above, atmospheric carbon (dioxide) and methane are some of the gases from biospheric sources that Lovelock implicates in maintaining oxygen levels. Yelk are therefore often

characterised as animals whose exhalations and gases are tangibly observed or seen to affect the surrounding atmosphere. Given these animal characters' vast herd sizes, a more substantial impact on Helliconia's planetary atmosphere can be inferred. And, indeed, later the text explicitly acknowledges that atmospheric 'parameters for existence came within the regulatory functions of […] [the] biosphere' (ibid, p. 1086).

Like their gaseous emissions, the presentation of the yelk as a herd, as with the shoals of assatassi, allows Aldiss to depict animal characters as being part of Gaian-scale climatic forces. Indeed, the yelk's first appearance highlights the vastness of the herds. For example, the yelk herds are described as being 'without end' (Aldiss 2010, p. 9), with the human characters noting the 'world [became] one inescapable teeming animal' (ibid, p. 12). Such vastness lends itself to a climatic analogy with the yelk described as 'travelling solidly on a wide front', where the lexical item *front* suggests a meteorological event (ibid, p. 9). This is just one example of a conceptual metaphor that Aldiss's *Helliconia* frequently draws upon, namely CLIMATIC FORCES ARE ANIMALS, a conceptual metaphor that foregrounds a Gaian perspective. The characterisation of the yelk as a climatic force is present in numerous examples: the yelk herds are compared to an avalanche – 'avalanche of shaggy life' (ibid, p. 12) – a river – '[t]hey were as much a natural force as the river' (ibid, p. 121) – and a thunderous storm – '[a] heavy dull continuous thunder marked the approach of the herd' (ibid, p. 12). As Lovelock has noted, '[t]heories of the climate and the chemical composition of Earth's surface either ignore the presence of the biosphere or assign to it a passive role; a sort of non-participating spectator at a demonstration of physics and chemistry' (1982, p. 797). This is challenged by Aldiss's characterisation of yelk with the above strategies presenting the yelk as participating in the atmospheric and climatic forces through which Gaia regulates the planet.

Finally, drawing on the 'relational roles' schema, specifically 'ecological interactions', the yelk's offspring are characterised as being in a parasitic relationship with their parents. The text describes such creatures – yelk, biyelk, assatassi, gunnadu – as 'necrogenes'. Whilst on the surface this may not appear to be a Gaian interaction, the fact that the yelk's offspring cause the paternal host to die

suggests that this represents another example of population balancing, which, as in many other science fiction texts, is presented as an instance of Gaian-scale homeostatic functioning. The yelk's reproductive method and offspring are therefore described as follows:

> After mating, the […] sperm developed within the warm interior into small maggotlike forms, which grew as they devoured the stomach of their maternal host. A time came when the maggot-yelk reached a main artery. It could then spread in its numbers like seed in the wind throughout the host animal, causing death within a short while. […] At length, two or possibly three small rapid-moving yelks would emerge from throat or anus (Aldiss 2010, p. 19).

The yelk's characterisation as a necrogeneous species is similar to the Yanfolk's cultural practice of *shrimashey*, in which a member of the species replaces another of its kind. This balancing of animal populations is also made clear with the text's explanation of assatassi reproduction: 'assatassi propagation involved destruction' (ibid, p. 807). Here the use of lexical antonymy – *propagation* and *destruction* – highlights how necrogenes' reproductive method consists of a balance between these opposing concepts. In a similar vein, drawing on the 'proper name' category, referring to yelk's offspring via the compound maggot-yelk (figure 30) implicates death and decay in the reproductive process. Later the text implicates the necrogenes' lives as part of broader planetary balances, suggesting the yelk's and assatassi's 'corporate lives were never more than part of the equipoise of the planet to which they belonged' (ibid, p. 1086).

1	their maternal host. A time came when the maggot-yelk reached a main artery. It could then
2	ripped up the belly of the animal. The maggot-yelk were within, no bigger than a fingerna
3	to the freezing air. Left to themselves, the maggot-yelk would live in safety inside the skins
4	a bag, into which he scraped the dying maggot-yelk. Meanwhile his father was dissecting t

Figure 30: Concordance lines for lexeme *MAGGOT-YELK* in AntConc

The assatassi, or, due to their metamorphic nature, fish-lizards, are also necrogenes who first appear in *Helliconia Summer*. Indeed, the creatures are introduced through a dramatic event known by the human characters as the 'Death Flight of the Assatassi'. Characterised as a migratory species, the

assatassi's migration from sea to land changes from being a 'long leisurely swim, without apparent aim' to 'a race' towards the creatures' final location and fatal stage of reproduction (Aldiss 2010, p. 805). As with the yelk, the agency behind the assatassi's seemingly purposive behaviour, which at species-level is assumed to be propagation, is undermined by connecting the animal characters' sudden death-seeking behaviour to broader planetary forces. The assatassi's death flight is therefore presented as being caused by the weather: 'the onset of monsoon weather in the [...] sea brought a changed behaviour pattern [in the assatassi]' (ibid). Through a relational process of the circumstantial sub-type, the process – *brought (about)* – encodes the circumstances under which the fish-lizard's behaviour comes into existence (see: Halliday & Matthiessen 2004, p. 243). This causal relationship suggests that the agency behind these animal characters' behaviours, i.e. the race towards propagation and death, does not come from the creatures themselves but from climatic conditions. If as is proposed by Lovelock, climatic and atmospheric equilibrium are under the control of a Gaia-like entity, the Original Beholder in *Helliconia*, then the assatassi's death flight is presented as being heavily influenced by such an entity.

The assatassi are also creatures who, like the yelk, are intimately connected to Gaian-scale bio-geochemical processes. Their characterisation similarly draws on the CLIMATIC FORCES ARE ANIMALS conceptual metaphor, but more specifically foregrounds Gaian-scale cycles including the hydrologic and phosphorous cycle. As Birch notes of Lovelock's theory, these cycles 'all involve feedback processes that result in the composition of the atmosphere or of the oceans remaining remarkably constant', providing compelling evidence for Gaia's existence (1999, pp. 100-101). To begin with the hydrologic cycle, the assatassi are depicted as spending part of their lives in the sea and part on land following water's cyclic journey around the planet. When the creatures first begin their 'death flight', it is described as being a kind of rain: 'the sea rose, opened, and rained assatassi' (Aldiss 2010, p. 805). Describing the assatassi's migration to land as *rain* is the first of many comparisons between this animal

species and water.[59] For example, during their death flight, the air is described as being 'so full […] with them [assatassi]' that they form 'a solid body of fast-moving fish-lizard' (ibid, p. 806). Like evaporated water, the assatassi fill the air, and, drawing on the 'proper names' category, the naming strategy used here – *a solid body of fast-moving fish lizard* – blurs distinctions between the creatures and water. In addition, references to the creatures as 'fish lizards' highlights the various metamorphic stages – 'miniature iguana' in juvenile form and fish in adult form (ibid, p. 807) – that the creatures take and can be compared to the various states in which water can manifest itself during its cycle.

Similarly, after a brief cessation, the assatassi death flight restarts and is described as being '[a] second wave […] r[ising] from the sea', where again the creatures are analogous to water (Aldiss 2010, p. 813) – there is also a 'first wave' (ibid, p. 806). A human character, on finding their dead friend, also compares the fish-lizards to the destructive force of water – '"How can mankind ever build up bulwarks against nature, when it keeps flooding in like a deluge […] ?"' (ibid, p. 808). Lastly, when outlining the creatures' terrestrial development, the assatassi are shown returning to the sea, as does water: 'the miniature iguanas […] made their way back to the great parent sea, […] to replenish the cycle of assatassi life' (ibid, p. 807). Describing the assatassi's return to the sea as part of a cycle – *the cycle of assatassi life* – and the sea as a *parent* suggests that the assatassi are intertwined with one of the fundamental processes involved in Gaia's homeostatic regulation of planetary conditions.

This is also true of the assatassi's role in the phosphorous cycle, phosphorous being a nutrient chiefly found in bones (and rocks). It is argued that the main mechanism of transport of phosphorous from marine environments to terrestrial ones is through migrating fish (see: Doughty et al 2016). In Lovelock's theory, he posits the migratory behaviours of fish, such as salmon, fulfil a Gaian function: 'it is worth asking ourselves whether the movements of migratory birds and fish serve the larger Gaian purpose of phosphorus recycling' (Lovelock 1979, p. 105). Aldiss's narrative also hints at the role that the assatassi play in disseminating nutrients to terrestrial environments:

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[59] As well as the assatassi, other animal characters are also presented in this way: flambreg are described as an 'avalanche', forming 'living streams' which 'swe[ep] away' other forms of life (Aldiss 2010, pp. 745-747).

All round, rocks and trees were covered with smashed bodies of fish. [...] The death-flight had taken many fish a long way inland. The sombre jungles overhanging the mouth of the Kacol were now interpenetrated by fish-lizards which would be rotten (Aldiss 2010, p. 807).

The focus on the fish-lizard's broken and decaying bodies, the means through which phosphorous would pass from body to environment, and the distance from the sea – *had taken many fish a long way inland* – appears similar to Lovelock's discussions on migratory fish's nutrient-disseminating Gaian function. Indeed, drawing on the 'animal body' category, the feature that 'chiefly distinguishes' the assatassi is highlighted as being its large bony skull – a 'straight bill of bone, supported by a boney cranium' (ibid, p. 806) – which happens to be a main source of phosphorous in animal bodies. The depiction of assatassi as nutrients is also conveyed in references to them as meals for humans and birds, as in concordance lines 24, 27 & 28 (figure 31).

24	tacked by the scavenging birds, devouring impaled	assatassi, while the hornets and bees they disturb
25	deaths occasioned by the death-flight of the	assatassi. Only when they were out of the bay
26	belly of the cloud. A second wave of	assatassi rose from the sea, like a wing unfurling
27	folk, even slaves, were indulging in a grand	assatassi fry. Fish moved in to give the corpse
28	gathered by the water's edge. The great	assatassi feast was ending. Here was a time to

Figure 31: Concordance lines for lexeme *ASSATASSI* in AntConc

5.6.2 Wutra('s) worms

This animal character, as its name suggests, is connected with the primitive god in *Helliconia*, named Wutra, a god featured in the human(oid)s' religion. Drawing on the categories 'proper name' and 'company', the wutra worm is often associated with this god. For example, the human characters state that their preferred god, Akha, is 'prowling the mountains with a celestial club, looking for Wutra and his dreadful accomplices [...] the worm' (Aldiss 2010, p. 35). Similarly, in *Spring* the narrative suggests that the wutra worms living underground were 'sent by Wutra' (ibid, p. 64). Wutra is depicted as 'god of the skies', which, as outlined below, can also be connected to the wutra worm character, which experiences an airborne metamorphic state (ibid, p. 14). More tangibly, the god Wutra is said to have

'Two Sentinels' – 'the Two Sentinels […] being in the sky, they belonged to Wutra' – that watch out for him (ibid, p. 45). It is not merely coincidence then that, during the wutra worms' metamorphosis into their flying forms, they are also described splitting in two. Whilst the text suggests that the human(oid)s' religious mythology is influenced by their interactions with the phagors, it is similarly connected to the wutra worm. The wutra worm's various explicit and veiled associations with Wutra extend the god's mythological status to the creature itself. In *Spring,* for example, Yuli's stabbing of the worm leads it to bleed out 'ichor' (ibid, p. 94) and the creatures' aerial metamorphosis highlights awe and power – they are 'beautiful in their power' (ibid, p. 339). In *Summer* also, the creature's stated rarity hints at a mythological figure – 'their appearances before the eyes of men were rare' (ibid, p. 844). As with Lovelock's hypothesis that provides evidence for the scientific reality of an earth system, named after an ancient deity (Gaea), the characterisation of the wutra worm highlights a similar twinning of reality based upon mythology.

In addition to the wutra worms' connection to Wutra, they are also connected to another primitive god, Akha. For example, in *Spring,* Akha is depicted as a 'god of the earth and underground', where associations between this god and subterranean environments hint at the wutra worms' influence again on human mythology (Aldiss 2010, p. 41). Similarly, the human(oid)s worship Akha in underground temples and are said to be 'liv[ing] in its [Akha's] veins' (ibid). The veins which Yuli and the other monks live in are likely to have been carved by wutra worms: 'Wutra put the worm into the labyrinth of passages in Akha's holy mountain. The worm is large and long, its girth being about equal to that of a passageway' (ibid, p. 69). Subterranean worship continues into *Summer* also, with the religious zealots worship of the contemporary god, Akhanaba – in *Summer* the distinctions between Akha and Wutra are lost – occurring in places deep underground, still based in the mountains where the wutra worm lives during its terrestrial stage (ibid, p. 866). As with Wutra, the wutra worms seem closely associated with the primitive gods Akha and later Akhanaba.

Alongside the wutra worms' mythical status, they appear also as a corporeal animal characters, that, whilst undergoing many metamorphoses, always have a worm-like physical form. Drawing on the

'species' schema, the choice to depict a worm-like character is influenced by the shifting perspective offered by Lovelock's hypothesis, where creatures involved in the regulatory function of Gaia's system have increased importance. As mentioned above, worms are often considered to be instrumental in fixing atmospheric carbon. In 1982, for example, Lovelock notes 'carbon dioxide is pumped out of the air by the biota[,] […] [a] process […] assisted by the mechanical and chemical break down of rocks by plant roots, fungi and lichens and by the numerous invertebrates of the soil' (p. 800). The wutra worm in *Helliconia* challenges the 'species' schema for worms by super-sizing the creature in line with its relative importance within this Gaian perspective. In *Spring*, for example, it is explicitly described as 'gigantic' and Yuli notes that the creature's body is miles long – 'there were miles of it' (Aldiss 2010, p. 92). In *Summer* too the creature leaves its subterranean habitat, metamorphoses into a winged worm, but is similarly large: it 'loom[s] over the treetops' and is able to bite a female phagor – slightly taller than a human – in half (ibid, p. 337). It also appears later in *Summer* as a marine-based creature, again drawing on descriptions that emphasise its vast size: it 'tower[s] above the masts of the Good Hope [a ship]' and is explicitly described as 'gigantic' and 'great' (ibid, pp. 843-844). Only in its juvenile form, as 'scupperfish', does the wutra worm appear closer to the size of its terrestrial counterpart. The choice to represent the wutra worm as a huge creature impossible to ignore seems a particularly Gaian re-evaluation of the importance of this species.

The wutra worm character can also be linked to Gaian influences through its many metamorphic forms, as with the assatassi. Drawing on the 'setting' category, the creature is depicted moving from a subterranean environment – 'the cave system was crawling with worms' (Aldiss 2010, p. 93) – to living in the upper atmosphere – 'their long thin bodies undulated through the atmosphere' (ibid, p. 339) – to a marine environment – 'a mass rose from the water' (ibid, p. 843) – before finally returning below ground. These realms make up the inanimate parts of the biosphere implicated in Gaia's functioning – indeed, Lovelock's (1979) research is structured around such regions ('The Contemporary Atmosphere' [chp. 5], 'The Sea' [chp. 6], 'Gaia and Man: the Problem of Pollution' [chp. 7]). Lovelock notes that the 'biosphere learned to synthesise […] components from the basic raw materials of the air, sea, and the

Earth's crust', which, seeing as animals are mobile parts of the biosphere, allows them to distribute 'trace elements needed for specific mechanisms and functions' (1979, pp. 25-26). The wutra worm's metamorphic life cycle is therefore associated with regions of the biosphere deemed important to Gaia theory, showing the worm to be part of this circulatory function. As mentioned above, the wutra worms are seen as having carved the 'veins' [i.e. passageways] of Akha, the Earth god, within which the religious monks live. In its later aerial forms also, the split worms are seen flying 'in […] opposite direction[s], following favourable air-octaves' (ibid, p. 339).[60]

Though the wutra worms are not depicted performing the specific Gaian function of carbon fixing, it does appear as an animal character associated with other elements that cycle through the planet Helliconia. In its subterranean stage, for example, Yuli highlights the smell and the gas that appears in the creature's presence: It was a ripe aroma of festering fish, of scumble [shit], of rotten cheese' (Aldiss 2010, p. 92). The wutra worms are characterised as a foul-smelling creature, associated with sulphur. Indeed, the rotting smell associated with the approaching worm is one of the main characteristics of sulphur compounds. Sulphur is a key element discussed in detail in Lovelock's (1972) outlining of Gaian processes. Specifically, he argues the production of dimethyl sulphide by phytoplankton in the ocean influences cloud formation, a mechanism that helped stabilise planetary temperatures. It is also, as he shows, produced in terrestrial soil, though in smaller volumes. Similarly, Yuli's reaction to the wutra worm's smell – 'choking them with filth and stink' (Aldiss 2010, p. 92) – aligns it with sulphur compound, sulphur dioxide, an acrid gas implicated in sulphur's cycle. Like the assatassi's characterisation, the wutra worms are characters connected to key elements that cycle through the planet's biosphere and perform regulatory functions.

Later in *Spring,* the wutra worms are depicted taking on their aerial forms. Unlike the terrestrial form they take in the 'prelude' chapters, the aerial wutra worms perhaps pose the biggest challenge to the 'species' schema, as worms, even marine-based species, are largely found in soils or on sea beds. However, drawing on the 'animal body' schema, the worm's metamorphosis still largely follows

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[60] Octaves, air or land, are defined as being veins also: 'These [the planet's] veins are called land-octaves' (Aldiss 2010, p. 41).

features found in marine species, especially polychaete worms. For example, the creature's features are described as follows: 'the jaws of the new head sprouted fleshy feelers, behind which came a mouth […] with two eyes set horizontally in it' (Aldiss 2010, p. 338). The *fleshy feelers* are similar to tentacular cirri in the marine-dwelling polychaete. The worms' bodies are also covered with 'a layer of slime' (ibid). On taking to the air, the creatures' 'long thin bodies', 'whiskered tails' and 'tentacle appendages' seem to 'undulate[s] through the atmosphere' (ibid, p. 339). These *whiskered tails* reference the stiff hair-like structures known as setae, found in both earthworms and polychaetes. The metamorphosis foregrounds the popular myth that a worm, severed in half, will produce two separate individuals (Marren & Mabey 2010). The focus on these features suggests that even in its aerial form the wutra worm seems aligned with a worm 'species' schema.

The wutra worms' aerial metamorphosis highlights other elements that are Gaian-inspired also. For example, drawing on the category 'company', the creature is pictured emerging from its subterranean environment through a rajabaral 'tree'. The wutra worm is depicted 'enter[ing] the rajabaral through its roots, […] [where] [i]ncreasing warmth encouraged it to moult and metamorphose' (Aldiss 2010, p. 337). The rajabarals, like their real-world counterparts, are often used as a building material, but also appear similar to volcanic vents – 'the rajabarals steamed from their flat lids' (ibid, p. 279). Like volcanoes, they are implicated in altering the planetary atmosphere and temperature, with the rajabarals' function said to be to heat 'the air [in the atmosphere] […] with the heat of the earth', which leads to a change in seasons (ibid, p. 147). The wutra worms' association with rajabaral trees therefore aligns them with greater Gaian-scale forces. Indeed, the wutra worm's emergence, appearing as an eruption – 'Suddenly, [the rajabaral's] top blew, pieces falling like shattered pottery, and out from the top reared a Wutra's worm' (ibid, p. 337) – implicates them in speeding up the heating process, as depictions of exploding rajabarals are foregrounded in the final pages of *Helliconia Spring* (ibid, pp. 442-443), which is followed subsequently with *Helliconia Summer*. Regulation of planetary temperature, with minor fluctuations that allow for the continuance of life, is one of the key pieces of evidence

Lovelock (1972) pointed towards in his early research on Gaia theory, and Aldiss implicates the wutra worms in these processes via the characters' connection to the rajabarals.

As with earlier depictions in *Spring*, the worm is associated with the sulphur cycle, with the smell of 'scumble, festering fish, and decaying cheese' in the air when it emerges (Aldiss 2010, p. 337). But, it is also involved in the carbon cycle through respiration. For example, as it begins to fly, the worm is depicted breathing: 'the leading aperture, the mouth, gulped in air, expelling it through rear vents' (ibid, p. 339). Whilst the gill-like *rear vents* might appear to challenge the 'species' schema, marine-based worms often have gills for breathing. Describing the wutra worm's gill-like appendages as *rear vents* also emphasises the ANIMAL BODY IS A MACHINE conceptual metaphor. As with the Yanfolk, this foregrounds the cybernetic influences present in Gaia theory, an influence that considers those 'processes and […] properties exclusive to living things and […] highly automated machines' (Lovelock 1979, p. 48). Such a characterisation strategy is foregrounded all the more due to the fact that Helliconian society appears largely medieval and pre-industrial, highlighted by an under-represented semantic domain of 'Y1: Science and Technology in General' (*LL250.41*) in Wmatrix. Like the Yelk, the wutra worms are also associated with gaseous elements often explored through Lovelock's theory. Although in his later work Lovelock states that 'breathing is a potent source of carbon dioxide' (2009, p. 74), his earlier work (1982), as mentioned above, begins to connect carbon cycling with worms' Gaian-scale functioning. Aldiss's characterisation of the wutra worms' emission of carbon dioxide therefore appears influenced by Lovelock's theory.

In its final metamorphic stage in *Summer*, the wutra worm is depicted as being a marine species, whose physical traits similarly reinforce the worm 'species' schema. Its body is long, thin and segmented – 'sections of its roped body' (Aldiss 2010, p. 844) – it appears to be a slimy, similar to the mucus that covers terrestrial worms – 'its […] body still agleam in the viscous air' (ibid) – and it still has the tentacular cirri found in marine worms – 'whiskers that writhed like eels' (ibid).

Though the wutra worms appear only fleetingly during this stage, they draw on the same conceptual metaphor used to characterise the yelk, namely CLIMATIC FORCES ARE ANIMALS. The

worms are therefore characterised as a raging storm. When the worms appear, the water is described as 'boil[ing]', 'convuls[ing], and 'churning', all of which suggest an impending storm (Aldiss 2010, p. 843). The text further elaborates that:

> The storm was its [the worm's] element. […] A second monster appeared, this one in a rage[.] […] [I]t rose, then struck at the waves […]. The two creatures joined forces. […] One lashing tail smashed against the side of the caravel, breaking planking and treenails. Then both beasts were gone. The waters lay flattened where they had been (ibid, p. 844).

The use of the relational clause of the possessive sub-type – *the storm was its element* – disrupts typical boundaries between animals and climatic forces. This interpretation is made stronger by the fact that the storm's beginning and ending coincides with the appearance and departure of the wutra worms. The creature's 'actions' also suggest a destructive force akin to a raging storm. For example, their tails *smash[]* and *break[]* the ships in the area and the water is *flattened*. However, as well as this conceptual metaphor, the worms' depictions also draw on pathetic fallacy, with one of the wutra worms described as being *in a rage*. As mentioned above with the yelk, Lovelock's Gaia proposes that 'major changes in the Earth's environment have been brought about by life itself' and stresses that 'the links between life and its environment [are] closed, in a cybernetic sense' (1982, p. 799). Closed cybernetic systems, like the one presented by Lovelock between life and its environment, often stress mutual causality and reciprocity, meaning that parts of the system affect each other. This characterisation of the wutra worms, which draws on the CLIMATIC FORCES ARE ANIMALS conceptual metaphor, its destructive actions and elements of pathetic fallacy similarly suggest a reciprocal relationship between Gaian components, in this case the biosphere and atmosphere.

5.7 Conclusions

Lovelock's Gaia theory has remained an unexplored influence on the animal characters that feature in science fiction texts, despite the theory heavily implicating the biosphere, including animals, in Gaia's functioning. In most cases, the limited research that has focused on Gaia theory's influence in sf texts has centred on human characters' relationships with a sentient planet, particularly Canavan (2016) and

Yanarella's (2001) research. Those few, such as Voller (1989) who briefly discuss animal characters, like the phagors in the *Helliconia* trilogy, tend to focus on the relationships these characters have with the human(oid)s, rather than discussing connections to the Gaian context. For example, Voller notes that humans and phagors have 'a deeply commensal relationship [as] [...] a virus transmitted by a phagor tick is instrumental in regulating human populations' (ibid, p. 145), but does not connect this with the Gaian entity's goal of homeostasis (see: Ernest 2008). Indeed, Aldiss's text suggests phagors are guided by ancestors 'tethered' to the Original Beholder, the Gaian entity in *Helliconia*: 'the needs of one phagor were the needs of the whole world' (Aldiss 2010, p. 335). Overall, very few, if any, scholars have analysed the relationship between animal characters and a Gaian entity, or how those elements influential to Lovelock's theory – homeostasis and feedback loops, its geo-physiological approach, and its focus on element cycling – feature concretely in sf texts and influence its animal characters.

I argued in the introduction that, as well as the Gaian context receiving little scholarly attention, Lovelock's theory was an important concept to consider in relation to animal characterisation as it appears, partly, to align with animal studies' perspectives. For example, I noted that Gaia theory tends to reverse still predominant 'hierarchy of species' values where more complex life is considered more valuable than simpler lifeforms. Lovelock's theory reverses this paradigm by arguing that the 'tough reliable workers composing the microbial life of the soil and sea-beds are the ones that keep things moving' (1979, p. 40). In *Helliconia* (Aldiss 2010), this influence can be seen by the wutra worms' characterisation, as they are not only aligned with the human(oids) deities but are also supersized making them impossible to ignore. Though my focus has been on the characterisation of wutra worms, this research can be situated alongside that conducted by Crist (2004), who explores Darwin's work on earthworms retrospectively through a Gaian perspective, arguing along with Darwin that worms are not merely '"trifles"' but vital geo-engineers. It can also be aligned with Stibbe's (2012) exploration of the 'commonplace' animals, including insect invertebrates, depicted in Japanese Haiku, where the creatures' connection to the local environment mixed with the genre's ecological perspective emphasises the 'special worth in the subjects it [the haiku] describes' (p. 150). Along with these pieces

of research, this chapter has foregrounded those animal characters, invertebrates, most unlikely to receive scholarly attention (see: Clark 2016).

In line with this idea, I also suggested Gaia theory challenges anthropocentric attitudes, due to its re-evaluation of the lack of importance of highly complex animals, like humans. In *Dramaturges of Yan* (Brunner 1974 [1972]), for example, the characterisation of Shyalee switched from her being heavily objectified by Marc to someone who rejects him and accepts Yannish culture (pp. 193-195). I argued their relationship dramatized a switch from an anthropocentric worldview to a Gaian one, especially considering Shyalee's later integration with the Gaian-like entity, Yan. This chapter therefore aligns with ecolinguistic scholars' research, which attempts to explore how various discourses might support biocentric perspectives, such as Gaia theory (Fill & Mühlhäusler 2001).

Contrastively, however, I noted that the Gaian context is occasionally ambivalent towards animal studies' perspectives, particularly when the needs of the Gaian-scale entity are placed above the needs of those creatures that inhabit it. Following the Doolittle Objection, Lovelock's (1979) hypothesis is occasionally ambiguous as to where agency of an animal's actions lie, i.e. do animals fulfil larger Gaian-scale functions acting as 'good citizens' or follow 'selfish' impulses acting in line with their species' interests? In *Dramaturges of Yan* (Brunner 1974 [1972]), I noted that the Yanfolk were depicted under the control of the Gaian organism, Yan, with this depiction challenging the ethical nature of this relationship. Whilst this represented a creative departure from the Gaian context, due to the heavy-handed nature of the planet's control and the planet's genocidal intent, Yan's utilisation of the Yanfolk problematizes some of the tensions between Gaia theory and animal studies' perspectives. More broadly, interactions between Gaian rights and those of individual species are still contested by environmental ethicists. Lynch et al note, for example, that 'the animal rights approach […] ha[s] not generally taken up a global view of species rights as they intersect with the rights of Gaia' (2019, p. 45) – indeed, other environmental ethicists see similar tensions (Guither 1998, pp. 21-22).

In attempting to outline the ways in which Gaia theory has been utilised in these texts, this chapter has outlined a number of characterisation strategies that appear prominent. In line with other sf texts,

some of these texts have attempted to present a creative grappling with the idea of animal population controls. As mentioned above, other sf texts have featured animal characters whose roles include population balancing, including the cephalopods in *Door into Ocean* (Slonczewski 1986) and the *skavu* in *Ally* (Travis 2007). In the text's analysed in this chapter, this idea is given a creative twist. In *Dramaturges of Yan*, the cultural practice of *shrimashey* practiced by the Yanfolk – its effects are seen as physical scarring on Kaydad's body (p. 196) – is presented as being a means to regulate their population. Similarly, in *Helliconia*, the yelk and assatassi are animal characters that are described as being 'necrogenes', animals that reproduce through death, keeping their population sizes in check (pp. 207-208). These examples highlight a variety of strategies used by sf writers to depict a scientific concept – homeostasis – through characterisation. This suggests that, as in the other chapters, a concept fundamental to a particular scientific context may have various manifestations in sf texts.

Other characterisation strategies that appear prominent are also presented and similarly adhere to Gaia theory's influences and principles. In *Dramaturges of Yan* (Brunner 1974 [1972]), for example, I noted how the previously individuated characters, Shyalee and Kaydad, appeared in the latter parts of the novel as machines and the wilders were seen as having minds that worked like computers, drawing on the cybernetic influences present in Lovelock's theory (pp. 199-200). This characterisation strategy also appeared in *Helliconia*, though very briefly, with the wutra worms (p. 216). Despite its importance, the cybernetic influences in Lovelock's theory are only occasionally acknowledged (see: Botkin 2012, Marshall 2002, Sagan & Whiteside 2004). Marshall, for example, notes that Lovelock's research often rests on a 'mechanistic heritage' despite many seeing the approach as a purely holistic one (2002, p. 210). Though the presentation of animals as being machine-like has a long history stretching back to Descartes, I have argued in this chapter that this strategy is also a manifestation of Lovelock's scientific heritage. Presenting animal characters (and their corporeal counterparts) as machines is problematic and, as noted in this chapter, is used in Brunner's text to deny the Yanfolk's agency and minds, leading to exploitation by the planet Yan. This chapter is therefore situated alongside previous research on early-modern representations of animals as machines (Shugg 1968, Fudge 2006),

but focuses on contemporary manifestations of the phenomenon and is grounded by these sf texts engagements with Gaia theory.

In addition, this chapter has highlighted characterisation strategies in these sf texts that appear unique and have similarly passed unnoticed by previous researchers. For example, *Dramaturges of Yan* (Brunner 1974 [1972]) represents the Yanfolk as though they were parts of Yan's (geo-)physiology, appearing as organs (p. 201) or skin cells (p. 202), which, in ways similar to their presentation as machines, encourages exploitation by the planet Yan. In *Helliconia*, characterisations of the animals, including the yelk (p. 207), assatassi (pp. 209-210) and the wutra worms (pp. 216-217), drew repeatedly on the conceptual metaphor CLIMATIC FORCES ARE ANIMALS, implicating them in Gaia's regulatory functions. As well as representing animals as climatic forces, Aldiss's text showed how animal characters were implicated in element cycling and atmospheric gas production, including the yelk's production of methane (pp. 206-207), the assatassi's involvement in the water (pp. 209-210) and phosphorous cycle (pp. 210-211), and the wutra worm's association with sulphur (p. 214 & p. 215) and carbon dioxide production (p. 216). These analyses represent original contributions to the representation of animal characters in sf, which sensitively situates them amongst the Gaian context.

As in the other chapters, Culpeper's (2001) methodology, and my subsequent amendments, has proved invaluable for grounding aspects of these analyses. Along with the many other categories that have proved useful in previous chapters – 'action' (p. 200, p. 217), 'setting' (p. 213), 'species' (p. 196, p. 205, p. 212), 'relational role' (p. 207), 'animal body' (p. 193, p. 197, p. 211, p. 214), 'appearance' (p. 193, p. 195, p. 205), 'proper names' (p. 202, p. 205, p. 208, p. 210, p. 211), and 'company' (p 195, p. 211, p. 215) – categories not yet highlighted in other chapters have been highlighted here. For example, with Shyalee's characterisation, the category 'sex' highlighted how Marc objectified her body (p. 193), and the category 'preferences' showed how Marc aligned Shyalee with Yannish culture and clothing against her own interests (p. 194). Both categories helped to develop a picture of Shyalee's relationship with Marc before her later alignment with the Gaian entity, Yan. Similarly, the corpus linguistic approaches – collocations (p. 205-206), keywords (p. 200), semantic tags (p. 216), and concordance

analysis – have continued to provide useful support for the analyses conducted throughout this chapter.

In terms of expanding this chapter's focus, firstly, I would recommend that the characterisation strategies noted above be explored in relation to other Gaian-inspired texts. As mentioned in the introduction, the creatural timmys in Tepper's (1998) *Six Moon Dance* could be analysed, as well as the *skavu* in Travis's *Ally* (2007) and the sea-swallowers in Slonczewski's *Door into Ocean* (1986). This would work to confirm the validity of the characterisation strategies found, and, potentially, broaden the number of strategies sf authors employ when presenting their animal characters in these Gaian-inspired texts. Secondly, as with the previous chapter, it could prove interesting to explore the ways in which an animal character's direct speech might align with a Gaian focus. For example, Goatly (1996) draws on Gaia theory's worldview to create a list of 'consonant' grammar recommendations that align with the contemporary scientific realities of interconnectedness and holism. These include the use of reciprocal pronouns, ergative structures, and nominalisations. In line with Culpeper's categories, 'syntactic structure' and 'lexis', these consonant grammatical features could be used to explore animal character's speech in Gaian-inspired sf texts, further adding to the characterisation strategies noted above.

6 Overall Conclusions

Through close analyses, this thesis has explored the ways that various scientific contexts, including behaviourism, the concept of entropy, and the Gaia hypothesis have influenced the characterisations of represented animals in sf texts. I outlined extensively in the introduction how science fiction's predilection for ideas over characters' internal psychologies (section 1.3) and its constitutive relationship with science (section 1.4) makes the genre uniquely suited for a scientific contextual exploration of character. This thesis therefore sits alongside other stylistic and literary critical research that acknowledges sf's 'holistic view of knowledge [...] that is not divided into the "two cultures" of sciences and arts' (Stockwell 2003a, p. 198). It also argued that despite the relationship between sf and science being crucial for the genre, sf should not merely be seen as entirely deferential to scientific contexts, something which is often seen by some as being sf's (particularly 'hard' sf's) pedagogic function (see: Benford 1994, Stockwell 2003, Westfahl 2005, Vrasidas et al 2015, Thévenon 2018). Like Ryan (2011), I have seen these science and narrative engagements as being reciprocal ones (section 1.5). In the behaviourism chapter, for example, the dogs' training in the isolated attic is not represented in *Animal Farm* (Orwell 2008 [1945]), despite the fact that Skinner's research specialised on histories of reinforcement, which became foundational to his laboratory-practice-based approach.

In the various chapters each of the scientific contexts was justified. Behaviourism and Gaia, for example, have rarely been considered as an informing context in science fictional works, whilst entropy, although occasionally explored, has never been considered in relation to animal characterisation. Alongside these gaps I also outlined how each context could be aligned with the broader animal studies approach attempted in this thesis. Behaviourism therefore perpetuates damaging conceptualisations of animal life with animals lacking agency (the ants in 'Remote Control'), being viewed in mechanistic and utilitarian ways (the dogs in *Animal Farm*), and trained using cruel and exploitative techniques (all newt characters in *War with the Newts*). Entropy, I noted, challenges human exceptionalism, creating space for animal characters (the arthropods and reptiles in *Drowned World*), but contrastively it can also highlight the ethical dimensions of energy usage and its eventual exhaustion (the wub in 'Beyond

Lies the Wub' and the rats in 'The Rodent Laboratory'). Similarly, Gaia theory subverts the 'great chain of being' placing emphasis on those lowly creatures vital to Gaian processes (the wutra worm in *Helliconia*), but can also present animals as being functional parts of Gaia that actually denies them ethical consideration (the Yanfolk in *Dramaturges of Yan*).

In exploring these contexts, I felt it was important not only to draw on a variety of sf text types – short stories, novels and trilogies were covered – but also well-known authors alongside authors that have received little scholarly attention, such as Kateley (1930), Platt (1966) and Brunner (1974 [1972]). This breadth not only offered my research a comprehensive insight into how scientific contexts affected animal characterisation, but also allowed me to spotlight sf authors that have remained obscure.

Whilst I outlined the various approaches and methods that narratologists (and some stylisticians) have used to analyse animal characters, I argued that many had tended to utilise frameworks that make sense when analysing 'round' animal characters – such as homodiegetic narration, focalisation, direct speech, and mind style (see: Fowler 1995, Nelles 2001, Herman 2013, Bernaerts et al 2014, Herman 2016a, Herman 2016b, Daniellson 2017). In order to explore the animal characters in sf I instead drew on and amended Culpeper's characterisation framework. This was supported by a variety of corpus linguistic approaches that have already been utilised by other researchers for characterisation analysis (Culpeper 2001, Culpeper 2002, Hubbard 2002, Semino 2004, Archer & McIntyre 2010, Bednarek 2011, Mahlberg 2012, Balossi 2014, Mahlberg & Stockwell 2015, Ruano 2018). Culpeper's model was the primary framework chosen as it is the most comprehensive yet developed in stylistics, accounts well for flat characters, particularly through its top-down elements (i.e. its schematic categories), and, despite claims to the contrary, cognitive approaches like Culpeper's have been considered to be inherently contextualist (Palmer 2010, Zunshine 2010, Strasen & Wenzel 2012, Strasen 2013, Woldemariam 2014, Vaeßen & Strasen 2015, Stockwell 2020).

As a brief reminder and summary, my analysis chapters explored the variety of ways scientific contexts were influencing animal characterisation. In the behaviourism chapter, my explorations of 'Remote Control' (Kately 1930), *War with the Newts* (Čapek 2010 [1937]) and *Animal Farm* (Orwell 2008

[1945]) highlighted various ways Watson and Skinner's research was influencing the animals characterised in the texts. These included: anti-mentalism, specifically the downplaying of the mind or brain as a cause of behaviour (the squirrels, pp. 80-81, the ants, pp. 89-90), the methods employed to operantly condition animal subjects (the trained newts, pp. 94-95, the circus newts, pp. 109-110, the dogs, pp. 116-120), the extreme position of environmental determinism found in behaviourism (Andrew, p. 104, the circus newt, pp. 108-109, the dogs, p. 113), the strong influence of physiological reflexes on early behaviourist psychology (the circus newt, pp. 110-111), the conditioning of verbal behaviour (Andrew, pp. 100-105, the circus newt, pp. 108-109), and the use of animals themselves as aversive stimuli and punishers (the dogs, pp. 114-120).

In the entropy chapter, I highlighted how the animals characterised in 'Beyond Lies the Wub' (Dick 1999 [1952]), *The Drowned World* (Ballard 2012 [1962]) and 'The Rodent Laboratory' (Platt 1966) were being influenced not only by the classical thermodynamic context (i.e. the heat death hypothesis), but also non-equilibrium thermodynamic theories which considers how entropy effects fundamental life processes and structures. I argued the characterisations of animals highlighted these influences in a number of ways, including: depictions of physical exhaustion (the wub, pp. 141-142, the iguanas, pp. 159-160, the rats, p. 171-172), depictions of homogeneity associated with equilibrium distributions found in closed systems (the wub, pp. 140-141, the rats, pp. 168-169), animals as active agents of entropy involved in processes such as degradation, destruction or dissolution (the flies, pp. 151-152, the mosquitoes, pp. 154-155, the iguanas, pp. 160-161, the crocodiles, pp. 164-165), behavioural changes which can be associated with increasing levels of environmental entropy, such as increased appetite and metabolism (the iguanas, pp. 161-162, the crocodiles, pp. 165-167) and a switch from plant-eating to meat-eating (the wub, p. 146), and entropic and physicalist perspectives on animal death and life (the wub, pp. 146-148, the rats, p. 171).

Finally, in the Gaia chapter, I analysed the animal characters in *The Dramaturges of Yan* (Brunner 1974 [1972]) and the *Helliconia* Trilogy (Aldiss 2010), and showed that Lovelock's theories were influencing animal characterisation. These influences could be seen in: the changing relationship

between animal characters from possessed objects to Gaian subjects (Shyalee, pp. 193-195), depictions of animal characters instrumental in maintaining homeostasis (Kaydad, pp. 196-198), depictions of animal characters as part of the planet's physiology (Yanfolk, pp. 201-202), drawing on the cybernetic influences in Gaia, animal characters presented as machine-like (Yanfolk, pp. 199-200, the wutra worm, p. 216), connections between animal life and the gases associated with Gaia's functioning (the yelk, pp. 206-207, the wutra worms, pp. 214-215), animals presented as being involved in element cycling (the assatassi, pp. 210-211), the distinction between climatic forces and animals being blurred (the yelk, p. 207, assatassi, pp. 209-210, the wutra worm, pp. 216-217), and foregrounding species important to Gaia's functioning (wutra worms, pp. 212-213). Overall, the analyses conducted in my chapters offers compelling evidence that these scientific contexts were heavily influencing the way animal characters were presented.

This thesis has made a number of original contributions to the development of stylistics research. Firstly, and beginning broadly, this research is situated within a discipline which has only recently begun to engage in any serious way with literary characters and characterisation. As McIntyre has noted, 'despite landmark studies such as Culpeper (2001), characterisation has remained on the fringes of stylistic research for a long time' (2010, p. 14). Though this situation is beginning to change (see: Archer & McIntyre 2010, Balossi 2014, Bednarek 2012, Culpeper 2009, Culpeper & Fernandez-Quintanilla 2017, Hubbard 2002, Mahlberg 2012, Mahlberg & Stockwell 2015, McIntyre 2015a, Nahajec 2014, Semino 2004), the focus of much stylistics research, when it does focus on literary character, has prioritised human character analysis. Apart from Herman's research (2018), which encompasses both narratological and stylistic approaches, few scholars in stylistics have engaged in meaningful ways with the many animal characters present in literary texts.

Such avoidance is perhaps historically rooted in the discipline's heavy focus on frameworks that explore characterisation through abilities putatively attached only to human beings and human social conventions, including speech and thought presentation (Leech & Short 2007), mind-style (Fowler 1977), conversation analytic and pragmatic approaches, such as conversational structure and

implicature (Grice 1975) and politeness strategies (Brown & Levinson 1987, Culpeper 1996). Heavily dependent on the level of anthropomorphism an animal character is presented with, these frameworks will not always prove useful in animal character analyses, particularly with the flatter characters prevalent in sf. Whatever the reasons may be, this research's original contribution can be located in this gap in stylistics research: not only does it add to the dearth of studies in stylistics on character and characterisation, it also focuses on characters that have yet to undergo any significant stylistic analysis. As Kreilkamp notes 'animal[] [characters] tend to exist away from the center, at the margins: in [...] characterizations that are minor, ephemeral, precarious, short-lived, and disadvantaged' (2018, p. 2). Overall, in stylistics research, animal characters have remained largely ignored and this thesis goes a significant way towards addressing this gap.

Secondly, but closely related to the first point, one of the important influences drawn upon in this thesis's approach is the animal studies movement, which as yet has not found a foothold in stylistics research, though its influences can be noted in the interrelated disciplines of narratology and critical discourse analysis (Stibbe 2012, Sealey & Oakley 2013, Cook 2015, Cook & Sealey 2017) – more broadly, this thesis's approach is also indebted to and driven by similar critical stylistic approaches, particularly those that centre around issues of gender and female character representation (Burton 1982, Mills 2016). Following work conducted by other animal studies' scholars, this research has attempted to explore the representations of animals in human culture, not only acknowledging their proliferation in literary texts and analysing them with a degree of detail rarely afforded such characters, but also showing that animals (and their representations) matter (Porter 2010, McHugh 2009b). In line with animal studies approaches, the analyses conducted above have elucidated ways that scientific contexts have perpetuated damaging conclusions about animal beings, which are frequently acknowledged and critiqued by these sf texts. To give just one example, the mechanistic representation of Sarah, the ant, in Kately's (1930) 'Remote Control', underpinned by behaviourist principles, is framed as being ethically dubious through the depiction of Kingston as a mad scientist. With species-level extinctions and frequent proposals to rename the current geologic age the 'Anthropocene', it is vital that the animal

studies movement continues to influence disciplines across academia, including stylistics. This engagement with animal studies and the critical impulse that drives such research – challenging speciesism – represents another of this thesis's original contributions to stylistic research, broadening its potential connections to other areas of critical scholarship.

Thirdly, this thesis has proposed a scientific contextualist approach to the literary text and characterisation, which was justified in this research's choice of text type, science fiction. This thesis therefore aligns with those stylisticians who argue for a cultural or contextualist stylistics (Verdonk 2002, Weber 1996, Zyngier 2001). Alongside these stylisticians, my analyses highlight how stylistics 'goes hand in hand with developments in linguistics, literary and cultural theory' and can be considered an 'interdisciplinary venture' (Zyngier 2001, p. 375). The analyses conducted in this chapter highlight the strength of such contextualist approaches, but also expand the scope of a cultural or contextualist stylistics to those contexts rarely explored (i.e. science) (see also: Ryan 2011, Butt 2007, Nerlich et al 2001, Herman 2013). This contextualist positioning also extends to these sf texts' characters and characterisation, and I have argued vehemently that a contextual approach to character is both appropriate and productive in science fictional character analyses (section 1.3 & 1.4), something the above chapters have clearly elucidated. This research therefore also sits alongside research by narratologists and media scholars, who argue that, as well as 'mimetic' aspects of characterisation, character analyses should be informed by contextual factors and genre (Phelan 1989, Eder 2010, Mikkonen 2017). By reading animal characters in sf and foregrounding these texts' engagements with scientific contexts, I have shown how 'association of a represented being with such [contextual] meanings may […] be achieved by different kinds of processes like generalizing over properties and developments of a character, identifying similarities and analogies, or drawing metaphorical and intertextual connections' (Eder 2010, p. 88). Although socio-political contexts 'ha[ve] remained an ongoing concern for stylistics', this scientific contextualist approach to the literary text and character is largely unexplored in stylistics research and represents another of this thesis's original contributions to

the discipline (Page et al 2018, p. 7). It also brings stylistics into dialogue with literary critical approaches, such as science and literature studies.

Fourthly, another of the core areas I have innovated in this thesis is by outlining how Culpeper's framework with some minor amendments can be utilised for animal character analyses. The amendments proposed are necessary as the *a priori* assumption made by Culpeper is that the characters analysed are human. Expanding on the schematic components of the model allowed me to elaborate on the prior knowledge the reader may bring to bear on their interpretation of an animal character, and my chapters have shown numerous times how such knowledge fundamentally underpins the interpretations presented. For example, the undermining of the spiders and crocodiles' 'behavioural traits' in *Drowned World* (Ballard 2012 [1962]) highlighted how their characterisation foregrounded the scientific context of entropy (p. 156 & p. 163). Of all the categories proposed for schematic amendment – 'working animals', 'relational roles', including 'human-animal relationships' and 'ecological interactions', 'sex', 'species' or 'species-type', 'ecological niche', 'behavioural traits', 'animal capabilities', 'animal body' – only one of these categories, 'companion animals', didn't feature in my analyses. However, I would argue this is largely because these sf texts did not present such an opportunity rather than the category itself being redundant.

As well as the schematic elements of Culpeper's methodology undergoing amendments, the textual cues also underwent changes. The sole category I added was 'vocalisations', a form of communication that can convey meaning, which I found particularly useful when analysing the dogs in *Animal Farm* (Orwell 2008 [1945]) (p. 120) and the iguanas in *The Drowned World* (Ballard 2012 [1962]) (pp. 160-161). Many of the other categories underwent minor amendments or clarifications. For example, the 'conversational structure and implicature' category can be used to explore the power dynamics not just between a human and animal character – drawn on in my analysis of Andrew (pp. 102-103 & p. 105) – but also to explore the dynamics of an animal society, or, as was the case in Dick's use of skip-connecting in 'Beyond Lies the Wub' (1999 [1952]), foreground principles important to an animal character and its species (p. 146). Whilst some amendments may have a utility beyond the

specified focus of this research, and hence would sit alongside other stylistic research that has refined

Culpeper's (2001) methodology (Walker 2012), it is worth noting that my focus on animal characters

heavily influenced the scope of the amendments made to the framework. For example, the 'verse and

prose' category, broadened to focus on 'register' – a category I used in the analysis of Andrew in Capek's

(2010 [1937]) *War with the Newts* (p. 103) – is useful in relation to this thesis as animal characters are

other-than-human and likely to be unfamiliar with human social conventions. Overall, the textual cue

amendments proved effective for facilitating the analyses conducted in these chapters.

The utility of this framework and its amendments to flat animal characters cannot be understated

as the majority of research, even that which is conducted under the auspices of animal studies

scholarship, has tended to focus on heavily anthropomorphised and often 'round' animal characters

(see: Elick 2015, Keen 2011, Cosslett 2006, DeMello 2013, Herman 2013, Herman 2016a, Herman

2016b, Caracciolo 2016, Bernaerts et al 2014). Culpeper's (2001) framework has proved particularly

useful not solely for presentations of 'round' animal characters, but also those characters falling within

standard definitions of 'flat' characters. In this thesis, flat animal characters would include the squirrels

and ants in 'Remote Control', the dogs in *Animal Farm*, the arthropods and reptiles in *The Drowned

World*, the rats in 'The Rodent Laboratory', and the yelk and wutra worms in *Helliconia* – as such my

approach sits alongside the few animal studies scholars whose research has prioritised flat animal

characters (see: Kreilkamp 2018, Cole 2016). If, as Forster stated in his original theory, the pug in

Mansfield Park 'is flat, like most animals in fiction' (2005 [1927], p. 77) and 'the animal [is often seen

as] the model and measure of [a] flat character' (Moore 2011, p. 83), then stylisticians (and literary

scholars) must find suitable analytic tools with which to reliably analyse and engage with them. The

development of Culpeper's framework therefore represents another of my major contributions.

Fifthly, though closely linked to the fourth point, the amendments to this framework and its use

in my analyses has highlighted how cognitive approaches, like Culpeper's, can be used in tandem with

and strengthen a contextualist approach. To name just one example, the 'animal body' schema for the

ants in 'Remote Control' (Kateley 1930) is disrupted by their subsequent presentation as appendages

attached to the ant brain at the nests' centre. This shift in characterisation strategy alongside other elements of the ants' presentation highlights a rejection of animal agency in line with that proposed by behaviourist psychology at the time. Some scholars argue one of the fundamental issues with the cognitive stylistic approach is its tendency towards an 'internalist perspective' and its 'ahistorical […] treatment of context' (Page 2011, p. 292). My work therefore adds to the few stylisticians (Montoro 2007, Strasen & Wenzel 2012, Ahmad 2012, Strasen 2013, Vaeßen & Strasen 2015) and discourse analysts (van Dijk 2006) who have attempted to tangibly connect cognitive and contextualist approaches to text analysis.

Sixthly, many of the above analyses have focused on the corporeal nature of the animal characters. Indeed, when considering both the schematic and textual cue categories together, very few of the categories featured in all the animal character analyses apart from the 'animal body' schema and 'appearance' categories: they appeared in my analysis of the ants (Kately 1930), all the newt characters (Capek 2010 [1937]), the dogs (Orwell 2008 [1945]), the wub (Dick 1999 [1952]), the iguanas (Ballard 2012 [1962]), the rats (Platt 1966), the Yanfolk (Brunner 1974 [1972]), the assatassi, and the wutra worms (Aldiss 2010). Though Culpeper's categories and my subsequent amendments keep the categories 'animal body' and 'appearance' as distinct, in other frameworks like Babb's (2002) these would form a single category (namely, *korpor*). A focus on corporeal characterisation is unsurprising given that animal characters' in sf are often externally presented. However, this finding appears consistent with other scholars' analyses of literary animal characters. Literary critics have noted that animal characters are often 'first and foremost a living body – material [and] temporal' (Pick 2011, p. 3).

Characters' bodies appear to have been a neglected area of literary textual research. In literary criticism, Korte highlights that literary body language research is 'limited […] and lacks a satisfactory conceptual framework' (1997, p. 6). In narratology, critics such as Babb (2002) and Punday (2000) have noted there is a dearth of research focusing on the body, which is 'rarely […] studied as a narratological object' (ibid, p. 227). Punday's call for a 'corporeal narratology' is further justified by Babb's (2002)

claims that Cartesian dualism has led narratologists to prioritise consciousness at the expense of characters' physicality. In stylistics also, Mahlberg's research (2012) features a chapter on body-part clusters in Dickens's fiction, which, though grounded in her data-driven approach, also highlight the importance of physical dimensions of characterisation that have 'hitherto gone unobserved' (Demmen 2014, p. 248).

Such a corporeal focus on characterisation matters particularly for animal characters, since, as animal studies approaches note, corporeality helps readers to engage their sympathetic imagination. As Alexander notes, 'the body and feeling, rather than reason, form the existential and ethical link between non-human animals and humans and is, therefore, the basis for interspecies morality' (2016). Although my analyses explored how the 'animal body' and 'appearance' features often linked to the scientific context, they also frequently raised ethical issues. To name just a few examples, the circus newt's poor physical condition was a result of violence done to him through negative reinforcement (pp. 109-110); the proxemics analysis between the wub and the crew members highlighted how the wub's entropic perspective was deemed ethically problematic (p. 148); the re-conceptualisation of the Yanfolk's bodies as skin cells, particularly with the wilders' analysis, highlighted the callous attitude that the Gaian-like entity, Yan, had towards their suffering (pp. 201-202). This corporeal focus is another area in which this thesis has contributed to the development of stylistics research.

Recommendations for further research following a similar trajectory outlined in this thesis could include considering other scientific contexts and their influences on the animal characters presented in sf texts. These recommendations, however, come with some words of caution about choosing and working with a scientific context. Considerations for stylisticians utilising a scientific context include: (1) focusing on a few key scientists involved with the development of the context or centring analysis around a succinct concept or theory. With Behaviourism, for example, I focused only on Watson and Skinner's research, as drawing on other later developments in behaviourism could have proved analytically impractical; (2) highlighting the central tenets of the scientific context clearly and concisely, maintaining accuracy but avoiding an overlong complex history of the ideas – getting the

right balance between scientific context and stylistic analysis is crucial, as scientific contexts will likely need more elaboration than socio-historical ones. For example, behaviourists, like Tolman, believed that thought influenced behaviour and reinforcement was not a crucial element of an organism's learning history, which largely contradicts behaviourism's core tenets as Watson and Skinner saw them. Such detail is relevant for the development of behaviourist thought but unless this directly informs the stylistic analyses these intricacies are best left out; (3) remembering that the interaction between science and narrative is not one-way (Ryan 2011). Narrative texts and their authors are likely constrained as to which parts of a scientific context can be utilised, as noted above.

With these cautions in mind, scientific concepts that could prove useful to explore further include Darwin's theory of evolution. This theory has already been explored by SLS (science and literature studies) researchers in relation to literary texts (see: Levine 1991, Beer 2009, Holmes 2009), and, given this foundation, such a body of research could readily be extended thorough stylistic considerations of animal characterisation. Sf texts that draw on evolutionary ideas include Blish's (2000 [1958]) *A Case of Conscience*, featuring the Lithian, a reptile-like species, Nourse's (1964 [1953]) 'Family Resemblance', featuring a pig character, and Vonnegut's (1985) *Galapagos*, which presents a sea lion-like species. As well as Darwinism, the contemporary development of biotechnology could be explored in relation to animal characters' presentations in sf. This is an area that has similarly been considered by other animal studies scholars (Twine 2010). The animal character and sf texts that might feature in such analyses could include the dinosaurs in Crichton's (1990) *Jurassic Park*, the human-animal hybrids in Hallam's (2006 [2001]) *Dr Franklin's Island*, and the pigoons, a pig-baboon hybrid animal, in Atwood's (2003 [2009]) *Oryx & Crake*.

Another recommendation for further research would be to utilise the amendments I have made to Culpeper's framework for stylistic explorations of animal characters in other literary texts – canonical figures such as Kafka (Lucht & Yarri 2010) and Coetzee (Wiegandt 2020) have oeuvres that feature many prominent animal characters – and genres in which animals are also prolific, such as fantasy. Similarly, the framework would also prove useful for stylistic explorations that centre around specific animal

groups and species – indeed, many animal studies scholars have done just this (see: Ortiz-Roble's (2016) on horses, dogs, birds and cats, McHugh (2011) on dogs, horses and pigs). Culpeper's framework would prove invaluable in highlighting the characterisation strategies used for animals that fulfil various roles in human-animal relations. For example, exploring the ways rats are characterised as pets, laboratory animals or wild creatures in literary texts could also prove a productive extension of this framework.

In addition, further developments to Culpeper's characterisation model could be explored. In particular, I considered, but ultimately rejected, adding elements to the model that incorporated zoosemiotic categories (Sebeok 1968). Zoosemiotics explores non-linguistic elements of animal communication, such as the 'bow' a dog performs before initiating play (Bekoff 2006, p. 131). Incorporating non-verbal communication would however represent a radical reworking of Culpeper's (2001) categories and such an undertaking was considered outside the scope possible for this thesis. As well as being a significant undertaking, I also rejected this approach as sf texts tend to present flat animal characters. However, such additions for texts that feature round animal characters, like the rat narrator in Zaniewski's (1994) *Rat*, could benefit from analyses that draws on a specie's non-verbal communicative conventions.

Bibliography

<u>Primary References</u>

Adams, Richard. 2015. *Plague Dogs*. London: Oneworld Publications.

Aldiss, Brian W. 1979. *Galaxies like Grains of Sand*. London: Panther.

———. 2008. *Hothouse*. London: Penguin Books.

———. 2010. *Helliconia: Helliconia Spring: Helliconia Summer: Helliconia Winter*. London: Gollancz.

———. 2020. *Cryptozoic*. London: Gollancz.

Anderson, Poul. 1978. *Question and Answer*. London: Ace Books.

Asimov, Isaac. 2004. *The Foundation Trilogy*. New York: SFBC Science Fiction.

———. 2016. *Foundation's Edge*. London: HarperVoyager.

Atwood, Margaret. 2003. *Oryx & Crake*. London: Virago Press.

Baker, J. A. 2017. *The Peregrine*. London: William Collins.

Bakis, Kirsten. 1997. *Lives of the Monster Dogs*. London: Sceptre.

Ballard, J. G. 1998. 'The Voices of Time'. In *The Voices of Time*, 9–40. England: Phoenix.

———. 2012. *The Drowned World*. London: Fourth Estate.

———. 2014a. *The Crystal World*. London: Fourth Estate.

———. 2014b. *The Drought*. London: Forth Estate.

Benford, Gregory, and David Brin. 1986. *Heart of the Comet*. Toronto ; New York: Bantam Books.

Bernstein, Herbert. 1969. 'Stimulus-Response'. In *Analog: Science Fiction Science Fact* 84 (1), edited by John W. Campbell, 92–111.

Blish, James. 2000. *A Case of Conscience*. New York: Del Ray Impact.

Boulle, Pierre. 2013. *Planet of the Apes*. Translated by Xan Fielding. London: Vintage.

Brin, David. 1990. *Earth*. New York: Bantam Books.

Brunner, John. 1973. *Bedlam Planet*. London: Sidgwick & Jackson.

———. 1974. *Dramaturges Of Yan*. London: New English Library.

———. 2003a. *Stand on Zanzibar*. London: Millennium.

———. 2003b. *The Sheep Look Up*. Dallas: BenBella Books.

Bulgakov, Mikhail. 2005. *The Heart of a Dog*. Translated by Michael Glenny. London: Vintage.

Campbell, John W. 2003. 'The Machine'. In *A New Dawn: The Complete Don A. Stuart Stories*, edited by James A. Mann, 53–68. Framingham, MA: NESFA Press.

Čapek, Karel. 2010. *War with the Newts*. Translated by M Weatherall and R Weatherall. London: Penguin.

———. 2012. *War with the Newts*. Translated by David Wyllie. Oxford: Benediction Classics.

Cortázar, Julio. 1985. 'Axolotl'. In *Blow-up, and Other Stories*, translated by Paul Blackburn, 3–10. New York: Pantheon Books.

Crichton, Michael. 1990. *Jurassic Park*. New York: Knopf.

Crowley, John. 2000. *Beasts*. London: Victor Gollancz.

Dick, Philip K. 1999. 'Beyond Lies the Wub'. In *Beyond Lies the Wub: The Collected Short Stories of Philip K. Dick, Vol. 1*, 27–34. London: Millennium.

———. 2007. *Do Androids Dream of Electric Sheep?* London: Gollancz.

———. 2012. *Ubik*. Boston: Houghton Mifflin Harcourt.

Dickinson, Peter. 2008. *Eva*. New York: Laurel-Leaf Books.

Ellison, Harlan. 2014. *Vic and Blood*. New York: Open Road Integrated Media.

Elton, Ben. 2006. *Stark*. London: Black Swan.

Fast, Howard. 1965. 'The Large Ant'. In *Spectrum IV*, edited by Kingsley Amis and Robert Conquest, 124–33. New York: Harcourt.

Fleming, Ian. 2012. *Casino Royale*. London: Vintage.

Gloss, Molly. 2003. 'Lambing Season'. In *The Year's Best Science Fiction: Twentieth Annual Collection*, edited by Gardner Dozois, 167–76. New York: St Martin's.

Golding, William. 2011. *The Inheritors*. London: Faber.

Groff, Lauren. 2011. 'Above and Below'. *The New Yorker*, 13 June 2011.

Halam, Ann. 2006. *Dr Franklin's Island*. London: Orion Children's Books.

Hamilton, Edmond. 1936. 'The Earth Brain'. In *The Horror on the Asteroid and Other Tales of Planetary Horror*, 129–83. London: Philip Allan.

Herbert, Frank. 2011. *Hellstrom's Hive*. London: Gateway.

Hodgson, William. 1908. *The House on the Borderlands*. London: Chapman & Hall.

Huxley, Aldous. 2007. *Brave New World*. London: Vintage.

Kafka, Franz. 2005. 'The Burrow'. In *The Complete Short Stories*, edited by Nahum N. Glatzer, translated by Muir Edwin and Willa Muir, 325–59. London: Vintage.

Kateley, Walter. 1930. 'Remote Control'. In *Amazing Stories* 5 (1), edited by T. O'Conor Sloane, 22–30.

Kotzwinkle, William. 2014. *Doctor Rat*. New York: Open Road Integrated Media.

Kress, Nancy. 1990. *Brain Rose*. New York: William Morrow & Company.

Le Guin, Ursula. 1979. *The Earthsea Trilogy*. London: Penguin Books.

———. 1990a. 'Mazes'. In *Buffalo Gals: And Other Animal Presences*, 61–66. London: Gollancz.

———. 1990b. 'Vaster than Empires and More Slow'. In *Buffalo Gals: And Other Animal Presences*, 92–128. London: Gollancz.

Lem, Stanislaw. 2003. *Solaris*. London: Faber & Faber.

Linklater, Eric. 1944. *The Wind on the Moon*. London: Macmillan.

London, Jack. 2001. *The Call of the Wild*. London: Scholastic.

Manning, L. 1934. 'The Living Galaxy'. *Wonder Stories* 6 (4): 436–44.

McCaffrey, Anne. 1989. *Decision at Doona*. New York: Ballantine.

McIntyre, Vonda N. 1978. *Dreamsnake*. Boston: Houghton Mifflin

Miller, Walter M. 2016. *Conditionally Human*. United States: Positronic Publishing.

Mitchison, Naomi. 1985. *Memoirs of a Spacewoman*. London: Women's Press.

Morrison, Grant, and Frank Quitely. 2014. *WE3*. New York: DC Comics.

Niven, Larry, and Jerry Pournelle. 1986. *Footfall*. London: Sphere.

Norton, Andre. 1959. *The Beast Master*. New York: Harcourt.

Nourse, Alan E. 1964. 'Family Resemblance'. In *Beyond Infinity*, 162–74. London: Corgi.

Olsen, Bob. 1934. 'Peril Among the Drivers'. In *Amazing Stories* 8 (11), edited by T. O'Conor Sloane, 36–83.

Orwell, George. 1999. *Nineteen Eighty-Four*. London: Secker & Warburg.

———. 2008. *Animal Farm: A Fairy Story*. London: Viking.

Platt, Charles. 1966. 'The Rodent Laboratory'. In *New Worlds* 49 (165), edited by Michael Moorcock, 25–45.

———. 1977. *Garbage World*. London: Gollancz.

Pohl, Frederik. 1986. *The Coming of the Quantum Cats*. New York: Bantam/Spectra.

Pullman, Philip. 2003. *His Dark Materials*. New York: Dell Laurel-Leaf.

Purdom, Tom. 1977. *The Barons of Behaviour*. London: D. Dobson.

Reklaw, Jesse. 2006. *Couch Tag*. Seattle, Washington: Fantagraphics Books.

Robinson, Frank M. 1981. 'The Maze'. In *A Life in the Day of … and Other Short Stories*, 1–25. New York: Bantam Books.

Rowling, J. K. 2000. *Harry Potter and the Philosopher's Stone*. London: Bloomsbury.

Scott, Jody. 1986. *Passing for Human*. London: Women's Press.

Sheldon, Alice B. 2000. *Meet Me at Infinity*. New York: Tor.

Simak, Clifford D. 2011. *City*. London: Gollancz.

Skinner, Burrhus F. 2005. *Walden Two*. Indianapolis: Hackett Publishing Company.

Slonczewski, Joan. 2000. *A Door into Ocean*. New York: Orb.

Smith, Cordwainer. 1989. *The Instrumentality of Mankind*. London: Gollancz.

———. 2017. *Norstrilia*. London: Gollancz

Stapledon, Olaf. 2011. *Sirius: A Fantasy of Love and Discord*. London: Gollancz.

Stevens, Paul Drew, Vincent Crenshaw, B. Sobel, and D. Gavagan. 1990. 'Patches'. In *Real Animal Heroes: True Stories of Courage, Devotion, and Sacrifice*, edited by Paul Drew Stevens, 19–24. New York: New American Library.

Swift, Jonathan. 2005. *Gulliver's Travels*. Oxford ; New York: Oxford University Press.

Tepper, Sheri S. 1989. *Grass*. 1st ed. New York: Doubleday.

———. 1999. *Six Moon Dance*. New York: Avon Eos.

Tiptree, James. 1978. 'The Psychologist Who Wouldn't Do Awful Things to Rats'. In *Star Songs of an Old Primate*, 227–54. New York: Ballantine.

———. 2014. 'The Last Flight of Doctor Ain'. In *Her Smoke Rose up Forever*, 1–8. London: Gollancz.

Tolkien, J. R. R. 2007. *The Lord of the Rings*. London: HarperCollins Publishers.

Traviss, Karen. 2007. *Ally*. The Wess'har Wars. New York: HarperCollins.

Varley, John. 1984. *Demon (Gaea Trilogy Book Three)*. New York: Putnam.

———. 1987. *Wizard (Gaea Trilogy Book Two)*. New York: Ace Books.

———. 2013. *Titan (Gaea Trilogy Book One)*. New York: Ace Books.

Vaughan, Brian K, and Niko Henrichon. 2006. *Pride of Baghdad: Based on a True Story*. New York: DC Comics.

Vonnegut, Kurt. 1985. *Galápagos*. New York: Delacorte Press/Seymour Lawrence.

———. 2008. *Cat's Cradle*. London: Penguin.

Watson, Ian. 1975. *The Jonah Kit*. New York: Scribner.

Wells, H. G. 2005a. *The Island of Dr. Moreau*. Stilwell, KS: Digireads Publishing.

Wells, H. G. 2005b. *The Time Machine*. Penguin Classics. London ; New York: Penguin Books.

Wilson, Robert Anton. 1988. *Schrödinger's Cat Trilogy.* New York: Dell.

Woolf, Virginia. 2009. *Flush*. Oxford: Oxford University Press.

Zaniewski, Andrzej. 1994. *Rat*. Translated by Ewa Hryniewicz-Yarbrough. New York: Arcade Publishing.

Zoline, Pamela. 1988. 'The Heat Death of the Universe'. In *The Heat Death of the Universe and Other Stories*, 13–28. New York: McPherson & Company.

Secondary References

Aaltola, Elisa. 2012. *Animal Suffering: Philosophy and Culture*. Basingstoke: Palgrave Macmillan.

Adams, Carol J. 1990. *The Sexual Politics of Meat: A Feminist-Vegetarian Critical Theory*. Cambridge: Polity Press.

Ahmad, Hussain. 2012. 'Teaching Cognitive Stylistics of Socio-Cultural and Religious Boundaries'. *Journal of Applied Linguistics: Selected Papers*. Brooklyn, NY: Lulu.com.

Alber, Jan. 2016. *Unnatural Narrative: Impossible Worlds in Fiction and Drama*. Lincoln: University of Nebraska Press.

Alexander, Melissa Rose. 2016. 'Mortal Bodies – An Approach to Representing Animals in Literature' [Online]. *Sloth: A Journal of Emerging Voices in Human-Animal Studies* 2 (1). https://www.animalsandsociety.org/human-animal-studies/sloth/sloth-volume-2-no- 1-winter-2016/mortal-bod ies-an-approach-to-representing-animals-in-literature/.

Amis, Kingsley. 1960. *New Maps of Hell: A Survey of Science Fiction*. London: Four Square Books.

Andersen, Corinne. 2009. 'A Ghost in the Rigging: Vonnegut and Koestler'. *Science Fiction Studies* 36 (1): 177–81.

Anthony, Lawrence. 2019. *AntConc* (version 3.5.8) [Software]. Tokyo: Waseda University. https://www.laurenceanthony.net/software.

Archer, Dawn, and Dan McIntyre. 2010. 'A Corpus-Based Approach to Mind Style'. *Journal of Literary Semantics* 39 (2): 167–182. https://doi.org/10.1515/jlse.2010.009.

Asaro, Catherine, and Kate Dolan. 2012. 'The Literature of Planetary Adventure'. In *Strange Divisions and Alien Territories: The Sub-Genres of Science Fiction*, edited by Keith Brooke, 39–60. Basingstoke: Palgrave Macmillan.

Attebery, Brian. 1992. *Strategies of Fantasy*. Bloomington: Indiana University Press.

Babb, Genie. 2002. 'Where the Bodies Are Buried: Cartesian Dispositions in Narrative Theories of Character'. *Narrative* 10 (3): 195–221. https://doi.org/10.1353/nar.2002.0017.

Baker, Paul. 2006. *Using Corpora in Discourse Analysis*. London ; New York: Continuum.

Baker, Steve. 2001. *Picturing the Beast: Animals, Identity, and Representation*. Urbana: University of Illinois Press.

Bakhtin, Mikhail. 1941. *Rabelais and His World*. Bloomington: Indiana University Press.

Balossi, Giuseppina. 2014. *A Corpus Linguistic Approach to Literary Language and Characterization: Virginia Woolf's The Waves*. Amsterdam ; Philadelphia: John Benjamins Publishing.

Banfalvi, Gaspar. 2013. *Homeostasis - Tumor - Metastasis*. New York: Springer.

Barlow, Aaron. 2005. *How Much Does Chaos Scare You?: Politics, Religion and Philosophy in the Fiction of Philip K. Dick*. Brooklyn, NY: Lulu.com.

Barthes, Roland. 1987. *Image, Music, Text*. Translated by Stephen Heath. London: Fontana Press.

Bascomb, James. 2015. *Far Orbit Apogee: Speculative Space Adventures*. Albuquerque, New Mexico: World Weaver Press.

Baum, William M. 1994. *Understanding Behaviorism: Science, Behavior, and Culture*. New York: HarperCollins College Publishers.

Beckman, Frida. 2017. 'J G Ballard's Dark Ecologies: Unsettling Nature, Animals and Literary Tropes'. In *Animalities: Literary and Cultural Studies beyond the Human*, edited by Michael Lundblad, 60–79. Edinburgh: Edinburgh University Press.

Bednarek, Monika. 2010. *The Language of Fictional Television: Drama and Identity.* New York: Continuum International Publishing.

———. 2011. 'The Stability of the Televisual Character: A Corpus Stylistic Case Study'. In *Telecinematic Discourse: Approaches to the Language of Films and Television Series*, edited by Roberta Piazza, Monika Bednarek, and Fabio Rossi, 185–204. Amsterdam ; Philadelphia: John Benjamins Publishing.

———. 2012. 'Constructing "Nerdiness": Characterisation in The Big Bang Theory'. *Multilingua* 31 (2): 199–229. https://doi.org/10.1515/multi-2012-0010.

Beer, Gillian. 2009. *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction*. 3rd ed. Cambridge ; New York: Cambridge University Press.

Bekoff, Marc. 2006. *Animal Passions and Beastly Virtues: Reflections on Redecorating Nature*. Philadelphia: Temple University Press.

Benford, Gregory. 1994. 'Real Science, Imaginary Worlds'. In *The Ascent of Wonder: The Evolution of Hard SF*, edited by David G. Hartwell and Kathryn Cramer, 15–23. London: Orbit.

Berge, Anne Marit K. 2005. 'The Narrated Self and Characterization: Paul Auster's Literary Personae'. *Nordic Journal of English Studies* 4 (1): 101–20.

Berger, Albert I. 1988. 'Theories of History and Social Order in "Astounding Science Fiction", 1934-55 (Théories de l'histoire et de La Structure Sociale Dans "Astounding Science Fiction", 1934-55)'. *Science Fiction Studies* 15 (1): 12–35.

Bernaerts, Lars, Marco Caracciolo, Luc Herman, and Bart Vervaeck. 2014. 'The Storied Lives of Non-Human Narrators'. *Narrative* 22 (1): 68–93. https://doi.org/10.1353/nar.2014.0002.

Birch, Charles. 1999. *Biology and the Riddle of Life*. Sydney: University of New South Wales Press.

Bloom, Harold. 2006. *George Orwell's Animal Farm*. New York: Chelsea House Publishers.

Bloomfield, Leonard. 1933. *Language*. New York; Toronto: Holt, Rinehart and Winston.

Blum, Harold Francis. 1955. *Time's Arrow and Evolution.* 2nd ed. Princeton, N.J: Princeton University Press.

Boakes, Robert A. 1984. *From Darwin to Behaviourism: Psychology and the Minds of Animals*. Cambridge ; New York: Cambridge University Press.

Boehrer, Bruce Thomas. 2010. *Animal Characters: Nonhuman Beings in Early Modern Literature*. Philadelphia: University of Pennsylvania Press.

Bolander, Brook, and Miriam A. Locher. 2015. '"Peter Is a Dumb Nut": Status Updates and Reactions to Them as "Acts of Positioning" in Facebook'. *Pragmatics* 25 (1): 99–122. https://doi.org/10.10 75/prag.25.1.05bol.

Boltzmann, L. 1974. 'The Second Law of Thermodynamics'. In *Ludwig Boltzmann: Theoretical Physics and Philosophical Problems: Selected Writings*, edited by B McGinness, 13–32. Dordrecht: D. Reidel.

Booker, M. Keith, and Anne-Marie Thomas. 2009. *The Science Fiction Handbook*. Chichester ; Malden, MA: Wiley-Blackwell Publishing.

Borgards, Roland. 2017. 'Animal Studies'. In *Rethinking Nature: Challenging Disciplinary Boundaries*, edited by Aurélie Choné, Isabelle Hajek, and Philippe Hamman, 221–31. London ; New York: Routledge.

Boston, P.J. 2008. 'Gaia Hypothesis' [Online]. In *Encyclopedia of Ecology*, edited by Erik Jorgensen and Brian D Fath, 1727–31. Elsevier. https://doi.org/10.1016/B978-008045405-4.00735-7.

Botkin, Daniel B. 2012. *The Moon in the Nautilus Shell: Discordant Harmonies Reconsidered*. Oxford ; New York: Oxford University Press.

Bould, Mark, and Sherryl Vint. 2011. *The Routledge Concise History of Science Fiction*. London ; New York: Routledge.

Bousfield, Derek. 2014. 'Stylistics, Speech Acts and Im/Politeness Theory'. In *The Routledge Handbook of Stylistics*, edited by Michael Burke, 118–35. London ; New York: Routledge.

Boyd, Michael. 1983. *The Reflexive Novel: Fiction as Critique*. London ; East Brunswick, NJ: Bucknell University Press.

Breland, K, and M Breland. 1961. 'The Misbehavior of Organisms'. *American Psychologist* 16: 681–84.

Brembs, Björn. 2003. 'Operant Conditioning in Invertebrates'. *Current Opinion in Neurobiology* 13 (6): 710–17.

Brezina, Vaclav, Tony McEnery, and Stephen Wattam. 2015. 'Collocations in Context: A New Perspective on Collocation Networks'. *International Journal of Corpus Linguistics* 20 (2): 139–73. https://doi.org/10.1075/ijcl.20.2.01bre.

Brooke-Rose, Christine. 1981. *A Rhetoric of the Unreal: Studies in Narrative and Structure, Especially of the Fantastic*. Cambridge: Cambridge University Press.

Brooks, D. R., and E. O. Wiley. 1988. *Evolution as Entropy: Toward a Unified Theory of Biology*. 2nd ed. Chicago: University of Chicago Press.

Bulleid, J. 2019. 'Vegetarianism and Animal Empathy in the Life and Works of Philip K. Dick.' *Foundation* 48 (133): 47–59.

Burt, Jonathan. 2006. *Rat*. Animal. London: Reaktion Books.

Burton, Deidre. 1982. 'Through Glass Darkly: Through Dark Glasses'. In *Language and Literature: An Introductory Reader in Stylistics*, edited by Ronald Carter, 195–214. London: Allen and Unwin.

Busse, Beatrix. 2006. *Vocative Constructions in the Language of Shakespeare*. Amsterdam ; Philadelphia: John Benjamins Publishing.

———. 2011. '"One Should Never Underestimate the Power of Books": Writing and Reading as Therapy in Paul Auster's Novels'. In *Beyond Cognitive Metaphor Theory: Perspectives on Literary Metaphor*, edited by Monika Fludernik, 176–95. New York: Routledge.

———. 2014. '(New) Historical Stylistics'. In *The Routledge Handbook of Stylistics*, edited by Michael Burke, 101–17. London ; New York: Routledge.

———. 2016. 'New Historical Stylistics'. In *The Bloomsbury Companion to Stylistics*, edited by Violeta Sotirova, 177–88. London ; New York: Bloomsbury Academic.

Butt, David. 2007. 'Thought Experiments in Verbal Art: Examples from Modernism'. In *Language and Verbal Art Revisited: Linguistic Approaches to the Study of Literature*, edited by D Miller and M Turci, 68–96. London ; Oakville: Equinox.

Calhoun, J. B. 1962. 'Population Density and Social Pathology'. *Scientific American* 206: 139–48. https://doi.org/10.1038/scientificamerican0262-139.

Calkins, Jennifer. 2010. '*How Is It Then with the Whale?*: Using Scientific Data to Explore Textual Embodiment'. *Configurations* 18 (1): 31–47. https://doi.org/10.1353/con.2010.0005.

Campbell, Ian. 2018. *Arabic Science Fiction*. Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-91433-6.

Canavan, Gerry. 2016. *Octavia E. Butler*. Urbana: University of Illinois Press.

Capshew, James H. 1993. 'Engineering Behavior: Project Pigeon, World War II, and the Conditioning of B. F. Skinner'. *Technology and Culture* 34 (4): 835–57. https://doi.org/10.2307/3106417.

Caracciolo, Marco. 2015. 'Naïve Physics and Cosmic Perspective-Taking in Dante's Commedia and Calvino's Cosmicomiche'. *MLN* 130 (1): 24–41. https://doi.org/10.1353/mln.2015.0006.

———. 2016. *Strange Narrators in Contemporary Fiction: Explorations in Readers' Engagement with Characters*. Lincoln: University of Nebraska Press.

———. 2018. 'Notes for an Econarratological Theory of Character'. *Frontiers of Narrative Studies* 4 (1): 172–89. https://doi.org/10.1515/fns-2018-0037.

Caracciolo, Marco, Andrei Ionescu, and Ruben Fransoo. 2019. 'Metaphorical Patterns in Anthropocene Fiction'. *Language and Literature* 28 (3): 221–40. https://doi.org/10.1177/0963947019865450.

Carbone, Larry. 2004. *What Animals Want: Expertise and Advocacy in Laboratory Animal Welfare Policy*. Oxford ; New York: Oxford University Press.

Carson, Rachel. 1962. *Silent Spring*. Boston: Houghton Mifflin.

Cavalieri, Paola. 2001. *The Animal Question: Why Nonhuman Animals Deserve Human Rights*. Oxford ; New York: Oxford University Press.

Cawthorn, James. 1966. 'I Love You, Semantics'. *New Worlds* 164 (August): 144–49.

Chaisson, Eric J. 2005. 'Non-Equilibrium Thermodynamics in an Energy-Rich Universe'. In *Non-Equilibrium Thermodynamics and the Production of Entropy*, edited by Axel Kleidon and Ralph D. Lorenz, 21–31. Berlin: Springer-Verlag. https://doi.org/10.1007/11672906_2.

Chapman, Eric J., Daniel L. Childers, and Joseph J. Vallino. 2016. 'How the Second Law of Thermodynamics Has Informed Ecosystem Ecology through Its History'. *BioScience* 66 (1): 27–39. https://doi.org/10.1093/biosci/biv166.

Chatman, Seymour Benjamin. 1978. *Story and Discourse: Narrative Structure in Fiction and Film*. Ithaca, NY ; London: Cornell University Press.

Chellan, Noel. 2016. *Capital: An Energy Perspective*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Chiras, Daniel D. 2019. *Human Biology*. 9th ed. Burlington, MA: Jones & Bartlett Learning.

Chomsky, Noam. 1959. 'A Review of B. F. Skinner's Verbal Behavior'. *Language* 35: 26–58.

Claeys, Gregory. 2017. *Dystopia: A Natural History*. Oxford: Oxford University Press.

Clark, Jonathan. 2016. 'Which Animals Do We Study?' [Online Blog]. *Animals in Society: Animal Studies Scholar Advocacy*. https://animalsinsocietygroup.wordpress.com/2016/06/27/series-why-animal-studies-with-jonathan-l-clark/.

Clark, Stephen R. L. 1999. *The Political Animal: Biology, Ethics, and Politics*. London ; New York: Routledge.

Clarke, Bruce, and Manuela Rossini. 2011. 'Literatures and Sciences'. In *Routledge Companion to Literature and Science*, edited by Bruce Clarke and Manuela Rossini, 1–3. New York: Routledge.

Cockshott, W. Paul. 2009. *Classical Econophysics*. London ; New York: Routledge.

Cohn, Dorrit. 1978. *Transparent Minds: Narrative Modes for Presenting Consciousness in Fiction*. Princeton, N.J: Princeton University Press.

Cole, Lucinda. 2016. *Imperfect Creatures: Vermin, Literature, and the Sciences of Life, 1600-1740*. Ann Arbor: University of Michigan Press.

Collard, Andrée, and Joyce Contrucci. 1989. *Rape of the Wild: Man's Violence against Animals and the Earth*. Bloomington: Indiana University Press.

Collins, Luke. 2015. *Language, Corpus and Empowerment: Applications to Deaf Education, Healthcare and Online Discourses*. London ; New York: Routledge.

Conrad, Joseph, and Tanya Agathocleous. 2009. *The Secret Agent*. Peterborough, Ontario: Broadview Editions.

Cook, Roland C. 2009. *Sex, Sin and Science: What Evolution Says about Religion and Desire*. Indianapolis, IN: Dog Ear Publishing.

Cook, Guy. 1995. *Discourse and Literature: The Interplay of Form and Mind*. Oxford: Oxford University Press.

———. 2015. '"A Pig Is a Person" or "You Can Love a Fox and Hunt It"': Innovation and Tradition in the Discursive Representation of Animals'. *Discourse & Society* 26 (5): 587–607. https://doi.org /10.1177/0957926515576639.

Cook, Guy, and Alison Sealey. 2017. 'The Discursive Representation of Animals'. In *The Routledge Handbook of Ecolinguistics*, edited by Alwin F. Fill and Hermine Penz, 311–24. New York: Routledge. https://doi.org/10.4324/9781315687391.

Cook, Vivian, and David Singleton. 2014. *Key Topics in Second Language Acquisition*. Bristol: Multilingual Matters.

Cosslett, Tess. 2006. *Talking Animals in British Children's Fiction, 1786-1914*. Aldershot, England ; Burlington, VT: Ashgate.

Couffer, Jack. 1992. *Bat Bomb: World War II's Other Secret Weapon*. Austin: University of Texas Press.

Coveney, Peter, and Roger Highfield. 1992. *The Arrow of Time: A Voyage Through Science to Solve Time's Greatest Mystery.* London: Fawcett.

Cramer, Kathryn. 1994. 'On Science and Science Fiction'. In *The Ascent of Wonder: The Evolution of Hard SF*, edited by David G. Hartwell and Kathryn Cramer, 24–29. London: Orbit.

Crist, Eileen. 2000. *Images of Animals: Anthropomorphism and Animal Mind*. Philadelphia: Temple University Press.

———. 2004. 'Concerned with Triffles? A Geophysiological Reading of Charles Darwin's Last Book'. In *Scientists Debate Gaia: The Next Century*, edited by Stephen Henry Schneider, James R. Miller, Eileen Crist, and Penelope J Boston, 161–72. Cambridge, MA: MIT Press.

Csicsery-Ronay, Istvan. 2011. *The Seven Beauties of Science Fiction*. Middletown, CT: Wesleyan University Press.

Culpeper, Jonathan. 2001. *Language and Characterisation: People in Plays and Other Texts*. Harlow, England ; New York: Longman.

———. 2002. 'Computers, Language and Characterisation: An Analysis of Six Characters in Romeo and Juliet.' In *Conversation in Life and in Literature: Papers from the ASLA Symposium*, edited by Ulla Melander-Marttala, Carin Ostman, and Merja Kyto, 11–30. Uppsala: Association Suedoise de Linguistique Appliquee.

———. 2009. 'Reflections on a Cognitive Stylistic Approach to Characterisation'. In *Cognitive Poetics: Goals, Gains and Gaps*, edited by Geert Brône and Jeroen Vandaele, 125–59. Berlin ; New York: Mouton de Gruyter.

Culpeper, Jonathan, and Jane Demmen. 2015. 'Keywords'. In *The Cambridge Handbook of English Corpus Linguistics*, edited by Douglas Biber and Randi Reppen, 90–105. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139764377.006.

Culpeper, Jonathan, and Carolina Fernandez-Quintanilla. 2017. 'Fictional Characterisation'. In *Pragmatics of Fiction*, edited by Miriam A. Locher and Andreas H. Jucker, 93–128. Berlin ; Boston: Walter de Gruyter.

Curzan, Anne, and Chris C Palmer. 2006. 'The Importance of Historical Corpora, Reliability, and Reading'. In *Corpus-Based Studies of Diachronic English*, edited by R Facchinetti and M Rissanen, 17–34. Berlin: Peter Lang.

Danielsson, Karin Molander. 2017. '"And in That Moment I Leapt upon His Shoulder": Non-Human Intradiegetic Narrators in The Wind on the Moon' [Online]. *Humanities* 6 (2): 1-14. https://doi. org/10.3390/h6020013.

Daston, Lorraine, and Gregg Mitman. 2007. *Thinking with Animals: New Perspectives on Anthropomorphism*. Chichester: Columbia University Press.

Delaney, Samuel. 2005. 'Some Presumptuous Approaches to Science Fiction'. In *Speculations on Speculation: Theories of Science Fiction*, edited by James E. Gunn and Matthew Candelaria, 289–300. Lanham, MD: Scarecrow Press.

DeMello, Margo, ed. 2015. *Speaking for Animals: Animal Autobiographical Writing*. New York ; London: Routledge.

Demmen, Jane. 2014. 'Michaela Mahlberg. *Corpus Stylistics and Dickens's Fiction.*' *Functions of Language* 21 (2): 248–58. https://doi.org/10.1075/fol.21.2.05dem.

Dijk, T. A. van. 2006. 'Discourse, Context and Cognition'. *Discourse Studies* 8 (1): 159–77. https://doi.org/10.1177/1461445606059565.

Dolev, Shahar, and Avshalom C Elitzur. 1998. 'Biology and Thermodynamics: Seemingly-Opposite Phenomena in Search of a Unified Paradigm'. *The Einstein Quarterly: Journal of Biology and Medicine* 15: 131–46.

Domjan, Michael. 2015. *Principles of Learning and Behavior*. 7th ed. Stamford, CT: Cengage Learning.

Doolittle, W. F. 1981. 'Is Nature Really Motherly?' *CoEvolution Quarterly*, 29: 58–62.

Doughty, Christopher E., Joe Roman, Søren Faurby, Adam Wolf, Alifa Haque, Elisabeth S. Bakker, Yadvinder Malhi, John B. Dunning, and Jens-Christian Svenning. 2016. 'Global Nutrient Transport in a World of Giants'. *Proceedings of the National Academy of Sciences* 113 (4): 868–73. https://doi.org/10.1073/pnas.1502549112.

Duranti, Alessandro. 2009. 'Universal and Culture-Specific Properties of Greetings'. In *Linguistic Anthropology: A Reader*, edited by Alessandro Duranti, 2nd ed, 188–213. Malden, MA: Wiley-Blackwell.

Eder, Jens. 2010. 'Understanding Characters'. *Projections* 4 (1): 16–40. https://doi.org/10.3167/proj .2010.040103.

Eder, Jens, Fotis Jannidis, and Ralf Schneider. 2010. 'Characters in Fictional Worlds: An Introduction'. In *Characters in Fictional Worlds: Understanding Imaginary Beings in Literature, Film, and Other Media*, edited by Jens Eder, Fotis Jannidis, and Ralf Schneider, 3–66. Berlin ; New York: Walter de Grutyter.

Egan, G. 2012. 'Homeostasis in Shakespeare'. In *Posthumanist Shakespeares*, edited by Stefan Herbrechter and Ivan Callus, 77–94. Basingstoke ; New York: Palgrave Macmillan.

Elick, Catherine L. 2015. *Talking Animals in Children's Fiction: A Critical Study*. Jefferson, NC: McFarland & Company.

Ellis, Rod. 2010. *Second Language Acquisition*. Oxford: Oxford University Press.

Elms, Alan C. 2004. 'The Psychologist Who Empathized with Rats: James Tiptree, Jr. as Alice B. Sheldon, PhD'. *Science Fiction Studies* 31 (1): 81–96.

Enenkel, K. A. E., and P. J. Smith, eds. 2007. *Early Modern Zoology: The Construction of Animals in Science, Literature and the Visual Arts*. Leiden ; Boston: Brill.

Enquist, Magnus, and Stefano Ghirlanda. 2005. *Neural Networks and Animal Behavior*. Princeton: Princeton University Press.

Ernest, S.K.M. 2008. 'Homeostasis' [Online]. In *Encyclopedia of Ecology*, edited by Erik Jorgensen and Brian D Fath, 1879–84. Elsevier. https://doi.org/10.1016/B9780080454 05-4.00507-3.

Eyck, Laura. 2008. 'Social Learning'. In *21st Century Psychology: A Reference Handbook*, edited by Stephen F. Davis and William Buskist, 351–59. Los Angeles: SAGE Publications.

Fill, Alwin, and Peter Mühlhäusler, eds. 2001. *The Ecolinguistics Reader: Language, Ecology and Environment*. London: Continuum.

Fischer, William B. 1984. *The Empire Strikes out: Kurd Lasswitz, Hans Dominik, and the Development of German Science Fiction*. Bowling Green, OH: Bowling Green State University Popular Press.

Fischer-Starcke, Bettina. 2009. 'Keywords and Frequent Phrases of Jane Austen's *Pride and Prejudice*: A Corpus-Stylistic Analysis'. *International Journal of Corpus Linguistics* 14 (4): 492–523. https://doi.org/10.1075/ijcl.14.4.03fis.

Fludernik, Monika. 1996. *Towards a 'Natural' Narratology*. London: Routledge.

Flys Junquera, Carmen. 2018. 'Ecofeminist Replicants and Aliens: Future Elysiums through an Ethics of Care'. *Women's Studies* 47 (2): 232–50. https://doi.org/10.1080/00497878.2018.1430415.

Forster, Edward Morgan. 2005. *Aspects of the Novel*. London: Penguin.

Fowler, Roger. 1977. *Linguistics and the Novel*. London: Methuen.

———. 1995. *The Language of George Orwell*. Basingstoke: Macmillan.

Freedman, Carl Howard. 2000. *Critical Theory and Science Fiction*. Hanover: Wesleyan University Press ; University Press of New England.

Freese, Peter. 1997. *From Apocalypse to Entropy and Beyond: The Second Law of Thermodynamics in Post-War American Fiction*. Essen: Die Blaue Eule.

Frolov, Y. P. 2007. *Pavlov and His School: The Theory of Conditioned Reflexes*. United States: Young Press.

Fuchs, Alfred H, and Katherine S Milar. 2003. 'Psychology as a Science'. In *Handbook of Psychology*, edited by Alan M Goldstein and Irving B Weiner, 11: 1–20. New York: Wiley.

Fudge, Erica. 2006. *Brutal Reasoning*. Ithaca, NY ; London: Cornell University Press.

———. 2009. 'At the Heart of the Home: An Animal Reading of Mikhail Bulgakov's *The Heart of a Dog*'. *HUMaNIMALIA* 1 (1): 10–21.

Garrard, Greg. 2004. *Ecocriticism*. London ; New York: Routledge.

Garrison, James W., Stefan Neubert, and Kersten Reich. 2012. *John Dewey's Philosophy of Education: An Introduction and Recontextualization for Our Times*. New York: Palgrave Macmillan.

Georgi, Sandro, and Reinhard Jung. 2010. 'Use of Swarm Intelligence to Involve Customers in Product Innovation'. In *On Collective Intelligence*, edited by Theo J. Bastiaens, Ulrike Baumöl, and Bernd J. Krämer, 63–74. Berlin: Springer.

Gewirtz, Jacob L. 2001. 'J. B. Watson's Approach to Learning: Why Pavlov? Why Not Thorndike?' *Behavioral Development Bulletin* 10 (1): 23–25. https://doi.org/10.1037/h0100478.

Giannelli, M. A. 1986. 'Three Blind Mice, See How They Run: A Critique of Behavioral Research with Animals'. In *Advances in Animal Welfare Science*, edited by Michael W. Fox and Linda D. Mickley, 109–64. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-009-4247-9.

Gillis, Ryan. 1998. 'Dick on the Human: From Wubs to Bounty Hunters to Bishops'. *Extrapolation* 39 (3): 264–71. https://doi.org/10.3828/extr.1998.39.3.264.

Giovanelli, Marcello, and Jessica Mason. 2018. *The Language of Literature: An Introduction to Stylistics*. Cambridge: Cambridge University Press.

Glendening, John. 2002. '"Green Confusion": Evolution and Entanglement in H. G. Wells's "The Island of Doctor Moreau"'. *Victorian Literature and Culture* 30 (2): 571–97.

Goatly, Andrew. 1996. 'Green Grammar and Grammatical Metaphor, or Language and the Myth of Power, or Metaphors We Die By'. *Journal of Pragmatics* 25 (4): 537–60. https://doi.org/10.101 6/0378-2166(95)00057-7.

———. 2004. 'Corpus Linguistics, Systemic Functional Grammar and Literary Meaning: A Critical Analysis of Harry Potter and the Philosopher's Stone'. *Ilha Do Desterro* 46: 115–54.

Gomel, Elana. 2016. 'Character Degree Zero: Space and the Posthuman Subject'. In *Science Fiction Beyond Borders*, edited by Shawn Edrei and Danielle Gurevitch, 1–13. Newcastle upon Tyne: Cambridge Scholars Publishing.

Gottlieb, Erika. 1992. *The Orwell Conundrum: A Cry of Despair or Faith in the Spirit of Man?* Ottawa: Carleton University Press.

Green, Clarence. 2017. 'Introducing the *Corpus of the Canon of Western Literature* : A Corpus for Culturomics and Stylistics'. *Language and Literature* 26 (4): 282–99. https://doi.org /10.1177/0963947017718996.

Greenland, Colin. 1983. *The Entropy Exhibition: Michael Moorcock and the British 'New Wave' in Science Fiction*. London ; Boston: Routledge & Kegan Paul.

Griffin, Donald R. 2001. *Animal Minds: Beyond Cognition to Consciousness*. Chicago: University of Chicago Press.

Guither, Harold D. 1998. *Animal Rights: History and Scope of a Radical Social Movement*. Carbondale: Southern Illinois University Press.

Gunn, James, ed. 2002. *From Here to Forever*. Lanham, MD: Scarecrow Press.

Hackenberg, T. D. 1995. 'Jacques Loeb, B. F. Skinner, and the Legacy of Prediction and Control'. *The Behavior Analyst* 18 (2): 225–36. https://doi.org/10.1007/bf03392710.

Haglund, Jesper, Fredrik Jeppsson, and Helge Strömdahl. 2010. 'Different Senses of Entropy— Implications for Education'. *Entropy* 12 (3): 490–515. https://doi.org/10.3390/e120304 90.

Haldrup, Michael, Kristine Samson, Mads Hobye, and Nicolas Padfield. 2015. 'Remix Utopia: Eleven Propositions on Design and Social Fantasy'. *Nordes 2015: Design Ecologies* 6: 1–9.

Hall, Geoff. 2016. 'Stylistics and Literary Theory'. In *The Bloomsbury Companion to Stylistics*, edited by Violeta Sotirova, 244–62. London ; New York: Bloomsbury Academic.

Hall, Marion, and Tim Halliday. 1998. *Behaviour and Evolution*. Berlin ; New York: Springer.

Halliday, M. A. K., and Christian M. I. M. Matthiessen. 2004. *An Introduction to Functional Grammar*. 3rd ed. London ; New York: Arnold.

Halliday, Michael A. K. 1971. 'Linguistic Function and Literary Style: An Enquiry in to the Language of William Golding's *The Inheritors*'. In *Literary Style: A Symposium*, edited by Seymour Benjamin Chatman, 330–65. London: Oxford University Press.

———. 1992. 'New Ways of Meaning. The Challenge to Applied Linguistics'. In *Thirty Years of Linguistic Evolution: Studies in Honour of René Dirven on the Occasion of His Sixtieth Birthday*, edited by René Dirven and Martin Pütz, 59–95. Philadelphia: John Benjamins Publishing.

Hamilton, Bill, and Elliot M. Katz. 2014. 'The Future of War and Animals'. In *Animals and War: Confronting the Military-Animal Industrial Complex*, edited by Anthony J. Nocella, Colin Salter, and Judy K. C. Bentley, 109–16. Lanham, MD: Lexington Books.

Hamilton, John. 2007. *Man-Made Horrors*. Edina, MN: ABDO Publishing.

Haraway, Donna Jeanne. 1989. *Primate Visions: Gender, Race, and Nature in the World of Modern Science*. London ; New York: Routledge.

———. 2008. *When Species Meet*. Minneapolis: University of Minnesota Press.

Hardie, Andrew. 2014. 'Log Ratio: An Informal Introduction' [Online Blog]. *ESRC Centre for Corpus Approaches to Social Science (CASS)* http://cass.lancs.ac.uk/log-ratio-an-informal-introduction/.

Harré, Rom. 2009. *Pavlov's Dogs and Schrödinger's Cat: Scenes from the Living Laboratory*. Oxford ; New York: Oxford University Press.

Harris-Fain, Darren. 2005. *Understanding Contemporary American Science Fiction: The Age of Maturity, 1970-2000*. Columbia: University of South Carolina Press.

Harte, John. 1988. *Consider a Spherical Cow: A Course in Environmental Problem Solving*. California: University Science Books.

Hartner, Marcus. 2017. 'Bodies, Spaces, and Cultural Models: On Bridging the Gap between Culture and Cognition'. *Journal of Literary Theory* 11 (2): 204–222. https://doi.org/10.1515/jlt-2017-0020.

Hartwell, David G. 1994. 'Hard Science Fiction'. In *The Ascent of Wonder: The Evolution of Hard SF*, edited by David G. Hartwell and Kathryn Cramer, 30–40. London: Orbit.

Heidegger, Martin. 2001. *The Fundamental Concepts of Metaphysics: World, Finitude, Solitude.* Translated by William McNeill and Nicholas Walker. Bloomington: Indiana University Press.

Heinricy, Shana. 2013. 'Absorbent and Yellow and Porous Is He: Animated Animal Bodies in Spongebob Squarepants'. In *Perspectives on Human-Animal Communication: Internatural Communication*, edited by Emily Plec, 77–92. New York: Routledge.

Heise, Ursula K. 2013. 'From the Blue Planet to Google Earth' [Online]. *E-Flux Journal* 50. https://www.e-flux.com/journal/50/59968/from-the-blue-planet-to-google-earth/

Hendrix, Howard V. 2009. 'Fighting out of Context: Culture Wars within and without Science Fiction, from Snow to Sokal'. In *Science Fiction and the Two Cultures: Essays on Bridging the Gap between the Sciences and the Humanities*, edited by Gary Westfahl and George Edgar Slusser, 37–48. Jefferson, NC: McFarland & Company.

Hergenhahn, B. R. 2009. *An Introduction to the History of Psychology*. 6th ed. Australia ; Belmont, CA: Wadsworth Cengage Learning.

Heringman, Noah. 2003. 'The Commerce of Literature and Natural History'. In *Romantic Science: The Literary Forms of Natural History*, edited by Noah Heringman, 1–22. Albany: University of New York Press.

Herman, David. 2004. *Story Logic: Problems and Possibilities of Narrative*. Lincoln, Nebraska: University of Nebraska Press.

———. 2011a. 'Linguistics'. In *The Encyclopedia of the Novel*, edited by Peter Melville Logan, Olakunle George, Susan Hegeman, and Efraín Kristal, 486–90. Malden, MA: Wiley-Blackwell.

———. 2011b. 'Storyworld/Umwelt: Nonhuman Experiences in Graphic Narratives'. *SubStance* 40 (1): 156–81. https://doi.org/10.1353/sub.2011.0000.

———. 2012. 'Towards a Zoonaratology: Storytelling and Species Difference in Animal Comics'. In *NARRATIVE, INTERRUPTED: The Plotless, the Disturbing and the Trivial*, edited by Markku Lehtimäki, Laura Karttunen, and Maria Mäkelä, 93–119. Berlin ; Boston: Walter de Gruyter.

———. 2013. 'Modernist Life Writing and Nonhuman Lives: Ecologies of Experience in Virginia Woolf's Flush'. *Modern Fiction Studies* 59 (3): 547–68. https://doi.org/10.1353/mfs.2013.0034.

———. 2016a. 'Animal Autobiography; Or, Narration beyond the Human' [Online]. *Humanities* 5 (4): 1-17. https://doi.org/10.3390/h5040082

———. 2016b. 'Building More-Than-Human Worlds: *Umwelt* Modelling in Animal Narratives'. In *World Building: Discourse in the Mind*, edited by Joanna Gavins and Ernestine Lahey, 53–70. London ; New York: Bloomsbury Academic. https://doi.org/10.5040/978147429 5444.

———. 2018. *Narratology beyond the Human: Storytelling and Animal Life*. Oxford: Oxford University Press.

Herring, Juliet. n.d. 'Compiling Literary Corpora' [Online Document]. https://www.birmingha m.ac.uk/Documents/college-artslaw/corpus/Intro/Unit51CompilingLit Corpora.pdf.

Heuser, Sabine. 2003. *Virtual Geographies: Cyberpunk at the Intersection of the Postmodern and Science Fiction*. Amsterdam: Rodopi.

Hewitt, Elizabeth. 1994. 'Generic Exhaustion and the "Heat Death" of Science Fiction'. *Science Fiction Studies* 21 (3): 289–301.

Higgins, David M., and Roby Duncan. 2013. 'Key Critical Concepts, Topics and Critics'. In *The Science Fiction Handbook*, edited by Nick Hubble and Aris Mousoutzanis, 125–42. London: Bloomsbury.

Ho, Yufang. 2012. *Corpus Stylistics in Principles and Practice: A Stylistic Exploration of John Fowles' The Magus*. New York: Continuum.

Hogan, Walter. 2009. *Animals in Young Adult Fiction*. Lanham, MD ; Toronto ; Plymouth: Scarecrow Press.

Höing, Anja. 2017. 'Unreliability and the Animal Narrator in Richard Adams's The Plague Dogs' [Online]. *Humanities* 6 (1): 1–13. https://doi.org/10.3390/h6010006.

Holmes, John. 2009. *Darwin's Bards: British and American Poetry in the Age of Evolution*. Edinburgh: Edinburgh University Press.

Hori, M. 2014. *Investigating Dickens' Style: A Collocational Analysis.* Basingstoke ; New York: Palgrave Macmillan.

Hovanec, Caroline. 2018. *Animal Subjects: Literature, Zoology, and British Modernism*. Cambridge ; New York: Cambridge University Press.

Hsueh, Yeh, and Benyu Guo. 2012. 'China'. In *The Oxford Handbook of the History of Psychology: Global Perspectives*, edited by David B. Baker, 81–124. Oxford ; New York: Oxford University Press.

Hubbard, E.H. 2002. 'Conversation, Characterisation and Corpus Linguistics: Dialogue in Jane Austen's *Sense and Sensibility*'. *Literator* 23 (2): 67–86. https://doi.org/10.4102/lit.v23i 2.331.

Hume, Kathryn. 1984. *Fantasy and Mimesis: Responses to Reality in Western Literature*. New York: Methuen.

Ingwersen, Moritz. 2016. 'Solid-State Fiction: J G Ballard and the Crystallization of Life'. In *Narrating Life: Experiments with Human and Animal Bodies in Literature, Science and Art*, edited by Stefan Herbrechter and Elisabeth Friis, 73–91. Leiden ; Boston: Brill Rodopi.

Jacobs, Joela. 2017. 'Special Issue "Animal Narratology"' [Online Blog]. *Humanities*. https://www.md pi.com/journal/humanities/special_issues/animal_narratology.

Jockers, Matthew L. 2014. *Text Analysis with R for Students of Literature*. New York: Springer.

Kahn, Mary. 2001. 'The Passive Voice of Science: Language Abuse in the Wildlife Profession'. In *The Ecolinguistics Reader: Language, Ecology and Environment*, edited by Alwin Fill and Peter Mühlhäusler, 241–244. London: Continuum.

Kalat, James W. 2011. *Introduction to Psychology*. 9th ed. Belmont, CA: Wadsworth Cengage Learning.

Karier, Clarence J. 1986. *The Individual, Society, and Education: A History of American Educational Ideas*. 2nd ed. Urbana: University of Illinois Press.

Kasdorf, Krista. 2006. 'Ubiquitous Entropy and Heat Death in Philip K. Dick and Pamela Zoline' [Masters Dissertation]. Florida Atlantic University. https://search.proquest.com/openview/74bfca076c0e460cf757b66d295201dd/1?pq-origsite=gscholar&cbl=18750&diss=y.

Katz, H.A., P.S. Warrick, and M.H. Greenberg. 1974. *Introductory Psychology Through Science Fiction*. Chicago, IL: Rand McNally College Publishing.

Keen, Suzanne. 2006. 'A Theory of Narrative Empathy'. *Narrative* 14 (3): 207–36. https://doi.org/10.1353/nar.2006.0015.

———. 2011. 'Fast Tracks to Narrative Empathy: Anthropomorphism and Dehumanization in Graphic Narratives'. *SubStance* 40 (1): 135–55.https://doi.org/10.1353/sub.2011.0003.

Kelly, J. A. 1986. 'Alternatives to Aversive Procedures with Animals in the Psychology Teaching Setting'. In *Advances in Animal Welfare Science*, edited by Michael W Fox and Linda D Mickley, 165–84. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-009-4247-9.

Kelly, James P, and John Kessel. 2009. 'Introduction'. In *The Secret History of Science Fiction*, edited by James P Kelly and John Kessel, 7–20. San Francisco, CA: Tachyon Publications.

Ketterer, David. 1974. *New Worlds for Old: The Apocalyptic Imagination, Science Fiction, and American Literature*. Garden City, N.Y: Anchor Press.

Keyes, Flo. 2006. *The Literature of Hope in the Middle Ages and Today: Connections in Medieval Romance, Modern Fantasy, and Science Fiction*. Jefferson, NC: McFarland & Company.

Khan Academy. 2020. 'The Laws of Thermodynamics: First and Second Laws of Thermodynamics, as They Apply to Biological Systems' [Online Blog]. *Khan Academy*. https://www.khanacademy.org/science/biology/energy-and-enzymes/the-laws-of-thermodynamics/a/the-laws-of-thermodynamics.

Kirwan, Cyril. 2013. *Making Sense of Organizational Learning: Putting Theory into Practice*. Burlington, VT: Gower.

Klama, John. 1988. *Aggression: The Myth of the Beast Within*. New York: Wiley.

Kohák, Erazim V. 2000. *The Green Halo: A Bird's-Eye View of Ecological Ethics*. Chicago, IL: Open Court.

Kondepudi, Dilip, and I. Prigogine. 2015. *Modern Thermodynamics: From Heat Engines to Dissipative Structures*. 2nd ed. Chichester: John Wiley & Sons.

Korte, Barbara. 1997. *Body Language in Literature*. Toronto ; Buffalo: University of Toronto Press.

Korthals, Michiel. 2016. 'Human-Animal Interfaces from a Pragmatist Perspective'. In *Animal Ethics in the Age of Humans: Blurring Boundaries in Human-Animal Relationships*, edited by Bernice Bovenkerk and Jozef Keulartz, 73–88. Cham, Switzerland: Springer.

Koteyko, Irina. 2015. 'The Language of Press Advertising in the UK: A Multi-Dimensional Study'. *Journal of English Linguistics* 43 (4): 259–83. https://doi.org/10.1177/0075424215605566.

Krapfl, J.E., and E.A. Vargas. 1977. *Behaviorism and Ethics*. Kalamazoo, MI: Behaviordelia.

Kreilkamp, Ivan. 2018. *Minor Creatures: Persons, Animals, and the Victorian Novel*. Chicago: The University of Chicago Press.

Kress, Nancy. 2007. 'Ethics, Science and Science Fiction'. In *SciFi in the Mind's Eye: Reading Science through Science Fiction*, edited by Margret Grebowicz, 201–9. Chicago: Open Court.

Kuzmičová, Anezka. 2013. 'Mental Imagery in the Experience of Literary Narrative: Views from Embodied Cognition' [PhD Dissertation]. Stockholm University. https://www.researchgate.net/publication/312172940_Mental_Imagery_in_the_Experience_of_Literary_Narrative_Views_from_Embodied_Cognition/link/587492b908aebf17d3b20b7a/download.

Kuźnicki, Sławomir. 2017. *Margaret Atwood's Dystopian Fiction: Fire Is Being Eaten*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Lambourne, Robert J., Michael Shallis, and Michael Shortland. 1990. *Close Encounters? Science and Science Fiction*. Bristol ; New York: Adam Hilger.

Landon, Brooks. 2014. 'Extrapolation and Speculation'. In *The Oxford Handbook of Science Fiction*, edited by Rob Latham, 23–34. Oxford ; New York: Oxford University Press.

Lane-Petter, W. 1968. 'Cannibalism in Rats and Mice'. *Proceedings of the Royal Society of Medicine* 61 (12): 1295–96.

Langford, David. 2009. *Starcombing: Columns, Essays, Reviews and More*. Rockville, MD: Cosmos Books.

Langford, David, and Peter Nicholls. 2017. 'Entropy' [Online]. In *The Encyclopedia of Science Fiction*, edited by John Clute, David Langford, Peter Nicholls, and Graham Sleight. London: Gollancz. http://www.sf-encyclopedia.com/entry/entropy.

———. 2018. 'Devolution' [Online]. In *The Encyclopedia of Science Fiction*, edited by John Clute, David Langford, Peter Nicholls, and Graham Sleight. London: Gollancz. http://www.sfencyclope dia.com/entry/devolution.

Langley, Gill, ed. 1989. *Animal Experimentation: The Consensus Changes*. London: Macmillan.

Larsen, Erik. 2015. 'Entropy in the Circuits: *McTeague*'s Apocalyptic Posthumanism'. *Nineteenth-Century Literature* 69 (4): 509–38. https://doi.org/10.1525/ncl.2015.69.4.509.

Latham, Rob. 2006. 'New Worlds and the New Wave in Fandom: Fan Culture and the Reshaping of Science Fiction in the Sixties'. *Extrapolation* 47 (2): 296–315.

Leary, David E. 2004. 'On the Conceptual and Linguistic Activity of Psychologists: The Study of Behavior from the 1890s to the 1990s and Beyond'. *Behavior and Philosophy* 32 (1): 13–35.

Leech, Geoffrey, and Michael Short. 2007. *Style in Fiction: A Linguistic Introduction to English Fictional Prose*. 2nd ed. Harlow: Pearson/Longman.

Lehan, Richard Daniel. 1998. *The City in Literature: An Intellectual and Cultural History*. Berkeley: University of California Press.

Levine, George Lewis. 1987. 'One Culture: Science and Literature'. In *One Culture: Essays in Science and Literature*, edited by George Lewis Levine, 3–34. Madison, WI: University of Wisconsin Press.

———. 1991. *Darwin and the Novelists: Patterns of Science in Victorian Fiction*. Chicago: University of Chicago Press.

Lindeman, R. L. 1942. 'The Trophic-Dynamic Aspect of Ecology'. *Ecology* 23: 399–418.

Lindsay, Steven R. 2000. *Handbook of Applied Dog Behavior and Training*. Ames, IA: Iowa State University Press.

Lorenz, Konrad. 1981. *The Foundations of Ethology*. New York: Springer-Verlag.

Lotka, A. J. 1922. 'Contribution to the Energetics of Evolution'. *Proceedings of the National Academy of Sciences* 8: 148–54.

Lovelock, James. 1972. 'Gaia as Seen Through the Atmosphere'. *Atmospheric Environment* 6: 579–80.

———. 1979. *Gaia: A New Look at Life on Earth*. Oxford ; New York: Oxford University Press.

———. 1982. 'The Regulation of Carbon Dioxide and Climate: Gaia or Geochemistry'. *Planet Space Science* 30 (8): 795–802.

———. 1991. 'Gaia: A Planetary Emergent Phenomenon'. In *Gaia II: Emergence*, edited by W Thompson, 30–49. New York: Lindisfarne Press.

———. 2000. *The Ages of Gaia: A Biography of Our Living Earth*. 2nd ed. Oxford: Oxford University Press.

———. 2009. *The Vanishing Face of Gaia: A Final Warning*. London: Penguin.

Lovelock, James, and C. E. Giffin. 1969. 'Planetary Atmospheres: Compositional and Other Changes Associated with the Presence of Life'. *Advances in the Astronautical Sciences* 25: 179–93.

Lovelock, James, and Lynn Margulis. 1973. 'Atmospheric Homoeostasis by and for the Biosphere: The Gaia Hypothesis'. *Tellus* 26 (2): 2–10.

Lucht, Marc, and Donna Yarri, eds. 2010. *Kafka's Creatures: Animals, Hybrids, and Other Fantastic Beings*. Lanham, MD: Lexington Books.

Luckhurst, Roger. 1994. 'The Many Deaths of Science Fiction: A Polemic'. *Science Fiction Studies* 21 (1): 35–50.

———. 2005. *Science Fiction*. Cambridge ; Malden, MA: Polity.

Lund, Nick. 2010. *Intelligence and Learning*. New York: Palgrave Macmillan.

Lyn, Heidi. 2017. 'The Question of Capacity: Why Enculturated and Trained Animals Have Much to Tell Us about the Evolution of Language'. *Psychonomic Bulletin & Review* 24 (1): 85–90. https:// doi.org/10.3758/s13423-016-1129-z.

Lynch, Michael J, Michael A Long, and Paul Stretesky. 2019. *Green Criminology and Green Theories of Justice: An Introduction to a Political Economic View of Eco-Justice*. London: Palgrave Macmillan

Lyons, John. 1977. *Semantics*. Cambridge ; New York: Cambridge University Press.

Mackenzie, Brian D. 1981. 'Experimental Psychology'. In *Dictionary of the History of Science*, edited by W. F. Bynum, E. J. Browne, and Roy Porter, 139–40. Princeton, N.J: Princeton University Press.

Mackey, Alison. 2006. 'Second Language Acquisition'. In *An Introduction to Language and Linguistics*, edited by Ralph W Fasold and Jeff Connor-Linton, 433–65. Cambridge: Cambridge University Press.

Mader, Douglas R. 2006. *Reptile Medicine and Surgery*. 2nd ed. St. Louis, MO: Saunders Elsevier.

Mahlberg, Michaela. 2012. *Corpus Stylistics and Dickens's Fiction*. New York: Routledge.

Mahlberg, Michaela, and Dan McIntyre. 2011. 'A Case for Corpus Stylistics: Ian Fleming's *Casino Royale*'. *English Text Construction* 4 (2): 204–27. https://doi.org/10.1075/etc.4.2.03mah.

Mahlberg, Michaela, and Peter Stockwell. 2015. 'Mind-Modelling with Corpus Stylistics in *David Copperfield*'. *Language and Literature* 24 (2): 129–47. https://doi.org/10.1177/0963947015576168.

Malmgren, Carl Darryl. 1991. *Worlds Apart: Narratology of Science Fiction*. Bloomington: Indiana University Press.

Malone, John C. 2017. 'John B. Watson'. In *Encyclopedia of Animal Cognition and Behavior*, edited by Jennifer Vonk and Todd Shackelford, 1–9. Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-47829-6_936-1.

Manahan, Stanley E. 2013. *Fundamentals of Environmental and Toxicological Chemistry: Sustainable Science.* 4th ed*.* Hoboken: CRC Press.

Mandal, Fatik Baran. 2015. *Textbook of Animal Behaviour.* New Delhi: PHI Learning.

Mandala, Susan. 2010. *Language in Science Fiction and Fantasy: The Question of Style*. London ; New York: Continuum.

Mannheim, Karl. 1997. *Collected Works*. London: Routledge.

Marchettini, N., F. M. Pulselli, and E. Tiezzi. 2006. 'Entropy and the City'. In *The Sustainable City IV: Urban Regeneration and Sustainability*, 263–72. Tallin, Estonia: WIT Press. https://doi.org/10.2 495/SC060251.

Marchitello, Howard, and Evelyn Tribble. 2017. 'Introduction'. In *The Palgrave Handbook of Early Modern Literature and Science*, edited by Howard Marchitello and Evelyn Tribble, xxv–xlvi. London: Palgrave Macmillan.

Margolin, Uri. 1986. 'The Doer and the Deed: Action as a Basis for Characterization in Narrative'. *Poetics Today* 7 (2): 205. https://doi.org/10.2307/1772759.

Margulis, Lynn. 1998. *Symbiotic Planet: A New Look at Evolution*. New York: Basic Books.

Marren, P., and R. Mabey. 2010. *Bugs Britannica*. London: Random House.

Marsden, Ben. 2013. 'Introduction'. In *Uncommon Contexts: Encounters between Science and Literature, 1800-1914*, edited by Ben Marsden, Hazel Hutchison, and Ralph O'Connor, 1–20. London: Pickering & Chatto.

Marshall, Alan. 2002. *The Unity of Nature: Wholeness and Disintegration in Ecology and Science*. London: Imperial College Press.

Mastropierro, Lorenzo. 2018. *Corpus Stylistics in Heart of Darkness and Its Italian Translations*. London ; New York: Bloomsbury Academic.

Maude, Ulrika. 2013. 'Pavlov's Dogs and Other Animals in Samuel Beckett'. In *Beckett and Animals*, edited by Mary Bryden, 82–93. Cambridge: Cambridge University Press.

Maule, Victoria. 1996. 'On the Subversion of Character in the Literature of Identity Anxiety'. In *Impossibility Fiction: Alternativity, Extrapolation, Speculation*, edited by Derek Littlewood and Peter Stockwell, 107–26. Amsterdam ; Atlanta, GA: Rodopi.

Maultsby, Maxie, and Mariusz Wirga. 2001. 'Behavior Therapy'. In *Assessment and Therapy: Specialty Articles from The Encyclopedia of Mental Health*, edited by Howard S. Friedman, 9–22. San Diego, CA: Academic Press.

McConnell, Frank D. 2009. *The Science of Fiction and the Fiction of Science: Collected Essays on SF Storytelling and the Gnostic Imagination*. Jefferson, NC: McFarland & Company.

McGreevy, Paul, and Andrew McLean. 2010. *Equitation Science*. Chichester ; Ames, IA: Wiley-Blackwell.

McGuirk, Carol. 2008. 'Science Fiction's Renegade Becomings'. *Science Fiction Studies* 35 (2): 281–307.

McHugh, Susan. 2009a. 'Literary Animal Agents'. *PMLA* 124 (2): 487–95.

———. 2009b. 'Animal Farm's Lessons for Literary (and) Animal Studies'. *HUMaNIMALIA* 1 (1): 24–39.

———. 2011. *Animal Stories: Narrating across Species Lines*. Minneapolis: University of Minnesota Press.

McIntyre, Dan. 2015a. 'Characterisation'. In *The Cambridge Handbook of Stylistics*, edited by Peter Stockwell and Sara Whiteley, 149–64. Cambridge: Cambridge University Press.

———. 2015b. 'Towards an Integrated Corpus Stylistics'. *Topics in Linguistics* 16 (1): 59–68. https://doi.org/10.2478/topling-2015-0011.

Mendlesohn, Farah. 2003. 'Introduction: Reading Science Fiction'. In *The Cambridge Companion to Science Fiction*, edited by Edward James and Farah Mendlesohn, 1–14. Cambridge ; New York: Cambridge University Press.

Meyers, Walter Earl. 1980. *Aliens and Linguists: Language Study and Science Fiction*. Athens: University of Georgia Press.

Michaelian, K. 2011. 'Thermodynamic Dissipation Theory for the Origin of Life'. *Earth System Dynamics* 2 (1): 37–51. https://doi.org/10.5194/esd-2-37-2011.

Middelhoff, Frederike. 2018. 'Recovering and Reconstructing Animal Selves in Literary Autozoographies'. In *Animal Biography: Re-Framing Animal Lives*, edited by Andre Krebber and Mieke Roscher, 57–80. New York: Springer.

Mikkonen, Kai. 2008. 'Presenting Minds in Graphic Narratives'. *Partial Answers: Journal of Literature and the History of Ideas* 6 (2): 301–21. https://doi.org/10.1353/pan.0.0022.

———. 2017. *The Narratology of Comic Art*. New York: Routledge.

Miller, Gavin. 2008. 'Animals, Empathy, and Care in Naomi Mitchison's "Memoirs of a Spacewoman"'. *Science Fiction Studies* 35 (2): 251–65.

Miller, Joseph D. 2002. 'Popes or Tropes: Defining the Grails of Science Fiction'. In *Science Fiction, Canonization, Marginalization, and the Academy*, edited by Gary Westfahl and George Edgar Slusser, 79–88. Westport, CT: Greenwood Press.

Miller, N. E., and J. Dollard. 1941. *Social Learning and Imitation.* New Haven, CT: Yale University Press.

Mills, D. S. 2010. 'Circus'. In *The Encyclopedia of Applied Animal Behaviour and Welfare*, edited by D. S. Mills and Jeremy N. Marchant-Forde, 105–6. Wallingford ; Cambridge, MA: CABI.

Mills, John A. 1998. *Control: A History of Behavioral Psychology*. New York: New York University Press.

Mills, Sara. 2014. 'The Stylistics of Relationships'. In *The Cambridge Handbook of Stylistics*, edited by Peter Stockwell and Sara Whiteley, 558–72. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139237031.041.

———. 2016. *Feminist Stylistics*. London: Routledge.

Milojevic, I., and S. Inayatullah. 2003. 'Futures Dreaming Outside and on the Margins of the Western World'. *Futures* 35 (5): 493–507. https://doi.org/10.1016/S0016-3287(02)00095-2.

Mitman, Gregg. 1999. *Reel Nature: America's Romance with Wildlife on Films*. Cambridge, MA: Harvard University Press.

Mittenberger, Raymond G. 2012. *Behavior Modification: Principles and Procedures*. 5th ed. Belmont, CA: Wadsworth Cengage Learning.

Monchinski, Tony. 2008. *Critical Pedagogy and the Everyday Classroom*. New York: Springer.

Montoro, Rocío. 2007. 'The Stylistics of Cappuccino Fiction: A Socio-Cognitive Perspective'. In *Contemporary Stylistics*, edited by Marina Lambrou and Peter Stockwell. London ; New York: Continuum.

———. 2012. *Chick Lit: The Stylistics of Cappuccino Fiction*. London: Continuum.

Moore, Lisa Jean, and Mary Kosut. 2013. 'Bees, Borders and Bombs: A Social Account of Theorizing and Weaponizing Bees'. In *Animals and War: Studies of Europe and North America*, edited by Ryan Hediger, 29–44. Leiden ; Boston: Brill.

Moore, Simon C., and M. Oaksford. 2002. 'Emotional Cognition'. In *Emotional Cognition: From Brain to Behaviour*, edited by Simon C. Moore and M. Oaksford. Amsterdam ; Philadelphia: John Benjamins Publishing.

Moore, Stephen D. 2011. 'Why There Are No Humans or Animals in the Gospel of Mark'. In *Mark as Story: Retrospect and Prospect*, edited by Kelly R. Iverson, Christopher W. Skinner, and Society of Biblical Literature, 71–94. Atlanta: Society of Biblical Literature.

Morowitz, Harold J. 1979. *Energy Flow in Biology: Biological Organization as a Problem in Thermal Physics*. Woodbridge: Ox Bow Press.

Murphy, Graham J. 2008. 'Considering Her Ways: In(ter)Secting Matriarchal Utopias'. *Science Fiction Studies* 35 (2): 266–80.

Murphy, Patrick D. 1987. 'Dialogics and Didacticism: John Brunner's Narrative Blending (Propos Dialogiques et Didactiques: Le Mélange Narratif de John Brunner)'. *Science Fiction Studies* 14 (1): 21–33.

Nadeau, Robert L. 1980. 'Physics and Metaphysics in the Novels of Kurt Vonnegut, Jr.' *Mosaic: A Journal for the Interdisciplinary Study of Literature* 13 (2): 37–47.

Nahajec, Lisa. 2009. 'Negation and the Creation of Implicit Meaning in Poetry'. *Language and Literature* 18 (2): 109–27. https://doi.org/10.1177/0963947009105340.

———. 2014. 'Negation, Expectation and Characterisation: Analysing the Role of Negation in Character Construction in To Kill a Mockingbird (Lee 1960) and Stark (Elton 1989)'. In *Pragmatic Literary Stylistics*, edited by Billy Clark and Siobhan Chapman, 111–31. Basingstoke: Palgrave Macmillan.

Nelles, William. 2001. 'Beyond the Bird's Eye: Animal Focalization'. *Narrative* 9 (2): 188–94.

Nerlich, Brigitte, David D Clarke, and Robert Dingwall. 2001. 'Fictions, Fantasies, and Fears: The Literary Foundations of the Cloning Debate'. *Journal of Literary Semantics* 30 (1): 37-52. https://doi.org/10.1515/jlse.30.1.37.

Newmyer, Stephen T. 2006. *Animals, Rights, and Reason in Plutarch and Modern Ethics*. New York: Routledge.

Nicholls, Peter. 1975. 'Jerry Cornelius at the Atrocity Exhibition: Anarchy and Entropy in "New Worlds" Science Fiction 1964-1974'. *Foundation* 0: 22–44.

Nicol, Charles. 1976. 'J.G. Ballard and the Limits of Mainstream SF'. *Science Fiction Studies* 3 (2): 150–57.

Nikolajeva, Maria. 2010. *Power, Voice and Subjectivity in Literature for Young Readers*. New York: Routledge.

Nini, Andreas. n.d. 'Multidimensional Analysis Tagger (v. 1.3) - Manual' [Online Document]. https://413971bd-a-62cb3a1a-s-sites.googlegroups.com/site/multidimensionaltagger /Manual.pdf?attachauth=ANoY7coq5cXaorduBT1WaeADkBY879fH9hqvR5K0n1GPRIW mMgEHEOiDiqXWHVoiMThvbCDGGBc3xyufODfLaedGXnYpB0-vi8VrD7EYbd81NFIzlKO clWyNru5amldHbJdEl Tvlk06qTA1_vs_A5vJDn2tjfLaXDRCuQpB_Imfs-flL2I8ng9Z12kzkI Vm3vxhwvcXVtpeSo1pZFWSlD 3Fcft1nKaIKg%3D%3D&attredirects=0.

———. 2018. *Multidimensional Analysis Tagger* (version 1.3.1) [Software]. https://sites.google.com /site/multidimensionaltagger/

Nocella, Anthony J., Colin Salter, and Judy K. C. Bentley. 2014. *Animals and War: Confronting the Military-Animal Industrial Complex*. Lanham, MD: Lexington Books.

O'Donohue, William T., and Kyle E. Ferguson. 2001. *The Psychology of B.F. Skinner*. Thousand Oaks, CA: Sage.

Ohrem, Dominik, and Roman Bartosch. 2017. *Beyond the Human-Animal Divide: Creaturely Lives in Literature and Culture*. New York: Palgrave Macmillan.

Oller, John W., and Stephen D. Oller. 2010. *Autism: The Diagnosis, Treatment, & Etiology of the Undeniable Epidemic*. Sudbury, MA: Jones and Bartlett.

Oparin, Aleksandr Ivanovich. 1938. *The Origin of Life*. New York: Dover.

Ortiz-Robles, Mario. 2016. *Literature and Animal Studies*. London ; New York: Routledge.

Oxford English Dictionary. 1976. '"homoeostasis, n."' [Online]. https://oed.com/view/Entry/88 025?redirectedFrom=homeostasis.

Packer, Sharon. 2015. *Neuroscience in Science Fiction Films*. Jefferson, NC: McFarland & Company.

Page, Ruth. 2011. 'Response to Target Essay on Social Minds: A Contextualist Perspective'. *Style* 45 (2): 292–95.

Page, Ruth, Beatrix Busse, and Nina Nørgaard. 2018. 'Introduction: Language, Text and Context Revisited'. In *Rethinking Language, Text and Context: Interdisciplinary Research in Stylistics in Honour of Michael Toolan*, edited by Ruth E. Page, Beatrix Busse, and Nina Nørgaard, 1–14. New York: Routledge.

Pak, Chris. 2016. *Terraforming: Ecopolitical Transformations and Environmentalism in Science Fiction*. Liverpool: Liverpool University Press.

Palmer, Alan. 2010. *Social Minds in the Novel*. Theory and Interpretation of Narrative. Columbus: Ohio State University Press.

Panksepp, Jaak. 2008. 'The Affective Brain and Core Consciousness: How Does Neural Activity Generate Emotional Feelings?' In *Handbook of Emotions*, edited by Michael Lewis, Jeannette M. Haviland-Jones, and Lisa Feldman Barrett, 3rd ed, 47–67. New York: Guilford Press.

Parrinder, Patrick, ed. 1979. *Science Fiction: A Critical Guide*. London ; New York: Longman.

———. 2000. 'Science Fiction: Metaphor, Myth or Prophecy?' In *Science Fiction, Critical Frontiers*, edited by Karen Sayer and John Moore, 23–34. Basingstoke: Macmillan.

Perry, Kathryn. 2004. 'Unpicking the Seam: Talking Animals and Reader Pleasure in Early Modern Satire'. In *Renaissance Beasts: Of Animals, Humans, and Other Wonderful Creatures*, edited by Erica Fudge, 19–36. Urbana: University of Illinois Press.

Phelan, James. 1989. *Reading People, Reading Plots: Character, Progression, and the Interpretation of Narrative*. Chicago: University of Chicago Press.

———. 2007. 'Estranging Unreliability, Bonding Unreliability, and the Ethics of "Lolita"'. *Narrative* 15 (2): 222–38.

Phelps, Brady J. 2014. 'Operant Rodent Manipulanda Applied with Goldfish' [Online]. *Innovative Teaching* 3 (1). https://doi.org/10.2466/07.08.IT.3.8.

Phillips, Julie. 2007. *James Tiptree, Jr.: The Double Life of Alice B. Sheldon*. New York: Picador.

Pick, Anat. 2011. *Creaturely Poetics: Animality and Vulnerability in Literature and Film*. New York: Columbia University Press.

Plumwood, Val. 2002. *Environmental Culture: The Ecological Crisis of Reason*. London ; New York: Routledge.

Pons, Michel. 2019. 'Exergy Analysis and Process Optimization with Variable Environment Temperature'. *Energies* 12 (24): 1–19. https://doi.org/10.3390/en12244655.

Porter, Pete. 2010. 'Teaching Animal Movies'. In *Teaching the Animal: Human-Animal Studies across the Disciplines*, edited by Margo DeMello, 18–29. New York: Lantern Books.

Porush, David. 1991. 'Prigogine, Chaos, and Contemporary Science Fiction (Prigogine, Le Chaos, et La Science Fiction Contemporaine)'. *Science Fiction Studies* 18 (3): 367–86.

Preisler, Bent. 1997. *A Handbook of English Grammar on Functional Principles*. 2nd ed. Aarhus: Aarhus University Press.

Prigogine, Ilya. 1955. *Thermodynamics of Irreversible Processes*. New York: John Wiley & Sons.

Prince, Gerald. 1988. 'The Disnarrated'. *Style* 22 (1): 1–8.

Prucher, Jeff, ed. 2007. *Brave New Words: The Oxford Dictionary of Science Fiction*. Oxford ; New York: Oxford University Press.

Punday, Daniel. 2000. 'A Corporeal Narratology?' *Style* 34 (2): 227–42.

Purvis, Ben, Yong Mao, and Darren Robinson. 2017. 'Thermodynamic Entropy as an Indicator for Urban Sustainability?' *Procedia Engineering* 198: 802–12. https://doi.org/10.1016/j.proeng.20 17.07.131.

Ramsden, Edmund, and Jon Adams. 2009. 'Escaping the Laboratory: The Rodent Experiments of John B. Calhoun & Their Cultural Influence'. *Journal of Social History* 42 (3): 761–92.

Ratelle, Amy. 2015. *Animality and Children's Literature and Film*. Basingstoke ; New York: Palgrave Macmillan.

Rayson, Paul. 2009. *Wmatrix: A Web-Based Corpus Processing Environment* [Software]. Computing Department: Lancaster University. https://ucrel-wmatrix4.lancaster.ac.uk/.

Reich, W.T. 1998. *Bioethics: Sex, Genetics & Human Reproduction*. New York: Macmillan.

Richards, Graham. 2002. *Putting Pscyhology in Its Place: A Critical Historical Overview*. 2nd ed. Hove ; New York: Routledge.

Rifkin, J. 2003. *The Hydrogen Economy*. New York: Jeremy P. Tarcher/Penguin.

Rifkin, Jeremy. 2011. *The Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World*. New York: Palgrave Macmillan.

Rigato, Emanuele, and Alessandro Minelli. 2013. 'The Great Chain of Being Is Still Here' [Online]. *Evolution: Education and Outreach* 6 (1). https://doi.org/10.1186/1936-6434-6-18.

Rimmon-Kenan, Shlomith. 2002. *Narrative Fiction: Contemporary Poetics*. 2nd ed. London ; New York: Routledge.

Roberts, Adam. 2006. *Science Fiction*. 2nd ed. The New Critical Idiom. London ; New York: Routledge.

Roberts, Ian F. 2001. 'Maupertuis: Doppelgänger of Doctor Moreau'. *Science Fiction Studies* 28 (2): 261–74.

Rogers, K. 2014. *Attention Complex: Media, Archaeology, Method.* New York: Palgrave Macmillan.

Rosch, Eleanor. 1978. 'Principles of Categorization'. In *Cognition and Categorization*, edited by Eleanor Rosch and Barbara Lloyd, 27–48. Hillsdale: Lawrence Elbaum Associates.

Rowan, Andrew N. 1984. *Of Mice, Models, and Men: A Critical Evaluation of Animal Research*. Albany: State University of New York Press.

Ruano, Pablo. 2016. 'A Corpus-Stylistic Approach to Dickens' Use of Speech Verbs: Beyond Mere Reporting'. *Language and Literature* 25 (2): 113–29. https://doi.org/10.1177/096 3947016631 859.

———. 2018. 'A Corpus-Based Approach to Charles Dickens's Use of Direct Thought Presentation'. *Corpora* 13 (3): 319–45. https://doi.org/10.3366/cor.2018.0152.

Ruse, Michael. 2013. *The Gaia Hypothesis: Science on a Pagan Planet*. Chicago ; London: The University of Chicago Press.

Russ, Joanna. 1975. 'Towards an Aesthetic of Science Fiction'. *Science Fiction Studies* 2 (2): 112–19.

Ryan, Marie-Laure. 2011. 'Narrative/Science Entanglements: On the Thousand and One Literary Lives of Schrödinger's Cat'. *Narrative* 19 (2): 171–86. https://doi.org/10.1353/nar.2011.0007.

Ryder, Mary Ellen. 2003. 'I Met Myself Coming and Going: Co(?)-Referential Noun Phrases and Point of View in Time Travel Stories'. *Language and Literature* 12 (3): 213–32. https://doi.org/10.1177/09639470030123003.

Sacks, Harvey. 2006. *Lectures on Conversation: Volumes I & II*. Edited by Gail Jefferson. Oxford: Blackwell.

Sagan, Dorion, and Jessica Whiteside. 2004. 'Gradient Reduction Theory: Thermodynamics and the Purpose of Life'. In *Scientists Debate Gaia: The Next Century*, edited by Stephen Henry Schneider, 173–86. Cambridge, MA: MIT Press.

Salter, Colin. 2014. 'Introducing the Military-Animal Industrial Complex'. In *Animals and War: Confronting the Military-Animal Industrial Complex*, edited by Anthony J. Nocella, Colin Salter, and Judy K. C. Bentley, 16–29. Lanham, MD: Lexington Books.

Sanders, Scott. 1977. 'Invisible Men and Women: The Disappearance of Character in Science Fiction'. *Science Fiction Studies* 4 (1): 14–24.

Schneider, E.D., and J.J. Kay. 1994. 'Life as a Manifestation of the Second Law of Thermodynamics'. *Mathematical and Computer Modelling* 19 (6–8): 25–48. https://doi.org/10.1016/08957177(9 4)90188-0.

Schneider, Eric D., and Dorion Sagan. 2005. *Into the Cool: Energy Flow, Thermodynamics, and Life*. Chicago: University of Chicago Press.

Schneider, Klaus P. 2003. *Diminutives in English*. Tübingen: Max Niemeyer.

Schneider, Ralf. 2001. 'Toward a Cognitive Theory of Literary Character: The Dynamics of Mental-Model Construction'. *Style* 35 (4): 607–39.

Scholes, Robert. 1975. *Structural Fabulation: An Essay on Fiction of the Future*. Notre Dame, IN: University of Notre Dame Press.

Schrödinger, E. 1944. *What Is Life? The Physical Aspect of the Living Cell*. Cambridge: Cambridge University Press.

Scott, Mike. 2009. 'In Search of a Bad Reference Corpus'. In *What's in a Word-List? Investigating Word Frequency and Keyword Extraction*, edited by Dawn Archer, 79–92. Farnham ; Burlington, VT: Ashgate Publishing.

Sealey, Alison, and Lee Oakley. 2013. 'Anthropomorphic Grammar? Some Linguistic Patterns in the Wildlife Documentary Series Life'. *Text & Talk* 33 (3). https://doi.org/10.1515/text-2013-0017.

Sebeok, Thomas A. 1968. 'Zoosemiotics'. *American Speech* 43 (2): 142–144. https://doi.org/10.2307/454548.

Semino, Elena. 1997. *Language and World Creation in Poems and Other Texts*. London: Longman.

———. 2004. 'Representing Characters' Speech and Thought in Narrative Fiction: A Study of *England, England* by Julian Barnes'. *Style* 38 (4): 428–51.

Shapiro, Kenneth, and Marion Copeland. 2005. 'Toward a Critical Theory of Animal Issues in Fiction'. *Society & Animals* 13 (4): 343–46. https://doi.org/10.1163/156853005774653636.

Shaw, Bruce. 2010. *The Animal Fable in Science Fiction and Fantasy*. Jefferson, NC: McFarland & Company.

Sheffield, Charles. 2000. *The Compleat McAndrew*. New York: Baen Books.

Shepherd, Tania M. G., and Tony Berber Sardinha. 2013. 'A Rough Guide to Doing Corpus Stylistics'. *Matraga* 20: 66–89. https://doi.org/10.12957/matraga.2013.19841.

Sherwood, Lauralee, Hillar Klandorf, and Paul H. Yancey. 2013. *Animal Physiology: From Genes to Organisms*. 2nd ed. Belmont, CA: Brooks/Cole.

Shippey, T. A. 2016. *Hard Reading: Learning from Science Fiction*. Liverpool: Liverpool University Press.

Shiraev, Eric. 2011. *A History of Psychology: A Global Perspective*. Thousand Oaks, CA: SAGE.

Sholette, Gregory. 2013. 'Occupology, Swarmology, Whateverology: The City of (Dis)Order versus the People's Archive'. In *Critical Digital Studies: A Reader*, edited by Arthur Kroker, 2nd ed, 283–92. Toronto: University of Toronto Press.

Shugg, Wallace. 1968. 'The Cartesian Beast-Machine in English Literature (1663-1750)'. *Journal of the History of Ideas* 29 (2): 279. https://doi.org/10.2307/2708581.

Sidnell, Jack. 2010. *Conversation Analysis: An Introduction*. Chichester ; Malden, MA: Wiley-Blackwell.

Simmons, Laurence, and Philip Armstrong. 2007. 'Bestiary: An Introduction'. In *Knowing Animals*, edited by Laurence Simmons and Philip Armstrong, 1–26. Leiden ; Boston: Brill.

Simpson, Paul. 2004. *Stylistics: A Resource Book for Students*. London ; New York: Routledge.

Skinner, B. F. 1938. *The Behavior of Organisms*. New York: D. Appleton-Century Company.

———. 1957. *Verbal Behavior*. Acton, MA.: Copley.

———. 1960. 'Pigeons in a Pelican'. *American Psychologist* 15: 28–37.

———. 1978. *Reflections on Behaviorism and Society*. Englewood Cliffs, N.J: Prentice-Hall.

Sleigh, Charlotte. 2011. *Literature and Science*. Basingstoke: Palgrave Macmillan.

Smith, C.C. 1986. *Twentieth-Century Science-Fiction Writers*. St. James, MO: St. James Press.

Smith, Roger. 1996. 'Behaviourism'. In *Companion to the History of Modern Science*, edited by Robert Cecil Olby, G N Cantor, J R R Christie, and M J S Hodge, 410–24. London: Routledge.

Sperber, Dan, and Deirdre Wilson. 2001. *Relevance: Communication and Cognition*. 2nd ed. Oxford ; Cambridge, MA: Blackwell Publishers.

Stableford, Brian. 2014. *Science Fact and Science Fiction: an Encyclopedia.* Abingdon ; New York: Routledge.

Stableford, Brian M., and David Langford. 2018. 'Psychology' [Online]. In *The Encyclopedia of Science Fiction*, edited by John Clute, David Langford, Peter Nicholls, and Graham Sleight. London: Gollancz. http://www.sf-encyclopedia.com/entry/psychology.

Staddon, J. E. R. 2014. *The New Behaviorism*. 2nd ed. New York ; London: Psychology Press.

Stam, Henderikus, and Tanya Kalmanovitch. 1998. 'E L Thorndike and the Origins of Animal Psychology'. *American Psychologist* 53 (10): 1135–44.

Stephenson, Gregory. 1991. *Out of the Night and into the Dream: A Thematic Study of the Fiction of J.G. Ballard*. New York: Greenwood Press.

Stibbe, Arran. 2012. *Animals Erased: Discourse, Ecology, and Reconnection with the Natural World*. Middletown, CT: Wesleyan University Press.

Stockwell, Peter. 1994. 'To Be or Not to Be a Phagocyte: Procedures of Reading Metaphors'. In *Literature and the New Interdisciplinarity: Poetics, Linguistics, History*, edited by Roger D. Sell and Peter Verdonk, 65–78. Amsterdam: Rodopi.

———. 2000a. *The Poetics of Science Fiction*. Harlow ; New York: Longman.

———. 2000b. '(Sur)Real Stylistics: From Text to Contextulising'. In *Contextualized Stylistics: In Honour of Peter Verdonk*, edited by Tony Bex, Peter Verdonk, and Peter Stockwell, 15–38. Amsterdam: Rodopi.

———. 2003a. 'Introduction: Science Fiction and Literary Linguistics'. *Language and Literature* 12 (3): 195–98. https://doi.org/10.1177/09639470030123001.

———. 2003b. 'Schema Poetics and Speculative Cosmology'. *Language and Literature* 12 (3): 252–71. https://doi.org/10.1177/09639470030123005.

———. 2020. *Cognitive Poetics: A New Introduction*. London ; New York: Routledge.

Strasen, Sven. 2013. 'The Return of the Reader: The Disappearance of Literary Reception Theories and Their Revival as a Part of a Cognitive Theory of Culture'. *Anglistik: International Journal of English Studies* 24 (2): 31–48.

Strasen, Sven, and Peter Wenzel. 2012. 'Construction of Identities, Polar Opposites, and Cultural Models: The Binary Approach to Cultural Interaction'. In *The Worldly Scholar*, edited by Gordon Collier, Marc Delrez, Anne Fuchs, and Benedicte Ledent, 21–35. Amsterdam: Rodopi.

Strauss, Claudia, and Naomi Quinn. 1997. *A Cognitive Theory of Cultural Meaning*. Cambridge ; New York: Cambridge University Press.

Sullivan, Heather I. 2010. 'Unbalanced Nature, Unbounded Bodies, and Unlimited Technology: Ecocriticism and Karen Traviss' Wess'har Series'. *Bulletin of Science, Technology & Society* 30 (4): 274–84. https://doi.org/10.1177/0270467610373821.

Sundberg, Mark L. 2016. 'Verbal Stimulus Control and the Intraverbal Relation'. *The Analysis of Verbal Behavior* 32 (2): 107–24. https://doi.org/10.1007/s40616-016-0065-3.

Suvin, Darko. 1979. *Metamorphoses of Science Fiction: On the Poetics and History of a Literary Genre*. New Haven: Yale University Press.

Tartakovsky, R. 2009. 'E. E. Cummings's Parentheses: Punctuation as Poetic Device.' *Style* 43 (2): 215–47.

Thévenon, Marie. 2018. 'Using Science Fiction as a Teaching Tool in ESP Classes for Science Students' [Online]. *ILCEA*, 31: 1–18. https://doi.org/10.4000/ilcea.4688.

Thompson, R. 1982. 'Modern Fantasy and Medieval Romance: A Comparative Study'. In *The Aesthetics of Fantasy Literature and Art*, edited by Roger C. Schlobin, 211–25. Indiana ; Sussex: University of Notre Dame Press.

Thorndike, Edward L. 1911. *Animal Intelligence: Experimental Studies*. New Brunswick, NJ: Transaction Publishers.

Toates, Frederick. 2009. *Burrhus F. Skinner*. Basingstoke: Palgrave Macmillan.

Tolman, E. C. 1945. 'A Stimulus-Expectancy Need-Cathexis Psychology'. *Science* 101 (2616): 160–66. https://doi.org/10.1126/science.101.2616.160.

Toolan, Michael J. 2009. *Narrative Progression in the Short Story : A Corpus Stylistic Approach*. Amsterdam ; Philadelphia: John Benjamins Publishing.

Torrance, T. F. 1990. 'Fundamental Issues in Theology and Science'. In *Science and Religion: One World - Changing Perspectives on Reality*, edited by Jan Fennema and Iain Paul, 35–46. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-009-2021-7.

Toumey, Christopher P. 1992. 'The Moral Character of Mad Scientists: A Cultural Critique of Science'. *Science, Technology, & Human Values* 17 (4): 411–37. https://doi.org/10.1177/01622 4399201700401.

Twine, Richard. 2010. *Animals as Biotechnology: Ethics, Sustainability and Critical Animal Studies*. London ; Washington, DC: Earthscan.

Tyrrell, Toby. 2013. *On Gaia: A Critical Investigation of the Relationship between Life and Earth*. Princeton: Princeton University Press.

Uexküll, J. von. 2010. *A Foray into the Worlds of Animals and Humans*. Translated by J. D. O'Neil. Minneapolis: University of Minnesota Press.

Ulancowicz, R. E., and B. M. Hannon. 1987. 'Life and the Production of Entropy'. *Proceedings of the Royal Society London* 232: 181–92.

Umar, Aishat. 'Exploring Creativity in Narrative Fiction: A Stylistic Analysis of Characterisation in Abubakar Gimba's *Witnesses to Tears*'. Paper presented at *PALA 2015 Conference*. University of Kent, Kent, July 15-18 2015 https://www.pala.ac.uk/uploads/2/5/1/0/25105678/umar_aish at.pdf.

'Unjustly Neglected Works of Science Fiction'. 1993. *Science Fiction Studies* 20 (3): 422–32.

Urbanski, Heather. 2007. *Plagues, Apocalypses and Bug-Eyed Monsters: How Speculative Fiction Shows Us Our Nightmares*. Jefferson, NC: McFarland & Company.

Vaeßen, Julia, and Timo Lothmann. 2014. 'Do You Read Me? Metaphor as a Pathway to the Conceptualisation of Literary Identity'. *International Journal of Literary Linguistics* 3 (1): 1–18.

Vaeßen, Julia, and Sven Strasen. 2015. 'A History of Anthony in 31/2 Endings: History, Memory and Fabulation in Julian Barnes's *The Sense of an Ending*'. In *Last Things: Essays on Ends and Endings*, edited by Gavin Hopps, Stella Neumann, Sven Strasen, and Peter Wenzel, 81–100. Frankfurt am Main ; New York: Peter Lang.

Vale, Nick. 2012. *The Newer Testament: The Bible of No Free Will*. United States: Xlibris Corporation.

Vanderbeke, Dirk. 2003. 'Analogies and Insights in "Morpho Eugenia": A Response to June Sturrock'. *Connotations* 13 (3): 289–99.

Varis, Essi. 2020. 'Alien Overtures: Speculating about Nonhuman Experiences with Comic Book Characters'. In *Reconfiguring Human, Nonhuman and Posthuman in Literature and Culture*, edited by Sanna Karkulehto, Aino-Kaisa Koistinen, and Essi Varis, 79–105.

Vechinski, Matthew James. 2016. 'Christine Brooke-Rose and the Science of Fiction: Rethinking Conceptual Writing and Artificial Intelligence in *Xorandor*'. *Critique: Studies in Contemporary Fiction* 57 (4): 448–63. https://doi.org/10.1080/00111619.2015.1091288.

Verdonk, Peter. 2002. *Stylistics*. Oxford: Oxford University Press.

Viney, William. 2007. '"A Fierce and Wayward Beauty": Waste in the Fiction of J.G. Ballard, Part III' [Online Blog]. *Ballardian*. http://www.ballardian.com/a-fierce-and-wayward-beauty-part-3.

Vint, Sherryl. 2009. 'Science Studies'. In *The Routledge Companion to Science Fiction*, edited by Mark Bould, 413–22. London: Routledge.

———. 2010. *Animal Alterity: Science Fiction and the Question of the Animal*. Liverpool: Liverpool University Press.

Volk, Tyler. 1998. *Gaia's Body*. New York: Springer. https://doi.org/10.1007/978-1-4612-2190-6.

Voller, Jack G. 1989. 'Universal Mindscape: The Gaia Hypothesis in Science Fiction'. In *Mindscapes, the Geographies of Imagined Worlds*, edited by George Edgar Slusser and Eric S. Rabkin, 136–54. Carbondale: Southern Illinois University Press.

Vrasidas, Charalambos, Lucy Avraamidou, Katerina Theodoridou, Sotiris Themistokleous, and Petros Panaou. 2015. 'Science Fiction in Education: Case Studies from Classroom Implementations'. *Educational Media International* 52 (3): 201–15. https://doi.org/10.1080/09523987.2015.107 5102.

Waal, Frans de. 2016. *Are We Smart Enough to Know How Smart Animals Are?* New York: W.W. Norton & Company.

Wagar, W. Warren. 1982. *Terminal Visions: The Literature of Last Things*. Bloomington: Indiana University Press.

Walker, Brian David. 2012. 'Character and Characterisation in Julian Barnes' Talking It over : A Corpus Stylistic Analysis' [PhD Dissertation]. Lancaster University. https://ethos.bl.uk/OrderDet ails.do?uin=uk.bl.ethos.625457.

Walsh, Clare. 2003. 'From `Capping' to Intercision: Metaphors/Metonyms of Mind Control in the Young Adult Fiction of John Christopher and Philip Pullman'. *Language and Literature* 12 (3): 233–51. https://doi.org/10.1177/09639470030123004.

Warrick, Patricia S. 1980. *The Cybernetic Imagination in Science Fiction*. Cambridge, MA ; London: MIT Press.

Watson, David L., and Roland G. Tharp. 2014. *Self-Directed Behavior: Self-Modification for Personal Adjustment*. 10th ed. Australia: Wadsworth Cengage Learning.

Watson, John B. 1913. 'Psychology as the Behaviorist Views It.' *Psychological Review* 20 (2): 158–77. https://doi.org/10.1037/h0074428.

———. 1924. *Behaviorism*. New Brunswick, N.J: Transaction Publishers.

———. 1926a. 'Behaviourism a Psychology Based on Reflex-Action'. *Journal of Philosophical Studies* 1 (4): 454–66.

———. 1926b. 'What the Nursery Has to Say about Instincts'. In *Psychologies of 1925*, edited by C Murchinson, 1–34. Worcester, MA: Clark University Press.

Watson, J B, and R Rayner. 1920. '"Conditioned Emotional Reaction"'. *Journal of Experimental Psychology* 3: 1–14.

Weber, Jean Jacques, ed. 1996. *The Stylistics Reader: From Roman Jakobson to the Present*. London ; New York: Arnold.

Weisenburger, Steven. 1995. *Fables of Subversion: Satire and the American Novel, 1930-1980*. Athens: University of Georgia Press.

Westfahl, Gary. 2005. 'Hard Science Fiction'. In *A Companion to Science Fiction*, edited by David Seed, 187–201. Malden, MA: Blackwell Publishing.

Whitman, Will, and David A Washburn. 2017. 'A History of Animal Personality Research'. In *Personality in Nonhuman Animals*, edited by Jennifer Vonk, Stan A Kuczaj, and Alexander Weiss, 3–18. New York: Springer Berlin Heidelberg.

Wicken, J. 1987. *Evolution, Thermodynamics, and Information: Extending the Darwinian Program*. New York: Oxford University Press.

Wiegandt, Kai. 2020. *J.M. Coetzee's Revisions of the Human: Posthumanism and Narrative Form*. London: Palgrave Macmillan.

Wiener, Norbert. 2007. *Cybernetics or Control and Communication in the Animal and the Machine*. 2nd ed. Cambridge, MA: MIT Press.

Willis, Martin. 2015. *Literature and Science: A Reader's Guide to Essential Criticism*. London: Palgrave Macmillan.

Woese, C. R., O. Kandler, and M. L. Wheelis. 1990. 'Towards a Natural System of Organisms: Proposal for the Domains Archaea, Bacteria, and Eucarya'. *Proceedings of the National Academy of Sciences of the United States of America* 87 (12): 4576–79. https://doi.org/10.1073/pnas.87.12 .4576.

Woldemariam, Haileleul. 2014. 'The Teaching and Learning of Poetry at Postgraduate Level: A Cognitive Stylistics Approach'. *NAWA Journal of Language and Communication* 8: 19–43.

Woloch, Alex. 2003. *The One vs. the Many: Minor Characters and the Space of the Protagonist in the Novel*. Princeton, NJ: Princeton University Press.

Woods, Nicola. 2006. *Describing Discourse: A Practical Guide to Discourse Analysis*. London ; New York: Hodder Arnold.

Xiao, R, and T McEnery. 2005. 'Two Approaches to Genre Analysis: Three Genres in Modern American English'. *Journal of English Linguistics* 33: 62–82.

Yampell, Cat. 2008. 'When Science Blurs the Boundaries: The Commodification of the Animal in Young Adult Science Fiction'. *Science Fiction Studies* 35 (2): 207–22.

Yanarella, Ernest J. 2001. *The Cross, the Plow and the Skyline: Contemporary Science Fiction and the Ecological Imagination*. Parkland, FL: Brown Walker Press.

Yar, Majid. 2014. *The Cultural Imaginary of the Internet: Virtual Utopias and Dystopias*. Basingstoke ; New York: Palgrave Macmillan.

Young, Robert J. 1999. 'The Behavioural Requirements of Farm Animals for Psychological Well-Being and Survival'. In *Attitudes to Animals: Views in Animal Welfare*, edited by Francine L. Dolins, 77–100. Cambridge ; New York: Cambridge University Press.

Zamora, Lois Parkinson. 1989. *Writing the Apocalypse: Historical Vision in Contemporary U.S. and Latin American Fiction*. Cambridge ; New York: Cambridge University Press.

Zencey, Eric. 1986. 'Some Brief Speculations on the Popularity of Entropy as Metaphor'. *The North American Review* 271 (3): 7–10.

Zotin, A. I. 1984. 'Bioenergetic Trends of Evolutionary Progress of Organisms'. In *Thermodynamics and Regulation of Biological Processes*, edited by I. Lamprecht and A. I. Zotin, 451–58. Berlin: Walter de Gruyter.

Zumpe, Doris, and Richard P. Michael. 2013. *Notes on the Elements of Behavioral Science.* London: Springer Verlag.

Zunshine, Lisa. 2008. *Strange Concepts and the Stories They Make Possible: Cognition, Culture, Narrative*. Baltimore: Johns Hopkins University Press.

———, ed. 2010. *Introduction to Cognitive Cultural Studies*. Baltimore: Johns Hopkins University Press.

Zyngier, Sonia. 2001. 'Towards a Cultural Approach to Stylistics'. *CAUCE* 24: 365–80.