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# Animal representations in Margaret Atwood's novels: a study based on pan-indexicality model

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**Abstract:** Margaret Atwood is a Canadian author of more than thirty-five books and the winner of prestigious literary prizes, such as the Booker Prize, the Giller Prize, and the Governor General's Award. Her influence on Canadian literature and contemporary literature as a whole is phenomenal. Nevertheless, little is known with respect to how Atwood represents animals covering the full range of her novels. This paper reports on the analysis of animal representations in Atwood's seventeen novels through Python programming and close reading under the framework of a new semiotic research finding, a pan-indexicality model within the context of literature and the environment. This study investigates the frequencies of animal vocabulary in the seventeen novels, the changes of animal representations in her novels before 1990s and after 1990s, and the implication of the ever-changing animal representations during the fifty years. This paper concludes that nonhuman animal descriptions in Atwood's novels of 1970s and 1980s run at a high level and decrease in her novels of 1990s, while scientific animal descriptions increase in her novels of 2000s and 2010s. Nonhuman animals in her novels of 1970s and 1980s are instrumentalized as a vehicle for indigenization and national individuation from the United States, and scientific animals in her novels of 2000s and 2010s are instrumentalized in the service of environmental apocalypticism. This study suggests that the pan-indexicality model can be employed to understand the meaning of signs in literature and the environment from the perspective of authorial intention, with reference to authors' encyclopedic knowledge, personal experience, social, and cultural background information.

**Keywords:** pan-indexicality model; animal representation; ecocriticism; Margaret Atwood's novels; Python programming

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# 1 Introduction

Literary imagery, being recognized by the material turn in contemporary literary studies, is a representation of objects that both delivers recognizable images and offers angles through which they are analyzed. Literary images are delivered by language that has its own theorized and complex semiosis. The formal semiosis of literary images has not been fully studied, because images with second or *n*th-degree representations are not signs accepted by formal semiotics (Sonesson 1996). However, there is a semiosis of all perceived things (Sonesson 1996), both real objects (Krampen 1994) and mediated objects are being studied now. “Virtually anything can be a sign ... if it manifests sign functions” (Merrell 2001, p. 34).

In recent approaches in humanity, such as ecocriticism, “the conception of purely cultural objects has been problematized” (Maran and Kull 2014, p. 42). Kull (1998, p. 351) claims that it is possible to “investigate human relationships to nature which have a semiotic (sign-mediated) basis.” These statements point to the need for the interdisciplinary observation that would allow new findings in semiotics to perceive literary animal signs as influenced by readers’ encyclopedia knowledge and cultural texts, which are rooted in authors’ perception of them and bodily engagement with them. In recent years, a pan-indexicality model (Wang 2019) has been proposed, which can be rightfully used for interpreting linguistic signs.

Animal signs apparently function as “semiotic resources” (Nørgaard 2018, p. 20) within or through “human perception” (Krampen 1994, p. 517), where they have “systems of meaning” (Kress and van Leeuwen 2006, p. 19). Atwood describes nonhuman animals or creates scientific animals that have complex referential roles representing corresponding social cultural meanings in her novels. For instance, Atwood’s representation of nonhuman animals in *Surfacing* is instrumentalized in the service of settler–invader fantasies of both national identity and national individuation from the United States (Aguila-Way 2016).

To explore this subject with a more concrete focus, this study adopts a new theoretical insight in semiotics to explore the cultural meanings of literary images of selected objects, animals, in all novels composed by Margaret Atwood, ranging from 1969 to 2019, from the perspective of authorial intention based on the pan-indexicality model through both Python programming and close reading. This study intends to work as a guide to help general readers get into the texts, stimulating them to use their own imagination and follow their own instinct. It would offer them an opportunity to question the conventional attitudes toward animals, raise their awareness of environmental protection, and eventually rethink the interaction between humans and animals for a more sustainable future.

## 2 Related studies

Twentieth-century studies in ecological dynamism, sciences of quantum physics, and relativity theory have challenged literary explorations of human place in different cultures by now. Ecocriticism, “the study of the relationship between literature and the physical environment” (Glotfelty and Fromm 1996, p. xviii), springs out of this context, to some degree, reviving pastoral and romantic attitudes to the nature, but mainly responding to alarm about the vulnerability of biological environments increasingly destroyed by modern science and human technologies. New challenges from wild animal extinction, spreading pollution, and climate change have stimulated fiction writers and poets to increase their attention to environmental dangers. Meanwhile, theoretically sophisticated and increasingly complex analysis of environmental literature has begun to dominate ecocriticism by its third decade.<sup>1</sup> Environmental criticism has developed to more consideration of collective social situations, such as those of postcolonial social and political realities, vulnerable communities forced to live in polluted surroundings, and threats from globally spreading pollution and climate change.

While the emphasis on environmental justice and risk from climate change has become global, exploring literary engagements with animal studies is another area of expansion (Westling 2013). Images of animals in literary texts are hardly taken seriously (Clark 2011) and they are the latest candidates in an unending procession of victims—minorities, women, the poor—calling for rights and justice, or just a decent treatment. Works of a series of philosophers—Peter Singer, Tom Regan, Mary Midgley, Carol Adam, Jacques Derrida, Donna Haraway, and Cary Wolfe—have radically reshaped the conventional view of the animal as a counterpart to the human. After Singer’s *Animal Liberation* (1975) on the cruelty and extent of human exploration of animals, Regan published *The Case for Animal Rights* (1983), followed by studies like Midgley’s *Animals and Why They Matter* (1984) and Adam’s *The Sexual Politics of Meat* (1990).<sup>2</sup> Being understood as his “animal turn (perhaps return)” (Goldman 2018, p. 161), Derrida (2008, p. 41) declares that the “question of the animal was also, here and elsewhere, one of our permanent concerns.” Haraway (2013) argues that humans and animals do not exist as divided entities but, instead, have

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1 See Lawrence Buell, “Ecocriticism: Some Emerging Trends,” *Qui Parle: Critical Humanities and Social Sciences* 19 (2011), 87–115; Ursula Heise, “A Hitchhiker’s Guide to Ecocriticism,” *PMLA* 121(2006), 503–516; and Timothy Clark, “Introduction” in *The Cambridge Introduction to Literature and the Environment*, pp. 1–11.

2 Peter Singer, *Animal Liberation*, 2nd edn. (London: Pimlico, 1995); Tom Regan, *The Case for Animal Rights* (Berkeley: University of California Press, 1983); Mary Midgley, *Animals and Why They Matter* (Harmondsworth: Penguin, 1984); and Carol Adams, *The Sexual Politics of Meat* (New York: Continuum, 1990).

coexisted through their co-constitutive relationships within specific naturecultures across evolutionary time. Wolfe (2003, p. xiii) makes a great effort to establish a philosophical grounding for animal rights and makes it clear why humans have to move beyond utilitarian justifications of the “rights of animals.” Wolfe draws much attention to reopening the question of ethics and posthumanism as a question for reflection, rather than a ready-made ideological or political position ripe for action. Wolfe’s *Animal Rites* is an example of questioning the preconception of sovereignty of humans over animals, raising the question of animal subjectivity, and producing the institution of speciesism, which is fundamental in the formation of western subjectivity and sociality.

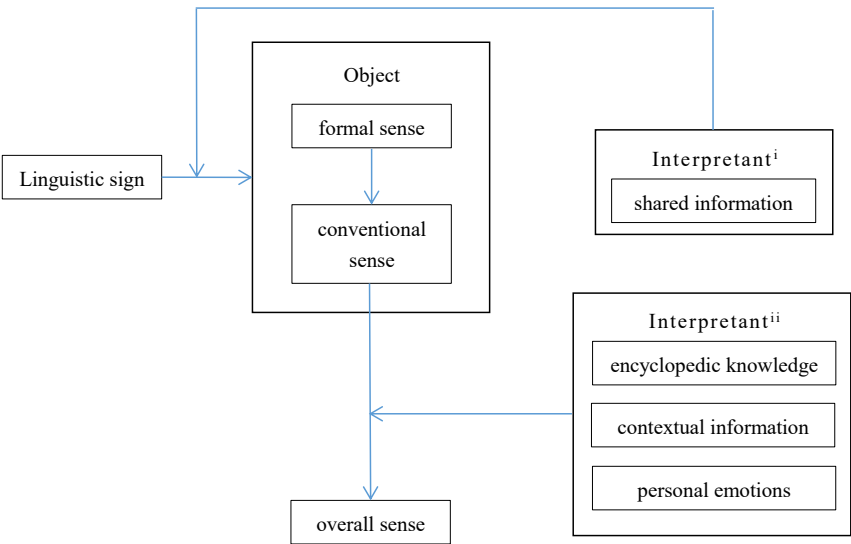
While fruitful readings of critical animal studies have derived from works with arguments loosely related to posthumanism (Clark 2011), new materialisms may interconnect the animal and environmental advocacy (Adamson et al. 2016) in recent years. New materialist approaches, which shift their attention to substances, physical agencies and corporeality, suggest that animals should be considered within material systems—not only within habitats and ecosystems but within food systems, chemical industries, big pharma, and other fields of global capitalism as well. Shukin (2009, p. 16) urges us to view animal bodies as “capital becomes animal, and animals become capital” in a “semiotic and material closed loop, such that the meaning and matter of the one feeds seamlessly back into the meaning and matter of another.”

The above theoretical resources lead ecocriticism to a new territory interweaving critical animal studies with modern environmental literature. The studies are part of an increasing scholarly interest in animals and their place within and outside of human cultures. Rothfels (2002) illustrates in great detail that human representations of animals are in some way deeply related to our cultural environment and this cultural environment is deeply rooted in a history. Daston and Mitman (2005) demonstrate that humans apply animal representations in literature to transcend the confines of human/animal aspects of self/other binary. Armstrong (2008) explores human–animal relationship in the context of globalizing modernity. McFarland (2013) applies critical animal studies to question the conventional human/animal binary and argues that humans should respect the subjective integrity of other animals. Huggan and Tiffin (2015) study the overlap between the global problem of human relations with nonhuman creatures. Baranovitch (2023) explores animal representations and the human–animal relationship in *Empty Mountains*, demonstrating that the symbolic functions of animals are not confined only to religious rituals, but are used to establish ethnic identities as well. Every discipline has a stake in the crucial environmental issues of our time, while interdisciplinarity and cross-disciplinary discourses, like animal representations in literature, not only enhance but are indispensable to environmental protection and sustainable development.

### 3 Theoretical framework

The theoretical framework of this study provided here is not a view to interpret literary animals as a text. Instead, it is a view that describes perceptual processes as sign processes on the basis of sign relations.

The discussion section of this study is hinged on the pan-indexicality model of linguistic signs. The model is proposed to be used for interpreting linguistic signs based on Peirce's trichotomy of signs and the notion of indexicality (Wang 2019). Figure 1 is a description of the pan-indexical process that affects the meaning of a linguistic sign. The pan-indexical process, containing Peirce's basic sign components, i.e., sign, object, and interpretant, allows us to interpret a linguistic sign within the classic semiotic framework. A linguistic sign *per se* does not carry any meaning, but it hints at a certain object, helping the addressee to find out what the object literally and figuratively refers to. Interpretant<sup>i</sup> refers to the shared information comprehended by both the addresser and the addressee, which leads to a correct understanding of what the object refers to. Interpretant<sup>ii</sup> refers to the addressee's personal encyclopedic knowledge, perception of the contextual information, and personal experience in the process of actual communication. The formal sense of a linguistic sign is comprehended almost automatically but still subject to the Interpretant<sup>i</sup>. Conventional sense of a linguistic sign refers to the standard definition that can be found, for



**Figure 1:** The pan-indexical process of linguistic signs (Wang 2019).

example, in a dictionary. Overall sense of a linguistic sign involves many factors that interact with each other and solely related to Interpretant<sup>ii</sup>.

As the above model has been proved to be effective in the general sense (Zhu and Duan 2022), this study hereby applies it to a more specific realm of literature and the environment. In nature writing, the meanings of nature need mediation by human semiotic processes and should consider the following factors: "(1) textual natural environment; (2) written text; (3) author of the text; (4) reader" (Maran 2007, p. 281), which both the author of the written text and the reader are included. A written text of nature writing "may be open and include descriptions of the author's experiences of different places as well as various cultural and literary references" (Maran 2007, p. 282). Meanwhile, many meaning connections that are hinted in the written text may be inaccessible to the reader when the reader's nature experience is absent or quite different from that of the author. Therefore, a linguistic sign in literature as an index frequently presupposes a meaning potential, and whether this meaning potential can emerge or not is determined by the author.

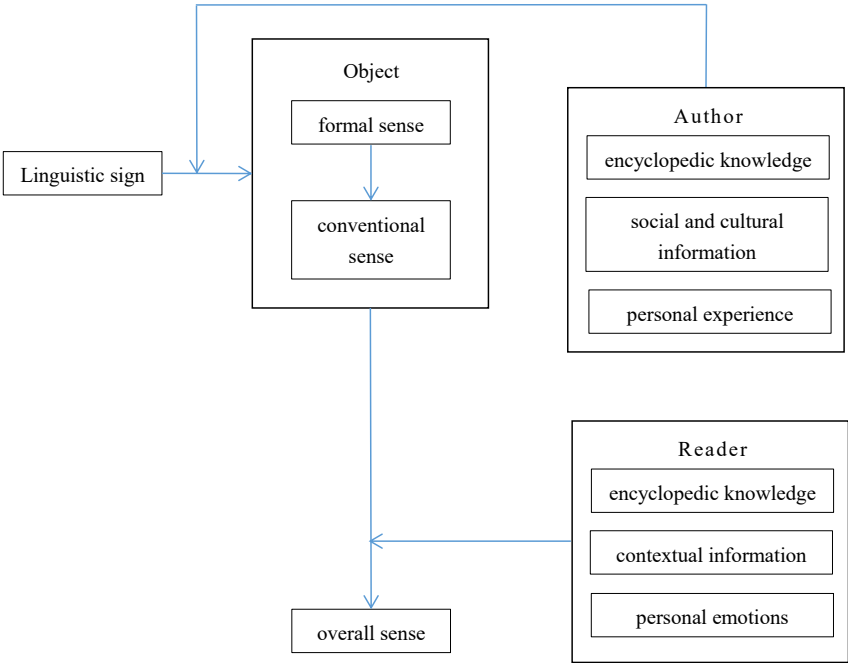
Many ecocritics claim that the value of any form of representation partially depends on the human intentions behind it.<sup>3</sup> With no existing authorial intention analysis of animal signs in literature that could provide a framework for the current study, this section is presented as a contribution to a better understanding of this area. Based on a condensed examination of theories concerning the pan-indexicality model of linguistic signs and the model of analysis in nature writing, this study modifies the analytical model of indexicality to fit into a specific realm of literature and the environment, as shown in Figure 2 above. Three factors related to the authorial intention: encyclopedic knowledge, social and cultural background information, and personal experience, interact with each other to present the meaning potential within the context of environmental writing.

This study tries to figure out a mode of analysis of authorial intention, which avoids simple empirical presentation, since it is impossible to develop more comprehensive understanding unless the authors' specific internal information and their social and cultural background information are taken into consideration together.

In terms of internal information, it contains the author's encyclopedic knowledge and personal experience, both of which exert influence on what the linguistic sign precisely means. Encyclopedic knowledge refers to vast and complete knowledge about a subject, while personal experience varies to each individual author. Environmental writers are often "literary psychologists" (Shi and Slovic 2020, p. 3) because they seem to be particularly fascinated about studying themselves when they go through life, interacting with their own bodies, with other species, with other

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3 See Karen Warren, Simon Estok, David Abram, and others.



**Figure 2:** The pan-indexical process of linguistic signs in literature and the environment.

people, with places, experiencing different emotions, applying their physical senses to examine, and appreciate their relationships with the world. In this way, they are more likely to express explicitly their focus on the psychological phenomenon of “consciousness” or “awareness,” or sense of place, or environmental values, or the rhetorical issue of environmental persuasion—to demonstrate environmental values in a persuasive style that might encourage government officials and fellow citizens to care more about environmental phenomena.

As for the social and cultural background information, it is derived from the method in the analysis of cultural groups developed by Williams (2014). He claims that the social and cultural significance of such groups, especially in the last two centuries, “is great: in what they achieved and in what their modes of achievement can tell us about the larger societies to which they stand in such uncertain relations” (Williams 2014, p. 126). The same consideration applies to the analysis of environmental writers, especially as we now view them at some historical distance. The real point of social and cultural analysis of authors is to find out the social information within a context of a much wider history, involving general relationships of education and social class. It is to, further, find out the effects of the relative position of

any information on their writing activities: effects that may frequently be presented merely as evidence or facts but which, viewed in a different perspective, might be seen as essential in less realized ways.

Based on the above pan-indexicality model with reference to authorial intention analysis, the following sections try to apply the analytical model of indexicality with validity in the theoretical facet to a more specific detail, analyzing animal representations in Atwood's novels.

## 4 Research design

For the purpose of exploring Atwood's novels further, the current study warrants deeper analysis through both distant reading and close reading, two dimensions of literary analysis that have yet to be fully integrated.

### 4.1 Research questions

The present study, adopting Python programming and the pan-indexicality model, aims to address the following questions:

- 1) What are the animal vocabulary frequencies in Atwood's seventeen novels?
- 2) What are the differences of animal representations in Atwood's novels during different periods of time?
- 3) What do the ever-changing animal representations suggest when looked into from the pan-indexicality model?

### 4.2 Subjects

Atwood's "influence on Canadian literature is phenomenal, and her influence on contemporary literature as a whole is immense" (Macpherson 2010, p. ix). She is the author of more than thirty-five books, ranging from poems to novels, short story collections, children's books, and books of essays. She has won a number of prestigious literary prizes, including The Booker Prize, The Giller Prize, and The Governor General's Award. Moreover, Atwood's novels were selected because they have been translated into more than twenty-two languages and are widely enjoyed, studied, and taught.

To avoid vocabulary difference among different genres, this study restricts itself to Atwood's seventeen novels, covering the full range of her novels. This section focuses on animal representations in the seventeen novels. The animal vocabulary is



processed through Python programming, and the roles of animal signs in the seventeen novels are analyzed based on the above analytical model of pan-indexical process in the realm of literature and the environment, with particular attention given to the author's encyclopedic knowledge, personal experience, social, and cultural background information.

### 4.3 Instruments

In response to the first research question, it began with the construction of a corpus of Atwood's seventeen novels, covering a time span from 1969 to 2019. Next, the corpus was divided into five corpora on the basis of a time span of each ten years. Based on Oxford Historical Thesaurus, animal vocabulary was classified into ten subcategories. Total word frequencies for animal vocabulary of the ten subcategories in the five corpora were calculated and normalized by calculating thousand-word frequency ratio through Python programming. Ultimately, a graph of total thousand-word frequency ratio for animal vocabulary of the five corpora was outputted.

In response to the second research question, five corpora were reconstructed into two, before 1990s and after 1990s, based on the result of the first research question. Top 20 and top 100 animal words of the ten subcategories in the two corpora were selected according to total word frequency through Python programming. They were normalized by calculating thousand-word frequency ratio. Then two Word Cloud Diagrams of top 100 word lists and two Word Relation Diagrams of top 20 word lists of the two corpora were outputted through Python programming. The last step was to select the overlapping animal vocabulary out of top 20 animal word lists of each ten subcategories in the two corpora and output bar charts to show the differences of thousand-word frequency ratio for animal vocabulary during the time periods of before 1990s and after 1990s.

In response to the third research question, a close analysis of Atwood's seventeen novels under the framework of the pan-indexicality model of linguistic signs within the context of literature and the environment was conducted to reveal what the ever-changing animal representations suggest.

### 4.4 Data collection procedures

In response to the first research question, it began with the construction of a corpus of Atwood's seventeen novels, covering a time span from 1969 to 2019. Next, the corpus was divided into five corpora on the basis of a time span of each ten years

(see Table 1). Corpus 1 consists of four novels: *The Edible Woman* (1969), *Surfacing* (1972), *Lady Oracle* (1976), and *Life Before Man* (1979). Corpus 2 consists of three novels: *Bodily Harm* (1981), *The Handmaid's Tale* (1985), and *Cat's Eye* (1988). Corpus 3 consists of two novels: *The Robber Bride* (1993) and *Alias Grace* (1996). Corpus 4 consists of four novels: *The Blind Assassin* (2000), *Oryx and Crake* (2003), *The Penelopiad* (2005), and *The Year of the Flood* (2009). Corpus 5 consists of four novels: *MaddAddam* (2013), *The Heart Goes Last* (2015), *Hag-Seed* (2016), and *The Testaments* (2019). It is noted that the novel of 1969 was classified into the corpus of 1970s because it is very close to that period and there is only one novel in the previous decade.

The second step was to construct a vocabulary classification algorithm model. Sinykin et al. (2019) claim that the classification algorithm in quantitative literary studies should be built on an authorized dictionary. Hence, animal vocabulary in the current study was collected according to Oxford Historical Thesaurus that originally consists of twenty subcategories, as shown in Figure 3 below. Ten subcategories were selected to collect animal vocabulary in novels according to the following rules. First, regarding part of speech, objective, verb, and adverb were removed, and the noun form remained. Second, subcategories mainly covering terms, such as vertebrates, amphibians, and reptiles, were removed because they rarely appear in fiction discourse. Third, the subcategory “animal body” was removed to prevent confusion with the description of human being. Eventually, ten categories of animal vocabulary were obtained, as shown in Figure 4 below. After identifying ten subcategory animal vocabulary in the five corpora, the animal word frequencies of each corpus were calculated and normalized by calculating thousand-word frequency ratio through Python programming.

In response to the second research question, the different periods of time were defined as before 1990s and after 1990s, based on the results of the first research question. Hence, the five corpora were divided into two new corpora, before 1990s

**Table 1:** Five corpora of Margaret Atwood's novels.

No.	Decade	Novels
1	1970s	<i>The Edible Woman</i> (1969), <i>Surfacing</i> (1972), <i>Lady Oracle</i> (1976), <i>Life Before Man</i> (1979)
2	1980s	<i>Bodily Harm</i> (1981), <i>The Handmaid's Tale</i> (1985), <i>Cat's Eye</i> (1988)
3	1990s	<i>The Robber Bride</i> (1993), <i>Alias Grace</i> (1996)
4	2000s	<i>The Blind Assassin</i> (2000), <i>Oryx and Crake</i> (2003), <i>The Penelopiad</i> (2005), <i>The Year of the Flood</i> (2009)
5	2010s	<i>MaddAddam</i> (2013), <i>The Heart Goes Last</i> (2015), <i>Hag-Seed</i> (2016), <i>The Testaments</i> (2019)

Animal subcategory			
Part of speech	Animal life & surrounding	Animal type	Animal related term
- noun - adjective - adverb - verb (intransitive) - verb (transitive)	- by nature - by habitat - by habits or actions - by locomotion - by eating habits - by noises	- domestic animal - animals hunted - family unit - animals collectively - animal body	- invertebrates - chordates - vertebrates - fish - amphibians - reptiles - birds - mammals - zoology

Figure 3: Animal subcategories in Oxford Historical Thesaurus.

Animal subcategory	- by nature
	- by habitat
	- by habits or actions
	- by locomotion
	- by eating habits
	- by noises
	- domestic animal
	- animals hunted
	- family unit
	- animals collectively

Figure 4: Animal subcategories selected for this study.

and after 1990s. Then thousand-word frequency ratios for all animal words in the two corpora were calculated through Python programming. Top 100 word lists and top 20 word lists of the two corpora were constructed. The final step was to compare the overlapping vocabulary out of top 20 animal word lists for novels before 1990s and after 1990s through Python programming.

In response to the third research question, novels were specifically classified into three categories: 1970s and 1980s with reference to nonhuman animals, 1990s with reference to feminist and historical discourses, and 2000s and 2010s with reference to scientific animals.

## 5 Results

The first research question aims to find out different animal descriptions in Atwood's novels with a time span of each ten years. The total number of thousand-word frequency ratios for animal vocabulary in five corpora were calculated and outpitted in Figure 5.

According to Figure 5, the total number of thousand-word frequency ratio for animal vocabulary in novels of 1970s starts with a high point of 16.6 and that of 1980s rises up to the highest point of 17.8. It returns to around 16 in novels of 1990s. The total number of thousand-word frequency ratios for animal vocabulary in novels of 2000s and 2010s keep decreasing down to below 15.

The above result seems to differ from the “animal turn” in contemporary ecocriticism, which suggests a shift from early focus on human's relations to nature and living environment to current focus on human's relations to nonhuman animals (Wang 2020, p. 34). Results of the second research question contribute greatly to find out whether the deviation really exists.

The second research question aims to discover the changes of animal representations in Atwood's novels before 1990s and after 1990s. First, the Word Cloud Diagram of top 100 word list and the Word Relation Diagram of top 20 word list for novels before 1990s were outpitted in Figures 6 and 7. Second, the Word Cloud Diagram of top 100 word list and the Word Relation Diagram of top 20 word list for novels after 1990s were outpitted in Figures 8 and 9, which show that there is one animal vocabulary, “crake,” ranking top 20 word list for novels after 1990s.

The above two diagrams show that no animal vocabulary ranks either top 20 or top 100 word list for novels before 1990s.

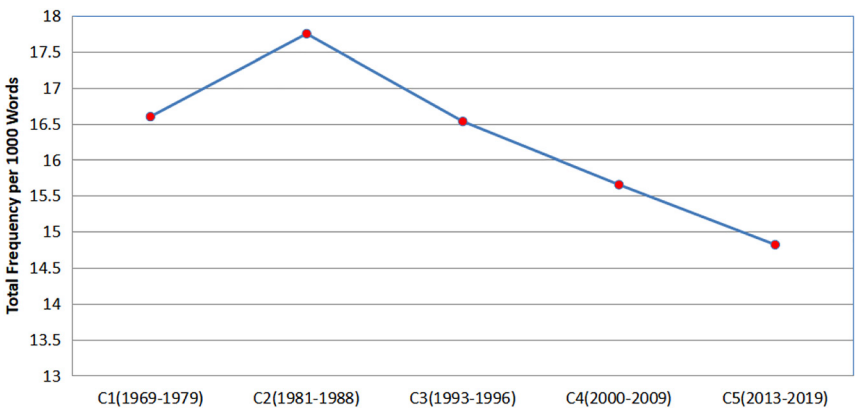
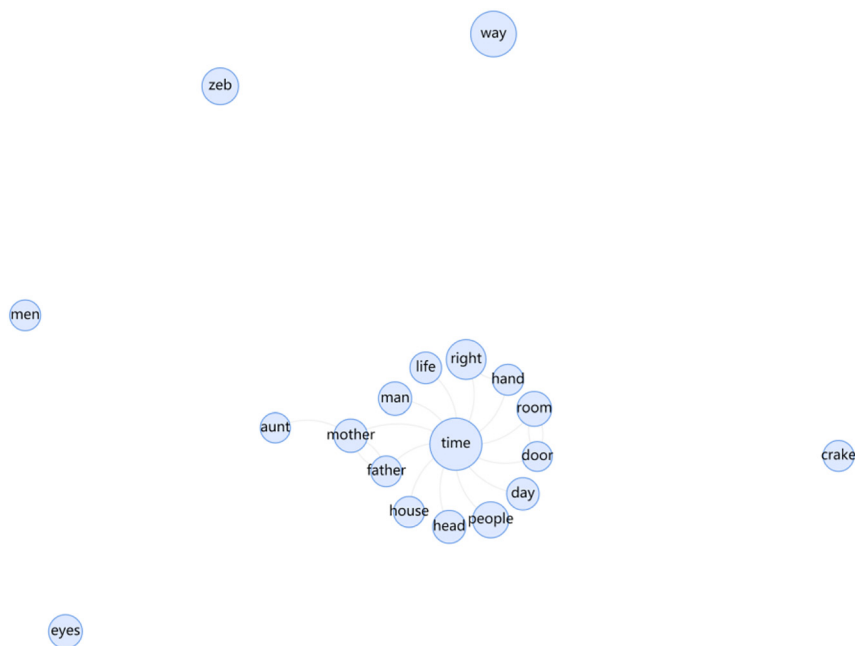


Figure 5: Total number of thousand-word frequency ratios for animal vocabulary in five corpora.



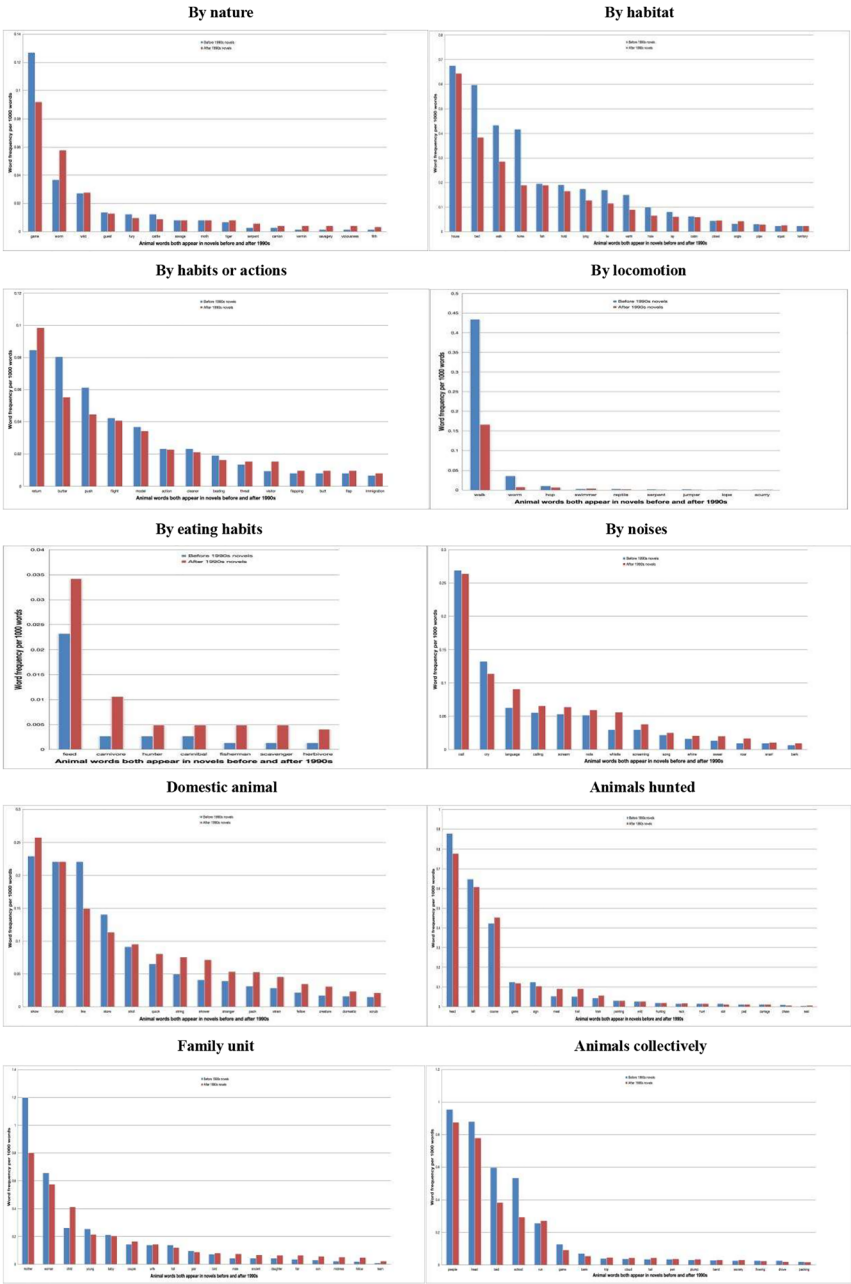


**Figure 8:** Word Cloud Diagram of top 100 word list for novels after 1990s.



**Figure 9:** Word Relation Diagrams of top 20 word list for novels after 1990s.

focused on the comparison of overlapping animal vocabulary used in novels before 1990s and after 1990s. Based on the ten subcategories of animal vocabulary, ten bar charts were generated as shown in Figure 10 below.

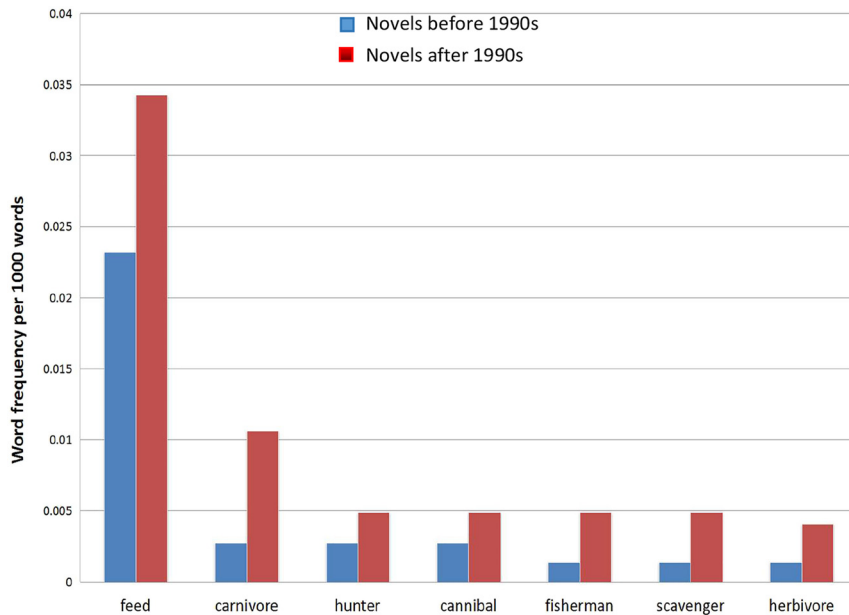


**Figure 10:** Comparison of overlapping animal vocabulary of 10 subcategories in novels before 1990s and after 1990s.

The above ten bar charts show that the majority of top 20 animal vocabulary in the ten subcategories shares the same tendency that thousand word frequency ratio for animal vocabulary in novels before 1990s is higher than that of after 1990s, but with the exception of category “by eating habits” as shown in Figure 11 below.

The above bar chart illustrates that “feed,” “carnivore,” “hunter,” “cannibal,” “fisherman,” “scavenger,” and “herbivore” are used more frequently in novels after 1990s than before 1990s. These eating habits vocabulary might be related to “crake,” the only animal vocabulary ranking top 20 word list for novels after 1990s. Crake is both a kind of extinct animal and the name of a mad scientist who adopts this name through playing extinction, a game that he becomes a Grandmaster through identifying extinct animals in *Oryx and Crake*.

The third research question aims to find out the implication of the ever-changing animal representations from the perspective of the pan-indexicality model of linguistic signs. The combination of quantitative and qualitative analysis reveals that the “animal turn” does exist and shifts from nonhuman animals to scientific animals in Atwood's seventeen novels. Nonhuman animal descriptions in her novels of 1970s and 1980s run at a high level, decrease in novels of 1990s, and scientific animal descriptions increase in her novels of 2000s and 2010s. A close analysis of the result will be illustrated from the



**Figure 11:** Comparison of overlapping animal vocabulary in subcategory of “by eating habits” in novels before 1990s and after 1990s.



perspective of the author's encyclopedic knowledge, personal experience, social, and cultural background information in the following discussion section.

## 6 Discussion

In the context of this study, the term “animal” is applied in a broad sense, ranging from nonhuman animals such as fish to creatures invented by new science such as the crakers in *Oryx and Crake*. In many cultures, animal representation is very important and it plays a huge role in their traditions and religious practices. It should be noticed that the concept of animal varies in different cultures and thus Atwood's novels should be regarded as reflecting a North American or, more specifically, Canadian cultural background. The interpretation of animal representation of the novels is based on the cultural assumption, education, stereotypes, and personal experience from this culture.

In this section, the empirical study results would relate animal representation to “aspects of critical interpretation” (Leech 2008, p. 55), with reference to the author's encyclopedic knowledge, personal experience, social, and cultural background information, according to the pan-indexicality model.

### 6.1 Animal descriptions in Atwood's novels

The results of the first two research questions illustrate that nonhuman animal descriptions in Atwood's novels of 1970s and 1980s run at a high level and decrease in novels of 1990s, while scientific animal descriptions increase in novels of 2000s and 2010s. The following part analyzes the above results from the perspective of the author's encyclopedic knowledge and personal experience.

Atwood's encyclopedic knowledge about nonhuman animals might contribute greatly to a high degree of nonhuman animal descriptions in her novels of 1970s and 1980s. Atwood had an unusual early childhood, spending summers in Canadian “bush” because her father, an entomologist, brought the family together with him on his research explorations. It was not until Atwood was five that she started to live generally in cities. Atwood weaves stories from cities of Canada and her everyday life in the bush of which nonhuman animals are the central part.

Atwood's encyclopedic knowledge about science might contribute significantly to a high degree of scientific animal descriptions in her novels of 2000s and 2010s. Her imagination of scientific animals should not be surprising, given the interest in science that grows in the family: her father is an entomologist and her brother a neurophysiologist. Atwood herself enjoyed learning science at school, so

much so that she believes that “if she hadn’t become a writer, she would have gone on with science” (Sandler 1990, p. 46), and today she “reads popular scientific accounts as a recreation” (Walker 1990, p. 176). There is no evidence that Atwood possesses a thorough grasp of physics or that she has any serious intent to instruct her readers. Instead, she focuses on a few striking ideas that runs with them in her imagination.

Atwood’s experience of growing up in Canadian North assists us to understand one of the most major themes in her writing, the formation of feminine identity, which results in the decrease of nonhuman animal descriptions in her novels of 1990s. Being raised up in Canadian North, far away from societal propaganda, she could observe the behaviors that were deeply rooted in her urban peers who were in lack of diverse role models. As Atwood has mentioned, “Not even the artistic community offered you a viable choice as a woman” (Sullivan 1998, p. 103). Her stories describe how female characters transform from ingenues to insightful women. In her novels, Atwood creates scenarios in which women, burdened by the inequalities and regulations of their societies, recognize that they must rebuild braver, self-reliant personae so as to survive.

## 6.2 Differences of animal representations in Atwood’s novels before 1990s and after 1990s

Atwood’s representations of animals are in some way deeply related to her social and cultural environment, and this cultural environment is deeply rooted in a history. This part analyzes that animal representations from the perspective of the social and cultural background regarding to the periods of novels were composed, historicizing them by situating them within the context of 1970s and 1980s nationalist discourses that instrumentalized nonhuman animals as a vehicle for indigenization and national individuation from the United States, and within the context of 2000s and 2010s discourses that instrumentalized scientific animals as a vehicle for environmental apocalypticism.

### 6.2.1 Animal representations in Atwood’s novels before 1990s

Before 1990s, seven novels, *The Edible Woman*, *Surfacing*, *Lady Oracle*, *Life Before Man*, *Bodily Harm*, *The Handmaid’s Tale*, and *Cat’s Eye*, appeared in the wake of a wave of cultural nationalism fueled in Canada, on one hand, by the increasing anti-Americanism stemmed from the Vietnam war and the rise of American cultural imperialism during the postwar area. It was also a period of heated debate over the politics of difference inside Canada itself. The rise of the Aboriginal rights

movement and Quebec separatism, along with the politicization of the nation's burgeoning immigrant constituencies, interrupted the Anglo-Canadian nation-building project (Mackey 2002, p. 63). The external and internal political and cultural forces coalesced to highlight the need for Canadians to construct a distinct and unified sense of themselves as a nation. Indeed, it was precisely during this period of time that the beaver became the official national symbol of Canada, serving as a “tool of effective governance to involve Canadians in a project of national identity building and unity” (Shukin 2009, p. 3). By incorporating the beaver's qualities as an innocent indigenous inhabitant of the land, Canada could view itself as a peaceable entity, readily distinguished from the United States.

Nonhuman animals functioned as vehicles for settler–invader fantasies of indigenization in Atwood's novels before 1990s. *Surfacing*, one of her most widely read novels, is a typical example. *Surfacing* ends with an assurance of the protagonist's self-identity and connection to the national landscape, and it applies animal metaphors to fulfill the indigenizing ends. Fee (1987, p. 16) reads *Surfacing* as “romantic nationalist” text in which the settler subject is capable of confirming her national belonging in the land through a totem transfer involving nonhuman animals. However, although *Surfacing* enacts a quest in which the protagonist seeks the belonging to the land through an association with nonhuman animals, Atwood ironizes and ultimately condemns this impulse, highlighting the physical and symbolic violence that is evident in this logic of incorporation. In many Atwood's novels during that period, animal representations were drawn on to fill a perceived lack in the national historical and cultural conscientiousness. Nonhuman animals not only manifest the indigenous closeness to nature, but when depicted in positions of victimhood, also evoke notions of “disappearing Indians” and “doomed races” conducive to settler–invader fantasies of indigenization (Goldie 1989, p. 25). Animal representations provide a metaphor that confirms the feasibility of capturing the essential feature of indigenous peoples—their closeness to nature, meanwhile reinforcing their imminent disappearance.

Apart from functioning as a vehicle for the indigenization, nonhuman animals in Atwood's novels were instrumentalized in the service of the fantasies of Canadian individuation from the United States that prevailed Canadian cultural politics during the period of 1970s and 1980s. In her seminal work of literary criticism *Survival*, Atwood (2004) observed that Canadian literary texts often rely on images of suffering animals as symbols of Canada's status as a nearly extinct nation threatened by American imperialism. Atwood publicly addresses the question of Americanism in *Surfacing* through creating the figure of a nameless narrator who intends to consolidate her national and individual selfhoods by aligning herself with animal figures whom she views as victims of American imperialism. Although Atwood's

narrator attempts to instrumentalize nonhuman animals as symbols of victimhood in relation to the threat of American imperialism and cultural hegemony, the quests are ironized and eventually thwarted by momentary manifestations of the divergent agency of nonhuman animals. Nonhuman animals are placed at the forefront of cultural debates regarding the relation between Canada and the United States by encapsulating “an important facet of the Canadian psyche”: Canadians’ understanding of themselves as “threatened victim[s] confronted by a superior alien technology against which [they] fee[l] powerless, unable to take any positive defensive action, and, survive each crisis as [they] may, ultimately doomed” (Atwood 2004, p. 96). Nonhuman animals are represented as symbols for the Canadian national psyche.

### 6.2.2 Animal representations in Atwood's novels after 1990s

In 1990s, two novels, *The Robber Bride* and *Alias Grace*, were published within the context of feminist and historical discourses, which results in the decrease of nonhuman animal descriptions. In *The Robber Bride*, the author's parallel concerns of postcolonial and feminist discourses are expressed. Her consideration of the influence of colonization on Canada is unable to be separated from her assessment of the influence of patriarchy on Canadian women. Victimized minority groups and victimized countries respond to their victimization in very much similar way. In *Alice Grace*, a new genre is introduced to Atwood's oeuvre: the historical novel. Atwood wrote a historiographic metafiction that presents a fictionally arranged version of the historical event on the basis of a combination of a series of narratives.

In 2000s and 2010s, eight novels, *The Blind Assassin*, *Oryx and Crake*, *The Penelopiad*, *The Year of the Flood*, *MaddAddam*, *The Heart Goes Last*, *Hag-Seed*, and *The Testaments*, appeared in a wave of urbanization resulting in the degradation of “global environment in ways that may ultimately undermine ecosystem services, human welfare, and the long-term sustainability of human societies” (Foley et al. 2005). Dense urban spaces are linked to environmental stressors, such as air pollution, increased noise, crime, and overcrowding (Rugel et al. 2019). In the Anthropocene, we confront the entanglement of culture and nature in global phenomena such as “human-caused climate change” (Sweet 2022, p. 57), biodiversity loss, and the connected effects and outcomes. Consequently, humans are haunted with anxieties about human efforts to control the natural world (Westling 2022) and manipulate science.

Nonhuman animals created by science in Atwood's novels of 2000s and 2010s, which contribute greatly to the increase of animal descriptions, were instrumentalized as a vehicle for environmental apocalypticism. Atwood's ecoapocalyptic *MaddAddam* trilogy, dramatizing how human activities produce scientific animals

that have the capacity of ruining the natural world, display both the necessity for data derived from scientific experiments and the need for reconfiguring the boundaries between human health, nonhuman animal health, politics, scientific practices, and environmentalism. In Atwood's *MaddAddam* trilogy, its apocalyptic scenes are so close to what we are experiencing in our daily life that we feel the dismemberment of the natural world, fear the prospect of human doom, and recognize the inaction and paralysis demonstrated by the trilogy's characters, who are faced with an economy that profits from the earth's destruction.

Scientific animals like crakers, pigeons, and rakunks are invented by scientists in *Oryx* and *Crake*. The crakers, genetically modified people, are particularly invented to replace humans. Pigeons are invented to harvest spare organs. Rakunks are invented as pets by combining a raccoon and a skunk. Some other animals are invented as disasters that ought to be exterminated. Readers are shown that the corporatist economy is manipulating science and will destroy the natural world. An environmental practice, the God's Gardeners, is exemplified in *The Year of the Flood* to promote species balance and diversity and endeavor to minimize human destruction to the natural world. The motivation for such practice stems from the suffering that results from the harm done to the ecosystem. Such motivation arises out of a kind of prophecy, seen not as much as foretelling the future but as telling the present in a way that guides people to see where things are heading for. It reminds people of the destruction by human greed and the urgency to practice a better way. The ecological grief arising in the above two novels is heightened in *MaddAddam* by raising readers' awareness that not only has the world ended but humans as a species are coming to an end. Readers are shown that those characteristics that originally made humans successful—competitiveness, love, violence, jealous, insatiable appetites—are the same characteristics that eventually doomed them.

### 6.3 Reconceptualizing human and animal relations during reclamation

Though the novels are not about animals, it is concerned with the interspecific contact between animals and protagonists. Therefore, sufficient attention is paid to the functions of animals in the novels and their relation to humans. Nonhuman animal descriptions and scientific animal imaginations in Atwood's novels not only seek to reinforce the instrumentalizing tendency in Canadian national discourse, but also open up a space for a more ethical acknowledgment of animals, one that resonates with latest calls, by posthumanist theorists like Wolfe (2003) and Haraway (2013), for literary texts that highlight the material interactions through which humans and animals establish common worlds while maintaining their irreducible

differences. Nonhuman animals depicted in Atwood's novels of 1970s and 1980s play a central role in the efforts to produce a distinctly historical and cultural Canadian conscientiousness. Scientific animals created in Atwood's novels after 2000 remind people of the ecological grief stemming from the corporatist economy that manipulates science and destroys the nature world. In the meantime, they also seek to reconceptualize human–animal relationship by transcending the confines of human/animal aspects of self/other binary. Though animals are served as food for humans (Scott-Phillips and Heintz 2023) and humans conventionally consider themselves as innately superior to nonhuman animals, Atwood reminds her readers that nobody has the power to claim superiority. Critiques of exclusive notions of the human problematic in the first place lead to new attitudes of respect toward animals from which humans can no longer be so dogmatically distinguished. Animals are portrayed as “beings with an ontological and moral status comparable to humans” (You 2023, p. 7). It is, therefore, safe to say that animals should be regarded as dynamically perceiving and acting subjects rather than as objects for human emotional or cognitive projection. Animals' capacity for suffering and sentience made them worthy of ethical consideration as an individual existence in the ecosystem as a whole.

## 7 Conclusion

Traditional ecocriticism has already explicitly displayed the “animal turn” in literary narrative (Wang 2020). With the advancement of Python programming and the pan-indexicality model of linguistic signs, the combination of quantitative and qualitative analysis of Atwood's seventeen novels in this study is given the capacity to extract primary factors from a seemingly complicated phenomena, thus deepening the understanding of the “animal turn” in contemporary ecocriticism and the findings of the shift *per se*.

The quantitative inquiry into the seventeen novels reveals that nonhuman animal descriptions in Atwood's novels of 1970s and 1980s run at a high point and decrease in novels of 1990s. “The strengths of one approach tend to be the weaknesses of the other” (Duff 2011, p. 39). Combining Python programming result with close reading of the novels after 1990s, it is revealed that scientific animal descriptions increase in the novels of 2000s and 2010s. A close analysis under the framework of the pan-indexicality model demonstrates that nonhuman animals depicted in Atwood's novels of 1970s and 1980s are instrumentalized as a vehicle for indigenization and national individuation from the United States, and scientific animals invented in her novels of 2000s and 2010s are instrumentalized in the service of environmental apocalypticism.

This study can shed light on how animal signs are represented from the perspective of the pan-indexicality model. It suggests that the pan-indexicality model can be employed to understand the meaning of signs in literature and the environment, with particular reference to the authorial intention: authors' encyclopedic knowledge, personal experience, social, and cultural background information. It is advisable that future research could construct a larger corpus of novels composed by diverse fiction writers. It is also worthwhile to investigate whether the pan-indexicality model can be employed to interpret the meaning of linguistic signs in other forms of literature, for instance, climate change poetry.

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