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Ecolinguistic phrasing in environmental communication: A comparative study

Matt Drury[*], Janet M. Fuller[**], Merel C. J. Keijzer[**], Paula Almonacid-Hurtado[***], and John C. J. Hoeks[**]

Abstract

Many ecolinguistic studies suggest that textual features such as nominalisations can remove agency from key actors. Texts which employ such phrasings are suggested to repudiate human responsibility for environmental destruction. However, there is a lack of experimental evidence for this proposed effect. Another unknown is the extent to which language proficiency influences any effect. This study takes a comparative approach in which native English speaker and non-native English speaker participants compared two texts on environmental destruction, one written in a typical academic style and the other drawing on ecolinguistic insights. Participants made a series of value judgements based on the texts, with the main aim being to determine whether phrasing affected the degree to which participants thought that humans were held responsible for the environmental destruction described in the text. Overall, regardless of the language proficiency and educational background of the participants, the "ecolinguistically" styled text which "de-nominalised" verbs with human subject pronouns and used "human" as a noun modifier made participants feel as though humans affect the environment more than the traditionally "academic" style text. This finding that phrasing can affect the "construal" of responsibility has implications for the study of ecolinguistics and also for environmental communication more broadly.

Keywords: ecolinguistics; construal; moral responsibility; linguistic nominalisation; pronouns; erasure

[*] University of Groningen, The Netherlands. E-mail: m.r.drury@rug.nl (corresponding author)
[**] University of Groningen, The Netherlands
[***] EAFIT University, Colombia

1. Introduction

The concept of agency has been widely discussed by scholars from a variety of disciplines, though there is no consensus on its definition (Ahearn, 2001). An agent can be described as "someone — or something — bringing about … [a] transformation" of state (Darics & Koller, 2019, p. 5). Agency may exist at the individual (de Jaegher & Froese, 2009), collective (Wertsch et al., 1993), or textual level, that is, how written language is used to encode agency within a text (Cooren, 2004). This study focuses on how agency is encoded in texts, while acknowledging that its performative aspect is bound up with its encoding in the wider context in which a text is embedded (Duranti, 2004). In creating a text, an author chooses, either consciously or subconsciously, how to express their ideas. While the publication for which they are writing, their personal standpoint, and socio-political factors can dictate or restrict these choices, the language chosen can affect the framing of a given story or situation (Lakoff, 2006, 2010). Indeed, agency can be (intentionally) removed from the doer of an action "to construct stories which repudiate responsibility" (Harre & Stearns, 1995, p. 128). Responsibility here is used in the normative, retrospective sense in that an agent has moral responsibility for an outcome if they have moral responsibility for causing this outcome (Sartorio, 2007; Williams, 2019). In this study, we focus on how such responsibility is attributed or repudiated through text and the subsequent effects on the audience.

Clearly, the social embeddedness of a given text plays an important role in (re)producing certain discourses (Potter et al., 1993; van Dijk, 2008a); however, in this study we are more interested in the presence of certain grammatical and lexical features. Much critical work in (eco)linguistics attests to the presence or absence of these features in reproducing discourses (Zhu, 2024; Laurie & Thompson, 2024; Xiong, 2014; Cunningham et al., 2022). However, there is a lack of studies which investigate the impact of the use of such features on the audience; in other words, how different linguistic phrasings actually affect how meaning is construed. Construal in this context refers to how meaning is made and content is interpreted, specifically how a given situation or "reality" can be interpreted in different ways through the language choices employed (Langacker, 2019). Different choices made in a text are likely to elicit different construals of a situation (Fausey & Boroditsky, 2010; Wittenberg & Levy, 2017). The characteristics of the construer may also play a role in construal; the educational background (van den Broek et al., 2015), language proficiency (Littlemore, 2023), and values (Lakoff, 2014) of the reader may influence how they interpret a given text. As such, this study experimentally investigates how readers' construals of responsibility for environmental destruction are influenced by changing the linguistic phrasing of a text. We look at both native speakers and second language learners to investigate whether construal patterns for the task differ depending on educational background, mother tongue, and language proficiency. The following section examines the concept of construal before discussing how linguistic phrasing can contribute to construal by erasing actors. Following this, we describe the methods used in the study before

presenting and discussing the results.

2. Background

2.1. Characteristics of the textual material

2.1.1. Construal

Language can be used in different ways to draw attention to a particular aspect of a scene, affecting how that scene is construed (Evans, 2019). Construal is determined by the interaction between the object (in our case, the text) and the subject (the reader) of the conceptualisation (Verhagen, 2007). These two parties share a common ground of shared knowledge (i.e., of the situation and perhaps of the cultural and communicative context) which they use to make sense of a third concept or object (Verhagen, 2012).

Different construals can be invoked by changes in the lexical and grammatical aspects of a text. At a broad level, the specific choice of what aspect of a situation a writer highlights or even includes can clearly affect construal of the situation. For example, an instance of deforestation could be represented as either wanton destruction of nature or the necessary harvesting of natural resources depending on the lexical choices made (e.g., the choice between "destroy" and "cut/chop down" as a verb). However, even focusing on a seemingly objective act can invoke different construals; representing a scene in active or passive voice is one example (Machin & Mayr, 2023). The clause "he cut down the tree" is distinct from "the tree was cut down (by him)" in the focus of the sentence and the agent involved. Linguistic phrasing can also vary in the specificity or abstraction of the chosen terms. Abstraction can be represented in levels of word choice (e.g., look at > examine > scrutinise) or amount of detail included (e.g., "He used his favourite axe to chop down the oak tree" vs "He chopped down the tree") (Langacker, 2019; Evans, 2019). Similarly, different choice of words can be used to describe one situation at the same semantic level (e.g., "I live in the flat **below** Ted" vs "Ted lives in the flat **above** me"). In any one utterance, several dimensions of construal can come into play (Verhagen, 2007).

2.1.2. Erasure

No text can fully represent the interests of all social actors involved in a given situation; the writer by necessity must omit some details or interests. When an actor is systematically removed from a text, one implication is that the actor could be simply unimportant to the writer (which may not always be as negative as it seems) (Stibbe, 2021; Baker & Ellece, 2011). For example, it is possible (or indeed likely) that a text on soil functioning erases individual species of microbes for the reason that there are simply too many to mention and there is a lack of knowledge about the precise acts each species performs. Despite this erasure, microbes *are* the key element in soil functioning, but the writer may be more concerned about the process than "who does what". In other cases, there is the implication

that erasure may be an attempt to distance an actor from the act; in other words, to remove agency (Stibbe, 2021). There might be a more negative connotation in erasure, such as the erasure of non-binary people from texts which refer to only two genders (Namaste, 2000). This section discusses how actors can be erased from texts using various linguistic mechanisms and the subsequent impact that this has been reported to have on agency and responsibility.

2.1.3. Salience of the agent

There are a number of linguistic mechanisms by which actors can be erased from texts. These include passive agent deletion, nominalisation, use of non-finite clauses which function as a grammatical participant, and use of the so-called middle voice (van Leeuwen, 2008). As Langacker (2008) states: "When one participant is left unspecified, the other becomes more salient just through the absence of competition" (p. 384). Similarly, removing the doer of an action from a sentence can serve to position an event as "something that happens", something unavoidable (van Dijk, 2008b; Machin & Mayr, 2023). Consequently, agency, and by extension moral responsibility, are also removed from the doer. Consider the following transformation:

- *Humans destroyed the forest* (active clause with human as agent) positions humans as the agent responsible for the action verb "to destroy".
- *The forest was destroyed* (by humans) (passive clause with optional agent included as a prepositional phrase) moves the responsible agent to the end of the clause, and gives the option of removing the doer altogether.
- The noun phrase, *the destruction of the forest* (nominal phrase) further decreases salience, both by removing the agent, as well as reducing the importance of the event to a phrase within a clause. (Halliday, 1993)

Reintroducing the agent as a possessive noun within a noun phrase, as in *human destruction of the forest* would appear to increase agency through increasing salience of the agent (Sichel, 2010; Alexiadou et al., 2013). Dreyfus (2017) suggests that this type of language falls on a cline of responsibility: active voice → passive voice with agent → passive voice without agent → middle voice. Active sentences with a human subject assume more responsibility than passive or middle voice constructions (see Davidse & Heyvaert, 2007), the latter of which are employed for a range of purposes, among which is the obfuscation of responsibility for a given action (as in "the pot was broken" or "the pot broke"). Middle voice is only used in a limited range of contexts and as such is not included in our analysis.

There are a number of functions of nominalisation; indeed, much academic communication relies on nominalised forms in the production of more information-dense noun phrases (Biber & Gray, 2010; Coffin et al., 2005). In other situations, the nominalised form is the conventional way to express a concept (e.g., evolution, deforestation). However,

nominalisation may also have the function of erasing the actor from a discourse or negating responsibility for an action (e.g., "discrimination against immigrants is increasing", which removes the actor doing the discriminating (van Dijk, 2008b, p. 827)). Passive transformations also have the effect of removing or at least downgrading the role of the agent within a sentence (Machin & Mayr, 2023), as in the example of humans and the forest above.

2.1.4. Agency and categorisation

Categorisation may also play a role in an object's salience and potential erasure from a text. Textual representations of reality are always necessarily incomplete, but there are degrees of which a representation fore- or backgrounds an entity. For example, the word "oak" fails to convey many aspects of a tree's existence, but is still more visually representative than "biotic component". The more vivid a "visual representation", the more salient or "profound" the reality which is represented (Stibbe, 2021, p. 145). The word "biodiversity" represents a hypernym for organisms, which serves to erase the organisms themselves (Stibbe, 2014). According to prototype theory (Rosch et al., 1976), we cannot form mental images of such superordinate categories, which may reduce the salience of organisms when represented in such a way. Drury et al. (2022) propose that introducing organisms by their basic category (the simplest level at which people can easily visualise an example of that category) increases their prominence and helps make them more relatable when communicating issues related to their survival.

2.1.5. Erasure in ecolinguistics

There are several levels at which discourses can erase (elements of) the natural world. Firstly, nature can be erased completely by excluding mention of it. For example, economics textbooks often talk about production and processes but erase the raw materials involved (Williams & McNeill, 2005). In one textbook, the process of bread making avoids mention of the wheat or the plants from which bread is made, or indeed any natural elements, referring instead to capital, labour, and output (Stibbe, 2021). Complete erasure is also present in most definitions of sustainability, which fail to mention animals explicitly (Vinnari & Vinnari, 2022), and in the Sustainable Development Goals (SDGs), which almost completely erase animals and plants (Stibbe, 2021; Drury et al., 2023). In some cases, nature is not completely erased; it is instead backgrounded. In the SDGs, when animals and plants are included, "they are represented as existing only as resources for efficient utilisation by humans" (Stibbe, 2021, p. 158).

Although the agent can be removed by nominalisation of a clause, there is some evidence that when reconstructing such information, "the agent is usually recoverable from the linguistic or situational context" (Kies, 1985, p. 306). As such, people introduce their own agent within discussions, frequently attributing responsibility to "we", "humans", or

"people" as the subject (Schleppegrell, 1997). While this implies that it is widely recognised that humans cause environmental destruction in general, the relationship between language, and more specifically the linguistic phrasing chosen, and this attribution of responsibility is not described.

2.2. Characteristics of the construer

Texts themselves do not have a meaning independent of the reader and are therefore subject to interpretation; in other words, meaning emerges from the interaction between the reader and the text (Fish, 1980). Readers can be seen as active participants in creating meaning from a text, as they bring their assumptions, education, and views into play when interpreting a text. As such, these characteristics may play a role in construing meaning from textual information.

The readers of scientific reports and communication on biodiversity in English are likely to belong to two main groups. Firstly, native speakers of English form an obvious category, particularly policymakers, researchers, those working at NGOs, industry professionals, educators and students, and the general public at large. The second group includes those people who do not speak English as a native language, but operate at a level which is presumably proficient enough to make sense of these texts (e.g., policymakers, students, researchers). It seems reasonable to assume that most non-native speakers who read such texts in English have, at some stage, participated in higher education. This study seeks to investigate the impact of educational background, language proficiency, and values on construal.

2.2.1. Education

Certainly the educational background of a reader can affect how written material is construed. At a fundamental level, some background knowledge of the topic and the lexis used in describing it is necessary for a reader to even comprehend a text (Snow, 2010; Shanahan & Shanahan, 2008). As scientific language is extremely specific (Hyland, 2004), it stands to reason that language knowledge is a prerequisite for understanding such texts. But more broadly than this, education in general provides critical thinking and analytical skills which readers use to make meaning of a text; indeed, higher educational attainment often equips readers with a more sophisticated ability to construe complex or abstract content (van den Broek et al., 2015). Higher education then fosters academic literacies which affect how those who have studied at a higher education institution comprehend and construe texts (Lea & Street, 1998).

2.2.2. Language (proficiency)

Most construal research to date has focused on construal in a first language. However, as

languages may differ in how they grammatically represent a given situation, construals are also likely to differ (Verhagen, 2012). As such, "to some extent learning a foreign language involves learning how to present and package information in different ways and from different viewpoints" (Littlemore, 2023, p. 18). At a broader level, research by Athanasopoulos (2006) has investigated how the cognitive processes that influence how reality is perceived and that are connected to first language change when a second language is learned. It was found that at lower language proficiencies, there is no change, but at higher proficiencies (such as those needed to participate in higher education in a second language), cognitive patterns could change and become more similar to the second language. The effect that language proficiency might have on text construal has not received much attention to date. As such, in this study, we are interested in how different linguistic phrasings/representations of a situation affect how the situation is construed by both native speakers and second language readers.

2.2.3. Values

Values are deeply held beliefs or principles that guide individuals, groups, or societies in determining what is considered right, wrong, important, or desirable. They serve as fundamental guidelines for behaviour, decision-making, and interpersonal interactions. Values often reflect cultural, ethical, personal, and social priorities and shape how people make sense of their world. Values remain more or less constant over time and they "serve as guiding principles for the evaluation of people and events and for behaviours" (de Groot & Thøgersen, 2018, p. 168); it seems likely that values can also shape how people construe texts.

According to Lakoff (2014), individuals can interpret the same text differently based on their political beliefs, which themselves have been shown to reflect moral values (Graham et al., 2009). Individuals base their worldviews on their inherent values, and create internal cognitive frames through which they interpret input (Lakoff, 2014). These frames lead people to understand and evaluate text in distinct ways depending on how well the content aligns with their worldview. Value is also connected to construal through confirmation bias: the theory that we interpret new information in a way that confirms our pre-existing beliefs or values (Nickerson, 1998). Taber and Lodge (2006) exposed participants to arguments for and against controversial political issues and assessed how they evaluated supportive and contradictory arguments. The researchers found that participants engaged in motivated skepticism, otherwise known as biased reasoning, to reinforce their pre-existing beliefs. It seems plausible then, that the values which a reader holds might play a role in how they construe textual information.

3. This study

This study investigates the encoding of agency through grammatical manipulations within

a text. In particular, it studies how responsibility for environmental destruction is attributed differently based on the linguistic phrasing used and based on the first language of the reader. Many studies claim that certain sets of grammatical features (e.g., nominalisation) obscure the agent responsible for an action (e.g., for destroying nature); however, there is limited evidence that such structures do indeed make a difference to the reader. Virtually absent altogether are studies that compare first and second language speakers. In the study, native speaker and non-native speaker participants compared two texts: one written using insights from ecolinguistics, which uses grammatical and lexical features to connect the agent (humans) more closely to the action (destroying the environment), and one in a control condition (general academic version), which uses features which obscure agency (e.g., nominalisation). Although this study was conducted via one experiment, we have divided it into two sections below for clarity: In Part I, participants evaluate and compare the two texts, and in Part II, they identify linguistic features responsible for their construal. The following questions formed the basis of our investigation:

1) To what extent does an ecolinguistically styled text make participants perceive humans as more accountable for environmental destruction than a text in the control condition?
2) What role do educational background, native language and proficiency in a second language, and reader values play in this respect?
3) What are the grammatical and lexical features that both L1 and L2 participants find important in attributing responsibility for environmental destruction to humans?

Following Fausey and Boroditsky (2010) and Stibbe (2021), it seems likely that the ecolinguistic text will lead readers to perceive humans as accountable for environmental destruction more than the control text, and that this effect will also be present in higher level language learners as much as in L1 speakers (Athanasopoulos, 2006). It is unclear what the effect of educational background would be, but it seems likely that readers who have participated in university courses would be more comfortable reading and understanding the control text than those who are unused to reading material written in this style (Lea & Street, 1998). Values are expected to play a role in construal as well, with those participants who have values more strongly associated with care for the natural world being more strongly affected by the ecolinguistic text (Lakoff, 2014).

4. Methodology

4.1. Participants

Prior to the study, ethical approval was obtained from the ethics committee of the Faculty of Arts at the University of Groningen (#79863692). This study asked different groups of participants to compare two English texts on biodiversity, both of which employed

different linguistic phrasings.

4.1.1. Native speakers

For the study, it was important to test native speakers to establish a native speaker baseline for the study. Native speakers in this study were defined as those who had grown up in an English language and cultural environment. Evidently, those native speakers who have studied at university are more likely to have read scientific articles than those who have not. As this study looks at language use on a scientific topic, it was decided to test groups of native speakers both with and without a university education to identify the impact that education and familiarity with academic writing may have on construal. As the texts did not assume any prior knowledge of environmental issues, the impact of existing knowledge on text construal was not considered in this study.

Native speaker participants were recruited using the online platform Prolific. For the first group, specifications were set to include all native English speakers over the age of 18 who did not have university level educational qualifications and who were not currently students. The second group of native speakers were those who had completed education at or above undergraduate level and who were not currently students.

4.1.2. Non-native speakers

English is frequently used in environmental communication to reach audiences for whom English is not their first language. Examples of this are the use of English language resources in university education, and communication from the Intergovernmental Panel on Climate Change (IPCC) or Conference of Parties (COP) regarding global environmental issues. As such, we included non-native speakers who were currently involved in university education; these groups represented educated, non-native English speakers. Most non-native speakers who have achieved high proficiency in English are likely to have been involved in higher education to some extent, so inclusion of non-native speakers who had not participated in higher education was deemed unnecessary. In addition, only upper-intermediate or high level speakers were included as higher proficiencies were necessary to complete the task.

However, we did include participants at two different proficiency levels to identify whether English proficiency played a role in text construal. Participants in group 3 were recruited from a program in Coast and Marine Management at a Dutch university of applied sciences. These students were estimated to have an English proficiency of CEFR level B2 (upper intermediate). Group 4 participants were recruited from a program in English Language and Culture at a Dutch research university and had a combination of C1 and C2 (advanced). A total of 332 participants took part in this study, and the numbers per group is presented in Table 1.

Table 1: Details of the frequency and gender of the 332 participants that took part in this study

Participant group	N (Male, Female, Did Not Say)
1. Native British English speakers without a university degree (NS NoUni).	85 (22, 63, 0)
2. Native British English speakers from the UK with a university degree (NS Uni).	79 (21, 57, 1)
3. Dutch students with an English level of around B2 (NNS B2).	97 (40, 55, 2)
4. Dutch students with an English level of C1 or higher (NNS C1+).	71 (23, 45, 3)

4.2. Materials

4.2.1. Texts

As humans are directly or indirectly responsible for the recent dramatic biodiversity loss around the world (Habibullah et al., 2022), biodiversity represents a suitable topic for this study. Two texts detailing the current situation regarding biodiversity loss were written. To enhance the ecological validity of the study to the greatest extent possible, the texts represented broadsheet journalism by providing three of the four moves often associated with this genre — presenting the case, reaching a verdict, and offering recommendations for action (Tongsibsong, 2014).

In text 1, the control text, linguistic features present in international and academic communication on biodiversity (such as in UN communications) were used (e.g., nominalised forms, academic word list words[1], topic-specific words). Text 2, the "ecolinguistic" text, replicated the content and moves of text 1, but adjusted the phrasing as per the recommendations of Drury et al. (2022):

1) Nominalised forms were largely replaced/reanimated with active sentences using the pronouns "we" and "our" to represent "humans".
2) Human responsibility for destroying the environment was made explicit using a noun modifier form of "human" as part of subject noun phrases.
3) Superordinate categories for organisms were replaced with exemplars, or with countable nouns (e.g., animal and plant species instead of biodiversity).

[1] The academic word list is a list of the most commonly occurring word families in academic text writing. These words are independent of discipline, and form approximately 10 percent of any academic text. https://www.wgtn.ac.nz/lals/resources/academicwordlist

5. Part I: Text comparison and evaluation

5.1. Measurement: Part I

5.1.1. Text evaluation

A questionnaire (see Supplementary Material A) was created using Qualtrics software (Qualtrics, Provo UT), in which participants were asked to read both texts, and to compare them on a number of aspects (please contact the lead author for a copy of this questionnaire). The main focus of the study was to investigate which text made participants perceive that humans affect the environment to a greater extent. In addition to this question and following Thibodeau et al. (2017), we formulated five additional questions to help us understand how the differences in phrasing affected participants view other aspects of their relationship with nature. Given that both natural systems and the human relationship with them are complex, it was important to ensure that a given phrasing did not oversimplify the situation. In addition, a key component of environmental communication is accuracy, so we investigated whether participants found both texts equally accurate. The two texts were presented, with the following questions:

i) Which text is more thought-provoking? (*Thought-provoking*),
ii) Which text makes the earth seem more complex? (*Complexity*),
iii) Which text makes you feel more connected to the environment? (*Environmental-connection*),
iv) Which text made you feel more as though humans affect the environment? (*Humans-affect-environment*),
v) Which text is more accurate? (*Accuracy*) and
vi) Which text is more misleading? (*Misleading*).

While *humans-affect-environment* was the most relevant variable for this study, inclusion of the others served two functions: i) to conceal the aims of the study and minimise production of "desirable" response behaviour, and ii) to provide related and potentially important information about the impact of linguistic phrasings on construal. In addition to the direct choice of text 1 or text 2, participants were given the options, "neither text" and "both texts equally".

5.1.2. Values

As participants' core values may influence their construal of the texts, a set of questions in the questionnaire aimed to identify participants' values. The values considered here are shown in Table 2. Participants were asked a series of questions from the Environmental Portrait Value Questionnaire (E-PVQ) (Bouman et al., 2018) which gives 17 descriptions

of people and asks participants to state to what extent they are similar to the description (see Table 2 for examples). These were presented to participants in a random order before the texts were presented.

Cronbach's alpha was run within each value to ensure that the measurement of core values was consistent between participants (Bouman et al., 2018). The Chronbach's alpha tests between the value questions revealed a good fit for all values: biospheric (0.89, M = 5.48, SD = 1.14), altruistic (0.75, M = 5.77, SD = 1.09), hedonic (0.77, M = 5.83, SD = 0.90), and egoistic (0.71, M = 3.46, SD = 1.06), all within reasonable limits (Nunnally, 1978). According to Nunnally, 0.7 and higher is a good fit, 0.8 is better, and above 0.9 is the best fit. The mean (M) and standard deviation (SD) were calculated for respondents' answers for each of the E-PVQ values in SPSS (version 26).

Table 2: Details of the four values tested in this study

Value	Definition	Example statement from E-PVQ
Biospheric	concern for nature and the environment	It is important to them to prevent environmental pollution
Altruistic	concern for other people	It is important to them to be helpful to others
Hedonic	self-interested care about enjoyment and minimising effort	It is important to them to have fun
Egoistic	self-interested care about resources such as money and power	It is important to them to have money and possessions

5.2. Procedure: Part I

Participants first answered the demographic questions before answering questions on their values. Then, they read the two texts and compared them by answering the six evaluation questions. The average time to answer the questionnaire (including Part II) was 9 minutes.

5.2.1. Data analysis: Part I

We did two types of analyses. First, we performed a logistic regression for each comparison question (*thought-provoking, complexity, environmental-connection, humans-affect-environment, accuracy, misleading*) with the participant group as the main predictor variable and with the covariates Value, Gender, and Age group. For these analyses, Python version 3.11.5 was used. The model was tested for convergence and goodness of fit for all variables. For all statistical procedures used in this study, the alpha value was set at 5%.

In the second type of analysis, we then employed chi-squared goodness-of-fit tests to

test for differences between the answers to each of the seven comparison questions. We included all four possible responses for these questions (text 1 is preferred, text 2 is preferred, both are acceptable, neither is acceptable). Given that this study represented a direct comparison between two texts, it was also important to understand whether any differences found in these chi-square tests were due to differences between text 1 and text 2, or whether the other categories (both texts, neither text) caused some statistical interference. We then re-ran the chi-squared tests, except that we restricted the response options to text 1 versus text 2.

5.3. Results: Part I

5.3.1. Logistic regression

The first part of the analysis compared the participants' responses to the questions comparing the two texts. The majority of multinomial regression results did not show significant differences between variables, indicating that for the most part there was no interaction between language/education, value, and the six questions. However, the regression analysis did yield a number of significant results. Participant groups 3 (Coefficient = −1.7831, $p < 0.05$) and 4 (Coefficient = −1.7253, $p < 0.01$) (both non-native English speakers in Dutch higher education) were both significantly less likely to perceive text 2 as accurate compared to text 1. In addition, participant group 4 (non-native English speakers with English at a C1 or C2 proficiency level) were more likely to feel connected to the environment when reading text 2 compared to text 1 (Coefficient = 1.5139, $p < 0.05$).

5.3.2. Chi-square

When the participant groups were pooled (i.e., one group comprising all participants), the chi-squared test showed a significant difference between responses for all six comparison questions (Table 3); as this analysis did not reveal the nature of the difference and did not directly distinguish only between text 1 and text 2, the analysis was repeated for the responses for text 1 and text 2 only (Table 3). The results of this further analysis showed that significantly more participants felt that text 2 made them feel that humans affect the environment than text 1. However, significantly more participants felt that text 1 was more accurate and made the earth seem more complex. On the other hand, significantly more participants felt that text 2 made them feel more connected to the environment, was more thought-provoking, and was more misleading than text 1. These results are presented in more detail in Table 3.

Table 3: Results for the six categorical variables, that is, the number of participants who chose each option. The two columns on the right-hand side present the chi-square and significance level for the comparison between text 1 and text 2 only. Bold face indicates the directionality of any significant finding in the text 1–text 2 comparison.

	Text 1	**Text 2**	**Both texts**	**Neither text**	**Text 1 vs Text 2**	
					χ^2	**Sig**
Thought-provoking	89	**180**	52	11	30.74	$p < 0.001$
Complexity	**221**	47	43	21	112.97	$p < 0.001$
Environmental-connection	89	**173**	51	19	26.93	$p < 0.001$
Humans-affect-environment	48	**218**	62	4	88.35	$p < 0.001$
Accuracy	**146**	70	104	12	7.06	$p < 0.001$
Misleading	35	**108**	7	182	18.88	$p < 0.001$

5.4. Discussion: Part I

Most of the results from the regression analysis failed to find a significant difference between groups related to language, education, or values. The lack of significant differences is important in its own right because it shows that, irrespective of education level (for native speakers) and language level (for non-native speakers), the phrasings in text 2 made more participants feel that humans affect the environment than those in text 1. One possible explanation for this finding is that the language level of the non-native speaker participants was relatively high (B2 and above). Learning another language has been claimed to improve cognitive flexibility (Li et al., 2014; Shoghi Javan & Ghonsooly, 2018), and can alter the way in which those who speak a second language at a high level construe the world and other languages (Littlemore, 2023). Bilinguals with an intermediate second language (L2) proficiency have been shown to retain many of the cognitive processes associated with grammatical representation in their native language, but those with advanced L2 proficiency showed more similar patterns to the L2 (Athanasopoulos, 2006). Non-native speaker participants in this study had a proficiency of upper-intermediate to advanced (B2–C2), which could explain the lack of difference between them and the native speakers. The native speakers in this study were not asked about proficiency in other languages and so they could potentially have been bilingual with the cognitive advantages this confers, yet not asked to demonstrate this flexibility within this study. The similarity between the natives and non-natives here could also of course be explained by the fact that English and Dutch are typologically closely related languages in many ways (both belong to the West

Germanic language family) and so may elicit similar construal patterns (cf. Verhagen 2012). Another factor that has been shown to play a role in the adoption of L2 cognitive patterns is age of L2 acquisition (Boroditsky, 2001). The L2 participants in this study had completed Dutch education, and so had started learning English at an early age (at age 10 at the latest), which also provides an explanation for the lack of difference between native and non-native speakers attested here.

The surprising finding that values did not play a role in construal is also significant. Essentially, even those people with lower biospheric values and higher egoistic or hedonic values still viewed the changes in text 2 as enhancing construal of human responsibility. As readers are likely to interpret information in line with their values, and seek confirmation of their views in a text, this finding stands out. Clearly, the communicative choices made in such forms of communication have a profound impact on the audience, regardless of values or first language (assuming they have an English level of B2 or above). The non-native speaker participants all belonged to the academic community, although the two proficiency levels tested were enrolled in different study programs. The B2 group were students of marine management, which combines environmental and business studies; the C1+ group were students of English language and culture. The literature on the pro-environmental values and sustainability knowledge of different disciplines is mixed, with some studies finding students from biological and social sciences to have higher biospheric values than their peers from business studies (Arshad et al., 2021). Other studies find differences (Fisher & McAdams, 2015) or no differences in sustainability knowledge between disciplines (Damico et al., 2022). It is unclear whether prior knowledge or predisposition to biospheric values were different in the student participants in this study compared with those from other disciples. However, the fact that values had no impact on construal across the board suggests that the framing of moral agents in text 2 was so strong that it transcended value. The fact that the texts did not have an overt political position may also have contributed to this finding; much research on values and construal has been done on the basis of political values and texts (e.g., Lakoff, 2014; Taber & Lodge, 2006).

The results from this study also suggest that the stylistic features used were important in shaping the participants' construal. Significantly more participants felt that text 1 made them feel as though the earth was complex compared to text 2. Text 1 was written in a more academic style, as evidenced by the use of nominalizations and "academic" language (see Supplementary Material B for a vocabulary profile of both texts) (e.g., Halliday, 1993; Swales & Feak, 2016). On the other hand, text 2 contained fewer academic expressions such as animal names and personal pronouns, and as such, may have been perceived to be more emotive in style and less formal in register, especially by those students who had received input on academic writing in English. While in terms of subordinate clauses, academic texts are not more complex than other registers, they are likely to contain more embedded (noun) phrases (Fang et al., 2006) and may be more difficult to comprehend for non-academics (Biber & Gray, 2010). The stylistic choices in text 1 represented that of much academic and institutional (e.g., UN, EU) writing about environmental issues, and

therefore may have been more in line with readers' expectations on this subject matter. While text 2 represented the issues at hand in a more direct way, the increased lexical complexity/abstractness in text 1 presented a view in which the reader had to interpret more (as reflected in their answers to the responsibility question). It seems reasonable that the more complex and abstract phrasings in text 1 presented the earth as a more complex place than the straightforward (and simpler) text 2, which could in turn make the attribution of responsibility to any one actor (i.e., humans) harder.

6. Part II: Identifying lexical features

6.1. Measurement (Questionnaire Part II)

In the final task of the questionnaire, participants had to identify words or phrases in text 2 which they felt indicated that humans are responsible for environmental destruction, more or less than in text 1. They were presented with a version of text 2 in which they could highlight words, phrases, or sentences and select either "more", "less", or "the same" as text 1.

6.2. Data analysis: Part II

The groupings from Drury et al. (2022) introduced in the Materials section above were used to code four main categories:

i–ii) "Denominalisation" or "reactivation" of nominalised forms was achieved by the i) use of personal pronouns (e.g., we, our), and ii) the use of active sentences (e.g., reducing consumption vs buy fewer unnecessary things, eating less meat vs eat more plant-based foods).
iii) The word "human" was used as a noun modifier (e.g., human actions, human-led climate change).
iv) Subordinate categories such as animals, species, and animal names were used instead of the superordinate category biodiversity.

The response from each participant was coded separately to identify which of these features in text 2 they had deemed important in making them feel that humans are responsible for environmental destruction more (or less) than the text 1 equivalent.

6.3. Results: Part II

6.3.1. Lexical features

The use of all of the ecolinguistic features in text 2 made participants perceive humans as more responsible for environmental destruction than their equivalent features in text 1 in

the pooled dataset (Table 4; Figure 1).

Table 4: The numbers of participants who felt that text 2 made them feel that humans are responsible for environmental destruction more/less than text 1. These results are divided into and presented in the linguistic categories used for the coding. The results of the chi-squared tests are also shown.

Phrasing feature	**Text 2 more**	**Text 2 less**	χ^2	**Sig**
Pronoun	131	7	111.42	$p < 0.001$
Active sentences	130	12	98.06	$p < 0.001$
Human as a noun modifier	167	9	295.10	$p < 0.001$
Subordinate categories	35	18	4.74	$p < 0.05$

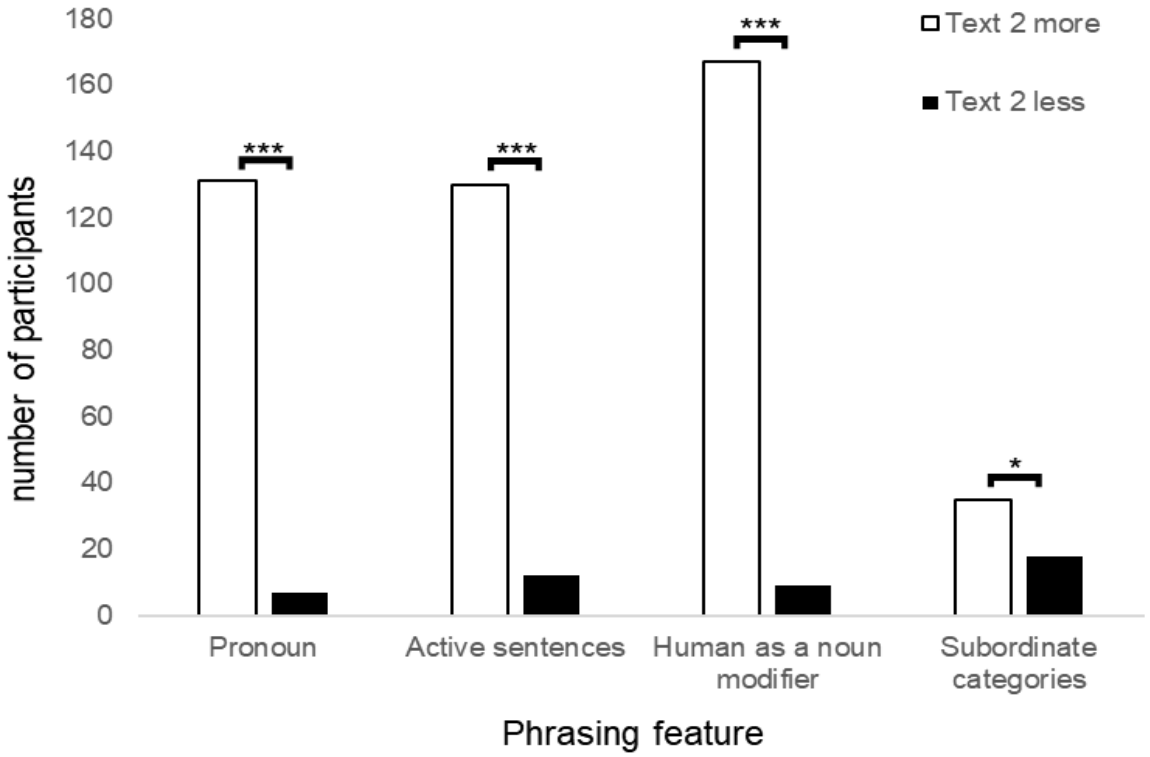

Figure 1: The number of participants who stated that each of the four linguistic features represented in text 2 made them feel that humans are responsible for environmental destruction more or less than their equivalents in text 1. Differences between the texts are significant, with the significance level given by the number of asterisks (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$).

Unfortunately, a glitch in the questionnaire program meant that no answer was required for the questions in Part II about the precise lexical features in text 2. Consequently, 156 participants (47 percent) did not answer this question. As nearly 66% of participants (218

out of 332), answered, in Part I, that text 2 made them feel that humans affect the environment more than text 1, it seems likely that the majority of those who completed Part II came from this group. As such, the result still gives an important insight into the lexical features that were important for attributing responsibility to humans for environmental destruction but may have been skewed in terms of the subsample of participants who completed Part II.

6.4. Discussion: Part II

All of the linguistic features identified made participants perceive humans as responsible for environmental destruction more than their equivalents in text 1. Of these, the use of the pronoun "we", the use of "human" as or in a noun modifier (i.e., "human actions", "human-led"), and the de-nominalisation/activation of nominal forms stood out as most pivotal in producing this reaction. Many critical discourse analysis and ecolinguistic studies have speculated that some of these choices (e.g., nominalisations) play a role in reproducing (often environmentally destructive) discourses within a text (Alexander, 2018; Drury et al., 2022; Fouad, 2019; Haig, 2001; Stibbe, 2021).

Recent research by Golshaie and Hosseini (2022) suggests that nominalisation can reduce construal of agency. One of the effects of nominalising a verb phrase is to make a text more abstract (Machin & Mayr, 2023). In doing so, the subjects of this transformation lose some of the properties that are typically expressed in the verb phrase (e.g., tense, voice, etc.) (Bello, 2016), which thereby increases the extent to which implicit knowledge is required to understand the sentence (Mackenzie, 2007). As such, "reanimating" or "de-nominalising" verbs is likely to decrease the implicit knowledge that is required to understand an utterance (Sword, 2011). In the case of the participants in this study, the salience of the verb phrase coupled with the agent ("we") in text 2 may have been the key factors in the participants' responses to this question.

A small number of participants (less than 10 percent) responded that they felt that the grammatical and lexical features in text 2 made them feel less inclined to think that humans are responsible for environmental destruction than the equivalents in text 1. No follow-up question was provided that can shed light on what led to these responses, but it is possible that these participants responded to the overall style of the text. As discussed previously, text 1 was more "academic" than text 2, and some of the participants may have felt that pronouns and naming animals undermined the authority of the text, and hence attributed responsibility to humans more based on the phrasings in text 1. As the non-native speakers in this study were in higher education in the Netherlands, they had all received some instruction on academic writing, which might have solidified this feeling.

7. General discussion

This study investigated the effects of linguistic phrasing on participants' perceptions of

moral responsibility through a direct comparison of two texts. The first, text 1, represented much current academic and institutional discourse on biodiversity, whereas text 2 drew on ecolinguistic principles to convey the same message. Of the 332 participants who took part (164 English native speakers, 168 non-native speakers) significantly more participants indicated that text 2 made them feel that humans affect the environment compared to text 1. This finding is of particular importance because it underlines the power of linguistic phrasing in shaping construals about moral responsibility. Reversing the erasure and backgrounding of actors serves to clearly attribute responsibility to them by increasing their agency.

This study aimed to compare phrasing *between* texts, so further work (i.e., a blind, independent samples test of these variables) would be necessary to investigate whether participants are equally able to easily attribute responsibility to humans when only faced with one phrasing choice. The outcome of a study by Schleppegrell (1996, as cited in Schleppegrell, 1997) suggested that this was indeed the case: "Students respond to texts that have agentless nominalizations such as *habitat loss*, *ozone destruction* and *depletion of the rainforests* by putting the hidden participants back into their spoken and written discourse about these issues" (Schleppegrell, 1997, p. 247; emphasis in original). However, the task in Schleppegrell's study required participants to demonstrate their productive language competency; it is unclear whether, at the level of perception discussed here, participants would think as deeply about each phrase and the agents responsible to the same extent while reading. If not, an absence of critical examination of the phrases in question coupled with repeated exposure in the media and education materials could serve to entrench these destructive human acts as "things which happen" without full consideration of the social actors behind them.

A distinction that should be discussed at this point is whether simply rephrasing sentences to include clear attribution of human responsibility is sufficient or even desirable. On the one hand, the use of "we" may trigger a frame of "we need to do more" and "we are in this together", essentially demonstrating individual forward-thinking responsibility (Fahlquist, 2009). On the other hand, although humans in general *are* responsible for environmental destruction, they are not all *equally* responsible (Fahlquist, 2009); indeed, some of those hit hardest by the effects of climate change (e.g., some indigenous communities) are not at all responsible for causing it. By lumping everyone together with pronouns "we"/"us", the agents who are responsible for most environmental destruction (i.e., big business, fossil fuel companies, politicians) are not explicitly mentioned (Frumhoff et al., 2015). The explicit targeting of fossil fuel industries in attributing moral responsibility for climate change may be more effective in shaping opinion to this effect, which could lead to more effective and widespread top-down measures (Piggot, 2018).

There are a number of implications of this work for both ecolinguistics and environmental communication. In terms of ecolinguistic research, this study has provided evidence that construal of agency, and with it moral responsibility for environmental destruction, can be reduced by using nominalisations and the other features studied here.

This confirms hypotheses of critical discourse scholars working in this and other fields that phrasing impacts how people perceive texts (e.g., Stibbe, 2015; Goatly, 2018). More broadly, when communicating about environmental issues, it is clear that phrasing matters, and we would encourage those communicating about sustainability and biodiversity to pay more attention to the phrasing used in order to demonstrate who is responsible for the position we find ourselves in. Through this, we can then understand how to transform our ways of doing things to avoid committing the errors (and environmental crimes) of the past.

There were a number of limitations to this study. First, although we attempted to maximise the ecological validity of the texts by mimicking the style typically found in biodiversity and climate change literature, the texts were artificially created for the purpose of the study. Further work could therefore work with authentic texts. However, with recent developments in generative AI, text creation is no longer restricted to the domain of scientists, and the standard for authenticity is likely to change. Indeed, further research could investigate the prevalence of these different features in AI-generated texts on environmental issues. As current AI is trained on historical data in which erasure of the sort studied here is common, the expectation would be for a similar style in AI output, with its avoidance of responsibility issues. An additional issue is that the stylistic differences (including those reflected in perceived earth system complexity) could have reduced the authority of text 2, and in doing so undermined its message: that humans are responsible for environmental destruction. The interaction between stylistic choices and perception of legitimacy or authority was not tested directly here, but could form an interesting basis for further work.

8. Conclusion

In conclusion, the linguistic choices when writing a text can play a role in how that text is construed by the audience. In this study, two texts with similar content but different phrasing were compared by participants. An "ecolinguistically" styled text made participants feel as though humans affect the environment more than a text written in a more traditionally "academic" style. The erasure of the human agents in the "academic" text affected how participants attributed responsibility for environmental destruction when the two texts were compared. Therefore, erasing those responsible in a text effectively hid this information cognitively as well. Notably, this construal was independent of first language, English language level, educational level, and values of the participants. This association between linguistic features and construal of responsibility has been suggested in much writing in ecolinguistics, but this study shows that, in a direct comparison at least, the phrasing does play a role in shaping construal. This finding has implications for the study of ecolinguistics at a narrow scale, and on environmental communication at a much broader level.

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Supplementary material A

Questionnaire used in the study (informed consent form removed)

1. What is your gender?
   Male
   Female
   Non-binary / third gender
   Prefer not to say

2. How old are you?
   Under 18
   18 – 24
   25 – 34
   35 – 44
   45 – 54
   55 – 64
   65 – 74
   75 – 84
   85 or older

3. What are you studying?

4. At what level are you currently studying?
   Bachelor degree
   Masters degree
   PhD
   Other

5. What is your first language / mother tongue?

6. What other languages do you speak?

7. If English is not your mother tongue, and if known, what is your approximate level in English? (e.g., C1)

8. Below you will find brief descriptions of different people. For each person we describe what is very important to them. Please read each description carefully and indicate how much this person is like you. The meaning of the scores is as follows:
   1 means that the person is totally not like you,
   7 means that the person is totally like you.

The higher the score, the more the person is like you.
Please try to distinguish as much as possible in your answering by using different scores. The person that is most like you should thus receive the highest score. The person that is the least like you, the lowest.

It is important to them to have money and possessions.
It is important to them to be helpful to others.
It is important to them to prevent environmental pollution.
It is important to them to have fun.
It is important to them that every person has equal opportunities.
It is important to them to work hard and be ambitious.
It is important to them to have control over others' actions.
It is important to them to protect the environment.
It is important to them to enjoy the life's pleasures.
It is important to them to take care of those who are worse off.
It is important to them to have authority over others.
It is important to them to do things he/she enjoys.
It is important to them to respect nature.
It is important to them that every person is treated justly.
It is important to them to be in unity with nature.
It is important to them to be influential.
It is important to them that there is no war or conflict.

9. Please read both texts and answer the questions below:

Text 1
Biodiversity has been declining at an alarming rate in recent years. For example, many studies have shown that many mammal, insect, amphibian, fish, and bird species are now at risk of extinction. The main reasons for this decline are habitat loss, deforestation, pollution, expansion of urban areas, industrial scale agriculture and other activities such as overfishing. In addition, climate change has contributed to biodiversity loss by changing the climatic conditions that many species require. Biodiversity is important as it provides many of the ecosystem services that humans need in order to survive (e.g., pollination, flood mitigation, food provision). There is no one solution to these problems, but individual steps such as reducing consumption, decreasing individual carbon footprints, and eating less meat can certainly help. Indeed, there are many benefits of changing our lifestyles; there would be less pollution, more community, and more abundant nature.

Text 2
Many animal and plant species have been dying off in large numbers in recent years.

For example, many studies have shown that animals such as elephants, rhinos, tigers, polar bears, whales, bees, frogs, and meadow birds are now at risk of extinction. Human actions are responsible for this decline. We have destroyed natural habitat for agriculture, mining, and city development; we have polluted rivers and air with our factories; and we have caught too many fish, too quickly for them to replenish themselves. In addition, human-led climate change has changed the conditions that many animals and plants need to survive. Nature has an intrinsic value, but we also rely on it for our own survival (e.g., food, flood protection). Although there is no one solution to these problems, we must all help as much as we can. For example, we can buy fewer unnecessary things, use renewable energy, and eat more plant-based foods. We can all benefit from changing our lifestyles; we would have cleaner air, closer communities, and more abundant nature.

Compare the two texts.
Read both texts and answer the following questions by selecting one of the following options:
Text 1
Text 2
Neither
Both equally

Which text is more thought-provoking?
Which text makes the earth seem more complex?
Which text makes you feel more connected to the environment?
Which text makes you feel more that humans affect the environment?
Which text seems more accurate?
Which text seems more misleading?

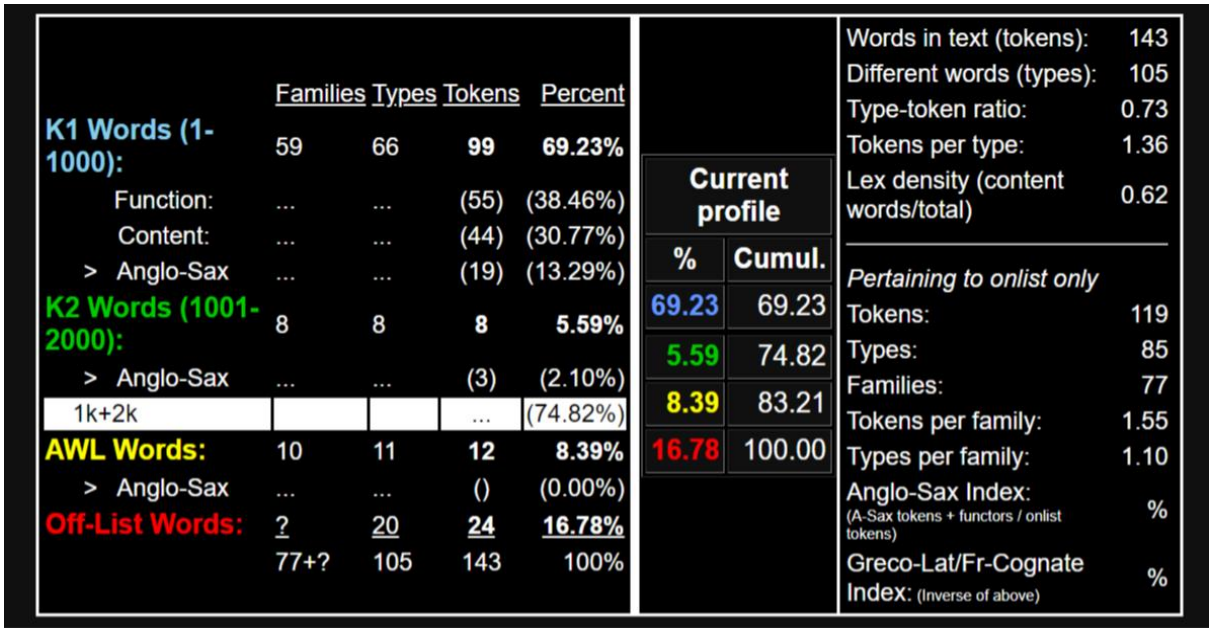
10. What words/clauses/phrases in text 2 make you feel that humans are responsible for the environmental destruction mentioned more or less than in text 1? Compare the texts (above), then click on the relevant words (or click, hold, and drag to select all words that comprise a clause or phrase) and select more or less from the options. For example, if the phrase "animal and plant species" (text 2) makes you feel that humans are responsible for the environmental destruction mentioned less than the word "biodiversity" (text 1), highlight these words and select less in the dropdown menu.

11. Please provide a short username by which you can identify your response if you choose to withdraw it from the study.

Supplementary material B

Vocabulary profiles of text 1 and text 2

Text 1:

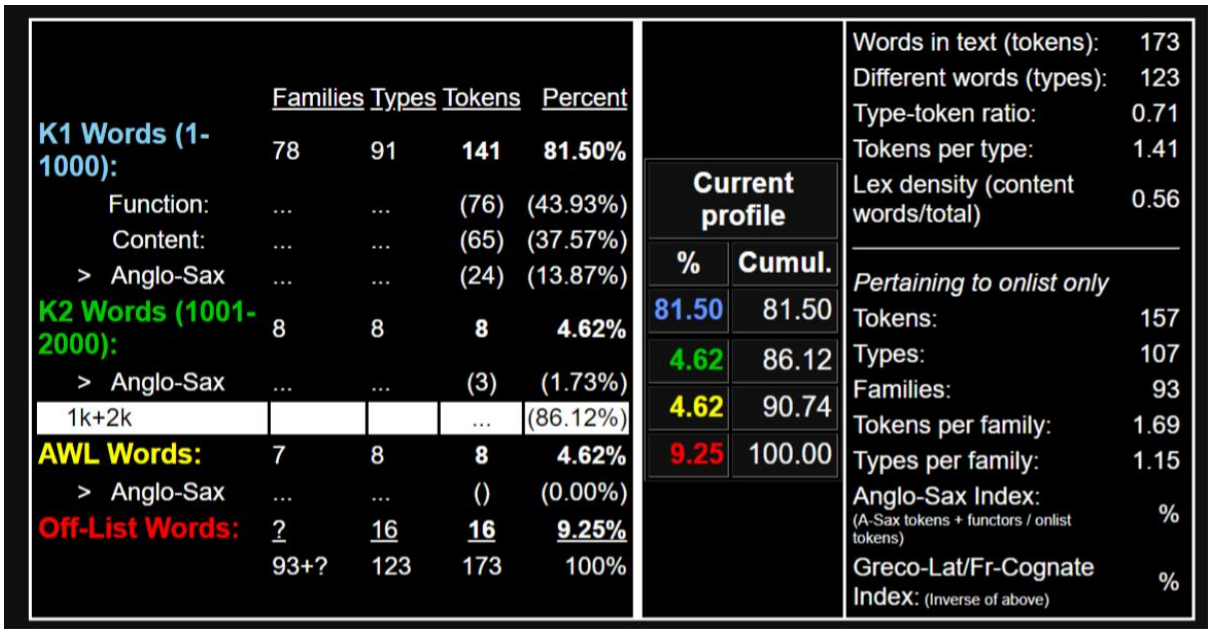


	Families	Types	Tokens	Percent
K1 Words (1-1000):	59	66	**99**	**69.23%**
Function:	...	...	(55)	(38.46%)
Content:	...	...	(44)	(30.77%)
> Anglo-Sax	...	...	(19)	(13.29%)
K2 Words (1001-2000):	8	8	**8**	**5.59%**
> Anglo-Sax	...	...	(3)	(2.10%)
1k+2k			...	(74.82%)
AWL Words:	10	11	**12**	**8.39%**
> Anglo-Sax	...	...	()	(0.00%)
Off-List Words:	?	20	**24**	**16.78%**
	77+?	105	143	100%

Current profile	
%	Cumul.
69.23	69.23
5.59	74.82
8.39	83.21
16.78	100.00

Words in text (tokens):	143
Different words (types):	105
Type-token ratio:	0.73
Tokens per type:	1.36
Lex density (content words/total)	0.62
Pertaining to onlist only	
Tokens:	119
Types:	85
Families:	77
Tokens per family:	1.55
Types per family:	1.10
Anglo-Sax Index: (A-Sax tokens + functors / onlist tokens)	%
Greco-Lat/Fr-Cognate Index: (Inverse of above)	%

Text 2:



	Families	Types	Tokens	Percent
K1 Words (1-1000):	78	91	**141**	**81.50%**
Function:	...	...	(76)	(43.93%)
Content:	...	...	(65)	(37.57%)
> Anglo-Sax	...	...	(24)	(13.87%)
K2 Words (1001-2000):	8	8	**8**	**4.62%**
> Anglo-Sax	...	...	(3)	(1.73%)
1k+2k			...	(86.12%)
AWL Words:	7	8	**8**	**4.62%**
> Anglo-Sax	...	...	()	(0.00%)
Off-List Words:	?	16	**16**	**9.25%**
	93+?	123	173	100%

Current profile	
%	Cumul.
81.50	81.50
4.62	86.12
4.62	90.74
9.25	100.00

Words in text (tokens):	173
Different words (types):	123
Type-token ratio:	0.71
Tokens per type:	1.41
Lex density (content words/total)	0.56
Pertaining to onlist only	
Tokens:	157
Types:	107
Families:	93
Tokens per family:	1.69
Types per family:	1.15
Anglo-Sax Index: (A-Sax tokens + functors / onlist tokens)	%
Greco-Lat/Fr-Cognate Index: (Inverse of above)	%