

1 **This bookmark gauges the depths of the human:**
2 **how poetry can help to personalise climate change**

3
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7
8 **Abstract**

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10 By conducting a qualitative content analysis of 72 poems written about climate change by
11 poets from across the world, this study demonstrates how these poets have interpreted the, at
12 times, esoteric principles of climate change. The results of this study indicate that these
13 interpretations highlight the need to re-position humans in the epicentre of the debate so that
14 a meaningful dialogue around the subject might be established, especially amongst non-
15 specialists.

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1. Introduction

For each of the last three decades, temperatures at the Earth's surface have been rising, reaching levels higher than any recorded since the middle of the nineteenth century, when multiple independently produced measurements first began (Stocker et al., 2013). This recent warming has been caused by an anthropogenic increase in the atmospheric concentrations of carbon dioxide, methane, and other greenhouse gases, which have increased to levels unprecedented in the last 800,000 years (Seinfeld and Pandis, 2016). Carbon dioxide concentrations alone have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from emissions caused by changes in land use (Leung et al., 2014). Understanding and quantifying greenhouse gas emissions is central to international efforts to slow their growth rate in the atmosphere, in order to mitigate the humanitarian and economic impacts of global warming.

The effects of increased greenhouse gas emissions are not just limited to an increase in global temperatures; they are also profoundly influencing our climate, resulting in an increase in the number of heatwaves, extreme weather events and flood risk (Van Aalst, 2006). However, the implications of climate change on our environment and society is not solely dependent on how the Earth system responds to changes in greenhouse gases; instead it depends on the extent to which humankind responds through changes in their lifestyle, attitude, and policy (Moss et al., 2010). Therefore, alongside the work of scientific research that aims to quantify these emissions (see e.g. Palmer et al., 2018), it is necessary for non-scientists to support and develop appropriate mitigation strategies against global warming. In order for this to be done effectively, they need to be both aware that it is taking place, and to be certain that it is anthropogenic (Hassol, 2008). They also need to realise that no matter where they are in the world they are at risk from the effects of climate change (Dominelli, 2011).

Howe et al. (2015) conducted a study amongst US citizens to determine the extent to which they believed global warming was happening, and how they believed it affected them. They found that of the 12,061 people surveyed between 2008 and 2013, 70% believed global warming to be happening, while only 53% believed it to be anthropogenic. Similarly, only 49% of them considered scientists to agree on the anthropogenic nature of global warming; in reality that consensus is at least 97% (Cook et al., 2016). Amongst these same participants, a slim majority (51%) believed that global warming was already harming people in the US, yet only 40% thought that global warming would harm them personally, with 33% of respondents stating that they discussed global warming at least occasionally with friends and family. These results would therefore suggest that while many US citizens still need convincing about the anthropogenic nature of global warming, a more pressing concern is perhaps the need to convince them of the risk that it poses at the individual and local level.

It is perhaps unfair to single out US citizens for such analysis. Between 2008 and 2009, Gallup (the global performance-management consulting company) conducted a major

62 worldwide poll across 127 countries about personal attitudes towards climate change (Gallup
63 and Newport, 2010). While this is an older data set, the results are in-line with the work of
64 Howe et al. (2015): 63% of people surveyed claimed to know something about climate
65 change, with only 55% agreeing that it was anthropogenic and 47% acknowledging that it
66 posed a serious personal threat. While many climate change communication efforts focus on
67 convincing citizens of the anthropogenic nature of climate change (see e.g. Nerlich et al.,
68 2010), more work is clearly needed to help address the perceived disconnect between global
69 effects and personal threat. What is needed is something that can transcend cultural barriers,
70 and which can contextualise and personalise a global problem. What is needed is poetry.

71
72 In his treatise *A Defence of Poetry* (written in 1821 and first published posthumously in
73 1840), the English Romantic poet P.B. Shelley (1890, pp. 46) wrote that:

74
75 Poets are the hierophants of an unapprehended inspiration; the mirrors of the gigantic
76 shadows which futurity casts upon the present; the words which express what they
77 understand not.

78
79 A hierophant is considered to be a person who interprets sacred mysteries or esoteric
80 principles. Is there a mystery more sacred than how best to safeguard our planet? Is there a
81 principle more esoteric than the effective mitigation of climate change? In Ancient Greece,
82 hierophants were needed to interpret the will and needs of the gods for the rest of society; at
83 the behest of Shelley might we now turn to poets to interpret the will and needs of our planet?
84 Talking about climate change is difficult. Even experts find it challenging to establish a
85 common language that communicates their research, statistics, and emotions effectively (see
86 e.g. Hulme, 2009). Poetry offers a way to establish this common language, presenting an
87 opportunity for people to express themselves in a different way, to find a fitting language that
88 enables them to talk about climate change in a manner that is personal to them, and which
89 can potentially help them to find the words that are needed to communicate with others more
90 effectively (see e.g. Illingworth and Jack, 2018 and references therein).

91
92 The purpose of this research is not to introduce a mutual exclusivity between scientists and
93 poets, as there are many examples of scientists for whom poetry is an integral part of their
94 practice (Illingworth, 2019b), and who do a commendable job of communicating their
95 research (and the research of others) through poetry (see e.g. McCarty, 2014; Januchowski-
96 Hartley et al., 2018 and references therein). Rather, this research seeks to investigate how
97 poetry (as opposed to science) has been used to interpret climate change, and how this might
98 then be used to re-consider the ways in which science also engenders dialogue around this
99 topic.

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102 By conducting a detailed qualitative content analysis for a selection of climate change poetry,
103 this study aims to understand how poets have interpreted the principles of climate change,
104 and how these interpretations might be used to engender the dialogue that is needed to
105 meaningfully address the issue. In Section 2, I discuss the methodology that I adopted in this
106 study, and in doing so outline a new approach with regards to how poetry might be used as

107 data to reveal insight into a particular topic (in this instance attitudes towards climate
108 change). Section 3 contains a discussion of how the emergent categories and themes relate to
109 the research questions, and Section 4 contains the conclusions, along with future directions
110 for research.
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113 **2. Methodology**

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115 The methodology that I adopted in this study involved treating poetry as data, allowing for a
116 contextual meaning of the text to be analysed in relation to climate change. While several
117 other methods exist for the analysis of textual data (e.g. ethnography, phenomenology,
118 grounded theory, etc.), I have chosen qualitative content analysis because of its ability to
119 highlight both the context and the content of the chosen text, which for a subjective medium
120 such as poetry is essential. In outlining the methodology that was used in this study I also
121 intend to provide a blueprint for the qualitative content analysis of poetry with respect to
122 other topics of interest. Previous studies have treated poetry as data to explore certain topics
123 but have tended to focus on methods of inquiry (see e.g. Furman, 2004; Hunter, 2002; Shapiro,
124 2004), autoethnography (see e.g. Furman, 2006; Maurino, 2016), or quantitative coding (see
125 e.g. McDermott Jr and Porter, 1989; Hoover et al., 2014). Similarly, while other research has
126 been conducted in relation to climate change and poetry, this has tended to focus on either
127 literary criticism (see e.g. Trexler and Johns-Putra, 2011; Griffiths, 2017) or action research
128 (see e.g. Miller and Brockie, 2015), the former of which typically involves re-reading much
129 older bodies of texts, while the latter introduces recall and interviewer / facilitator bias. By
130 performing a qualitative content analysis on poetry that has been written recently, but not for
131 the sole purpose of research, this study aims to better understand the way in which poets
132 interpret climate change, and how this might be used to better personalise the subject.

133

134 Any approach which utilises a qualitative content analysis should be guided by these seven
135 steps: formulate research questions; select sample to be analysed; define the categories to be
136 applied; outline the coding process; implement the coding process; determine
137 trustworthiness; and analyse the results of the coding process (Hsieh and Shannon, 2005). In
138 defining my methodology, I will outline the first six of these steps here, with the seventh (the
139 analysis) being presented in Section 3.

140

141 **2.1 Formulation of Research Questions**

142

143 As discussed above, the combination of poetry as data and qualitative content analysis as
144 method were chosen so as to better understand the ways in which poets independently
145 interpret the principles of climate change, and in doing so how this might be used to widen
146 the debate around climate change by making it something that people identify more
147 personally with. For the purposes of this study, this was formalised into the following two
148 research questions:

149

150 RQ1: how have poets interpreted the, at times, esoteric principles of climate change?

151 RQ2: how might these interpretations be used to better personalise the debate around
152 climate change so that it is discussed more widely?

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155 **2.2 Selection of Samples to be Analysed**

156
157 In selecting the poetry for this study, I wanted to engage with a body of work that captured a
158 wide range of interpretations, and from a large number of poets. Selecting poetry from only
159 one or several poets would have limited the potential interpretations, while picking poetry
160 which I identified as being about climate change could potentially have introduced an
161 interpretative bias before any content analysis had taken place. As such I needed a collection
162 of poetry that was definitely about climate change, and which was written by more than a
163 handful of poets. At this stage I also decided to rule out any venture that I had personally
164 been involved with (either through the editing, soliciting, or submission of poetry) so as to
165 avoid interviewer / facilitator bias.

166
167 *Magma* is an international magazine of poetry that is published three times a year in Spring,
168 Autumn and Winter, both on paper and as a digital edition. The editorship circulates among
169 the group which runs the magazine, with an occasional guest editor, and the ethos of the
170 publication is a commitment to publish the best in contemporary poetry, from little known
171 poets to more established ones. Each issue has a designated theme, with submissions for each
172 issue released several months before. Issue 72 of *Magma* was entitled ‘The Climate Change
173 Issue’, with the following call for submissions advertised via their website (Magma, 2018):

174
175
176 We’re looking for poems that engage with the theme of climate change in any way,
177 that reflect it, have it as an emotional underlay, or react against it... Send us poems of
178 grief, anger, despair, dystopian angst, scepticism, devil’s advocacy, activism,
179 optimism, humour, joy... Elegies, satire or whatever.

180
181 The openness of the call made it clear to the poets that they were free to interpret the topic of
182 climate change, which made it an ideal data source for this study. In addition to an editorial,
183 book reviews, and extended features ‘The Climate Change Issue’, which was published in
184 Autumn 2018 and edited by Matt Howard, Fiona Moore, and Eileen Pun, featured 72 original
185 pieces of poetry from 57 authors (Howard et al., 2018). The background of the poets was
186 considered, but only after the coding had been done so as to avoid any bias. After reading the
187 biographical information of these poets and conducting a background search, only two of
188 them could be considered to be active scientists, one of whom is a futurist working for a
189 sustainability non-profit organisation, and the other of whom is an environmentalist, who at
190 the time of writing was working on a master degree in Ecology and Environmental Studies.
191 Given that the RQs are focussed on how poets have interpreted climate change for a non-
192 specialist audience, and that both of these writers self-identify as poets, their poetry was not
193 excluded from study, especially since the ideas and themes explored in their poetry did not
194 result in the emerging of any new codes or categories (see Section 2.4). In addition to the
195 inclusion of these two scientist poets, several of the poems in the issue (8 in total) came about
196 from invited discussions between scientists and conservationists from the Cambridge
197 Conservation Initiative. However, the poets themselves could still be considered to be non-
198 specialists who were interpreting climate change following conversations with climate
199 change experts, and so their poetry was included in the analysis.

200
201 While it is not necessarily the case that poetry anthologies will always exist for a particular
202 topic, it is also true that many poems do in fact make the topics of their intent sufficiently
203 clear so as to avoid interpretive bias. However, in order to answer RQ1 for this study it was
204 necessary to pick contemporary poetry written from a wide selection of poets, for which ‘The
205 Climate Change Issue’ presented the ideal source. The following quotation, taken from the
206 editorial, also outlines how the overarching tenet of this issue is fully congruent with the
207 rationale behind this study, i.e. that climate change should not be just the sole preserve or
208 concern of the scientist (Howard et al., 2018, p. 5):

209
210 It seems redundant to say climate change isn’t just a scientific concern when its scope
211 is no less than total – perhaps we are waiting for human consciousness and behaviours
212 to catch up.

213
214

215 **2.3 Definition of Categories to be Applied**

216
217 A conventional approach to qualitative content analysis was adopted in this study, with pre-
218 conceived categories being avoided, and instead being determined by the implementation of
219 the coding process (see Section 2.4). While in some instances a directed content analysis
220 might be more appropriate, this is usually used in those instances where an existing theory
221 would benefit from further description (Hsieh and Shannon, 2005). As the research questions
222 to be addressed in this study are unique, a directed approach is inappropriate. Similarly, a
223 summative content analysis would fail to fully account for the context of the poetry alongside
224 its content.

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226 **2.4 Outline and Implementation of Coding Process**

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228 The outline and implementation of the coding process have been combined here, as they are
229 closely interrelated, and discussing them together serves to better highlight how such an
230 approach was adopted in this study.

231

232 A traditional approach to coding data during qualitative content analysis (see e.g. Braun and
233 Clarke, 2006, and references therein) would be to begin by identifying meaning units in the
234 text, condensing these down to smaller units and then labelling these units with codes. These
235 codes would be chosen so as to describe what each meaning unit was about, after which
236 different codes would be grouped into thematic categories according to content and context,
237 before looking for any emerging theme(s) that expressed an underlying meaning of the text
238 and which could be directly related back to the research question(s) (Erlingsson and
239 Brysiewicz, 2017). Whilst this overall schema can be observed in the process outlined below,
240 the approach that I adopted differed slightly in its treatment of condensed meaning units,
241 which should be avoided when treating poetry as data for qualitative content analysis. This is
242 because in addition to overly short meaning units leading to fragmentation (Greeneheim,
243 2004), poems, unlike transcripts or survey responses, have been crafted by the author so that

244 every word and sentence has 'meaning'. As such each line (and perhaps each word) of the
245 poem could already be considered to be a meaning unit and should not be condensed further.

246
247 In conducting my analysis, I began by reading all of the poems in 'The Climate Change
248 Issue' to familiarise myself with their content and context. I then went through each of the
249 poems in the order in which they appeared in print, and assigned codes to sections of the
250 poems that addressed RQ1 (i.e. how had these poets interpreted climate change). Assigning
251 an overall meaning or tone to the poem as a whole was avoided, as this would introduce a
252 degree of subjectivity that is inappropriate unless a phenomenological approach is being
253 adapted, in which the lived experiences of the researcher(s) is being considered as an
254 essential part of the analysis (see e.g. Illingworth and Jack, 2018). As such an approach is not
255 compatible with the research questions of this study, I instead assigned codes to lines of text
256 which made reference to a specific label. These labels emerged from the poems, and were
257 chosen to be as objective as possible, as can be seen from Table 1.

258
259 As well as avoiding tone and sticking to specific references in the text, coding occurrences
260 were always chosen to be literal rather than metaphorical or symbolic, so that further
261 subjectivity could be avoided. For example, "and gulls strewn like heaps of soiled rags
262 among oil-glistened // bodies of harbor seals after the blowout on Platform A" was coded as
263 'Fauna', whereas "I meet Al Gore // in the lovely woods // of sleep // he's braver // than a
264 tiger" was not, as in this instance the tiger was being used to symbolise bravery (here, and
265 throughout this manuscript, // is used to indicate a line break in the poem, i.e. the termination
266 of one line of the poem and the beginning of a new one.). These lines were however coded as
267 'Humans' because they made explicit reference to a human being other than the author of the
268 poem, i.e. Al Gore.

269
270 As each new code was realised I went back through the poems that had previously been
271 coded to see if these also contained any lines that could be labelled with this newly emergent
272 code. I then read all of the poems in full again and made sure that each of them had been
273 coded accurately and that a saturation of emergent codes had been reached. This resulted in a
274 total of 21 codes. I then read each of the poems again and made sure that no coding had been
275 missed. Following this I went through each of the individually coded segments and checked
276 to make sure that they really did belong in this category, checking that (for example) Al Gore
277 being described as a brave tiger was coded as 'Human' rather than 'Fauna'. At this stage I
278 realised that one of the codes that I had created was at odds with my methodology, and so it
279 was removed. 'Personification' has been defined as 'any poems that were written as if from
280 the point of view of nature / the Earth system', and although there were four such instances of
281 this code, I considered this to be too subjective for the analysis, and so it was removed. This
282 resulted in the 20 codes that are outlined alongside their definitions in Table 1.

283
284 After this coding had taken place, I read through all of the coded references and then grouped
285 these into categories, which consisted of codes that appeared to deal with the same issue.
286 Table 2 outlines the categories and corresponding codes, along with the number of times they
287 occurred. These categories, and their relation to the research questions are discussed further

288 in Section 3. After these codes had been grouped as such I went back through each of the
289 individual occurrences (e.g. the 152 segments of poetry that were categorised as ‘Habitat’) to
290 make sure that they did indeed belong in this category. As can be seen from Table 2, this
291 resulted in 5 individual categories: ‘Habitat’, ‘Reactions’, ‘Language’, ‘The Present’, and
292 ‘Our Future’.

293
294 Following this categorisation of the codes, they were further examined for any themes that
295 expressed underlying meaning in relation to the research questions (Erlingsson and
296 Brysiewicz, 2017), the results of which are presented in Section 3.6. In determining these
297 emergent themes, I re-considered each of the emergent categories with respect to the RQs,
298 looking for any commonalities and/or overlaps, in a manner analogous to the emergence of
299 the original codes and categories that is described above.

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301

302 **2.5 Trustworthiness of Coding**

303

304 In order to improve the trustworthiness of this content analysis, I followed the checklist
305 outlined by Elo et al. (2014), which involved checking for trustworthiness at the preparation,
306 organisation, and reporting phases of the analysis. In the preparation phase, the data
307 collection, sampling strategy, and unit of analysis (unit of meaning) selection were carefully
308 considered and have been justified above. During the organisation phase, the categorisation,
309 interpretation, and representativeness of the analysis was assured by repeatedly checking for
310 consistency, e.g. by checking each of the individual occurrences of text against the
311 categories. The reporting phase is covered in Section 3 of this study, but here trustworthiness
312 was assured by providing enough detail to ensure that the reader can evaluate the
313 transferability of the results.

314

315 In order to establish the trustworthiness of the analysis of poetical data, Shapiro (2004) also
316 recommends establishing an audit trail, ensuring that there has been a theoretical saturation of
317 the data, and where possible involving more than one researcher. While the audit trail and
318 saturation of data have been discussed (with Table 1 and Table 2 demonstrating how the
319 emergent codes and categories in this study were defined and organised), in this instance only
320 one researcher was used to analyse the data, and as such this may introduce biases to the
321 interpretation of the data. However, this is also true for any content analysis that involves
322 only one researcher (Elo et al., 2014). As the goal of this analysis is not to guarantee the
323 systematic development and use of a code book, the interpretive process is not overtly
324 affected by the use of a solo researcher. Furthermore, the transparency of the coding and
325 subsequent analysis further improves the trustworthiness of the approach.

326

327 **3. Results and Discussion**

328

329 As can be seen from Table 2, five major categories emerged from the methodology that was
330 adopted in analysing these poems. I now discuss each of these emergent categories, how they
331 relate to RQ1 (“how have poets interpreted the, at times, esoteric principles of climate

332 change?”), and how they compare to other research that has been conducted in terms of the
333 communication of climate change. Following a discussion of these categories I present the
334 overall theme that emerged from conducting this analysis, and how this relates to both RQ1
335 and RQ2 (“how might these interpretations be used to better personalise the debate around
336 climate change so that it is discussed more widely?”).

337

338 **3.1 Habitat**

339

340 The most prominent category to emerge with regards to the ways in which poets interpreted
341 the principles of climate change was ‘habitat’. This category emerged from a variety of
342 different sources, with many of the poems focussing on a celebration of habitat (either the
343 flora or the fauna or both) as is evident from the snippets of the following two poems: ‘A
344 Trip to Mount General in Late Winter’ by Huang Fan and translated from Chinese into
345 English by Lei Gianni (Howard et al., 2018, p. 13):

346

347 In the bamboo grove where you can almost
348 forget who you are – if you are steadfast as the plum blossoms
349 that hold on to early spring

350

351 And ‘Beijing Parakeets’ by David Tait (Howard et al., 2018, p. 11)

352

353 but I wait beneath the bare pomegranate tree
354 and watch the two old parakeets, lovebirds,
355 huddled up together, one cleaning the feathers
356 on the other’s head, the other softly singing.

357

358 Both of these poems celebrate habitat, but they also ground this celebration in how habitats
359 (and nature) are experienced and appreciated by humans, as is also evident from this extract
360 from ‘Notes from a transect’ by Polly Atkin (Howard et al., 2018, p. 47)

361

362 One school wins a visit from the scientist. When she asks
363 *does anyone have wildlife stories to share?*
364 the whole school put up their hands.

365

366 In contrast to this celebration of current habitats, and how they are appreciated, several of the
367 poems also considered the loss of habitat. The following two extracts from ‘An eco-worrier
368 tweets’ by Neetha Kunaratnam (Howard et al., 2018, p. 41) and ‘ISOTHERM’ by Jos Smith
369 (Howard et al., 2018, p. 54), demonstrate how this loss was explored by the poets for both
370 flora and fauna, respectively:

371

372 while we pine for the pines,
373 and they plane the mighty planes

374

375 And:

376
377 What does a loss of birds look like?

378
379 What is the collective noun
380 for such losses? Would you hear
381 the silence of lapwings, of thrushes?

382
383 As with the celebration of habitat, what is particularly interesting with regards to how the
384 poets chose to represent this loss, was that it was almost always contextualised with respect
385 to humans, i.e. “*we pine for the pines*” and “*Would you hear the silence of lapwings*”
386 (emphasis in italics is my own). While the following extract from ‘Notes from a transect’ by
387 Polly Atkin (Howard et al., 2018, p. 48) makes clear that this habitat loss should not be
388 ranked, it is clear that any quantification / rationalisation of loss is seen by the poets to be
389 reliant on human consideration:

390
391 Is it cheaper to weep for a sea otter – clutching
392 paws in the water – than a lake?

393
394 Exploring this idea of loss further, it is the relationship between humans and habitat, and in
395 particular how conflict has arisen to become the dominant connection between the two, that
396 many of these poems aspire to, as is evident from this extract from ‘The loss of birds’ by Nan
397 Craig (Howard et al., 2018, p. 64):

398
399 They were everywhere, I insist. *Everywhere.*
400 You smile politely and begin to drift away.
401 WAIT! I shout. They also *sang!*

402
403 This need for human contextualisation might be seen to be an unconscious (or conscious)
404 reflection by the poets on the role that humans are playing on impacting the climate, and the
405 fact that we are the only species that are able / willing / conscious of making such an impact.
406 This concept is further evident in Matthew Griffiths’ ‘Pantones for the Anthropocene’, the
407 very title of which makes reference to the current geological epoch, viewed as the period
408 during which human activity has become the dominant influence on climate and the
409 environment (Howard et al., 2018, p. 35):

410
411 This bookmark gauges the depths of the human,
412 Laid to the layers to show where a new one
413 Rises like icing, a fresh fall of snow on
414 A stiffening stratum, and so – with the golden
415 Spike on the graphlines not otherwise seen –

416
417 Habitat loss, and in particular extinction risk, has long been presented by scientists as one of
418 the most visible effects of climate change, with e.g. Thomas et al. (2004) stating that a large
419 fraction of species could be driven to extinction by expected climate trends over the next 50

420 years. As such, it is perhaps not surprising that many of the poets chose to explore the role of
421 habitat and climate change, and in doing so further examine the evolving relationship
422 between humans and nature. [This analysis supports the ongoing debate in anthropology about](#)
423 [the conception of nature and the role of humans within this concept \(see e.g. Descola,](#)
424 [2013;Habermas, 2014\).](#) What these poems make evident, is that despite our behaviours (and
425 the original code that was adopted in Table 1) it is impossible to view ‘humans’ and ‘nature’
426 as two mutually exclusive entities, as although anthropogenic climate change may be having
427 a hugely negative effect on nature the two systems are clearly interrelated, or as noted by
428 Corlett (2015, p. 4):

Deleted: however

429
430 If humans are now the dominant ecological force on the planet, then it is impossible
431 to separate ‘humans’ and ‘nature’ in the way that conservation has traditionally tried
432 to do.

433 434 **3.2 Reactions**

435
436 This category represents those poems that explore the reactions that humans have towards
437 climate change, the largest proportion of which represent an acknowledgment that climate
438 change is happening and also that humans are largely to blame for its cause and effects, either
439 because of very specific incidents, as evidenced in this extract from ‘Río Nuevo’ by Leo Boix
440 (Howard et al., 2018, p. 75):

441
442 New owners didn’t rotate their crops.
443 A Martian landscape rapidly arose.

444
445 Or because of more general attitudes and behaviours, as expressed by Patrick Sylvain in
446 ‘Ego’ (Howard et al., 2018, p. 26):

447
448 In the boundless universe,
449 I am less than a speck.
450 But my ego,
451 The size of a planet,
452 Defames the world.

453
454 The outcomes of these attitudes are also examined by the poets, with Matthew Griffiths, in
455 his poem ‘Pantones for the Anthropocene’, exploring the notion that burying our heads in the
456 sand has simply served to further distance ourselves from both the problem and also nature
457 more generally, (Howard et al., 2018, p.35):

458
459 Lifting our arses up in the confusion
460 Of air and ourselves we have made of the future
461 And off the hot core of that gobstopper, nature.
462

464 Alongside this general acknowledgment that climate change is anthropogenic, there is also
465 some doubt. However, this reaction does not manifest itself in terms of climate change denial,
466 but rather in terms of the degree to which we can truly quantify its extent, as demonstrated by
467 Penelope Shuttle in ‘An Inconvenient Truth’ (Howard et al., 2018, p. 65) :

468
469 no one knows where the past goes
470 no one knows anything about
471 anything on this dirty little planet
472 of ours

473
474 This doubt and uncertainty is accompanied by a realisation that climate change is not a
475 simple problem, either in conception or communication, as Polly Atkin observes in ‘Notes
476 from a transect’ (Howard et al., 2018, p. 46):

477
478 in the data the scientist says it’s hard
479 to ask questions to prise apart correlation
480 habitat or climate disturbed or not
481 disturbed perception or preconception
482 it depends what scale you concern yourself with

483
484 An interesting issue that arises in these poems is that despite an acknowledgment and
485 ownership of the problem, very few solutions for mitigating against or even adapting to
486 climate change are presented. In ‘A way of managing diversity’ Kathryn Maris tells us that
487 “We must band together against this encroaching threat” (Howard et al., 2018, p. 58), while
488 in ‘Do not turn this page !!!’ Roger Bloor states “then what is the answer? // 0 level carbon
489 emission target” (Howard et al., 2018, p. 98). However, despite a lack of actual solutions
490 several of the poets still express hopes for the future, with Joanna Guthrie observing in ‘Here,
491 afterwards’ that (Howard et al., 2018, p. 12):

492
493
494 at which you will look down
495 from time to time
496 amazed at the journey
497 their new strength
498 the way that they’ve
499 adapted best of all
500 to this time

501
502 In considering the reactions that humans take towards climate change, these poems have
503 interpreted climate change as something that does exist, and that we (as humans) are largely
504 to blame for, but there is a distinct lack of any real, or even perceived, solutions to the
505 problem. There is hope, but less certainty in what this will actually look like / how it will
506 physically manifest itself. There is also an acceptance that things are not simple, and that in
507 interpreting these results and trying to make sense of them, scientists have a difficult job that

508 is made more so by trying to represent error bars and standard deviations as something that
509 still possesses an urgency. Such an attitude is reflective of recent research that has revealed
510 that the language used by the global climate change watchdog, the Intergovernmental Panel
511 on Climate Change (IPCC), is overly conservative (Herrando-Pérez et al., 2019).
512

513 Previous studies (see e.g. Budescu et al., 2009) have shown that there is a large disconnect in
514 the ways that scientists and non-scientists understand uncertainty, and that as such the
515 communication of uncertainty has the potential to undermine effective action unless climate
516 change messages are framed appropriately (Morton et al., 2011). However, these poems
517 would seem to suggest that the poets take into consideration the nuances of quantifying
518 climate change. These poems also clearly demonstrate that there is an acknowledgment of the
519 anthropogenic nature of climate change, but that a likely barrier to engagement is a perceived
520 lack of potential solutions, as has also been discussed by e.g. Lorenzoni et al. (2007).
521

522 **3.3 Language**

523
524 Another category to emerge from this content analysis was the importance of language. Many
525 of the poems adopted language that could be considered to be spiritual or quasi-religious; for
526 example, Ben Smith in the poem ‘Data Sets’ observes that (Howard et al., 2018, p. 18):
527

528 This is the real work of divination:
529 not grand prophecies
530 but data gathering.

531
532 While ‘Data Sets’ uses quasi-religious language as a comparison for the underlying science
533 of understanding climate change, several other poems encompass this form of language as a
534 direct invocation for protection and/or help from a higher power, as is evident in these lines
535 from Sarah Gridley’s ‘Diabolic Clouds Over Everything’ (Howard et al., 2018, p. 97): “For
536 the love of God, // or otherwise”, and also these from Leo Boix’s ‘Villanelle (Un Paisaje)’
537 (Howard et al., 2018, p. 9): “An altar to pray for a better world”.
538

539 In contrast to this use of spiritual language, other poems use a form of language that could be
540 classified as scientific, i.e. they make reference to a specific fact or piece of technical jargon,
541 such as the line ‘Light breeze is the first sign of barometric change’ in Rachel Mead’s poem
542 ‘A Beaufort Scale for Depression’ (Howard et al., 2018, p. 28) or “Say hello to the Man Age,
543 so long to the Holocene” in Matthew Griffiths’ ‘Pantones for the Anthropocene’ (Howard et
544 al., 2018, p. 35), where the poet explains the title of the poem by making reference to another
545 geographical period, and drawing attention to the notion that the Anthropocene is a
546 functionally different epoch from that of the Holocene (see e.g. Waters et al., 2016). By using
547 scientific language in this way, the poets are introducing their readers to new research and
548 findings albeit in a markedly different style to that used in scientific research or even popular
549 science articles.
550

551 One of the most stylistically interesting poems in the collection is Cat Campbell's 'CH4 is a
552 much more potent greenhouse gas than CO2', which takes the work done by Worrall et al.
553 (2010) on 'Peatlands and climate change', and interspaces the scientific findings of this
554 report with lines of poetic text (represented in italics), the effect of which is to introduce the
555 reader to scientific fact (both that of the title and the notion that peatlands can be a source as
556 well as a sink of carbon) whilst simultaneously humanising it (Howard et al., 2018, p. 15):

557
558 It is possible for a peatland,
559 *site of battles and back-breaking crofting,*
560 to be a net sink for carbon,
561 *blood, sweat, grief and hate,*
562 but at the same time
563 *to be a source of enough tranquillity*
564 to have a net positive
565 *effect on human nature and a*
566 radiative forcing (i.e., warming)

567
568 As well as turning to the languages of science and religion in an attempt to convey their
569 message, several of the poems also made use of languages other than English. The poems in
570 this collection included only one complete translation, '暮冬时节将军山行' by Huang Fan
571 that was translated from Chinese into English as 'A Trip to Mount General in Late Winter'
572 by Lei Yanni. The other poems that used a language other than English interspersed the text
573 with words from that language, such as the use of Spanish by Leo Boix in Villanelle (Un
574 Paisaje)' or 'Stotterin into Anthropocene' by Christine De Luca, which was written entirely
575 in the Shetlandic dialect, with the reader not presented with a translation, but rather a glossary
576 of terms (for example, that the word 'glunsh' means to 'swallow greedily'). What was
577 particularly interesting about these poems was that the author had clearly chosen to write
578 sections of the poem in a language other than English as it enabled them to more fully
579 express what it was that they meant to say about climate change.

580
581 In considering the emergent category of language across these poems, it is evident that using
582 only a singular official language (i.e. English) or technical language (i.e. science) is not
583 sufficient to interpret and communicate the causes and consequences of climate change, and
584 that by doing so we are at risk of ostracising those communities that are not fluent in these
585 chosen languages. English-speaking status has been shown to be a limiting factor in
586 participating in the IPCC (Ho-Lem et al., 2011), whilst many studies often omit non-English
587 research when conducting large-scale research into barriers to climate change adaptation (see
588 e.g. Biesbroek et al., 2013). These poems suggest that by restricting the *lingua franca* of
589 climate change to scientific English, it is perhaps not surprising that it is discussed less
590 widely than is needed for meaningful action to take place.

591 592 **3.4 The Present**

593

594 This category considers those poems that make reference to the current state of the climate
595 change system, outside of those already emergent in the category of habitat discussed in
596 Section 3.1. Poems that were categorised as such included those that discussed the weather as
597 an interrelated aspect of the climate system, either through a specific example, as
598 demonstrated in this extract from ‘Change’ by D A Prince (Howard et al., 2018, p. 29):
599

600 But these fields are,
601 again, under water, brought
602 to the brink of drowning
603

604 Or else through the notion that something is ‘not quite right’, and that one of the ways that
605 this can be observed is through changes in the weather, as is apparent in ‘This Weather’ by
606 Siún Carden (Howard et al., 2018, p. 29):
607

608 she finds it swirling there, and she can’t say
609 she’s been herself, this weather.
610

611 In addition to the current state of the weather, this category also considered those poems that
612 made reference to the current state of pollution. The majority of poems that made reference to
613 this topic were concerned with plastics in the oceans, such as this extract from ‘There is No
614 Alternative’ by Momtaza Mehri (Howard et al., 2018, p. 56):
615

616 the future belongs to the yolky bopping heads of plastic ducks
617 green bottle caps cigarette butts everything touched by the lips
618 then cast unuttered into oceans into the pooled memory cells of the universe
619

620 There was only one mention of air pollution in any of the poems, occurring in ‘Beijing
621 Parakeets’ by David Tait: “I’ve already got a pollution headache ... the smog of Beijing
622 simmering around us.” (Howard et al., 2018, p. 11) The relative popularity of plastic
623 pollution in these poems is likely symptomatic of the increase in public attention that this
624 issue has received following the BBC TV series *Blue Planet II* and the subsequent media
625 outcry (see e.g. Kenward, 2018). In future years, such a collection of poetry might would
626 likely contain more poems on other environmental topics that had risen amongst the public
627 consciousness.
628

629 Across all of the poems, only two of them made reference to an actual historical event and in
630 both instances, these referred to storms. In ‘Howling Wind’, Patrick Sylvain observes how
631 “Hurricane Matthew broke spines already fractured” (Howard et al., 2018, p. 26), while in
632 ‘Tip #5 What not to say whilst online dating’, Helen Moore recalls a recent storm in Bristol,
633 remarking that (Howard et al., 2018, p. 60):
634

635 Beaufort 9 bludgeoning Bristol, pounding the city
636
637 like WWII was recurring. On the Harbourside,

638
639 gales chucking slops at houseboats, yachts,
640 clinking masts like Chinese businessmen gan bei-ing a deal
641

642 It should be noted that while one of these poems recalls a well-known global event
643 (Hurricane Matthew was the storm that caused catastrophic damage and a humanitarian crisis
644 in Haiti in the Autumn of 2016) and localises it to the frame of reference of the reader, the
645 other makes reference to a localised storm and contextualises it with reference to a global
646 event (WWII), thereby highlighting the ability of the poet to interpret and frame the
647 principles and effects of climate change in order to communicate to the reader.
648

649 The poems in this category also consider the general effects of climate change in terms of
650 things being either broken or killed, not in terms of specific fauna or flora (see Section 3.1)
651 but rather a general sense of death and destruction, as evidenced by the following line from
652 ‘Beaufort Scale for Depression’ by Rachel Mead (Howard et al., 2018, p. 28): “Widespread
653 structural damage. Zero visibility. This is the point of collapse, the black hole.”
654

655 This category highlights the ‘messy’, interrelated nature of climate change, and demonstrates
656 that poets are not afraid to discuss several different systems (climate change, weather,
657 pollution, etc.) in order to communicate to their audience. While scientists are often at pains
658 to point out the differences between weather and climate, and the confusion that such a
659 misunderstanding can entail (see e.g. Weber and Stern, 2011), it is also true that beliefs in
660 climate change are affected by local weather conditions (Li et al., 2011). By presenting
661 changes in both the weather and climate alongside one another, the poets are aiming to reach
662 out to their audience and ground them in a language that they understand rather than to
663 confuse them or cut off from a particular line of enquiry. By not allowing such interrelated
664 discussions to take place (confusing as the may sometimes be), there is also the argument that
665 a non-scientific audience is being denied access to solutions from an interrelated field. One
666 such example is the success of the Montreal Protocol in tackling the Ozone Layer (Oberthür,
667 2001), as while it has been shown that a non-scientific audience often confuses stratospheric
668 ozone depletion with the greenhouse effect (Bostrom et al., 1994), presenting the Montreal
669 Protocol as an exemplar of how government policy can engender positive environmental
670 change on a global scale, can help to present some of the potential solutions to the climate
671 change issue that these poems have highlighted as being less than readily available (see
672 Section 3.2), thereby overcoming one of the potential barriers to dialogue.
673

674 **3.5 Our Future** 675

676 In contrast to the previous category, this final category is one that emerged as a result of
677 poems that discuss possible futures that might arise as a result of the current climate system.
678 There is a large range of temporal scale in these poems, with some imaging the fallout of a
679 climate catastrophe in a not-too-distant future, such as that presented in this extract from
680 ‘There Is No Alternative’ by Momtaza Mehri (Howard et al., 2018, p. 56)
681

682 The Alliance of Small Island States were the earliest to disappear
683 the shepherds were the last the gospel preachers of accumulation had nowhere to go
684 they were too busy competing with the skies to notice them folding in
685
686 Whilst others are grounded in a future quite markedly different from our current state, such as
687 ‘Theft-saving’ by Amaan Hyder, who imagines a future where (Howard et al., 2018, p. 63):
688
689 You fly a distance of twenty planets
690 to a zoo to see your first animals,
691
692 pure as the night their ancestors were taken,
693 beamed up out of extinction.
694
695 And others much further still, with ‘I was human once’ by Ama Bolton considering the Earth
696 system many years from now when there are no humans left at all (Howard et al., 2018, p. 8),
697 and where:
698
699 through centuries of firestorm
700 when things cool down I’ll know it’s time
701 to spin the whole unholy yarn
702 all over again
703
704 Whilst these poems create the framework for a future Earth based on a variety of different
705 scenarios, other poems also reflect on the ‘consideration of the future’ itself, and how useful
706 (or not) this might be in combatting climate change. This extract from Sarah Gridley’s
707 ‘Diabolical Clouds Over Everything’ being a particularly powerful rallying call against the
708 inaction that can sometimes arise from over-pontification (Howard et al., 2018, p. 97):
709
710 No one will draw in the future. Soon
711 we will stop having to ask,
712
713 What must the future hold?
714
715 Aside from discussions of imagined futures for the Earth system and humans in general, the
716 poems in this category also make specific reference to children and their relationship with
717 both ourselves and nature. Some of these poems focus on what we choose and have chosen to
718 leave behind as an inheritance, such as in ‘Estate’ by Steve Kendall (Howard et al., 2018, p.
719 96):
720
721 To our children
722 we bequeath the promises we made, their rightful solitude
723
724 Other poems consider the responsibilities that we have for our children’s current and future
725 wellbeing, as evident by the line “I would like my children to feel safe” in Kathryn Maris’ ‘A

726 way of managing diversity' (Howard et al., 2018, p. 58). By asking the reader to consider the
727 future implications of climate change on future generations these poems support the narrative
728 that many members of the public consider providing a better life for future generations to be
729 the most important motivator in taking action against climate change (see e.g. Leiserowitz et
730 al., 2009). As noted by Pahl et al. (2014), in order for people to acknowledge the future
731 implications of their current lifestyles and community choices, it is first necessary to improve
732 how we engage them in envisioning the future, and as is demonstrated here poetry provides
733 one potential way for providing this engagement.

734

735 **3.6 An Emerging Theme**

736

737 In considering these categories in the context of RQ1 ("how have poets interpreted the, at
738 times, esoteric principles of climate change?"), a clear theme emerges: the central role that is
739 occupied by humankind. This role concerns how we as humans have accepted our past, how
740 we are moulding our future, the extent to which we are defending and destroying our shared
741 habitat with nature, and how we determine both the language of communication and
742 appropriate reactions.

743

744 This positioning of humans in the epicentre of the climate change debate might at first be
745 seen to be somewhat egotistical or even narcissistic. Just as the famous philosophical thought
746 experiment asks 'if a tree falls in a forest and no one is around to hear it, does it make a
747 sound?' to some extent these poems ask us to consider 'if the climate is changed but no one is
748 around to measure it, does it actually change?' There is an arrogance here, but in addressing
749 RQ2 ("What does this tell us about how scientists can talk about climate change to non-
750 specialist audiences?") it is a necessary one, i.e. that in order to establish the dialogues that
751 are needed to enact change it is vital to remind audiences of the central role that humans *do*
752 occupy in terms of both cause and effect. Without this re-positioning, there is a danger that
753 climate change will be assumed to be beyond the control and responsibility of humankind;
754 yet, as noted by Urry (2015, p. 46) it is vital to remember that climate change "is not a purely
755 'scientific' problem and that human actions are central to this apparent warming of the
756 planet." Similarly, without such re-positioning the phrase 'climate change' itself risks being
757 interpreted as a phenomenon that is passively happening, rather than something that we, as
758 humans, are both causing, and are thus ultimately responsible for mitigating.

759

760 Whilst studies such as those conducted by O'Neill and Nicholson-Cole (2009) have shown
761 that fear is generally an ineffective tool for motivating genuine personal engagement, failing
762 to remind people of the role that humans have played in causing climate change, and the role
763 that they must now assume in mitigating against it, is arguably equally ineffective in
764 establishing the dialogue that is first needed before meaningful action can take place. In the
765 foreword to the poem 'Sample Basket Red List 2318', Jen Hadfield writes that (Howard et
766 al., 2018, p. 68):

767

768 To approach the global crisis we need to attend to the local crisis. Isn't approaching
769 the global crisis by addressing local specificity one of the things poetry is best at?

770

771 By acting as modern-day hierophants, this study argues that poets can highlight to scientists
772 and communication experts the challenges to engendering individual and collective action on
773 the topic of climate change. These findings manifest themselves in a need to re-position
774 humans at the centre of the climate change debate, and in so doing to consider the use of a
775 language that is localised and personal, to help broaden the conversation to every human.

776

777 **4. Conclusions**

778

779 By acknowledging that there is a lack of dialogue around climate change amongst a non-
780 specialist audience, this study set out to ask “how have poets interpreted the, at times,
781 esoteric principles of climate change?” (RQ1) and in doing so to determine “how might these
782 interpretations be used to better personalise the debate around climate change so that it is
783 discussed more widely?” (RQ2). By conducting a detailed qualitative content analysis on a
784 selection of climate change poetry, a number of categories emerged with regards to the poets’
785 interpretation of the topic, with ‘Habitat’, ‘Reactions’, ‘Language,’ ‘The Present’, and ‘Our
786 Future’ all being underpinned by an emergent theme of the need to re-centre climate change
787 around humankind.

788

789 In considering future communications around climate change, this study recommends that the
790 role of humankind in causing and potentially mitigating climate change is made explicit, and
791 that in doing so scientists and communication experts consider carefully the language that is
792 being used. In particular, it is vital to determine if a monopoly of English and/or technical
793 scientific language is at risk of de-personalising the topic, thereby making it less likely to be
794 discussed. In considering how poetry might offer a different perspective to science in
795 interpreting climate change and its effects, future studies might also wish to consider the role
796 of emotions (see e.g. Smith and Leiserowitz, 2014;Roeser, 2012). particularly with respect to
797 establishing a common language.

798

799

800 This study has also outlined how poems might be used as a form of data to provide further
801 insight into the interpretation of scientific topics by non-specialists, and how such
802 interpretations might lead to recommendations to establishing a dialogue with such an
803 audience. The main limitations of this method are via the potential for bias in either the
804 selection of the poetry or in the coding and subsequent analysis. However, by selecting a
805 broad range of independent poetry (as was done here) and taking care to outline the
806 transparency of such an approach (for example by carefully describing the relationship
807 between emergent codes, categories, and themes), the trustworthiness of this method can be
808 established. While the poetry that was used for this analysis was selected because of its broad
809 range, there is a potential limitation introduced by the relative exclusivity of submitting to
810 poetry journals such as *Magma*. While *Magma* does not charge poets for submitting to their
811 magazine (as was the case for ‘The Climate Change Issue’), this is not the case for other
812 journals. Furthermore, submitting work to poetry journals requires a certain level of cultural
813 literacy that may risk excluding a range of diverse voices from contributing.

814

815 In order to further explore the importance of language a future study that investigated the
816 interpretation of poetry written in multiple languages and dialects would be conducive;
817 however, such an interpretation would be reliant on a multilingual research team and/or
818 translation of the poems that had been sanctioned by the poet. Future studies would also
819 benefit from multiple colleagues undertaking the content analysis that has been described in
820 this paper, as doing so would better recognise potential differences in any interpretations,
821 thereby improving the triangulation of the coding and subsequent analysis. Such future

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822 studies might also consider poetry that is being written by scientists to help interpret climate
823 change, for example the work of Rachel McCarthy (McCarthy, 2015). This approach would
824 also be conducive in helping to dismiss the notion that poetry and science are mutually
825 exclusive rather than complementary fields of research and practice.
826

Deleted: ¶

827 At the beginning of the poem ‘Tip #5 What not to say whilst online dating’ Helen Moore
828 quotes the American poet political activist Grace Paley (Howard et al., 2018, p. 60):
829

830 It is the responsibility of the poet to be a woman to keep an eye on this world and cry
831 out like Cassandra, but be listened to this time.
832

833 In Greek mythology, Cassandra was the daughter of Priam and Hecuba and was cursed to
834 utter prophecies that were true but that no one believed. Clearly this responsibility should not
835 just lie with the poet, but in interpreting climate change for a non-specialist audience, the
836 poets that featured in this study have demonstrated the importance of re-positioning humans
837 at the very centre of the topic.

838 **Data Availability**

839 The poems that were selected for the analysis, along with their coded categories, are
840 available through (Illingworth, 2019a)
841
842

843 **Competing interests**

844 Author SI is the chief executive editor of *Geoscience Communication*.
845
846
847

849

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985

*Table 1: the codes that emerged from the content analysis. *The number of occurrences is not limited to one per poem.*

Code	Description	Occurrences*
------	-------------	--------------

Fauna	Makes specific reference to mammals (other than humans), insects, birds, fish, etc.	61
Flora	Make specific reference to plants, trees, etc.	32
Mutually Exclusive	Makes specific reference to humans and nature being unable to live together in harmony.	31
Science	Makes specific reference to a specific scientific fact or piece of scientific information.	31
Acknowledgment	Makes specific reference to acknowledging that there is something wrong with the current climate system.	30
Humans	Makes specific reference to humans, not as the narrator of the poem but rather as objects that feature in it.	28
Weather	Makes specific reference to the weather.	26
Blame	Specifically attribute blame to someone / something for the current state of the climate system.	22
Death	Makes specific reference to death.	19
Spiritual	Makes specific reference to a spiritual or religious concept.	19
Children	Makes specific reference to children.	16
Other Language	Used another language (other than English) to communicate what they wished to express.	14
Pollution	Makes specific reference to pollution.	11
Hope	Makes specific reference to hope that is either present in or may arise from the current state of the climate system.	10
Future	Makes specific reference to the future.	9
Looking Away	Makes specific reference to humans looking away or being agnostic in our attitudes towards the current climate system.	9
Broken	Makes specific reference to things being broken.	7
Doubt	Makes specific reference to doubting the existence and impacts of negative anthropogenic climate change.	6
Solutions	Makes specific reference to a potential solution to the negative effects of climate change.	4
Specific Event	Makes reference to a specific event brought about / affected by climate change.	2

986

987 *Table 2: the categories that emerged, alongside their corresponding codes. *The number of*
988 *occurrences is not limited to one per poem.*

Category	Corresponding Codes	Occurrences*
Habitat	Fauna, Flora, Mutually Exclusive, Humans	152
Reactions	Acknowledgment, Blame, Hope, Looking Away, Doubt, Solutions	81
Language	Science, Spiritual, Other Language	65

The Present	Weather, Death, Pollution, Broken, Specific Event	65
Our Future	Children, Future	25

989

990 **Response to Referee 1**

991

992 Thank you for taking the time to read this manuscript, and for providing helpful and specific
 993 feedback for how to improve this work. Below I have responded to all your comments (which
 994 for ease of use I have **{written in bold}**), and indicated how I have changed the manuscript
 995 to account for these changes. Any line references refer to those provided in the { *Geoscience*
 996 *Communication Discussions*} preprint.

997

998

999 **{ Thank you very much for the opportunity to review this manuscript. I found the work
 1000 to be particularly well written, and the topic especially timely. I also appreciated the
 1001 author taking the time to set-out and give detail to the methodology that informed and
 1002 framed this research - this is often a over-looked element of qualitative research that I
 1003 believe is important with regards to interpreting the dependability of the study and
 1004 allowing reviewers like me to follow, audit, and critique the study. I also found it
 1005 particularly valuable to have lines from different poems represented within the text and
 1006 in relation to the different codes identified through the study.}**

1007

1008

1009 Thank you for such a generous and kind comment. It is very heartening to hear that this
 1010 research is appreciated, and it encourages me to continue to pursue this line of work in my
 1011 future research.

1012

1013

1014 **{ Starting on Line 79. I know the focus of the paper is on the nonexpert communicating
 1015 about climate change, but as you also note in your methodology and evaluation of the
 1016 authors of the poems in your study, sometimes scientists are poets, poets are scientists. I
 1017 wonder if you could highlight, even if just briefly in this paragraph of the introduction,
 1018 the potential value, indeed examples of, scientists who do communicate about climate
 1019 change through poetry? This has been highlighted in a related paper as one way that
 1020 they [scientists], and others, can communicate and generate dialogue about complex
 1021 topics (see Januchowski-Hartley et al. 2018 and the text about scientists who write
 1022 poems in relation to their research and even their interpretations of climate reports).
 1023 Perhaps this only warrants a brief mention in the introduction, and potentially then also
 1024 revisited in your conclusion section, as noted below. I believe it is important that we not
 1025 make an unnecessary dichotomy between scientists and poets, and as you found in your
 1026 study, these people do exist, and it is possible that even others who were not explicit
 1027 about their professional life in their author bio are also scientists (here in the broadest
 1028 sense).}**

1029

1030

1031 Thank you for raising this important issue. It is of course very important to highlight that
 1032 several scientists also write poetry and that these two identities are not mutually exclusive. In
 1033 order to better address this point, I have inserted the following lines of text in the manuscript
 1034 after Line 90 (in the Introduction):

1035

1036
1037 The purpose of this research is not to introduce a mutual exclusivity between scientists and
1038 poets, as there are many examples of scientists for whom poetry is an integral part of their
1039 practice (Illingworth, 2019b), and who do a commendable job of communicating their
1040 research (and the research of others) through poetry (see e.g. McCarty, 2014; Januchowski-
1041 Hartley et al., 2018 and references therein). Rather, this research seeks to investigate how
1042 poetry (as opposed to science) has been used to interpret climate change, and how this might
1043 then be used to re-consider the ways in which science also engenders dialogue around this
1044 topic.

1045
1046
1047 **{ Starting on Line 779. Here I think you could potentially highlight how poetry can be**
1048 **used as a venue/method/or conduit for diverse people, including scientists, to establish a**
1049 **dialogue amongst each other. The paper referenced above by Januchowski-Hartley et**
1050 **al. 2018 also highlighted the value for scientists, and indeed those learning science, to**
1051 **include poetry in their practice and lives to engage with the topics they work on (or**
1052 **learn about) and to communicate about those topics in broader dialogues. I noted above**
1053 **that it would be a shame to segregate out scientists, not all scientists are climate**
1054 **scientists either, from consideration of non-specialists. I do appreciate that you retained**
1055 **those people in the study who did self-identify as scientists.}**

1056
1057
1058 This is a very important point, as poetry is indeed a very powerful conduit for establishing
1059 dialogue between diverse people, including between scientists and non-scientists. This has
1060 been explored in several of my other research papers (see e.g. Illingworth and Jack,
1061 2018; Illingworth et al., 2018), which I also reference in the Introduction to this manuscript.
1062 However, the purpose of this study was not to investigate the potential for poetry to act as an
1063 active conduit, but rather to investigate how poets (who were mainly non-scientists) have
1064 interpreted the, at times, esoteric principles of climate change. Therefore, whilst I absolutely
1065 agree with your statement (and indeed base much of my research ethos on this), I believe that
1066 in this instance including a further exploration of this would be extending beyond the
1067 research design of this particular study.

1068
1069
1070 **{ Perhaps my above point also links into your closing paragraph. You could link to /cite**
1071 **related works where scientists, particularly climate scientists, are also using poetry (and**
1072 **visual artwork) to interpret climate change; that can be interpreted as being for non-**
1073 **specialist audiences and move toward broadening the dialogue. I leave it for you to**
1074 **consider; I thought it potentially strengthens or broadens your closing argument.}**

1075
1076
1077 Again, I absolutely agree with this point and whilst it is not the main focus of this study it is
1078 certainly worth highlighting, as such the following text has been inserted into the manuscript
1079 at Line 790:

1080
1081
1082 Such future studies might also consider poetry that is being written by scientists to help
1083 interpret climate change, for example the work of Rachel McCarthy (McCarthy, 2015). This
1084 approach would also be conducive in helping to dismiss the notion that poetry and science are
1085 mutually exclusive rather than complementary fields of research and practice.

1086
1087
1088 { Finally, I do see value in multiple colleagues undertaking the content analysis; even if
1089 conducting separate content analyses and then comparing the messages that emerge.
1090 Perhaps this is an additional direction that could be pursued in future works that you
1091 or others lead. This would be valuable in also recognizing different people's
1092 interpretations of poems, because after all, 'Do nothing to a poem that it never was
1093 written to have done to it' (Robert Frost), and whatever our interpretations are of a
1094 poem, are potentially not those of what the author intended. This could also suggest
1095 some potential value in a follow-up study that couples content analysis with interviews
1096 [of poets] (though I recognize some poets might not be comfortable with that).}
1097
1098
1099 I am in complete agreement that multiple colleagues undertaking the content analysis would
1100 be of benefit for future research direction. As such I have inserted the following text into the
1101 manuscript directly after Line 787:
1102
1103
1104 Future studies would also benefit from multiple colleagues undertaking the content analysis
1105 that has been described in this paper, as doing so would better recognise potential differences
1106 in any interpretations, thereby improving the triangulation of the coding and subsequent
1107 analysis.
1108
1109
1110 { References}
1111
1112
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1117
1118
1119 Illingworth, S., and Jack, K.: Rhyme and reason-using poetry to talk to underserved
1120 audiences about environmental change, { Climate Risk Management}, 19, 120-129,
1121 <https://doi.org/10.1016/j.crm.2018.01.001>, 2018.
1122
1123
1124 Illingworth, S.: { A sonnet to science: scientists and their poetry}, Manchester University
1125 Press, Manchester, UK, 2019.
1126
1127
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1129 Oester, S.: Poetry as a Creative Practice to Enhance Engagement and Learning in
1130 Conservation Science, { BioScience}, 68, 905-911, 2018.
1131
1132
1133 McCarthy, R.: { Element}, Smith/Doorstop, Sheffield, UK, 2015.
1134
1135

1136 McCarty, V. M.: Poetry, Science and Truth: The Case of Poet-Scientists' Miroslav Holub and
1137 David Morley, { Interdisciplinary Science Reviews}, 39, 33-46, 2014.
1138
1139

1140 **Response to Referee 2**

1141 Thank you for taking the time to read this manuscript, and for providing helpful and specific
1142 feedback for how to improve this work. Below I have responded to all your comments (which
1143 for ease of use I have { **written in bold**}), and indicated how I have changed the manuscript
1144 to account for these changes. Any line references refer to those provided in the { *Geoscience*
1145 *Communication Discussions*} preprint.
1146
1147

1148 { **The role of emotions in science communication is not explicitly addressed but seems to**
1149 **be critical. Here, further reference to current research on the role of emotionality in**
1150 **science communication can increase the rationale for this article. (e.g. Smith &**
1151 **Leiserowitz (2014) The Role of Emotion in Global Warming Policy Support and**
1152 **Opposition. Risk Analysis. Vol 34 (5). Doi:10.1111/risa.12140) [Line 86 to 90] Stuart**
1153 **Hall’s concept of ‘Encoding – Decoding’ can help to shed light on the central problem**
1154 **discussed in this publication. While the ‘academic language’ is used by scientists to**
1155 **convince decision makers to take action against climate change, this language is not**
1156 **successfully decoded by the public. Poetry can offer a different “language” that might**
1157 **help to decode climate change from another perspective. Hall – while being somewhat**
1158 **outdated – might present a theoretical frame for this article from a social or even**
1159 **cognitive science perspective and to introduce a somewhat more critical perspective on**
1160 **the interpretation of poetry as well. Hall, S.: Encoding/decoding in Television Discourse,**
1161 **in: Centre for Contemporary Cultural Studies: Culture, Media, Language: Working**
1162 **Papers in Cultural Studies, 1972–79, Hutchinson, London, 1973.}**
1163
1164

1165 I agree that further reference to current research on the role of emotionality in science
1166 communication would help to strengthen the justification for this research. I have stopped
1167 short of using the suggested works to determine the theoretical frame for this article, as I
1168 believe that I have already provided a detailed description of the research design for this
1169 study. Whilst such a re-framing is beyond the scope of this current work, it is certainly
1170 something that would merit further investigation in a future study. As such I have inserted the
1171 following text after Line 787:
1172
1173

1174 In considering how poetry might offer a different perspective to science in interpreting
1175 climate change and its effects, future studies might also wish to consider the role of emotions
1176 (see e.g. Smith and Leiserowitz, 2014;Roeser, 2012), particularly with respect to establishing
1177 a common language.
1178
1179

1180
1181 { [Line 157 to 175] **To better understand the sample, an introduction into the readership**
1182 **of the { Magma } magazine would be helpful. Otherwise, one might wonder about**
1183 **potential social-cultural biases or a moral framing effect (maybe even some sort of**
1184 **confirmation bias) related to the overall magazine’s concept and marketing strategy.}**
1185
1186
1187

1188 This is a very good point. I have inserted the following text after Line 787 to address the
1189 potential social-cultural biases that this may introduce:

1190
1191 While the poetry that was used for this analysis was selected because of its broad range, there
1192 is a potential limitation introduced by the relative exclusivity of submitting to poetry journals
1193 such as *{ Magma }*. While *{ Magma }* does not charge poets for submitting to their magazine
1194 (as was the case for ‘The Climate Change Issue’), this is not the case for other journals.
1195 Furthermore, submitting work to poetry journals requires a certain level of cultural literacy
1196 that may risk excluding a range of diverse voices from contributing.
1197
1198

1199
1200 **{ Methodology and operationalization is very well described in chapters 2.3 and 2.4.**
1201 **Nevertheless, the description of the analytical method lacks reference to e.g. the**
1202 **thematic analysis approach, which has been critically described for example by Braun**
1203 **and Clark (Braun & Clarke (2006). Using Thematic Analysis in Psychology. Qualitative**
1204 **Research in Psychology Vol. 3 (2)).}**

1205
1206
1207 Thank you for pointing this out, I agree that an additional reference could be provided here,
1208 and as such the following text has been added after Line 222:

1209
1210
1211 A traditional approach to coding data during qualitative content analysis (see e.g. Braun and
1212 Clarke, 2006, and references therein) would be to begin by identifying meaning units in the
1213 text, condensing these down to smaller units and then labelling these units with codes.
1214
1215

1216 **{ [Line 406 to 412] A very lively discussion among anthropologists is addressed here –**
1217 **the conception of nature and the role of humans within (or outside) this concept. This**
1218 **could be addressed by referring to e.g. Habermas (2004). The Future of Human Nature.**
1219 **or Descola (2013). Beyond Nature and Culture.}**

1220
1221
1222 Thank you for bringing my attention to these studies, and the references therein. I agree that
1223 my argument in this section would be strengthened by referring to this work, and as such the
1224 following text has been inserted after Line 408:

1225
1226
1227 This analysis supports the ongoing debate in anthropology about the conception of nature and
1228 the role of humans within this concept (see e.g. Descola, 2013; Habermas, 2014).
1229
1230

1231 **{ [Line 727 to 741] I highly appreciate the critical element in this chapter, but I may**
1232 **have missed the link to the analysis of the climate related poetry. While I fully support**
1233 **the statements in this paragraph, I would like to recommend a more robust transition**
1234 **from the analysis results to the statement proclaimed. Since 3.6 represents the core**
1235 **message of this article, a sound argumentation is needed to strengthen the claim, that**
1236 **“the central role occupied by humankind” can be derived from the poetry analyzed.}**
1237

1238
1239 The emergence of “the central role occupied by humankind” came through a consideration of
1240 the five major categories that are discussed in Section 3.1 – 3.5 with respect to the RQs. The
1241 emergence of this theme is a result of the qualitative content analysis that I had described in
1242 Section 2.4, specifically Lines 226-228 and 284-286. In order to make this approach clearer I
1243 have inserted the following text after Line 286:
1244
1245

1246 In determining these emergent themes, I re-considered each of the emergent categories with
1247 respect to the RQs, looking for any commonalities and/or overlaps, in a manner analogous to
1248 the emergence of the original codes and categories that is described above.
1249
1250

1251 **{ [Lines 769 to 770] I am surprised, that there is no category dedicated to the**
1252 **actors/main characters of the poems. Especially, while you argue that all categories are**
1253 **“underpinned by an emergent theme of the need to re-center climate change around**
1254 **humankind.” Maybe you can briefly explain, while you have not focused on the actors?}**
1255
1256

1257 I agree that exploring the actors of the poems would be interesting, and indeed in my initial
1258 research design it is something that I had considered. However, I was not confident that I
1259 would be able to fully identify who the actors of the poems were in every instance, and that
1260 as such I would be introducing an additional degree of subjectivity that would potentially
1261 have weakened the reliability of the analysis. Future studies could certainly be aimed in this
1262 direction, perhaps aligned with either an interpretation of the poetry by multiple researchers
1263 (see ‘Response to Referee 1’) or a correspondence with the poets to more accurately
1264 represent the actors in the poems.
1265
1266

1267 **{ References}**

1268
1269 Braun, V., and Clarke, V.: Using thematic analysis in psychology, { *Qualitative research in*
1270 *psychology*}, 3, 77-101, 2006.
1271
1272

1273 Descola, P.: { *Beyond nature and culture*}, University of Chicago Press, 2013.
1274
1275

1276 Habermas, J.: { *The future of human nature*}, John Wiley & Sons, 2014.
1277
1278

1279 Roeser, S.: Risk communication, public engagement, and climate change: a role for emotions,
1280 { *Risk Analysis: An International Journal*}, 32, 1033-1040, 2012.
1281
1282

1283 Smith, N., and Leiserowitz, A.: The role of emotion in global warming policy support and
1284 opposition, { *Risk Analysis*}, 34, 937-948, 2014.
1285
1286
1287

1288 **Response to Referee 3**

1289 Thank you for taking the time to read this manuscript, and for providing comments on how it
1290 could be improved. Below I have responded to all your comments (which for ease of use I
1291 have { **written in bold**}), and indicated how I have changed the manuscript to account for
1292 these changes. Any line references refer to those provided in the { *Geoscience*
1293 *Communication Discussions*} preprint.
1294
1295

1296 { **I can envisage there being value in an overview and analysis of poetry with relation to
1297 the environment that uses categorisation and similar procedures, perhaps along the
1298 lines of the ‘distant reading’ methodology of the Stanford Literary Lab; or, on another
1299 track entirely, an analysis of how poetry has been or can be used in public engagement
1300 contexts, or perhaps in self-conscious collaboration with scientists and/or
1301 communicative agendas. However, the sample of work here was too small to support the
1302 first endeavour, and the second did not seem to be at issue, though the model of
1303 communication which underpinned the essay suggested this as the most appropriate
1304 context. Broadly speaking, the article requires much more nuanced framing and
1305 discussion. Even given the journal’s remit of raising awareness of the importance and
1306 value of science communication from a scientist’s point of view, and understanding that
1307 poetry is being examined within that context, the discussion here cannot avoid involving
1308 concepts, ideas and methods that are well-established in non-science fields, which bear
1309 on the discussion of poetry in any disciplinary or cultural context, and which are
1310 currently absent or insufficiently considered.**}

1311
1312
1313 I am sorry that you do not approve of the methodology that I adopted in this study. Naturally,
1314 as this is the first study of its kind I would expect there to be some criticisms of the approach
1315 that I have adopted. However, I believe that my methodology is carefully laid out and fully
1316 justified in the manuscript. I disagree that this article requires more nuanced framing and
1317 discussion, as what I have set out to do is to demonstrate how poetry might be analysed using
1318 qualitative content analysis, carefully outlying the limitations of my study, and suggesting
1319 how future endeavours might seek to build on and expand this work. Furthermore, as can be
1320 seen from the breadth of my references, this study has sought to fully engage with concepts,
1321 ideas and methods that are well-established in non-science fields.
1322

1323
1324 { **I am afraid that I found the discussion of poetry to be reductive, ahistorical and
1325 simplistic. What evidence is there for poetry being ‘something that can transcend
1326 cultural barriers’ (cf. issues of translation, cultural capital, marketing and publishing
1327 economies, etc), and why should poetry, any more than any other medium, be able to
1328 ‘contextualize and personalise a global problem’? Particularly when one imagines the
1329 tiny readership for { *Magma*} and other poetry in comparison to other mediums! How
1330 does the fact that much poetry since at least the high modernist period has been
1331 criticized for being – and in some cases deliberately has been – difficult, oblique and
1332 non-referential, relate to the presentation of it as establishing a ‘common language’? A
1333 claim which seems to unconsciously draw on Wordsworth’s 1802 Preface to Lyrical
1334 Ballads (‘a selection of language really used by men’, etc), but struggles to account for
1335 much of the actual writing, publishing and reception of poetry since that time. A single
1336**}

1337 issue of { *Magma* } is not sufficient to prove the overarching argument claimed – which
1338 would need to be revised to at least take into account the particular nature of that
1339 publication and of poetry magazine publication more broadly (readership, aesthetic,
1340 and so on). There exist many other collections of environmental poetry which would
1341 deepen the context for this argument, and also greatly complicate it (e.g. *The Ground*
1342 *Aslant*, ed. Harriet Tarlo; *The Thunder Mutters: 101 Poems for the Planet* ed. Alice
1343 Oswald). More incidentally, but perhaps still tellingly, Shelley’s treatise was written in
1344 1821 and published in 1840 (unlike your edition) – and the original historical context in
1345 which the poem was written goes a long way towards explaining its thinking and intent,
1346 which has since undergone, it is an understatement to say, considerable discussion,
1347 revision and contestation}

1348
1349

1350 I apologise for any offence that I have caused in my discussion of the poetry in this research
1351 study, it was certainly not my intent to cause any ill harm.

1352
1353

1354 With regards to the limitations of using a single issue of { *Magma* }, I believe that I have fully
1355 identified these limitations in the manuscript. However, as noted in my response to Referee 2,
1356 restricting this study to the poems that featured in ‘The Climate Change Issue’ does introduce
1357 a limitation to the study. I have now addressed this by inserting the following text after Line
1358 787:

1359
1360

1361 While the poetry that was used for this analysis was selected because of its broad range, there
1362 is a potential limitation introduced by the relative exclusivity of submitting to poetry journals
1363 such as { *Magma* }. While { *Magma* } does not charge poets for submitting to their magazine
1364 (as was the case for ‘The Climate Change Issue’), this is not the case for other journals.
1365 Furthermore, submitting work to poetry journals requires a certain level of cultural literacy
1366 that may risk excluding a range of diverse voices from contributing.

1367
1368

1369 Thank you for your helpful comment regarding Shelley’s { *A Defence of Poetry* }. The edition
1370 that I was using was from 1890 (not 1840), although I have amended the text so that the
1371 reader is fully aware of the providence of the text. The following text now appears in Line
1372 72:

1373
1374

1375 In his treatise *A Defence of Poetry* (written in 1821 and first published posthumously in
1376 1840), the English Romantic poet P.B. Shelley (1890, pp. 46) wrote that:

1377
1378

1379 **{ While the coding of poems by categories might potentially yield some useful analysis, I**
1380 **do not think it is sophisticated or subtle enough here to answer ‘RQ1: how have poets**
1381 **interpreted the, at times, esoteric principles of climate change?’ (140). Perhaps it is**
1382 **simply a case that the RQ needs rephrasing, but there are basic questions here that are**
1383 **being conflated, perhaps the most pressing of which is: can the poets’ interpretations of**
1384 **climate change (and surely the more appropriate word would be something like**
1385 **‘renderings’ or ‘representations of’) be assumed to be identical with those of readers?**
1386 **And as the answer is surely ‘no’, where does that leave the communication argument?**

1387 **Complex questions of poetic functioning, representation and of reading/interpretation**
1388 **are being overridden.}**

1389
1390
1391 Thank you for your comments, but what you are proposing is a completely different research
1392 project to the one that I have designed and carried out. I appreciate the time that you have
1393 taken in reading and critiquing this manuscript, but it is clear that I have not conducted a
1394 study in the way that you would have done yourself if you were also conducting a similar
1395 investigation. As such I must respectfully disagree with your comments, as we clearly have a
1396 fundamental difference of opinion with regards to the research design that I have adopted,
1397 and which I have subsequently fully justified in the manuscript.

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1400 **{ It is unclear to me whether sections of poems could be and were multiply categorized.**
1401 **For instance, ‘But these fields are, / again, under water, brought / to the brink of**
1402 **drowning’ was mentioned for being categorized as ‘the present’, but is it not also**
1403 **‘reaction’ and ‘habitat’? More broadly, the categorizing needs to be much tighter and**
1404 **more targeted to be operable. For instance, ‘Reactions’, ‘those poems that explore the**
1405 **reactions that humans have towards climate change’ – it is hard to see how any poem**
1406 **dealing, however tangentially, with climate change wouldn’t fall into this category? The**
1407 **positioning of the extracts from the poems narrows down the possible complexity of the**
1408 **questions under discussion, and of the extracts themselves. A minor instance: the author**
1409 **states that poets ‘had clearly chosen to write sections of the poem in a language other**
1410 **than English as it enabled them to more fully express what it was that they meant to say**
1411 **about climate change’, but other possible reasons can surely be envisaged (e.g. questions**
1412 **of cultural capital, identity formation, deliberate estrangement of Anglophone reader**
1413 **etc.).}**

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1416 You have highlighted here what I agree is the main limitation of this study, i.e. that additional
1417 researchers conducting their own content analysis and creating their own codebooks would
1418 improve the triangulation of the analysis that I provide, and that multiple colleagues
1419 undertaking the content analysis would be of benefit for future research direction. As such I
1420 have inserted the following text into the manuscript directly after Line 787:

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1423 Future studies would also benefit from multiple colleagues undertaking the content analysis
1424 that has been described in this paper, as doing so would better recognise potential differences
1425 in any interpretations, thereby improving the triangulation of the coding and subsequent
1426 analysis.

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1430 **{ The conclusions reached were rather anticlimactic and commonplace. For instance, is**
1431 **it news to anyone that ‘using only a singular official language (i.e. English) or technical**
1432 **language (i.e. science) is not sufficient to interpret and communicate the causes and**
1433 **consequences of climate change, and that by doing so we are at risk of ostracising those**
1434 **communities that are not fluent in these chosen languages’ (564-8)? The question of**
1435 **communication is reduced to the overly narrow purview of issues such as language**
1436 **(which is in any case too casually categorized and understood – there are very many**

1437 theories of poetic language which needed to be taken into account here, e.g. Jakobson's
1438 Functions of Language, 1960, itself much contested since) and subject matter; and more
1439 consideration surely needs to be given to questions of ideology and its formation and
1440 perpetuation, within with communication takes place. The idea that climate change 'is
1441 discussed less widely than is needed for meaningful action to take place' (572-3)
1442 obscures the fact that climate change is surely discussed very widely and with great
1443 frequency (see any newspaper), and the implication that more meaningful action awaits
1444 better communication needs at least some reflection and justification, and probably
1445 qualification.}

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1448 Again, I apologise that the conclusions that I reached in this manuscript, were in your opinion
1449 'commonplace' and 'anticlimactic'. I must once again respectfully disagree with your
1450 commentary, as I believe that throughout this manuscript I have clearly evidenced both the
1451 research design and the subsequent analysis. Furthermore, I believe that the findings of this
1452 study will be of genuine use to people who are communicating climate science to diverse
1453 audiences, and that furthermore (as discussed at length in the manuscript), that this study
1454 provides a sturdy framework for people wishing to adopt a similar approach to analysing
1455 poetry using such an approach in the future – the commentary from the other referees would
1456 suggest that there is value in this, although I fully understand that this is not an opinion that
1457 you share.

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1459 { References}

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1461
1462 Shelley, P. B.: { *A defense of poetry*}, Ginn, 1890.
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