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Title: Climate Knowledge or Climate Debate? Using Word Embeddings and Critical Discourse Analysis to Compare Expert and Media Representations of Climate Knowledge

Abstract:

Although scientists and activists have been sending warnings on the evolution of climate change and its potential risks since the 1970s, it is widely recognized that climate action so far has been insufficient to remain under the critical threshold of 2°C increase. As they participate in the mediatization of science and therefore in making knowledge accessible to lay audiences, the media have the potential to play a crucial role in raising awareness to climate change and climate action. However, this popularization process usually implies a certain degree of transformation of experts' discourses (Nikitina 2020), for instance through selecting certain types of information at the expense of others, thus promoting specific representations or ideologies. As they are amenable to be used across various types of discourses and to evolve accordingly, terms constitute indexes to evaluate this transformation process and to access the representations which emerge as a result. While media coverage of climate change has been shown to imply selective knowledge and meaning transformation (Carvalho 2007; Brand & Brunnengräber 2012; Kunelius & Roosvall 2021), studies assessing the potential for climate experts' terminology to acquire ideological undertone as it enters mediatic discourses are still scarce. Through this article, we thus aim to compare the meaning climate experts and the media give to terms pertaining to climate change and to determine whether potential cotextual variation between the two communities has ideological implications. Exploiting the distributional hypothesis and the idea that cotext informs meaning (Harris 1954), we use the deep learning algorithm Word2vec (Mikolov *et al.* 2013, González Granado *et al.* 2021) to identify terms whose cotext of occurrence is prone to high variability according to whether it is included in a newspaper corpus on climate change or one composed of reports from intergovernmental organizations. We then rely on statistical tools from corpus linguistics to extract the principle co-occurrences of three of the terms thus identified – *adaptation* and *energy security* –, which we compare with one another and with co-occurrences found in terminographic discourse. Finally, we combine this quantitative approach with Critical Discourse Analysis by performing a manual analysis of concordance lines of frequent cotexts (Baker *et al.* 2013) to interpret the variation in terms of meaning and ideological significance. Results suggest that the appropriation of expert terminology by the media does entail a certain degree of conceptual variation, which notably seems to allow for bringing issues of social justice, financing and energy transition into focus and assessing expert knowledge along those lines.

Introduction

As carriers of knowledge, terms play a crucial role in the mediatization of science. Yet the circulation of terms is not without consequences for their conceptual content, which tends to lose determinacy or vary according to the discourse it appears in. This phenomenon, referred to as *determinologization* (Meyer and Makintosh 2000, 199) among other labels, can have

several implications when it comes to climate change. First, one might wonder whether it is an obstacle to the diffusion of knowledge around this topic and to the conscientization that can lead to climate action. Secondly, it raises questions as to the motivations behind this process: can it be related to specific stances on climate-related matters? Are these stances specific to certain types of discourse? If so, studying terms across different types of discourse might provide a more thorough picture of the climate crisis than concepts alone, allowing one to apprehend this phenomenon not only through expert knowledge but also through how this knowledge is appropriated, reformulated and debated by various discourse communities.

This article thus aims at participating in this enterprise by identifying terms that have a propensity to see their meaning vary as they circulate between expert and media discourses on climate change, and by accounting for the potential ideological implications of such variation. To do so, we rely on a mixed methodology that combines word embeddings, corpus linguistics (CL) and Critical Discourse Analysis (CDA) and use these tools to compare the cotexts of key terms in reports by intergovernmental organizations and in newspapers articles. The modalities and motivations of the variation thus observed are then accounted for through two case studies, as we apply CL and CDA tools to analyze the discourses around the terms *adaptation* and *energy security* more thoroughly.

1. The media, the experts, and the diffusion of climate knowledge

Originally confined within the sphere of science where it was conceived as a physical phenomenon, climate change has become a transdisciplinary question if not a debate, as suggested by the title of Mike Hulmes' book, *Why we Disagree about Climate Change* (2009). Documenting different perspectives that have emerged on climate change since the early days of its study, the author demonstrates the kaleidoscopic nature of this phenomenon, which has been apprehended differently over time and across communities. In this section, we would like to draw attention to two types of actors that have participated in shaping this kaleidoscope each in their own way, namely climate experts and the press.

As the boundaries defining the category « climate experts » are fuzzy, one will here consider intergovernmental organizations (IGOs) – including the IPCC – as prototypes: composed of scientists who assess scientific findings on climate change and diffuse them through reports published at regular intervals, the latter has come to be considered as the « official expert » on climate change (Mauger-Parat & Péliz 2013, 2). As for other IGOs, such as the World Bank or the World Meteorological Organization, they have played a crucial role in providing institutional tools for the political apprehension of climate change on the global stage, while also publishing regular scientific reports to account for the evolution and the potential consequences of this phenomenon. Altogether the reports produced by these various institutions have become repositories of knowledge on climate change.

An instance of mediation of specialized knowledge (Moirand 2004, 84; Peynaud 2018, 1-2), the press plays a key role in relaying expert knowledge on climate change to lay audiences and in legitimizing climate science in public opinion (Mauger-Parat et Peliz 2013, 369). Its coverage of this topic has yet not been linear and homogeneous, sometimes unquestionably

embracing scientific findings, sometimes showing various degrees of skepticism regarding the very existence of climate change, its anthropogenic origin, or the actions necessary to apprehend it (Carvalho 2007). Climate change knowledge publication by the press has thus been shown to imply a variety of framings (Peypaud 2018 ; Hulmes 2009, 65, 67, 226 ; Carvalho 2007; Ereaut & Segnit 2006, 2007), which can be motivated by the ideological culture of the given newspaper, readership preferences, market demand, competition with other newspapers, as well as the broader societal context (Gotti 2014, 27). In fact, these different framings can be described as necessary consequences of the recontextualization of science (Fairclough 2003, 51), a phenomenon which refers to the transformations entailed by moving a material from one context to another (ibid.).

As building units for specialized discourses on the one hand, and carriers of knowledge on the other, terms also constitute a scale at which such recontextualization can be observed. This can materialize through the denomination chosen to refer to a concept or at the level of the concept itself, which might become more specific or broaden as it enters media discourses, as it takes up specific connotations. In the field of climate change, the first phenomenon can be illustrated by the competing denominations *global warming* and *climate change*, which tend to be associated with different framings and consequently to mobilize different audiences (Benjamin *et al.* 2016). In the same manner, a concept such as *carbon* (Nerlich & Koteyko 2009; Koteyko *et al.* 2010) as well as the prefix *eco-* (Dury 2008) have been shown to lose part of their specialized meaning as they enter media discourses, thus illustrating the recontextualization of concepts, or more specifically *determinologization*, whereby the meaning of a term dilutes as it attracts public attention (Meyer et Mackintosh 2000, 205). This « dilution » (ibid.) tends not to be neutral, as the term might acquire connotations and ideological undertones: studying the appropriation of the concept of *gene editing* by the media by looking at its semantic prosody in discourse, Nikitina (2020) for instance showed that the latter could be described as a form of enhancement on the one hand or as a dangerous technology on the other, thus exhibiting both positive and negative connotations. In spite of these findings, studies on the phenomenon of determinologization in the context of climate change discourses such as that of the media remain sparse, usually documenting it at the level of one to two terms selected *a priori*. Glossaries specifically designed to account for climate change terminology¹ provide one with full lists of terms potentially subjected to the same phenomenon, which are yet to be studied. More importantly, there is a need to better understand the motivations and potential ideological implications of this phenomenon, as they tend to both reflect and shape public opinion and as such influence the actions that might be seen as acceptable or not in response to climate change.

¹ Those which accompany each IPCC report since 1992 as well as that of the International Union for Conservation of Nature (IUCN) (<https://portals.iucn.org/library/sites/library/files/documents/2011-118.pdf>) or of the United Nations Framework Convention on Climate Change (UNFCCC) (https://unfccc.int/resource/cd_roms/na1/ghg_inventories/english/8_glossary/Glossary.htm) are notable examples.

2. Theoretical and methodological framework: word embeddings, corpus linguistics and Critical Discourse Analysis

2.1. A « methodological synergy »²

The perspective from which terms are studied in this article is that of socioterminology, defined as a subfield of terminology that considers the circulation of terms and knowledge across various types of discourses and the various forms of variation that might be associated with this phenomenon (Delavigne & Gaudin 2022). The type of variation we focus on in this study is semantic variation between a specialized and non-specialized community, which corresponds to the result of the process of determinologization defined previously. Therefore, the definition of *semantic variation* considered here does not pertain to polysemy – whereby a single denomination is used to refer to two different referents – but to differences in the way one single referent is conceptualized and described in discourse while being designated by the same denomination.

Operating within this framework, our aim is to identify the terms that are the most likely to see their meaning being negotiated as they enter non-specialized discourses such as the general press³, and to account for the ideological implications of this process, as we hypothesize that this recontextualization of the terms and of the knowledge they carry is not neutral. As such, one does not start from terms selected *a priori*, but from a set of all the terms on climate change shared by the press and by climate experts. This implies starting with a potentially large set of data, before zooming-in to account for concept transformation at the level of specific terms.

To account for these two scales, we rely on Corpus-assisted Discourse Analysis (Nikitina 2020; Baker *et al.* 2008; Partington *et al.* 2004), a methodological framework that combines Corpus-linguistics tools with Critical Discourse Analysis (Stubbs 1994, 212; Fairclough & Wodak 1997). This mixed-method has successfully been used to study specific concepts and the connotations they might be associated with in discourse, for instance to account for the conceptualization of refugees and asylum seekers (Baker *et al.* 2008), gene editing (Nikitina 2020), mental illnesses (Price 2022) or for discourses on Wahhabism (Salama 2011). Drawing on these articles, we most specifically rely on a comparison of the most specific collocates of the terms under study in an expert and a press corpus, and combine it with a detailed analysis of concordance lines and of the broader context of occurrence of those terms. Yet, the object of these studies are pre-selected terms, for which the researchers had the intuition that they might indeed undertake ideologically-motivated semantic variation, while we start from the assumption that any term can potentially be subject to such variation.

2.2. Word embeddings using Word2vec

In order to identify the terms that are the most likely to see their meaning vary in discourse, we resort to word embeddings, which rely on the distributional hypothesis (Harris 1954) to provide a representation of words' meaning based on their contexts of occurrence. This

² We borrow this expression from Baker *et al.* (2008).

representation – or *vector* – can then be compared with that of other words based on their location within a vector space: thus, a large distance between the vectors of two words would indicate strong differences between the cotexts of occurrence of those two words and, by extension, between their respective meanings. In our case, the two words at stake would be a single term but considered in two different discourses, one representing climate expertise and another accounting for its use in the media. As such, word embeddings have been used to compute semantic similarity in the domain of law (Sugathadasa *et al.* 2017), computer science (Mishra & Sharma 2019) or biomedicine (Pedersen *et al.* 2007) among others.

An algorithm that facilitates the extraction of word embeddings is Word2vec (Mikolov *et al.* 2013), which uses a neural network model to automatically learn word vectors from corpora (Gonzales Granado 2021, 61; Mikolov *et al.* 2013). It can do so relying either on the CBOW (« continuous-bag-of-words ») approach, whereby the term under study (henceforth, *node*) is predicted by calculating the sum of the vectors of its collocates, or Skip-gram, whereby it is the cotext of the node which is predicted, from its own vector (*ibid.*).

The efficiency of each of these two approaches tends to depend on the characteristics of the corpus under study, especially for units which have a low frequency (Denigot & Burnett 2021: 298-299, 302). Word embeddings extracted from a small corpus can be influenced by the specific views and ideologies that characterize the latter, and thus represent those views rather than a more universal version of the meaning of the words. However, this bias is in fact of interest in our study, as we want to account for the way these views influence the meaning of a given term when the latter is used by non-specialists. Thus, we hypothesize that a large semantic distance between the word vectors of a given word in two different corpora is indicative of a difference in the way that word is used by the communities represented by these corpora, and that this difference might be ideologically motivated. Conversely, extracting word embeddings and measuring the distance between them can be a first step to identify ideological undertones in the way terms are used in certain discourses.

2.3. Critical discourse analysis

For the more qualitative part of our study, which notably implies interpreting the word vectors thus obtained, we rely on a methodology based on Critical Discourse Analysis (Stubbs 1994, 212; Fairclough & Wodak 1997). This implies taking into consideration « social, political, historical and intertextual contexts, which go beyond analysis of the language within texts » (Baker *et al.* 2008, 273–4). In order to account for this broader context, we will consider the genre of the texts under study and the professional culture of the communities that produced them, and assess how they might influence discursive choices. For the textual level, we will analyze specific collocates in discourse using concordance lines and looking at their broader cotext of occurrence, i.e. at the scale of a whole paragraph or article. We will more specifically pay attention to predicative strategies (« what traits, qualities and features are attributed to them across the corpora? », Nikitina 2020, 56) and analyze the prosody associated with the latter, be it the connotations implied by a given collocate or those emanating from the broader cotext (*ibid.*; Cheng 2012): this should allow us to pinpoint potential ideological motivations in the representation of a given concept.

3. Identifying terms that are most likely to see their meaning debated

3.1. Description of the corpus

Our research aims require both to have an awareness of the terminological practices of experts on climate change and to account for those of the media. To document climate experts' uses of terms, we rely on a corpus made of reports by several intergovernmental organizations, such as the IPCC, the World Meteorological Organization, the World Bank, the UNFCCC, etc.³, and published between 2007 and 2022.

The corpus representing the media is made of articles published by general newspapers from the British and American press. They have been published over the same period as the IGO reports and represent different political opinions. Articles were gathered using the Europress database and a set of keywords sharing the modifier *climate* (*climate action, climate change, climate crisis, climate emergency, climate justice, etc.*) as well as *global warming, global heating, IPCC* and *greenhouse gas effect*. The table below describes the composition of the two resulting corpora⁴ (note that the number of documents differs widely between the two corpora, as IGO reports are far longer than press articles while also being more rarely produced):

Table I: Description of the IGO and press corpora

	Word count	Number of documents	Entities
IGOs	1 217 351	48	UNFCCC, IPCC, UNDP, UNEP, UN, UNCDF, UN-REDD, World Bank, World Meteorological Organization
MEDIA	1 363 183	1 433	Financial Times, New York Times, USA Today, The Guardian, The Telegraph

The size of our corpora can be described as relatively small considering that we intend to build Word2vec models out of them: as corpora get smaller, the precision of the vectors decreases as well, especially for words that are not very frequent (Denigot & Burnett 2021, 298-299, 302). In order to ensure a minimum level of precision, we thus decide to consider only the vectors of terms that are well distributed in the two corpora: the number of cotexts that inform the vectors are therefore higher than for less frequent terms. We also fine-tune our corpora by removing stopwords, numbers and punctuation and by lemmatizing them. Finally, we make sure to try

³ UNFCCC (United Nations Framework Convention on Climate Change), IPCC (Intergovernmental Panel on Climate Change), UNDP (United Nations Development Program), UNEP (United Nations Environment Program), UN (United Nations), UNCDF (United Nations Capital Development Fund), UN-REDD (United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries).

⁴ The two corpora can be accessed at <https://hdl.handle.net/11403/climate-discourses/v3.2>.

different hyperparameters (Bernier-Colborne 2017, 45) when building the models, in order to see which ones produce the most convincing results in terms of semantic precision. This trial and error process leads us to choose CBOW as the method for retrieving word vectors, along with a window size of 5 words and a vector size of 300. These hyperparameters are in fact in line with those chosen by Gonzales-Granado (2001, 63) to study a corpus composed of humanitarian texts which, while being far much larger than ours (75 million occurrences), shares with it its specialized nature.

3.2. Building the word2vec models

Once the hyperparameters have been chosen, we build a Word2vec model for each of our two corpora (IGOs and press), which allows us to obtain two matrices, each representing the vectors of all the words contained in the corpus they correspond to. The two matrices are then automatically intersected, in order to reduce them to the vocabulary that is shared by the two communities, before being aligned using the `procrustes()` and `protest()` functions in R (package `vegan` (Gonzales-Granado 2021, 72)). This latter step is necessary to address the issue of « spatial non-comparability » (Rodman 2020, 96), whereby matrices which have been computed through different models cannot be directly compared as the vectors they contain only make sense in reference to their own unique environment. We then intersect the aligned matrices with a list of terms that are both specific in the domain of climate change and well distributed in our two corpora, in order to reduce those matrices to the vectors of the terms that are actually of interest to our study⁵.

3.3. Measuring cosine similarity

Finally, we compare the vectors of the terms in the resulting matrices by calculating the cosine similarity between those vectors, using the function `word2vec_similarity()` from the `word2vec` package in R. This measure corresponds to a score comprised between 0 and 1 and allows one to have an idea of the semantic proximity between the IGO and the press version of the same term: the closer to 0 the score is, the more likely it is that the contexts – and therefore the meaning – of the term under study differ between the two corpora. Results of this process can be accessed at https://hdl.handle.net/11403/climate-discourses/v3.2/terminological_variation_igos_press/cosine_similarity_igos-press.xlsx. The third column accounts for the cosine similarity score, while the last one represents the rank of each version of one same term compared to all the other terms in the list: a rank of 1 thus means that the IGO and the press versions of a term are respectively their closest semantic neighbour in the other corpus.

3.4. Results

⁵ The list of terms (accessible at: https://hdl.handle.net/11403/climate-discourses/v3.2/terminological_variation_igos_press/common_terms_igos_press.csv) was obtained within the framework of an internship at the OLST (Observatoire de Linguistique Sens-Texte, University of Montreal) and with the help of Patrick Drouin, using a measure of the specificity score in TermoStat (Drouin 2003) and of the Inverse Document Frequency to respectively retrieve terms specific to the topic of climate change and account for their distribution.

Out of the 130 terms under study, 97 turn out to have a similarity score below 0,5. For some of those terms, the cosine score might yet be influenced by a difference in the number of occurrences of the node term, which might lead to a greater variety of cotexts in the corpus where the term appears the most. For example, *adaptation* (similarity score: 0.24) totalizes 1949 occurrences in the IGO corpus, whereas it appears only 111 times in the press corpus. While a frequency threshold could have enabled us to discard terms which are far more present in one corpus than in the other, it might still be relevant to analyze the cotexts of those terms in the press corpus to see which semantic features are actualized indeed – and therefore deemed as important by the press – and which ones tend to be backgrounded. We thus chose to focus on *adaptation* for our case studies, a choice that is also motivated by the relative centrality of that concept in the domain of climate change, as exemplified by the specialization of the IPCC's Working Group II on that topic. We also decide to further analyze the cotexts of *energy security*, which shows a comparable number of occurrences in both corpora (59 in the press corpus and 47 in the IGO corpus). Although a detailed analysis of the contexts of all the terms displaying a relatively low similarity threshold would be necessary to evaluate the propensity of climate change terminology to be subject to (ideologically-motivated) semantic variation as it is recontextualized, these two case studies might give us some insight on the motivations and implications of such variation.

4. Terminology put to the test of ideology: how are concepts being negotiated as they enter media discourses?

4.1. Case study n°1: *Adaptation*

4.1.1. Terminographic definition

The term *adaptation* is defined by the IPCC as « the process of adjustment to actual or expected climate and its effects », with this adjustment aiming at « moderat[ing] harm or exploit[ing] beneficial opportunities » (2022, 2898) when it concerns human systems, and as potentially requiring human intervention when it concerns natural system. Through this definition, several semantic features can be identified. First, *adaptation* appears as an answer to a danger (« harm ») or stimuli, which is climate change and its impacts. Secondly, this adjustment can have two different objectives: it can be a way to minimize the adverse effects of the climate or to take advantage of these effects. Thirdly, adaptation can somehow be prepared, since part of the effects it aims at adjusting to are « expected ». Consequently, whether it concerns human or natural systems, it requires specific measures and actions. While a reference for our following analysis of *adaptation*, these semantic features also raise questions as to the actual implications of this process: if adaptation can be anticipated, what are the means for actually preparing it and who are the actors in charge of its preparation? What are the opportunities associated with this process and who can benefit from adaptation? Do natural and human systems have the same chances when it comes to adaptation to climate change? These questions may trigger a variety of answers in discourses and thus be a cause of

variation between the two communities: as such, it is important to bear them in mind during our analysis of the discourses at stake.

4.1.2. Collocational and Critical Discourse Analysis

This section aims at comparing the cotexts of occurrence of *adaptation* in the press and in the IGO corpora, the relatively low similarity score of this term suggesting that there might be important differences between the two communities. To this aim, we conduct a comparative analysis of the 30 most cofrequent collocates of *adaptation* in both corpora⁶.

We then complete this collocational analysis with a more qualitative one, using CDA tools to interpret the meaning associated with the node and its collocates in context. In each following subsection, we summarize the different patterns identified through this methodology and evaluate their potential ideological implications. We argue indeed that they reflect different representations of *adaptation*, each highlighting specific aspects of this process while foreshadowing others, and as such potentially subsuming certain ideologies. For each pattern, differences and commonalities between IGO organizations and the press are highlighted:

Adaptation as an answer to risk – One of the main differences between the two communities is their treatment of risk, whose avoidance is described as one of the aims of adaptation in the terminographic definition of the term. The collocational analysis reveals indeed that this concept is exclusively present among the collocates representing the IGO corpus, namely « risk » and « risks », which are respectively the 8th and 14th most frequent collocates used by this community. In discourse, these collocates are used in contexts where risk is assessed (« **risk levels were estimated** for current adaptation », « specific **risk assessments** of vulnerable groups, which are applied in adaptation planning processes »), or where its reduction is explicitly described as an objective of adaptation: « The ultimate goal of adaptation is to **reduce risks** associated with the impacts of climate change ».

While the collocates « impacts » and « effects » in the press corpus also hint at the risks of climate change and at the necessity of adaptation measures to reduce them, the meaning of these two nouns backgrounds the idea of uncertainty that is explicit in the concept of *risk*. As such, the treatment of adaptation by the media does not appear to imply any assessment of the risks that condition the implementation of adaptation measures. While this can be linked to the relative technicity of risk assessment, whose description would be deemed as too complex to be communicated to lay audiences, it also participates in decontextualizing adaptation, which appears as a general solution to climate change among others such as mitigation and resilience rather than as a necessary measure for the locations and communities the most at risk.

Adaptation as an opportunity – Another pattern identified pertains to cotexts describing adaptation as an opportunity. This representation, which also appears in the terminographic definition of the term, is carried by the collocates « opportunities » and « development » in the press corpus (18st and 22th most frequent collocates respectively), and primarily by

⁶ The full list can be accessed at https://hdl.handle.net/11403/climate-discourses/v3.2/terminological_variation_igos_press/collocates_igos-press.xlsx.

« development » in the IGO corpus (rank: 20), where adaptation and development tend to be described as co-benefiting one another, provided that the latter is sustainable: « strengthen sustainable development co-benefits, including adaptation », « can lead to adaptation, mitigation, and development co-benefits », « reveals the benefits of ambitious mitigation and effective adaptation for sustainable development and, conversely ». While these excerpts also associate these co-benefits to the mitigation of climate change, in the press, opportunities might be described as being specific to adaptation, distinguishing it from mitigation:

« We ought to be engaged in a serious debate about the choices we face in deciding how we respond. What, for example, is the right balance between mitigation, in which we attempt to limit the increase in global temperatures, and adaptation, in which we minimise the negative effects and exploit opportunities? » (TEL-2021-36)

In the latter excerpt from a recent article by the Telegraph, adaptation and mitigation strategies are opposed, the former being presented under a more valuable light than the latter. The verb « attempt » and the use of an infinitive form (« to limit ») to describe mitigation suggest that this strategy is almost vain and that its outcomes belong to an hypothetical future. Conversely, adaptation is associated with two different outcomes introduced as direct objects of conjugated verbs in the present tense (« minimise the effects and exploit opportunities »), which presents the given outcomes as being already actualized and therefore as more accessible than those associated with mitigation actions. In the broader context, mitigation also turns out to be described as entailing « a lower quality of life and a higher cost of living », while the newspaper also suggests that there is no point in curbing emissions as « other countries will not do so », thus feeding an argumentation whereby adaptation is a more valuable response to climate change than mitigation. Similarly in the Financial Times, adaptation is described as « a way to improve lives » and is opposed to mitigation (« Cutting emissions is not the only way to reduce the impacts of climate change. Adaptation and development are alternatives »), while this latter strategy is presented as legitimate only from an alarmist perspective and is as such discredited:

« But **emissions reduction** is not the only way to keep the impacts of climate change in check. Yesterday's IPCC report – repeating its **prophecies of doom if emissions are not curbed** – missed an opportunity to advise policy makers on how to improve lives. » (FT-2014-34)⁷

Thus, representing adaptation as entailing opportunities appears to be used by certain newspapers as a discursive strategy to achieve specific goals, such as promoting adaptation actions and discrediting mitigation, and therefore potentially influencing the orientation of climate funding and policy. This framing of adaptation yet raises questions as to the beneficiaries of this type of approach to climate change: is adaptation an opportunity for everyone and under which conditions?

Adaptation as a financing issue: The very question introduced above finds echoes in another representation of adaptation, whereby its implementation is described as being conditioned by

⁷ A reference corresponding to the name of the file – in that case a press article – from which the abstract was extracted is added after each quote from our corpora.

the availability of fundings. This representation is in fact particularly central in the press corpus: looking at the full list of collocates whose specificity scores were equal or superior to 3 in both corpora, we found that 23,81% of the collocates of *adaptation* pertained to financing in the IGO corpus, while they amounted to 50,45% in the press corpus, a difference which is statistically significant⁸. Analysis of the cotexts of occurrences of the most specific collocates pertaining to that topic in the press reveals that it is largely associated with questions of social justice and equity, whereby developed countries are depicted as having the duty to help finance adaptation in the least developed ones (« The COP26 deal also committed rich countries to double their levels of finance for climate adaptation », « motivate governments to contribute to a fund that will support poor countries already facing the effects of climate change »). In several articles, this attribution of responsibilities is supported by direct quotes from authoritative sources such as experts or shareholders, calling for an increase in fundings from developed countries. This discursive strategy, called *attribution* (Sinclair 1986) and illustrated in the excerpt below, tends to be used by the media to back up their claims, which in our case is the idea that rich countries are not doing enough:

« Furthermore, he argues that the poor world will bear much of the burden of a damaged earth and he⁹ stresses that the rich world has a particular responsibility to provide funding for mitigation and adaptation since it is the now developed world that has generated a disproportionate share of greenhouse gas emission. » (FT-2008-30)

Besides, the attribution of responsibilities for financing adaptation also relies on the definition of two broad categories of actors – namely « developing » or « poor » countries on the one hand and « developed countries » on the other, which tend to be depicted as victims and villains respectively. Looking at the broader cotext around the excerpt above, we indeed identified several traits supporting this characterization: developing countries being described as « struggling », « upse[t] », « in debt distress », while developed countries are accused of « not doing enough » and « failing ». This echoes findings by Fløttum (2014, 7), who described this type of characterization as a recurrent pattern in climate change discourses.

While recurrent in the press, the idea that adaptation funding is insufficient also appears in the IGO corpus, where adaptation needs of developing countries are described as being « five to ten times greater than current international public adaptation finance flows » (UNEP 2021). In fact, the UNEP has dedicated a special report to the topic of *adaptation finance gap*, defined as « the difference between the financial costs of adapting to climate change in developing countries and the amount of money actually available to meet these costs » (2016). As such, the importance given by the press to adaptation funding – especially framed as a social justice issue – tends to reflect a certain awareness of the gap thus documented by climate experts. Yet, it might also lead them to ignore other aspects of adaptation finance described in the IGO corpus, such as the necessity to better understand climate risks to properly direct adaptation fundings and ensure that their use leads to effective adaptation, the need of diversifying the

⁸ To calculate significance, we relied on Log-likelihood and used Paul Rayson's online calculator (<https://ucrel.lancs.ac.uk/llwizard.html>): we entered the total frequency of all the units pertaining to the topic – finance in that case – in the « frequency of words » section and the total frequency of *adaptation* in each corpus in the « corpus size » section. The probability that the difference was due to size effect was less than 1 in 10 000.

⁹ This pronoun refers to Professor Sir Partha Dasgupta, emeritus Indian-British economist at Cambridge University.

potential funding sources – notably by taking into consideration non-international financial flows –, as well as the actual difficulties in tracking certain adaptation finance flows.

4.2. Case study n°2: *Energy security*

4.1.1. Terminographic definition

The term *energy security* is defined by the IPCC (2022, 2907) as « the goal of a given country, or the global community as a whole, to maintain an adequate, stable and predictable energy ». As such, this definition provides the parameters through which this goal can be measured, which take the forms of values: « adequate », « stable » and « predictable ». The Panel also describes the measures that might need to be implemented to attain energy security, such as « safeguarding the sufficiency of energy resources to meet national energy demand at competitive and stable prices and the resilience of the energy supply » or « enabling development and deployment of technologies ». Note that this definition does not draw any link between climate change and energy security, which might therefore primarily be conceptualized in discourse, paving the way for variations in the representation of this very relationship.

4.1.2. Collocational and Critical Discourse Analysis

The number of occurrences for *energy security* in both corpora was lower than for *adaptation* (47 in the IGO corpus and 59 in the press corpus), so that the co-frequency of the corresponding collocates also tended to be lower. Yet, some patterns did emerge from comparing the 30 most cofrequent collocates in the discourses of the communities:

- *Energy security as an objective*: In line with its terminographic definition, the concept of energy security is apprehended as a goal in both corpora. However, the collocates through which this pattern materializes tend to differ between the two types of discourse, implying some differences in the way this objective is represented. In the IGO corpus, *energy security* is thus associated with the collocates « improve », « improved » and « increased » (rank: 3, 13 and 19 respectively), indicating that the goal at stake is in fact progressive and that efforts should be made to increase its current level. In the press corpus however, the idea of energy security as an objective is associated with the collocates « challenges », « challenge », « concerns », « detrimental », « wrestling », and « ensure » (rank = 6, 14, 7, 20, 19 and 22 respectively), which, while highlighting the difficulty of guaranteeing energy security, also suggest that what is at stake is not so much achieving and improving the latter as maintaining it. The two following excerpts illustrate this representation:

[1] « " Existing tensions over access to water are almost certain to intensify in the region, leading to further political instability **with detrimental implications for Europe's energy security** and other interests." the paper says. » (FT-2008)

[2] « Any concerns that achieving energy access for all **would magnify the challenges of energy security** or climate change are unfounded: it would only increase global energy demand by 1 % in 2030 and CO2 emissions by 0.6 %. » (Guardian-53)

In both excerpts indeed, energy security is presented as being under threat, be it by political instability ([1]), or by the prioritization of another objective, namely energy access ([2]), a perspective which is absent in the IGO corpus. Note though that in the latter excerpt, taken from an article by the Guardian, the threat caused by prioritizing energy access over energy security is described as « unfounded » by the newspaper, thus discrediting specific opinions and beliefs around energy security. Doing so, the latter still gives voice to these contrary opinions, thus providing hints of an actual debate on the matter in the public opinion.

• *Climate change mitigation as a threat to energy security (and vice versa)*: Through the question of whether energy security is threatened emerges another one, which is that of the reasons why it would be. While the two previous excerpts give us examples of potential causes, analysis of the cotexts of the collocates carrying the idea of threat in the press also brings to the fore climate change mitigation as a potential threat in several articles:

[3] « The framing narrative is the story of how the European Union's politicians and officials tried to forge collective approaches to meet three often **conflicting challenges**: competitiveness, **energy security, and climate change**. » (FT-2009-187)

[4] « Beyond any vagueness in this week's statements is the challenge that **climate policy must compete with other pressing global problems, particularly rising prices for energy**. This reality was on display in Japan in the days leading up to the leaders' formal sessions. Gwyn Prins, an expert on climate policy at the London School of Economics and Political Science, was there for discussions preceding the formal talks and noted that **current concerns about energy security were already clearly interfering with discussions aimed at climate stability** » (NYT-2008-25)

[5] « In Canada, Australia, Japan and countries across Europe, the global economic crisis and other near-term concerns **have pushed climate issues to the back burner**. For China and India, economic growth and **energy security are more vital priorities** » (NYTx9)

[6] « Mr. Haass said “ single issue advocacy ” policies like the promotion of democracy, human rights or **climate change almost always collide with traditional priorities like war and peace, energy security** and alliances. » (NYT-2021-42)

More specifically, the argument put forward through these various excerpts is that climate change mitigation and energy access are two conflicting objectives, and that the measures implemented to achieve one of the two might be detrimental to the other (« conflicting challenges », « compete with », « interfering with », « collide with »). Illustrating this conflicting relationship is an excerpt from the New York Times published in 2008 explaining

that « concerns over energy security » leads European countries to plan the implementation of « 50 coal-fired plants over the next five years », a project which would not have been possible if climate migration had been the priority of European governments at that time since burning coal contributes greatly to greenhouse gas emissions. More fundamentally, the question underlying this argument is that of whether some objectives should have precedence over other goals (« priorities » [5], [6]) and how to actually determine which one should be a priority indeed. While most of these excerpts are taken from the least recent articles of our corpus, the last excerpt, by the New York Times, suggests that those questions are still very much debated in US policy. In fact in this article, entitled « Biden Vowed to Make Climate ‘Essential’ to Foreign Policy. The Reality Is Harder », the journalist gives voice to a plethora of political actors (« Mr Haass said », « President Biden pledged », « said Laurence Tubiana », « Secretary of State Antony J. Blinken said », « said Jon Finer, Mr. Biden’s deputy national security adviser and a former chief of staff to Mr. Kerry », etc.), as well as to a climate activist « Jennifer Morgan, executive director of Greenpeace International », thus representing the ongoing debate as to whether climate change mitigation should take precedence over other objectives such as energy security at the scale of one article. Yet, one might argue that while representing different opinions, the newspaper also participates in fostering this debate, which in other articles as well as in other newspapers might be backgrounded by the idea that climate change and energy security are in fact two intertwined concerns. We discuss this view in the next section.

• *Energy security as a co-benefit (of climate mitigation)*: Opposed to the idea that climate mitigation and energy security are two conflicting objectives is the view that these two contemporary concerns are in fact interrelated in such a way that addressing one might entail addressing the other. This idea was associated with the collocate « intertwined » in the press corpus (rank = 21) (ex.: « addressing climate change is intertwined with addressing domestic priorities like pollution, energy security and even national security ») and with « co-benefit » in the IGO corpus (rank = 14) (ex: « Realizing emissions reductions in the transport sector is often a co-benefit of addressing traffic congestion, air quality and energy security »). It also emerges from the cotextual analysis of the collocate « improve » in the latter corpus, whereby climate change mitigation is presented as a way to improve energy security:

« For non-climate philanthropists and analysts, the economic, social, and environmental benefits provide insights on **how emissions mitigation measures can also improve public health and food and energy security** » (WB-2014-5)

In this excerpt, *energy security* is coordinated with two other objectives and values (« public health », « food [security] »), which are also presented as co-benefices of climate change mitigation policies. As such, the prioritization of climate mitigation is legitimized by the IGO organization, which presents it as an all-encompassing objective, whose promotion allows one to address other key societal concerns. By addressing this argument to « non-climate philanthropists and analysts », which can be interpreted as a relatively neutral strategy to refer to actors who would not be prone to prioritize climate mitigation measures, the World Bank

also adds a voice to the debate around the potential conflicting relationship between energy security and emission reductions, a voice that is very much presented as that of science in the broader context: « provide insight », « a variety of case studies are estimated using a range of metrics », « multiple benefits assessment », etc. Thus, this last example illustrates the idea of a dialogue between the press, which relays diverging opinions around the relationship between climate mitigation and energy security, and climate experts, where the concerns raised by the most skeptical of those opinions are answered, using the rhetorical and methodological tools of science.

5. Synthesis and discussion: Co-creating responses to climate change through science and debate

Half of the patterns identified in the contexts of both *adaptation* and *energy security* turn out to pertain to semantic features already present in the terminographic definitions of those concepts: adaptation and energy security as objectives that should be promoted, adaptation as an answer to risk, and as an opportunity. Yet, these elements of meaning are not treated equally between the two communities – *adaptation as an answer to risk* being for instance given significantly more prominence in the IGO corpus – or are conceived differently, as illustrated by the emphasis on the challenges in achieving and maintaining energy security in the press corpus. In fact, in the press corpus, these semantic features appear to be singled out and used as foundations for specific representations, which they support: describing adaptation as an opportunity was in some instances used as a way to relativize – if not discredit – the necessity of mitigation policies, just like highlighting the challenges of maintaining energy security could be used as a discursive strategy to make this goal a priority at the expense of emission reduction.

As for the patterns which were not present in the terminographic definitions (*adaptation as a financial issue*, *climate mitigation and energy security as two conflicting challenges* and *energy security as a co-benefit of climate mitigation*), their materialization in discourse could also be associated with specific representations and purposes: *adaptation as a financial issue* was thus intertwined with questions of social justice and responsibility and mobilized in contexts calling for further funding from developed countries to the poorest, while describing energy security as a co-benefit of climate mitigation appeared as an answer to journalistic discourses describing the latter as being at odds with maintaining the former.

As such, the appropriation and mobilization of those terms in discourse seems to entail a form of dissection of the concept they carry to focus on semantic features (/objective/, /opportunity/, etc.) or on conceptual relations (i.e. energy security and climate mitigation as co-hyponyms and hyponyms of what we may call *societal objectives*) in order to more specifically and exhaustively apprehend the implications of those concepts for specific communities or society at large. As such, this phenomenon entails backgrounding part of the semantic content of the terms and can therefore prevent the diffusion of essential knowledge, for instance on the level of risk that conditions the necessity of adaptation measures if we consider the fact that the trait /risk/ was under-represented in the press corpus. Yet, it can also be a way to further knowledge by putting it to the test of public opinion and allow for a debate on its most controversial and least unanimous implications to emerge. Considering the

controversy between climate sceptics and scientists, Mauger-Parat and Péliz (2013, 368) thus explain that debating a politico-scientific topic such as climate change is in fact part of the process of knowledge construction. We argue that the same might be true for debates around specific concepts of climate change terminology, as suggested by our analysis of the « *energy security as a co-benefit of climate mitigation* » pattern in the IGOs' discourse, which appeared as an answer to specific concerns voiced by the press. A consequence of this thesis is that it invites one to reconsider the idea of a necessary top-down diffusion of knowledge, which would be received and accepted unquestioned by lay audiences, to favour instead a perspective whereby knowledge would be co-constructed through a dialogue between instances representing different views and playing different roles. In this dialogue, science would offer facts, assessments and suggestions (ex.: « To meet the Paris goals, electricity needs to be decarbonized by 2050 », UNCDF), whose implications would then be voiced and put to the test of public opinion by the press (ex. « climate policy must compete with other pressing global problems, particularly rising prices for energy »), which would also relay potential concerns and opposing worldviews on the matter at stake. Doing so, it stages a debate which might in turn redirect climate research toward finding answers to the concerns being raised, as it allows for gaps in the social dimension of climate knowledge to be brought to the fore.

6. Concluding remarks

Through this article, we combined tools from corpus linguistics and natural language processing with Critical Discourse Analysis to identify and analyse terms whose associated concepts might be a subject of debate in media discourse. This methodology implied considering several scales of analysis – from that of the whole terminology shared by two communities, through the most specific collocates of a term, to that of the occurrence of the given term in discourse, thus zooming-in to reveal patterns and uses and to complement the limits of each of these tools taken separately. Relying on cotextual variation as an indicator for potentially diverging treatments of climate terms between experts and media discourses, we found *energy security* and *adaptation* to be subject to a certain degree of variation indeed, notably reflecting differences in the hierarchization of societal objectives and concerns in the press (climate adaptation vs. mitigation, energy security vs. climate change mitigation). More fundamentally, the appropriation of those concepts by the press allows for questions which might not be necessarily addressed by science to be brought to the fore: how to finance climate adaptation/ mitigation and who should be responsible for their funding? Should these two issues be considered as equal priorities? Are these more important than other societal concerns and if so, can focusing on the former have detrimental consequences for those other concerns? As such, studying the treatment of specific concepts by lay audiences can be a way to make explicit those underlying questions and allow for actual answers to emerge, be it through overt public and political debates or through further scientific research.

In the field of terminology, further research could include analyzing media discourses around a greater number of « climate terms », or fine-tuning the methodology proposed to do so, for instance by bootstrapping the corpora at the document scale in order to increase the

stability of the word vectors (Dénigot et Burnett 2021, 302) or by using language models from the BERT family for extracting word embeddings¹⁰.

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¹⁰ A suggestion from Emmanuel Cartier, whom I thank. BERT (or Bidirectional Encoder Representations from Transformers) is a family of models that produce context-dependent word representations, thus capturing information on the contexts surrounding each occurrence of the word under study.

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