

# Climate Consciousness and Congressional Convergence: Increased Environmental Public Salience and Content Similarity in Swiss Left-Wing and Green Environmental Bills.

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## **Abstract**

Why have parliamentary bills on environmental issues introduced by mainstream left-wing parties and green parties become more similar in content over the past 20 years? Drawing on the literature on political agendas, in particular “party system agendas”, I examine how parties respond to each other’s agendas and to issues that are salient to the public. I argue that left-wing parties introduce environmental legislation in order to attract green voters.

Using Switzerland as a case study, I apply a text-as-data approach that measures the content similarity of parliamentary bills through word embeddings. I find that increased public salience of climate change correlates with a lagged increase in content similarity between environmental bills introduced by the Swiss mainstream left-wing party (SP) and the Swiss Green Party (GPS). This suggests that the SP reacts to the GPS agenda with the aim of attracting green voters, demonstrating how parties respond to voters’ environmental concerns.

## **Introduction**

Parliamentary bills on environmental issues introduced in the Swiss parliament by the Social Democrats (SP) and the Green Party (GPS) have become increasingly similar in content over the past 20 years. This finding results from a text-as-data analysis of these parliamentary bills. By calculating word embeddings for each bill and placing the bills in a high-dimensional semantic space, the change in distance between bills can be measured over time. The bills examined show a decrease in distance in the semantic space, indicating that they have become more semantically similar. Why have they become more similar?

To answer this question, I apply the theory of party system agendas to explain why political actors put certain issues on their agendas. Research shows that public salience influences what parties prioritise and that political parties respond to each other's agendas, especially when two parties are ideologically close. Following the literature, we can expect that as environmental issues become more salient to the public, mainstream left-wing parties will prioritise these issues by introducing parliamentary bills that are more similar in content to those introduced by green parties. Left-wing parties do this in an attempt to attract green voters and thus gain an electoral advantage. I test this hypothesis in Switzerland, focusing specifically on the SP, the mainstream left-wing party, and the GPS.

To explain the decrease in semantic distance between parliamentary bills, I measure the salience of environmental issues using the popularity of the search term "climate change" in the search engine Google. I model the change in distance with the change in salience using correlations and ordinary least squares linear regression models. I set up two models, one of which uses a lagged outcome, i.e., modelling a time lag between the change of environmental issue salience and the change of parliamentary bill similarity. The results show that an increase in search term popularity is associated with a lagged increase in content similarity between environmental bills introduced by the SP and the GPS.

The structure of the paper begins with a literature review that examines existing research on how party agendas are influenced and shaped. This is followed by a theory and hypothesis section in which I outline the theoretical framework and present the hypothesis to be tested. Next, I explain why Switzerland is an appropriate case for this study. In the following section, I describe the data used and the natural language processing methods applied to analyse the content of the parliamentary bills. I then describe how the relationship between the dependent and independent variables was measured. I end with a presentation of the results, discussing their implications and suggest directions for future research.

## **Literature Review**

Political agendas are a hierarchy of issues (Green-Pedersen and Mortensen 2010, 260), whereby issues constitute problems that are important to voters (Petrocik 1996, 826). Relevant actors,

such as political parties, influence this hierarchy of issues. Actors put issues on their agendas that are salient to the public (Sides 2006, 407). Defining and influencing agendas is important because it determines what politics is about and is therefore a way of exercising political power (Edwards and Wood 1999, 327; Schattschneider 1975, 68).

Parties respond to each other's agendas as part of the "party system agenda" (Spoon et al. 2014, 374). This is a model that describes how political parties set the agenda in the context of issue competition (Green-Pedersen and Mortensen 2010, 257). In this model, the ongoing debate between political parties influences the "party system agenda" (Green-Pedersen and Mortensen 2010, 260), whereby parties emphasise issues that bring an advantage for themselves. However, parties also have to respond to all salient issues in the "party system agenda" at all times (Green-Pedersen and Mortensen 2010, 261), even if they are potentially damaging.

Parties with similar ideologies tend to be more responsive to each other than parties with less similar ideologies. This phenomenon, called the "party bloc effect" (Adams and Somer-Topcu 2009, 842; Green-Pedersen and Mortensen 2015, 760), is due to the ideological proximity between parties within the same bloc or party family.

What underpins this phenomenon? First, Green-Pedersen and Mortensen (2015, 750) show that parties in the same bloc share issue preferences and thus have a common interest in focusing on the same issues. Second, the authors explain that in a multiparty system, parties from the same party bloc are likely to be governmental coalition partners. In order to present themselves as a credible government alternative, parties from the same bloc need to show likeness by focusing on similar issues. Third, Adams and Somer-Topcu (2009, 828) show how an ideological spatial argument supports the "party bloc effect". The authors explain how parties that are close to each other in an ideological space, shift their policy positions when other parties in close proximity change their policy positions, as both parties, due to their ideological proximity, compete for a very similar set of voters. On the other hand, if a party that is ideologically further away shifts its policy position, the first party has no immediate reason to adjust its own position as a reaction.

When exploring how different parties within left-wing party families respond to each other's agendas regarding environmental issues, the literature presents varied results. On one hand, Abou-Chadi (2016, 431) indicates that mainstream left-wing parties tend to de-emphasize green issues, recognizing green parties as the successful owners of these environmental topics. On the other hand, Spoon et al. (2014, 375) point out that when left-wing parties do focus on environmental issues, they stand to gain electorally, which enables them to attract voters from green parties. However, for these electoral benefits to materialize, certain conditions must be met: first, the environmental issue in question must be highly salient among the public, enhancing the likelihood of gaining votes through green mobilization. Second, the electoral system

needs to be accommodating to smaller parties, and third, the green party must be perceived as a significant electoral threat by left-wing parties (Spoon et al. 2014, 372, 375, 366).

In the next section, I develop theoretical expectations based on the framework by Spoon et al. (2014) and apply it to Switzerland.

## Theory and Hypothesis

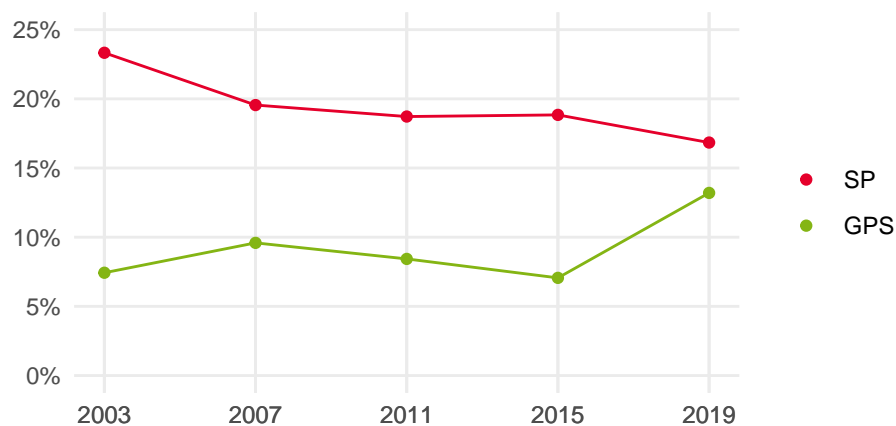
How do political parties respond to the increased salience of environmental issues? Research shows that when environmental issues become more important to voters, political parties adjust their agendas to address these issues. Specifically, under the condition that left-wing parties consider the green parties to be an electoral threat, we expect mainstream left-wing parties to place environmental issues on the “party system agenda” through the introduction of parliamentary bills.

In order to win over green party voters, left-wing parties will introduce parliamentary bills that are similar in content to bills proposed by the green party. By winning over these voters, left-wing parties gain an electoral advantage. This leads to the following hypothesis:

**Hypothesis:** An increase in the public salience of environmental issues leads to an increase in the content similarity between parliamentary bills of mainstream left-wing parties and of green parties on environmental issues.

## Case Selection: Switzerland

Figure 1: Development of Party Strengths per Election Year (National Council)



Source: Swiss Federal Statistical Office (<https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases.assetdetail.27145667.html>, retrieved 9 May 2024)

In order to test this hypothesis, I turn to Switzerland. Specifically, I examine the Swiss mainstream left-wing party (Swiss Social Democrats, German: “Sozialdemokratische Partei der Sch-

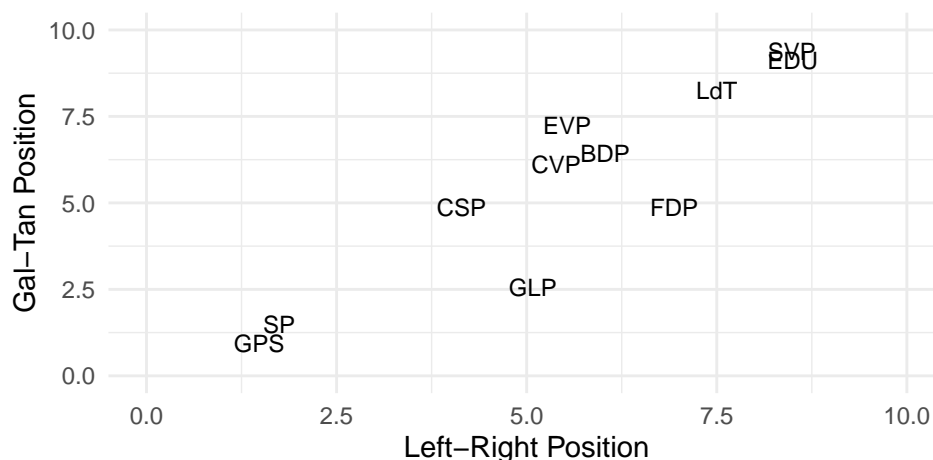
weiz”, SP) and the Swiss green party (Swiss Green Party, German: “Grüne Schweiz”, GPS). Switzerland, the SP and the GPS are suited for the following reasons.

First, environmental issues have become more salient in Switzerland over the past 20 years. Lüth and Schaffer (2022, 171) show that the electoral importance of energy and environmental issues among Swiss voters has increased between 2002 and 2022. This increase in salience is driven by voters (Lüth and Schaffer 2022, 184), thus political parties need to respond to this development and place environmental issues on their agenda.

Second, Switzerland has an electoral system that accommodates smaller parties, as highlighted by Linder and Mueller (2017, 102). The electoral success of small parties such as the GPS (see Figure 1) further highlights how the Swiss electoral system accommodates and fosters small parties.

Third, I argue that the SP perceives the GPS as an electoral threat. The GPS has increased their vote share in the past 20 years, while the SP have lost vote share. Specifically, the GPS has increased its share of votes in the Swiss National Council from 7.43% in 2003 to 13.24% in 2019, while the SP has decreased its share from 23.33% to 16.84% over the same period, as shown in Figure 1.

Figure 2: Placement of Major Swiss Parties in Ideological Space (Average of 2014 and 2019)



Source: 2014 and 2019 Chapel Hill Expert Surveys (<https://www.chesdata.eu/ches-europe>, retrieved 9 May 2024)

I consider this electoral success of the GPS to have occurred at the expense of the SP. This is because both parties belong to the same party family and are thus ideologically close. Both parties highlight issues such as social welfare and gender equality and both are pro-union (Linder and Mueller 2017, 132, 136, 137). When examining both parties in a two-dimensional left-right/liberal-authoritarian ideological space, the SP and GPS are their closest neighbours (see bottom left corner of Figure 2). Following this spatial argument, both parties are interested in canvassing the same group of voters.

In sum, the SP emphasises environmental issues in an effort to win over voters from the GPS, a small party that it perceives to be an electoral threat. The SP does this by proposing parliamentary bills that cover environmental topics that are similar in content to GPS bills.

## Data and Methods

### Data

**Parliamentary Bills** My analysis covers 2756 parliamentary bills<sup>1</sup> that include the tag “Environment” (German: “Umwelt”).<sup>2</sup> These bills were introduced by the SP party (1169 bills) and GPS party (1587 bills) or by their members of parliament in both chambers of the Swiss parliament, namely the National Council (“Nationalrat”) or the Council of States (“Ständerat”). The parliamentary bills are provided by the open data webservice of the Swiss parliament.<sup>3</sup> These webservices are made accessible for further analysis through the R package “swissparl” (Zumbach and Gföhler 2021).

Central to my analysis is a parliamentary bill’s submitted text. This section is crucial because it is where the author of the bill presents their case and explains the purpose of the bill. The submitted text provides the essential context and rationale for the bill, making it a key element in understanding its intent and focus.

Due to Switzerland’s four official languages, parliamentary items of business can be written either in German, French, Italian or Romansh. The Federal Administration (German: “Bundesverwaltung”) translates most items of business in to German, French and Italian. Some are only translated into German and French.<sup>4</sup> In the context of this research, I have chosen to use par-

<sup>1</sup>Parliamentary bills include the following nine types of parliamentary proposals that can be introduced in the Swiss parliament (translation provided by the Swiss parliament unless stated otherwise): Parliamentary Initiative (“Parlamentarische Initiative”), Question (“Anfrage”), Urgent Question (own translation: “Dringliche Anfrage”), Interpellation (“Interpellation”), Urgent Interpellation (own translation: “Dringliche Interpellation”), Motions (“Motion”), Postulates (“Postulat”), Question Time – Question (“Fragestunde – Frage”), Petitions (“Petition”)

<sup>2</sup>Employees of the Parliamentary Services tag bills with one or several of the following terms that were developed by the Parliamentary Library (Source: Personal email communication with the media spokesperson for the Parliamentary Services): National Policy (“Staatspolitik”), General Law (“Recht Allgemein”), International Politics (“Internationale Politik”), Economy (“Wirtschaft”), Parliament (“Parlament”), Finance (“Finanzwesen”), Social Issues (“Soziale Fragen”), Transportation (“Verkehr”), Environment (“Umwelt”), Urban Planning and Housing (“Raumplanung und Wohnungswesen”), Health (“Gesundheit”), Education (“Bildung”), Media and Communication (“Medien und Kommunikation”), Security Policy (“Sicherheitspolitik”), Agriculture (“Landwirtschaft”), Migration (“Migration”), Science and Research (“Wissenschaft und Forschung”), European Policy (“Europapolitik”), Culture (“Kultur”), Energy (“Energie”), Civil Law (“Zivilrecht”), Employment and Labor (“Beschäftigung und Arbeit”), Human Rights (“Menschenrechte”), Criminal Law (“Strafrecht”), International Law (“Internationales Recht”), Taxation (“Steuer”), Social Protection (“Sozialer Schutz”), Judiciary (“Gerichtswesen”). Own translation from German to English.

<sup>3</sup><https://www.parlament.ch/de/%C3%BCber-das-parlament/fakten-und-zahlen/open-data-web-services>, retrieved 12 May 2024

<sup>4</sup><https://www.parlament.ch/de/%C3%BCber-das-parlament/parlamentsw%C3%B6rterbuch/parlamentsw%C3%B6rterbuch-detail?WordId=206>, retrieved 14 May 2024

liamentary bills in German, as my German is more proficient than my French, simplifying the examination process.

The bills under examination were introduced between March 2004 and December 2023. I choose this time frame because it coincides with the electoral rise of the GPS and also covers a substantial period before the increased public salience of environmental issues starting in the beginning of the 2010s. This allows for a before-after comparison.

**Public Salience of Environmental Issues** Lüth and Schaffer (2022, 171) use the “Swiss Election Study” (Selects)<sup>5</sup> to measure the salience of environmental issues in the public sphere. In this survey, respondents are asked what their “most important problem” is (Variable “mip1”). I calculate the share of respondents who chose “Environment & Energy” as their most important problem from a list of different issues.<sup>6</sup> This provides a solid measurement of the public salience of environmental issues. However, the Selects survey is only carried out every four years during Swiss parliamentary elections, thus providing only four data points in my time range of examination (2007, 2011, 2015 and 2019). This stands in contrast to the number of sessions in this time period that I will use to group parliamentary bills by (see “Operationalisation” further below). I thus need a way of measuring public salience of environmental topics on a more frequent basis.

I turn to Google Trends<sup>7</sup> as an alternative way to measure public salience. Google Trends is a tool that enables the evaluation of public interest in specific search terms and topics (Nghiem et al. 2016, 10). Data on Google Trends are available from 2004 onwards. I examine the monthly popularity of the search term “climate change” in Switzerland, where data are available between February 2007 and May 2024. I pick the search term “climate change” because it is largely congruent with the same issues that the Selects question described above touches upon. It is thus an adequate way of measuring public salience of environmental topics.

A brief visual comparison of both measures show that both Selects and Google Trends generally follow a similar trend line on environmental issues (see Figure 3). This underlines the legitimacy of using Google Trends as a way of measuring public salience of environmental topics.

## **Operationalisation**

**Dependent Variable: Semantic Similarity between Parliamentary Bills** The dependent variable of my model is the semantic similarity between parliamentary bills. Using word em-

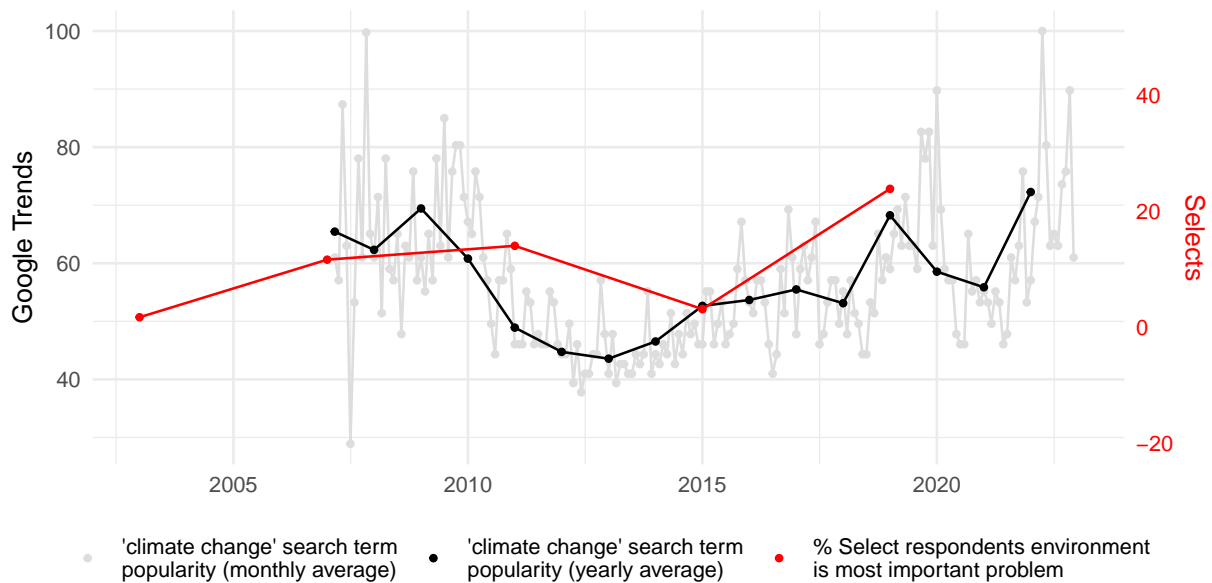
<sup>5</sup><https://forscenter.ch/projects/selects/>, retrieved 12 May 2024

<sup>6</sup>All issues respondents could pick as their “most important problem”: Agriculture, economics, education and youth & culture, environment & energy, European integration, finances & taxes, gender issues & discrimination, immigration & asylum, international relations&conflicts and foreign policy & army, labour market, law & order, political system and parties & politicians, public health, public service & infrastructure, regions & national cohesion, social security, other problems, no problem, don’t know / no answer / wildcode.

<sup>7</sup><https://trends.google.com>, retrieved 12 May 2024



Figure 3: Google Trends and Selects Comparison



beddings, a natural language processing (NLP) technique, I map parliamentary bills into a high-dimensional vector space and measure the distance between them. This distance correlates with their content overlap. Bills with similar content are closer together in the vector space, while those with less similar content are further apart.

### Independent Variable: Measuring Salience of Environmental Issues with Google Trends

Google Trends provides a positive integer value to measure the “search interest” of a term within a specific time frame and geographic region.<sup>8</sup> These values are scaled between 0 and 100, reflecting a topic’s proportion relative to all searches across all topics.<sup>9</sup> When examining the search term “climate change” in Switzerland between February 2007 and May 2024, there is an outlier in April 2022 (see red line in Figure 4). This is likely due to the United Nation’s Intergovernmental Panel on Climate Change (IPCC) report published in April 2022,<sup>10</sup> which was widely discussed in the media.

This outlier, with a value of 100, causes the rest of the data series to display relatively low variation due to the way Google Trends scales values. This low variation becomes more apparent when comparing the Google Trends data up until March 2022 (see blue line in Figure 4). Low variation is problematic for modelling the data later on, as it makes effects less pronounced. To restore the variation lost in the time series that includes April 2022, I recalculated each value by following these steps: First, I calculate the relative change of each value in the shorter series (blue line) with respect to its first value, obtaining the “multiplier.” Second, I align the starting points of both series (blue and red line) by adding a value of 42 to the longer series (red line).

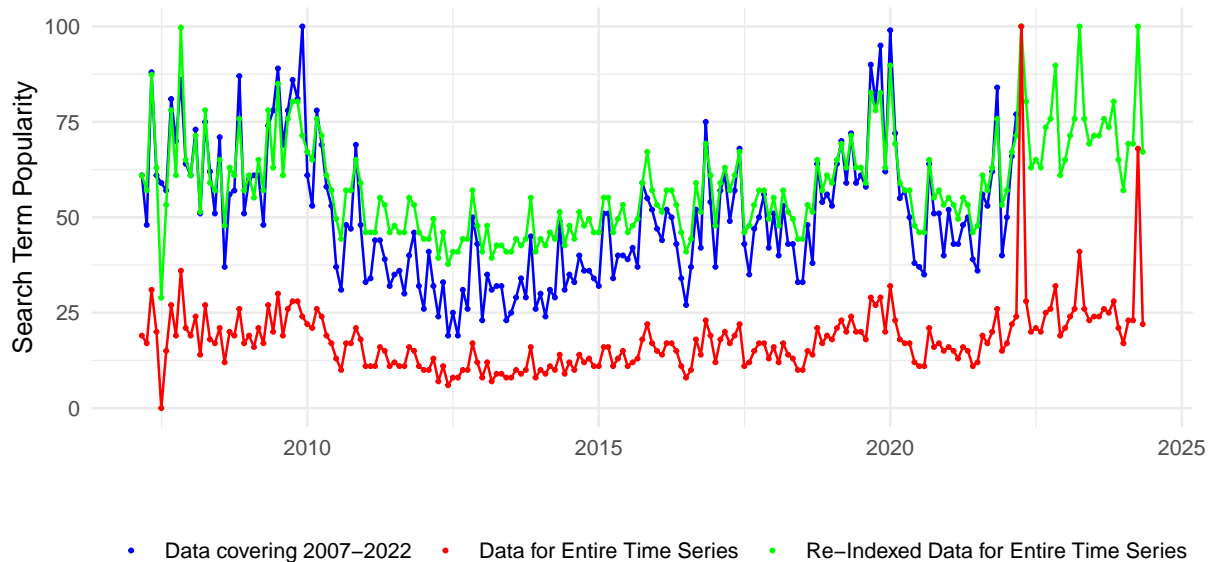
<sup>8</sup><https://trends.google.com>, retrieved 13 May 2024

<sup>9</sup>[https://support.google.com/trends/answer/4365533?hl=en&ref\\_topic=6248052&sjid=14532437735057784414-EU](https://support.google.com/trends/answer/4365533?hl=en&ref_topic=6248052&sjid=14532437735057784414-EU), retrieved 13 May 2024

<sup>10</sup><https://www.ipcc.ch/report/sixth-assessment-report-working-group-3>, retrieved 18 May 2024

Third, I multiply each value in the longer series (red line) by the “multiplier” from the first step. This results in a more pronounced variation in the longer series that mirrors the shorter series (see green line in Figure 4). Finally, I cap maximum values of the re-indexed series (green line) at 100.

Figure 4: “climate change” Search Term Popularity (Monthly Average)



## Methods

**Semantic Similarity using Word Embeddings** In order to test the hypothesis, it is necessary to measure the content similarity between parliamentary bills. This leads to NLP approaches that use text as data (Rodriguez and Spirling 2022). In NLP terms, how can the semantic similarity between documents, in particular parliamentary bills, be calculated (Ali et al. 2018, 907)?

The “Word Mover’s Distance” is a method proposed by Wang and Dong (2020, 4) for measuring the semantic distance between documents. This technique applies the concept of text representation in semantic space as a means of measuring similarity. The underlying principle is to represent a text as a point in a multidimensional semantic space (Jurafsky and Martin 2009, 109). In this space, texts that are semantically similar are positioned closer to each other than texts that are dissimilar. Consequently, the distance between two texts in this space can be used to make a statement about their semantic similarity.

In order to place text in this semantic space, the meaning of a text must be converted into embeddings. These embeddings are learned representations of word meanings (Jurafsky and Martin 2009, 97). In short, these representations are computed using the probability of a word appearing near another word in the same text (Jurafsky and Martin 2009, 122). The representations take the form of vectors (Jurafsky and Martin 2009, 109), which are simply a list of numbers (Jurafsky and Martin 2009, 111) that represent the location of a text in semantic space.

Computing probabilities of words appearing near other words is a cumbersome and computationally expensive endeavour. As an alternative, datasets of existing probabilities can be used. For example, Facebook AI Research distributes “pre-trained word vectors” through fastText,<sup>11</sup> an open-source word embeddings library. I apply fastText in this paper for the following three reasons. First, fastText provides word embeddings for the German language,<sup>12</sup> which is essential in order to place parliamentary bills written in German in semantic space. Second, fastText elegantly deals with unknown words, i.e., words that are new to the model.<sup>13</sup> Third, fastText is open source, thus ensuring reproducibility.

Embeddings are good at recognising synonyms, e.g., showing that the words “car” and “automobile” have a high semantic similarity (Jurafsky and Martin 2009, 121). This principle of embedding single words can be extended to whole documents, where a document represents a point in the semantic space instead of a single word (Le and Mikolov 2014). Thus embeddings can be used to measure the similarity between documents, in this case parliamentary bills. In political science, embeddings have also been used to measure the positions of candidates (Case 2023, 11) and party ideology (Rheault and Cochrane 2020, 29). Word and document embeddings are thus a tried and tested technique for analysing political texts.

Parties introduce different numbers of bills in each parliamentary session.<sup>14</sup> For this reason, and also because it does not make sense to compare single parliamentary bills with each other, I group all bills put forward by a party in a session and calculate the “middle point” of these bills in the semantic space. This middle point can be found by calculating the average position of all documents in a group.

This centroid represents the overall semantic content of all bills in a group. In other words, the “middle point” reflects the overall semantic content of a party in a session. It effectively summarizes the collective characteristics or the “average” bill within a group, thus identifying the group’s central tendencies. The distance between two groups in semantic space, i.e., two middle points, can be calculated using the Euclidean distance. This measure requires the coordinates of two points in order to calculate the distance between these points. The coordinates of the middle points are given by the vectors, thus calculating the distance can be performed with the programming language R (R Core Team 2022) by applying the following formula (Tabak 2008, 150):

<sup>11</sup><https://fasttext.cc/>, retrieved 17 May 2024

<sup>12</sup><https://dl.fbaipublicfiles.com/fasttext/vectors-crawl/cc.de.300.vec.gz>, retrieved 17 May 2024

<sup>13</sup>For a more detailed explanation of how fastText handles unknown words, please see Jurafsky and Martin (2009, 127).

<sup>14</sup>The Swiss parliament meets in four ordinary three-week sessions per year. Additionally, the parliament assembles for further sessions, named “special” or “extraordinary” sessions that deal with issues that were not dealt with in the ordinary sessions (<https://www.parlament.ch/en/%C3%BCber-das-parlament/parlamentsw%C3%B6rterbuch/parlamentsw%C3%B6rterbuch-detail?WordId=197>, retrieved 10 May 2024).

$$distance(\mathbf{p}, \mathbf{q}) = \sqrt{\sum_{i=1}^n (p_i - q_i)^2}$$

$p$  and  $q$  represent two points in an  $n$ -dimensional space. These points are expressed as embeddings, i.e., vectors or lists of numbers representing their coordinates. The variable  $i$  represents the  $i$ -th coordinate of a point in the  $n$ -dimensional space.

To sum up, in order to measure the semantic similarity between the parliamentary bills introduced by the SP and GPS, I place these bills in semantic space. I then group the bills by party and session and then calculate the middle point of each group. Using the Euclidean distance, I calculate the distance between the middle points of groups in semantic space. The more semantically similar two groups of bills are, the smaller the distance between them in semantic space.

**Differencing and Time Lag** Due to the limited scope of this seminar paper, I keep the analysis simple by examining the variable change between observations instead of creating a time series model. The purpose of using the change between observations is to explore a potential relationship between the variables without considering the factor of time. To retrieve the difference, I calculate the change in both the independent and dependent variables from one parliamentary session to the next and use these as my independent and dependent variables.

As a further exploration, I lag the dependent variable by one unit, i.e., by one parliamentary session. This approach aims to model the delayed effect of environmental topics in the public sphere on parties and their parliamentary bills they introduce. In other words, I assume a delay in parties reacting to a change in public salience.

## Correlation

In the first step, I calculate the correlation between the dependent and independent variables using the Pearson correlation. This method is suitable as an initial, straightforward check to see if there is a correlation between the two variables. The Pearson correlation can be used because the data under examination are continuous, assume a linear relationship, contain few outliers and are normally distributed.

I also compare the un-lagged and the lagged dependent variable to see if lagging the dependent variable makes a difference. This comparison helps to understand whether past values of the independent variable have an impact on the current dependent variable, thereby providing additional insight into the temporal dynamics of the relationship between the dependent and independent variables.

Table 1: Bill Count Overview

	All Bills	Environmental Bills
All Parties	41568	5282
SP	11173	1169
GPS	5319	1587

## Linear Regression

In a second step, I model the relationship between the differences using an ordinary least squares (OLS) linear regression model. This helps to determine whether there is a statistically significant relationship between the dependent and independent variables, and quantifies the strength and direction of this relationship.

Given the data, this is the most appropriate method because OLS regression is effective for continuous data and assumes a linear relationship between variables. It is also robust to outliers and is appropriate for normally distributed data, which matches the characteristics of the dataset under consideration. This leads to the two model specifications:

Model 1:

$$\Delta \textit{Euclidean Distance} = \beta_0 + \beta_1 \Delta \textit{Search Term Popularity} + \epsilon$$

Model 2:

$$\Delta \textit{Euclidean Distance}_{s+1} = \beta_0 + \beta_1 \Delta \textit{Search Term Popularity}_s + \epsilon$$

In these models, Delta ( $\Delta$ ) indicates the change between two observations, specifically between two parliamentary sessions.  $s + 1$  represents the lagged variable, where  $s$  denotes the current parliamentary session and  $s + 1$  stands for the next session.

## Results

### Descriptive Analysis

Table 1 gives an overview of the number of bills introduced in the Swiss parliament between March 2004 and December 2023. During this period, approximately 12.7% of all bills introduced contained the tag “environment”. The SP introduced more than twice as many bills in all categories as the GPS, but around 400 fewer bills on environmental issues. Approximately 10.5% of SP bills dealt with environmental issues, while almost 30% of GPS bills dealt with environmental issues. These differences are logical as the SP has more seats in parliament than the GPS (see Figure 1) and environmental issues are more central to the GPS agenda.

Figure 5: Bills per Year

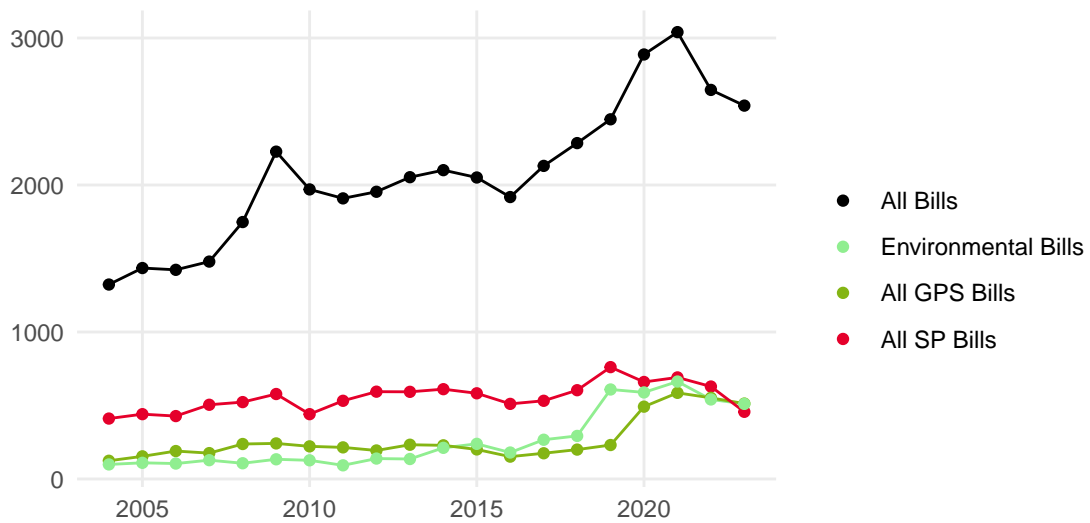
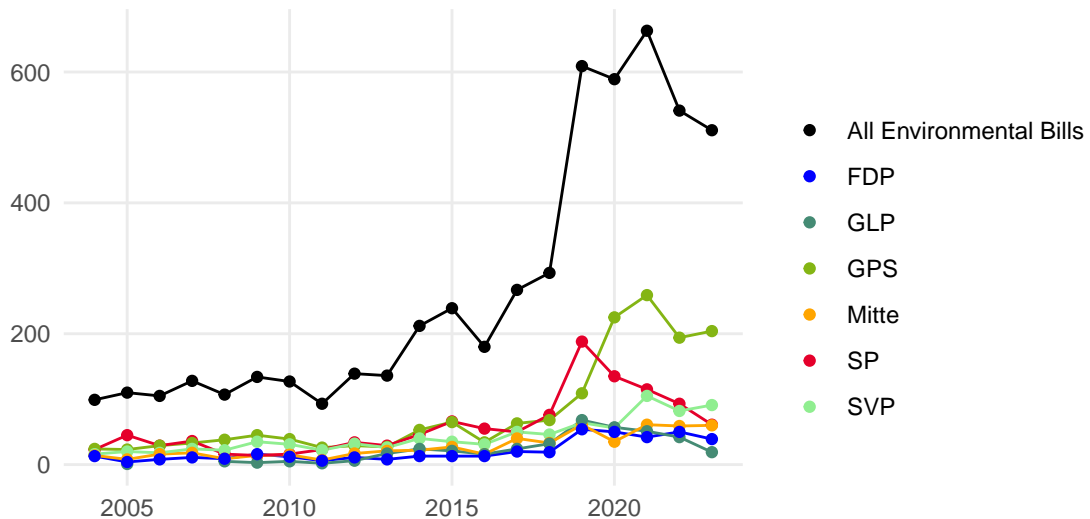


Figure 5 shows how the number of all parliamentary bills has increased over the last 20 years. The number of bills introduced by the SP and the GPS has remained mostly constant, except for an increase after the 2019 election, when the GPS achieved its best election result in history. Comparing the number of bills with an environmental label with all bills, the number of environmental bills remained more or less constant until the early 2010s. After this period, there was a slow increase until the late 2010s, followed by a sharp increase.

Figure 6: Environmental Bills per Year by Party



If we break down the number of environmental bills by party (Figure 6), we can see that all parties introduced roughly the same number of these bills until the late 2010s. Around 2019, all parties started to introduce more environmental bills, with the SP and GPS leading the way. After this brief spike, all parties except the GPS reduced their number of environmental bills.

Again, this makes intuitive sense, as the GPS owns green issues and had just come off a very successful election in 2019.

In summary, while the total number of parliamentary bills has increased over the past 20 years, the number of environmental bills remained largely unchanged until the late 2010s. It was during this period that there was a notable increase in the number of environmental bills introduced in the Swiss parliament. The GPS appears to be a driving force behind many of these bills, with the SP also introducing a significant number of environmental bills compared to other major parties in the Swiss parliament.

In the next step, I examine the lengths of the bills introduced by counting the number of words in each bill. This is relevant because measuring content similarity by calculating the embedding of a bill requires calculating the embedding of each word. Consequently, the more words in a single bill, the more information is available, leading to a more precise placement of the bill in semantic space. If the number of words varied significantly between bills, this could have a negative impact on the accuracy of the analysis.

Figure 7: Word Count of Bills

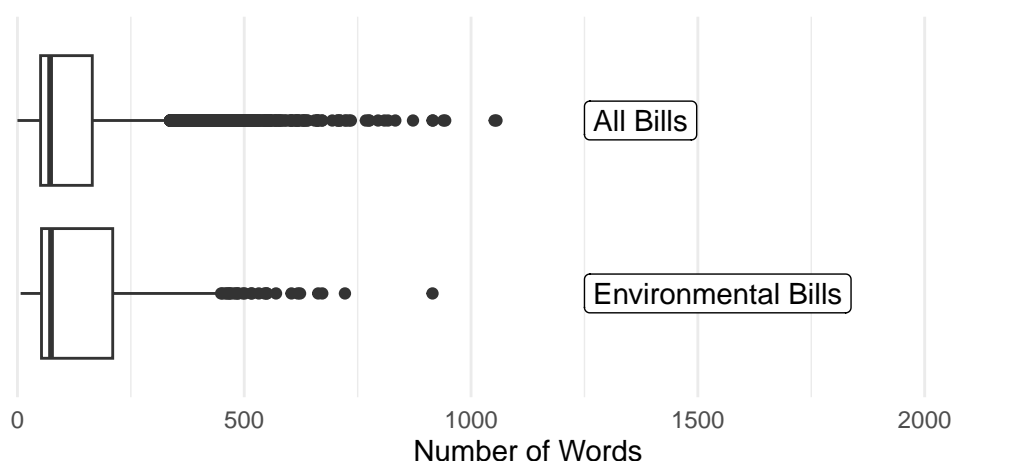
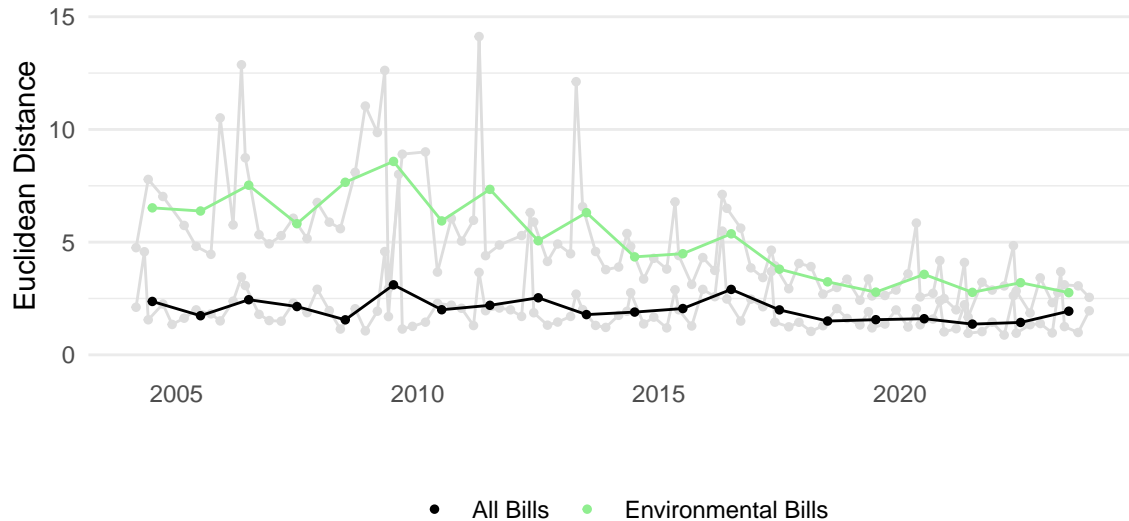


Figure 7 shows that the number of words in all bills (median: 72 words) and the number of words in environmental bills (median: 74 words) are almost the same. Over time, the number of words in bills remains stable, with the standard deviation of the median for each year being 7.72 for all bills and 12.49 for environmental bills. A similar stability is observed for environmental bills introduced by the SP and the GPS, with the standard deviation of the median over time being 13.77 for SP bills and 14.95 for GPS bills.

In summary, this brief examination of bill length shows that the number of words per bill remains fairly consistent over time. This consistency is beneficial for the application of a text-as-data approach, as it ensures that a comparable amount of data is available per bill throughout the period under study.

I continue with an overview of descriptive statistics of the semantic similarity between bills introduced by the two parties over time.

Figure 8: Euclidean Distance between SP and GPS Environmental Bills over Time (Session and Yearly Averages)



Looking at all types of bills proposed by the SP and the GPS, we can see that the average distance between all bills has remained roughly constant over time (see the black line in Figure 8). On the other hand, if we consider only environmental bills, there is a clear downward trend over the last 20 years (see the green line in Figure 8). This downward trend indicates that the distance between these bills has decreased over time, suggesting that they have become more semantically similar.

Figure 8 shows both the semantic distances per session in grey and the distances averaged by year in black and green. Averaging by year facilitates visual interpretation by smoothing out fluctuations. However, this method has the caveat that all sessions are given the same weight, which may distort perception as some sessions contain fewer bills than others.

It is important to note that the distance values themselves cannot be interpreted in isolation. For example, a distance value of 3 has no inherent meaning. These values must be interpreted comparatively. So a distance value of 2 is smaller than a distance of 3, meaning that two groups of parliamentary bills with a smaller distance are semantically more similar.

## Inferential Analysis

**Correlation Results** First, I present the results of the correlation between the change in search term popularity and the change in Euclidean distance. The correlation coefficient is 0.19, with borderline statistical significance at conventional levels ( $p = 0.11$ ). This suggests a positive but weak correlation, indicating that an increase in search term popularity is associated with an



Figure 9: Correlation Plots

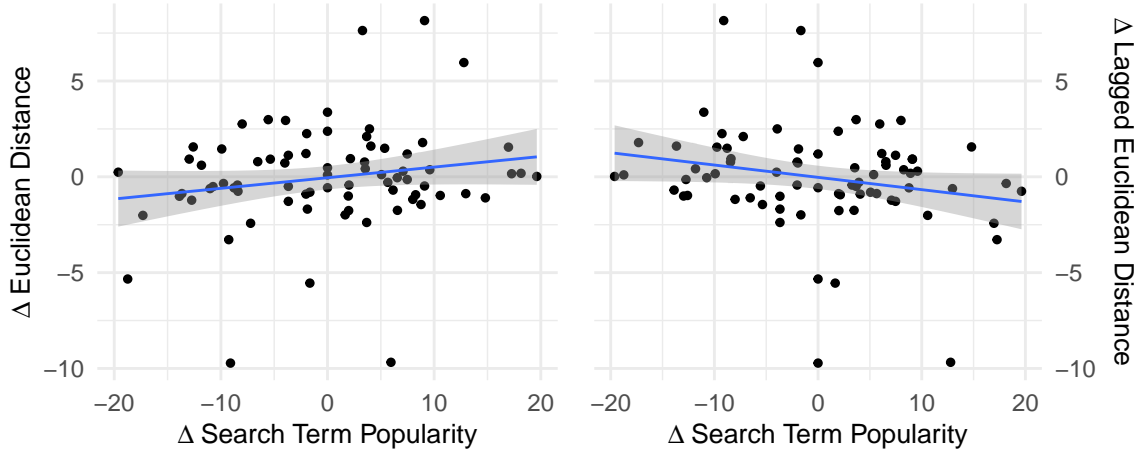


Table 2: Linear Regression Model Results

	Model 1	Model 2 (Lagged Independent Variable)
Intercept	-0.048 (0.877)	-0.028 (0.928)
Δ Search Term Popularity	0.055 (0.106)	-0.064+ (0.061)
Num.Obs.	76	76
R2	0.035	0.047
R2 Adj.	0.022	0.034

+  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Dependent variable: Δ Euclidean distance between grouped bills; p-values in parentheses.

increase in Euclidean distance between the bills, i.e., the bills become less similar. This finding contradicts my theory and does not support my hypothesis.

However, when the time lag is applied to the Euclidean distance, the results point in the opposite direction. The correlation coefficient between the change in search term popularity and the *lagged* change of Euclidean distance is  $-0.22$ , with statistical significance at conventional levels ( $p = 0.06$ ). This indicates that an increase of the popularity of the search term “climate change” is associated with a decrease in Euclidean distance between parliamentary bills introduced by the SP and the GPS, lagged by one parliamentary session. This decrease in distance suggests that SP and GPS parliamentary bills become more similar when public attention to environmental issues increases.

**Linear Regression Results** Next, I present the results of the linear regression model. These results, displayed in Table 2, are consistent with the correlation results. Using the un-lagged dependent variable (Model 1), we observe a positive relationship between the two variables with borderline statistical significance. Model 2, which applies the lagged dependent variable, shows a negative coefficient for the independent variable at a statistically significant level ( $p < 0.1$ ).

This indicates that an increase in the change of the search term popularity is associated with a decrease in the change of the Euclidean distance in the following parliamentary session.

I assume that the difference between the un-lagged and lagged dependent variables in both the correlation analysis and the linear regression models is due to the delayed response of political actions to public opinion. In this research, parliamentary bills are introduced as a reaction to the public's interest in topics. However, this reaction does not occur immediately. The process of introducing parliamentary bills takes time, as they need to be written and political allies must be secured. This lag shows that it takes time for public opinion to affect the legislative process.

A caveat regarding the linear regression model results is that the coefficient value cannot be interpreted beyond its sign. The informative value of the coefficient is limited because the distance value between groups of bills can only indicate whether two groups are closer or further apart compared to other groups. Thus we can only interpret the polarity sign of the coefficients and conclude that an increase in the change in search term popularity is associated with a decrease in the Euclidean distance of groups of bills in semantic space.

Returning to the hypothesis, we cannot reject the statement that an increase in the public salience of environmental issues is associated with an increase in the content similarity of parliamentary bills. However, for this statement to hold, semantic similarity must be lagged by one parliamentary session. Furthermore, these results can only be generalised to Switzerland.

Returning to the theory, and based on the results presented above, we can assume that the SP perceives the GPS as an electoral threat and is reacting to this and also to the increased salience of environmental issues amongst the public. The SP responds to this by introducing environmental legislation that is increasingly similar to that of the GPS. The SP sees potential in winning over GPS voters, who are ideologically much closer to its existing base than voters from other parties, by introducing parliamentary bills that are similar in content to those bills introduced by the GPS.

This may be an indication that the SP is becoming more environmentally oriented in an attempt to appeal to GPS voters. By focusing its legislative efforts more on environmental issues, the SP may be trying to broaden its appeal and capture a segment of the electorate that is increasingly concerned with environmental issues.

The SP's strategic shift could have wider implications for Swiss politics. If the SP continues to prioritise environmental issues, and public concern about these issues grows, it could intensify competition for environmentally conscious voters. According to the "party system agenda" theory, this will force other parties to adapt their agendas to include environmental issues. Consequently, this dynamic could lead to a more environmentally friendly legislative agenda overall, as parties compete for the support of an electorate that increasingly prioritises environmental concerns.

In conclusion, the results suggest that the increased public salience of environmental issues leads parties, especially those with overlapping ideological bases such as the SP and GPS, to introduce more similar parliamentary bills on environmental issues. This strategy reflects parties' responsiveness to voters' environmental concerns and their efforts to remain competitive in an evolving political landscape.

## **Conclusion**

The aim of this paper is to examine why parliamentary bills on environmental issues introduced by mainstream left-wing parties and green parties have become more similar in content over the past 20 years. To answer this question, I turn to the literature on political agendas, in particular "party system agendas". In this context, parties place issues on their agendas that are salient to the public and respond to each other's agendas. One way of putting issues on the agenda is to introduce parliamentary bills dealing with those issues.

Research shows that parties that are ideologically close to each other tend to be more responsive to each other's agendas. Specifically, in the context of mainstream left-wing parties and green parties, left-wing parties focus on environmental issues in order to attract green voters. For this to happen, three conditions need to be met: high public salience of environmental issues, an electoral system that favours smaller parties, and the perception of green parties as a significant electoral threat by left-wing parties. Following the literature, we can assume that when environmental issues become more salient to the public, mainstream left-wing parties will put environmental issues on the "party system agenda" by introducing parliamentary bills that address environmental topics.

In order to test this assumption, I turn to Switzerland. Switzerland is well-suited for this examination because environmental issues have become more salient among the public in the past 20 years. Additionally, Switzerland has an electoral system that is beneficial for small parties, and the Social Democrats (SP), the mainstream left-wing party, perceive the Green Party (GPS) as an electoral threat due to the GPS's electoral success and ideological proximity.

I apply a text-as-data approach and measure the content similarity of parliamentary bills introduced by the SP and GPS on environmental topics using word embeddings. These bills are placed in semantic space and grouped by party and parliamentary session. I then calculate the centre of each group and measure the Euclidean distance between the SP and GPS centres over time. To explain the change in distance between groups of parliamentary bills, I measure the salience of environmental issues amongst the public by using the popularity of the search term "climate change" provided by Google Trends. The results indicate that an increase in search term popularity is associated with a lagged increase in content similarity between parliamentary bills introduced by the SP and the GPS. This suggests that the SP is reacting to the GPS agenda, perceiving it as an electoral threat and aiming to win over green voters.

Future research should apply more time-series specific analyses, as the present study does not take this into account. In addition to the Euclidean distance used to measure semantic similarity between parliamentary bills, other similarity measures should be considered, such as the Word Mover's Distance (Kusner et al. 2015) or more advanced geometric approaches, such as the method proposed by Heidarian and Dinneen (2016). When exploring pre-trained word embedding alternatives, future research could benefit from an approach where the embeddings are fine-tuned for political texts, especially parliamentary bills. This would better capture the content meaning of the bills, allowing for a more accurate measure of content similarity.

This paper takes a simple approach to categorising environmental bills, which can be extended in further studies by using more advanced natural language processing techniques that detect environmental issues within the content of bills. In addition, future studies could look beyond parliamentary bills by considering party manifestos or parliamentary speeches when examining how agendas are set.

In addition, future research should apply more refined methods for measuring the public salience of environmental issues. One possible direction could be to analyse news and media outlets, which would also allow differentiation between social groups, as public opinion may vary between different demographic groups. Finally, it makes sense to extend this research beyond Swiss parties, as the growing salience of environmental issues is a global phenomenon that will influence public opinion and policy well into the future.

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## **Appendix**

### **Reproducibility**

All scripts used to prepare data and build models are available on Github:

<https://github.com/fabianaiolfi/MSP2>

### **Use of Artificial Intelligence**

OpenAI's ChatGPT 4 and 4o<sup>15</sup> and DeepL Write<sup>16</sup> were used in a supporting manner to edit texts and develop R scripts. ChatGPT prompts can be made available upon request:

[fabian.aiolfi@stud.unilu.ch](mailto:fabian.aiolfi@stud.unilu.ch)

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<sup>15</sup><https://openai.com/chatgpt>, retrieved 19 May 2024

<sup>16</sup><https://www.deepl.com/en/write>, retrieved 19 May 2024

# Statement of Authorship



Kultur- und Sozialwissenschaftliche Fakultät  
Politikwissenschaftliches Seminar

## Selbständigkeitserklärung

Zur Seminararbeit mit dem Titel

Climate Consciousness and Congressional Convergence: Increased  
Environmental Public Salience and Content Similarity in Swiss Left-Wing  
and Green Environmental Bills.

eingereicht von

Fabian Aiolfi

Hiermit erkläre ich, dass ich die oben genannte Seminararbeit selbständig verfasst und keine anderen als die von mir angegebenen Quellen und Hilfsmittel benutzt habe und dass diese Seminararbeit noch nicht anderweitig eingereicht wurde.

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Diese Erklärung ist zusammen mit der Arbeit einzureichen oder sinngemäss in die Arbeit zu integrieren.

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## Use of Artificial Intelligence

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A handwritten signature in black ink, consisting of a stylized 'F' and 'A' intertwined, followed by a horizontal line.

[Fabian Aiolfi]