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Legitimacy of New Forms of Governance in Public Discourse - An Automated Media Content Analysis Approach Driven by Techniques of Computational Linguistics

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Abstract

For political scientists, it is increasingly important to explore large text collections without time-consuming human intervention. We are presenting a language technology tool kit that allows political scientists to extract information on various forms of governance from a comprehensive multilingual corpus. The tool kit allows searching for governance entities and measuring their salience, tonality and media frames. In substantial terms, our pipeline enables scholars of governance to extend their research focus to the previously neglected area of public communication.

1 Introduction

Automated approaches to analyze unstructured text data have made tremendous progress in computational linguistics in the last decades (Jurafsky and Martin, 2009). At the same time, social scientists are increasingly in need of such approaches, since the number of large, digitally available text collections is constantly growing. The obvious task then is to transfer the comprehensive computational linguistic tool set in order to meet the specific requirements of social scientific studies (Wueest et al., 2011). In this contribution, we present a pipeline of language technologies that allows the analysis of public communication in a specific yet fundamental research domain for the political sciences: democratic governance.

The denationalization and privatization of democratic governance poses formidable challenges to the traditional, territorially grounded forms of democratic authorities (Zürn, 1998). At the European and international level, new modes of governance such as supra-national and inter-governmental bodies as well as transgovernmen-

tal networks have come to supplement classic intergovernmental governance (Abbott and Snidal, 2008). At the sub-national level, regulatory agencies and public-private partnerships increasingly spread across metropolitan regions by transforming traditional regional and local state institutions (Kelleher and Lowery, 2009).

These various new forms of governance have in common that they organize political authority along functional rather than territorial lines, which also implies that they are decoupled from representative democratic control. This is why observers often declare a loss of democratic legitimacy for the political system (Follesdal and Hix, 2006; Keohane et al., 2009). However, other scholars usually point to formal accountability mechanisms such as governmental and parliamentary oversight as well as judicial review, which can at least partly compensate a deficit in democratic legitimacy (Lodge, 2002). Other, more informal mechanisms of accountability such as media coverage, in contrast, have been either neglected or dismissed as scarcely relevant (Maggetti, 2012).

This is surprising, given that public communication plays an ever more decisive role for setting the political agenda and establishing the distribution of information on policy making in modern democratic societies (Walgrave et al., 2008; Müller, 2014; Arnold, 2004). Media coverage is assumed to hold new forms governance accountable through reputational mechanisms (Gentzkow and Shapiro, 2006). If media regularly pay critical attention to governance processes, they can encourage the formation of an informed public opinion (O'Donnell, 1998). This, in turn, mounts pressure on governance actors to explain, justify and – if necessary – correct their conduct.

In the following, we present a comprehensive corpus and language technology pipeline, which enable political scientists to assess these questions.

The paper begins by presenting our operationalization of indicators that allow the reliable measurement of governance accountability in a large-scale text analysis. Subsequently, we will describe the software pipeline and language technologies necessary to implement the operationalization, before we present a case study highlighting the feasibility of our approach.

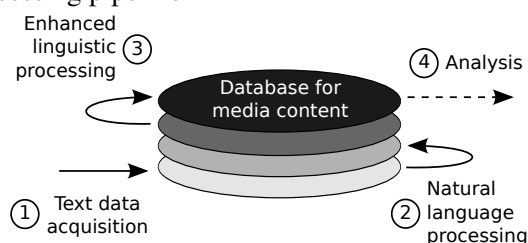
2 Measuring media coverage on governance accountability

So far, mediatized accountability mechanisms have only been dealt with in conceptual elaborations or comparative case studies that entailed manual content analyses (Maggetti, 2012; Coglianesi and Howard, 1998; Gerhards and Roose, 2007). Although these contributions are theoretically insightful and empirically rich, their focus on a narrow set of actors, geographical units or media sources always faces the necessity to justify why their cases provide more than just idiosyncratic evidence. We suggest that an automated large-scale analysis helps to achieve a more broad analytical support on the question whether and how media scrutinize on the accountability of governance processes.

2.1 Sample

The anchor of the analysis is a large gazetteer of pre-defined entities related to governance (see Figure 1). These entities refer to actors (collective actors and individuals), policy fields and regulation such as treaties or directives. At the moment, a comprehensive gazetteer of entities for 3257 queries is integrated in the document retrieval. The entities cover a large variety of forms of governance: transgovernmental networks, independent as well as private regulatory authorities, metropolitan bodies, supranational parliaments and international environmental governance outcomes.

Figure 1: Stylized workflow in the language processing pipeline



In a first step, a comprehensive corpus of the following newspapers, newswires and online sources is established by retrieving all articles for the keyword gazetteer via API accesses to media content databases such as Lexis Nexis (① in Figure 1).

- *Quality*: Frankfurter Allgemeine, Süddeutsche Zeitung, Welt, Tageszeitung (Germany); Figaro, Le Monde (France); Neue Zürcher Zeitung, Le Temps (Switzerland); The Guardian, London Times, Independent (UK)
- *Tabloid/Freesheets*: Bild (Germany); Aujourd'hui en France, 20 minutes (France); Blick, Le Matin, 20 Minuten (Switzerland); Daily Mail, Daily Mirror, Metro (UK)
- *Magazines*: Spiegel, Stern, Zeit (Germany); Nouvel Observateur, L'Express (France); Weltwoche, Wochenzeitung, L'Hedbo (Switzerland); New Statesman, Spectator, Economist (UK)
- *Regional*: Berliner Zeitung, Stuttgarter Zeitung, Stuttgarter Nachrichten (Germany); Le Parisien, Le Progrès (France); Tagesanzeiger, Berner Zeitung (Switzerland); London Evening Standard, City A.M., Birmingham Mail, Birmingham Post (UK)
- *Online sources*: Spiegel Online (Germany), Figaro Online, Le Monde Online (France); 20 Minuten Online (Switzerland); BBC News Online (UK)
- *Newswires*: Associated Press, Agence France Presse, Deutsche Presse Agentur, BBC Monitoring, Europolitics, ENP Newswire, AWP

Since different types of media systems (Hallin and Mancini, 2004), as well as different types of media (Strömbäck and Kaid, 2008) possibly cover governance in different ways, the media sources are sampled so that there is a balanced set of outlets in our four countries (Switzerland, Germany, France, and United Kingdom). From each type of outlets, the outlet with the highest circulation (or website visits in the case of the online sources) was chosen. As far as possible, we also cover other potential variations such as different ideological leanings. In addition to these country-specific media samples, we also include a range of internationally operating newswires, which provide us with information on the general reporting on governance in disregard of specific journalistic cultures in single media outlets.

Subsequently, an additional layer of data consisting of the compressed documents along with initial meta-data (source, date-of-publication etc.) is added to the database (②). At a third stage, we employ a full natural language processing chain, which includes morphological analysis, tagging,

lemmatizing, and dependency parsing (3). Finally, a fourth layer of enhanced linguistic analysis – named entity recognition, co-reference resolution, sentiment detection, opinion mining and topic modeling – is implemented to calculate the indicators of interest we will discuss in the following (4).

2.2 Salience

The attention media pay to specific forms of governance is the obvious starting point of the data generation process. No media attention is the worst case in terms of question regarding the public accountability and legitimization of governance, since 'quiet politics' (Culpepper, 2010) implies low interest by the public and, correspondingly, high leverage for particular interests and dishonest conduct in governance processes. The first necessary measure therefore is salience, defined as the visibility of specific forms of governance in the media.

2.3 Tonality

A second crucial information on governance entities is the media's evaluation of these governance entities in terms of tonality. The tone of media reports on governance entities yields useful results if changes in tonality signify reactions to events on the governance processes under concern (Maggetti, 2012). For example, if a corruption scandal shakes a governance actor, we expect media reports to shift to a negative tone. This also implies that tonality has to be measured at the level of the specific entity and not at the level of text documents as a whole.

2.4 Issues

Governance entities may draw media attention for different reasons, but not all are relevant for the research objective. If a sports magazine reported on the passion of the head of the Swiss Financial Markets Supervisory Agency (Finma) for windsurfing (which arguably is true), hardly any political analyst would deem this information relevant to understand financial market regulation in Switzerland. More generally, evidence on the thematic context in which governance entities are mentioned is key to assess whether media reports on specific entities are actually covering the governance processes of interest.

2.5 Frames

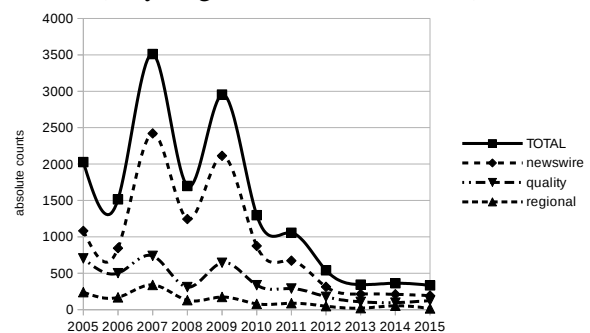
What is still missing is information on the reasons why the media report on governance entities, i.e. which interpretations and problem definitions journalists convey to the reader. To this aim, we additionally conduct a media frame analysis (Entman et al., 2009; Goffman, 1974). In the context of this analysis, we specify frames as generic schemata of interpretation that refer to the main source of democratic legitimacy of governance entities as it is reported in the text documents. More precisely, we separate input-oriented legitimacy frames from throughput- and output-oriented ones (Easton, 1965; Schmidt, 2013). Input legitimacy is thus present if media refer to participatory aspects, civil society involvement, popular support and democratic accountability in general, or public interest representation with regards to governance processes. Throughput denotes the quality of governance processes in terms of their accountability, legality and transparency. Output legitimacy, accordingly, refers to the efficiency and effectiveness of governance.

3 The public accountability of the Kyoto Protocol

3.1 Salience

For this case study we measure salience as the occurrence of articles in the media coverage across the timeline. Although a simple measurement, the salience reveals on the one hand important insights about the presence of the respective entity and, on the other hand, offers the opportunity to closer scrutinize the content near the peaks.

Figure 2: Salience of articles referring to Kyoto Protocol (only English articles; n=15,849)



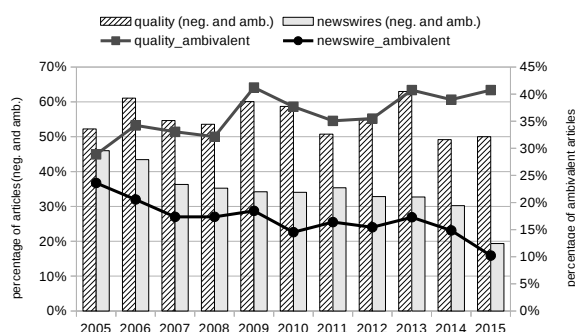
As can be seen in Figure 2, the visibility manifests itself with two clear peaks in 2007 and 2009. A closer investigation of the respective cov-

erage points towards the importance of the Fourth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) in 2007 and the 2009 United Nations Climate Change Conference in Copenhagen which triggered each an increased attendance to the subject.

3.2 Tonality

To measure tonality in the media coverage, we apply a linguistically informed sentiment analysis system, similar to (Taboada et al., 2011). The system used for this task was evaluated in another case study for the tracking of coverage tonality which yielded good results (see Wueest et al. (2014)). A more detailed description can be found in (Klenner et al., 2014). Although the tonality can be derived for singular entities in the given texts, we aggregate in this case study on the document level since the thematical focus is narrowed by the data acquisition process (i.e. the query to the media databases).

Figure 3: Comparison of negative and ambivalent tonality between media types *quality* and *newswire*



In Figure 3 we focus on the difference of tonality regarding the level of critique considering different media types: the bars show the percentage of articles of negative and ambivalent tonality (ordinate on the left-hand side). It is obvious that the coverage in quality papers is much more critical than in the newswire articles. The lines show the percentage of only the ambivalent articles (ordinate on the right-hand side) which reveals that the difference between the two media types mainly stems from the much higher percentage of ambivalent articles, that is, articles which discuss the topic under different perspectives, considering chances and risks as well as progress and failure in the implementation process.

3.3 Issues

We apply structural topic models (STM) (Roberts et al., forthcoming) to explore the thematic context in which the media writes about governance. STM is a data-driven technique, which allows us to estimate document probabilities for latent variables, called topics. STM builds on the Latent Dirichlet Allocation, a hierarchical mixed-membership model in which the document-topic and word-topic probabilities have a common prior drawn from a Dirichlet distribution (Blei et al., 2003). One of the STM's major innovations is that the prior distribution of topics (i.e. topic prevalence) can be influenced by covariates. In the following analysis, we use the newspaper names and a b-spline with 10 degrees of freedom on a monthly trend variable to control for unwanted linguistic differences across news outlets and over time. In addition, we apply a parametric evaluation of the most probable topic-word vectors in order to find the optimal number of topics. To this purpose, we use word2vec (Mikolov and Dean, 2013), which learns and aggregates term similarities through a shallow neural network process. These term similarities can then be used to compare topic coherence and exclusiveness across different topic models. For the Kyoto protocol corpus, word2vec suggests a granularity of 19 for a candidate range of 3 to 20 topics.

Figure 4: Dynamics of selected topics

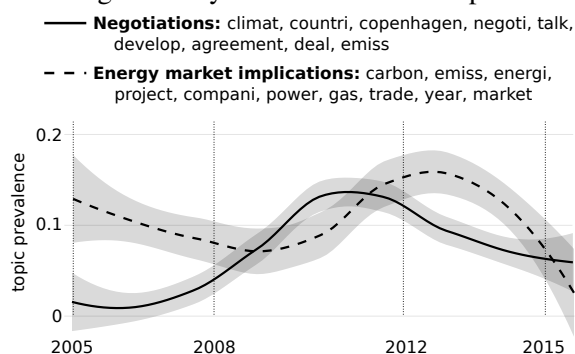


Figure 4 shows the trends in the prevalence of two especially meaningful topics over time. In addition, the list of the 10 most probable word stems for each topic is listed.

The first topic summarizes the different negotiation rounds on the Kyoto protocol, most notably the first commitment period from 2008 until 2012 with the Copenhagen summit in 2009 as key event. Reports on the different negotiations accordingly

peak in this period. The second topic, in contrast, highlights the consequences of the Kyoto protocol on the energy markets and emission trading. Quite intuitively, this topic becomes most prevalent in the aftermath the big policy decisions from 2011 on.

3.4 Frames

While we have focused on purely empirical data for the other indicators, we will report first insights from the methodological approach used for the framing measurement.

In contrast to the measurements for the other indicators which are derived generically, we rely on annotated data for the framing. More precisely, we annotate the frames using the brat annotation tool (Stenetorp et al., 2012). So far, our three annotators build a valuable training corpus of about 14,000 frames¹. After an intensive training phase, inter-annotator agreement is constantly high (micro-averaged F1-scores for fine-grained frame categories that range between 0.66 for 23 documents during and 0.71 for 5 documents at the start of the annotation). Since the annotation task is not yet finished and the implementation of the supervised machine learning approach is still under development we report preliminary results for a baseline, using paragraph-based bag-of-words model including different settings but based on only about 15% of the frames.

First attempts have revealed that the recognition of frames is a challenging task, especially since we encounter a skewed distribution in the data (i.e. paragraphs containing frames vs. paragraphs without frames). Additionally, the distribution between the different types of frames is skewed as well (i.e. some frames occur much more than others), which then again complicates the task for a supervised learning approach. Hence we plan to implement the automated approach designed as follows: in the first stage we will apply a model that tries to detect paragraphs with mentions of democratic legitimacy (as a generic category). Second, we will then differentiate between input, output and throughput frames and apply the fine-grained frame classification in the end within this categories.

For frame detection we report an F1-score of 0.81 (micro-averaged) and 0.66 (macro-averaged)

¹At this point we must thank Michelle Amman, Anna Sigrist and Anna-Lina Müller for their excellent work on the manual annotation data.

for the binary classification as a baseline. Table 1 shows precision, recall, and F1 scores for the individual categories. In the second scenario we added the annotated text passages (TP) upweighted to the bag-of-words (BoW) and word embeddings (emb.) features. Interestingly, precision was much more positively affected than recall for the frames while it was the other way around for the paragraphs not containing frames. It has to be mentioned that these first baseline results leave room for improvement, especially for recall. However, we propose a more thorough generalization based on a deeper linguistic analysis (i.e. syntactic and semantic information) for a better performance but such an approach is yet to be implemented.

Table 1: Evaluation of 10-fold cross-validation for the detection of frames in paragraphs

	Frame			No Frame			Acc.
	Prec.	Rec.	F1	Prec.	Rec.	F1	
BoW+emb.,	0.44	0.36	0.40	0.84	0.87	0.85	0.76
BoW+emb.+TP	0.61	0.36	0.45	0.84	0.94	0.89	0.81

In the conducted experiments the following features have proven useful for the classification task: unigrams (including lower-cased variant), bigrams, word embeddings (from GloVe (Pennington et al., 2014)), and especially the upweighted annotated text passages. Additionally, we do not include class bias.

4 Conclusion

This project starts from the assumption that the salience, tonality and issues in media reports on governance entities reveal crucial evidence on whether and how media coverage entails mechanisms of accountability. More precisely, if media adjust their attention according to events related to specific governance entities, if media react to failure with a negative tone – and to success with a positive tone – and if the media really cover the issues related to the area of responsibility of these governance entities, media coverage actually constitute an 'accountability forum' for this governance entity.

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