

COMBINING TEXT AND IMAGES IN FRAMING CLIMATE CHANGE IN THE NEWS:
A COMPARISON OF FIVE DEMOCRACIES AROUND THE WORLD

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Abstract

This paper presents the first fully integrated analysis of multimodal news frames. A standardized content analysis of text and images in newspaper articles from Brazil, Germany, India, South Africa, and the USA covering the UN Climate Change Conferences 2010-2013 was conducted using a subset of photo-illustrated articles (n=432) as well as the entire conference coverage (n=1,311). In the photo-illustrated articles four overarching multimodal frames were identified: a global warming victims, a civil society demands, a political negotiations, and a sustainable energy frame. The distribution of these global frames across the five countries is relatively similar, and a comparison of frames emerging from the national subsets also reveals a strong element of cross-national frame convergence. This is explained by the news production context at global staged political events, which features uniform media access rules and similar information supplies as well as strong interaction between journalists from different countries and between journalists and other actors. Event-related frame convergence across vastly different contexts is interpreted as one mechanism by which truly transnational media debate can be facilitated that can potentially serve to legitimize global political decisions. In conclusion, perspectives for future qualitative and quantitative multimodal framing research are discussed.

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Most of our contemporary media environment is multimodal in character. Print journalism combines written text with visuals of various kinds, among which news photographs are paramount. Television news and online news videos offer multimodal compositions of moving images, spoken language, and sound, enhanced by written text inserts. Online news often combines all of the above in multimodal arrangements. But what do the different representational modes contribute to the meaning of news offerings? And how is meaning constructed synergetically using different modes at the same time? In political communication and journalism research we do not find good answers to these questions and no general model of multimodal news provision. Moreover, in the analysis of text-based journalism (print and online) written text and images have traditionally been studied separately even though captions have sometimes been used to interpret visuals. Or the study of one mode, mostly text, has been implicitly overgeneralized as if textual analysis was sufficient to capture the meaning of multimodal compositions.

In this study we directly address these gaps in extant research by proposing a method to identify multimodal news frames related to a salient global issue, namely climate change. More specifically, we study newspaper coverage of four annual United Nations Climate Change Conferences (officially called Conferences of the Parties – COPs) between 2010-2013 in five democratic countries around the world (Brazil, Germany, India, South Africa and the USA). Instead of measuring the prevalence of individual textual or visual properties separately, a multimodal frame analysis reveals how the arrangement of these elements creates distinct perspectives on the issue across larger bodies of news items. In addition to proposing a new strategy of empirical inquiry, we also aim at ascertaining how uniform such multimodal news

framing is around the globe. We therefore ask: To what degree does a unique global political media event such as a COP entice cross-national similarities in multimodal framing that supersede country-specific context factors?

The growing importance of transnational and global governance regimes which serve as common points of reference for nationally distinct journalistic systems might result in commonalities in news framing, particularly when high-level meetings or summits interrupt normal news-making routines and provide a shared set of information inputs for journalists to cover (Adolphsen 2014). Global conferences and summit meetings typically feature uniform media access rules as well as strong interaction between journalists from different countries as well as between them and other actors such as government delegations, NGOs, experts and lobby groups. Adolphsen and Lück (2012) also report that a “camp feeling” has emerged between journalists and civil society groups because participants have attended previous COPs together and production facilities are often spatially confined and support dense interaction. It stands to reason that such a uniform global production context might produce similarities in media coverage even in vastly different countries and thus might contribute to what has been called “discourse convergence” in previous studies (Wessler et al. 2008).

Conversely, a prevalence of distinct national logics in news production should yield observable differences in frames present in the news across countries. For example, we could assume that frames focusing on the problems and victims of climate change would dominate coverage in less developed countries (Brazil, India, and South Africa in our sample) because coping with climate change-related damage might be more difficult for these countries and thus command more media attention. Alternatively, victim-related frames could be hypothesized to be more prevalent in the countries with the highest long-term Climate Risk Index (CRI) scores (i.e., India, and to a lesser degree the U.S. and Germany; cf. Kreft and Eckstein 2013). Or we could deduce from previous studies (Painter and Ashe 2012; Grundmann and Scott 2014) that

the denial of anthropogenic climate change (“climate skepticism”) should be an important frame in the U.S. but not in any of the other four countries. Germany, in turn, should show the highest prevalence of support for an active climate policy aiming at emission reductions (Peters and Heinrichs 2008). In the Indian press the prevalent critique of “carbon colonialism” by (Billett 2010) attributes responsibility for climate change to the West, particularly the U.S., and sees developing countries as victims – a pattern that, again, can be assumed to separate the framing in India, South Africa and Brazil from the other two countries. Whatever the concrete assumption is, such statements predict considerable framing differences between countries or country groups that should surface in our analysis.

Multimodal Frame Analysis

News visuals are of great importance in globalized news production because they are often provided by globally operating news image agencies such as AP, Reuters, and Getty Images (cf. Fahmy 2005), particularly when they relate to global events such as the COPs. In addition, a staged political media event provides many shared photo opportunities for journalists from around the world. Non-governmental organizations (NGOs) such as Greenpeace in particular produce such opportunities to strategically offer attention-grabbing motifs for news photographers who would otherwise be left mainly with ordinary ‘talking heads’ as their subjects. Thirdly, the perception of photographs is based on a relation of similarity between the image and what is depicted and thus “does not appear to require prior familiarity with the particular representational conventions of those pictures” (Messaris and Abraham 2001:216). Their indexical quality constitutes the “potential value of photographs as evidence” (Messaris 1998:130). This characteristic can obscure (more so than in written texts) the presence of diverse latent meanings embedded in photographic representations and entice journalists to assume that pictures are universally intelligible and can be unproblematically reproduced and understood across the globe.

The global proliferation, the strategic production, and the often assumed universal intelligibility of news visuals might foster similarities in the journalistic use of such pictures (see O'Neill et al. 2013) and, by implication, in the composition of textual-visual frame elements that would be missed by conventional text-based framing research. Conversely, an exclusive analysis of visual framing elements would neglect the potential of written news texts for contextualizing news photos through the presentation of speakers and arguments in line with national particularities. How these cross-cutting influences shape national news content about a global issue across countries remains an open empirical question which can best be answered through comparative multimodal analysis. We, therefore, present the first study to reconstruct issue-specific multimodal news frames by using textual frame elements and visual content elements simultaneously. Methodologically, we follow the classification procedure proposed by Matthes and Kohring (2008) for news texts, but we feed both textual and visual elements into a joint cluster analysis.

While multimodality has become a major focus in areas such as linguistic studies and critical discourse analysis, the existing research on news framing in general and media framing of climate change in particular is still largely characterized by an alternative between either textual or visual approaches. Only a small number of fairly recent studies have delved into the comparative analysis of written texts and visuals in climate coverage (DiFrancesco and Young 2011; Roosvall and Tegelberg 2013; Nielsen and Schmidt Kjærgaard 2011). We argue for strengthening this focus for two reasons: First, a concurrent analysis of written text and visual depictions more closely resembles the reality of news production as described above, especially when considering the observable increase in visualization not only in popular, but also in quality news outlets. Second, a multimodal approach helps us uncover salient patterns of textual-visual compositions which are more akin to readers' holistic perception of such multimodal news items. Our results can then also serve as empirically validated journalistic

repertoires for subsequent media effects studies on climate change.

Our methodological approach encompasses all three types of semiotic resources as defined by Bateman (2008): (a) text-typographic (the written words of a news item), (b) pictorial-representational (news photos), and (c) diagrammatic-representational (charts, diagrams, or maps). Recent comparative studies in visual communication on multimodality have used this basic typology in their analysis of structural aspects such as the visual grammar of online newspapers (Knox 2007) and the organizing of verbal-visual content in tabloid newspapers (Kong 2013). This analysis of such formal features along semiotic and linguistic paradigms can – and should – be complemented by a multimodal understanding of substantive news framing across the different types of semiotic resources.

Comparing Climate Change Frames

We study the topic of climate change for two reasons: First, the potentially disastrous effects of climate change make it a highly relevant societal problem. Journalism plays an important role in relating this issue (its causes, consequences, and political treatment) to audiences. Media effects research suggests that the framing of climate change can affect climate-friendly attitudes and behavioral motivations in recipients (cf. Nisbet et al. 2013; Beattie et al. 2011; for the perception of visuals see O'Neill and Nicholson-Cole 2009; O'Neill et al. 2013; Metag et al. 2016). Thus, an analysis of that framing carries strong social relevance. Second, in order to assess the degree of cross-national similarities in news coverage on a global scale a single news topic is needed that receives substantial media attention across the globe. Climate change lends itself to this type of analysis, along with very few other topics of global importance such as, for example, terrorism or poverty. While the basic parameters of the issue of climate change are quite robust (there is a very stable set of causes, risks, and treatment options), climate change affects different countries with different severity. Combined with varying levels of economic development and energy dependency, this leads to quite

distinct vulnerabilities, to country-specific national action plans, and hence to differential discursive opportunity structures for publicly discussing the issue (cf. Ferree et al. 2002). While we keep system characteristics as similar as possible in a global study by choosing democracies only, our countries of investigation are marked by different levels of economic development (three newly industrialized and two industrialized countries), by nationally distinct issue cultures with respect to climate change, and by different journalistic cultures (cf. Shoemaker and Cohen 2005). Our study therefore serves as a hard test for the existence of similarities in national issue framing. The existing research on climate change coverage has not addressed the question we pose here. In fact, the relatively few internationally comparative studies either cover a set of more similar countries (mostly in the West) or focus on a fairly narrow aspect of climate coverage (e.g., climate skepticism, which is not salient in the material we study) or investigate issue attention rather than issue framing (see the studies meta-analyzed by Schäfer and Schlichting 2014).

Method

We conducted a comparative standardized content analysis of climate change coverage around the UN Climate Change Conferences in Cancún, Mexico (COP 16, 2010), Durban, South Africa (COP 17, 2011), Doha, Qatar (COP 18, 2012), and Warsaw, Poland (COP 19, 2013). The material was sampled from nationally distributed and widely-read daily newspapers from Brazil (Folha de Sao Paolo, O Globo), Germany (Süddeutsche Zeitung, Frankfurter Allgemeine Zeitung), India (Times of India, The Hindu), South Africa (Daily Sun, The Star) and the United States of America (The New York Times, The Washington Post)ⁱⁱ. We analyze leading daily print newspapers for three reasons: First, newspapers, especially quality papers, are opinion-forming media widely read by political and business elites as well as journalists and thus constitute “leading media” in their respective countries. Second, the form and structure of a daily newspaper is quite consistent across countries, fostering cross-national comparability of media

content largely undiluted by differences in medium-specific forms of presentation. Third, the national daily newspapers we study devote quite consistent levels of attention to the topic of climate change during the COPs. By contrast, preliminary analyses of other media such as television news or weekly magazines showed relatively little to almost no regard for this topic over time. Therefore, national daily newspapers turned out to be the most expedient choice for tracking and comparing the framing of climate change across countries.

To be selected, articles either had to be highlighted by a layout element ('topical vignette') referring to a climate conference or had to mention one of the following keywords in the article's headline, sub-headline, visual caption, or text body: climate change, global warming, Cancún, Durban, Doha, Warsaw, greenhouse effect, Kyoto Protocol, climate summit, climate conference, climate talks, climate politics, or climate science. In a second step, all selected units were manually checked for relevance.ⁱⁱⁱ In total, 1,311 text-based articles were found.

We use three strategies in analyzing the sample: In strategy 1, we select only those text-based articles for our multimodal frame analysis that were illustrated by at least one photograph or photomontage (n=432) to assess articles that employ a multimodal arrangement of text-typographic and pictorial-representational resources. In strategy 2, we use the total population of text-based articles for our frame analysis, regardless of accompanying illustrations (n=1,311) to test whether the frame structure found in the multimodal articles reemerges in the entire set of articles, or whether distinct non-visual or text-only frames exist in newspaper coverage of climate change. Finally, in strategy 3, we again use the subsample of photo-illustrated articles (n=432) and conduct separate exploratory cluster analyses for all five countries to test whether frames found across newspapers from five countries can also be found when we cluster articles within the country-specific subsamples. This method of analysis allows for less salient but nationally flavored multimodal frames to be detected that might have been 'swallowed up' by

our clustering across all countries.

Each article was first segmented into statements attributed to actors (n=5,561). A statement contained either an utterance made by an identifiable individual, collective, or institution (in a direct quote or indirectly paraphrased) or (b) information given by the author of the article (most often a journalist). All statements were then coded for the presence or absence of a predefined set of climate-change-related frame elements.^{iv} Since we defined a statement as a number of related direct or indirect quotes, stated by one and the same actor within an article or by the article's journalistic author, the coded statement of an actor could be distributed over various passages across the article. Building on Entman (2004), we coded text-based climate change framing on the following dimensions: (a) problem definition (consequences of climate change, such as increases in temperature, melting ice/glaciers, etc.), (b) identification of causes (e.g., greenhouse gas emissions, deforestation), and (c) treatment recommendations (remedies, such as clean energy, a global climate treaty, financial assistance to disadvantaged countries etc.). The coding categories were based on the most salient attributes of climate change discussed in the 4th Assessment Report by the Intergovernmental Panel on Climate Change (IPCC 2007). The final set of variables for the content analysis was developed through qualitative pre-examinations of representative parts of our media sample as well as various rounds of pretesting categories for applicability to coding media content. The frame dimension of (d) moral evaluation proved difficult to operationalize in our case. The only approximation of moral judgment to be systematically found in news coverage were countries or groups of countries being singled out as the causal agents of climate change due to their greenhouse gas emissions. Since this measure, however, conceptually overlaps with the identification of causes we refrain from including these measures in our frame detection analysis and use them as contextual information only. Explicitly positive evaluations of climate change - such as an outright denial of any problematic consequences or a highlighting of economically beneficial

ramifications - were included as variables in our codebook but proved to be all but absent from the media coverage of the COPs.

Unlike news texts, visuals do not feature clearly defined propositional structures (cf. Messaris and Abraham 2001). Therefore, we followed Rodriguez and Dimitrova (2011) in coding image content on a denotative level by recording depictions of different types of actors relevant to the climate debate as well as displays of environments, flora and fauna, technological objects or infrastructure, as well as PR stunt installations by environmental NGOs. Coders had the opportunity to code multiple image content categories for a single visual. For example, a photo depicting a symbolic action staged by an NGO on the beach in Cancún would have been coded for the NGO personnel as actors, for the PR stunt installation, and the for “ocean/ocean coast”. In this denotative approach the connotations of such depictions are not derived separately for the visuals, but surface in the multimodal cluster analysis that reconstructs which pictorial elements are typically combined with which text-based issue frames. The textual elements thus confer the connotations.

Six coders with near-native speaker status in at least two of the languages involved (English, German, and Portuguese) underwent an intensive, multi-wave coder training. The final pretest was performed on random samples of 76 textual articles and 91 visuals. Despite the complexity of the coding scheme intercoder reliability reached at least a .70 level with either Brennan and Prediger’s kappa or Krippendorff’s alpha for all textual frame and image content variables mentioned (see Wozniak et al. 2016) for a detailed discussion of the codebook development as well as country-specific reliability scores for all individual variables).

Hierarchical cluster analyses on the textual and visual content data were conducted to explore the coverage for distinct multimodal frames of climate change. Cluster analysis is a statistical technique to group cases that are similar among each other but different from other groups of cases. It has become a common tool in framing analysis to identify groups of articles

with similar combinations of frame elements. These group-wise combinations of frame elements can then be interpreted as frames (cf. Matthes and Kohring 2008). Such disaggregated data collection enables a more reliable and valid measurement of frames as compared to holistic ways of frame detection. Furthermore, this method allows for the discovery of frames (i.e., specific arrangements of textual and visual components of news items) not previously theorized and thus differs from approaches that identify pre-defined issue frames in the media material (cf. O'Neill et al. 2015).

Before the cluster analyses could be run the frame element data had to be aggregated to the same unit of analysis. As textual frames were measured on the statement level (i.e., below the article level) and image content was coded on the article level, we aggregated all data onto the article level using dummy variables (0 = frame element absent in article, 1 = frame element present in article). A frequency analysis of all aggregated text-based and visual frame element variables yielded 33 variables (19 text-based; 14 visual) with a saliency of at least 3.0 percent^v across the sample of 432 illustrated articles (strategy 1), and 34 variables (22 text-based; 12 visual) with a saliency of at least 2.0 percent across all 1,311 articles (strategy 2).^{vi} For strategy 3, frequency analyses were conducted for each country subsample separately; the number of variables with a saliency of at least 3.0 percent varied from 30 (Brazilian articles) to 35 (South African and U.S. articles). For each of the strategies a separate hierarchical cluster analysis was conducted (Ward method, binary Euclidian distance) covering news items as well as editorials and opinion columns.^{vii} We identified the number of clusters by using the 'elbow' criterion.^{viii} To determine the structural compositions of these clusters – which we interpret as news frames – we cross-tabulate the cluster affiliations of the articles with the individual frame elements.

Results

The hierarchical cluster analysis across all five countries yielded four multimodal frames of climate change – both for the photo-illustrated subsample (strategy 1) and the total set of

articles (strategy 2) – that are statistically distinct, substantively different, and rather non-discriminatory across countries. Based on the 432 photo-accompanied articles, we found the following four multimodal frames: (1) the global warming victims frame, (2) the civil society demands frame, (3) the political negotiations frame, and (4) the sustainable energy frame (Table 1). Frame elements that satisfied a two-step criterion of salience are highlighted as defining the particular frame: Firstly, within each cluster (vertical criterion), we regard a single frame element's presence of 20 percent as somewhat salient and a presence of 40 percent or more as highly salient. Secondly, a frame can be discriminated by those elements that may fall below the margins of the vertical criterion within a cluster, but still stand out as being distinct between clusters by exceeding the overall share of the respective frame element across all cases by more than 50 percent (horizontal criterion).^{ix} Frame labels were chosen on the basis of both the salient textual and visual frame elements in each cluster in order to avoid using visual elements as ancillary frame information only.

- TABLE 1 ABOUT HERE -

Over a third (36%) of the 432 articles belongs to a frame that can be described as the global warming victims frame. On the verbal level, this cluster emphasizes all possible consequences of climate change, with the increase in temperature figuring most prominently (71%). The burning of fossil fuels is explicitly attributed as the cause for climate change in half of the articles in this cluster. As regards remedial actions, we find a somewhat salient endorsement of clean energy (32%) and, in horizontal perspective, endorsements of reforestation and other local efforts of climate change mitigation. These salient textual frame elements are combined with depictions of ordinary citizens (35%) and scientists as well as a variety of natural landscapes (38%), snow and ice (17%), and deserts and animals. The global

warming victims frame thus presents both verbally and visually a panorama of problems and hardships as well as the people affected by them.

The second cluster, accounting for 29 percent of photo-illustrated articles, constitutes what we call the civil society demands frame. Unlike the victims frame, this frame focuses on the full range of potential remedies for climate change effects: from the mention or explicit endorsement of clean energy (61%) through financial help for disadvantaged countries (48%) and the adoption of a new binding global treaty to reduce carbon emissions (44%) to reforestation / prevention of further deforestation (21%). The textual emphasis on such demands for remedial action is supported by visuals of NGO representatives or environmental activists (62%) and their PR stunts (30%).

A surprisingly small amount of visualized articles (12%) is characterized by the political negotiations frame. Again, unlike the global warming victims frame, here the consequences of climate change are virtually absent. Yet, similar to the civil society demands frame, a variety of remedies are emphasized in this cluster, clean energy being the most salient (40%) alongside the adoption of a new binding treaty (28%). Also, the explicit endorsement of financial help for disadvantaged countries stands out in this frame (26%), as does the call for action in general (22%). However, these solutions uniquely combine with colliding national interests (34%) as the central cause for the general problem of climate change. This textual framing becomes literally visible in pictures of politicians (92%) who engage in the often difficult and frustrating negotiations about potential solutions.

The fourth and final frame, shared by 23 percent of the 432 photo-illustrated articles, can be labeled the sustainable energy frame. It emphasizes the core narrative of the climate change debate, in which fossil fuels and the resulting greenhouse gas emissions are the central cause (72%) for an increase in temperature (29%). The solution offered in this cluster of articles is an expansion of clean energy (90%) and the agreement on a new binding treaty that would govern

the worldwide reduction of greenhouse gas emissions (23%). The visual framing in this cluster mirrors the text, showing conventional industries (29%) together with traffic and green energy plants (14% and 11%, respectively, but both discriminatory between clusters). As regards the actors depicted, this frame displays both politicians (25%) and ordinary citizens (23%).

When we cluster all articles in the sample irrespective of their illustration by news photographs (strategy 2; n=1,311) we also find four frames of which the global warming victims frame and the sustainable energy frame remain virtually unchanged in their composition of frame elements (data provided in the online appendix). The civil society demands and the political negotiations frame, on the other hand, appear as one composite frame in the full dataset. The resulting political dispute frame combines most of the demands elements with the most distinct elements of the negotiations frame, including photos of politicians during negotiations. Finally, from the clustering of the total population of articles a fourth frame emerges, which we label common sense frame. It is both the largest and least distinctive frame to emerge from our analysis with only three out of the 34 frame elements appearing in more than 20 percent of articles. This cluster constitutes a residual class for articles with a rather low incidence of framing devices. Articles in this cluster are shorter (roughly 400 words as opposed to over 500 in other clusters), contain less visual elements (26.5% versus 43% of articles in other clusters) and are more often opinion- rather than fact-based (27% opinion-oriented items versus 17% in the other clusters).

To sum up, the simultaneous analysis of textual and visual elements has yielded a small number of clearly discernible news frames in newspaper coverage of the UN Climate Change Conferences. Textual and visual elements generally correspond well in substantive terms. Conversely, in the rather nondescript cluster that lacks a distinct textual frame content (the common sense frame in strategy 2) visuals are comparatively rare and varied. However, it is important to note that no text-only frame of climate change emerged from the analysis even

though two thirds of the entire set of articles did not carry a visual. All of these findings hint to the crucial role of text-image correspondences in generating recognizable frame content in news coverage.

Comparing Multimodal Frames across Countries

The distribution of the four frames is relatively similar across the five very different countries (Table 2). For photo-illustrated articles (strategy 1) $\lambda = .047$, i.e., the chance to correctly predict the frame of a random article increases by only 4.7 percent if we know in which country this article was published. In the entire population of articles (strategy 2) the association between frames and countries even disappears completely ($\lambda = .000$). The national context in which a climate change article is produced does not have a decisive effect on journalists' choice of multimodal frames. Still, a close examination of all the cells in Table 2 yields a few noticeable exceptions, particularly relating to the Indian newspapers in which the civil society demands and the political negotiation frames are more salient on average than elsewhere. Conversely, the global warming victims frame is somewhat more prominent in the U.S. newspapers. While there are modest differences in individual cases, we do not find an overarching pattern that would clearly privilege certain frames in particular countries. In particular, we did not find evidence that the victims-centered frame is systematically more salient in the economically less developed countries (Brazil, India, South Africa) or in the countries with the highest long-term climate risk (India as well as the U.S. and Germany; Kreft and Eckstein 2013). Obviously, the global frames we detected constitute different general ways of approaching the topic across countries.

This result is even more significant in light of the fact that about 85% of the multimodal articles are original reporting produced by staff members of the respective newspaper. Only 4% of these particularly rich items originate from news agencies while roughly 10% were written by other authors (mostly opinion pieces by politicians, scientists or other stakeholders). The

only exception from this pattern is South Africa where about 60% of the photo-illustrated articles are original reporting, 10% come from news agencies and no less than 30% from other authors. In the full sample that includes non-illustrated articles (n=1,311) the same pattern emerges: original reporting 81%, news agencies 6%, other authors 13%. Again, South Africa deviates from this average with roughly half of the articles written by newspaper staff, and a quarter each for news agencies and other authors. These findings correspond well with our first-hand observations at the conferences in Doha (2012) and Warsaw (2013) that most of the newspapers whose coverage we study did send reporters – with the exception of the South African papers and O Globo from Brazil. The low numbers for news agencies in both samples of coverage belie the suspicion that the similarities in frame distribution we find could have been caused by the newspapers around the globe simply printing the same news agency reports. Of course, it is conceivable that on-site reporters use news agency reports among other sources as input for their stories without acknowledging this in the byline. But it remains significant that although the newspapers' own writers are responsible for the bulk of COP coverage the framing of these conferences turns out to be relatively similar across these vastly different countries.

- TABLE 2 ABOUT HERE -

The overall frame distribution pattern becomes somewhat more ambiguous when we compute and compare country-specific cluster solutions (strategy 3). Given the exploratory character of hierarchical cluster analysis, it is not surprising that results vary across countries as regards the number of statistically recommended frames as well as their specific configurations. The Indian and the U.S. subsamples show the strongest similarities with the results of the global cluster solution (Table 3). Both countries yield four-cluster solutions, and a cross-tabulation of frame affiliations for articles based on strategy 1 and strategy 3, respectively, shows moderate to

substantial associations (India: $\lambda=.620$, USA: $\lambda=.435$). By contrast, we find six frames in the Brazilian sample ($\lambda=.429$), five frames in the South African sample ($\lambda=.382$), and only three frames in the German sample ($\lambda=.145$).

- TABLE 3 ABOUT HERE -

Despite mediocre associations between the global and the country-specific cluster solutions, a substantive comparison of frame content reveals rather high levels of consistency in how frames are configured: for instance, we find global warming victims frames in all five countries, civil society demands frames in all countries but Germany, and sustainable energy frames in all countries but India. The most volatile frame is the political negotiations frame which only reappears in the Indian and Brazilian subsample and is specifically accentuated by the domestic deforestation/reforestation debated in the latter case.

More generally, we find three patterns of national/global cross-classification in Table 3: A few national frames completely mirror our globally detected frames with convergent classification of articles (between strategies 1 and 3) at 100%. A second group of national frames presents variations of the respective global frame. A case in point here is the splitting up of the civil society demands frame in India into one variant that highlights visuals of conventional industry and one that depicts NGO activists while both feature similar textual framing elements including the need for financial assistance. Both frame variants display a substantial level of convergent classification with the global civil society demands frame ranging around 80%. In a third group of national frames, however, the respective global frame acquires a distinct national flavor in the coverage of a particular country. For example, the Brazilian newspapers merge the sustainable energy and political negotiation frames with the nationally significant de-/reforestation debate, a combination not found in any of the other countries. Consequently, the

degree of convergent classification with the global political negotiations frame is only slightly above 40% in this case. This “national flavor” pattern speaks to the significance of journalistic domestication through which reporters and editors partly adapt the global frame supply offered at the global climate change conferences to national concerns (for qualitative analyses of domestication, see Eide et al. 2010). But it is important to note that in the case we have studied this is by no means the overriding pattern.

Conclusion

In this paper we report the first fully integrated multimodal analysis of news frames. We show that text and image elements uniquely combine in defining distinct issue frames. In selecting and highlighting aspects of the issue while omitting others in a given article, newspaper journalists utilize four distinguishable multimodal frames, in reporting the annual UN Climate Change Conferences. The correspondence of textual and visual elements in producing discernible frames becomes apparent in the subset of photo-illustrated articles. When all articles are clustered, of which two thirds carry no illustration, the frame structure includes one residual frame with less distinct visual and textual content. However, we did not find a frame exclusively carried by text-only items, which shows that text-image relations are crucial in defining coherent news frames. This central aspect is missed by earlier studies that confine themselves to either textual or visual analysis in determining frames. Our multimodal model of frame analysis thus paints a more realistic picture of news media content and helps move framing analysis closer to the actual production and reception situations in newspaper journalism.

Most importantly, the national context in which multimodal articles on the climate conferences are produced does not automatically lead to vastly different national framings. Instead, the cross-national similarity we find in the distribution of multimodal frames can be interpreted as the outcome of a shared globalized production environment that journalists encounter at global events (Lück et al., 2016). Our results support the idea that in the context of

such events relatively similar professional routines for identifying and arranging frame elements do exist across contexts. Particularly in multimodal content production that relies on globally distributed news images the interpretive packages deployed by journalists can transcend the confines of nationally-based journalisms. However, in comparing country-specific multimodal frames with the global frames we find that some national frames do add distinct national flavors to more widely shared frame content. Journalistic domestication counterbalances the global trajectory to some degree. But our results suggest that we should not overestimate the power of this national logic.

What then are the larger lessons we can learn from our case study on the UN Climate Change Conferences when we look beyond the field of climate change communication? Our study speaks to the debate about whether in the course of increasing globalization news coverage becomes transnationally similar or rather remains nationally distinct, and about the driving forces for either of these tendencies (Hafez 2005; Reese 2008). In this context, the COPs serve as an example for global political events more generally and help reveal typical production features that will create event-driven frame convergence in other topical areas, too. For example, our results are in line with the study by Curran et al. (2015) who find remarkable convergences in cross-national coverage even for national political events (elections) that were reported globally.

Moreover, the existence of event-driven frame convergence is significant for the emergence of “global public sphere moments”, that is, mediated discussion on global problems going back and forth between national public spheres of otherwise vastly different countries (Schäfer et al 2014; Wessler 2012). It is beyond the scope of this paper to ascertain the level of such cross-border contention empirically, but we have established one mechanism by which such transnational discursive integration can be facilitated, namely event-related convergence of news frames. Future research could look more closely at the extent to which global events have

direct repercussions for how global issues are discussed in the various national media - and whether, by implication, the communicative basis for legitimizing global political decisions expands. In the case of climate change, the long-awaited adoption of the Paris Agreement at COP21 in 2015, by which all countries vow to follow nationally determined action plans and review their effectiveness regularly, offers an excellent case for evaluating whether the terms of this negotiation result actually reflect a common understanding of the issue circulating in trans-border media debate.

Finally, in methodological terms, the increasing co-occurrence of different modalities in the reality of newspaper and most other forms of journalism is becoming ever more important for journalism research to consider. Inferences about both the construction of meaning by journalists and the interpretation of meaning by media users can only validly be made if we account for the multimodal nature of media representations in our content analyses. The type of standardized frame analysis in the tradition of Matthes and Kohring (2008), which we apply to multimodal material here for the first time, records the presence or absence of particular frame elements in the news product. It thus focuses on manifest motifs in images and the explicit mentioning of topical aspects in news texts and reconstructs frames as non-random configurations of such motifs and aspects. This approach increases intersubjective reliability in frame analysis and facilitates etic comparisons across countries and journalism cultures.

However, the approach we have developed has limitations when it comes to capturing the forms in which motifs and issue aspects are rendered and the exact ways in which visual resources contribute to the resulting overarching frame. In particular, the approach presented so far disregards color, camera angles, image composition and other elements of visual depiction, and it does not record metaphors, argumentative structures or rhetorical strategies in news texts. Of course, such more formal elements of news framing can in principle be included in standardized, disaggregated frame analysis such as the one we have conducted. For example, one

could include shot length as a visual framing device together with the motifs depicted in a cluster analysis to grasp more of the look-and-feel of journalistic coverage. Or the use of particular catchwords in written text (e.g. “climate change” vs. “global warming”; see Schuldt and Roh 2014) could be included as a textual framing element in standardized approaches.

Concerning the specific contribution of visual resources to the overarching frame of a news item Martinec and Salway (2005) offer an important distinction between relations of elaboration, extension, and enhancement, which is based on Halliday’s functional grammar. In relations of elaboration the information contained in the text is conveyed in a more general or specific way through the image. Extension means that new, related information is provided with the image that was not contained in the text. And in relations of enhancement the image circumstantially qualifies the text temporally, spatially or with respect to a reason or purpose. A thorough investigation of such logico-semantic relations between image and text would further illuminate how exactly a multimodal frame is built in the news.

Thus, we propose two complementary methodological avenues for future research on multimodal news frames. Quantitative framing researchers should find ways to incorporate a limited set of relevant formal framing features into their standardized schemes to capture more semiotic richness. This will allow for a reconstruction of news frames that comes even closer to the actual reading/viewing experience and thus offers more potential to adequately inform framing effects research. For qualitative researchers specializing in either visual or textual analysis it seems paramount to leave the disciplinary confinements behind and study text-image relations in greater detail. Such qualitative multimodal frame analysis can help elucidate meaning construction processes that rely on distinct logico- semantic text-image relations rather than simple co-occurrence of elements. In the long-term vision, it might even be hoped that these two avenues for future research will coalesce to reconstruct and compare across cultures the multimodal dynamics of sense-making that lie at the heart of the journalistic profession, but that

so often escape our attention.

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Table 1: Composition of multimodal climate change frames (articles with photo only; column percentages)

Text-based frame elements		Global warming victims frame <i>n=156</i>	Civil society demands frame <i>n=125</i>	Political negotiations frame <i>n=50</i>	Sustainable energy frame <i>n=101</i>	total <i>n=432</i>	λ (symmetric)
Consequences	increase in temperature	71.2	30.4	6.0	28.7	41.9	0.236
	extreme weather	41.0	9.6	2.0	17.8	22.0	0.057
	melting ice	35.9	8.0	4.0	4.0	16.7	0.043
	economic difficulties	16.0	10.4	6.0	12.9	12.5	0.000
	societal consequences	34.0	18.4	6.0	15.8	22.0	0.000
Causes	fossil fuels	50.0	52.8	4.0	72.3	50.7	0.094
	deforestation	12.8	9.6	8.0	5.9	9.7	0.000
	national interests	10.9	23.2	34.0	15.8	18.3	0.034
Remedies	clean energy mentioned	10.9	60.8	40.0	71.3	42.8	0.280
	reforestation mentioned	9.6	20.8	14.0	7.9	13.0	0.033
	new treaty mentioned	9.0	44.0	28.0	22.8	24.5	0.107
	financial help mentioned	10.9	48.0	24.0	13.9	23.8	0.113
	clean energy endorsed	32.1	36.0	24.0	90.1	45.8	0.257
	reforestation endorsed	15.4	4.8	14.0	5.9	10.0	0.000
	new treaty endorsed	14.7	27.2	20.0	17.8	19.7	0.030
	local efforts endorsed	7.1	2.4	0.0	4.0	4.2	0.000
	financial help endorsed	17.3	18.4	26.0	12.9	17.6	0.000
	no action rejected	17.9	16.8	22.0	11.9	16.7	0.000
new treaty rejected	3.8	7.2	8.0	4.0	5.3	0.010	
Visual frame elements							
urban landscape	14.1	21.6	4.0	18.8	16.2	0.014	

	natural landscape	37.8	13.6	4.0	23.8	23.6	0.029
	ocean, coast	12.2	20.8	0.0	5.9	11.8	0.021
	snow, ice, glacier	16.7	0.0	0.0	3.0	6.7	0.000
	desert, steppe	6.4	0.8	0.0	4.0	3.5	0.000
	animal	12.2	1.6	0.0	4.0	5.8	0.000
	traffic	5.1	6.4	0.0	13.9	6.9	0.020
	conventional industry	5.8	12.0	0.0	28.7	12.3	0.061
	green technology	1.9	0.0	0.0	10.9	3.2	0.280
	PR stunt	1.3	29.6	4.0	4.0	10.4	0.109
Actors	politician	10.3	2.4	92.0	24.8	20.8	0.197
	NGO	5.8	61.6	10.0	4.0	22.0	0.261
	scientist	12.2	6.4	0.0	2.0	6.7	0.000
	ordinary citizen	34.6	14.4	2.0	22.8	22.2	0.013

DARK GREY: frequency of at least 40 percent of articles in cluster; **LIGHT GREY**: frequency between 20 and 39.9 percent of articles in cluster; **BOLD**: elements that stand out in cross-cluster comparison (exceeding average relative frequency of element by more than 50 percent)

Table 2: Distribution of multimodal news frames per country (articles with photo only, n=432)

Frame/Country	Brazil	Germany	India	South Africa	USA	total (articles)
Global warming victims frame	34 28.8%	54 42.5%	30 30.3%	17 37.0%	21 50.0%	156 36.1%
Civil society demands frame	32 27.1%	29 22.8%	39 39.4%	15 32.6%	10 23.8%	125 28.9%
Political negotiations frame	14 11.9%	13 10.2%	22 22.2%	0 0.0%	1 2.4%	50 11.6%
Sustainable energy frame	38 32.2%	31 24.4%	8 8.1%	14 30.4%	10 23.8%	101 23.4%
n (articles)	118 100.0%	127 100.0%	99 100.0%	46 100.0%	42 100.0%	432 100.0%

$\lambda = .047$ (asymmetric with frames as dependent variable)

Table 3: Multi-modal frame comparison across countries (based on photo-illustrated articles, n=432)

Total (n=432)	Brazil (n=118)	Germany (n=127)	India (n=99)	South Africa (n=46)	USA (n=42)
4 cluster solution	6 cluster solution $\lambda=.429^*$	3 cluster solution $\lambda=.145$	4 cluster solution $\lambda=.620$	5 cluster solution $\lambda=.382$	4 cluster solution $\lambda=.435$
Global warming victims (n=156) 1. increase in temperature 2. fossil fuels 3. extreme weather 4. V natural landscape 5. melting ice / rising sea levels 6. V ordinary citizens	Global warming victims (n=12) – 100%** 1. V natural landscape 2. melting ice / rising sea levels 3. V snow, ice, glacier 4. increase in temperature 5. societal consequences 6. V ordinary citizens Victims + consequences & remedies (n=11) – 82% 1. increase in temperature 2. clean energy	Victims + remedies (n=43) – 60% 1. fossil fuels 2. increase in temperature 3. clean energy endorsed 4. new treaty endorsed 5. no action rejected 6. new treaty mentioned Global warming victims (n=48) – 48% 1. increase in temperature 2. V natural landscape 3. clean energy	Global warming victims (n=29) – 86% 1. increase in temperature 2. fossil fuels 3. melting ice / rising sea levels 4. extreme weather 5. V ordinary citizens 6. V natural landscape	Global warming victims (n=20) – 60% 1. V ordinary citizens 2. increase in temperature 3. societal consequences 4. extreme weather 5. fossil fuels 6. natural landscape Global warming victims + help (n=6) – 50% 1. extreme weather 2. societal consequences 3. clean energy	Global warming victims (n=17) – 88% 1. increase in temperature 2. extreme weather 3. V natural landscape 4. V ordinary citizens 5. melting ice / rising sea levels 6. fossil fuels Global warming victims + help (n=6) – 83% 1. financial assistance mentioned 2. financial

- | | | | |
|-----------------------------------|------------------------------------|----------------------------------|----------------------------|
| 3. extreme weather | 4. melting ice / rising sea levels | 4. financial assistance endorsed | assistance endorsed |
| 4. financial assistance mentioned | 5. extreme weather | 5. V politician | 3. increase in temperature |
| 5. societal consequences | 6. societal consequences | | 4. fossil fuels |
| 6. reforestation endorsed | | | 5. no action rejected |
| | | | 6. extreme weather |

Civil society demands (n=125)	Civil society demands (n=23) – 83%	Civil society demands (industry) (n=13) – 77%	Civil society demands I (n=7) – 100%	Civil society demands (industry) (n=6) – 67%
1. V NGO activists	1. V NGO activist	1. fossil fuels	1. V NGO activists	1. clean energy mentioned
2. clean energy mentioned	2. clean energy mentioned	2. V conventional industry	2. clean energy endorsed	2. new treaty mentioned
3. fossil fuels	3. V PR stunt installation	3. clean energy mentioned	3. colliding national interests	3. new treaty endorsed
4. financial help mentioned	4. fossil fuels	4. new treaty mentioned	4. financial assistance endorsed	4. increase in temperature
5. new treaty mentioned	5. financial assistance mentioned	5. colliding national interests	5. new treaty endorsed	5. fossil fuels
6. clean energy endorsed	6. clean energy endorsed	6. financial assistance mentioned	6. V urban landscape	6. financial assistance mentioned

Civil society demands (n=27) – 81%	Civil society demands II (n=4) – 75%
1. V NGO activists	1. fossil fuels
2. financial assistance mentioned	2. new treaty mentioned
3. clean energy endorsed	3. new treaty endorsed
4. fossil fuels	4. increase in temperature
5. clean energy mentioned	5. societal consequences
6. colliding national interests	6. V PR stunt installation

Political negotiations (n=50)	Clean energy / reforestation debate (n=27) – 41%
1. V politician	1. clean energy mentioned
2. clean energy mentioned	2. V politician
3. colliding national interests	3. reforestation mentioned
4. new treaty mentioned	4. clean energy endorsed
5. financial help endorsed	5. reforestation endorsed
6. financial help mentioned	6. V natural landscape

Political negotiations (n=30) – 70%
1. V politician
2. clean energy mentioned
3. colliding national interests
4. financial assistance mentioned
5. no action rejected
6. financial assistance endorsed

	Sustainable energy + causes & consequences (n=15) – 73%			
	<ol style="list-style-type: none"> fossil fuels clean energy mentioned 			
Sustainable energy (n=101)	<ol style="list-style-type: none"> clean energy endorsed V politician clean energy endorsed increase in temperature colliding national interests 	Sustainable energy (n=36) – 44%		
<ol style="list-style-type: none"> clean energy endorsed fossil fuels clean energy mentioned V conventional industry increase in temperature V politician 		<ol style="list-style-type: none"> clean energy mentioned fossil fuels clean energy endorsed increase in temperature financial assistance mentioned new treaty mentioned 	Sustainable energy (n=9) – 78%	
	Sustainable energy (n=30) – 60%			Sustainable energy (n=13) – 54%
	<ol style="list-style-type: none"> fossil fuels clean energy endorsed clean energy mentioned V ordinary citizen V urban landscape V natural landscape 		<ol style="list-style-type: none"> clean energy endorsed fossil fuels clean energy mentioned V business 	<ol style="list-style-type: none"> fossil fuels clean energy endorsed clean energy mentioned increase in temperature new treaty endorsed V urban landscape

* indicates overall symmetric association between articles’ frame attribution in country-specific and overall cluster analysis

** indicates percentage with which articles’ frame attribution in country-specific cluster analysis corresponds with frame attribution in overall cluster analysis

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ⁱⁱ For India and South Africa we selected English-language newspapers for practical reasons, possibly even enhancing the “elite” orientation of the sample. Sampling periods were for COP 16 November 22 to December 19, for COP 17 November 28 to December 14, for COP 18 November 19 to December 4, and for COP 19 4 November to 30 November.

ⁱⁱⁱ At least one full paragraph had to focus on causes or impacts of global warming, climate change politics and policies, climate science, climate justice, and/or measures to mitigate or adapt to the effects of global warming.

^{iv} The complete codebook is available in the online appendix at www.climate.uni-mannheim.de/downloads.

^v For statistical reasons, very rare variables should be excluded from the clustering procedure.

^{vi} We decided on a lower threshold across all variables for the cluster analysis of all articles (strategy 2) to account for the fact that only 37 percent of articles contained images so that visual variables had a lower probability of showing up in the entire dataset from the outset.

^{vii} There is discussion in the literature whether hierarchical cluster analysis may be performed with categorical data. We therefore first subjected all 34 variables to a principal component analysis with Varimax rotation, yielding a Kaiser-Meyer-Olkin value of .593 (“miserable”, see Dziuban & Shirkey, 1974, p. 359) and correlations between the variables ranging from -.206 to

.451 with the majority in the range of -.10 to .10. We therefore refrained from a factor analysis and continued clustering with our initial variables (instead of principal components).

^{viii} To apply the 'elbow criterion', we checked the increase in the Sum of Squared Distances (SSD) for different cluster solutions and stopped clustering after an observed 'jump' in the increase. To facilitate better interpretation we calculated the relative 'slope' between SSDs for the last ten clustering steps and then the 'slope quotient' between slopes. The resulting 'quotients' provide a quite clear numerical indication for the 'jump' in the increase of SSDs.

^{ix} In 154 of the 432 articles causal agents were singled out as being responsible for climate change, four of which were particularly salient: China (in 39 articles), developed countries as a group (35), the USA (30), and India (13). The distribution of these responsibility attributions over the four multimodal frames did not reveal a consistent pattern.