Work Package 1
Deliverable 1.3

The International Geomedia Agenda

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Executive Summary

This deliverable provides **conceptual grounds** for the analysis of opinions about international conflicts in the media, crossing the perspectives of quantitative geography and media studies. In particular, it presents the state of the art of interdisciplinary literature about the agenda setting and the role of information gatekeepers; it provides a theoretical typology of literature about public opinion analysis in social media; it studies connections in agent-based social models between mass media and social media in setting the agenda and influencing opinions; and finally it investigates how these topics have been developed in the literature related to international conflicts.

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1 Introduction

1.1 Motivation

Deliverable 1.3 “The International Geomedia Agenda” aims at providing the conceptual grounds necessary for carrying out some of the main tasks of the H2020 ODYCCEUS project, notably the case study analysis. Taking into account the interdisciplinarity of the field of study and the large spectrum of questions to be investigated, it will focus on a specific aspect, that is to say the analysis of opinions about international conflicts in the media.

As a first step, it is necessary to clarify which are the main concepts, and consequently research areas, that are related to such a topic. As summarized in Figure 1, it is possible to identify four main thematic areas that are concerned by this study.

1) The media. The first area concerns the phenomena related to the production of information and notably the role of the media. In this category today we can include a variety of actors, form mass media to social media, from global to local media.

2) The agenda. The second area concerns all concepts and theories referring on the role of the media in setting the agenda, that is to say in defining people representations.

3) The opinions. The third area concerns the consumption of information and notably the formation of individual opinions (or attitudes). Here, it is interesting to focus on the relationship between the media agenda and the creation and diffusion of individuals’ opinion.

4) The international conflicts. The fourth area concerns the specific case of the interactions between the media agenda and the individual attitudes in relation to international conflicts. In this context, the dimension of space becomes crucial, by defining a geomedia agenda.

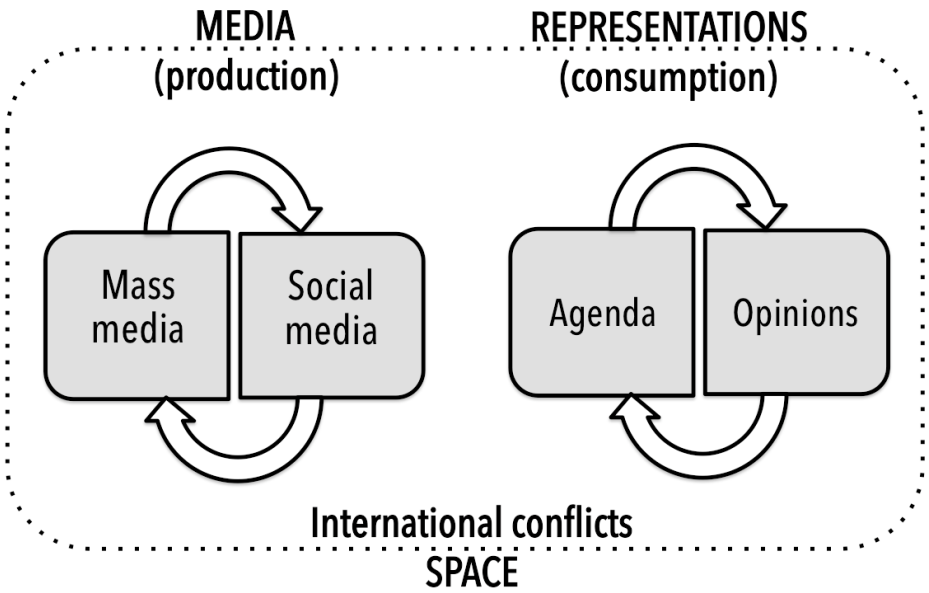


Figure 1. Key concepts related to the International Geomedia Agenda

1.2 Role in the project

In order to cover these key concepts, this deliverable will be organized in four chapters.

The first chapter will present the state of the art of interdisciplinary literature about the agenda setting and propose the concept of the international media agenda. It is linked with all work packages because it will provide basic concepts related to the interaction between the media and the opinion. Yet, it will be particularly useful for **WP5 Case studies** (notably **T5.2** Contested European boundaries: geopolitics **and T5.3** Contested European boundaries: refugees), that should carefully take into account the already verified dynamics of production and consumption of news. Moreover, the functioning of the international geomedia agenda will be integrated, first in the modelling structures of **WP2** (notably **T2.4** "Social and spatial interaction models"), and, then, in the Penelope platform (**WP4 Tools – T4.4** and **T4.5**) in order to provide spatial views of opinion dynamics.

The second chapter will provide a theoretical typology of literature about public opinion analysis in social media. It is strictly related to **T1.5** "The impact of new social media". It will support the modelling tasks (**WP2,** notably **T2.1** "Models for the co-evolution of representations, opinions and communication groups") in order to consider the different ways in which opinions can be modelled based on Twitter data. Moreover, it will provide a state of the art highlighting strong and week points of already existing multi-scale techniques. This will definitively help the development of an original multi-scale algorithm (**WP3 Methods**, notably **T3.3** "Multilevel dynamical networks for the analysis of opinion dynamics and geopolitical conflicts"). Finally, it will provide a solid bibliography for case studies aiming at analysing political affiliation through Tweets (**WP5** – **T5.1** and **T5.6**).

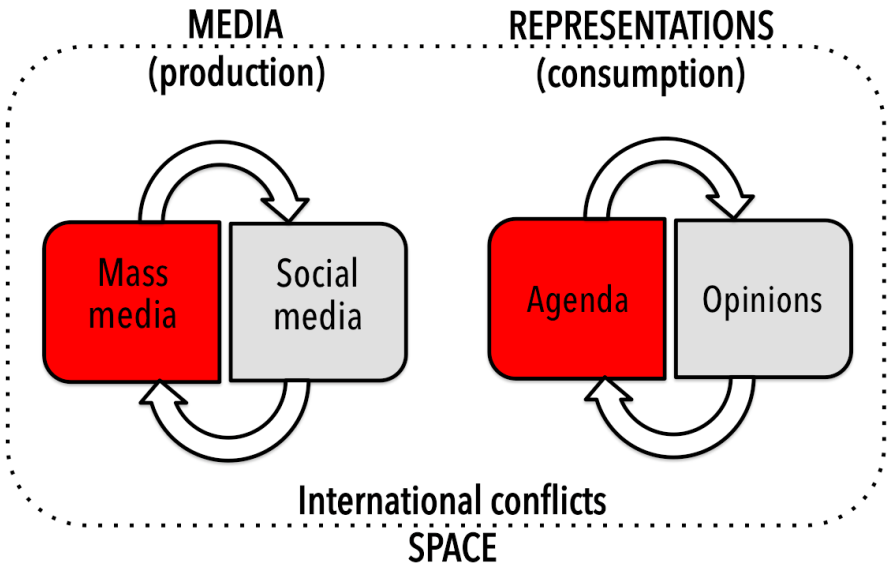
The third chapter will study connections between mass media and social media in setting the agenda and influencing opinions in the literature on agent-based models of social interactions. The objective will here consist in providing a typology of existing approaches in the domain that simultaneously consider "horizontal" interactions, to study the effect of decentralized dynamics (social media), and "vertical" interactions, to study the effect of broadcast dynamics (mass media). It will hence contribute to the integration of mass media in agent models (**WP2** – **T2.1**), to the analysis of multi-dimensional and multi-media data (**WP3** – **T3.3**), and to the integration of such tools in the Observatory and Facilitator (**WP4** – **T4.4** and **T5.5**).

Finally, the last chapter will investigate how these topics have been developed in the literature related to international conflicts. Its contribution will guarantee a solid background for **WP2** (**T2.4**) and for the originality of the case studies, notably about Contested European boundaries (**WP5 – T5.2** and **T5.3**).

1.3 Work done

As said, the main goal of this deliverable is to provide a common and solid ground to all partners of the project by key concepts and to build a unique interdisciplinary vision of previous research in the field. To do so, this deliverable will mainly include a structured and explained bibliography useful to build original research on it. Yet, the second chapter is based on an original study that has been resumed in a paper recently accepted by the *French Journal of Sociology / Revue Française de Sociologie*.

2 Mass Media and the International Geomedia Agenda



2.1 The State of the Art of Agenda Setting and Related Studies

In order to study opinion dynamics, it is important to remind the main theories that have modelled the action of mass media, and notably the press, in defining the public agenda, that is which representations citizen have about the reality. The goal, here, is not to resume all existing theories but to identify the more useful to the project and to highlight connections between key references provided at the end of the deliverable.

Even if it has more than seventy years and it have received very significant critics, the **agenda setting theory** is still a starting point when considering the action of mass media on people's representations. The idea of agenda-setting was already underlying in *Public Opinion* (1922) of Walter Lippmann that he titled "The World Outside and the Picture in Our Head" and where he highlighted the effect of the pseudo-environment constructed by news media on the public opinion. In 1963, Cohen stated « the press may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think about » (Cohen, 1963). Based on this first idea that media have the power to influence the attention of readers in the selection of news to be consumed, McCombs and Shaw (1972) try to verify the existence of the agenda setting function of mass media defined as follows: "the mass media set the agenda for each political campaign, influencing the salience of attitudes toward the political issues". In order words, agenda setting refers to the idea that there is a strong correlation between the emphases that mass media place on certain issues (*e.g.*, based on relative placement or amount of coverage) and the importance attributed to these issues by mass audiences. The authors identify a cause-and-effect relationship between the media agenda and the public agenda that has been demonstrated by numerous empirical studies based on surveys but also on laboratory controlled experiments in the following years.

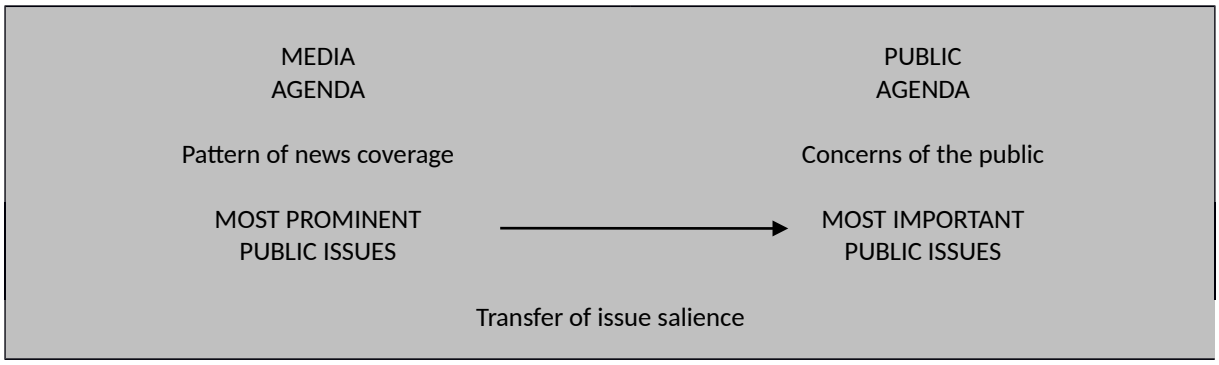


Figure 2. Agenda-setting role of the mass media (McCombs, 2014, p. 5)

According to the **Acapulco typology** (McComb, 1981), we can distinguish four perspectives of agenda setting studies according if they focus on the all agenda or on a single item and according if that they use individual or aggregate data: (I) Competition: studies that focus on the global agenda of the population; (ii) Automaton: studies on the entire agenda setting of an individual; (iii) Natural history: studies that use aggregate data to measure the salience of a single issue; (iv) Cognitive Portrait: studies on the salience of a single item of the agenda of an individual.

McCombs and Shaw, twenty years later, bring further their definition by stating: "Agenda setting is considerably more than the classical assertion that the news tells us **what** to think about. The news also tells us **how** to think about it". (McCombs and Shaw, 1993) So we can distinguish a first level of the agenda setting according to which media define just the object (the public issue) of people attention (what) and a second level according to which the media define also the **attributes** of the object (how). "In the agenda-setting theory, attribute is a generic term encompassing the full range of properties and traits that characterize an object". (McCombs, 2014, p. 41) Studying the attributes means studying the comprehension of the object, that is to say how it is framed by the news and understood by the individual.

MEDIA	PUBLIC
AGENDA	AGENDA
Transfer of salience	
Objects ==========> Salience of Objects	
First-level effects: Traditional agenda-setting	
Attributes ======> Salience of Attributes	
Second-level effects: Attribute agenda-setting	

Figure 3. First- and Second-level agenda-setting (McCombs, 2014, p. 41)

Some scholars have focused on this second-level of the agenda by developing the concept of "**framing**". They focus on how the object is presented in messages. Robert Entman (1993) proposes the following definition: "To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particu-

lar problem definition, causal interpretation, moral evaluation and/or treatment recommendation for the item described".

According to some scholars, attribute and frame are clearly distinct concepts. Dietram Schefuele (2000) argues that framing and agenda-setting operate via distinct cognitive processes (accessibility vs. attribution), and relate to different outcomes (perceptions of issue importance vs. interpretation of news issue).

According to other scholars notably close to the agenda setting theory (as Combs, Shaw and Weaver), the concepts of attribute and frame are synonymous. Weaver identifies the following similarities between these concepts: both are more concerned with how objects are depicted in the media; both focus on most salient or prominent aspects of the objects of interest; both are concerned with ways of thinking rather than objects of thinking. Yet, also some differences can be observed. First, based on Entman's definition, framing includes a broader range of cognitive processes (moral evaluations, causal reasoning, *etc.*) than agenda-setting attributes. Second, framing approach focuses more on news production process. Yet, McCombs *et al.* (1997) argue that framing effects should be seen as the extension of agenda setting because framing is about selecting "a restricted number of thematically related attributes". (p. 106)

Later, a third level of the agenda-setting has been identified that consists on the relationships between the objects and the attributes (Guo and McCombs, 2011). Indeed, agenda items cannot be studied as separated entities, yet the scholar should focus on the **network** of items where one can be a "compelling argument" that influences the salience of the other.

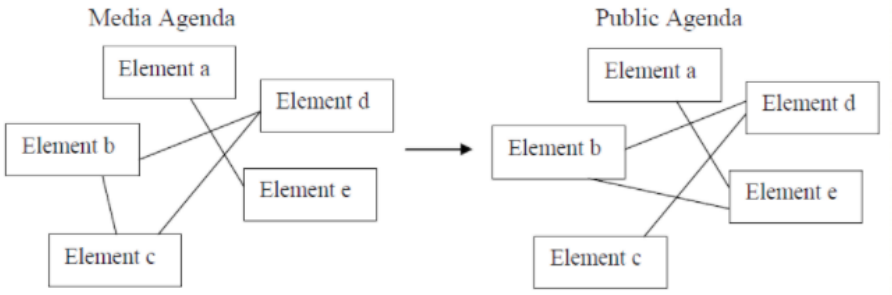


Figure 4. Third-level agenda-setting: network agenda-setting model

Even if scholars generally agree on the interest of the concept of "agenda", in the last years several authors have raised important critics about this theory. In particular, several scholars focus on the question "who sets the media's agenda?" and oppose to the agenda setting theory the concept of **agenda building**. Indeed, it is useful to underline the reciprocal interactions between the media and their sources (Weaver et Elliott, 1985) or even more in general the interaction sources-media-public. Berkowitz (1992) introduces also the terms "policy agenda-setting" and "policy agenda-building" in order to provide a more complex view of these two theories. The agenda building theory has played a key role in identifying the influence of the political system on the media agenda (Lang and Lang, 1981). Rogers and Dearing

(1988) argue that, beside media agenda and public agenda, also the **policy agenda** has to be taken into account. The policy agenda[1] is constituted by the elite policy makers' agendas that influence the media agenda.

Another important group of theories have focused on the routines inside the media in order to explain how journalists work for setting the agenda (Gieber, 1964). Scholars in this field usually develop ethnographic or sociological studies for investigating the **news making process** (Golding and Elliott, 1979). Thousands of papers in the last seventy years have tried to describe the role of journalist and the power of social control of newsrooms (Breed, 1955). In this field, the concept of "**gatekeeper**" has emerged as particularly useful (White, 1950). According to Lang and Lang (1981), framing news is a form of gatekeeping. For example, the Watergate case has been perceived as a scandal when news has started to frame it as a scandal.

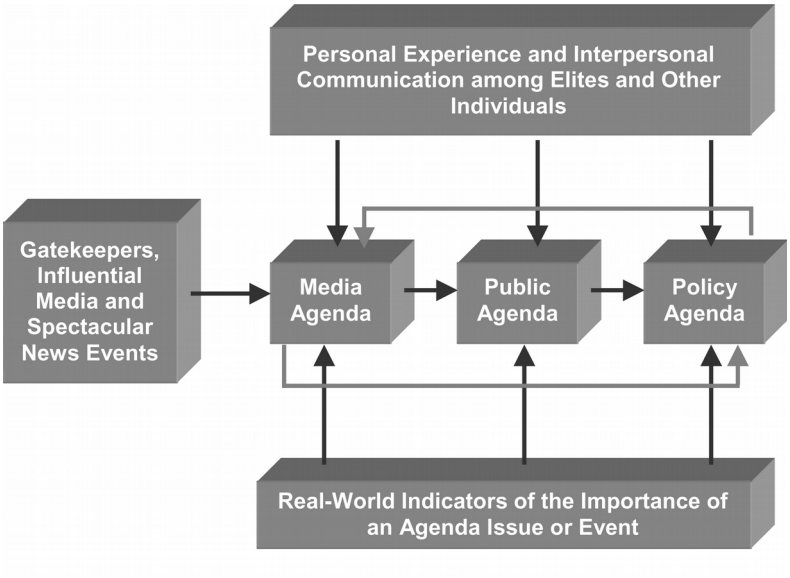


Figure 5. Rogers and Dearing, 1988

What is particularly interesting for researchers working in the ODYCCEUS project is considering how the **explosion of Internet** has profoundly affected this scenario. Several scholars have tested the agenda setting theory on online news. One of the main objects of study was to compare the cause-and-effect relationship between media agenda and public agenda in traditional media, such as press and TV, with the Internet. In general, scholars find that online news are less effective in setting agenda than traditional news (Althaus and Tewksbury, 2002; Conway and Patterson, 2008). However, there is no doubt that the agenda-setting effects are valid also on the web. For example, Ku *et al*. (2003) verify the influence of candidate websites on the public agenda during the 2000 US presidential campaign.

1 More recently scholars have started to focus also on the political agenda as a dependent variable by studying how the media and public agendas might influence elite policy maker's agendas (Walgrave and Van Aelst, 2006).

Several scholars have described the effects of digital technologies on journalism. Boczkowski (2005) notes the similarity between offline and online news that he justifies considering the facilitation of journalists' long-standing habits of monitoring the competition of news available on different media. One of the emerging effects of online news is related to concurrence. The issue of concurrence in the journalism sector is surely not new. The media mimesis – or "the circular flow of information" to use an expression of Pierre Bourdieu (1996) – has been demonstrated multiple times. No doubt, a story published in a medium will be easily published by others. The danger to loose a story is one of the main fears of a journalist. What changes with Internet is that this mechanism becomes faster and larger. News may circulate quicker and be available on multiple supports without added costs.

Moreover the journalist scene is occupied by new types of gatekeepers called "**cybermediaries**" (Sarkar *et al*. 1995) that aggregate and spread out information more quickly, mainly by relying agency content. If at a first look, this increase of information gatekeepers is expected to produce a major diversity of information, Marty *et al*. (2009) demonstrated through on empirical case study on French news websites that news published on websites are generally redundant and only few major stories can be identified. In a further paper, Smyrnaios *et al*. (2010) showed how the long tail theory cannot be applied on online news and they denounced the lack of pluralism of information on the web. They state: "If the agenda-setting effect assumption is largely accepted in the field of traditional media, it is not always the case when it comes to the web." However, they demonstrated that 20 % of the most important topics of the news agenda generate 80 % of the distributed articles. So, thank to the action of info-mediaries, the Internet offer a similar scenario of traditional media. Likewise, several scholars had comparable findings in other national contexts: Boczkowski and de Santos (2007) for Argentina, Dagiral and Parasie (2012) for Germany and Cottle and Ashton (1999) for the UK.

As a result, scholars have demonstrated that the explosion of news on the web brings about the impoverishment of content. Diversity of information is just a mythical aspect and generally content is unoriginal. Information has to be diffused immediately. Consequently, the editorial work of the journalist is not so necessary for diffusing the information online. Often, the press release of agencies is simply published and republished several times. And this is especially through for international news. Not only this information is very expensive for the newspaper, but also the fact that other media can instantly reprise it can make all efforts to satisfy the audience useless. As underlined by Chris Paterson (2005), "as news providers increase in quantity and scope, the original sources of consequential international news stories are few" (p. 145). The scholar points out: "I wish suggest the problem identified here should be viewed as a manifestation of our globalised and converged age and not merely as a continuation of the news agency influence over international news which has existed for nearby a century and a half" (p. 146).

2.2 Defining the International Media Agenda

Several scholars have developed empirical studies in order to justify and sometimes forecast the agenda of mass media especially focusing on international news. Since the sixties, numerous studies (Galtung and Ruge, 1965; Wu, 2000) try to identify the determinants of **newsworthiness**, that is to say the criteria used by media outlets, such as newspapers or broadcast media, to determine how much prominence to give to a story (Gans, 1979). Among the proposed criteria we can mention: the importance and interest of the fact; values related to the news (novelty, quality…); values related to the medium (good material, frequency, format); values related to the public; and competition-related values.

Several scholars among them have underlined the importance of the geographical and cultural proximity in the selection of news. By comparing the coverage in the Anglophone press of protest events happening in Argentina, Mexico and Paraguay in the year 2006, Herkenrath and Knoll (2011) conclude that "possible country differences in international protest coverage can ultimately be explained by the (spatial, cultural, political and economic) 'proximity' of the venue of the event to the place where the medium is published and the worldwide political and economic importance of the nation in which the event occurs ('elite nation')."

Moreover, studies have also highlighted the inequality of state coverage in international news. According to Einar Östgaard (1965), certain "factors" in the process of information treatment prevent the free flow of information. The same type of fact may be considered relevant or not relevant in a given state according to the area of the world where it occurs. Even if for the sake of this text it is not pertinent to present all this rich literature, just the fact that it exists and is still so prosperous, is a sufficient evidence of the centrality of the state as the main actor of international news.

Determinants proposed in the different studies are generally related to the scale of the nation: not only proximity, but also economical and political power (Wu, 2000). Some scholars emphasize the involvement of people in order to justify the press coverage of some international events. Yet, also in this case the person is less considered for his/her individual value rather than for his/her role in the national and international system. Using the definition of Galtung and Ruge (1965) we can say that elite-centred news are usually in terms of nation more than in terms of people.

Yet, today such criteria seem not sufficient any more in order to explain the media coverage of international events. Readers seem not so interested in events that answer to the 'proximity' requirement. Actually, they do not seem to be interested in international affairs at all. Daya Kishan Thussu (2007) describes the globalisation of a new phenomenon called "**infotainment**", a neologism which "refers to an explicit genre-mix of 'information' and 'entertainment' in news and current affairs programming" (p. 7).

Considering all these changing factors, **a more complex model[2] has to be proposed in order to explain the selection of news by mass media and consider the effect of it on public opinion**. In particular, we argue that is necessary to have a model for studying the international geomedia agenda, that is to say to study the media coverage of countries and of international events. In studying the international geomedia agenda, three dimensions become crucial: source, time, space. New research questions become relevant, such as: Which countries have benefited from the highest level of coverage during a specific week? Does the answer vary according to media? What are the weeks when a particular country has been most present in the news? Does the answer vary according to the media?

Moreover, it is interesting to see what is changing with online news. Theoretically, the Internet allows news organizations to overcome geopolitical hierarchies in international news flow. Practically, do they? Himelboim *et al*. (2010) try to answer to this question by analysing 223 news web sites in seventy-three countries. Yet, their study shows that traditional network structures and world hierarchies are reproduced in online media.

In order to answer to this new type of questions, we have proposed in a previous study a model of international geomedia agenda (Grasland *et al*., 2016). The goal was to have a normalised research tool that: provides a quantitative signature of media coverage for a given event; measures duration across time and identifies peaks; allows comparing signatures of different events (a domestic social and racial crisis such as Ferguson vs. a catastrophe such as the Malaysian Airlines crashes) or different media. Finally, this model aims at revisiting the agenda-setting theory and newsworthiness approaches to account for variations in media, space and time.

We made the hypothesis that it is possible to highlight fundamental properties of the international geomedia agenda of the daily newspapers by retaining from each news only: the media publishing the news; the date of publication of the news; the list of foreign countries cited in the news title.

Then, we considered three questions to explore the "cutting plans" of the international geomedia agenda:

Q1. Which countries received the most coverage in a specific week? Does the answer vary according to the media?

Q2. What are the weeks when a particular country has been most present in international news over a year? Does the answer vary according to the media?

Q3. Which week-country pairs have received the most attention from a specific media?

In order to answer these questions, we proposed a mathematical formalism. The geomedia cube is a three-dimensional representation to model media information flows. Each box *(m,t,s)* of the cube quantifies the media coverage of the media *m* concerning the country *s* during the period *t*. This amount of media coverage, denoted *v(m,t,s)*, is a function that ag-

2 GEOMEDIA was a project funded by the French Research Agency (2013-2016) that aimed at building an observatory of international media flows. The main output of this project is the model of international geomedia agenda to study the media coverage of countries and of international events.

gregates the articles of the corpus within the cube according to (1) the news to which they belong, (2) their publication date and (3) the result of the geographical labelling process.

In order to answer these questions, we proposed a simple mathematical formalism to represent media information flows as a three-dimensional data structure, namely the geomedia cube (Grasland *et al.*, 2016). Each cell *(m,s,t)* of this cube quantifies the news coverage of a given media outlet *m* concerning a given country *s* during a given time period *t*. To do so, the structure aggregates and counts all articles in the corpus under study according to (1) the media outlets that published them, (2) their publication dates, and (3) the result of the geographical labelling process. The cube can then be unfold along these three analysis dimensions in order to explore and study different acceptations of the media agenda. By fixing one dimension, one focuses on a particular slice of the cube that can be seen as a classical two-dimensional contingency table. Then, by computing a null model that preserves the table's marginals, one measures significant deviations between the observations and the model. This allows to detect prominent information within the cube that is later interpreted as potentially interesting specificities – or biases – within the media information flows.

For example, irregularities within the contingency table relating time periods to countries, that is for a given media outlet *m*, reveal geomedia events which coverage level cannot be only explained by the general interest of *m* for the country, or by the global activity of *m* during the detected time period. Such events hence correspond to significant deviations within the "mean" personal agenda of the considered media outlet. To give another example, irregularities in the contingency table relating media outlets to countries, that is for a given time period *t*, reveal another type of information regarding the "mean" spatial agenda of the media sphere. Events hence inform about the specificities of some media outlets with respect to the general spatial interests of other outlets at a given date. The three dimensions of analysis provided by the geomedia cube hence allow to explore and to quantify different aspects of the media agenda with respect to international events.

In previous work, this model has been tested only on mass media content. One of the goals of the ODYCCEUS project is to extend this model to social media content. In particular, it will be implemented on the Penelope platform in order to study agenda setting phenomena through time, space, event and also through media, from mass media to social media.

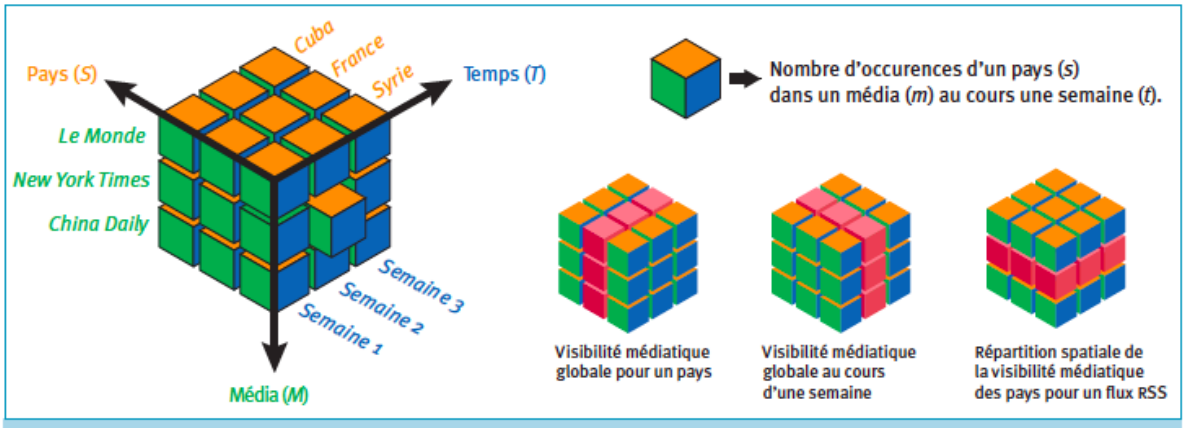
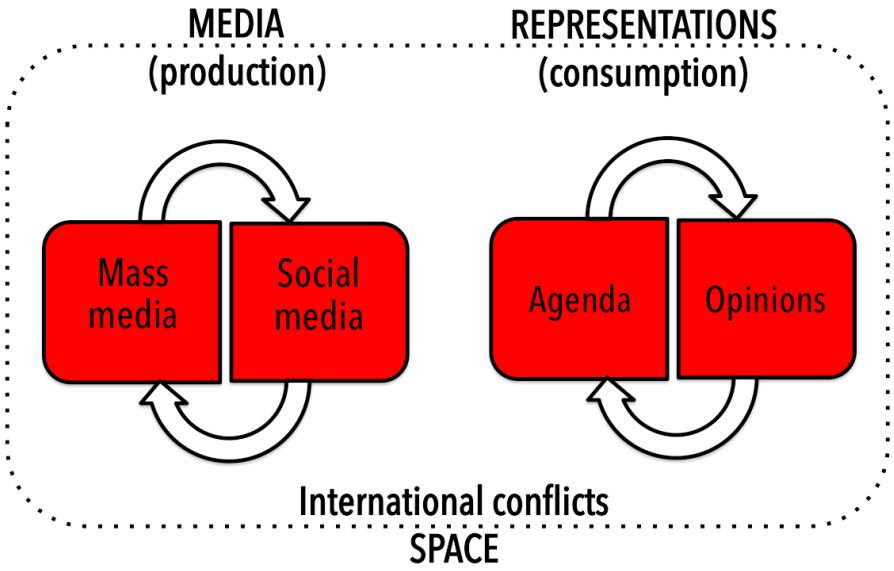


Figure 6. The geomedia cube (Grasland et al., 2016).

3 Social Media and the Analysis of Opinions



3.1 The State of the Art of Political Opinion Studies based on Twitter

The study of political opinion is a traditional field in social sciences. Researches related to elections, political parties and representatives have been filling the pages of social sciences journals for the last century. They often rely on empirical analysis based on traditional methods such as opinion polls, surveys, focus groups, or interviews. Yet, social research on public opinion has been affected by the recent deluge of new digital data on the Web, from blogs and forums to Facebook pages and Twitter accounts. This fresh type of information useful for mining opinions is emerging as an alternative to traditional techniques, such as opinion polls.

Considering that several WPs in ODYCCEUS are based on these new data, we have investigated the impact of the use of social media data on the social research on political opinion, by focusing on the specific case of studies based on Twitter data[3]. When compared to other social media, Twitter has received a lot of attention from scientists both because of how easy it makes the collection and treatment of data, and because of the wide scope of topics covered by online exchanges. Also, they are the most used type of data by the ODYCCEUS consortium.

Our research calls for the identification of theoretical views on political opinion in the literature based on Twitter data. As a preliminary step, it is useful to summarise the classification proposed by Robert Entman and Susan Herbst (2001) that identify four forms of framing public opinion based on methods used by scholars in the analysis of public opinion.

The first form is "**mass opinion**". According to this form, undoubtedly the most popular, public opinion can be defined as "the aggregation or summation of individual preferences as tabulated through opinion polls, referenda or elections". Within this form, opinions are not "reflective of thoughtful, informed citizens". They are rather artefacts of the tool used to collect them. The second form of public opinion is the "**latent public opinion**", which "underlies more fleeting and superficial opinions we find when conducting polls of the mass public".

3 Here we provide a summary, the full paper will be soon published in *Revue française de sociologie*.

This deeper preference depends on individual considerations and political predispositions, that is to say "stable, individual-level traits that regulate the acceptance or non-acceptance of the political communications that people receive" (Zaller, 1992, p. 22). The third form, called the "**activated public opinion**", refers to opinion "of engaged, informed, and organized citizens – those who are mobilizable during campaign periods and between elections as well". Within this form, we can clearly include all studies that insist on the role of opinion leaders and "influentials" (Katz and Lazarsfeld, 1955; Lazarsfeld *et al.*, 1948; Merton, 1968), but also of the media (Watts and Dodds, 2007) in the formation of political opinions. The fourth form of public opinion, called "**perceived majorities**", refers to the situations where the term opinion indicates "the perceptions held by most observers, including journalists, politicians, and members of the public themselves, of where the majority of the public stands on an issue". As opposed to previous forms, opinions here do not correspond to the preferences of people whether considered aggregately or individually, but rather to the representations of opinion produced by the media. They are not the actual sentiment but what the media reports. Consequently, in this case, studies do not try to evaluate people's opinion through polls or other techniques, but focus on the analysis of mediated opinion. This form of public opinion mainly includes studies focusing on agenda-setting.

In hundreds of papers[4] that try to analyse political opinion on Twitter, most of them focus on the use of Twitter for predicting voting result and that consider tweets as an alternative to traditional polls. It may be worthwhile to establish whether studies with similar research questions also share a similar theoretical view on political opinion. In these papers, it is possible to distinguish four conceptual models of political opinion, which are not exclusive and can also be combined in the same study (Table 1).

Conceptual model	**Eldam and Herbst's form**	**Data**	**Methods**
Preference	Mass opinion	Tweet as a unit	- Statistics - Basic sentiment analysis (lexicon)
Sentiment	Latent opinion	Tweet as a content	- Advanced sentiment analysis (unsupervised and supervised learning)
Interaction	Activated opinion	Tweet as an interaction	- Network analysis
Agenda	Perceived majorities	Tweet as a medium (agenda setter)	- Discourse analysis - Text-mining

Table 1. The four conceptual models of political opinion.

4 The state of the art is based on the analysis of the 70 most cited papers according to Scopus and Google Scholar corresponding to the query "political opinion AND twitter".

3.1.1 Opinion as a Preference

In the first group of studies (*preference*), political opinion is considered as an aggregate preference in relation to a determined object selected by the researcher. Researchers adopting this model are building corpora of tweets containing specific keywords or hashtags, such as the name of a candidate or a political party. They are interested in the tweet as a unit, as a whole (without considering co-occurrences inside it or the context of usage) and they are observing mainly the variation of volume of tweets according to different parameters (time, space, user, topic, *etc.*). Some of them use very basic sentiment analysis techniques (manually built lexicons) that produce a simple word count. In this group, we mainly find studies trying to predict election results (Tumasjan *et al.*, 2010; Livne *et al.*, 2011; Skoric *et al.*, 2012). Using different kinds of quantitative techniques, their aim is to verify whether there is a correlation between the number of tweets mentioning a candidate and the number of votes he or she receives. In this type of study, political opinion is clearly framed as mass opinion. Opinion is treated as quantifiable, measurable and countable. Tweets are used to study it as an aggregate phenomenon. Similarities to traditional polls can be easily identified. The researcher is forcing a question onto a pre-existing sample of data, assuming that this sample contains the answer.

3.1.2 Opinion as a Sentiment

Taking into account the limits of an approach simply based on the count of preferences, more recent studies have focused on individual attitudes. Researchers who adopted this definition may be also building corpora of tweets containing specific words or hashtags, yet they are interested in the tweet as content rather than as a mere countable unit. They may study co-occurrences of words or more advanced textual structures while trying to interpret the sentiment expressed in the text. The final goal is to obtain a complex view that takes into account the individual positions related to the object of study in accordance with the "latent opinion" form.

A tricky issue is how to define sentiment. In the last few years, the so-called sentiment analysis has become very popular. According to the definition of Wilson *et al*. (2005), sentiment is a question of contextual polarity: "Sentiment analysis is the task of identifying positive and negative opinions, emotions, and evaluations". The authors offer a sentiment lexicon enriched through supervised learning. Within our corpus, O'Connor *et al*. (2010), cited 635 times according to Scopus and 1487 times according to Google Scholar, base their analysis of sentiments on the lexicon in OpinionFinder. Their approach has been reproduced dozen of times in the following years. For example, Conover *et al*. (2011, the third more cited paper in Scopus) develop a content-based method on manual annotation (labelled data) for analysis of 355 millions tweets. More recently, scholars (Bermingham and Smeaton, 2011) have proposed supervised approaches for building sentiment classifiers. This particular approach also includes studies that qualify sentiments in a more qualitative way based on small corpora of data.

3.1.3 Opinion as an Interaction

Some researchers have broaden the scope of their study, shifting their attention from the tweet to its context in order to identify the network of interactions related to the formation and circulation of opinions. According to this conceptual model, opinions are individual senti-

ments generated not only by the predispositions of a person, but also and foremost influenced by his or her role in the society. Most of the studies in this field focus on the role of influentials coherently with the form of the "activated opinion". Here we can mention quantitative studies trying to identify opinion leaders based on network metrics. Thanks to the analysis of a corpus related to the political hashtags #FreeIran, #FreeVenezuela and #Jan25, Bastos *et al*. (2013) studied the structure of gatekeeping in Twitter by analysing retweet, mention and followers-following networks for each hashtag. They rejected the idea of the existence of hubs acting as gatekeepers by underlining the importance of committed minorities. Slightly different is the view developed by Park (2013) in his paper, in which he carried out a survey highlighting the difference between traditional opinion leadership based on two-step flow and opinion leadership on Twitter.

Some researchers combine content analysis with network analysis. Xu *et al*. (2012), focusing on activism networks, explored both opinion leadership through network statistics measures and political involvement through the analysis of the information profile and the content of tweets. Their results were the opposite of those obtained by Bastos *et al*. (2013), showing the connection between centrality and leadership. In order to predict political affiliation of Twitter users, Conover *et al*. (2011) combined content-based methods with structure analysis of political information in diffusion networks (retweet and mention networks), and actually validated network analysis as a more efficient solution for identifying political alignments of users. Similarly, Stieglitz and Dang-Xuan (2012) combined sentiment analysis (using Linguistic Inquiry and Word Count LIWC software[4]) with network analysis on a corpus of 64,000 tweets. Their purpose is to study whether articulated sentiment in political tweets has an effect on their retweetability. More qualitative studies analysed tweets of specific classes of users considered as influential, such as journalists (Molyneux, 2015).

3.1.4 Opinion as an Agenda

Other studies focus on the role of Twitter as a medium responsible for setting the opinion's agenda. In this case, the relation between the tweet and its author becomes irrelevant. Tweets are not equivalent to aggregate or individual opinions of people, yet they convey, to the people, social representations directly generated by the platform.

As an example, the study by Papacharissi and de Fatima Oliveira (2012, the second more cited in Scopus) traced the rhythm of news storytelling on Twitter via the #Egypt hashtag. The authors intended to identify the evolution of news values that determine the selection of news on Twitter. Methods here are content computer-mediated text analysis combined with discourse analysis. The attention is not really focused on opinion-making but on Twitter as a medium for sharing news.

This last approach rarely uses tweets as data but rather investigate Twitter as a social actor. Moreover, it raises the subjacent but essential issue of the validity of tweets as bottom-up data representative of people's opinions. Indeed, according to this model, tweets are the product of the platform rather than the product of the people (Marres, 2017).

3.2 Scaling-up Opinion Analysis: Investigating the Connection between Concepts and Methods

With categories now defined, it is interesting to match up conceptual views of political opinion with the question of methods. In particular, this chapter intends to observe cases where studies have been able to scale up from small to big data or, even better, to combine different scales of analysis in order to fill the gap between qualitative and quantitative research. In practice, we are interested in computational methods that would allow for a "multiscale" description of the data, that is methods able to simultaneously describe long-terms dynamics, macroscopic community structures as well as crucial details and micro-events that slip through the control of aggregative methods. If we try to cross conceptual approaches of political opinion with the above mentioned methodological oppositions, a number of interesting insights emerge. In each cell of Table 2, we describe the present situation and future perspectives in research that embraces the different opinion definitions in relation to three methodological challenges: multiscale vs. macro or micro approaches, explanatory vs; predictive approaches, supervised vs. unsupervised approaches[5]. This table may be a simple abstract representation, since most papers mix more than one conceptual model, yet this abstraction aims at showing the connection between conceptual choices and methodological solutions.

Concerning the first conceptual model, where opinion is considered as a collective preference, macro-structures are alone sufficient for the analysis. Studies in this field propose statistical techniques suitable for aggregates and almost exclusively result in predictive analyses. However, the merit of such research group is to raise the question of the representativeness of activity traces obtained through digital media, and notably that of the comparability between Twitter data and traditional opinion polls. Although it has been shown that there is no bijection between Twitter accounts and individuals (Boyd and Crawford, 2011) and that strong socio-economical biases in the current use of digital media might invalidate their representativeness, many scholars still have "some doubts about whether such bias could affect the *predictive skills* of social media analysis compared to traditional offline surveys" (Ceron *et al.*, 2014).

	Multiscale	**Explanatory**	**Supervised**
Opinion as a preference	No interest for multiscale: Research focuses only on aggregate analysis	No interest for explanatory methods: Research focuses only on prediction (no need for a model)	No interest for supervised learning: Basic lexicons are satisfying
Opinion as a sentiment	Toward multiscale: Looking at aggregates, but also at crucial users that have the strongest activity (or the strongest influence) on the platform	Toward explanatory: Studying the causal interactions between online and offline opinions (and not only their correlations)	Toward supervised: Developing more flexible sentiment categories that can be partially induced by data, yet supported by psychological models
Opinion as an interaction	Toward multiscale: Using network as a formal tool to measure multiscale structural properties of interactions and their formal inter-level relations (how micro influences macro, and vice-versa)	Toward explanatory: Developing mechanistic models of opinion diffusion to explain how the network structure is responsible for the observed (individual and collective) opinions	Toward supervised: Using structural measures of networks motivated by communication models, yet sufficiently general to discover new patterns of interaction
Opinion as an agenda	Toward multiscale: Studying the contribution of social media's specific users in setting mass media agenda	Limited interest in explanatory methods: Research focuses mainly on the analysis of the existent agenda and on the prediction of future agendas	No interest for supervised learning: Traditional techniques of text mining suffice

Table 2. Intersection between conceptual approaches of political opinion and methodological oppositions related to big data challenges.

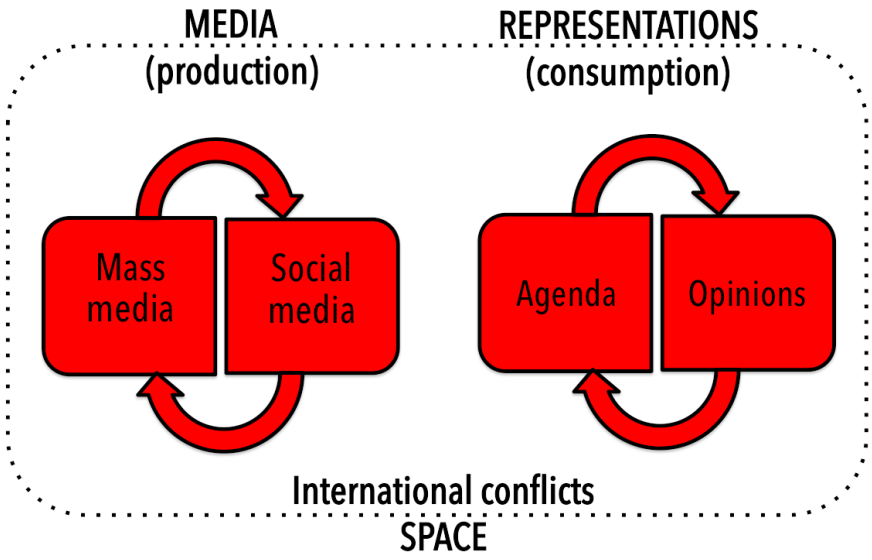
Papers exclusively based on the preference conceptual model are however very rare. This model is often mixed with the sentiment model. Yet, in both cases, when opinion is considered either as a sentiment or as a preference, methods for the prediction of election results or political polls could improve their efficiency by also focusing on crucial users with the strongest activity (or the strongest influence) on the platform, as suggested by Stieglitz and Dang-Xuan (2012). Such individuals could indeed constitute quite powerful predictors of global trends at a micro-level. The combination of such qualitative analysis with quantitative prediction would however require the use of network-based approaches in order to automatically identify such crucial individuals. Accordingly, going from the mere prediction of election results to their explanation requires a better understanding of causal interactions

between online and offline opinion making (and not only of their statistical correlations). As expressed in Ceron *et al.* (2014), one has to address "the question of the direction of causality", that is: "is the social media opinion becoming more similar to the general public opinion, or, on the contrary, are social media driving (or anticipating) the general public opinion?" In order to do so, the development of relevant sentiment categories is crucial, yet difficult in the context of ambiguous communication on Twitter. Developing more flexible sentiment categories that can be partially induced by data, yet supported by linguistic and psychological models, might help bridge the gap between the too-rigid opinion lexicons and the weakly-supervised approaches of machine learning.

Mixing analysis scales is especially relevant for scholars that investigate the network structure of political opinion. Indeed, interaction-based approaches often imply the combination of micro- and macro-measurements. In general, these approaches propose many formal tools to help measure structural properties of interactions on Twitter at different levels, from micro-structure, such as hubs and bridges, to macro-structures such as communities and other connectivity patterns. What is currently missing is a clear theoretical and empirical understanding of interconnections between such micro- and macro-measurements. For example, how is the presence of bridges and hubs in the network, corresponding to potential influencers from the perspective of communication sciences, correlated with the global connectivity or polarisation of opinions in the network? Consequently, mechanistic agent-based models of opinion diffusion, in particular the ones developed by Computational Social Sciences, constitute a promising line of research to explain how such network structures (both micro and macro) are responsible for the observed opinions (both individual and collective). To do so, the chosen structural measures need to be genuinely motivated by communication models, as described in Jürgens *et al.* (2011). They also need to remain sufficiently generic to discover new modes of interaction, thus achieving a trade-off between purely hypothetico-deductive approaches, formalising and testing communication models with graph-theoretic tools, and inductive approaches, able to adapt such structural analysis to the very diverse uses of digital media.

Studies that focus on tweet-generated agenda are rarely interested in mixing analysis scales. They either focus on the macro-level scale by identifying general factors capable to influence an agenda (such as studies on news value) or, conversely, on specific individuals, such as journalists or politicians, in order to study how the representations they produce can influence citizen or media agendas. These approaches do not currently study the two levels simultaneously, for example by providing a clear model of how the micro-agendas followed by journalists and politicians impact the collective macro-agendas and, conversely, how the macro-agendas might also produce top-down feedback on these micro-agendas. Yet, it is worthwhile to note that multiscaling is technically possible. Indeed, studies in this field might benefit from a better understanding of informational interactions between mass media (expressing a top-down political agenda) and digital media (building a bottom-up political agenda), thus showing how individual and collective agendas are tangled through the interaction of structurally-different areas of discussion. In order to do so, it is necessary to develop methods able to consistently address political opinion in their different production and consumption contexts, and to interpret them as different levels of opinion making.

4 Modeling Interactions between Mass Media and Social Media



Given the theoretical and empirical work that has been presented about the study of the mass media agenda (in Chapter 2) and of the social media agenda (through opinion mining in digital data, in Chapter 3), we are now interested in work that aims at studying the dynamic coupling of these two agendas, that is the intertwined production and consumption of news in these two discussion areas as well as the way they shape each others. In particular, the literature in Computational Social Sciences contains much work exploiting agent-based models to explain how individual and collective opinions may evolve in the presence of social and mass media influence. In what follows, we provide a typology of such models by considering technical differences as well as the underlying methodological stances that these differences imply.

4.1 Social Media and Mass Media Influence on Opinion Dynamics

Social influence is part of human social interactions, and it is particularly important to understand the dynamics of social media. In many situations, notably when sharing content or information online, people modify their behavior, opinions, beliefs according to the individuals with whom they interact. People ask those to whom they are connected what they think about specific topics and whether an information is accurate or relevant; they care about their responses to their own behavior and opinions and it is why they consider their behavior as potential model for their own. Although a lot of work has already been done, social influence is still a puzzling social phenomena, in particular, understanding the complex interactions between micro-level and macro-level processes involved in it. Indeed, social influence mechanisms can generate complex micro-macro links in which the outcome of individual interactions can be unexpected and unwanted, or at least unintended, from the individual's viewpoint.

Messages conveyed by masse media also shape people's attitudes and may induce an opinion shift. It means that human dynamics are not only influenced by the surrounding social context but also by the information brought by the media. However, it is not a one-way flow; indeed, blogs, TVs, newspapers are affected by a massive amount of individual and social factors, *e.g.*, tastes, goals, social pressure. In order to understand these mechanisms, we need to consider a number of factors, from the way information is produced to the way it is consumed.

In what follows, we review some agent-based models of opinion dynamics allowing, to a certain level, to explain how opinions may evolve in the presence of social and mass media influence.

One can wonder, and rightly so, if the complexity intrinsic to human opinions can accurately be described by mathematical models. Some authors claim that the most fundamental sociological problems are non-mathematical in nature (White, 1943; Abbott, 2013). Indeed, due to the chaotic nature of human opinions, modeling purposes are real challenges. However, the link between sociology and physics goes back a very long time (Hobbes and Gaskin, 1996). In his book published in 1996, Comte introduced the concept of "social physics" (Comte *et al.*, 1896). It relies on deterministic laws to study the social dynamics of a system. This concept can be seen as the foundation of modern sociology. Actually, the tools developed in statistics are well suited for a quantitative analysis of social systems since they are often composed of a high number of individuals. Furthermore, to go back to the original question, even if mathematical models are just, as their names indicate: models, there is no doubt about the benefits of developing some quantitative models to anticipate human behavior, see (Rand and Rust, 2011) for example.

Furthermore, even if most of agent-based models are theoretical, trying to find the conditions for consensus, polarization or clustering at the stationary state, it does not mean that these models are not thought to fit with empirical observations. Indeed, most of the time, mechanisms imagined in these models are inspired by psychological theories as well as by empirical facts. Furthermore, some predictions given by the simulations are confronted with experiments conducted in social sciences in order to validate, in a qualitative way, the credibility of the models. In order to show this, we try to catch, for each class of models defined in the next section, their motivations and main results.

Agent-based models are used to model a situation where autonomous agents interact with each other and their environment according to certain pre-defined rules at the level of the individual (micro). These models aim to understand the situation as a whole (macro) thanks to emergent behaviors from simulations. Depending on the level of realism or simplicity of the model, one can perform analytical calculations which offer a complementary explanation of the dynamical model. Of course, as George Box said: "all models are wrong but some are useful" (Launer and Wilkinson, 1979); so actually, what matters is the question one is interested in and what level of precision one wants to achieve.

Discrete-opinion models encompass the voter model (Clifford and Sudbury, 1973; Cox, 1989; Holley and Liggett, 1975), Axelrod model (1997), Sznajd model (2000), models based on social impact theory (Bordogna and Albano, 2007) and majority-rule models (Krapivsky and

Redner, 2003; Lambiotte, 2008). Majority rule is defined as a decision rule that selects alternative which has a majority, *i.e.*, more than half the votes. This rule is particularly employed in binary cases. However, when there are more than two choices, the majority rule selects the option that has the most votes, which can be less than the half. In the case where two options have obtained the same number of votes, another round can be established until an option takes the advantage but other alternatives are possible.

Some concepts adopted in the model with discrete choices are not applicable with continuous opinions as, for instance, the concepts of majority of an opinion or equality. Consequently, continuous opinions require a different framework and other models often based on bounded confidence, *i.e.*, a kind of negotiation rule. These latter include DeGroot model (1974), Friedkin model (1999; 2011), Deffuant model (2000) and Hegselman-Frause model (2002). See (Castellano *et al.*, 2009; Dong *et al.*, 2018) for further details.

All of these aforementioned models have been intensively used to study social influence and all of them give rise to many extensions. For instance, some authors introduced the concept of stubborn and/or extremist agents, *i.e.*, agents who do not change their opinion whatever happens (Yildiz, 2013; Ghaderi and Srikant, 2014). Another idea is to include the possibility of separating as a result of the interactions; hence the notion of repulsive links or antagonistic interactions (Salzarulo, 2006). People are immersed into a constant flow of news. Consequently opinion evolution is also affected by external factors, *e.g.*, advertising, political propaganda (see Figure 7).

Here, we focus on a simple mathematical criterion; more particularly a criterion applying on the opinion representation. Opinions can be represented by integers or real numbers. Amongst the discrete-opinion models, we make distinction between one-dimensional and multi-dimensional representations. Even if this distinction can be done for continuous opinions, it is far less common. Partly because the real representation allow to take into account a huge “precision” and variety in the opinion. Nevertheless, since continuous-opinions models received more attention for what concerns the role of media, we make distinction between the presence of one or multiple mass media outlets. We review, for each class of models, their core assumption, their simulation results and if possible, their links with empirical cases.

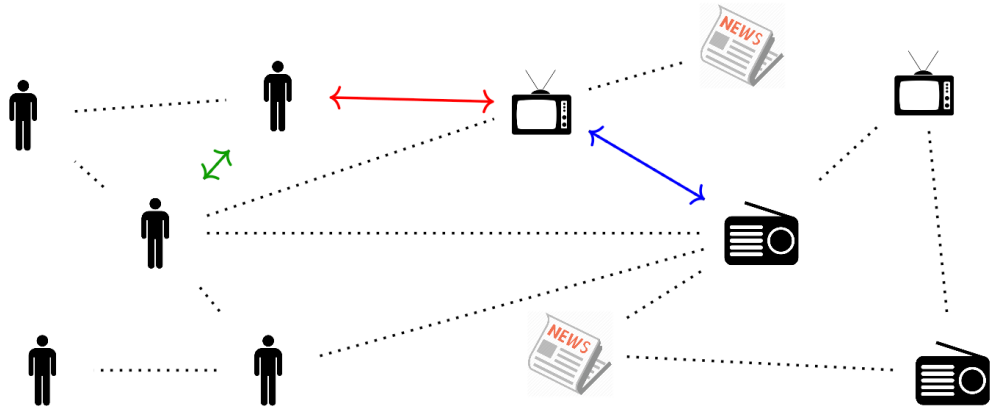


Figure 7. General representation of social and mass media influence

4.2 State of the Art of Models Connecting the Agenda of Mass Media and the one of Social Media

4.2.1 Discrete-opinion Models

Motivations. Modelling opinions by discrete representation is strongly motivated by statistical physics, often based on the analogy of ferromagnetic spins. This representation is the simplest form but it is appropriate and adequate for a variety of situations in which people are faced to a limited number of choices, *e.g.*, voting for one particular candidate, deciding to use a product or not, and so on. Even if discrete opinions are less prevalent in the literature, it is claimed in (Colaiori and Castellano, 2015) that when people are prompted with important questions that admit many possible answers, their attitudes tends to be polarized; most people sharing one out of two opposite opinions. So, this argument can motivate the discrete representation. In binary models, we can just say if opinions are the same or not but the notion of distance is not accounted, we cannot measure how dissimilar two different opinions are.

Uni-dimensional representation. A well known model is the voter model independently introduced by Clifford and Sudbury (1973) and by Holley and Liggett (1975). It describes the social dynamics of public opinions on different issues, and can hence be used for the study of social media dynamics. All agents are placed in regular lattices, opinions are discrete variables and agents update their opinion based on one of their randomly selected neighbour. In order to take into account the many situations where the number of available opinions is more than two, and where mass media also influence people's opinions, Hu (2017) introduces four extensions of the voter model. The binary opinions are extended to multiple opinions, people can be committed or stubborn (*e.g.*, opinion leaders), each person is associated with a persuasiveness indicator and media outlets are introduced. When a person interacts with such a media outlet, the opinion update is the same than with another individual (that is in the context of social media). With this configuration, it is found that both social media and mass media act as amplifiers in opinion diffusion. Furthermore, analytical calculations are performed and give the probability, when no committed people are present, that each opinion can eventually spread into the entire network. When committed people are placed in the social networks, the proportion of each opinion in the steady state are related only to mass media strength and the initial distribution of the committed people. These calculations are in good accordance with numerical simulations. An interesting finding is that there are two ways for the media to change people's opinions. First, by global broadcasting and, second, by peer influence among agents within social networks.

More generally, despite the simplicity of the voter model, its ability to model and predict real opinion in diffusion on both the individual and group levels has been validated by empirical data, even in presence of external force like mass media. For example, it has been confronted with data obtained during US presidential elections (Fernández-Gracia *et al.*, 2014) or in a little bit different case of diffusion of innovation (Karsai *el al.*, 2014). More related to media influence, a case study about the role of mass media in times of conflicts against civilians in Rwanda has been conducted (Yanagizawa-Drott, 2014). It is reported that broadcasting has a significant impact on participation in killings. First, the broadcasts increased militia violence directly by influencing behavior in villages and, second, indirectly by growing participation in

neighboring villages; this means that exposure to mass media can lead to significant spill-over effects via group influence.

Another general model, developed in (Colaiori and Castellano, 2015), offers three possible states to individuals, namely A, B or U (undecided). These individuals interact pairwise while exposed to an external force. Other works have shown the importance of the third state in the case of binary choices, *e.g.*, in political cases (Vazquez *et al.*, 2003) or in another extension of the voter model (Castelló *et al.*, 2006). They show that, as mass media force increases, the system tends to global consensus. However, some nontrivial outcomes are observed; in particular, hysteric phenomena and resilience of minority opinions, and in this case, consensus could be avoided, even when mass media and microscopic social interactions are biased in favour of the same opinion.

Actually, little work has been done concerning mass media influence in the case of discrete opinions. Notably because when we talk about discrete opinions, it is very often the binary case that is envisaged and the use of binary model does not allow the analysis of opinion drift under the influence of mass communication.

Multi-dimensional representation. The aforementioned models consider individuals having a single opinion about one topic, which is quite useful for understanding one-dimensional dynamics. However, it is far from reality. Indeed most often agents interact in a variety of different contexts, making the interaction model multilayered and multifaceted. Actually, the desire to maintain coherent behaviour when faced to multiple but related topics might play a crucial role in determining the agents' reaction and in the emergence (or not) of global consensus.

The model proposed in (Battiston *et al.*, 2016) takes into account this remark by proposing a multilayered extension of the Ising model of magnetic interactions (Castellano *et al.*, 2009). More precisely, this model considers the concurrent participation of agents to distinct but connected interaction levels which represent discussion topics or social spheres, the presence of social pressure and finally, mass media to which agents are subjected on each layer. For sake of simplicity, the social and mass media effect are only considered as mean-field effect, providing an approximation of the actual effects. The results show, among other things, the impact of media pressure. Especially in the presence of heterogeneous individuals, by an appropriate adjustment of the relative strength of the external field representing the mass media, one can indeed fix any consensus value on each layer. If the initial population is in an incoherent state, this leads the possibility of driving it to a more coherent mode and this, by a continuous way.

Axelrod model. In a famous paper, Axelrod wondered "If people tend to become more alike in their beliefs, attitudes and behaviour when they interact, why do not all such differences eventually disappear?" (Axelrod, 1997). The agent-based model proposed by Axelrod to study the dissemination of culture is based on the idea that similar individuals are more likely to interact with each other than dissimilar individuals, and the mutual influence increases the similarity between individuals. Actually, the dissemination of culture discussed by Axelrod can be seen as a case of multi-dimensional opinion model. The term "culture" can be compared to the term "opinion" and is represented by a vector of discrete values. Thus, the

Hamming distance between two culture vectors can represent the dissimilarity between the two corresponding individuals.

One can extend Axelrod's work and consider mass media where its message is also represented by a vector. It is what is envisaged in (González-Avella *et al.*, 2005); the concept of culture is conceived as a set of individual characteristics subject to social or external influence. By playing on the parameters such as the number of cultural features per cultural state as well as the intensity of the mass media influence, the numerical simulations highlight a nonequilibrium phase transition between an ordered phase (homogeneous culture), specified by mass media, and a non-equilibrium phase (culturally fragmented). Surprisingly, when the intensity of the mass media is above a certain threshold value, cultural diversity may appear.

In the same vein, Rodríguez and Moreno (2010) extent Axelrod model with social influence interaction for the study of mass media effect modeled as a extern agent which keeps the same cultural traits all the time and interacts with the entire network. It is found that at low and high values of initial social diversity, a state with only one cultural region is obtained, with a stronger dependency on the mass media strength for higher values. These results are quite intuitive since the higher the diversity of the initial cultural trait distribution, the smaller neighborhood of an agent. Furthermore, in their model, for a fixed network size, the increase of mass media strength always reinforces the monocultural state. On the contrary, when the size of the network increases, there is no longer a monocultural state but the number of cultures obtained remains limited. However, no link between the saturation value and the mass media strength was found.

Others works have been conducted (González-Avella *et al.*, 2006; 2010; Peres and Fontanari; 2011) where each individual is likely to interact with the mass media outlet with probability p at each iteration. This approach leads to the conclusion that as the probability to interact with such outlet increases, the fragmentation starts to occur more than the consensus.

Another study tries to combine the effect of mass media with noise (represented as random perturbations) (Mazzitello *et al.*, 2007). The mass media coupling here is able to affect the cultural traits of any individual in the society, even those who do not share any feature with the external message. For low noise rates, the ordered (culturally polarize) phase prevails while for larger noise rates, one can observe both the ordered and the disordered (culturally fragmented) phase. Further, the predictions of this model are confronted to statistical data measuring the impact of a mass media vasectomy promotion campaign in Brazil. A good agreement between model results and measured data can be achieved.

Finally, another line that is worth exploring is the network topology. Indeed, in order to model real situations, regular lattices or random social networks are not well suited. Instead, the underlying network topologies are often more intricate. In (Candia and Mazzitello, 2008; Gandica *et al.*, 2011), the authors envisage different network topologies. For instance, the community structure of social networks is represented by coupled random networks. They find that social modularity effects are of paramount importance for designing successful, cost-effective advertising campaigns.

4.2.2 Continuous-opinion Models

Motivations. We have seen that discrete representations are well suited when the dynamics at stake is a kind of majority rule. However, it has some limitations. For instance, each dynamics cannot be converted into a majority rule. Furthermore, as mentioned, the integers representing the opinions are labels which means that performing mathematical operations on them is senseless. Actually, to be able to measure the similarity (or dissimilarity) between two individuals within the social network, we have to consider a multidimensional representation and compute the Hamming distance between their opinion vector. Another drawback of discrete models is that it is difficult to take into account the emergence of extremism in the system since opinions are not always classifiable in ascending order, extremal opinions are less emphasized.

Conversely, continuous models take care of theses remarks. Indeed, the similarity between individuals can be computed as the simple difference between their opinion. Nevertheless and as previously said, with this choice of representation, the majority rule is no longer applicable. Instead, the more widespread mechanism is the bounded confidence one. They model opinions by means of a negotiation rule; agents interact through social media and change their opinion if they are close enough, *i.e.*, if the difference between their opinion is less than a given threshold. The Deffuant model (2000) and Hegselman-Krause model (2002) are part of them.

Some local rules. As said, bounded confidence models are the more widespread. For instance, the principal idea in the Deffuant model is that, if influence occurs between individuals, it always implies assimilation. This assumption is used to explain why under certain conditions, influence may no longer effect (Axelrod, 1997). In other words, if two agents disagree too much, in term of opinion, they can no longer influence each others. What should be the strength of the disagreement for this to happen has to be related with researches in social sciences and social psychology (Miller *et al.*, 2015). This mechanism can generate a snowball effect dynamics in the sense that, agreement strengthens influence which in turn, leads to greater agreement with those who have already a similar opinion.

However, it is not always the case. Indeed, in some cases, it has been observed that, after interacting, people want to become more dissimilar to other people. We can refer to this mechanism as repulsion or rejection. The underlying reasons might be diverse. For instance, it could be because their opinion are to dissimilar. But it can also be the result of a rational discussion; when people realize that even though they share a similar opinion, the underlying reasons are contradictory. Some researchers have also pointed the fact that not only homophily can modify people's behavior but also its counterpart, xenophobia (Flache and Macy, 2011). Another possible explanation can be the desire to stand out among other people. Of course, this list is just some possible explanations; a lot of other motivations can be cited.

Unique mass medium. In the case where a unique mass medium comes into play, we can think of an advertising or a (political) propaganda. A propaganda can be thought, for instance, as a message or a well documented fact that touches every individual at the same time with the intention of influencing people's opinions. To model the medium, a possible

way is to start from a bounded confidence model and to add an asymmetrical interaction between human agents and media.

This is the idea adopted in (Carletti *et al.*, 2006), where the authors study the conditions for an efficient propaganda in the Deffuant model by incorporating a single constant external message that interacts periodically with all individuals in the population simultaneously. They find four different scenarios, characterized by different sensitivities to the propaganda. More precisely, the efficiency of the message is explained in terms of the period during which the message is transmitted and open-mindedness thresholds associated to each person. As in some aforementioned discrete-opinion models, consensus cannot be achieve in the case of obsessive propaganda. Indeed, in this case, individuals move forward an extremist opinion or the naturally created opposition. If we draw a parallel with the real world, this can be compared to the well known over-exposure effect in marketing studies (Groucutt *et al.*, 2004).

As stated above, influence among agents within the social network can be either attractive or repulsive. Furthermore, a constant propaganda is somewhat limited; the motivation for a non constant propaganda is that the period of time during which the simulation is made is relatively extended; a constant signal is no longer appropriate enough. So, having this idea in mind, Martins *et al*. (2010) introduce repulsive interactions between agents and test a constant and a sinusoidal propaganda. They show that when agents prefer to have different opinions than some of their neighbors, consensus can be built around an external message, even in close-minded societies and regardless of whether the message is moderate or extreme. This result is important and quite surprising: by wanting to deviate from others, individuals end up having the same opinion.

Another paper introduces extremist individuals and external extremist propaganda as an additional source of influence on the long-term opinion of the population (Timothy, 2017). This extremist propaganda targets the extreme individuals which are constantly influenced by the propaganda. These individuals can, in turn, influence other individuals in the population. It is shown, through numerical simulations only, that non-extremist individuals can become so, after interacting with such people. To counter this extremist propaganda, a counter-propaganda with multiple opinions is introduced, showing that a centrist or too diversified propaganda does not always slow down the evolution of individual opinion towards an extreme.

In the precedent papers, agents interact by pair in a random fashion, while it is not really the case in real social media. In (Gargiulo and Gandica, 2017), an explicit network modeling the affinity between people is constructed and agents can only interact with their neighbors (presence of homophily), which makes the model more plausible. The dynamics is based on the Deffuant model and a propaganda is introduced, with the same mechanism than in (Carletti *et al.*, 2006). It is found that homophily does help the formation of consensus. Furthermore, the media effect depends on the network topology (as in the Siegel's theories (2013)) and in presence of homophily, the propaganda leads to strongly polarized opinion clusters.

Nowadays, in the real world, social media are the backbone of the diffusion of controversial subjects (Garimella *et al.*, 2017; 2018). Everyday, new debates feed the web and we can see the emergence of multiple opinions. These latter are not always in agreement with the authorities or political leaders (think for example of Venezuela's crisis, french university reform, US firearm laws, Obamacare, *etc.*). When these debates tend to become too deviant or too risky for the authorities, these ones fight back with strong media campaigns (think for example of vaccines' case).

According to the numerical simulations performed in these aforementioned works, on long time scale, these dangerous opinions would be naturally controlled. However, it is often a question of time and the leaders want to solve the "problem" as quickly as possible. Nevertheless, immediate (and to extremist) responses are probably the worst things that could happen (Carletti *et al.*, 2006; Gargiulo and Gandica, 2017), and the same in the Axelrod model (González-Avella *et al.*, 2005). Eventually, a solution would be to propagate counter-messages through the social network.

Multiple mass media. The introduction of mass media is a relevant feature to built realistic models. In the aforementioned models, only one mass media outlet is taken into account. To be more accurate, but more complex, we can consider that people are plunged into an environment where several mass media outlets come into play. These outlets can be in competition or not. The novelty of these two following models is that the opinions conveyed by mass media can effectively be influenced by the others agents (individuals of the social network or other mass media outlets); it is no longer a predefined constant/function. In other words, both individuals and media outlets can be deemed as autonomous agents.

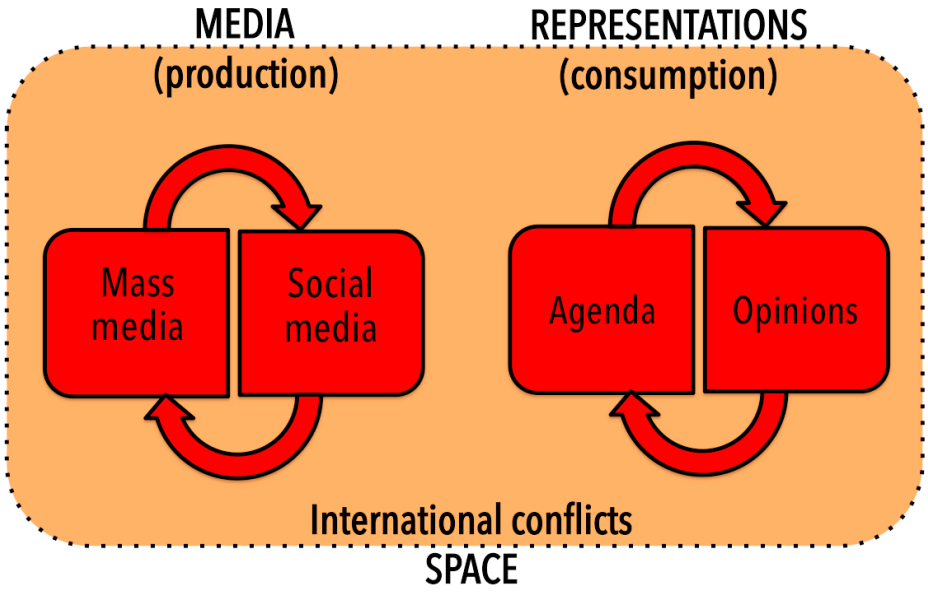
One way to do so is to consider a mass media network, separated from the social network of individuals. It is the case in (Quattrociocchi *et al.*, 2014), where the authors investigate how mainstream media signed interaction might shape the opinion space. The evolution of the two underlying networks are different: each media tries to captures the greatest number of followers whilst the gossip's dynamics is based on bounded confidence model. Furthermore, the interaction individuals-media is also based on bounded confidence. It means the two networks are interconnected and can influence each other. It is shown that, when each mass media outlet tries to mimic the most successful one, the messages delivered by the outlet tend to produce an impasse when amplified by the gossip dynamics. When the number of such mass media outlets increases, these effects are dwindling. The competition between the media generates a fragmentation of the opinion space thus preventing a consensus in the entire system. When changing the network topologies, these results still hold.

In (Wang and Fu, 2016), the authors are interested in how different patterns of the interactions between online social individual and offline traditional media contribute to opinions' distributing and clustering. More precisely, how the number of media outlets and antagonistic interactions might affect opinion dynamics. Their agent-based model is based on similarity and social judgment theory. Moreover, individuals are more likely to interact with each other if their opinion are close enough. By simulating, they show antagonistic interactions have a significant influence on opinions' fragmentation (which is different of what is found in (Martins *et al.*, 2010)) whereas the number of offline media has slight importance on opinions' clustering.

Alternative approaches. In the last decade, another attempt has been successfully applied to describe opinion evolution by means of mean field model equations. These models mainly use a system of diffusive ordinary/partial differential equations, that can be treated analytically. Following this line of thought, a kinetic model is used in (Boudin and Salvarani, 2016), following a mechanism close to a collisional mechanism in the Boltzmann equation with a cut-off effect (see (Boudin and Salvarani, 2010) for an explanation of modelling opinion by means of kinetic equations). This model considers some mechanisms of opinion formation where individuals, interacting with each others through social media, modify their opinion by means of spontaneous self-thinking and are influenced by (possibly multiple) mass media. The mass media have a fixed opinion through time. It is pointed that a plurality of media with different orientations is necessary to give birth to pluralism and prevent consensus. A very good point is that the model's predictions are confronted to some surveys related to the Scottish independence referendum of 2014: "Should Scotland be an independent country?" The obtained results provide a good qualitative agreement and allow to make a direct bridge with empirical data.

To sum up, we have reviewed some opinion dynamics models in which people are not only influenced by their peers, through social media, but also by mass media. We have divided these models into two classes: binary or continuous opinions. We have also made a distinction within each class between uni- or multi-dimensional representation and the presence of one or multiple media outlets. In this text, mass media have been modelled by two different strategies. The first one considered mass media outlets as entities with external given opinion while the second one envisaged mass media with a more intricate approach: their opinion could vary across time and could depend on people's opinion.

5 The Case Study of International Conflicts



As an "interactive process manifested in incompatibility, disagreement, or dissonance within or between social entities (i.e., individual, group, organization, etc." (Rahim 2010), conflict are fundamentally mediatised objects as they are the product of an interchange of antagonist opinions. In the field of management studies, Rahim proposes five elements to define conflicts: "1. Conflicts includes *opposing interests* between individuals or groups in a zero-sum situation; 2. Such opposed interests must be *recognized* for conflict to exist; 3. Conflict involves *beliefs*, by each side, that the other will thwart (or has already thwarted) its interests; 4. Conflict is a *process*; it develops out of existing relationships between individuals or groups and reflects their past interactions and the contexts in which these took place; and 5. Imply *actions* by one or both sides that do, in fact, produce thwarting of others' goals." Thus, the general elements for conflict definition are convergent with some definitions of opinion. To avoid a segmented analysis of conflicts (see Figure 8) Mitchell (1989) has noticed that for the study of behaviour of social entities in conflicts, communication patterns are a transversal way to reach the exchanges and interpretation of information and the use of stored information (memory) in the interpretation of the changing environment.

The Cold War period is a perfect example of how public opinions and media are contributing and are used to sustain antagonist structured vision of the Word (what sociologists call ideologies). 1962 Cuban missile crisis was a dramatic point of tension during which media were diffusing the idea that each super power will not hesitate to attack. This believe and the fear of its direct consequence (a nuclear apocalypse) leads to the thraw back of the Soviet fleet after weeks of tension. This example illustrate how media and representations are shaping international conflicts as well as the political space is structuring representations and media. More recently, Arab Springs (2011) and EuroMaidan protests (Ukraine, 2013) show the performative action of old and new media in the emergence or enhancement of geopolitical conflicts. We will now present a brief state of the art of the concept of "international conflict" to present the theoretical frame for the investigation of the link between this process and media.

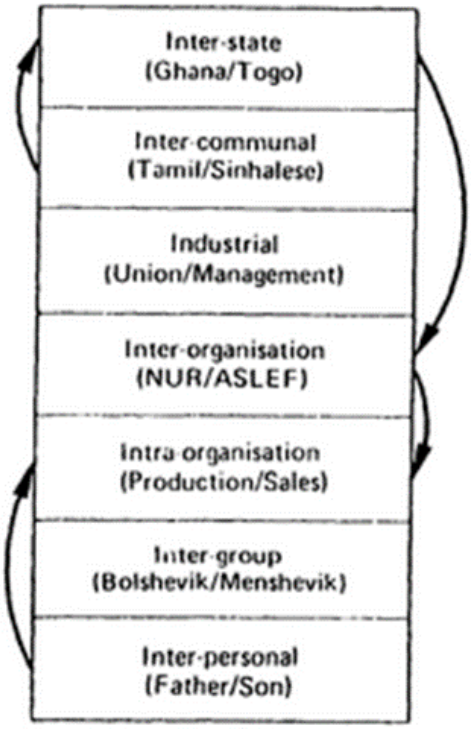


Figure 8. A general typology of conflicts according to Mitchell (1989)

5.1 The State of the Art of International Conflicts' Studies

Lacoste (1995) defines geopolitical conflicts as the rivalry for influence and power on territories and populations; concerning rivalry between all political powers, between states and political movements or armed groups more or less legal. All the rivalries aims at controlling, conquering or defending territory.

The illusion of media objectivity and neutrality has been abandoned since a while and the role of the media in international conflicts has been investigated through a triple direction:

1) the media report remote situations by conveying testimonies and images of the conflict, diffusing information to involved and distant actors. For instance, the civilian status of the journalist on the battlefield is defined by the Additional Protocols of the Geneva Convention on Humanitarian Laws (1949). Thus journalists are active and legitimized participants of the conflict (Hastings 1989).

2) the media contribute to the attitude formation by conveying political narratives about the conflict. For instance Groeble (1995) investigates the function of media in building an "enemy image" (a stereotyped, simplified and negative image). This process of alterization has been studied by Segev (2016) with the catchy category of "bad guys" of the international stage, that is to say geopolitical actors who are reported negatively by the media. This process is of course symmetrical: to the construction of enemies correspond a construction of alliances in the international sphere.

Definition of International	*Fields of studies*	*Definition of international conflict and examples in European space*	*Selected references or Journals*
The **pavement** of the World by countries and the system of exchanges between them (the World system). State territories and borders are the core objects.	Political geography Geopolitics Conflict and peace studies	International conflict concerns the partition and the **bordering of the World surface**. Border conflicts in the European space can concern both fragmentation conflicts (Kosovo, Georgia, Crimea…) and expansion conflicts (EU enlargement). In this context, opinion dynamics have been mostly studied in terms of **collective social representations** of territories.	(Galtung 1996) (Rosière 2007) (Foucher et Orcier 2010) *Journal of Peace research; Geopolitics; Political geography; L'Espace politique*
A **system of actors** (i.e. the States, political organizations like the UN or NGO) ruled by a regime of collectives norms: international law, international accords like for trade or military affairs.	International relations	International conflicts concerns the definition of the collective rules for the management of **inter-states relations**. Political conflicts in European space can concern the internal relation between states (Brexit, Refugee quotas) and the relation of the EU with the outside (CETA, TAFTA). In this context, opinion dynamics have been mostly studied in terms of **voting patterns and political coalitions.**	(Orbie 2009) (Beauguitte 2011); Postmodern diplomacy: (Wilga et Karolewski 2014) *International relations, International affairs, Conflict management and peace science…*
A **community** characterized by the collective stance of an important number of State authorities on a global or local topic.	Communication studies Political science	International conflicts concerns the controversies between state authorities for influencing the global or some local **political agenda**. Controversies in European space can concern internal rivalry to set European agenda and the EU capacity toward the outside (Death penalty, Climate change, State recognition, Human rights…). In this context, opinion dynamics have been mostly studied via the concept of **agenda setting and framing**.	Soft power: (Nye 2004); Nation branding: (Fan 2010); International news flows theory : (Wu 2000) (Segev 2016) *Public opinion quarterly; International communication Gazette; Journal of international communication*

Table 3. Typology of international conflicts studies

3) they can be used as a tool by protagonists of the conflict. As noted by Boulanger (2014) media, and especially social media (Rickli et Kaspersen s. d.) can be used as a tool by protagonists of the conflict to organize, mobilize, disseminate information, notably by the using of the so called “net-trolls strategies” which produce content massively in order to frame the agenda and the attitudes on a specific discussion. Finally, the media plays a role in the conflict in the possibility of recognition of the conflict by other international actors.

The analysis of “de facto states” is a highly relevant case for studying the relation between public opinion and localizable geopolitical conflicts through the prism of mediated communication streams. The focus of the ODYCCEUS project on the European space leads us to consider specifically the conflicts located in this large area. De facto states can be considered as a global phenomenon of fragmentation of the political map (Rosière, 2010). For instance, the recent Secession of Crimea and self-claimed autonomous territories in East Ukraine leads to an intense controversy involving a multiplicity of actors (politicians, journalists, NGO’s, political activists, etc.) proposing antagonists opinions, strong statement and lot of caricatures and common places about this topic. But this event cannot be understood without considering larger processes like USSR and Yugoslavian collapse that led to this fragmentation process.

It is sometime difficult to define what a “de facto state” is, especially because a lack of consensual and uniform definition in the fields of International Relations and Geopolitics (see Table 4), even if more and more specialists agreed with the typology proposed by Kolstø (2006) which manage the distinction between “failed states” (related to inefficient states) and “quasi-states”(used for states which are de *facto in*dependent but not recognized by the international community). These political entities differs from a territory controlled by a guerilla group or a civil war government because it comply three of the four conditions identifying the legal person of “state” according to the Montevideo Convention on Rights and Duties of States (1934): 1) to have a territory, 2) a permanent population, 3) institutions and 4) the ability to develop relation with other states. In others words, these political entities are looking like a state on the field with the exception of having a weak international legitimacy. Of course there are strong differences from one de facto-state to another: for instance, Turkish Republic of Cyprus (TRC – controlling the North part of Cyprus Island) is still officially recognized by only Turkey when the former Yugoslavian Republic of Kosovo is recognized by 116 States. According to Bachelet et al. (2017), the upholding of de facto states is only possible because of two determinant factors: the inability for the central state (for political and economic reasons) to restore its control on the separatist region and *the* financial, media exposure, diplomatic and military support of a “protecting” state. In other words, it is impossible to understand the creations of new de facto states without taking in considerations a larger time and spatial frame.

Reference	*De facto* **independent territory but not recognized**	**Legally recognized state but with limited souvereignty**
Jackson (1990)		Quasi-state
Helman and Ratner (1992)		Failed state
Zartman (1995)		Collapsed state
Pegg (1998) Anstis and Zacher (2010)	De facto state	
Pavel Baev (1998)	Para-state or quasi-state	
Kolossov and O'Loughlin (1998)	Pseudo-state	
King (2001)	Non-recognized state	
Kolstø (2006)	Quasi-state	Failed-state

Table 4. The diversity of the terminology relative to the territories with uncertain sovereignty according to (Rosière, 2010)

Indeed, the process leading to the formation of de facto states, could be interpreted through the grid of lecture of geopolitical controversies, understood as a conflictual competition between two contradictory geopolitical discourses (vision of how the world is, was and could be). Of course secession is always triumphing because of local claims and a strong support in the local population (exploitation of ethnic differences related to cultural disparities, heritage of an hegemonic situation) and a localization in relatively weak states. But, according to Kolstø (2006), they are mostly related to external processes, like the feeling – for the minority which would argue for independence – of being in danger (bodily or culturally) *and* the implication of (at least) an external power. This controversial dimension of quasi-states is also obvious in the discourses and strategies which use the UN legislation about international humanitarian law: the references to the right of people self-determination (more and more used in an extensive way in recent History – Hecthtner, 1975), challenge the supreme right of territorial integrity of each state and fuel the controversy between involved actors.

But the necessity to deal with different spatial scales get over the simple global/local opposition. First because all the current creation of *de facto* states were supported by a protective power (or patron state) involved in the region (Turkey for TRC, USA and NATO members for Kosovo, Armenia for Nagorny Karabakh and Russian Federation for Transnitria, Abkhazia and South Ossetia). In others terms, fragmentation could be the result of strategies developed by a geopolitical actor. Some researchers are also investigating the relation between the proximity of regional powers: "Most of pseudo-states are situated along the frontier of large 'civilizations'. [...] Obviously, civilizations are based not only on religions (Huntington's reduction) but on a complex of ideas and representations cementing culture, social practice and geopolitics" (Kolossov & O'Loughlin, 1999). Of course, a global power like United States has the ability to interfere with the creation of new de facto states, like in the case of Kosovo. Secondly, analyzing different scales and especially the regional one is relevant because economic disparities could be another factor leading to separatist claims (Ohmae, 2008; O'Loughlin et al., 2014).

De facto states are also multilevel dynamical objects. First because they are durable through time and because they are a frame for the resident population (creation of an independent education system, a police and an armed force, its own fiscal and political laws, etc. – Merle,

2018; Rosière, 2010). Secondly because de facto states aren't appearing on a blank page. Most of the conflicts located in the Russian periphery can be interpreted as different consequences of the USSR collapse (O'Loughlin et al., 2014): these particular conflicts could be seen as dynamic processes both related to short and long term events. For instance, Merle (2018) and Kolossov and al. (2014) analyze the role of the independence of Kosovo in the process which leads to the (re-)activation of other conflicts, like the Russo-Georgian conflict about Abkhazia and South Ossetia (2008) or the more recently events in Crimea and Eastern Ukraine (2014). Combined with the growing influence of NATO in East-Europa and central-Asia since the end of the 1990's, the support of Western powers to the secessionist Republic against Serbia (an historical ally of Russia) has been identified as a dangerous precedent by the Kremlin. The jurisprudence of Kosovo is also used by the Russian power as an explicit justification of the recent events in Georgia and Ukraine: "a precedent our Western colleagues created with their own hands…. When they agreed that the unilateral separation of Kosovo from Serbia, exactly what Crimea is going now was legitimate and did not require any permission from the country's central authorities" (discourses of President Putin in the Duma on Mach 18 2014, *in* O'Loughlin & al., 2014). This last point highlight the necessity to think such geopolitical conflict not as isolated events but as "system of conflict" (Merle, 2018): each controversy involves a complex set of actors, sharing antagonist objectives. Therefore the mediatization of this conflict has a structuring role: it is as well a strategic object but also a way of the intensification for the reduction of conflicts.

5.2 Theorizing a Methodological Gateways to Analyze the Links between Media and International Conflicts

The first gateway for analysing international conflicts in the media comes from Agenda setting theory. Galtung and Ruge's article in (1965) in the *Journal of Peace Research* can be considered as the cornerstone of international news flows theory. It provides general 'rules' governing the volume of news publication which have been empirically benchmarked on international conflicts cases, involving Congo, Cuba and Cyprus in four Norwegian newspapers. Most of related works have been able to determine the structural factors of salience of an event depending on the country where it took place (Wu, 2000). But all these models aren't explaining the emergence of conflicts which appears as residuals (more quoted than expected – Grasland, forthcoming). E. Segev (2016) has introduced conflict variables to analyse country coverage in different newspapers. The first group of variables introduce in the model are classical "national traits" gathering different measures of power (economy, military, population, area), but the second is "relatedness" gathering different variables of linkage (conflict, trade, common border, tourism, diaspora) and "event variables" composed of a measure of conflict intensity, a global peace index, the unemployment rate, GDP changes, and a death disaster accounting. This analysis has evidenced the competing presence of negatively reported countries (most of time when they are involved in a conflict) in the top of the hierarchy.

Analysing conflict agenda is a temporal challenge for news flows theory: the introduction of an historical depth of analysis to depart structural evolutions from conjectural situations of some regions or countries which are facing exceptional violent events (like wars, bombing,

terrorist attacks…) during the period of analysis. Those events contribute to globally twist the analysis which also depend on the temporal scale of aggregation of news (day, week, month, year, etc.). The temporal scale of analysis also affects the weight of some events depending on their nature. A very brief but intense event (like a terrorist attack) will have a great impact on the agenda at the day or week level but will be smoothed at the year scale. On the contrary, a long run event like a war will have several episodes and a cumulative effect which will higher the level of the country at the month or year scale but be undermined at a day or week scale.

If the first agenda setting theory can asses frame of the attention on a specific subject, simple analysis of frequencies cannot catch the substance of a geopolitical controversy. Thus we need to focus on the second agenda which is related to the analysis of the content of news.

The second gateway comes from International relations and Peace studies and is based on network analysis. In the wake of the quantitative turn in social sciences in the early 1960s, international relations and foreign policy studies have built up databases to quantify inter-state political stream. Event data were firstly developed by McClelland to introduce the system theory in the traditional approaches of diplomatic history. Event data analysis relies on a massive number of events reported by the press to produce patterns of international interaction: "*event-interaction is meant to refer to something very discrete and simple—to the veritable building blocks of international politics. They are the specific elements of streams of exchange between nations. Here are a few examples for hypothetical Nations A and B: Nation A proposes a trade negotiation, Nation B rejects the proposal, Nation A accuses B of hostile intentions, Nation B denies the accusation, Nation B deploys troops along a disputed boundary, Nation A requests that the troops be withdrawn,… Each act undertaken by each actor in this illustration is regarded as an event-interaction.*" (McClelland 1967 *in* (P. Schrodt 2001).

Event data are generated by collecting and examining press reports and eventually information from the field (NGO's reports, fieldwork etc.) on interactions between nation-states. For the UCPD, 60% of information come from the press and 40% from secondary sources used for disambiguation (Lisador, 2018). Basically, two kinds of variables are generated from textual data: qualitative variables providing the type of interaction with a category ontology; quantitative variables which measure a level of cooperation and conflict between states with a numerical score. For instance, a trade agreement would receive a positive score towards cooperation whereas a diplomatic relation shut would receive a negative score towards conflict. Event databases constitute in a three-steps pipeline composed of collecting a bunch of press sources (whom definition can have substantial influence on the output data), establishing a coding system ontology and process the coding. The two seminal databases, the World Event Interaction Survey (WEIS – McClelland, 1967) and the Conflict and Peace Data Bank (COPDAB – Azar 1980) used to code all interactions between all states and some non-state actors such as the UN or national liberation movements. This kind of event data are indicated as "actor-oriented" by Schordt(1995) recording all interactions between a set of international actors. He identifies a second type of event databases which are "episode-oriented" looking at events correlated to a specific historical event, primarily an international crisis or violent conflict. This second type correspond to the well-known Russell Leng's Behavioral Correlates

of War (Leng 1987), ancestor of today's Correlates of War[5] project. The Global Database of Event, Language and Tone[6] project (GDELT), supported by Google, has revived actor-oriented event data by collecting, translating and coding digitalised and digital media sources with automatic process. The GDELT collects and analyse most of World news agency, the Washington Post and the New-York Times and Google news.

This kind of approaches faces a reliability weakness regarding source bias and potential double count. Indeed, the choice of journalistic sources introduces editing and coverage bias in the report of international activities. Two responses have been introduced. The first stands that maintaining a consistent unique source (as the WEIS did) gives validity to the changes in patterns of interaction, and the pattern should not be seen as an objective measure but, relatively, in the changes over time. The second option was to use multiple sources to capture a maximum of diversity of events. The GDELT thanks to digital sources is doing so. Nevertheless, it introduces statistical hazards in longitudinal analysis. Leetaru and Schrodt (2013) have assessed the database and shown that the number of detected events grew exponentially between 1979 and 2012 and that the different sources have irregular levels of emission, otherwise noted, one source can have more influence on the result at a given date and less at an other one. The compensation of editorial bias by multiplication of sources is diminished by the absence of normalization across time and across sources. Then, the "sentence by sentence basis" of the procedure hypothesise that the information can be resumed by word co-occurrences at the sentence level, without consideration for embedded meanings at the text or paragraph level (Lisador, 2018).

Event-interaction data, beyond database production, has grounded some conceptual framework for studying international conflicts through the press with a state-to-state interaction approach. The media arena appears as a synthetic track of international relations which can be formalized as a spatial relation matrix for spatial analysis. However, coverage bias over sources and over time, or more generally the lack of awareness about international news flows distribution, newsworthiness and agenda setting constitutes a reliability gap in such data.

The third gateway is based on Discourse theory: in the 1990's the Geopolitics has been enriched by the influence of post-modern and post-colonial academics who oriented the geopolitics towards the analysis of discourses and representations of spaces and territories (Tuathail 1996). Geopolitical perceptions, knowledge and discourses about the geographical features of international relations became the very research object (Mamadouh 1998) based on the principle that *"the functioning of geographical knowledge not as an innocent body of knowledge and learning, but as an ensemble of technologies of power concerned with the governmental production and management of territorial space."* (Tuathail, 1996). This textual shift gets the geopolitics closer to media studies and conducts G. O'Tuathail and J. Agnew (1992) to propose four thesis for a narrative based geopolitics. The first thesis considers that designating places and locations is not simply spatializing a phenomenon into a euclidean

5 http://www.correlatesofwar.org/ (visited on 2018.02.06)

6 https://www.gdeltproject.org/ (visited on 2018.02.06)

referential but brings out a serial of narratives, World visions and appropriates political actions. As a correlate, the analysis of discourses on space is a way to reach some territorial narratives. Second, they defined two kinds of geopolitical production, the practical type which covers the daily action of politicians and administrators of state and the formal type which covers discourses of strategic thinkers and intellectuals. This petition in two types of geopolitics has been enlarged later by G. Ó Tuathail and S. Dalby (1998) who identified a third type of geopolitics, the popular geopolitics present in mass media, cinema, novels or cartoons, all three contributing to the spatializing of boundaries and dangers (the geopolitical map of the world) and the geopolitical representations of self and other (the geopolitical imagination). V. Kolosov (2003) has proposed a gradient more than categories between high and low geopolitics, that is to say between strategic and statecraft intellectuals discourses and a form of persistent geopolitical thinking present in vernacular discourses. Third, they considers the World system as a whole that implies a global analysis of discourses considering their embeddings into local, national and transnational interpretative communities. Finally, rather than state dominance, the normative power of the international stage is studied, that is to say the power to bring some narrative on the agenda and define the frame of interpretation. Critical geopolitics opened up a specific field of discourse analysis that focuses on territorial narratives in the press to address the political framing of international conflicts.

Discourse analysis has been the core methodology for critical geopolitics but was developed in different ways of analysis, sometimes without clear specification of methodology as noted by M. Müller (2011). The three main methodologies proposed below should not be understood as isolated but are used in combination for triangulation methodology. First methodology for discourse analysis focuses on the analysis of context of production of the text. General aspects of social life such as class, gender, ethnicity are considered as a distal context and are classical explanatory variables for discourse analysis (Toureille, 2017). The proximate context of text production considers the situation of enunciation, i.e. the capacities of the speaker and the interaction situation. This context is investigated with ethnographic research that analyse discourse settings to interpret them. Context is understood as a situational framework (Müller, 2011). For media studies, taking account of context can be both done in proximal or distal way. Economic situation of newspapers, readership, editorial lines or linkage with a political or syndical organization can be considered as the distal context and statistically implement as control variables. Nevertheless, the newsroom organization, collaboration with news agencies, other newspapers or journalists on the field, links with political networks, i.e. the proximal context should be analysed with ethnographic methods. The second direction of analysis is lexicometry that seeks to analyse lexical relations quantitatively through measures of frequency, specificity or co-occurrences. The measures of significance needs a reference corpus to assess the comparison and the definition of the unit of analysis (the sentence, the paragraph, the document) shall have substantial effect on the analysis. Glasze (2007) identifies three main qualities for lexicometry: *Thus, lexicometric approaches help to realise three basic principles of discourse theory: i) The research focus lies on the factually given discourse – not on any supposed intentions behind discourse. ii) Meaning is seen as being formed by the relation between lexical elements. Thus, the supposed fixation of signs within a relational net can be analysed by lexicometric analysis. iii) The temporality of any fixation may be analysed by comparing corpora of different contexts, e.g., over time.* For

Glasze, the transparent and a priori delineation of corpus based on key-words queries prevent the researcher from self-reinforcing results by selecting texts qualitatively. Nevertheless, this method is not able to analyse the relations between words (temporality, opposition, equivalence) and a narrative patterns method (or narrative inquiry) is proposed to pay attention to narrative techniques and storylines (Glasze, 2007). In this way the analysis pays attention to logical construction of texts and sense making by the narrator. The narrative attempt to position characters in space and time and to explain and normalize what has occurred.

This brief insight in territorial narrative analysis shows there is multiple methodologies for analysing geopolitical discourses and methodological triangulation (Morse, 1991) should be the rule. Beyond this diversity, we identify two main challenges for discourse analysis applied to geopolitical cases. The first one lays on the analysis of intermediate scales (transnational or macroregional) that implies to analyse various languages and equivocal objects like “Europe” (Toureille, 2017). It rises corpus delimitation issues ton ensure comparability of sources and treatment issues. For instance, lexicometry in particular lays on quantification of texts (frequency matrix) that is problematic for multilingual corpus. Idem, the question of meaning and narratives implies some adaptations. The second stake for analysing international conflicts in media is the link between narratives and public and individual opinions. Most of works which get the grip with that used to compare results from narrative analysis with surveys on the field or opinion barometers to benchmark the quality of media for tracking opinions (O’Loughlin, Tuathail, Kolossov, 2004).

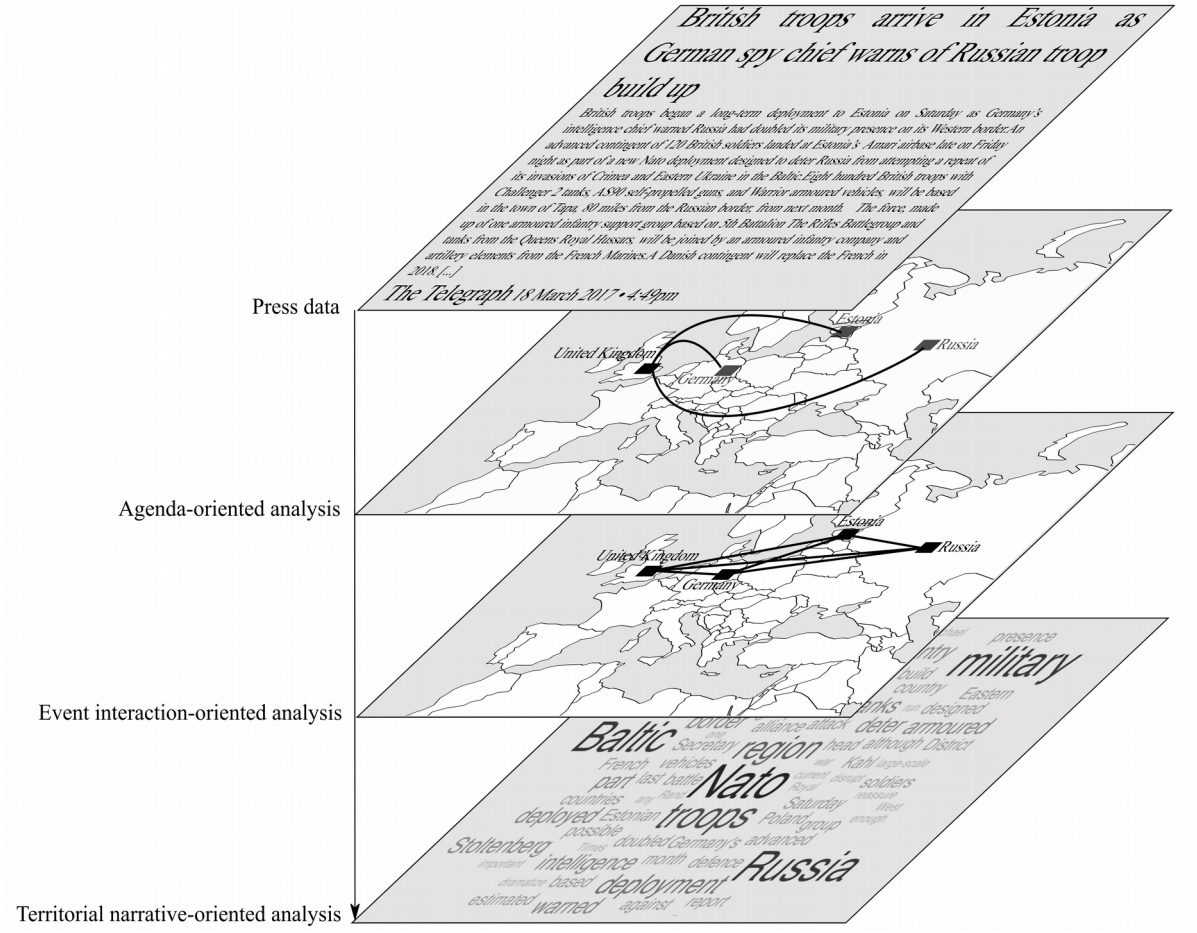


Figure 9. Spatial-textual analysis of media data: a typology

As a conclusion, this territorial dimension of opinion dynamics give the frame to understand: 1) that mediatized opinion dynamics are social constructs, 2) they have a spatial structure, 3) they emerge from multi-scaled socio-spatial interactions (eg. Local/regional/global but also individual/group/ society), 4) and that they are multidimensional and fundamentally complex objects.

6 Impact in the project

The concepts and theories presented here have been mainly developed in the field of media studies. As presented in the introduction, every one of them will play or has been playing a key role for the advancement of specific tasks of the ODYCCEUS project. However, in these first phases of the project, the concept of “agenda”, that was supposed to provide a common ground of all activities, has appeared not so interdisciplinary and open to mediate all the angles of ODYCCEUS. Yet, the past activities have allowed identifying the term of “frame” as very useful to provide the necessary common vocabulary to all WPs.

As said, the framing theory focuses on the process of selecting certain aspects of an issue to bring people's attention and to lead them a particular line of interpretation (Entman, 1993; Scheufele, 1999). Compared to the agenda-setting theory, the framing theory is based on the applicability model instead of on the accessibility model. So it allows tracing the connection between the production of news, and notably the characteristics attributed by the media for describing an object/issue, and the consumption of news, that is to say the attitudes of people (at individual and aggregate level) about the concerned object. Framing can be about the meaning of the object, but also about the ton with which it is presented (positive, negative or neutral). According to Kim at al (2011), the use of frames by media affect the way the audience thinks about the issue, for example they study the role of different media outlet in framing illegal immigration as a problem.

Another important point related to the concept of framing is its interdisciplinary origins. Framing is often traced back to roots in both psychology and sociology. As regards psychology, we can mention the experimental work by Kahneman and Tversky (1979, 1984), according to which different presentations of essentially identical decision-making scenarios influence people’s choices and their evaluation of the various options. As regards the sociological origin, it is mainly related to Goffman work (1974). According to it, individuals have pre-existing and long-standing schema (“primary frameworks”) that they use to actively classify and everyday interpret their life experiences and to make sense of the world around them. So, framing consists in activating such schema for interpreting real objects. This concept is very useful for the ODYCCEUS project because it guarantees the connection between the message in the media and the framework individuals employ to interpret the issue. As said by Scheufele and Tewksbury (2007):

“Framing therefore is both a macrolevel and a microlevel construct (Scheufele, 1999). As a macroconstruct, the term ‘‘framing’’ refers to modes of presentation that journalists and other communicators use to present information in a way that resonates with existing underlying schemas among their audience … Frames, in other words, become invaluable tools for presenting relatively complex issues, such as stem cell research, efficiently and in a way that makes them accessible to lay audiences because they play to existing cognitive schemas. As a microconstruct, framing describes how people use information and presentation features regarding issues as they form impressions.” (p. 12)

7 References

7.1 References about Mass media and the International Geomedia Agenda

Althaus, S. L., & Tewksbury, D. (2002). “Agenda setting and the “new” news: Patterns of issue importance among readers of the paper and online versions of the New York Times”, *Communication Research*, *29*, 2, 180-207.

Berkowitz, D (1992). “Who sets the media agenda? The ability of policymakers to determine news decisions”, *Public opinion*, *the press*, *and public policy*, Westport, CT:Praeger, 2, 81–102.

Boczkowski, P.J. & M. de Santos (2007). “When More Media Equals Less News: Patterns of Content Homogenization in Argentina’s Leading Print and Online Newspapers”, *Political Communication*, 24, 2, p. 167-180.

Boczkowski, P. J. (2010). *News at work: Imitation in an age of information abundance*. University of Chicago Press.

Boczkowski, P. J. (2005). *Digitizing the news: Innovation in online newspapers*. MIT Press.

Bourdieu, P. (1996). *Sur la télévision suivi de L’emprise du journaliste*, Paris: Liber, Raisons d’agir.

Breed, W. (1955). “Social control in the newsroom”, *Social Forces*, 33, 326-335.

Cohen, B (1963). *The press and foreign policy*. New York: Harcourt.

Cottle, S. & Ashton, M. (1999). “From BBC Newsroom to BBC Newscentre: On Changing Technology and Journalist Practices”, *Convergence*, 5, 3, 22-43.

Conway, M., & Patterson, J. R. (2008). “Today's Top Story? An Agenda-Setting and Recall Experiment Involving Television and Internet News”, *Southwestern Mass Communication Journal*, 24, 1, 31-48.

Dagiral, E. & Parasie, S. (2012). “Presse en ligne : où en est la recherche ?”, *Réseaux*, 2, 13-42.

Dearing, J & Rogers, E (1988). "Agenda-setting research: Where has it been, where is it going?". *Communication Yearbook*, 11, 555–594.

Entman, R. M. (1993). “Framing: Toward clarification of a fractured paradigm”, *Journal of communication*, 43(4), 51-58.

Galtung, J. & Ruge, M. H. (1965). “The structure of foreign news”, *Journal of peace research*, 2, 1, 64–91.

Gans, H. (1979). *Deciding what’s news*. New York: Vintage.

Ghanem, S. I., & McCombs, M. (2001). “The convergence of agenda setting and framing”, *Framing public life*, Routledge, 83-98.

Gieber, W. (1964), “News is what newspapermen make it”, in L.A. Dex Ter, D.M. White, *People*, *Society and Mass Communication*, Free Press, New York, 173-180.

Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. New York: Harper & Row.

Golding, P., & Elliott, P. (1979). “Making the news”, in H. Tumber (Ed.), *News: A reader*, New York: Oxford University Press, 112-120.

Grasland, C., *et al*. (2016). “L’agenda géomédiatique international : analyse multidimensionnelle des flux d’actualité”, *L’Espace géographique*, 45, 1, 25-43.

Guo, L., & McCombs, M. (2011). *Network agenda setting: A third level of media effects*. ICA, Boston.

Herkenrath, M. & Knoll A. (2011). “Protest events in international press coverage: An empirical critique of cross-national conflict databases”, *International Journal of Comparative Sociology*, 53, 3, 163-180.

Himelboim, I., Chang, T.-K., & McCreery, S. (2010). “International Network of Foreign News Coverage: Old Global Hierarchies in a New Online World”, *Journalism & Mass Communication Quarterly*, 87, 2, 297–314.

Kahneman, D., & Tversky, A. (1979). “Prospect theory—Analysis of decision under risk”, *Econometrica*, 47, 263–291.

Kahneman, D., & Tversky, A. (1984). “Choices, values, and frames”, *American Psychologist*, 39, 341–350.

Koopmans, R., & Vliegenthart, R. (2011). “Media Attention as the Outcome of a Diffusion Process A Theoretical Framework and Cross-National Evidence on Earthquake Coverage”, *European sociological review*, 27, 5, 636–653.

Ku, G., Kaid, L. L., & Pfau, M. (2003). “The impact of web site campaigning on traditional news media and public information processing”, *Journalism & Mass Communication Quarterly*, *80*, 3, 528-547.

Lang, G. E., et Lang, K. (1981). “Watergate : An exploration of the agenda-building process”, *Mass Communication Review Yearbook 2*, 447-468.

Lippmann, W (1922). *Public opinion*. New York: Harcourt.

Marty, E., Rebillard, F. & Smyrnaios N. (2009). “Online News between Redundancy and Diversity: A Quantitative Study of French Speaking News Websites”, *Colloque new media and communication*. Athen, 6-9 may.

McCombs, M. (2014). *Setting the agenda: Mass media and public opinion*. John Wiley & Sons.

McCombs, M. E., Shaw, D. L., & Weaver, D. H. (1997). *Communication and democracy: Explorining the intellectual frontiers in agenda-setting theory*. Mahwah, NJ: Erlbaum.

McCombs, M. E., & Shaw, D. L. (1993). “The evolution of agenda-setting research: twenty-five years in the marketplace of ideas”, *Journal of communication*, *43*, 2, 58-67.

McCombs, M. (1981). “The agenda setting approach”, in I. Nimmo & K. Sanders (Eds.), *Handbook ofpolitical communication*, Beverly Hills, CA: Sage, 121-140.

McCombs, M. E., & Shaw, D. L. (1972). “The agenda-setting function of mass media”, *Public opinion quarterly*, *36*, 2, 176-187.

Östgaard, E. (1965). “Factors Influencing the Flow of News”, *Journal of Peace Research*, 2, 1, 39- 63.

Paterson, C. (2005). “News agency dominance in international news on the internet”, *Converging media, diverging politics: A political economy of news media in the United States and Canada*, 145-163.

Rogers, M.E. & Dearing J. (1988). “Agenda-setting research: Where has it been, where is it going?”, In J. A. Anderson, *Communication yearbook 11*, Newbury Park, CA: SAGE, 555–594.

Sarkar, M.B., Butler, B. & Steinfield C. (1995). “Intermediaries and Cybermediaries: a continuing role for mediating players in the electronic marketplace”, *Journal of Computer-Mediated Communication*, 1, 3, 1-14.

Scheufele, D (2000). "Agenda-setting, priming, and framing revisited: Another look at cognitive effects of political communication". *Mass Communication & Society*, 3, 2, 297–316.

Scheufele, D. A., & Tewksbury, D. (2006). “Framing, agenda setting, and priming: The evolution of three media effects models”, *Journal of communication*, *57*, 1, 9-20.

Smyrnaios N., Marty E., & Rebillard F. (2010). “Does the Long Tail apply to online news? A quantitative study of French-speaking news websites”, *New Media & Society*, 12, 8, 1244–1261.

Tuchman, G. (1973). “Making News by Doing Work: Routinizing the Unexpected”, *American Journal of Sociology*, 79, 1, 110-131.

Thussu, D.K. (2007). *News as Entertainment: The Rise of Global Infotainment*. London: Sage.

Walgrave, S. & Van Aelst, P (2006). "The contingency of the mass media's political agenda setting power: Toward a preliminary theory". *Journal of Communication*, 56, 88–109.

Weaver, D. H. (2007). “Thoughts on Agenda Setting, Framing, and Priming”, *Journal of Communication*, 57, 1, 142–147.

Weaver, D., & Elliott, S. N. (1985). “Who sets the agenda for the media? A study of local agenda-building”, *Journalism Quarterly*, *62*, 1, 87-94.

White D. (1950), “The Gatekeeper : A Case Study in the Selection of News”, *Journalism Quarterly*, 4.

Wu, D.H. 2000. “Systemic Determinants of International News Coverage: A Comparison of 38 Countries”, *Journal of Communication*, 50, 2, 110-130.

7.2 References on Social Media and the Analysis of Opinions

ALLPORT F. H., 1937, « Toward a science of public opinion », *Public Opinion Quarterly*, 1, 1, p. 7-23.

ANDERSON C., 2008, « The End of Theory: The Data Deluge Makes the Scientific Method Obsolete », *Wired*, 16:7.

BARBERÁ P., JOST J. T., NAGLER J., TUCKER J. A., and BONNEAU R., 2015, « Tweeting From Left to Right: Is Online Political Communication More Than an Echo Chamber? » *Psychological Science*, 26:10, p. 1531-1542.

BASTOS, M. T., RAIMUNDO, R. L. G., and TRAVITZKI, R., 2013, « Gatekeeping Twitter: message diffusion in political hashtags », *Media, Culture & Society*, 35, 2, p. 260-270.

BERMINGHAM A. and SMEATON A. F., 2011, « On Using Twitter to Monitor Political Sentiment and Predict Election Results », *Workshop Sentiment Analysis where AI meets Psychology (SAAIP) at the International Joint Conference for Natural Language Processing (IJCNLP)*.

BLONDIAUX, L., 1998, *La fabrique de l'opinion. Une histoire sociale des sondages*, Paris, Le Seuil.

BORGATTI, S. P., 2006, « Identifying sets of key players in a network », *Computational, Mathematical and Organizational Theory*, 12, 1, p. 21-34.

BOURDIEU P., 1973, « L'opinion publique n'existe pas », *Les Temps Modernes*, janvier, 318.

BOYADJIAN, J., 2014, *Analyser les opinions politiques sur Internet: Enjeux théoriques et défis méthodologiques*, Doctoral dissertation, Montpellier 1, France.

BOYD D. and CRAWFORD K., 2012, « Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon», *Information, Communication & Society*, 15, 5, p. 662-679.

CALUDE C. and LONGO G., 2016, « The Deluge of Spurious Correlations in Big Data », *Foundations of Science*, p. 1-18.

CASINI L., and MANZO G., 2016, « Agent-based models and causality: a methodological appraisal", working paper, Linköping University. Available at http://www.diva-portal.org/smash/get/diva2:1058813/FULLTEXT01.pdf.

CAYROL R., 2011, *Opinion, sondages et démocratie*, Paris, Sciences Po Presses.

CERON A., CURINI L., IACUS S. M., and PORRO G., 2013, « Every tweet counts? How sentiment analysis of social media can improve our knowledge of citizens' political preferences with an application to Italy and France », *New Media & Society*, 16, 2, p. 340-358.

CIOFFI-REVILLA C., 2016, « Bigger Computational Social Science: Data, Theories, Models, and Simulations—Not Just Big Data », *8th International ACM Web Science Conference (WebSci'16)*.

COLLEONI E., ROZZA A., and ARVIDSSON A., 2014, « Echo Chamber or Public Sphere? Predicting Political Orientation and Measuring Political Homophily in Twitter using Big Data », *Journal of Communication*, 64, p. 317-332.

CONOVER M. D., GONÇALVES B., RATKIEWICZ J., FLAMMINI A., and MENCZER F., 2011, « Predicting the Political Alignment of Twitter Users », *Proceedings of the IEEE Third International Conference on Privacy, Security, Risk and Trust (PASSAT 2011) and the IEEE Third International Conference on Social Computing (SocialCom 2011)*, p. 192-199.

de Rosnay J., 1975, *Le Macroscope, vers une vision globale*, Paris, Le Seuil.

DRISCOLL K. and WALKER S., 2014, « Working Within a Black Box: Transparency in the Collection and Production of Big Twitter Data », *International Journal of Communication*, 8, p. 1745-1764.

ENTMAN, R. M. and HERBST, S., 2001, « Reframing public opinion as we have known it », in W. BENNETT, L. and ENTMAN R. M., *Mediated politics: Communication in the future of democracy*, Cambridge, Cambridge University Press, p. 203-225.

GAYO-AVELLO, D., 2013, « A meta-analysis of state-of-the-art electoral prediction from Twitter data », *Social Science Computer Review*, 31, 6, p. 649-679.

GINSBERG, B. 1986, *The Captive Public: How Mass Opinion Promotes State Power*, New York, Basic Books.

HABERMAS, J., 1962, *L'espace public*, Paris, Edition Payot.

HAYASHI C., 1998, « What is Data Science? Fundamental Concepts and a Heuristic Example», in C. Hayashi *et al.*, *Data Science, Classification, and Related Methods. Studies in Classification, Data Analysis, and Knowledge Organization*. Springer Japan. p. 40–51.

HE Y., SAIF H., WEI Z., and WONG K.-F., 2012, « Quantising Opinions for Political Tweets Analysis », *Proceedings of the Eighth International Conference on Language Resources and Evaluation (LREC 2012)*, p. 3901-3906.

HOGAN, B., 2014, "From invisible algorithms to interactive affordances: Data after the ideology of Machine Learning" in E. Bertino, S. A. Matei (eds.), *Roles, Trust, and Reputation in Social Media Knowledge 1 Markets, Computational Social Sciences*, DOI 10.1007/978-3-319-05467-4_7.

HOLMES, D.E., 2017, *Big Data. A very Short Introduction*, Oxford, Oxford University Press.

JUNGHERR A., JÜRGENS P., and SCHOEN H., 2011, « Why the Pirate Party Won the German Election of 2009 or the Trouble With Predictions: A Response to Tumasjan, A., Sprenger, T. O., Sander, P. G., & Welpe, I. M. "Predicting Elections With 140 Characters Reveal About Political Sentiment" », *Social Science Computer Review*, p 1-6.

JÜRGENS P., JUNGHERR A., and SCHOEN H., 2011, « Small Worlds with a Difference: New Gatekeepers and the Filtering of Political Information on Twitter », *Proceedings of the Third International Web Science Conference (WebSci 2011)*.

KATZ, E. and LAZARSFELD, P. E., 1955, *Personal influence: The part played by people in the flow of mass communication*, New York, Free Press.

KEY, V. O., 1966, *The Responsible Electorate: Rationality in Presidential Voting, 1936-1960*, with the Assistance of Milton C. Cummings, Cambridge, Harvard University Press.

LAMARCHE-PERRIN R., DEMAZEAU Y., and VINCENT J.-M., 2014, « Building Optimal Macroscopic Representations of Complex Multi-agent Systems », *Transactions on Computational Collective Intelligence*, vol. XV, LNCS 8670, p. 1-27.

LAZARSFELD, P. F., BERELSON, B., and GAUDET, H., 1948, *The peoples choice: how the voter makes up his mind in a presidential campaign*, New York, Duell, Sloan and Pearce.

LAZER D., PENTLAND A., ADAMIC L., ARAL S., BARABÁSI A.-L., BREWER D., CHRISTAKIS N., CONTRACTOR N., FOWLER J., GUTMANN M., JEBARA T., KING G., MACY M., ROY D., and VAN ALSTYNE M., 2009, « Computational Social Science », *Science*, 323, 5915, p. 721-723.

LIPPMANN, W., 1925, *The Phantom Public*, New York, Harcourt Brace.

LIVNE A., SIMMONS M. P., ADAR E., and ADAMIC L. A., 2011, « The Party is Over Here: Structure and Content in the 2010 Election », *Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media*, p. 201-208.

MASAD D., 2014, « Computational social science, data, and complexity », *Bad Networking*, available at http://davidmasad.com/blog/css-data-complexity/

MARRES, N., 2017, *Digital Sociology. The Reinvention of Social Research*, Wiley.

MARRES, N., 2012, « The redistribution of methods: on intervention in digital social research », *The sociological review*, *60*, S1, p. 139-165.

MEI Q., LING X., WONDRA M., SU H., and ZHAI C., 2007, « Topic Sentiment Mixture: Modeling Facets and Opinions in Weblogs », *Proceedings of the 16th international conference on World Wide Web (WWW'07)*, p. 171-180.

MERCIER, A., 2012, *Médias et opinion publique*, Les Essentiels d'Hermès, Paris, CNRS éditions.

MERTON, R. K., 1968, « Patterns of Influence: Local and Cosmopolitan Influentials », in R. K. MERTON (eds.), *Social Theory and Social Structure*, New York, Free Press, p. 441-474.

METAXAS, P. T., MUSTAFARAJ, E. and GAYO-AVELLO, D., 2011, « How (not) to predict elections », *Privacy, Security, Risk and Trust (PASSAT) and 2011 IEEE Third International Conference on Social Computing (SocialCom)*.

MOLYNEUX, L., 2015, « What journalists retweet: Opinion, humor, and brand development on Twitter », *Journalism*, 16, 7, p. 920-935.

NOELLE-NEUMANN, E., 1984, T*he Spiral of Silence. Public Opinion – Our Social Skin*, Chicago and London, University of Chicago Press.

O'CONNOR B., BALASUBRAMANYAN R., ROUTLEDGE B. R., and SMITH N. A., 2010, « From Tweets to Polls: Linking Text Sentiment to Public Opinion Time Series », *Proceedings of the Fourth International AAAI Conference on Weblogs and Social Media*, p. 122-129.

PAGE, B. I., and SHAPIRO R.Y., 1992, *The Rational Public: fifty years of Trends of Americans' Policy Preferences*, Chicago, University of Chicago Press.

PAK A. and PAROUBEK P., 2010, « Twitter as a Corpus for Sentiment Analysis and Opinion Mining », *Proceedings of the International Conference on Language Resources and Evaluation (LREC 2010)*, p. 17-23.

PAPACHARISSI, Z., and DE FATIMA OLIVEIRA, M., 2012, « Affective news and networked publics: The rhythms of news storytelling on# Egypt», *Journal of Communication*, 62, 2, p. 266-282.

PARK C. S., 2013, « Does Twitter motivate involvement in politics? Tweeting, opinion leadership, and political engagement », *Computers in Human Behavior*, 29, 4, p. 1641-1648.

PIGLIUCCI M., 2009, « The end of theory in science? », *EMBO reports*, 10:6.

PUNCH K., 1998, *Introduction to Social Research: Quantitative and Qualitative Approaches*, London, Sage.

REYNIÉ D. 1989, « Le nombre dans la politique moderne », *Hermès*, 4, Paris, CNRS edition, p.159-164.

SAVAGE M. and BURROWS R., 2007, « The coming crisis of empirical sociology », *Sociology*, 41, 5, p. 885–899.

SEVERO M., FEREDJ A., and ROMELE A., 2016, « Soft Data and Public Policy: Can Social Media Offer Alternatives to Official Statistics in Urban Policymaking? », *Policy & Internet*, 8, 3, p. 354-372.

SKORIC M., POOR N., ACHANANUPARP P., LIM E. P., and JIANG J. 2012, « Tweets and Votes: A Study of the 2011 Singapore General Election », *Proceedings of 45th Hawaii International Conference on Systems Science (HICSS-45 2012)*, *IEEE Computer Society*, Los Alamitos, CA, USA, p. 2583-2591.

STIEGLITZ S. and DANG-XUAN L., 2012, « Political Communication and Influence through Microblogging – An Empirical Analysis of Sentiment in Twitter Messages and Retweet Behavior », *Proceedings of the Forty-fifth Hawaii International Conference on System Sciences (HICSS 2012)*, p. 3500-3509.

TARDE G., 1989 (1901), *L'Opinion et la foule*, Paris, Les Presses Universitaires de France.

TUMASJAN A., SPRENGER T. O., SANDNER P. G., and WELPE I. M., 2010, « Predicting elections with Twitter: What 140 characters reveal about political sentiment », *Proceedings of the Fourth International AAAI Conference on Weblogs and Social Media*, p.178-185.

VENTURINI, T., and LATOUR, B., 2010, « The social fabric: Digital traces and quali-quantitative methods », *Proceedings of Futur en Seine 2009*, p. 87-101.

WATTS, D. J., and DODDS, P. S., 2007, « Influentials, networks, and public opinion formation », *Journal of consumer research*, *34*, 4, p. 441-458.

WILSON, T., WIEBE, J. and HOFFMANN, P., 2005, « Recognizing Contextual Polarity in Phrase-Level Sentiment Analysis », *Proceedings of the 2005 Conference on Empirical Methods in Natural Language Processing*, p. 347–354.

XU, W. W., SANG, Y., BLASIOLA, S., and PARK, H. W, 2014, « Predicting opinion leaders in Twitter activism networks: The case of the Wisconsin recall election », *American Behavioral Scientist*, 58, 10, p.1278-1293.

ZALLER, J. R., 1992, *The Nature and Origins of Mass Opinion*, Cambridge, Cambridge University Press.

7.3 References on Modeling Interactions between Mass Media and Social Media

D. Abbott. T*he reasonable ineffectiveness of mathematics* [point of view]. 101:2147 – 2153, 10 2013.

R. Axelrod. The dissemination of culture: A model with local convergence and global polarization. *Journal of Conflict Resolution*, 41(2):203–226, 1997.

F. Battiston, A. Cairoli, V. Nicosia, A. Baule, and V. Latora. Interplay between consensus and coherence in a model of interacting opinions. *Physica D Nonlinear Phenomena*, 323:12–19, June 2016.

C. M. Bordogna and E. V. Albano. Statistical methods applied to the study of opinion formation models: a brief overview and results of a numerical study of a model based on the social impact theory. *Journal of Physics: Condensed Matter*, 19(6):065144, 2007.

L. Boudin and F. Salvarani. Modelling opinion formation by means of kinetic equations, pages 245–270. Birkhäuser Boston, Boston, 2010.

L. Boudin and F. Salvarani. Opinion dynamics: Kinetic modelling with mass media, application to the scottish independence referendum. *Physica A: Statistical Mechanics and its Applications*, 444(C):448–457, 2016.

J. Candia and K. I. Mazzitello. Mass media influence spreading in social networks with community structure. *Journal of Statistical Mechanics: Theory and Experiment*, 2008(07):P07007, 2008.

T. Carletti, D. Fanelli, S. Grolli, and A. Guarino. How to make an efficient propaganda. *EPL (Europhysics Letters)*, 74(2):222, 2006.

C. Castellano, S. Fortunato, and V. Loreto. Statistical physics of social dynamics. *Reviews of Modern Physics*, 81:591–646, April 2009.

X. Castelló, V. M. Eguíluz, and M. San Miguel. Ordering dynamics with two nonexcluding options: bilingualism in language competition. *New Journal of Physics*, 8(12):308, 2006.

P. Clifford and A. Sudbury. A model for spatial conflict. *Biometrika*, 60(3):581–588, 1973.

F. Colaiori and C. Castellano. Interplay between media and social influence in the collective behavior of opinion dynamics. *Phys. Rev. E*, 92:042815, Oct 2015.

A. Comte, H. Martineau, and F. Harrison. *The Positive Philosophy of Auguste Comte*. Number vol. 3 in Bohn's philosophical library. G. Bell & sons, 1896.

J. T. Cox. Coalescing random walks and voter model consensus times on the torus in Zd . *Ann. Probab.*, 17(4):1333–1366, 10 1989.

G. Deffuant, D. Neau, and G. Amblard, F.and Weisbuch. Mixing beliefs among interacting agents. *Advances in Complex Systems* (ACS), 03(01n04):87–98, 2000.

M. H. Degroot. Reaching a consensus. *Journal of the American Statistical Association*, 69(345):118–121, 1974.

Y. Dong, M. Zhan, G. Kou, Z. Ding, and H. Liang. A survey on the fusion process in opinion dynamics. *Information Fusion*, 43:57 – 65, 2018.

J. Fernández-Gracia, K. Suchecki, J. J. Ramasco, M. San Miguel, and V. M. Eguíluz. Is the voter model a model for voters? *Physical Review Letters*, 112(15):158701, April 2014.

A. Flache and M. W. Macy. Small worlds and cultural polarization. 35:146–176, 01 2011.

N. E. Friedkin and E. C. Johnsen. Social influence networks and opinion change. 16, 01 1999.

N. E. Friedkin and E. C. Johnsen. Social Influence Network Theory: A Sociological Examination of Small Group Dynamics. *Structural Analysis in the Social Sciences*. Cambridge University Press, 2011.

Y. Gandica, A. Charmell, J. Villegas-Febres, and I. Bonalde. Cluster-size entropy in the axelrod model of social influence: Small-world networks and mass media. 84(4):046109, October 2011.

F. Gargiulo and Y. Gandica. The role of homophily in the emergence of opinion controversies. *Journal of Artificial Societies and Social Simulation*, 20(3):8, 2017.

K. Garimella, G. De Francisci Morales, A. Gionis, and M. Mathioudakis. The ebb and flow of controversial debates on social media. *ArXiv e-prints*, March 2017.

K. Garimella, G. De Francisci Morales, A. Gionis, and M. Mathioudakis. Quantifying controversy on social media. *Trans. Soc. Comput.*, 1(1):3:1–3:27, January 2018.

J. Ghaderi and R. Srikant. Opinion dynamics in social networks with stubborn agents: Equilibrium and convergence rate. *Automatica*, 50(12):3209 – 3215, 2014.

J. C. González-Avella, M. G. Cosenza, V. M. Eguíluz, and M. San Miguel. Spontaneous ordering against an external field in non-equilibrium systems. *New Journal of Physics*, 12(1):013010, 2010.

J. C. González-Avella, M. G. Cosenza, and K. Tucci. Nonequilibrium transition induced by mass media in a model for social influence. *Phys. Rev. E*, 72:065102, Dec 2005.

J. C. González-Avella, V. M. Eguíluz, M. G. Cosenza, K. Klemm, J. L. Herrera, and M. San Miguel. Local versus global interactions in nonequilibrium transitions: A model of social dynamics. *Phys. Rev. E*, 73:046119, Apr 2006.

J. Groucutt, P. Leadley, and P. Forsyth. *Marketing: Essential Principles, New Realities*. Kogan Page Series. Kogan Page, 2004.

R. Hegselmann and U. Krause. Opinion dynamics and bounded confidence: Models, analysis and simulation. *Journal of Artificial Societies and Social Simulation*, 5:1– 24, 2002.

T. Hobbes and J.C.A. Gaskin. *Leviathan*. Oxford world's classics. Oxford University Press, 1996.

R. A. Holley and T. M. Liggett. Ergodic theorems for weakly interacting infinite systems and the voter model. *The Annals of Probability*, 3(4):643–663, 1975.

H. Hu. Competing opinion diffusion on social networks. *Royal Society Open Science*, 4(11), 2017.

M. Karsai, G. Iñiguez, K. Kaski, and J. Kertész. Complex contagion process in spreading of online innovation. *ArXiv e-prints*, May 2014.

P. L. Krapivsky and S. Redner. Dynamics of majority rule in two-state interacting spin systems. *Phys. Rev. Lett.*, 90:238701, Jun 2003.

R. Lambiotte. Majority rule on heterogeneous networks. J*ournal of Physics A: Mathematical and Theoretical*, 41(22):224021, 2008.

R. L. Launer, G. N. Wilkinson, and United States. Army Research Office. Mathematics Division. *Robustness in statistics: proceedings of a workshop*. Academic Press Rapid Manuscript Reproduction. Academic Press, 1979.

T. V. Martins, M. Pineda, and R. Toral. Mass media and repulsive interactions in continuous-opinion dynamics. *EPL (Europhysics Letters)*, 91(4):48003, 2010.

K. I. Mazzitello, J. Candia, and V. Dossetti. Effects of mass media and cultural drift in a model for social influence. *International Journal of Modern Physics C*, 18(09):1475–1482, 2007.

M. Miller, J. Clark, and A. Jehle. Cognitive dissonance theory (festinger), 01 2015.

L. R. Peres and J. F. Fontanari. The media effect in axelrod's model explained. *EPL (Europhysics Letters)*, 96(3):38004, 2011.

W. Quattrociocchi, G. Caldarelli, and A. Scala. Opinion dynamics on interacting networks: media competition and social influence. *Scientific Reports*, 4(4938), 2014.

W. Rand and R. T. Rust. Agent-based modeling in marketing: Guidelines for rigor. *International Journal of Research in Marketing*, 28(3):181 – 193, 2011.

A. H. Rodríguez and Y. Moreno. Effects of mass media action on the axelrod model with social influence. pre, 82(1):016111, July 2010.

L. Salzarulo. A continuous opinion dynamics model based on the principle of metacontrast. *Journal of Artificial Societies and Social Simulation*, 9(1):13, 2006.

D. A. Siegel. Social networks and the mass media. *American Political Science Review*, 107(4):786–805, 2013.

K. Sznajd-Weron and J. Sznajd. Opinion evolution in closed community. *International Journal of Modern Physics C*, 11:1157–1165, 2000.

J. J. Timothy. How does propaganda influence the opinion dynamics of a population ? *ArXiv e-prints*, March 2017.

F. Vazquez, P. L. Krapivsky, and S. Redner. Constrained opinion dynamics: freezing and slow evolution. *Journal of Physics A: Mathematical and General*, 36(3):L61, 2003.

S. Wang and X. Fu. Opinion dynamics on online-offline interacting networks: Media influence and antagonistic interaction. In *Proceedings of the 8th ACM International Workshop on Hot Topics in Planet-scale mObile Computing and Online Social neTworking*, HotPOST '16, pages 55–60, New York, NY, USA, 2016. ACM.

L. A. White. Sociology, physics and mathematics. *American Sociological Review*, 8(4):373–379, 1943.

D. Yanagizawa-Drott. Propaganda and conflict: Evidence from the rwandan genocide. *The Quarterly Journal of Economics*, 129(4):1947–1994, 2014.

E. Yildiz, A. Ozdaglar, D. Acemoglu, A. Saberi, and A. Scaglione. Binary opinion dynamics with stubborn agents. *ACM Trans. Econ. Comput.*, 1(4):19:1–19:30, December 2013.

7.4 References on the Case Study of International Conflicts

Azar, Edward E. 1980. « The Conflict and Peace Data Bank (COPDAB) Project ». *Journal of Conflict Resolution* 24 (1): 143-52. https://doi.org/10.1177/002200278002400106.

Bachelet, A., Duquesney, L.-J., Merle, T., 2017. Conflits de souveraineté et frontières contestées. Les États de facto de l'espace post-soviétique. J. Power Inst. Post-Sov. Soc. Pipssorg.

Baev, P., 1998, *Russia's Politicies in Secessionist Conflicts in Europe in the 1990s*, Security Policy Library, 11 (Oslo, Norwegian Atlantic Committee)

Beauguitte, Laurent. 2011. *L'assemblée générale de l'ONU de 1985 à nos jours : acteur et reflet du Système-Monde : essai de géographie politique quantitative*. Paris 7. http://www.theses.fr/2011PA070073.

Boulanger, Philippe. 2014. *Géopolitique des médias: Acteurs, rivalités et conflits*. Armand Colin.

Caspersen, N., Stansfield, G., 2012. Unrecognized States in the International System. Routledge.

Dalby, Simon, et Gearóid Ó Tuathail. 1998. *Rethinking Geopolitics*. Psychology Press.

Fan, Ying. 2010. « Branding the nation: towards a better understanding ». *Place Branding and Public Diplomacy* 6 (mars): 97-103.

Florea, A., 2014. De Facto States in International Politics (1945–2011): A New Data Set. Int. Interact. 40, 788–811. https://doi.org/10.1080/03050629.2014.915543

Foucher, Michel, et Pascal Orcier. 2010. *La bataille des cartes : Analyse critique des visions du monde*. Paris: François Bourin Editeur.

Galtung, Johan. 1996. *Peace by Peaceful Means: Peace and Conflict, Development and Civilization*. 1 edition. Los Angeles: SAGE Publications Ltd.

Galtung, Johan, et Marie Holmboe Ruge. 1965. « The Structure of Foreign News. The Presentation of the Congo, Cuba and Cyprus Crises in Four Norwegian Newspapers ». *Journal of Peace Research*.

Glasze G., 2007, « The Discursive Constitution of a World-Spanning Region and the Role of Empty Signifiers: The Case of Francophonia », *Geopolitics*, vol.12, num.4.

Groeble, Jo. 1995. « The Role of the Mass Media in Modern Wars ». In *War: a Crual Necessity? The Bases of Institutionalized Violence*. Hinde Robert A., Watson Helen E.

Hastings, Max. 1989. « The Media and Modern Warfare ». *Conflict Quarterly*, n° Summer.

Helman, G.B., and, Ratner, S., R., 1992, "Saving Failed States", *Foreign Policy*, n°89, p. 3-20.

Jackson, R., 1990, *Quasi-states, Sovereignty, International relations and the Third World*, Cambridge University Press

King, C., 2001. The Benefits of Ethnic War: Understanding Eurasia's Unrecognized States. World Polit. 53, 524–552. https://doi.org/10.1353/wp.2001.0017

Kolossov, V. 2003. « "High" and "Low" Geopolitics: Images of Foreign Countries in the Eyes of Russian Citizens ». *Geopolitics* 8 (1): 121-48. https://doi.org/10.1080/714001015.

Kolossov, V., O'Loughlin, J., 1998. Pseudo-States as Harbingers of a new geopolitics: The example of the trans-dniester Moldovan republic (TMR). Geopolitics 3, 151–176. https://doi.org/10.1080/14650049808407612

Kolstø, P., 2006. The Sustainability and Future of Unrecognized Quasi-States, The Sustainability and Future of Unrecognized Quasi-States. J. Peace Res. 43, 723–740. https://doi.org/10.1177/0022343306068102

Lacoste, Yves. 1995. *Dictionnaire de géopolitique*. Flammarion.

Leetaru, Kalev, et Philip A. Schrodt. 2013. « Gdelt: Global data on events, location, and tone, 1979–2012 ». In *ISA annual convention*, 2:1-49. Citeseer.

Leng, Russell J. 1987. *Behavioral Correlates of War, 1816-1979*. Inter-university Consortium for Political and Social Research.

Lisador, Audrey, 2018, *Uppsala Conflict Data program: qualité et précision d'une base de données spatio-temporelle sur les conflits armés*, Master thesis, dir. C. Grasland, T. Giraud, Université Paris Diderot.

Mamadouh, V. D. 1998. « Geopolitics in the Nineties: One Flag, Many Meanings ». *GeoJournal* 46 (4): 237-53. https://doi.org/10.1023/A:1006950931650.

McClelland, Charles. 1967. « World-Event-Interaction-Survey: A Research Project on the Theory and Measurement of International Interaction and Transaction ». University of Southern California.

Merle, T., 2018. Les États non reconnus de l'ex-URSS, des « conflits gelés » oubliés aux marges de l'Europe, Abstract. Champs Mars 125–137.

Mitchell, C. R. 1989. *The Structure of International Conflict*. Springer.

Morse J. M., 1991, « Approaches to Qualitative-Quantitative Methodological Triangulation », *Nursing Research*, vol.40, num.2, 120.

Müller M., 2011, « Doing Discourse Analysis in Critical Geopolitics », *L'Espace Politique. Revue en ligne de géographie politique et de géopolitique*, num.12. http://espacepolitique.revues.org/1743

Nye, Joseph S. 2009. *Soft Power: The Means To Success In World Politics*. PublicAffairs.

Ohmae, K., 2008. The End of the Nation State: The Rise of Regional Economies. HarperCollins.

O'Loughlin, J., Kolossov, V., Toal, G., 2014. Inside the post-Soviet de facto states: a comparison of attitudes in Abkhazia, Nagorny Karabakh, South Ossetia, and Transnistria. Eurasian Geogr. Econ. 55, 423–456.

O'Loughlin J., Tuathail G. Ó., Kolossov V., 2004, « Russian geopolitical storylines and public opinion in the wake of 9–11: a critical geopolitical analysis and national survey », *Communist and Post-Communist Studies*, vol.37, num.3, 281-318.

Orbie, Jan, éd. 2009. *Europe's Global Role: External Policies of the European Union*. 1 edition. Farnham: Routledge.

Pegg, S., 1998. International Society and the de Facto State. Ashgate.

Rahim, M. Afzalur. 2010. *Managing Conflict in Organizations*. Transaction Publishers.

Rickli, Jean-Marc, et Kaspersen. s. d. « The global war of narratives and the role of social media ». World Economic Forum. Consulté le 25 juin 2018. https://www.weforum.org/agenda/2016/07/the-global-war-of-narratives-and-the-role-of-social-media/.

Rosière, Stéphane. 2007. *Géographie politique et géopolitique: une grammaire de l'espace politique*. Ellipses.

Rosière, S., 2010. La fragmentation de l'espace étatique mondial. Réflexions sur l'augmentation du nombre des États. L'Espace Polit. Rev. En Ligne Géographie Polit. Géopolitique. https://doi.org/10.4000/espacepolitique.1608

Schrodt, Philip. 2001. « Automated coding of international event data using sparse parsing techniques ». Chicago: Annual meeting of the International Studies Association.

Schrodt, Philip A. 1995. « Event data in foreign policy analysis ». *Foreign Policy Analysis: Continuity and Change in Its Second Generation*, 145-66.

Segev, Elad. 2016. *International News Flow Online: Global Views with Local Perspectives*. Peter Lang.

St. J Anstis, S.C., Zacher, M.W., 2010. The Normative Bases of the Global Territorial Order. Dipl. Statecraft 21, 306–323. https://doi.org/10.1080/09592296.2010.482477

Toureille E., 2017, *La Turquie en Europe, la Turquie dans le Monde: analyse d'une catégorie macro-régionale au regard d'une géographie des représentations de l' Europe et du Monde turco-centrée*. Paris, France, Paris Diderot.

Tuathail, Gearóid Ó, et John Agnew. 1992. « Geopolitics and discourse: Practical geopolitical reasoning in American foreign policy ». *Political Geography* 11 (2): 190-204. https://doi.org/10.1016/0962-6298(92)90048-X.

Tuathail, Gearóid Ó, et Gerard Toal. 1996. *Critical Geopolitics: The Politics of Writing Global Space*. University of Minnesota Press.

Wilga, Maciej, et Ireneusz Pawel Karolewski, éd. 2014. *New Approaches to EU Foreign Policy*. 1 edition. London New York: Routledge.

Wu, H. Denis. 2000. « Systemic determinants of international news coverage: A comparison of 38 countries ». *Journal of Communication* 2 (50): 110-30.

Zartman, I.W., 1995. Collapsed States: The Disintegration and Restoration of Legitimate Authority. Lynne Rienner Publishers.