NOT BITS BUT NETS OF INFORMATION:

TOWARDS A METHODOLOGY FOR ASSESSING THE ACQUISITION OF STRUCTURAL KNOWLEDGE FROM MEDIA DISCOURSE

Christian Baden

Universiteit van Amsterdam

INCOMPLETE DRAFT – FOR CITEABLE VERSION, PLEASE CONTACT THE AUTHOR

An earlier version of this paper has been presented at the 3rd ECPR Summer School in Methods and Techniques, 30 July - 16 August, at the University of Ljubljana, Slovenia. Paper to be presented at the Etmaal van de Communicatiewetenschap, 12-13 February 2009, at the Radboud Universiteit Nijmegen, the Netherlands.

Abstract

People learn about most of their more distant environment from the media. Many studies investigating political learning have shown investigated how bits of information are acquired and stored by people. However, knowing such bits alone is not enough to create political understanding; people need to align, contextualize, and organize their beliefs and create coherent belief systems. One likely key guide for knowledge integration is the structure of arguments and frames in public discourse. This study ventures to sketch a methodological framework that allows tracing complex argument structures in media discourse and personal cognition. It conceptualizes both media texts and personal accounts as manifestations of underlying semantic networks of beliefs. Juxtaposing public discourse and personal explanations, the proposed methodology allows investigating how people acquire not merely bits, but form whole nets of information following the proliferated media coverage.

The paper identifies several hurdles that need to be satisfactorily addressed for a valid comparison of networks: Language use differs vastly between professional and lay speakers, in oral or written discourse; Different ways of recording discourse (e.g., qualitative interviews) violate various statistical and frequentist assumptions; Larger or smaller corpus sizes and differently standardized discourses require specific coding strategies. The present paper addresses these issues and proposes ways how equivalent network representations can be created despite rather dissimilar discourse data. Crucially, it develops a notion of structural correspondence of data, which allows assessing and analytically treating the remaining incongruencies.

Applying the proposed methodology, the present paper uses exploratory data on media and campaign representations, as well as voters' accounts of the European Constitution in the Netherlands. Demonstrating the utility of the approach, several first results are reported: First, despite successfully learning central claims, people's knowledge structures locally deviate systematically from discourse accounts (e.g., on sovereignty and the role of the euro). Second, despite rather unsuccessfully grasping the treaty's contents, structural understandings of its significance corresponded well to specific saliently publicized arguments. Finally, several learned information bits were taken out of the provided and inserted into new contexts by the voters (notably human rights and democratic accountability). Focusing on nets, not bits of learned information may thus substantially deepen our understanding of media information effects.

People learn about most of their more distant environment from the media (Nelson & Oxley, 1999; Schaap, 2006; Sotirovic, 2003). Many studies investigating political learning have investigated how bits of information are acquired and stored by people. However, knowing such bits alone is not enough to create political understanding; people need to align, contextualize, and organize their beliefs and create coherent belief systems (Culbertson & Stempel, 1986; Kosicki & McLeod, 1990; Neumann, Just, & Crigler, 1992; Popkin, 1991; Schaap, 2006). Nevertheless, only few studies have investigated how exactly people integrate newly learnt information (Graber, 1988). Additionally, where attempted, the integration of information has proven difficult to capture in rigorous methodological frameworks. There appears to be a trade-off between a rich and context-sensitive assessment of acquired knowledge on the one hand, and the possibility to trace influences from the source to the media user in a controlled, convincing way. Depending on which aspect has been deemed more important, scholars have opted for different strategies in measurement and analysis, and have delivered scattered, if not contradictory evidence in consequence. Most researchers interested in the deeper structure of understandings have resorted to discourse-analytic techniques and ethnographic methods, at the cost of being unable to demonstrate matches between sent and understood information beyond argumentably plausible matches. Others have prioritized controlled, statistically evaluatable designs for testing causal hypotheses, but have found themselves unable to treat much context of itemized information in their analyses.

This paper ventures to sketch a possibility for reconciling rich, context-embedded data with rigorous testing of linkages between acquired understandings and consumed information sources. In view of the proposed approach, bits of information (as broadcast by the media or understood by an individual) should not be conceptualized as isolated, but embedded within belief systems that form a complex semantic net. Such semantic nets can be coherently constructed both from stimulus messages or public media

discourse and from individual accounts or other forms of recording the linkages people see between the investigated concepts. Modelling sent and received[1] information in equivalent semantic networks, one can not only test whether specific beliefs have been acquired, but also within which contexts beliefs are situated. Following Kintsch (1998) and many others, the distinction between isolated and context-embedded knowledge may indeed be a highly consequential one; while knowledge bits may be reliably reproduced even when no integration with other relevant beliefs has taken place, it is highly doubtful whether subjects in such cases can be said to have understood the implied information (e.g., many people will be able to correctly complete Einstein's formula '? = m · c^2' without having the slightest grasp of what either element, let alone the formula, means). At the other extreme, people may have understood information and be able to utilize it in explanations even though they cannot recall a specified bit of it when probed (Lupia & Prior, 2005). The distinction between testing context-free and context-embedded beliefs amounts to the distinction between itemized knowledge and substantive understanding (Berinsky & Kinder, 2006; Ferejohn, 1990; Robinson & Levy, 1986). Relating not bits, but nets of information may thus extend the widespread preoccupation with factual learning from the media into the acquisition of (more or less thorough) understandings.

This paper proceeds as follows: First, I will recapitulate the main cleavages and concerns discussed in the existing literature on media learning. Second, I will sketch out the principled argument that networks allow a more encompassing and rigorous, and ultimately more informative analysis of media learning than most existing approaches. Third, I will discuss the methodological assumptions required to employ comparative network analysis as a technique to investigate media learning, and subsequently address

[1] For the purpose of argument, I shall assume the simplest possible setup in which individuals have no relevant sources of information except for those provided or captured as sent information, and there is no feedback loop through which individual understandings might influence generated messages. As long as such linearity can be assumed (as is implied in the idea of learning from the media), the juxtaposition of two networks suffices; however, the model can be easily expanded to treat panel data, where corresponding semantic nets are constructed at multiple points in time.

several specific problems that need to be considered. Finally, I will provide an example of how comparable semantic nets can be constructed from complex media discourse and individual accounts. While some available techniques for the comparative analysis of these networks will be referred to, this paper does not actually conduct this step. The foremost concern of this paper is to discuss why and how media content and personal understandings can be modelled as semantic networks in a way that allows a meaningful comparative analysis. Once the networks are constructed in equivalent ways, the comparative analysis appears to be neither very problematic, nor very complicated.

THEORY

Researchers have long observed a curious mismatch in the field of media learning: While most people are convinced that they learn quite a lot from the media, empirical scientific evidence for this claim has been disappointing, to say the least. Findings are contradictory, and while a consensus seems to hold that some learning does take place, most scholars hold that it is, by any standard, not a very strong effect. If there is any consistency in findings on media learning, it is that qualitative and experimental studies are reliably more optimistic about substantial learning taking place than survey-based studies (Eveland, 2001; Milner, 2003; Neumann et al., 1992; Sturgis, Allum, Smith, & Woods, 2005). To account for the disparity, the former argue that survey based assessments of knowledge miss much that people have understood but aren't able to produce in response to a direct inquiry (Converse, 1990; Lupia & Prior, 2005; Visser, Holbrook, & Krosnick, 2007). In turn, quantitative researchers are wary of qualitative studies interpreting tacit knowledge into confused accounts.[2] Meanwhile, most scholars agree that knowledge will often be transformed upon integration (Früh, 1994; Graber, 1988; Schaap, Renckstorf, & Wester, 2005); curious evidence abounds that can be understood only if the context-integration of knowledge bits is taken into account: For

[2] Both qualitative and quantitative researchers, in their majority, have abandoned self-reports, which have been found highly problematic in terms of both validity and reliability (Czesnik, 2003; Slater, 2004).

instance, people occasionally falsely 'remember' bits of information they had not actually been exposed to, but arguably constructed themselves from background knowledge during integration (Pennington & Hastie, 1988). Some cannot answer straight questions but successfully circumscribe them, retaining traces of acquired knowledge even though the item itself has been lost (Kintsch, 1998); or inversely people recall context-free claims without being able to explain what these actually mean, documenting how integration has failed; the same could be argued to explain the recall of details while people have forgotten the main point of a story, while good recall of a constructed macroproposition without any recollection at all of the underlying arguments demonstrates abstracting integration (Graber, 1988; Kintsch, 1998; Popkin, 1991). These and many other observations have nurtured the conclusion that what matters for successful application of learned knowledge is the alignment of new beliefs within contexts of other stored knowledge; competent behaviour depends not so much on itemized, declarative knowledge but on structural, integrated knowledge (Eveland, Marton, & Seo, 2004).

However, there is thus much disagreement about how this should be taken into account by measurement; on the one side, there is a virulent debate going on within mostly quantitatively oriented text processing studies, discussing which kinds of inferences can 'reasonably' be expected from an 'informed' reader; if the set of expectable phenotypes of knowledge integration were known, this could extend the range of testable knowledge much closer towards structural knowledge; and on the other side, qualitative scholars are experimenting with novel methodologies that improve rigour and confidence in the applied interpretations; in order to address qualitative studies' difficulties in documenting causal connections between source and effect, much effort has been put into developing process models of discourse comprehension that bridge the gap argumentatively. Both camps are therefore occupying the wide middle ground in approaches, but are mostly not yet in sight of one another. The remaining differences are to a large extent

methodologically, not theoretically driven, but highly consequential nevertheless. Where contrary results have been turned up, these can mostly be accounted for by the different assumptions underlying measurement. Stressing different aspects of the investigated relationship, approaches enter different trade-offs. Most disputes between the approaches basically revolve around three main questions:

Knowledge transfer or transformation

One first question, which regrettably is rarely addressed explicitly, concerns whether knowledge needs to be somehow isomorphic with the source that informed learning (Scott, 2001). Approaches that feel safe affirming this allow a deductive development of measures, and consequently pre-coded measurement as is required for many quantitative techniques. As far as source and target are isomorphic, the presence or absence of belief representations can be decided dichotomously. Approaches that assume immediate transformation of knowledge in accordance with idiosyncratic or other pre-existing knowledge structures, by contrast, need to find more inductive and qualitative ways of measurement (Früh, 1994; Greenwald, 1968; Neumann et al., 1992); dichotomous decisions about the presence of knowledge are neither easy to derive, nor theoretically plausible.[3] Some hybrid stances assume that at first some propositions are taken over directly from a source, but are integrated by constructing inferences and elaborations beyond these (Schaap, 2006). Thus, only some expected knowledge can be deducted directly from the sources, while beyond this one can only guess which inferences might be formed. Those sufficiently confident in their guesses can apply deductive measures, while the others have to rely on open ended responses and code inductively (Valentino, Hutchings, & Williams, 2004). Obviously, if people indeed do transform knowledge,

[3] For instance, some approaches consider one 'bit' of knowledge to comprise multiple beliefs; they then code knowledge as present if all beliefs are expressed, but also allow partial knowledge if only some components are referred to by a respondent. (Früh, 1994)

deductive measures are likely to miss some of the acquired knowledge; for inductive approaches, this does not necessarily matter.

Itemized or context-embedded knowledge

The second main question concerns whether knowledge can be itemized. Arguably, the answer to this depends on what definition of knowledge one applies. As far as factual and semantic knowledge are concerned, it is quite plausible that claims of the format 'the president of the USA is Obama' or 'a swallow is a bird' can be learned and thus probed without considering the context within which these are made[4]. For such items, it may also be most plausible to assume that these are represented in isomorphic ways in people's imaginations. Knowledge about attributes and categories may be sometimes plausibly reducible to single items ('the economy is in recession', 'Angela Merkel is a conservative politician') (Converse, 1964). Where such single claims without (much[5]) context are the unit of analysis, much standardization in measurement can be achieved; multiple accounts can be coded by means of content analysis, or beliefs are probed using questionnaire methods with multiple choice or short claim completion tasks. For each belief it can be assessed whether it is correct (or corresponds to what the respondent was supposed to learn), and dichotomous or few-point scales can be developed (de Vreese & Boomgaarden, 2006; Sotirovic, 2003).

However, this may be much less convincing in other circumstances – for instance, Angela Merkel could well be seen as a centrist politician; and despite the seemingly clear definition of recession in scientific economics, it may often be hard even for experts to decide when exactly talk of recession is appropriate. The more equally valid categorizations and interpretations of an issue are imaginable (Neumann et al., 1992), and

[4] This argument has been made also for news information in general, (Delli Carpini & Keeter, 1996; Kosicki & McLeod, 1990), as well as for television news in particular (Garramone & Atkin, 1986).

[5] Questionnaire items, for instance, provide at least some information which delimits the range of possible contexts within which knowledge is reported. However, such techniques can assess knowledge only with regard to this one or few context(s), for repeatedly tapping the same belief suggesting changing contexts gives rise to intolerable inter-response effects.

the closer the benchmark for 'knowledge' approaches a notion of 'understanding' the issue, the more questionable itemized conceptions of knowledge become. Structural knowledge, lastly, almost by definition cannot be itemized – the context in which beliefs are situated cannot be separated from the belief without emptying the concept of structural knowledge (Eveland et al., 2004; Ferejohn, 1990; Schönbach, 1983). Researchers interested in structural knowledge, as well as those unconvinced that single claims retain their meaning across possible contexts, have therefore exhibited a preference for open ended[6], concept-sorting[7] or graphical ways[8] of assessing knowledge; These approaches allow the provision of more diverse probing cues, allow the respondents to follow multiple considerations at once, and retain the semantic context within which claims are made. Quantitative applications then transform accounts into network structures by means of relational content analysis, or derive distance or adjacency matrices from graphical and sorting tasks (Früh, 1994; Green et al., 2003; Popping, 2000; van Atteveldt, 2008).

A similarly clear-cut decision whether knowledge is 'present' in context-retaining data is only feasible if one can make assumptions about how much similarity is required (Pennington & Hastie, 1986). As there are neither theoretical nor empirical foundations for defining acceptable degrees of correspondence, it is very difficult to reduce context-embedded knowledge data into one-dimensional knowledge scores in a convincing way. Qualitative researchers, by contrast, do not need to reduce data complexity, and hence have embraced narrative and thematic contexts in their analyses. Additionally, being interested in people's subjective understandings and reconstructions, many reject a binary distinction between 'correct' and 'incorrect' beliefs. Keeping their analyses closely grounded in the data, they usually have little difficulty drawing confident conclusions

[6] for instance, (Berinsky & Kinder, 2006; Culbertson & Stempel, 1986; de Vreese & Boomgaarden, 2006)
[7] for instance, (Berinsky & Kinder, 2006; Kitzinger, 1994)
[8] for instance, (Green, Muncer, Heffernan, & McManus, 2003)

about the amount of learning that has occurred. Treating smaller samples and remaining cautious about far-reaching generalizations, qualitative approaches are thus nevertheless at an advantage whenever context cannot easily be reduced. Unless quantitative analytic techniques can be trained to treat contextualized data, they remain somewhat limited to relatively simple applications where context does not matter.

In principle, the same trade offs also apply to the measurement of source content. Although studies are often less careful in their treatment of the independent variable, a rigorous analysis doubtlessly requires that it is documented what people have been learning from. Survey based approaches often try avoiding the necessity to capture media content, focusing on claims to be learned that are present many times in public discourse. Aside the need to control for intervening variables such as exposure and attention, which will be discussed below, this again assumes that these claims can be isolated without loss in meaning. The more elaborate claims become, the less convincing is the assumption that a respondent has been exposed to some content in precisely this form. Several more recent studies therefore content analyze media coverage or control stimuli in experimental setups. Studies that capture media content in a way that corresponds to the way knowledge is measured, however, are rare and – except for a handful of framing studies – almost exclusively focus on itemized knowledge.

Controlling the causal link

The third main question that divides camps is how confounding influences and prior knowledge can and must be controlled (Visser et al., 2007). Here, statistical methods are at an advantage; for once, they can control for prior knowledge (which, of course, needs to be measured), and still determine significant similarities between sent and learned beliefs and belief structures. As long as it can be assumed that the information environment from which learning takes place is controlled or (more or less) fully known, attributing belief changes to learned information is not difficult. Analytic rigour differs

vastly in practice, of course – whether studies rely on exposure or attention (measured directly or by self-report), whether they reconstruct viewing probabilities at article, copy, outlet, media type or discourse level, or control information provision experimentally all together (Chaffee & Schleuder, 1986; McCombs, n.d.; Slater, 2004). However, in principle it is possible to construct a model within which all relevant influences are well-documented. Parametric tests and statistical significance can serve as highly convincing measures of learning from the media. This is, obviously, the main weakness of the qualitative way of assessment; while much less likely to overlook or decontextualize relevant beliefs, it remains a matter of argument to link these to the believed sources. While information environments can be investigated and prior beliefs can be assessed just as well, the analytic link between influences and outcomes remains vague. It is never possible to rule out that the detected understandings must be attributed to other causes or, worst of all, the researcher's imaginative interpretation. However, as long as the price for more rigorous causal analysis is a less valid measurement of sent and received meaning, the way out is hardly viable for many applications. What is needed is a methodological framework which reconciles rich, contextualized measurement with an analytic procedure which is rigorous and independent from subjective interpretations.

Structural equivalence

A crucial necessity for the development of a rigorous comparison between provided and acquired knowledge is that both be measured in ways that are directly comparable. In order to achieve this, it is useful to consider the problem from a different perspective. While media texts and personal knowledge are, epistemologically speaking, quite different concepts, knowledge cannot be accessed directly but is always inferred from productions such as utterances or accounts. Thus, what one fundamentally does when assessing learning from the media is comparing two types of accounts: personal accounts (believed to represent, more or less accurately, personal knowledge) and media accounts (where

the knowledge entering production is usually not discussed). There are still many differences between the two types of accounts – mostly because the latter involves institutional routines, knowledge of various people, and professional standardizations, which severely affects the mode of expression compared to personal ad hoc accounts. However, these differences are not epistemological any more, but confined to the surface structure of expression. A direct comparison is possible, provided the technical difficulties caused by different styles can be overcome. However, keeping in mind the research agenda which is not interested primarily in textual surface structures, the accounts should be compared not at the lexical, but at the semantic level. At this point, a decision needs to be made whether one considers media texts from the point of view of the author (diagnostic analysis) or the hypothetical reader (representational analysis). Due to the interest in learning, the latter might be more appropriate, but one can also imagine settings where the correspondence between authors' and readers' beliefs might be relevant.

The problem remains how this comparison can be achieved. Ideally, comparable representations should be composed of elements which do not require translation, and which cannot be transformed upon learning. For instance, both frames (relatively stable sets of contextualized beliefs) and beliefs (as single propositions linking two concepts) have meaning both with regard to media text and private cognition; however, both may be abstracted, circumscribed, elaborated, or otherwise transformed upon recognition (de Vreese & Boomgaarden, 2006; Druckman, 2001); equivalence between units cannot be established without some (necessarily arbitrary) decisions about how much transformation is admissible. Therefore, it makes sense to move to even finer grain and compare representations at the level of concepts and relations between these; a representation of texts at the level of concept associations is called a semantic network (Kintsch, 1998).

Semantic networks fulfil all the requirements raised by the intended comparison. Transforming texts into a formal representation at the semantic level, they are not principally affected by different surface structures of the texts; they react to various transformations of meaning – e.g., circumscription, truncation, elaboration, abstraction, etc. – but locate these in such ways that the relation to the transformed content is preserved. They retain the context of beliefs as adjacent areas, and thereby make visible re-alignments and re-interpretations of beliefs; and they allow comparison at – at least – three levels that are highly relevant to the analysis of learning from the media: At the 'atomic' level (Are the same concepts used? Are the same semantic relations formulated?), it can be investigated whether itemized knowledge bits have been acquired; at the 'molecular' level (In which contexts are the beliefs situated? Do beliefs differ if different frames are applied?) one can assess how acquired understandings are integrated into prior beliefs; and at the 'molar' level (How much does a person learn from the media, how much is discarded, what is constructed idiosyncratically?) it can be measured how influential media learning is for people's knowledge in general (Schaap, Renckstorf et al., 2005).

Semantic network representations can be derived from texts by means of relational content analysis (Popping, 2000; Schaap, Konig, Renckstorf, & Wester, 2005; van Atteveldt, 2008); to both concepts and relations, quantifiable properties can be assigned (e.g., frequencies of mentioning, or other more qualitatively derived salience measures such as positional or emphasis measures) and further properties can be calculated from those (e.g., distances of concepts, degrees of commonality to different texts). Since they hardly reduce the complexity of the data, they can be kept very close to the original texts, requiring only few theoretical assumptions; moreover, most required assumptions are relatively well-grounded. Both linguists and cognitive scientists have advanced network models as appropriate representations of semantic structure; they have argued that the

meaning of concepts can be derived from, and hence represented in, the concepts saliently associated with them. Almost in all sciences concerned with the meaning of texts, network representations have been found useful approximations of the manifold contingencies of meaning upon the relevant contexts.

There are, obviously, several choices left to make when representing accounts as semantic networks. For instance, it needs to be decided what exactly constitutes a 'link' between two concepts, and how re-occurring links are aggregated into the representation. One needs to decide whether single accounts are treated individually, grouped by respondent or author, outlet, media type, or even combined into wider co-constructed discourse networks. Ultimately, there are several available comparative analytic techniques to choose from – ranging from a juxtaposition of descriptive measures such as density and connectivity[9], over the identification of subgraphs pertaining to specific arguments or themes[10], to advanced techniques taking into account global and local structures at the same time[11]. However, the appropriate decisions on these issues follow from the research interest pursued, and must be addressed in different ways depending on the focus.

Constructing structurally equivalent semantic network representation

Semantic nets are highly flexible in accommodating quite diverse strategies in both construction and (comparative) analysis, and therefore offer a solution to most of the methodological difficulties haunting research on learning from the media. On the one side, they may bridge the gaps between the different scientific approaches, allowing isomorphic and non-isomorphic, itemized and contextualized data within the same framework – and still retain the possibility of a parametric, rigorous analysis. On the other side, they allow constructing structurally equivalent nets from texts with quite

[9] e.g., triadic census (de Nooy, Batagelj, & Mrvar, 2005; Schaap, 2006; Wasserman, 1977)
[10] e.g., (Baden & de Vreese, 2008; de Nooy et al., 2005)
[11] e.g., quadratic assignment procedure (Dekker, Krackhardt, & Snijders, 2007; Krackhardt, 1988); markov chain models (Snijders, Steglich, & Schweinberger, 2007)

different surface structures. The core requirement here is that if different operationalizations are used for different sources, they must be made to record equivalent phenomena on the semantic level. In order to achieve this equivalence, there are (at least) six main issues, which may interfere with the construction process, and hence need to be considered: differences in the range and detailedness of considerations, as well as the lexical structure of accounts, complicates the identification of equivalent concepts; deviating structural properties of texts and contexts, as well as varying means of expressing emphasis, interfere with the identification of relations between concepts; and lastly, the often extremely different sizes of text corpora carry some implications for admissible analytic approaches. I shall discuss these problems in turn.

Determination of the concept range

The first three problems are interrelated and concern the construction of a coding scheme that assigns concepts to the lexical structure of the texts. While the notion of learning from the media already presupposes that some, if not most concepts are relevant to both media and personal accounts, that does not mean that they occur in similar ranges, similar detail, or similar forms at all. On the whole, the main difference between personal and journalistic accounts is the varying degree of deliberate construction and professional standardization. Since personal accounts are mostly ad-hoc constructions, they are typically highly variable in terms of the concepts raised; they are often only locally coherent and comprise several loosely associated but not explicitly related considerations, or even completely unrelated comments. Therefore, the range of concepts required to transform the text can hardly be foreseen, neither from an explorative pilot nor – let alone – deductively (Baden & de Vreese, 2008; Schaap, 2006); inductive coding is mandatory unless the research question determines the set of few relevant concepts. By contrast, a small random sample of news reporting should give an accurate overview of the concept codes needed to capture most of the media coverage;

in some well-researched contexts, even deductive code development may suffice to cover large proportions of the corpus – although subsequently checking one's uncoded passages is certainly a good idea.

However, journalistic accounts are difficult to predict in a different sense: while the set of relevant topics is relatively constrained, media coverage varies extremely in its level of detail; some articles, particularly in print, cite the most specific aspects (e.g., legal provisions) while others boldly summarize complex situations at a highly abstracted level. Personal accounts, by contrast, are unlikely to go into the finest grain of topics unless the respondents were explicitly prompted to do so. Personal accounts are likely to feature anecdotes and generalizations, but rarely more than two levels of abstraction within the same issue. Practically, since the comparison of accounts requires that concepts are juxtaposed at the same level of abstraction, this necessitates the development of a hierarchical structure within the concept coding scheme. As long as the fine grain of codes required for specialized journalistic accounts can be collapsed, for analysis, to the next higher level of hierarchy where there is an equivalent code among the personal accounts, the variability in detail is not a problem for analysis.

Once the concept tree is determined, the problem remains to define coding rules which reliably and validly pick up those expressions referring to the concepts in the texts. Again, journalistic professional routines facilitate the task by delimiting a relatively standardized terminology and avoiding wordy or vague expressions in view of strong space or time constraints; media accounts are usually highly explicit in providing information such as actors' titles and functions, references to time, locations and sources; evaluative comment is limited and reserved mainly to clearly marked sections of the outlet (Neumann et al., 1992); sarcasm, irony, and similar forms of non-literal speech are uncommon, and figurative and metaphorical expressions are used, if at all, in highly consistent ways (e.g., as catch phrases that are applied to a certain event across a wide range of media). There

is thus a relatively tight link between concepts and terminology. This is certainly not the case for many personal accounts. People are much more liable to paraphrase, use figurative expressions or contrast literal speech resorting to irony; they are unlikely to consistently provide information such as titles, and are particularly unlikely to mention definitional or (believed) common knowledge information. They refer to the same concept in a multitude of ways, many of which are hardly predictable. Whereas a journalist meaning 'transparency' is likely to mention some flexion or close synonym of the word sooner or later, people's references to the same are likely to be highly variable, using the technical expression accidentally at best. This severely complicates the coding procedure. While journalistic language can be coded for concepts in relatively standardized, even computerized ways, there is little chance to avoid interpretative human coding for personal accounts. The same expressions may indeed point to different concepts occasionally – nuances that human coders may be directed to detect, but that are virtually invisible to any automated coding system. In order to achieve high confidence in the reliability and validity of coding, highly elaborate and specific instructions are required so that for each instance it can be decided whether a particular concept is referred to or not. In order to develop equivalent operationalizations for both personal and media account data, the code development thus needs to proceed inductively from more towards less messy data. Once the concepts are defined clearly enough to disambiguate the personal accounts data, human coders should have less difficulty applying these to the more standardized media coverage data; alternatively, the coding scheme can be re-translated into a journalistic repertoire of lexical expressions, which can then be coded automatically.

Identification of concept relations

Once the range of concepts has been determined, the next step in the construction of a semantic net is the identification of relations between concepts. Concepts can be related

on quite different levels – by crude co-occurrence, by syntactic dependency, by explicit or implicit semantic content. While strategies that pick up on the semantic nuances provide rich and valid data, this is extremely laborious in most cases; therefore, when defensible, it is desirable to opt for a cruder, but more efficiently codeable kind of relation. Unfortunately, this is usually not possible for ad hoc accounts, as most personal knowledge representations (and particularly oral ones) are. Respondents will typically not be sufficiently cognizant to produce well-structured accounts. Rather, accounts shift topics in unsystematic ways, and rarely contain related arguments within the same paragraphs (or transcribed turns); they jump back and forth between current and prior considerations and may often not finish, let alone fully spell out an argument. Algorithms which are dependent on automatically determinable context units fail if sentences are incomplete and considerations are discontinued in the middle of the paragraph. This becomes even worse with co-constructed accounts such as interviews or group discussions; there, interjections split even otherwise coherent turns into halves, other participants' comments derail arguments which are resumed several turns later; paragraph-spanning contexts become the norm rather than the exception as participants react to one another's contributions. Determining the referents of comments can rely neither on proximity, on syntactic structure, nor on formal structuring such as paragraphs breaks. By contrast, all these are available in well-organized, deliberately constructed journalistic accounts. Professional style advocates relatively self-contained paragraphs (due to the need to cut articles during the editing process), enabling acceptable detection of relatedness already from crude co-occurrence within paragraphs. Also paragraph-spanning relevant contexts, such as headlines (global topics) or other highlighting devices are easily determined. For a more detailed analysis, syntactic parsing can reliably identify the relevant predicates that allow the coding of semantic relations.

Large text corpora can be processed with minimal human intervention required (van Atteveldt, 2008).

Once the presence of a link is established, the next question concerns whether all connections are to be treated equally. One common strategy assumes that repetition is an indicator of link importance, discriminating relation strengths based on the frequency of occurrence. This assumption has a long tradition in the study of media effects, notably in agenda setting research, where it has been shown that people interpret repetitive news coverage as a sign of importance (McCombs, n.d.). Media corpora typically comprise multiple texts, each constructed following some putative criteria of newsworthiness, such that claims selected for coverage indeed convey a sense of relevance. However, this assumption is much less plausible in measured knowledge. There, repetition amounts to redundancy within the same personal account, which may or may not indicate relevance. Other markers of importance are much more plausible bases for the assessment of the strength of concept relations: Positional attributes (early mentioning) as well as the explicit qualification of beliefs as relevant are potentially available for the assessment of personal and media accounts alike. Aside that, if recorded, emphasis in speech or body language may be a highly relevant marker. Reliance on frequency alone may miss out on much of these, and becomes entirely questionable in co-constructed accounts. There, repetition may be an indicator of contestation just as much as of perceived relevance; beliefs which are highly salient may still be mentioned only once, acknowledged by all, and henceforth assumed as common knowledge. While some markers can probably be defined in a general way capable of sustaining quantitative coding, confidently capturing relation strength in such accounts will be extremely difficult. Automated techniques will be ill-suited to determine non-frequency-based relation strength, suggesting the use of interpretative methods instead.

Analytic strategies & necessities

Fortunately, however, corpus sizes of personal account data are typically much more limited than those of potentially learned media content. While media corpora easily reach scales where automated coding is the only feasible strategy, the amount of manual coding required for the analysis of personal accounts thus remains manageable. The different coding procedures, however, nevertheless need to be applied in ways capable of coding equivalent concepts and relations from both corpora. Whenever different measurement strategies are applied to both corpora, it must be established that both measure the same concept's or relation's presence in a text. Semantic networks represent structural properties of texts on the level of meaning, which implies that, once constructed, they are indifferent to how these properties have been measured. The key concern in the construction of comparable semantic networks, hence, is the selection and foundation of strategies which, despite the rather different surface structures, access the same structural properties in media and personal accounts.

Example

In the following, I will briefly sketch an illustrative example of how such structurally equivalent semantic networks can be constructed. In this case, the formation of Dutch voters' beliefs about the EU Constitutional treaty (which was subject to a national referendum in 2005) was investigated. On the one side, media-proliferated information has been operationalized as the sum of all press coverage involving any combination of the search phrases "EU constitution", "referendum" and "European Union" since the invention of the treaty. On the other side, Dutch voters' imaginations and beliefs were assessed in a series of focus group interviews (Baden & de Vreese, 2008). The two account types involved hence differ vastly on all the abovementioned dimensions of conceptual range and detail, lexical and syntactic structure, context structure, mode of emphasis and, lastly, the sheer amount of text. The analysis proceeded in five steps. First, the concept range in the focus group corpus was determined by inductive, qualitative

analysis. Subsequently, the coding scheme was applied and a set of defined semantic relations identified by means of manual coding. Third, the concept codes were translated into journalistic terminology, amended following deductive completion of categories and a pilot investigation, and disambiguated in a machine-readable fashion. Fourth, the media corpus was concept-coded using the AmCAT automated content analysis software (van Atteveldt, 2008). Finally, co-occurrence of concepts was determined using a syntax-sensitive algorithm, and random co-occurrences were filtered out by means of Bayesian statistics.

[*This draft is unfinished – my apologies! Hopefully, by the time of the Etmaal van de Communicatie-wetenschap, it will be completed. For a full version please contact the author: c.baden@uva.nl*]

REFERENCES

Baden, C., & de Vreese, C. H. (2008). Making sense: A reconstruction of people's understandings of the European constitutional referendum in the Netherlands. *Communications, 33*(2), 117-146.

Berinsky, A. J., & Kinder, D. R. (2006). Making sense of issues through media frames: Understanding the Kosovo crisis. *The Journal of Politics, 68*(3*), 640-656.

Chaffee, S. H., & Schleuder, J. (1986). Measurement and effects of attention to media. *Human Communication Research, 13*, 76-107.

Converse, P. E. (1964). The nature of belief systems in mass publics. In D. E. Apter (Ed.), *Ideology and discontent* (pp. 206-261). London: The Free Press of Glencoe.

Converse, P. E. (1990). Popular representation and the distribution of information. In J. A. Ferejohn & J. H. Kuklinski (Eds.), *Information and democratic process* (pp. 369-388). Urbana, IL: University of Illinois Press.

Culbertson, H. M., & Stempel, G. H. I. (1986). How media use and reliance affect knowledge level. *Communication Research, 13*(4*), 579-602.

Czesnik, M. (2003). *Subjective vs. objective political knowledge, and its impact on Electoral participation: Evidence from Poland.* Paper presented at the ECRP General Conference, Marburg, Germany.

de Nooy, W., Batagelj, V., & Mrvar, A. (2005). *Exploratory social network analysis with Pajek.* Cambridge, UK: Cambridge University Press.

de Vreese, C. H., & Boomgaarden, H. (2006). News, political knowledge and participation: The differential effects of news media exposure on political knowledge and participation. *Acta Politica, 41*, 317-341.

Dekker, D., Krackhardt, D., & Snijders, T. A. B. (2007). Sensitivity of MRQAP tests to collinearity and autocorrelation conditions. *Psychometrika, 72*(4), 563-581.

Delli Carpini, M. X., & Keeter, S. (1996). *What Americans know about politics and why it matters*. New Haven, CT: Yale University Press.

Druckman, J. N. (2001). The implications of framing effects for citizen competence. *Political Behaviour, 23*(3*), 225-256.

Eveland, W. P., Jr. (2001). The cognitive mediation model of learning from the news: Evidence from nonelection, off-year election, and presidential election contexts. *Communication Research, 28*(5), 571-601.

Eveland, W. P., Jr., Marton, K., & Seo, M. (2004). Moving beyond "just the facts": The influence of online news on the content and structure of public affairs knowledge. *Communication Research, 31*(1), 82-108.

Ferejohn, J. A. (1990). Information and the electoral process. In J. A. Ferejohn & J. H. Kuklinski (Eds.), *Information and democratic process* (pp. 3-19). Urbana, IL: University of Illinois Press.

Früh, W. (1994). *Realitätsvermittlung durch Massenmedien: Die permanente Transformation der Wirklichkeit*. Opladen, Germany: Westdeutscher Verlag.

Garramone, G. M., & Atkin, C. K. (1986). Mass communication and political socialization: Specifying the effects. *The Public Opinion Quarterly, 50*(1), 76-86.

Graber, D. A. (1988). *Processing the news: How people tame the information tide* (2 ed.). White Plains, NY: Longman.

Green, D. W., Muncer, S. J., Heffernan, T., & McManus, I. C. (2003). Eliciting and representing the causal understanding of a social concept: A methodological and statistical comparison of two methods. *Papers on social representations - Textes sur les représentations sociales, 12*, 2.1-2.23.

Greenwald, A. G. (1968). Cognitive learning, cognitive response to persuasion, and attitude change. In A. G. Greenwald, T. C. Brock & T. M. Ostrom (Eds.), *psychological foundations of attitudes* (pp. 147-170). New York: Academic Press.

Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. Cambridge, UK: Cambridge University Press.

Kitzinger, J. (1994). The methodology of focus groups: The importance of interaction between research participants. *Sociology of Health & Illness, 16*(1), 103-122.

Kosicki, G. M., & McLeod, J. M. (1990). Learning from political news: Effects of media images and information-processing strategies. In S. Kraus (Ed.), *Mass communication and political information processing* (pp. 69-83). Hillsdale, NJ: Lawrence Erlbaum Associates.

Krackhardt, D. (1988). Predicting with networks: Nonparametric multiple regression analysis of dyadic data. *Social Networks, 10*, 359-381.

Lupia, A., & Prior, M. (2005). *What citizens know depends on how you ask them: Political knowledge and political learning skills*: Munich Personal RePEc Archive.

McCombs, M. E. (n.d.). *The agenda-setting role of the mass media in the shaping of public opinion*.

Milner, H. (2003). *Creating an instrument for testing political knowledge: Theoretical considerations and preliminary findings*. Paper presented at the ECPR General Conference, Marburg, Gemany.

Nelson, T. E., & Oxley, Z. M. (1999). Issue framing effects on belief importance and opinion. *The Journal of Politics, 61*(4*), 1040-1067.

Neumann, R. W., Just, M. R., & Crigler, A. N. (1992). *Common knowledge: News and the construction of political meaning*. Chicago: University of Chicago Press.

Pennington, N., & Hastie, R. (1986). Evidence evaluation in complex decision making. *Journal of Personality and Social Psychology, 51*(2), 242-258.

Pennington, N., & Hastie, R. (1988). Explanation-based decision making: Effects of memory structure on judgment. *Journal of Experimental Psychology, 14*(3), 521-533.

Popkin, S. L. (1991). *The reasoning voter: Communication and persuasion in presidential campaigns*. Chicago: The University of Chicago Press.

Popping, R. (2000). *Computer-assisted text analysis*. London: Sage Publications.

Robinson, J. P., & Levy, M. R. (1986). *The main source: Learning from television news*. Beverly Hills, CA: Sage Publications.

Schaap, G. (2006). *The structure and complexity of news interpretation and their relation to viewer characteristics and news subject*. Paper presented at the IAMCR Conference, Cairo, Egypt.

Schaap, G., Konig, R., Renckstorf, K., & Wester, F. (2005). Measuring the complexity of viewers' television news interpretation: Differentiation. *Communications, 30*, 459-475.

Schaap, G., Renckstorf, K., & Wester, F. (2005). Conceptualizing television news interpretation by its viewers: The concept of interpretative complexity. *Communications, 30*, 269-291.

Schönbach, K. (1983). *Das unterschätzte Medium: Politische Wirkungen von Presse und Fernsehen im Vergleich* (Vol. 16). München, Germany: K. G. Saur.

Scott, B. (2001). Gordon Pask's conversation theory: A domain independent constructivist model of human knowing. *Foundations of Science, 6*, 343-360.

Slater, M. D. (2004). Operationalizing and analyzing exposure: the foundation of media effects research. *Journalism & Mass Communication Quarterly, 81*(1), 168-183.

Snijders, T. A. B., Steglich, C., & Schweinberger, M. (2007). Modeling the co-evolution of networks and behavior. In K. van Montfort, J. Oud & A. Satorra (Eds.), *Longitudinal Models in the Behavioral and Related Sciences* (pp. 41-72). London: Routledge.

Sotirovic, M. (2003). How individuals explain social problems: The influences of media use. *Journal of Communication, 53*, 122-137.

Sturgis, P., Allum, N., Smith, P., & Woods, A. (2005). *The measurement of factual knowledge in surveys*. Paper presented at the ECPR General Conference, Budapest, Hungary.

Valentino, N. A., Hutchings, V. L., & Williams, D. (2004). The impact of political advertising on knowledge, internet information seeking, and candidate preference. *Journal of Communication, 54*, 337-354.

van Atteveldt, W. (2008). *Semantic network analysis: Techniques for extracting, representing, and querying media content*. Free University of Amsterdam, Amsterdam, the Netherlands.

Visser, P. S., Holbrook, A., & Krosnick, J. A. (2007). Knowledge and attitudes. In W. Donsbach & M. Traugott (Eds.), *The SAGE Handbook on Public Opinion Research* (pp. 127-140): Sage.

Wasserman, S. (1977). Random directed graph distributions and the triad census in social networks. *Journal of Mathematical Sociology, 5*, 61-86.