



## Complex network tools in building expert systems that perform framing analysis

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### ABSTRACT

Framing, in its specific application to media research, is defined as the “central organizing idea for making sense of an issue or conflict and suggesting what is at stake.” It can be found in various disciplines of the social sciences, most notably in political science, psychology, and communication research. Due to the fuzzy nature of frames, identifying them has proven to be quite complex. Here, we perform framing analysis on a corpus of news texts on the population and family planning issue in the Philippines by operating two varying approaches: human-based and computer-assisted. A singular holistic approach to framing is initially implemented where coders/domain experts classify each news text to a specific pre-defined frame. This traditional approach is known to raise serious issues on the reliability and validity of the results mainly due to human’s intrinsic biases. To address such issues, we propose a novel technique that synergically combines the method of Matthes and Kohring (2008) and complex networks approach. In our model, the codings of texts are cast as a network of content analytic variables (CAVs). Our proposed method tackles the clustering issue that MK raised, which plagues framing scholars in the quantitative identification of news frames in texts. Moreover, the research is significant on a societal level as it also aims to gain perspective for reasons on the lack of progress in discussions about suitable population policies in most developing countries like the Philippines.

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### 1. Introduction

In recent years, much attention has been given to the study of frames in the field of communication research, particularly focusing on how the news media frame issues in text. Framing analysis is salient in understanding the potential of the media to influence public opinion (Entman, 1991; Bardhan, 2001). The subject has garnered a huge appeal across the communication and media disciplines including, but not limited to, policy, media content, and cultural studies (Joachim, 2003; Shah, Watts, Domke, & Fan, 2002; Hoerl, Cloud, & Jarvis, 2009; Yeo, Park, & Arabi, 2007; Ryan, Caragee, & Meinhofer, 2001).

Framing, in this context, is interpreted as the “central organizing idea for making sense of an issue or conflict and suggesting what is at stake (Gamson, 1989; Koch, 1998).” The main challenge is to identify and assess the latent schemes that emerge from a reporting of an issue and recognize them in the most optimized, reliable, and accurate way.

Early framing studies were particularly qualitative in nature using entirely hermeneutic approaches. As such, most of these

analyses were highly dependent on the experts doing the exegesis. Hence, such subjective procedure could potentially cast doubts on the reliability and accuracy of the interpretation (Scheufele & Scheufele, 2010; Van Gorp, 2005); moreover, issues on replicability plague the evaluation measures.

More recent studies, on the other hand, address these issues using more exact quantitative models (Miller, 1997; Miller, And-sager, & Riechert, 1998). Quantitative framing researchers argue that the methods provided are more precise and straightforward and are repeatable – usually done with the aide of “devices” as frame indicators (Koella, 2003). Most of these techniques are computer-assisted, which is the exact antithesis of the more traditional approach. Typically, the methods utilize frequency-statistics of certain keywords and their loci in the body of the texts (Legara, Monterola, David, & Atun, 2010; Murphy, 2001). Although the approach improves reliability, criticisms regarding its validity have been raised since it has been shown that some infrequently occurring words in the text could actually be “central to the meaning of a text”; and, by filtering in only the most frequently occurring words in the examination, a significant amount of nontrivial information can be lost in the process (Scheufele & Scheufele, 2010; Matthes & Kohring, 2008).

Although much has been done in expanding its domain, existing risks vis-à-vis the reliability and validity of framing protocols are still of major concern. Due to this fuzzy nature of frames, naming and quantifying them have proven to be quite complex, which calls

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for a multi-disciplinary approach involving both domain and computation experts.

On the other hand, the science of networks has emerged to be a leading approach in probing signatures of complex systems inherent in both nature and society. Networks have been shown to detect cryptic patterns that contain germane information about such systems, e.g. DNA nucleotides sequence data (Sinatra, Condorelli, & Latora, 2010), dissimilarity between poem and prose (Roxas & Tapang, 2010). In this study, one of the main challenges in applying network theory is in deciphering the hidden patterns through the use of the most appropriate symbolic representations of the compendium of data. It is important to correctly detect the “fundamental units carrying information” in constructing the networks (Sinatra et al., 2010).

Here, we investigate and improve upon existing framing analysis protocols and tackle them in the context of network theory. The research is relevant on two levels: social and methodological. The procedures performed here utilize text from media coverage of a vehemently debated issue in most, if not all, developing countries – the issue on population, reproductive health, and family planning. The population issue has consternated governments of developing countries when concerns are retracted to issues on poverty and women’s health. Particularly, we look into the Philippine news coverage. The Philippines is a developing country that is predominantly Catholic (80% of the population), and is ranked fourth (4) worldwide in terms of total population and population density and has been noted by the United States Census Bureau as a fast growing country (Central Intelligence Agency Online Factbook, 2012).

On the methodological significance, detecting media frames has produced a significant number of theories, techniques, and procedures. However, there are very few studies that compares the consistency of the results generated by these various methods because typically only one framing procedure is used to dissect an issue. Here, we utilize and compare three distinct methods in the study of media framing and compare their consistencies, advantages and procedural differences.

## 2. Data

This study covers a total of 346 news articles related to issues on population, family planning, reproductive health, and contraception. The period covered runs from 1987 to 2007. Data were taken from three of the most widely circulated broadsheets in the Philippines namely, the Philippine Daily Inquirer (PDI), the Philippine Star (PS), and the Manila Bulletin (MB).

## 3. Singular holistic approach to frames

Perhaps the most traditional method used to find frames is through the perusal of texts by experts of both the issues under study and the field of communication research. A singular holistic approach (SHA) to framing, which is deductive in nature, was carried out. Here, a single frame was considered as a lone reference to a whole article. Coders defined six frames after methodically familiarizing the topic through a careful review of a small sample of text on the issue. The pre-defined frame themes are as follows: the *population and development* frame (F1), the *family planning as conflict between government and church* frame (F2), the *women’s and reproductive health* frame (F3), the *population management threatens morals and values* frame (F4), the *population growth and demographic trends* frame (F5), and *others*. Communication research assistants were then instructed to classify each document in the corpus to a single dominant *frame* (chosen from the six pre-defined ones). Table 1 summarizes the number of articles classified in the six frames.

**Table 1**

Table summarizes the number of articles classified by domain experts in each of the six frames.

Frame	Number of articles
F1	62 (18%)
F2	62 (18%)
F3	104 (30%)
F4	42 (12%)
F5	38 (11%)
others	38

## 4. Frames as frame elements approach

In Section 4, frames are treated as a collection of elements comprising an issue, which makes the analysis more guided. Essentially, frames are dissected into several parts that are interconnected to each other. This notion was first introduced by Kohring and Matthes (2002) and the conceptual basis behind the technique stemmed from the widely-accepted definition of framing given by Entman: “the process of highlighting some select aspects of a news or an article to publicize a specific *problem definition, causal interpretation, moral evaluation, and/or treatment recommendation* for the item described” (Entman, 1993). These elements are thought to constitute a frame theme. It should be noted that depending on the issue at hand, there can be multiple cases of each of these elements.

Content analytic variables (CAVs) were then infused in the analysis making the classification more systematic. As an example, for the frame element *problem definition*, the corresponding CAVs are: topic/theme, actor, and proponent. Table 2 summarizes the frame elements and the associated CAVs. These CAVs are further anatomized into single binary variables, resulting to a total of 71 variables (see Tables 3–6). Coders then analyze each article based on the binary CAVs. A sample coding sheet is shown in Table 7 where columns represent the CAV scores while rows represent the cases.

### 4.1. Network construction of content analytic variables

Since by definition a frame is a collection of frame elements, it is presumed that such consists of a unique set of binary variables that form a dominant pattern, which emerges out of the CAVs’ interconnectivity. Matthes and Kohring (2008) emphasized that this procedure has an added complexity since it calls for an optimized clustering procedure of frame elements. In fact, MK disclosed that one of the liabilities in their method of using k-means clustering is that “problems may occur when conducting cluster analysis of frame element” since it does not have a systematic way of determining the optimal number of clusters (Matthes & Kohring, 2008).

One of the strengths of using complex networks in clustering analysis is its ability to extract these latent patterns without prior

**Table 2**

Frame elements and the corresponding content analytic variables.

Frame elements	Content analytic variables
Problem definition	Topic or theme Actor Proponent
Causal interpretation	Benefit attribution Risk attribution
Moral evaluation	Benefits Risks
Treatment recommendation	Solution Treatment

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