

# Raising and Rising Voices in Social Media

## A Novel Methodological Approach in Studying Cyber-Collective Movements

Emerging cyber-collective social movements (CSMs) have frequently made headlines in the news. Despite their popularity, there is a lack of systematic methodologies to empirically study such movements in complex online environments. We develop a novel methodology modeling CSMs from individual, community, and transnational perspectives by utilizing existing collective action theories and computational social network analysis. Using the Al-Huwaider online campaigns as a case study, we establish a rigorous and fundamental analysis that explains CSMs in multi-cultural settings. The methodology also assists in observing the transcending nature of CSMs for modeling transnational outreach. The research has implications to business, marketing and many other settings, beyond the exemplary setting chosen here for illustrative purposes.

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### 1 Introduction

Throughout history, various media have been centrally utilized in insurgent social movements. Abolitionists used newspapers, books, and the *Underground Railroad* as part of their struggles. In the 1979 Iran revolution leaflets and audio-cassettes played an important role in deposing the Shah of Iran (Sreberny-Muhammadi and Muhammadi 1994). And in the Philippines, it was *Veritas*, an independent radio run by the Catholic Church that became the source of resistance in a popular movement against dictator Ferdinand Marcos in 1986. The fax machine played a unique role during Augusto Pinochet's brutal rule as a dictator over Chile from 1973 until 1988 when public mass media were shut down by

the regime. Yet news about events in the country was disseminated by friends and relatives outside Chile anyway via fax machines. History shows that social changes and progress in human freedom can be shaped more effectively by the creative potential inherent in the new communication technologies or *technologies of freedom* (Pool de Sola 1983).

The 21st century has ushered in a new breed of social movements: the cyber-collective social movement. A cyber-collective social movement (CSM) is defined as a new social community – cultural, religious, or political – that emerges and rises in the online environment. Examples of such movements include: the Iranian Twitter movement (Quirk 2009), the Jihad Jane online recruitment (Knickerbocker 2010), and the 2011 *Arab Spring*, especially Egyptian and Tunisian revolts. Aided and abetted by advances in information and communication technologies, cyber-collective social movements have become the new paradigm in the contemporary political arena. From Tahrir Square to Zuccotti Park, individuals utilized CSMs to push forward their demands. For this reason, *Time* magazine aptly named “The Protester” as the person of the year for 2011. Despite the popularity of such movements, however, there is a lack of systematic methodologies to empirically study the emergence of cyber-collective social movements. A comprehensive, rigorous and

fundamental analysis explaining CSMs is not yet established. This contribution attempts to overcome this shortcoming.

Most existing studies attempting to understand CSMs are predominantly centered on online mapping, especially in the blogosphere. These studies primarily attempt to identify clusters of similarly interested individuals (bloggers). An example of such studies is Adamic and Glance's (2005) examination of the link graph between and across the American political blogosphere during the 2004 U.S. elections. This study observed certain inter-blog citation behavior patterns such as conservative bloggers tend to link more often than liberal bloggers, but there is no uniformity in the news or topics discussed by either conservatives or liberals. Another example is Kelly and Etling's (2008) study of the Iranian blogosphere. They analyzed 60,000 Iranian blogs using social network analysis and content analysis, and clustered these bloggers based on their political views (religious conservative, secular, and reform-minded) and topics of interests (ranging from politics and human rights to poetry, religion, and pop culture). Another study along a similar line is the study of the Arab Blogosphere, by Etling et al. (2009), consisting of 35,000 active blogs primarily from Egypt, Saudi Arabia, Kuwait, and other Middle East countries. This study managed to identify major clusters organized by countries, demographics, and discussion topics primarily centered on domestic politics and religious issues. A different approach in mapping the blogosphere is taken by Lin and Halavais (2004). They geocoded U.S. blogs from LiveJournal and Diary-Land using city names and three-digit ZIP codes specified by the bloggers in their postings. By identifying where people blog, local knowledge and culture can be gauged and certain behavior patterns can be identified.

These and other similar studies yield interesting findings and generate fascinating patterns showing how individuals collectively cluster themselves and discuss varied topics in the online environment. They have provided fundamental frameworks in understanding online social interactions and motivated us to ask further questions, such as: Why do certain patterns exist? What do they lead us to? Can we predict collective behavior from these maps/patterns? While existing studies have successfully provided necessary groundwork, they are not sufficient

in generating explanatory and predictive analysis. In addition, there is a lack of methodologies enabling the fundamental analysis of how online discussions converge to central themes.

In order to address this gap, here we leverage collective action (CA) theories (Olson 1965, see Sect. 2.1) and computational mapping in order to explain the underlying processes involved in CAs in social media. It is imperative to embrace conventional CA theories to study CSMs. More details on CA theories and their relevance in our study are presented in Sect. 2.1.

Using the *Al-Huwaider* online campaign (see Sect. 3 for detailed explanations) as a case to illustrate our methodology, the objective of our research reported here is to understand the underlying processes involved in CSMs. Based on this objective, we develop a novel methodological approach by reaching out to existing social theories on CA and computational social network analysis bearing the analysis upon three central tenets of individual, community, and transnational perspectives. The rest of the article is organized as follows: Sect. 2 reviews the relevant literature, Sect. 3 discusses the case study of the *Al-Huwaider* Campaign, Sect. 4 presents the data collection strategies followed by detailed research methodology coupled with the findings and analysis using real-world blog data in Sects. 5 and 6 presents the conclusion.

## 2 Literature Review

### 2.1 Collective Action Theories

Collective action (CA) can be defined as all activity of common or shared interest among two or more individuals (Olson 1965). Traditionally, CA theories can be traced back to Ronald Coase's (1937) economic explanation on why individuals choose to form partnerships, companies, and other business entities in trading rather than making bilateral contracts between individuals. In *The Logic of Collective Action*, Mancur Olson (1965) put forward a single basic premise of CA: "... individual rationality is not sufficient for collective rationality ..." (Sandler 1992, p. 3). Individual rationality is operationalized on axioms of consumer behavior (Alchian and Allen 1972). Consumers' willingness to participate in the

market correlates with predictability and efficient outcomes (Sandler 1992, p. 4).

Olson's classic book (1965) is mostly concerned with explaining and illustrating how collective failure results when individuals pursue self-interest. In his explanation of collective failure, Olson emphasizes group size, group composition and group asymmetry as contributing factors to collective failures and, further, argues that selective incentives and institutional design may overcome collective failures (Sandler 1992, pp. 9–10). Olson's argument is essentially based on the assumption that every person individually acts rationally, but if everyone chooses not to act – in respect to individual costs and benefits – no CA would occur. Forty years after Olson's, there are many CA theories descended from his argument, such as Club Theory (Sandler and Tschirhart 1980), the Neutrality Theorem (Warr 1982, 1983), Folk Theorem (Rubinstein 1979), and, the most prominent one, Rational Choice Theory (e.g., Becker 1976). Under Rational Choice Theory, it is understood that no individual can participate "against the rules of rational choice" (Lichbach 1996, p. 6). The collective choices are made by rational deliberation (Lewin 1988).

CA theory was also used to explain people's behavior in specific business and industry settings where no other theory suggested itself as a suitable explanation of certain observations. Such is the usage of CA, e.g., in the standards evolution, standards diffusion as well as standards adoption literature. Recent research in the adoption and diffusion of information systems standards in the mortgage, Radio Frequency Identification (RFID) adoption in the footwear and apparel, as well as the automotive parts supply industries demonstrates that CA serves as a very powerful theoretical concept to explain and predict such industry-level behavior of vertical industry standards consortia (Markus et al. 2006; Wigand et al. 2005).

As CA studies developed, different approaches emerged. In the 1970s and the early 1980s, Resource Mobilization Theory (MacCarthy and Zald 1979; Kerbo 1982; Ferey 1992) was the most influential approach in explaining more or less successful CA. Briefly summarized, this theory argues that the key obstacle to be overcome in order to be able to act collectively is the lack of financial and personal resources.

However, rational choice and resource mobilization theories are criticized for failing to answer the question as to how social meaning is constructed and how it works as a driving force for action (for an extensive critique see Kelly and Breinlinger 1996; Melucci 1996). New Social Movement Theory (NSMT) emerged as an alternative approach in reaction to this critique. Beyond economic and material rationales, this theory associates actions with belief systems that revolve around a set of values and symbols that are specific to the group (Snow et al. 1986; Johnston et al. 1994). To take into account the significance of the processes through which people attribute meanings to events and interpret situations and the role that CA groups play in this regard, CA theorists of NSMT have developed the concepts of collective identity (Klandermans 1991) and frame alignment (Snow et al. 1986). In this theory, shared issues and/or narratives and how individuals communicate and/or frame the narratives of grievance collectively are central to CAs.

Advanced communication technologies, such as the Internet, have transformed scopes, scales, and dynamics of collection action (Lim 2004a, 2006). Being “a convivial medium” (Lim 2003, p. 274) characterized by convergence, low cost, broad availability, and resistance to control, the Internet provides a greater scope for freedom, autonomy, creativity, and collaboration (Lim and Kann 2008, p. 82) for CAs. There are numerous examples of Internet-driven CAs such as the Zapatista movement in Mexico (Cleaver 1998; Bob 2005), the 1998 Indonesia student movement (Lim 2004b, 2006; Sen and Hill 2005) and the more recent (2009–2010) Facebook movements in Indonesia (Lim 2011, p. 19), the 2009 Green revolution in Iran, the 2011 anti-authoritarian movements in Egypt (Lim 2012), Tunisia, Syria, and Libya, and the Occupy movements in the United States and beyond. The maneuvers of these movements have exemplified characteristics beyond traditional CA (Friedland and Rogerson 2009). These movements have stirred debates on CA theories, raising questions of whether CA, profoundly dependent on the Internet and other new technologies, is as effective or successful as CA in more traditional modes (Bimber 2003; Norris 2002). There are a number of researches attempting to identify the “collective action process that can succeed online as well as shortcomings and disadvantages of online collective action”

(Bimber et al. 2005, p. 366). However, such research has not answered many other questions related to the emergence of various forms of CSMs. As CA theories were mostly developed in the pre-Internet era (Lupia and Sin 2003), it is imperative for us to reassess the conventional theories of CA. The emergence of CSMs has prompted us to examine and explore some fundamental aspects of CA that remain theoretically underdeveloped (Bimber et al. 2005, p. 366) and call for innovative foundational research that can provide insights in reconceptualizing CA theories in an online environment.

## 2.2 Social Network Analysis (SNA)

Melucci (1996, p. 20) defined collective action as “... a set of social practices (a) involving simultaneously a number of individuals and groups, (b) exhibiting similar morphological characteristics in contiguity of time and space, (c) implying a social field of relationships, and (d) the capacity of the people involved of making sense of what they are doing.” Such a definition is at the heart of scholars who attempt to make sense of structures and dynamics of CAs leading to the discovery that “collective action is significantly shaped by social ties” among prospective participants and the view of “collective actions as networks linking a multiplicity of actors” (Diani 2003, p. 1).

SNA has emerged as a set of methods geared toward an analysis of social structures and investigation of their relational aspects (Wigand 1988; Scott 1992). Most studies in this vein, however, look at how the involvement in networks affects individual behavior. The overall configuration of networks linking individuals is very rarely assessed in order to evaluate the potential for CA in a given collectivity, a needed research direction, which we will advocate below.

With the rise of CSMs, it is natural for social scientists to embrace the concept of computational social network analysis (CSNA) in analyzing these contemporary movements. CSNA provides a rich set of SNA methodologies to observe and explain characteristic patterns such as community extraction, expert identification, and information diffusion that are the most relevant in understanding CSMs central to our proposed methodology here.

**Community Extraction.** Communities play a vital role in understanding the

creation, representation, and transfer of knowledge among people, and are an essential building block of all social networks. However, the relationship of an individual to one another in a community is neither easily formalized nor consistent. To extract communities from a social network is, thus, not an easy task. There are three dominant approaches for community extraction: network-centric, content-centric, and hybrid approaches (Agarwal and Liu 2009).

*Network-centric* approaches leverage network structural properties to identify communities within a social network (Fortunato 2009). Since the fundamental assumption is that members of a community tend to interact more often with each other as compared to members of other communities, the network is partitioned into clusters with lower between cluster edges and higher within cluster edges (Hagen and Kahng 1992; Shi and Malik 2000; Luxburg 2007). Variations of the above network partitioning approaches address the dynamic nature of social networks (Ning et al. 2007; Chi et al. 2007a, 2007b).

*Content-centric* approaches rely on the assumption that the members of a community tend to talk about similar topics. Thus the communities are extracted based on the similarity of content available in the form of blog post texts or profile information of the individuals (Li et al. 2007; Brooks and Montanez 2006), which is inspired by the fundamentals of text mining and webpage clustering. Agarwal et al. (2010) proposed a novel clustering algorithm to meet the challenges of this highly dynamic environment. In this work, bloggers’ collective wisdom is extracted via the labels used by the bloggers to annotate their blogs and represented by a label relation graph that helps in discovering many interesting, complex, and latent relations among annotations.

*Hybrid approaches* leverage both content and network information to extract communities. The central tenet behind such an approach is: a set of blogs that are highly linked tend to share similar content and reflect tighter communities (Java et al. 2008). However, the sparse link structure and inherent differences between web pages and blogs (such as interactive and dynamic environment, highly-likely topic and user drift, low barrier to publication leading to extremely noisy data) demand novel approaches.

**Information Diffusion and Opinion Leaders.** Opinion leadership is reflected in the degree to which an individual is able to informally influence other individuals in the form of shaping or changing their attitudes or overt behavior in a desired way with relative frequency (Rogers and Shoemaker 1971; Merton 1957; Katz 1957). Accordingly, opinion leadership is earned and maintained by individuals' technical competence, social accessibility, and conformity to the social system's norms. Similarly, influential blog sites in the blogosphere exert influence over the external world and within the blogosphere (Gill 2004). The blogosphere, however, follows a power law distribution (Faloutsos et al. 1999) with very few influential blog sites that form the short head of the distribution and a large number of non-influential sites that form the *Long Tail* (Anderson 2006). Regardless of the blog(s) being influential or not, influential bloggers always exist. Information diffusion is often used to compute influence, by identifying the key players who maximize the information spread by leveraging theories from epidemiology (Gruhl et al. 2004), viral marketing (Richardson and Domingos 2002; Kempe et al. 2003; Chen et al. 2009), cascade models (Goldenberg et al. 2001; Leskovec et al. 2007), greedy models (Java et al. 2006), and submodularity-based models (Leskovec et al. 2007).

The casual environment of the blogosphere where not many blogs cite the actual source presents significant challenges to employ the above-mentioned purely link analysis based approaches. Song et al. (2009) define opinion leaders as those who generate novel ideas and opinions, which is estimated using cosine similarity between their posts and the ones they refer. However, there could be a blogger who is not very novel in his/her content but is largely followed by acting primarily as an information broker. Such a blogger will not be identified by the novelty-based approach. Goyal et al. (2010) showed that the influence probabilities between users can be learned based on their community affiliation logs. However, collecting user activity logs is extremely difficult and privacy invasive. Further, a few blogs list most active bloggers for a particular time window based on the number of submitted posts, or number of comments received, etc. (Gill 2004). Such statistics could easily mistake voluble bloggers for

influential bloggers. To avoid such inaccuracy Agarwal et al. (2008b) proposed a stochastic model to identify the influential bloggers leveraging content and network based social gestures of the influentials including recognition, novelty, eloquence, and activity generation.

### 3 Case Study: The Al-Huwaider Campaign

There are a myriad of incidents and stories demonstrating the formation of collective cause and its manifestation in the form of CSMs. Among these, there are abundant stories about brave female Muslim bloggers who passionately fight for issues concerning women's rights and civil liberties. For example, Dalia Ziada, a human rights activist and popular Egyptian blogger, uses blogs to fight for civil rights and women's rights in the Middle East. She is one of the key blogger-activists that helped bring down Mubarak in the 2011 Egypt revolution. Ziada said that blogging helped her to "communicate and network with people who share the same interests" (The Women's Eye 2011). In Indonesia, through the 2009 "Coin for Prita" online campaign, women (and men) made use of blogs and Facebook to support Prita Mulyasari (Herald Sun 2009) a 32-year-old mother of two, to help her pay the court's \$22,000 fine and to fight against the unjust court system. Prita was fined for defaming the Omni International Hospital in Jakarta. The defamation suit was based on an email complaint sent by Prita to her friends and relatives about the bad service she received at the hospital. Within ten days, the campaign successfully collected \$90,000, exceeding what was needed to pay the fine. Due to public pressure, in December 2009 the court decided that Prita was not guilty and the money thus was donated to a charity organization to help defending other "Pritas." In Morocco, in 2007, Lady Zee brought the *Bloguons Utile (Let's Blog Useful)* campaign to the *Blogoma* (Moroccan Blogosphere). This initiative was a call for bloggers to communicate about the imprisonment of Moroccan children and teenage prisoners. Through this campaign she mobilized over 80 bloggers, successfully raised money and even organized visits to the facilities where minors were incarcerated. Following this success, in 2009 Lady Zee used her *Bloguons Utile* campaign to support Gaza civilian war

victims and successfully raised 25 tons of medicine for the war-torn Gaza region (Lady Zee 2007).

There are many other similar stories. However, for the purpose of this article, we choose the Al-Huwaider Campaign story that is distinctive to the female Muslim blogosphere and also quite uniquely highlights how individual cause diffuses within the cyber-network of interactions and shapes into a CSM as time progresses.

The Al-Huwaider Campaign refers to the series of online campaigns for women's rights originally initiated by the Saudi writer and journalist Waheja Al-Huwaider and later became a regional phenomenon (Jamjoom 2010). Al-Huwaider has become a spokeswoman for women's rights, particularly in the Middle East and Central Asia, because of her relentless pursuit of gender equality. In August 2003, the Saudi Interior Ministry banned her from writing in the Saudi press. She has published her articles on the reformist Arabic websites and gained international recognition ever since.

Al-Huwaider started her *YouTube* campaign in 2007 but the one that gained international attention was her 2008 driving campaign. On International Women's Day 2008, Al-Huwaider drove a car in the Kingdom of Saudi Arabia (KSA), where it is forbidden for women to do so, while videotaping a plea to Saudi officials. She posted the video on *YouTube* and it attracted international audiences. Since then she has been posting several videos that are controversial in the eyes of authorities (of most Middle Eastern countries), such as: a video on *YouTube* rejecting the exclusion of Saudi female athletes from the Olympics in 2008. Another prominent online campaign of Al-Huwaider is the Black Ribbon Campaign in 2009, whose purpose is to end the *mahram*, or guardianship, laws. For three consecutive days she went to the Bahraini/KSA border and demanded to be allowed to cross without a letter of permission signed by her guardian (her teenage son) and posted her case online. Her most recent causes have been to oppose child marriages and female infanticide. It is important to note that the Al-Huwaider campaign never stopped in the online world. Her online campaign was intricately tied to her offline activities. In order to gain support and legitimacy, she translated her online causes into offline actions in the physical place,

such as driving a car when forbidden, and transformed these actions back to the online world. CSMs ultimately need to be connected to offline activities to be meaningful.

Despite the obstacles placed by the Saudi government, Al-Huwaider continues to promote her ideas, through her writings online. Her articles analyze the Arab social situation, criticize the status of human rights, and vehemently protest discriminations and violence against women. Her online campaign has not only become an inspiration but also an influential voice for collective movements, calling for reform, among Middle Eastern women. Al-Huwaider's campaign was mostly centered around *YouTube* videos and propagated through the blogosphere. Preliminary analysis on Al-Huwaider's campaigns has been published in Agarwal et al. (2011a, 2011b).

#### 4 Data Collection Strategies

As mentioned earlier, the overarching question of this study is: How do we understand the underlying processes involved in cyber-collective social movements (CSMs)? Or, more pragmatically, we seek to understand how decentralized online individual actions are transformed into CSMs. Methodologically essential questions to be addressed here are: How does individual cause diffuse into collective cause? What are the dynamics of influence in a cyber-collective network? Is the cyber-collective network capable of transcending the nation-state barriers? We elaborate more on these research questions in the next section on research methodology and analysis.

To investigate the research questions posed above we employ the following data collection strategies. We collected the blog posts of female Muslim bloggers from 17 different countries. We handpicked a seed set of 150 blogs primarily written in English but also containing text in Arabic, Indonesian, and French. Collecting multilingual data is imperative because the individuals posting in English (or a second language) do so to reach out to people outside of their cultures. Such bloggers, also referred to as “bridgebloggers” (McKinnon 2005; Zuckerman 2008), may not necessarily be the most prominent community members. Bloggers were included based on three shared characteristics, also known as the ‘triangulation’ strategy:

(1) explicit self-identification of gender and religious orientation – women over the age of 18, Muslim (verified through self-identification or Islamic references in their postings), (2) evidence gathered from blogger's friends and/or relatives, and (3) evidence gathered from bloggers' participation in other social media. Often bloggers' own multiple blogs and tend to cross-link between their blogs or even link to their friends' or relatives' blogs. Further, many bloggers explicitly mention their participation on other forms of social media such as MySpace, Twitter, Facebook, *YouTube*, etc. We leveraged bloggers' registration on multiple blogs and multiple social media (such as MySpace, Twitter, Facebook, etc.) and cross-linking features. These connections help in validation and ensuring that the author is a female Muslim blogger. Other demographic information, such as nationality, current residence, and name (if available), is also included.

Social media allow people to share data in multiple forms including text, images, audios, and videos. In our research, we focus on the textual form of data. It must be noted, however, that often individuals provide rich metadata along with the images, videos, or audio files, which is one of the main characteristics of Web 2.0 (O'Reilly 2007; Wigand et al. 2010). Metadata could be user provided tags (also known as folksonomy) or system defined categories used to catalogue user content, which primarily takes the textual form and is often concise and precise, making the analysis quite accurate. Further, the metadata constantly improves due to community participation in a phenomenon also referred to as collective intelligence (Surowiecki 2004).

#### 5 Research Methodology and Analysis of Findings

Information about individuals and their world views would be difficult to acquire from any other source, clearly showing the unique treasures and richness of information embedded in blogs begging to be discovered. Google's flu tracker is one example how data mining search information can be used in discovering early signs of influenza outbreaks. This example demonstrates that the web, including blogs, could be mined to track information and data about emerging trends and behaviors in almost any area (e.g., political trends and opinions, drug

use, racial tension, new films, new products, marketing applications). We have attempted to delve into emerging behavior patterns and their development into CSMs from individual, community, and transnational perspectives, and in so doing delineate the challenges, propose a research methodology, evaluate various strategies, and analyze our findings.

In order to cogently address the research questions posed in Sect. 1, we pursued a three-phased approach: phase 1, Individual Perspective; phase 2, Community Perspective; and phase 3, Transnational Perspective (Fig. 1).

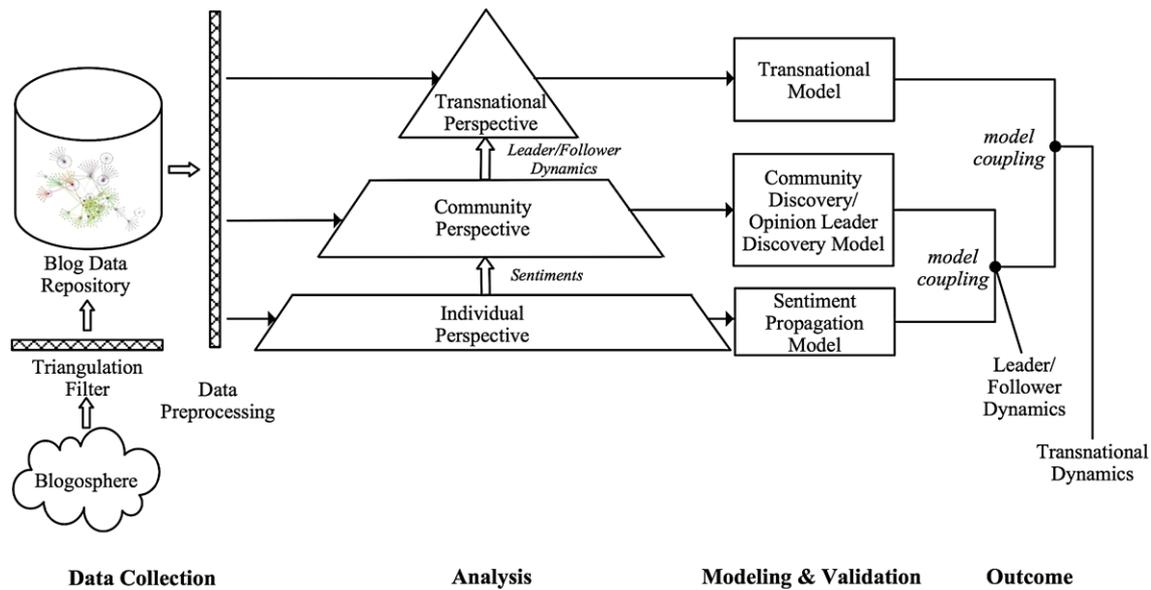
Leveraging the CA theories, especially the NSMT (Sect. 2.1), our methodology is centered on the concept of collective identity. This is demonstrated by taking into account the significance of the processes through which individuals (a) attribute meanings (translated in our methodology as ‘concern’) to events (or causes) and (b) find association with each other through such processes facilitated by social media networks.

##### 5.1 Individual Perspective

The Al-Huwaider campaign shows how an individual cause can be transformed into a collective cause. This scenario demands exploration as to how personal issues and concerns evolve and propagate in social networks and how they converge and form collective concerns. In exploring the Al-Huwaider campaign case, we preprocessed related blogs, identified issues and concerns representing individual cause, modeled their diffusion along the network, and analyzed their convergence to collective cause.

##### Preprocessing and Extracting Cause.

For the event related to the Al-Huwaider campaign, we analyzed different blog reactions. Often blogs are personal musings and bloggers tend to share content from varied topics. Blog posts containing relevant topics were summarized to reduce off-topic chatter narrowing in on the key information (Coombs et al. 2008). The summarized and segregated data is preprocessed by stop word elimination (removing words such as ‘a’, ‘an’, ‘the’, etc. that only have grammatical significance) and stemming (reducing inflected words to their root forms). Representative keywords are then generated using a tag cloud generator (Wordle.net). Alternatively, tag clouds (words scaled to their frequency of occurrence to illustrate



**Fig. 1** Overall architecture of the research design

their significance in a text document) could be directly generated from the blog post text avoiding the computationally-expensive topic segregation and summarization process. However, the identified tags in that case would be extremely noisy and irrelevant since they belong to several interrelated topics. Furthermore, restricting the analysis to top- $k$  tags would compromise the tag quality and consequently affect the analysis. As found in our prior investigation (Agarwal et al. 2008b), the tag cloud generator works well when used after topic segregation and summarization is performed. Other text analysis approaches such as absolute/relative term frequency (TF), inverse document frequency weight (IDF), phrases and proximity and similarity (Korfhage 1997; Baeza-Yates and Ribeiro-Neto 1999) could be used to analyze the occurrence of shared issues and concerns among the female Muslim blogosphere.

In this article, we randomly chose four blogs just to illustrate the application of our proposed methodology in analyzing the case. We started with the original narrative of Wajeha Al-Huwaider's cause to lift the ban of driving for Saudi women as a source of issues and concerns. Representative keywords were then extracted using a tag cloud generator. We repeated the extraction for each blog within Al-Huwaider's network to seek whether Al-Huwaider's issues and concerns were diffused to these blogs. Our finding (Fig. 2) shows the occurrence of similar keywords

representing similar issues and concerns across these blogs (e.g., Saudi, women, cars, drive/driving, right/rights). This figure shows how an individual cause of Al-Huwaider was propagated in social networks.

**Modeling the Diffusion of Cause.** We analyzed the extracted issues and concerns representing a certain cause and study their propagation. Specifically, we explored how network ties affect an individual's concerns. The proposed diffusion model extends the existing information diffusion models (linear threshold, independent cascade, etc.) described in Sect. 2.2 by considering concerns as the information chunks that propagate over the social network of bloggers. Since the underlying social network remains the same, the structural properties of the concern diffusion are no different than information diffusion characteristics. In other words, leaders of the community who are responsible for the fastest information diffusion also tend to be the major influencing factors on the individual's issues and concerns and hence the collective concerns of the community.

The finding from the individual perspective leads us to think about possible trajectories for future research. Beyond extracting issues and concerns, similar approaches can be used to extract individual sentiment and track how it is diffused into collective sentiment. The exploration of existing sentiment analyzers in combination with the use of sentiment

word thesaurus (SentiWordNet) will enable us to label the polarity and degree of the opinion word. For the future research agenda, we propose to longitudinally analyze the extracted issues, concerns and sentiments and to identify the factors involved in their respective propagation. We also propose to utilize existing cognitive and behavioral theories to gain deeper insights into the adaptation of individual behavior stemming from social interaction and cultural ties. These theories will form the basis of our exploration, aided by the development of novel statistical and stochastic diffusion models focusing on the transformation and propagation of sentiments along network ties over time. The model will help in advancing sociological as well as computational understanding of how collective sentiment shapes and is improved upon in later phases of the analysis by incorporating community and transnational factors.

## 5.2 Community Perspective

As mentioned earlier, Al-Huwaider was a major factor in mobilizing individual bloggers with similar concerns (towards various issues) into a community and in leading the movement, i.e. transitioning individual cause to collective cause and ultimately manifesting into a CSM. This also correlates with our findings in the individual phase, where the community leader was identified as the most significant influence over the individuals' concerns. To model this phenomenon, we



**Table 2** Top-10 influential blog posts discussing Wajeha Al-Huwaider's campaigns along with their influence scores and representative tags extracted using Wordle.net

Blog	Representative tags	Influence score
<a href="http://hotair.com/archives/2009/07/12/saudi-feminist-blocked-from-leaving-country/">http://hotair.com/archives/2009/07/12/saudi-feminist-blocked-from-leaving-country/</a>	Saudi, Al-Huwaider, Arabia, border, male, passport, permission, activists, rights, guardian	833
<a href="http://jezebel.com/5552458/japan-likely-to-reject-ban-on-sexualization-of-minors-playboy-model-jailed-for-boob+gripe">http://jezebel.com/5552458/japan-likely-to-reject-ban-on-sexualization-of-minors-playboy-model-jailed-for-boob+gripe</a>	Women, minors, drinkers, Japan, Yousef, freedom, infected, prisoners, police, jail, charges, allegations	824
<a href="http://volokh.com/posts/1245159018.shtml">http://volokh.com/posts/1245159018.shtml</a>	Saudi, Arabia, HRW, Human, rights, links, mail, organization, government, Israel, workers	739
<a href="http://thelede.blogs.nytimes.com/2009/03/12/saudi-woman-drives-for-youtube-protest/">http://thelede.blogs.nytimes.com/2009/03/12/saudi-woman-drives-for-youtube-protest/</a>	Saudi, Huwaider, driving, BBC News, Arabia, Arab, women protest, video, Fattah, car, YouTube	702
<a href="http://www.memeorandum.com/100418/p4">http://www.memeorandum.com/100418/p4</a>	Saudi, women, driving, Arabia, raped, reform, issues, populace	695
<a href="http://www.moonbattery.com/archives/2007/10/the_nobel_joke.html">http://www.moonbattery.com/archives/2007/10/the_nobel_joke.html</a>	Afghanistan, Navy, Murphy, bad, gore, Arafat, combat, killed, Marxist	690
<a href="http://latimesblogs.latimes.com/babylonbeyond/2010/06/saudi-women-use-fatwa-in-driving-bid.html">http://latimesblogs.latimes.com/babylonbeyond/2010/06/saudi-women-use-fatwa-in-driving-bid.html</a>	Women, Saudi, drive, Islamic, Wajeha, maternal, breastfeed, Obeikan, cars, ban, campaign	665
<a href="http://www.hrw.org/english/docs/2006/10/20/saudia14461.htm">http://www.hrw.org/english/docs/2006/10/20/saudia14461.htm</a>	Saudi, human, rights, police, detained, government, mabahith, Arabia, khobar, freedom	644
<a href="http://www.hrw.org/en/news/2006/10/30/saudi-arabia-lift-gag-order-rights-campaigner">http://www.hrw.org/en/news/2006/10/30/saudi-arabia-lift-gag-order-rights-campaigner</a>	Rights, al-Huwaider, Saudi, Arabia, human, September, mabahith, khobar, Abdullah, interrogated, police, officers	644
<a href="http://globalvoicesonline.org/2008/08/12/saudi-arabia-bans-women-from-olympics/">http://globalvoicesonline.org/2008/08/12/saudi-arabia-bans-women-from-olympics/</a>	Feminist, Burundi, Olympics, Wajeha, Macha, Women, Muharram	627

these blogs were similar, we assume the blogs were themselves similar. Column-vectors in this matrix (as illustrated in **Table 1**) are compared to compute (cosine) similarity between any pair of blogs (as demonstrated in Eq. (1) where  $B_m$  and  $B_n$  are the two blogs represented by the column vectors  $P_m$  and  $P_n$ , respectively) and unsupervised data mining algorithms such as  $k$ -means are used to identify communities.

$$\text{Sim}(B_m, B_n) = \frac{P_m \cdot P_n}{\|P_m\| \|P_n\|} \quad (1)$$

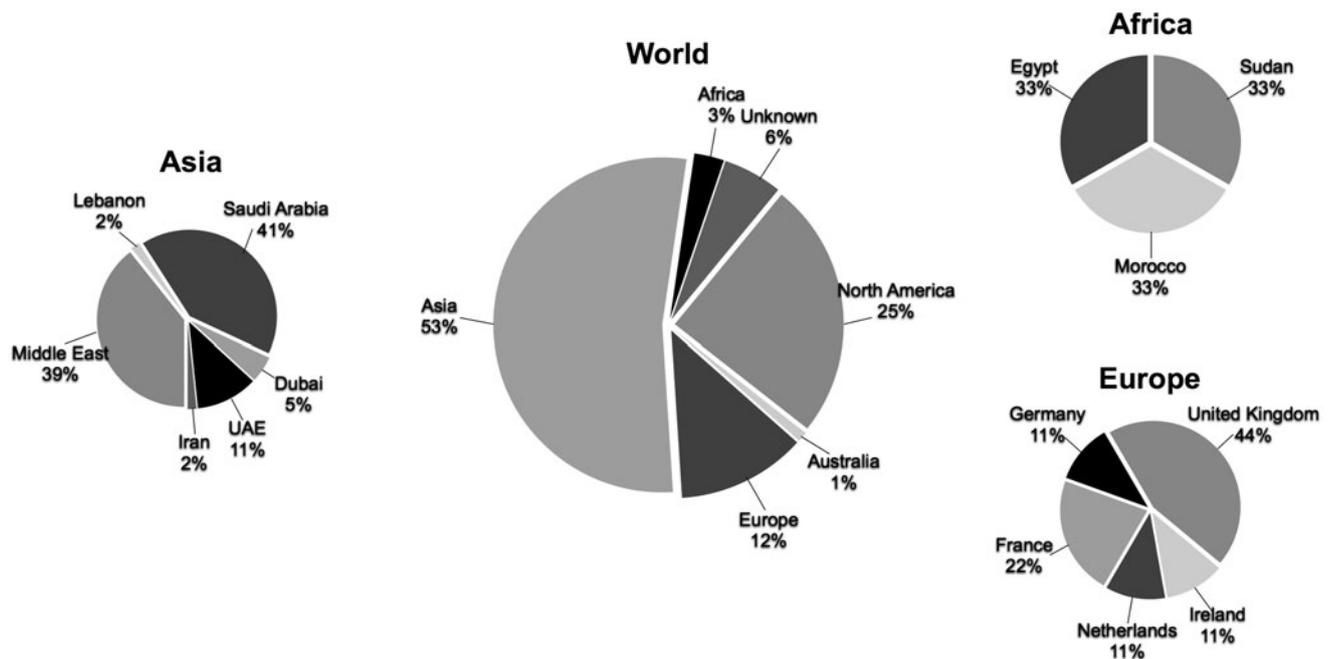
From this matrix, we learn that *Saudi Women* and *Sand Gets in My Eyes* share similar concerns and address all three causes: women's right to drive, *Black Ribbon* campaign, and (against) child marriage. The blog of *Tara Umm Omar*, however, only addresses two out of three while *My Pen My Paper* discussed both first and second causes in one blog posting. If we continue the list with more causes/concerns, we will get a better picture on the boundary of the community, those who are closely linked to each other by most issues/concerns or absolute com-

monality, those linked by partial commonality, and those not sharing common issues/concerns.

**Identifying Influentials.** Once communities of bloggers are extracted, our next step is to identify the influentials. We analyzed a community of 75 blogs sharing similar concerns for Al-Huwaider's campaigns and identified the top ten influential blogs, as illustrated in **Table 2**. Due to space limitations we cannot present the analysis of other blogs. All 75 blogs had an average influence score of 198.306. Among these blogs, the most influential blog cites a maximum influence score of 833 and the least influential one cites a minimum influence score of 1, with a standard deviation of 269.892. The influence score for each blog is provided by Technorati indexing service, which is directly proportional to the number and authoritativeness of blogs and other media that cite/link to the blog in question. The distribution indicates the expanse of the blogs in terms of the influence or authoritativeness. Representative tags extracted using Wordle are specified next to

the blog posts to give contextual background and the topical keywords. The analysis demonstrates a feasible approach to identify influential blogs for an event. It could be explored further to study the diffusion of topical keywords and/or sentiments to the blogs that link to these influential blogs. However, to study such diffusion behaviors, a blog network needs to be constructed. We plan this aspect of the analysis for our future work.

The individual perspective phase provides an understanding of how issues and concerns propagate along the network. The outcome of the community perspective phase enlightens us with a deeper understanding of leader-follower dynamics. Together outcomes from both phases lend insights into the emergence of CSMs in socio-culturally diverse environments. As a possible future direction, longitudinal analysis could be performed to address questions such as whether followers consistently follow the same leader(s), or is the influence time-variant, offering deeper understanding of group dynamics.



**Fig. 3** Transnational support for Wajeha Al-Huwaider's campaign

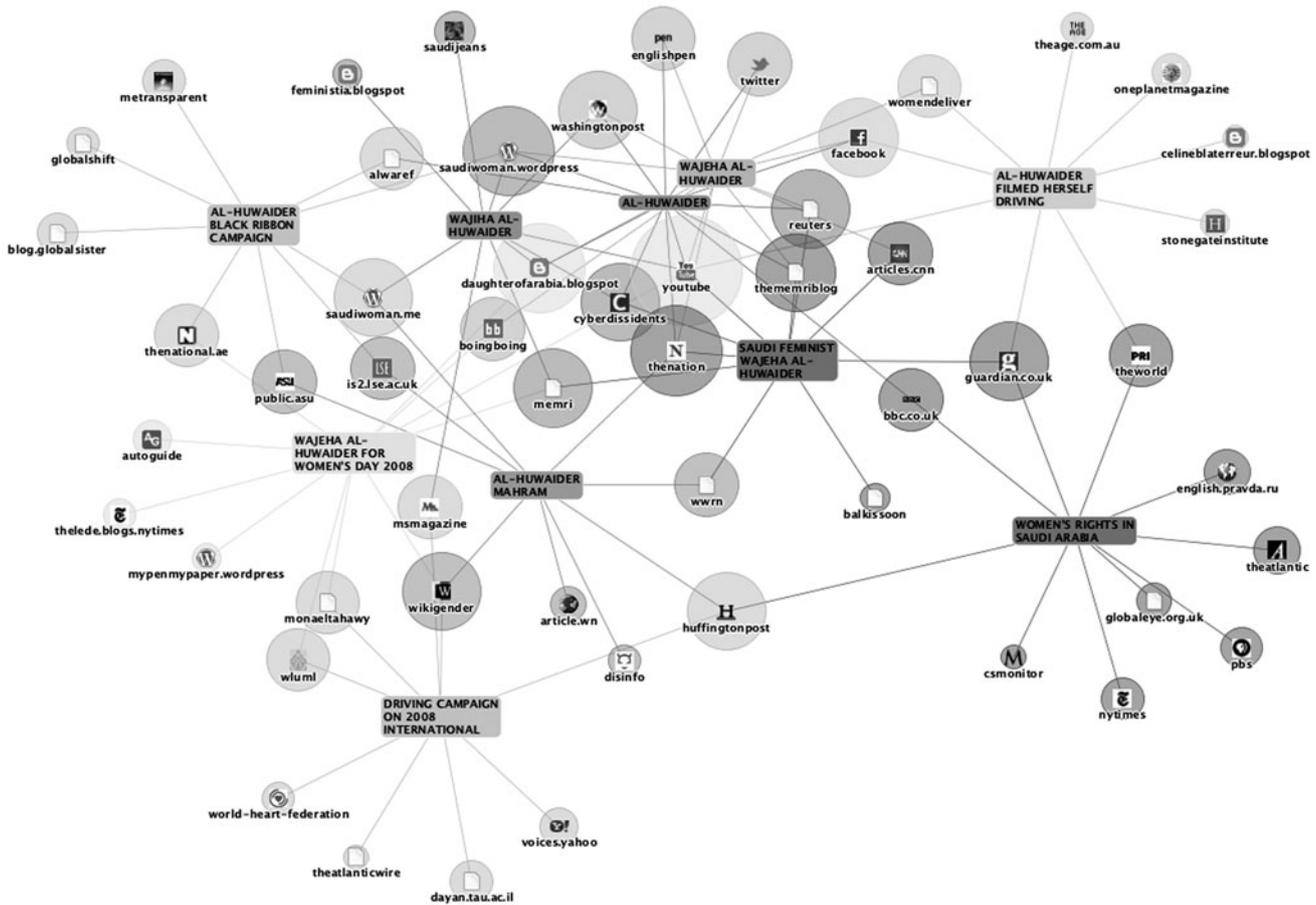
### 5.3 Transnational Perspective

In this phase, we studied and analyzed whether collective concerns in communities transcended nation-state barriers and converged into transnational CSMs or not. Analyzing the emergence of transnational actors and networks, structures relating to fluidity, and boundless organizational architecture, is key to the deeper understanding of transnational underpinning of CSMs. One such actor identified in our analysis was Wajeha Al-Huwaider. Despite the cultural, ethnic, political, social, and geographical diversity of Al-Huwaider's supporters, the sense of community superseded differences and converged individual concerns into CA. **Figure 3** illustrates the geographical distribution of transnational support for Al-Huwaider's campaigns obtained from analyzing the data. We sifted through the bloggers' profiles to extract their respective locations. If the information on their location was not provided, we checked the location from where the blog post was submitted by looking at the blog post header. In some cases, timestamps and the associated time zones helped in cross-referencing the locations. All blog posts/bloggers that did not provide location information or more precisely whose location could not be identified were eliminated from this analysis.

An alternative method to identify communities can also be utilized by clustering pages from blogs/sites based on issues discussed in those blogs and websites. In **Fig. 4** we can see that conversations around Al-Huwaider campaigns are diffused in various blogs, websites, news portal, and social media sites. Identified communities here are not always necessarily linked to each other, but they represent clusters of individuals and/or groups of individuals who share similar conversations. For example, individual blogs such as *saudiwoman.wordpress.com*, *daughterofarabia.blogspot.com*, *saudi-jeans.org*, *englishpen.org* and *feministia.blogspot.com*, share conversations around the profile of (Wajeha or Wajiha) Al-Huwaider with blogs of transnational organizations such as *TheMemriblog.org* and *cyberdissident.org*, as well as with *BoingBoing* and global news portal such as *CNN*, *BBC*, *The Nation*, and *Washington Post*. Using the issue of Al-Huwaider for Women's Day of 2008, *daughterofarabia.blogspot.com* is also clustered with another individual blog of *mypenmypaper.wordpress.com*, *Wikigender.org* (a transnational organization), *Mona Eltahawy's* blog (a prominent Egyptian American journalist), and the blogs of *The New York Times*. As can be seen in **Fig. 4**, while each issue represents a unique cluster, one blog can belong to more than one issue cluster depending of its participation in related issues.

By identifying clusters of conversations/contents, we can map the diffusion networks of issues and discover disparate communities that essentially share similar issues even without physical links. From the size of its node, we can also see how central *YouTube* was in the Al-Huwaider campaign. We can see that *YouTube* is connected to most communities that discuss the campaign from various angles/perspectives. From **Fig. 4** we also learn that in the Al-Huwaider campaign, issues are propagated transnationally mostly in the blogosphere and international news portals. We can spot that two individual blogs, *daughterofarabia.blogspot.com* and *saudiwoman.wordpress.com*, are central in such propagation.

Social networking platforms have undoubtedly intensified the degree of connectivity by building up capacity to circulate ideas and to transfer content very quickly across all barriers. Consequently, these platforms have favored a complex array of coordinated mobilization at the global level. Analyzing the emergence of transnational actors and networks, structures relating to fluidity and boundless organizational architecture, is key to the deeper understanding of transnational underpinnings of CSMs. This finding prompts us to seek answers for further questions such as, can transnational CSMs be autonomous from national constraints in terms of discourses,



**Fig. 4** Networks of issue clusters depicting Al-Huwaider campaign

strategies, and resources? Can we observe how CSMs evolve across multiple cultures? Can the shifting scale (from local and national to global and transnational) also bring about a change of culture and identity of these movements? With respect to outcomes and goals, can transnational CSMs deliver concrete strategies to overcome the unpredictability of their mobilizations? With respect to their internal dynamics, can transnational CSMs encourage their perpetuation through mitigating the individual convictions of the CAs?

Transnational models of CSMs can be used to track and predict the trajectory of certain issues within the social media, whether or not the issues will develop into transnational movements, and, if so, through which networks the issues will circulate. Such models provide insight into the factors that contribute to the per-

petuation of transnational online collective movements and elucidate the uncertainty of results and expectations. The opinion leader model, combined with the sentiment propagation model, provides highly useful, predictive analytical capabilities to identify transnational actors, networks, and structures.

For our future research agenda, an intensive issue-network observation can be performed for a certain period of time. Each issue arises from certain local or global events and we will analyze it closely before and after it occurred. Note that historical data available from portals like Global Voices<sup>1</sup> could be used to perform a retrospective analysis to develop and train models that have predictive capabilities. An issue can be observed for a certain period of time and an issue-network can be constructed leveraging our analysis from the

previous perspectives. The issue network could offer insights from different viewpoints. An issue-network could illustrate possible interactions among various issues highlighting shared patterns (demographic, geographic, etc.) and also differences leading to an aggregated analysis of issues. Furthermore, an issue-network could also provide analytical capabilities to study the role of various networks (social media or otherwise) in issue propagation, classification, and evolution. The issue can be geographically mapped periodically to detail the development of the issue-network. The mapping process can identify each individual and classify her into one or more clusters (e.g., an Egyptian Canadian female blogger who resides in Arizona, United States belongs to three clusters: Egypt, Canada, and United States). Geo-locations of the individuals could be obtained from the Ushahidi<sup>2</sup>

<sup>1</sup><http://globalvoicesonline.org/> – An open project supported by the Berkman Center for Internet and Society at Harvard University, Reuters, the MacArthur Foundation, Hivos, and other funding sources.

<sup>2</sup><http://www.ushahidi.com/> – An open project supported by the Knight Foundation, the MacArthur Foundation, Google, Cisco, Mozilla, Hivos, and other funding sources.

**Table 3** Summarization of the major findings, implications, and future research

Major findings	Implications	Future research
Social media has played a key role and irreversibly transformed organization and mobilization of social movements.	Our methodology would continue to embrace the conventional CA theories and help reshaping them further to better understand the implication of new forms of communication (facilitated by social media) for CA.	We will attempt to perform cross-cultural analysis, including a dataset from non-English speaking population.
The proposed methodology allows us to analyze the CSM on the three levels of individual, community, and transnational perspectives.	The proposed approach utilized in studying the diffusion of concerns can be used to examine how individual sentiment is diffused into collective sentiment.	We propose to longitudinally analyze the extracted issues, concerns and sentiment and to identify the factors involved in their propagation. We also propose to utilize existing cognitive and behavioral theories to gain deeper insights into the adaptation of individual behavior stemming from social interaction and cultural ties.
Network ties affect an individual's concerns. Leaders of the community tend to be the major influencing factors on the individual's issues and concerns and hence the collective concerns of the community.	Transnational models of CSMs can be used to track and predict the trajectory of certain issues within social media, whether or not the issues will develop into transnational movements, and, if so, through which networks the issues will circulate.	An intensive issue-network observation can be performed to illustrate possible interactions among various issues highlighting shared patterns (demographic, geographic, etc.) and also differences leading to an aggregated analysis of issues.
A community of bloggers can be defined by the issues discussed and the similarity in their opinions on common issues.	Our research also lends some insights into the relationship between social media and governance.	Future research may examine the notion that CA is a form of engagement and how this manifests itself within the context of media and governance. Such engagements seem to function as corrective mechanisms, thus taking on a role on their own within such a governance system.
Individual and community perspectives together help us study the leader-follower dynamics within a community with respect to an issue.	It would be important to understand the leader-follower dynamics better such that the role of leaders and followers can be studied in greater depth.	It would be highly desirable to 'design' the role of leaders in CAs. This would help to shape and steer CSMs better. Ultimately, being able to explain and predict such dynamics would be a major step forward.
By identifying clusters of conversations/contents, diffusion networks of issue can be mapped to discover communities even without physical links.	A community discovery approaches that utilize network ties could benefit from the content (issue) based approach proposed in our research.	In the future, we would like to develop a tool that can handle massive datasets to automatically extract issue clusters.
Analyzing the emergence of transnational actors and networks, structures relating to fluidity, and boundless organizational architecture, is key to deeper understanding of the transnational underpinning of CSMs.	Such capability will allow the researcher to examine the broad context and understanding of the setting. This implies also that having a better sense and understanding of 'community' seems to supersede other differences and would allow us to observe the convergence of individual sentiments into actual CA.	In the long run, such a capability would allow us to observe and then to explain and predict actual convergences of CAs.
crowdsourcing and other GIS platforms. The map of transnational collective movements then will show the overlap of various clusters and the expansion/evolution of networks. The issue networks and mapped clusters can be	studied longitudinally over chronological sequences of various events from the data, to identify and track how they merge/expand/split and exhibit other interesting patterns, regardless of their geographic dispersion and at local or global	scales. This dynamic evolution of issue-networks and clusters can be correlated with intrinsic factors including (but not limited to) demographic, cultural, economic, and political statistics <sup>3</sup> and extrinsic factors such as uprisings in socio-

<sup>3</sup>Such as unemployment, unemployment under 25 years, population below poverty, GDP per capita, Internet literacy and access, mobile phone/smart device market penetration, U.S. economic aid, U.S. military aid, population and male/female breakup, political leadership and tenure collected through open sources such as Gallup, C.I.A. World Factbook, U.S. A.I.D. 2009 Economic and Military Aid, U.S. Census International Data Base.

## Abstract

Nitin Agarwal, Merlyna Lim, Rolf Wigand

### Raising and Rising Voices in Social Media

#### A Novel Methodological Approach in Studying Cyber-Collective Movements

Emerging cyber-collective social movements (CSMs) have frequently made headlines in the news. Despite their popularity, there is a lack of systematic methodologies to empirically study such movements in complex online environments. Using the Al-Huwaider online campaign as a case to illustrate our methodology, this contribution attempts to establish a rigorous and fundamental analysis that explains CSMs. We collected 150 blogs from 17 countries ranging between April 2003 and July 2010 with a special focus on Al-Huwaider's campaigns capturing multicultural aspects for our analysis. Bearing the analysis upon three central tenets of individual, community, and transnational perspectives, we develop novel algorithms modeling CSMs by utilizing existing collective action theories and computational social network analysis. This article contributes a methodology to study the diffusion of issues in social networks and examines roles of influential community members. The proposed methodology provides a rigorous tool to understand the complexity and dynamics of CSMs. Such methodology also assists us in observing the transcending nature of CSMs with future possibilities for modeling transnational outreach. Our study addresses the lack of fundamental research on the formation of CSMs. This research contributes novel methodologies that can be applied to many settings including business, marketing and many others, beyond the exemplary setting chosen here for illustrative purposes.

**Keywords:** Collective action, Blogosphere, Muslim, Female bloggers, Opinion mining, Community, Influence, Transnational, Social network analysis, Al-Huwaider, Issue diffusion, Social media

demographically similar regions, which could yield deeper insights on the structural dynamics of certain key factors (viz, primary, secondary, and tertiary relations) that create 'affordance' for successful uprisings. With access to more data, we can generate an issue network for Al-Huwaider's campaigns following our analysis in Fig. 3. Such issue networks can help decrypt the dimensions of: issues (on local, global, global-local levels), clusters (nation or content-based), political affiliations (conservative, liberal), culture, time, and scale (network links, number of individuals, issue clusters) from actor and network perspectives.

## 6 Conclusion

From the analysis of the Al-Huwaider campaign we have learned that methodologically it is possible to observe how an individual cause evolves into a CSM in a complex online environment. Such observation is enacted by developing a methodological framework based on three levels of issue propagation and sentiment diffusion. The first level is the individual perspective where personal issues and concerns evolve and propagate in social networks online. The second level is the community perspective where online social networking facilitates the formation of an online community whose members share similar concerns and sentiments and the emergence of the influential or opinion leaders in the community. The third level is the transnational perspective where collective concerns in communities transcend nation-state barriers and converge into transnational CSMs.

We sought to understand the complexity and dynamics of CSMs. By reaching out to existing social theories on CA and computational social network analysis, we have proposed a novel methodological approach to study CSMs from individual, community, and transnational perspectives. The findings in this article also enable us to outline a future research agenda that is geared towards the development of more advanced computational models. Such models would better our understanding of conventional social theories, assist in developing new ones, reinforcing the development of more accurate and efficient social interaction modeling algorithms for diverse environments allowing us to identify political issues and influences as well as to determine the trajectory of emerging CSMs.

Moreover, our findings point out a need to discover further pathways of knowledge to fully understand people's cognitive and social behavior, individually and collectively, in online environments with diverse social, cultural, and political backgrounds. Our future research, thus will attempt to perform cross-cultural analysis, which includes a dataset from non-English speaking communities. Our methodology would continue to embrace the conventional CA theories and help reshape them further to better understand the implication of new forms of communication (facilitated by social media) for CA. Major findings, implications, and future research have been summarized in Table 3.

Envisioning our case study and analysis in the broader context, our research also lends some insights into the relationship between social media and governance. The Al-Huwaider case study presented in this article shows that CA is a form of engagement, especially citizen engagement, acting as a corrective mechanism and it is in itself a part of a governance system. In addition, such actions often also enable new organizational forms as well as refreshingly new forms of citizen and government engagement. Social media lend themselves to give citizens a new voice to be heard and, conversely, encourage citizens to engage and participate. Ongoing citizen participatory actions through social media, such as in online citizen journalism, can provide a mechanism to pursue a better governance through public monitoring for better decision-making, transparency, and accountability. Consequently, social media can potentially be a bridge to connect the government and its citizenry as well as a place where the two parties communicate, have dialogues, and together pursue a democratic form of governance.

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