Chapter 6
Mining Social Media Data to Discover Topics of Sustainability: The Case of Luxury Cosmetics Brands and Animal Testing

Chao Min, Eunmi Lee and Li Zhao

Abstract Animal experiments have been considered necessary procedures for safety verification and effectiveness validation in developing the products that directly affect the human body, such as medicines or cosmetics (Baumans, 2010; Hajar, 2011). For ending animal testing, social media can be a useful and effective tool for those opposed to animal testing and has been shown to produce measurable results (Wilkinson, 2014). The current research regarding sustainability and animal testing hasn't sufficiently taken advantage of the large-scale data set available online. By applying data-mining-based social network analysis, this study used the French cosmetics company NARS as an example to examine how public awareness and reaction to animal experiments is spread on social media. To quantify and identify the online discussion of Instagram and Twitter users across time, we analyzed two networks of hashtags connected through user posts. To generate the nodes, we first crawled all posts containing #animaltesting within four months for Instagram, one week for Twitter. In both networks, nodes are hashtags created by users when they publish posts on certain events. The findings will be useful for cosmetics companies, lawmakers, and animal advocacy organizations in understanding the network and information flow on social media and, in turn, know what information should be posted on social media to engage social media users and build positive brand reputation.

Keywords Animal testing · Data mining · Network · Sustainability

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Introduction

Animal experiments have been considered necessary procedures for safety verification and effectiveness validation in developing the products that directly affect the human body, such as medicines or cosmetics (Baumans, 2010; Hajar, 2011). Millions of animals are used in experiments worldwide each year, and the number of animals used in research has increased with technology advances in the area of medicine and cosmetics (Doke & Dhawale, 2015). As a result, interest in animal welfare that minimizes human's stress on animals and the realization of psychological happiness of animals has increased greatly, especially in developed countries including European nations and the USA (Dawkins, 2012). Recent studies show that Americans' verbal opposition to animal testing has grown significantly since 2001 among people of every gender, age group, and political affiliation (Bruner, 2014). The results are encouraging to animal advocacy organizations and demonstrate how much public opinion regarding animal testing has changed in a fairly short amount of time.

A possible reason is that people have more exposure to information about the cruelty that animals endure in laboratories, and the alternatives that are available (Bruner, 2014). One important channel through which the public can receive information is social media. For ending animal testing, social media can be a useful and effective tool for those opposed to animal testing and has been shown to produce measurable results (Wilkinson, 2014).

In recent years, social media has developed rapidly and has drastically transformed the way in which people communicate and collect information. Social media has become ubiquitous and plays an increasingly critical role in the exchange of information and opinions among the public. As a result, a large amount of user-generated content is available on social media sites such as Facebook, Twitter, and Instagram. Sustainability topics are also under active discussion on social media, and the public and consumers have more access to information on companies' efforts and practices to achieve sustainability (Goswami & Ha-Brookshire, 2015). However, the current research regarding sustainability and animal testing has not sufficiently taken advantage of the large-scale dataset available online. Only a few studies have focused on animal testing and social media, and most of those utilized surveys and interviews to discover how social media could promote sustainable practices (Scholtz, Burger, & Zita, 2016).

A large and diverse audience on the Internet expresses and shares opinions and provides feedback to other users, including media, businesses, and government. Thus, it is often necessary for businesses and policy makers to collect, monitor, and analyze user-generated data on social media sites. Accordingly, these large-scale datasets can be used to glean and identify the needs of the public and consumers and can generate meaningful insights into businesses and policy makers with respect to sustainability topics such as animal testing. Based on the feedback and ideas from social media users, specific actionable areas in which businesses or policy makers are leading and lagging can be found and this insight can further improve their performance in a wide array of fields. In this light, this study aims to (1) investigate

social media activities regarding animal testing through a large amount of user-generated content and (2) identify key influencers and major communities discussing animal testing by utilizing data mining-based social network analysis.

Review of Literature

Current Policies Concerning Sustainability and Animal Testing

Sustainable development has been defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987). Sustainability offers "win–win opportunities" to reconcile "environmental protection and smart economic growth" (European Union, 2006). In this light, animal protection represents such an opportunity and becomes one of the key objectives of sustainable development strategy (Keeling, 2005). In the 1950s, a so-called 3Rs principle of reduction, refinement, and replacement (Russel & Burch, 1959) was proposed and then expanded to promote the welfare of animals used in experiments (Bouhifd et al., 2012). More and more efforts have been developed to minimize or prohibit animal testing mainly in developed countries such as the European Union (EU) member states and the USA. For example, the EU adopted the regulation Registration, Evaluation, and Authorization of Chemicals (REACH) in 2007 to improve human health and environmental protection (European Chemicals Agency, 2017). Further, the EU has banned all animal testing for cosmetics in Europe since March 2013 (European Commission, 2013). These policies and regulations have led to pressure on the industry and promotion of the development of alternative methods to replace animal testing conducted to verify product safety (Basketter et al., 2012).

The cosmetics industry, in which testing on animals to make sure they are safe for consumers was widespread, is considered the area most impacted by these efforts (Long, 2016). Many cosmetics brands, such as L'Occitane, NARS, Estee Lauder, Benefit, and others, are not "cruelty-free" and still use animal testing (Chitrakorn, 2016). Despite the wide availability of alternatives, countless animals are still subjected to hazardous tests around the world due to industry inertia and bureaucracy. However, the EU, the world's largest cosmetics and personal care market, became one of the first regions in the world to ban animal testing for cosmetics (European Commission, 2013). A snowball effect can be observed as more and more countries introduce laws and proposals aimed at eliminating animal testing. In the USA, a bill called the Humane Cosmetics Act (H.R. 4148), which prohibits animal experiments in phases during the development of cosmetics, was initiated in 2014, but until recently, no progress had been made toward its passage. On June 6, 2017, the bill, which outlaws the development, sales, and transportation of animals for the use of animal experiments, entered the first stage of the legislative process (United States Congress, 2017). Figure 6.1 shows the historical paths and

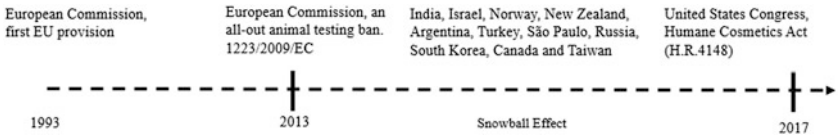

Fig. 6.1 Historical paths of animal testing policies in major countries related to cosmetics industry

the current status of animal testing policies in major countries in the world, especially in the cosmetics industry.

The biggest barrier to progress lies with China, where the cosmetics industry has shown rapid economic development (Lopaciuk & Loboda, 2013). China is a giant cosmetics market that cannot be ignored by multinational cosmetics companies, and many cosmetics and healthcare research and development centers there conduct experiments on various animals (Lu, Bayne, & Wang, 2013). Under the law amended on June 30, 2014, China issued the legal requirement that makeup products, perfumes, and skin, hair and nail care products manufactured and sold in China must be first tested on animals (Human Society International, 2017). The People for the Ethical Treatment of Animals (PETA) estimated that about 300,000 animals were sacrificed due to the mandatory Chinese animal testing enforcement since 2014 (Yan, 2017). China has been challenged by international animal rights organizations and NGOs over animal welfare and protection, and groups such as PETA are actively holding campaigns against animal experimentation and exports (Bayne, Ramachandra, Rivera, & Wang, 2015; Lu et al., 2013). The Chinese government has also been under the pressure of trade sanctions due to animal testing since joining the World Trade Organization (WTO) (Lu et al., 2013). In particular, PETA has been working to persuade the Chinese government to accept test results through alternative methods other than animal testing, and the Chinese government has stated that it will accept data from a non-animal test method for safety evaluations of cosmetics (PETA, 2012; PETA, 2016). However, the current laws and regulations of the Chinese Food and Drug Administration (CFDA) are still demanding animal testing results (Human Society International, 2017). With these small changes taking place, advocates for an animal welfare group are anticipating more advances under the policy on animal testing in China.

Social Media Influence on Sustainability and Animal Testing

The trend of public pressure is toward ending animal testing. Individuals, policy makers, and cosmetics companies will need to engage in a wide range of non-animal testing practices to address problems and challenges. As more and more consumers become aware of the realities of animal testing, dealing with public relations will be a nightmare for cosmetics companies (Chitrakorn, 2016; D'Souza, Taghian, Lamb, & Peretiatkos, 2006; Ramli, 2016). The emergence of social media

has created an opportunity for organizations such as companies and governments to manage their reputations and maintain relationships with the public (Lovejoy & Saxton, 2012; Wright & Hinson, 2011). Previous studies have found how the ubiquity of social media affects government interests, and policy accordingly reacts to it (Shirky, 2011). Therefore, social media can bring various stakeholders of the cosmetics industry together onto a new playing field.

Social media is widely used to acquire and share new knowledge and build relationships and is a useful tool for spreading campaigns around the world through the reach of online communication without cost and distance constraints (Hou & Lampe, 2015). According to the Social Media Industry Report (Stelzner, 2013), corporate marketers consider social media channels to be an important component of their marketing strategy and many nonprofit organizations in the USA believe that social media is an innovative communication means that will replace traditional Web sites (Nonprofit Technology Network, 2011). Using social media, positive messages such as animal protection campaigns are effectively conveyed, but it is also a vehicle for spreading information about negative events and forging public opinion. When a big news event occurs, social media spreads and propagates the information through social networks to people who are not aware of the news. Since July 28, 2017, when NARS, a French cosmetics company, stated on its Instagram account that animal testing is necessary to sell their products in China (NARS, 2017), there have been 250,000 e-petitions calling on the company to stop selling its products in China (Salemme, 2017). It is apparent that the use of social media among the younger generation is relatively high and social media is a powerful tool to deliver messages.

A few studies have researched how the public becomes aware of and reacts to animal experiments and the resulting shifting attitudes on social media (Goodman, Borch, & Cherry, 2012). The Gallup organization conducted an annual "Values and Beliefs" survey of 1000 American adults from 2001 to 2013 (PETA, 2014). Results showed that since 2001, there has been a yearly increase in the number of respondents being of the opinion that animal experiments are morally wrong. The results were disparate according to genders, respondents' age groups, and education levels. With respect to age groups, the younger generation from 18 to 29 years of age (54%) was more negative (opposed to testing) than those in their 30 s (about 33%) (PETA 2014). Interestingly, the younger generation's opposition to animal experiments increased to 54% in 2013, compared to 31% in 2001. This trend is due to the increased use of the Internet and social media during this period (PETA, 2014), along with an increase in interest in animal welfare (Morell, 2014). The fact that organizations such as PETA and the Foundation for Biomedical Research, which work on behalf of animal rights and welfare, have a strong presence on Facebook, Instagram, and Twitter indicated that social media has a great influence on the animal testing issue (Grimm, 2014; Wilkinson, 2014). Social media campaigns by animal rights organizations have been successful in raising public awareness of certain issues related to animal experimentation (Ormandy & Schuppli, 2014). This is further illustrated by the large memberships of social media groups with an animal rights or welfare focus (Ormandy & Schuppli, 2014) such as PETA, which has over 5.3 million Facebook likes and 1.04 million Twitter

followers (PETA "Home," 2017). It is apparent that social media has a great influence on forming public opinion related to animal testing.

Nonetheless, the role of social media in driving the opposition to animal testing and shaping public debates has not been sufficiently investigated. This study investigated how the issue of animal testing has been communicated, how it is shared, and what kinds of responses related to the topic can be found on social media. Specifically, as described in the next section, one event related to animal testing on social media was selected and a novel approach—data mining-based social network analysis—was used to analyze social media data.

Context and Approach

Research Context

This study focused on the two dominant social network sites worldwide: Twitter and Instagram. Twitter, which was founded in 2006, has around 330 million monthly active users as of the third quarter of 2017 (Statista, 2017a, b). It allows its users to post short messages limited to 140 characters and upload photographs or short videos via the Web or a mobile phone (Statista, 2017a, b). As one of the most popular social media platforms, Twitter enables its members to share and discover topics of their choice in real time (Statista, 2017a, b). One unique feature of Twitter is known as a "retweet," which enables its users to forward a tweet to their followers. This retweet function facilitates rapid dissemination of information to a larger public since retweets often reach beyond the original tweet's followers (Kwak, Lee, Park, & Moon, 2010). Another characteristic of Twitter is the use of hashtags and the reply function. A hashtag is a convention among Twitter users to set a thread of discussion by prefixing a word with a "#" character. This hashtag allows users to identify and emphasize their topics of interests and effectively target the intended audience (Thelwall, Buckley, & Paltoglou, 2011). The reply symbol, which is indicated as "@," allows Twitter users to post their messages to another Twitter user, thus facilitating effective discussions and engagement of larger audiences (Kwak et al., 2010). The @ sign and the hashtags are effective strategies used by Twitter users in order to relate one tweet to another in regard to a certain topic in real time. Therefore, messages and opinions are able to rapidly reach a wider audience (Thelwall et al., 2011).

Another form of communication, Instagram users can easily share their updates by taking photographs and short videos and adding hashtags to link the photographs and videos up to other content on Instagram featuring the same subject or overall topic (Sheldon & Bryant, 2016). Through the platform, other users can follow, view, like, and comment on these posts. Additionally, since it was acquired by Facebook in 2012 (Luckerson, 2016), Instagram has become one of the most popular social media platforms worldwide by benefiting from its association with Facebook, which allows Instagram content to be posted on Facebook

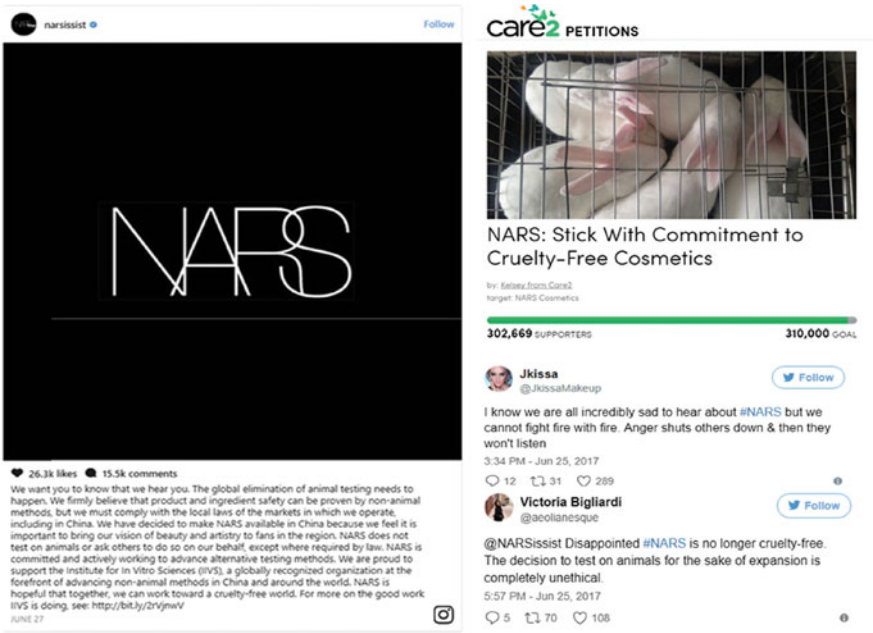

Fig. 6.2 NARS's statement about animal testing on Instagram, Care2 campaign, and consumers' opinions on Twitter. Captured on Oct 27th, 2017

simultaneously (Kawasaki & Fitzpatrick, 2014). It has 800 million monthly active users as of September 2017 (Statista, 2017a, b). Instagram users include both individuals and businesses, and their posts are generally annotated with hashtags, short texts, or keywords to be searchable.

Along with its enormous user base and powerful dissemination with hashtags, Instagram is a valuable social media channel for cosmetics brands to communicate with consumers. More than one million monthly cosmetics commercials were active on Instagram as of March 2017 (Statista, 2017a, b). Moreover, Instagram is powerful among teenagers and young millennials as more than half of the USA. Instagram user base is between the age of 18 and 29. Considering that millennial women ages 18–34 are the dominant consumers of cosmetics products (McCarthy, 2016), it is apparent that Instagram messages, topics, and agendas with respect to cosmetics is highly important to the cosmetics industry. Therefore, one recent event related to animal testing in the cosmetics industry was selected in this study to discover the influence of social media on forming public opinion about animal testing—NARS and #animaltesting. Twitter data was collected accordingly to determine whether people show different opinions on these two social media platforms.

NARS, a luxury makeup brand, recently decided to discontinue its cruelty-free status and conduct testing on animals in order to enter the Chinese market (Saltzman, 2017). It was a disappointing decision for many fans who love the makeup brand. On June 27, 2017, NARS posted a statement on Instagram to explain the circumstances

and the company's vision about animal testing. By October 27, 2017, within four months of this post, more than 15,500 comments were made. In addition, a new campaign by Care2 is calling for NARS to stop animal testing that has more than 300,000 signatures on an e-petition. The hashtag #animaltesting is used to join the discussion, and it has been promoted to attract more individual users and become a "trending" topic. The analysis of Instagram posts and tweets with the hashtag #animaltesting in this study revealed what people talk about and feel regarding animal testing. Figure 6.2 shows relevant information about this event.

Research Approach

Data mining-based social network analysis was used in this study. Web sources such as Twitter, Instagram, and Facebook have been commonly used in academic research in recent years (Sheble, Brennan, & Wildemuth, 2016). A wide range of techniques has been used in this research, and techniques for social network analysis using such data are still being developed (Son, 2016). Data mining-based social network analysis was used in this study to investigate the pattern of discussion regarding animal testing on Instagram. Social network analysis (SNA) has been used as an effective tool to understand the social organization of groups based on the associations or interactions between individuals (Wasserman & Faust, 1994). Additionally, social network analysis enables researchers to quantify and interpret the relationships among social entities that may be single individuals, groups of individuals, communities, or organizations (Cronin, 2016).

A social network is a social structure of people related (directly or indirectly) to each other through a common relation or interest (Liu, Sidhu, Beacom, & Valente, 2017). Computer-supported interpersonal communication, such as social media, has changed the way people connect with each other (Wellman, 2001). Computer networks are inherently social networks, linking people, organizations, and knowledge. With the massive data on the Internet, large-scale data sets can be obtained and utilized to understand people's behavior in the digital world. Researchers in computer science have proposed data mining-based social network analysis to describe their experiences in climbing the obstacles of informational challenges (Zuber, 2014). Data mining refers to the process of automated information extraction using as input a variety of complex or unstructured data sources (Feldman & Sanger, 2007). The data embedded into this social network is measured by databases and statistically prepares related messages to categorize the thoughts and people's behavior (Srivastava, Ahmad, Pathak, & Hsu, 2008). Data mining-based social network analysis would be a valuable approach for us to explain complex data sources and the social structure of social media users.

Network exchange theory, network flow theory, small world theory, and the strength of weak ties theory are often used to provide theoretical foundations of social network analysis (Borgatti & Lopez-Kidwell, 2015). The strength of weak ties claims that two people under strong ties tend to have overlapped social lives and have ties with a third person in common (Granovetter, 1973). Additionally, the

two people and the third person also tend to be similar in lifestyle and tastes (Granovetter, 1973). By contrast, a person who has loose ties to people and do not have common third persons can be a source of novel ideas and information (Granovetter, 1973). The theory of strength of weak ties has been applied to explain information flow and the ties within social networks. Borgatti and Lopez-Kidwell (2015) argue that the weak ties between persons in different social networks provide powerful strengths in that it has the potential of providing novel information.

Combined with mathematics methodologies, computer science and social science have together enhanced the foundation and presence of social network analysis and visualization as an interdisciplinary field (Bruns, 2012). In particular, researchers employing these methods have shown high interest in online social networks since the analysis of the online networks offers immense insights into researchers through the interleaving of human interactions (Zuber, 2014). Moreover, the abundance of readily accessible and apparently objective data on online social networks has attracted researchers (Bruns, 2012). It is easy and convenient to obtain information on who, what, when, how, where, and why from online social media platforms (Bruns, 2012).

Social network analysis (SNA) is often characterized as being visualized through nodes, ties, links, or edges (D'Andrea et al., 2010). While nodes indicate individual actors, people, or things within social networks, ties and links represent relationships or interactions that connect each node (D'Andrea et al., 2010). Visual representation of social networks analysis is important for delivering and interpreting network data and the result of the analysis (Freeman, 2000). Network visualization has the potential to provide insight into relationships among individual nodes and network structure and provide a much more abundant representation (Cronin, 2016). Numerous methods have been developed to visualize social network analysis (Caschera, Ferri, & Grifoni, 2008). Exploration of the data is implemented through displaying nodes and ties in a wide array of layouts and assigning diverse colors, size, and other advanced properties to nodes and links. Visual representations of networks may be a powerful tool to efficiently deliver complex information, but special attention is required to interpret nodes and graphics from visual displays.

Method

Instagram posts with the hashtag #animaltesting were crawled and limited dates from June 27, 2017, to October 27, 2017, four months since NARS posted a statement on Instagram to explain the circumstances of its decision and its vision about animal testing. Researchers obtained 3481 posts, among which 9029 hashtags were extracted and 22,617 edges between these hashtags were constructed based on hashtag co-occurrence in an Instagram post. In addition, to compare different social media platforms, tweets with the hashtag #animaltesting were crawled and limited dates from June 27, 2017, to July 4, 2017, one week from the NARS statement. Researchers obtained 3132 tweets, among which 251 hashtags were extracted and 251 edges between these hashtags were constructed based on hashtag co-occurrence in a tweet.

To quantify and identify the online discussion of Instagram and Twitter users across time, we analyzed two networks of hashtags connected through user posts. In both networks, nodes are hashtags created by users when they publish posts on certain events. To generate the nodes, we first crawled all posts containing #animaltesting within four months for Instagram, one week for Twitter. We then extracted all hashtags, which are naturally good representations of topics being discussed, from the Instagram and Twitter data. These became the initial nodes for the networks. To create edges between nodes, we look to the co-occurrence of hashtags in the same Instagram post or tweet, connecting two nodes if they occurred in the same post.

After the dataset was prepared, Gephi was used to analyze and visualize Instagram and Twitter data. Force Atlas layout algorithm was applied for Instagram network visualization. Fruchterman Reingold layout algorithm was employed for Twitter network visualization. With different algorithms, we aim to demonstrate different layout and visualization effects. Degree centrality, betweenness centrality, closeness centrality, and K-core were used as key indicators to measure the importance of a node in the network (Kitsak et al., 2010). As there can be hundreds of nodes and thousands of edges in the networks, we applied filters for some conditions (e.g., limiting node degree, K-core, or tag frequency) to present the core structure of topic discussion networks. We used Gephi's algorithms to roughly categorize the nodes into different clusters where hashtags in the same cluster are viewed to discuss related topics. For a better visualization effect, the nodes and edges are colored according to the groups that the nodes belong to.

Results and Discussion

Instagram Network with #Animal Testing

Figure 6.3 provides a visualized #animaltesting network on Instagram. Animal testing was shown as the central node in the Instagram network. According to

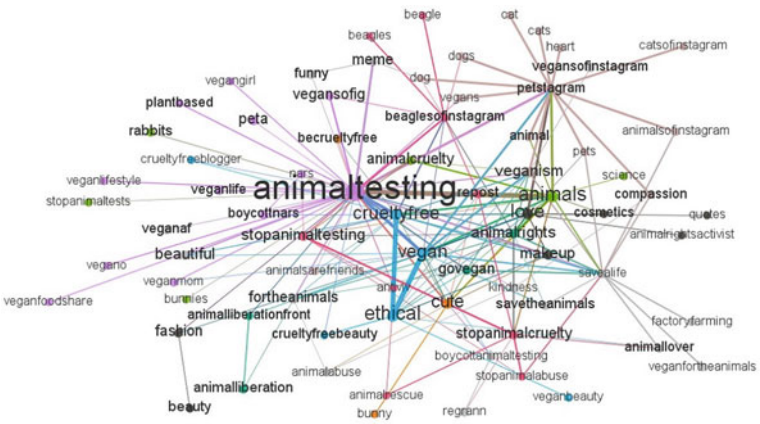

Fig. 6.3 Visualized #animaltesting network on Instagram

betweenness centrality, which indicates how often it appears between any two random nodes in the network (Freeman, 1977; Brandes, 2001), several nodes appeared as key junctions for communication within the network. These nodes were more influential as they were with the higher betweenness centrality. These nodes include #petstagram, #savealife, #vegan, #crueltyfree, #ethical, and #beagles of Instagram. Lots of Instagram users care about animal testing-related information because of their pets. Pet owners love to share photographs of their pets on social media. #petstagram and #beaglesofInstagram have turned many pets to social media stars. Pet owners love their pets and often think of their dogs and cats as members of the family (Kaplan, 2017). Empathy motivates them to promote the campaign against animal testing.

The network from Instagram regarding animal testing demonstrated a wide range of sub-themes as well. Distinct hashtag communities were present within the network classified by different colors. Pink color with the hashtag #animaltesting as the central topic emerged as the largest community in the network. Other topics with this community include #boycott NARS, #stopanimaltesting, #animalcruelty, #becrueltyfree, #vegansofig, #veganlife, #rabbits, #peta, #beaglesofinstagram. From the texts, it can be assumed that the communities that belong to the pink color are the most proactive in the opposition to animal testing and have a high interest in practicing vegan life. Rabbits and beagles are commonly used animals for experiments and PETA is an animal rights organization with the slogan "Animals are not ours to eat, wear, experiment on, use for entertainment, or abuse in any other way" (PETA, 2017). Additionally, pink color community indicated a great interest in vegan life with the hashtags #veganfoodshare, #veganmon, #vegano, #veganaf, #veganlifestyle, #veganlife, #vegansofig, #vegangirls, and others.

The second largest community in brown color with the main hashtag #petstagram indicated affection for animals and animal welfare. Other topics in this network include #dog, #cat, #heart, #pets, #animalsofinstagram, #catsofinstagram. It can be assumed that they own dogs or cats, so they want to share their love for animals and interact with other Instagram users who have the same concerns and interests. The community with blue color texts mainly showed the concerns about animal testing itself. Its hashtags include #crueltyfree, #ethical, #vegan. Green color texts indicated high relevance to brown color texts in that they care about animal love and rights. Its hashtags include #animals, #animalrights, # love, #savealife, #science, #animalcruelty.

Notably, #makeup, #cosmetics, #beauty, and #fashion were shown in the network with gray color community. As NARS is a well-known cosmetics brand, Instagram users wish these brands can work toward a cruelty-free world. Hashtags #makeup and #fashion have a relatively higher degree for their betweenness centrality. It means they are important local hubs for certain communities. However, they are not serving as important junctions for meaning circulation within the whole network. That is, there is a group of people who might be specifically interested in cosmetics brands and animal testing. However, beauty and fashion brands have not taken enough responsibilities to eliminate animal testing. Table 6.1 shows the top 15 nodes in the network and their betweenness centrality, top 15 nodes with degree information, and top 15 co-occurrence times on Instagram with #animal testing (Fig. 6.3).

Table 6.1 Instagram top 15 nodes with degree information, top 15 nodes in the network and their betweenness centrality, and top 15 co-occurrence times

Top 15 nodes with degree		Top 15 betweenness centrality		Top 15 co-occurrence times		
Label	Degree	Label	Betweenness centrality	Source	Target	Weight
Animal testing	1575	Animal testing	2912.207	Animals	Animal testing	100
Animals	575	Petstagram	850.344	Ethical	Vegan	94
Ethical	552	Save a life	664.256	Ethical	Cruelty Free	86
Love	512	Vegan	506.644	Animal testing	Cruelty Free	68
Cruelty free	436	Cruelty free	490.745	Animal testing	Vegan	66
Vegan	417	Animals	382.624	Petstagram	Animal testing	50
Cute	357	Ethical	352.574	Petstagram	Animals	50
Animal rights	292	Beagles of instagram	309.002	Petstagram	Animal	49
Veganism	285	Love	281.084	Petstagram	Love	48
Makeup	281	Meme	222.951	Petstagram	Dogs	47
Stop animal testing	272	Veganism	194.498	Petstagram	Dog	47
Beautiful	258	Go vegan	172.985	Petstagram	Pets	47
Art	251	Animal rights	167.774	Meme	Animal testing	46
Fashion	208	Cute	132.844	Petstagram	Cats	46
Peta	206	Kindness	132.605	Petstagram	Compassion	46

Twitter Network with #Animal Testing

Similar to the Instagram network, #animal testing was shown as the central node in the twitter network. The hashtag #love, #cruelty free, #morals, #3Dpring emerged as the most influential nodes within the network. Interestingly, Twitter users focused more on non-animal alternatives, such as 3D printing. Using 3D-printed skin to evaluate cosmetics is a hot topic in the beauty industry (Ashton et al., 2014). 3D skin innovation is viewed as an alternative to animal testing (Ashton et al., 2014). Also, #worldwide, #canada, and #fukushima were present in the network. According to the latest data of Twitter user demographics, 79% of Twitter accounts are based outside the USA (Aslam, 2017). Compared to Instagram, animal testing attracts attention worldwide on Twitter. Several distinct communities were categorized by different colors in the network. Most communities are similar to Instagram. However, it shows more variety of topics and interest. Not surprisingly,

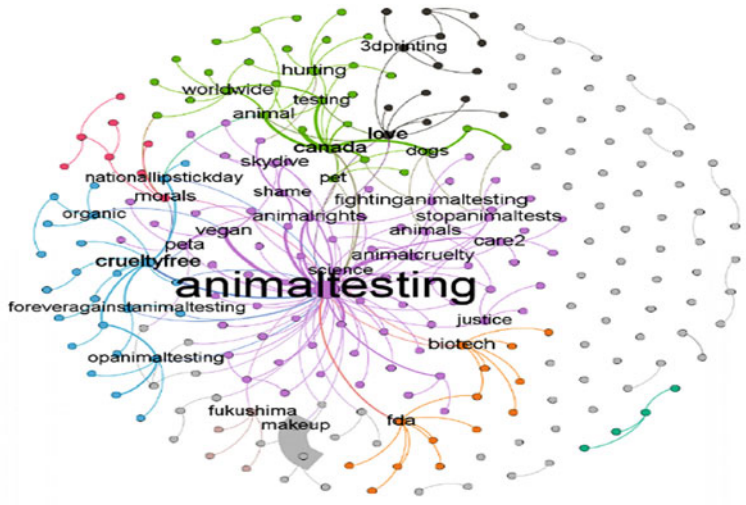

Fig. 6.4 Visualized #animaltesting network on Twitter

#makeup and #national lip stick day indicated that animal testing issues are associated with the beauty industry. Especially, according to co-occurrence times, when Twitter users tag #animaltesting, they often tag #NARS at the same time, which indicates the brand image of NARS is now negatively associated with animal testing. Table 6.2 shows the top 15 nodes in the network and their betweenness centrality, top 15 nodes with degree information, and top 15 co-occurrence times on Twitter with #animaltesting (Fig. 6.4).

Conclusions and Implications

Animal experiments have become a worldwide topic that attracts attention from industry professionals, consumers, policy makers, and scholars (Hou & Lampe, 2015). Social media can be a useful tool to educate consumers, build relationships, and promote sustainability. This study used the French cosmetics company NARS as an example to examine how public awareness and reaction to animal experiments is spread on social media. Social network analysis was used to study interactions regarding #animaltesting between social media users on both Instagram and Twitter. Social network analysis provides techniques to analyze the structure of a network and identify influential nodes in online communities. Four months of data after the NARS event were tracked on Instagram while one week of data was tracked on Twitter. Social media users on both Instagram and Twitter showed high interest on #vegan, #crueltyfree, #ethical, and #love. Several influential nodes revealed that the beauty industry is highly related to animal testing issues.

Table 2 Twitter top 15 nodes with degree information, top 15 nodes in the network and their betweenness centrality, and top 15 co-occurrence times

Top 15 nodes with degree		Top 15 betweenness centrality		Top 15 co-occurrence times		
Label	Degree	Label	Betweenness centrality	Source	Target	Weight
Animal Testing	66	Animal testing	13864.799	Makeup on animals	Makeup	35
Cruelty free	12	Love	2931.284	Canada	Save the dogs	6
Canada	12	Canada	1864.230	Animal testing	Vegan	5
Love	10	Cruelty Free	1845.558	Animal testing	Animal cruelty	4
Hurting	9	Animal	1629.094	Animal testing	Boycott	4
Animal rights	8	Morals	1515.994	Animal testing	NARS	4
Care2	8	3D printing	1240	Canada	Testing	4
Biotech	8	FDA	1153.833	Canada	Animal	4
FDA	8	Hurting	1007.682	Canada	Dogs	4
Worldwide	8	Biotech	981.1667	Animal testing	Animal rights	3
Animal	7	Worldwide	858.856	Animal testing	Cruelty free	3
Animal cruelty	7	National lipstick day	751.330	Canada	Share	3
Peta	7	Organic	726.833	Domains	Cats	3
Stop animal tests	7	Care2	724.5	Domains	Dogs	3
Animals	6	Go vegan	715	Animal research	Animal testing	2

The hashtags #makeup, #fashion, and #beautiful on Instagram and #nationallipstickday and #NARS on Twitter all showed that the NARS event had an enormous impact on attitudes and perceptions toward animal testing on social media. Social media users showed their support of using cruelty-free cosmetics and ending animal testing for beauty products.

Instagram users often link their love of pets to the anti-animal testing mindset and action. However, Twitter users focus on alternatives to animal testing, such as 3D printing and biotech. Twitter reached a variety of audiences and attracted worldwide intention. Interestingly, #Canada emerged on Twitter due to the news that the Cruelty-Free Cosmetics Act (S-214) was passed by the Senate Standing Committee on Social Affairs, Science and Technology in Canada (Graef, 2017).

It shows that Canada could be next to ban animal testing for cosmetics. In addition, some animal advocacy organizations such as PETA and Care2 influenced a great many people on social media. PETA and Care2 have a high number of people liking, sharing, and commenting on their tweets and Instagram pictures. They have led many social media campaigns and try to reach consumers around the world and convince them to avoid cosmetic companies that test their products on animals.

The findings will be useful for cosmetics companies, lawmakers, and animal advocacy organizations in understanding the network and information flow on social media and, in turn, know what information should be posted on social media to engage social media users and build positive brand reputation. In particular, personal and emotional messages can make people feel touched and remind them of their own pets. Then, more people will help oppose animal testing activities. At the same time, logistical responses should be noticed by cosmetics companies, lawmakers, and animal advocacy organizations. Valuable information such as alternatives to animal testing can convince and guide people to support ending animal testing for cosmetics. In addition, key influencers in each community were identified in this study. By targeting key influencers, cosmetics companies, lawmakers, and animal advocacy organizations will be able to spread relevant information more quickly and effectively. Additionally, data mining-based social network analysis has been confirmed as a promising approach to understanding new phenomena in social networking by taking advantage of large-scale datasets available on Internet.

Limitations and Future Research

This study offers future research opportunities. First, even though four months of data were collected on Instagram, this study did not investigate information mobilization. It would be very interesting to see how social media users shift their attitudes and change their opinions over the time. Second, people from different countries may have their own understanding about animal testing. It would be very important to track geographic locations of social media users in order to customize a social media campaign for different needs and focuses. Third, future research may want to focus on China where the cosmetics industry has seen rapid economic development. Since China has its unique social media platforms, understanding how social media users react to animal testing is critical for educating Chinese cosmetics consumers and promoting non-animal testing procedures.

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