The Case for Asymmetry in Online Research:
Caring About Issues in Australian and Canadian Web 1.0 Bee Networks

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We critically engage with the actor–network theory precept that human and nonhuman actants have symmetrical capacities. In contrast, we distinguish actor-actants, who have the capacity to care about other actants, from issue-actants, who do not. We explore the gathering of participants leading to the emergence of matters of concern by mapping how Australian and Canadian bee-related websites connect to the issue of bee extinction ("colony collapse"). A "symmetrical" hypothesis was that major differences in local geographies and exposure to parasites would result in different rates of connection. This hypothesis was confirmed: All influential Canadian actor-actants connected to "colony collapse," whereas no influential Australian actor-actants did. Our findings also suggest an "asymmetrical" interpretation: Influential Australian actor-actants were aware of the catastrophic disappearance of bees, but did not care. Denying that some actants have agency over others means that it is impossible to form a moral opinion about connections or about the rights of dominated actor-actants.

Keywords: species extinction, agency, actor–network theory, online networks, bees, environmental communication

In 2018, traditional and social media in Australia, the United Kingdom, and the United States were awash with commentary and debate about whether the exploitation of bees in the pollination of some monocultural crops of fruits and vegetables makes these foods unsuitable for vegans (Judkis, 2018; Webster, 2018; Wilkinson, 2018). Avocados and almonds grown on a large scale in some geographical areas

require "trucking in" bees to provide their pollination services, and this transportation and displacement of bees have been shown to be detrimental to their health. This media event is symptomatic of growing public interest in the lives of bees over the last decade, which began when a significant increase of so-called "colony collapse disorder" was detected in the United States in the mid-to late 2000s and bee populations across the world went into decline. Most of this interest has focused on the negative impacts for humans and the future food supply if fewer bees are available to pollinate crops (Benjamin & McCallum, 2009; Gallai, Salles, Settele, & Vaissière, 2009; Sharma & Abrol, 2014; van der Sluijs & Vaage, 2016), so the bee–vegan debate shifts attention to the rights of the bee. To understand why concern for these rights emerges, or does not emerge, we build on the question articulated by Latour (2004) in his discussion of how matters of fact become matters of concern: How many participants are gathered in a thing to make it exist and to maintain its existence?

The article has both empirical and theoretical aims. We empirically investigate how matters of concern come into being by framing the gathering of participants as the establishment of connections between organizations and issues in a local context. We test this proposition through a comparative case study: Given comparable network and societal characteristics, to what extent might local circumstances mean that issue x spreads in network $N1$, but not network $N2$? Our findings support the idea that local connections lead to the emergence or lack of emergence of matters of concern. We call this a "symmetrical" approach, which accords with actor–network theory's reference to "actants" rather than "actors" to overcome the divide between subjects and objects, humans and nonhumans, within relational assemblages.

Our findings also point to another explanation for the existence of connections between actors and issues: Some actors in $N1$ care and act about issue x, whereas similar actors in $N2$ do not care and do not act; we refer to this as an "asymmetrical" approach, as not all actants can care and act. Davis (2020) writes in *How Artifacts Afford* that "the main trouble with [actor–network theory] is its symmetrical treatment of all 'actants' within a web of relations" (p. 53), and our broader theoretical aim is to contribute to ongoing discussions about actor–network theory's difficulties in accounting for power, politics, and inequality. Our specific contributions are to distinguish "actor-actants" who can care from "issue-actants" who cannot, and to consider the moral implications of the existence of asymmetrical levels of agency.

Our methodology is social network analysis, a structural approach that measures the properties of nodes, such as connectedness to others, and of networks, such as density of connections. In line with previous investigations of online sociality (Ackland & O'Neil, 2011; O'Neil & Ackland, 2019a, 2019b), we collected and analyzed hyperlink and semantic network data. Our data sets of interconnected websites were harvested using the VOSON research tool and we document our methodological choices so that our $N1$ and $N2$ networks are, if not fully comprehensive, at least comparable.

The article unfolds as follows: Our second section presents approaches to the connection of actants in the online environment that adopt a symmetrical or actor–network theory-inspired perspective. Our third section defines our research question—Why do these connections sometimes not occur?—and the "symmetrical" hypothesis that networks have distinct local characteristics (in this case, different geographies and exposure to parasites), leading to different rates of connection to issue-actants in equivalent Australian and Canadian groups of websites. Our fourth section presents our methods for collecting online data and for

classifying actor-actants and issue-actants. In our fifth section, we examine these data using social network analytical metrics and our findings lead us to define, in addition to the symmetrical approach to the gathering of actants, an asymmetrical approach whereby actor-actants have the capacity to select or ignore issue-actants they care about (provided they are aware of their existence). Our sixth section addresses the analytical and moral implications of these contrasting approaches to the emergence of matters of concern. Conclusions are provided in the final section.

Background: Connections Among Actants

We distinguish covert and overt means of establishing connections between issue-actants (e.g., stories or hashtags) and actor-actants (e.g., people or organizations). In the first instance, actor-actants covertly manufacture concerns. For example, the Institute for Public Affairs, a Melbourne think tank funded by North American and Australian oil and mining industry actor-actants (Hamilton, 2012; Readfearn, 2018), was shown to have manufactured and disseminated, via conservative Murdoch-owned newspapers, climate change "fantasy themes" that sought to discredit the science of global warming (McKewon, 2012; see also Oreskes & Conway, 2010). Another example is when Russian Internet Research Agency "troll" Twitter accounts attempted to sow division in the United States by emphasizing racially inflammatory material (Jensen, 2018; Stewart, Arif, & Starbird, 2018). In contrast, our focus is on actor-actants who overtly care about issue-actants. The notion that "issues make publics" was articulated by Dewey (1927/1991) when he wrote, "The public consists of all those who are affected by the indirect consequences of transactions to such an extent that it is deemed necessary to have those consequences *systematically cared for* [emphasis added]" (pp. 15–16). Publics come into being as a response to issues as they currently exist, as well as in anticipation of their future impact; different publics may be constituted in response to the same issue.

We now outline symmetrical approaches to the connection of online actants. Marres (2007) proposes a science and technology studies perspective on public involvement in politics, which focuses on the attachments that people mobilize (and that mobilize people) in the performance of their concern with public affairs. With the development of social media, increased attention has been paid to platform affordances. Social networking and microblogging platforms are richly structured, with more "grammars of action" such as likes, replies, and retweets than what is allowed by Web 1.0 (Rieder, 2013). The bias and "noise" inherent in these proprietary platforms, whose inner workings are mysterious, have become a central concern (Marres & Moats, 2015; Rogers, 2018). In line with Bloor's (1982) analysis of controversies, Marres and Moats (2015) make a case for symmetry in online research: Controversies are events composing a mix of social, political, and scientific facets whose myriad connections all need to be equally mapped out, with no imposition by the researcher of what is at stake. The dynamics of events and of digital platforms should be paid equal attention as the most popular or "retweeted" content on Twitter may not be the most relevant, but rather the most Twitter-friendly, so that "we may only be finding out more about the logic of the platform itself, rather than the issue under study or the eventfulness of a particular tweet" (Niederer, 2019, p. 36).

These perspectives are inspired by actor–network theory; it is therefore necessary to provide a brief overview of this conceptual framework. Central to actor–network theory is the idea that humans and technologies are mutually shaping entities that engage in multifaceted webs of relations or "assemblages" with no preference or distinction between people and things. Actor–network theory is based on a "symmetric

metalanguage" (Callon & Latour, 1992) and the decision "that whichever term is used for humans we will use it for nonhumans as well. . . . By doing this crisscrossing of the divide we hope to overcome the difficulty of siding with one and only one of the camps" (Callon & Latour, 1992, p. 354). This commendable ethic of inclusion means that all members of the network are considered actants and all actants combine to create an assemblage.

For Latour, contextualizing the movements of entities through networks represents an imposition of the researcher's preconceived notions onto data: "Instead of trying to simulate and predict the social orders, we . . . prefer letting the agents produce a dynamic and collect the traces that their actions leave as they unfold so as to produce a rich data set" (Latour, Jensen, Venturini, Grauwin, & Boullier, 2012, p. 605). Actor–network theory's main epistemological concern is tracing the unfolding of connections. Working within these parameters, Venturini (2010, 2012) developed an empirical framework for "social cartography" or "controversy mapping." A controversy is a situation in which actants disagree, and research into online controversies should be proportional: Viewpoints should be given different visibility according to their representativeness, or how many actors subscribe to them; to their influence, as influential actors have better chances of shaping controversies; and to their interest, given that disagreeing minorities may offer new perspectives and challenge taken-for-granted assumptions (Venturini, 2012). Rogers, Sánchez-Querubín, and Kil (2015) use this framework to map how "associations are forged, and oppositions developed [so that] the constant renegotiated nature of the social is palpable" (p. 43). They also suggest that "cold controversies," "past controversies," and "underground controversies" should be avoided by analysts as they are not active or visible enough. Furthermore, social cartographers need to give "boundless controversies" a wide berth. This last recommendation serves to sidestep the empirical conundrum posed by an actor–network theory approach: Given that connections and translations potentially go on forever, when should one stop tracing?

Although some actor–network theory analysts might say that they do not concern themselves with nodes and edges, but rather with how forces, actants, elements, and concepts become associated in an actor-network, social cartography goes some way toward a form of network measurement. For example, "representativeness" and "influence" (Venturini, 2012) resemble social network analytical metrics: Influential actants are likely to be the most central in a network. In this article, we use social network analysis metrics to map the gathering of actants that leads to the formation of matters of concern.

Hypothesis and Case Study

In line with the symmetrical perspectives outlined above, we posit that local contexts and connections explain why matters of fact become matters of concern. We now detail our case study and hypothesis.

Colony Collapse Disorder

Factors influencing bee decline are complex and deeply interwoven with human actions that appear to be impacting bees' cognition, thus inhibiting their capacity to go about their usual business. Identified impacts include the use of neonicotinoid pesticides, lack of biodiversity in intensive farming practices, climate change and resulting increases in erratic weather that impact flowering, and the spread of pests and diseases

such as varroa mites in global bee populations (Klein, Boreux, Fornoff, Mupepele, & Pufal, 2018). Recognition of the death of colonies in "unusual circumstances" prompted the introduction of the nomenclature "colony collapse disorder" in 2006–2007 (Nimmo, 2015), which, in the following years, was identified as causing ongoing deaths and great concern for beekeepers (Andrews, 2019).

Rising public concern has prompted intense focus on identifying the root causes of colony collapse disorder. This has been marked by considerable divides among stakeholders, including hobbyist beekeepers, large biotechnology groups, agricultural and pesticide companies, entomologists, ecologists, and commercial growers reliant on bee pollination services to produce food (Andrews, 2019; Nimmo, 2015). The competing approaches to colony collapse disorder have been criticized for being dominated by reductionist approaches that distract from concerns for bee health (particularly the destructive potential of the varroa mite), the multilayered and interrelated factors that impact it, and indeed the nuances and complexities of human–insect and human–nature relations in the Anthropocene (Watson & Stallins, 2016).

Hypothesis: Local Contexts Lead to the Emergence of Matters of Concern

Our hypothesis is that the distinct local characteristics of Australia and Canada in terms of geography, climate and weather, recent experiences with specific parasites and diseases, and resulting biosafety regimes will cause actor-actants to react markedly differently to the disappearance of bees. To test this hypothesis, we tracked the spread of concern for the global decline in honeybee numbers (as proxied by the adoption of the term *colony collapse*) in two networks composing similar clusters of actor-actants.

We collected data on bee-related online networks in Australia and Canada, countries with similar land masses, postcolonial histories, multicultural societies, disadvantaged indigenous populations, and agribusiness and extractive industries-oriented economies. Although Hofstede's (2001) comparative categories have been challenged by McSweeney (2013) as "implausibly deterministic," they remain a useful tool. Australia and Canada score quasi-identically in five of six of Hofstede's "cultural dimensions" as indicated by consulting the Hofstede Insights Country Comparison[2]: power distance (Australia: 38, Canada: 39), individualism (Australia: 90, Canada: 80), masculinity (Australia: 61, Canada: 52), uncertainty avoidance (Australia: 51, Canada: 48), and indulgence (Australia: 71, Canada: 68). The one significant difference is long-term orientation (Australia: 21, Canada: 36).

Unlike Canada, Australia is an island continent with strict biosecurity regulations that have successfully prevented many undesirable pests and diseases from entering the country (Commonwealth Scientific and Industrial Research Organisation, 2014). Notably, as of 2020, Australia is the only inhabited continent to remain free of the varroa mite and to have no evidence of colony collapse disorder, both of which have been reported as reducing bee numbers in many nations (De Barro, 2014; Phillips, 2020). Despite this success, the varroa mite is identified as a major biosecurity threat for Australia and is expected to inadvertently enter the nation in the future, prompting industry calls for government to support the breeding of varroa-resistant bee stock (Commonwealth Scientific and Industrial Research Organisation, 2014; De Barro, 2014). A major focus for Australia remains the delaying and management of the arrival of

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[2] https://www.hofstede-insights.com/country-comparison/australia,canada/

pests and disease through strict importation and quarantine rules for bees and bee-related products and through a National Bee Pest Surveillance System that uses "sentinel hives" in high-risk locations, such as major sea and air ports, to provide an early warning system.[3] Mandatory registration and monitoring protocols for hives also play a role in preventing, or managing, the spread of parasites in Australia. However, changes in climate and the resulting alterations to weather patterns, including decreasing rainfall and increases in extreme weather events such as the devastating 2019–2020 bushfires, also pose a threat to feral and cultivated bee populations because of loss of hives and of the reduction in habitat and food sources for surviving bees (Phillips, 2020).

Canada also has stringent biosecurity regulations and quarantine processes in place that restrict the importation of bees and bee-related products from disease hotspots, require registration of beehives, and strictly control movement of hives within and among provinces. This is supported by a voluntary National Bee Farm-Level Biosecurity Standard. Despite these measures, the potential for pests and diseases to spread across the border shared with the United States represents an ongoing threat. The generally cold Canadian climate coupled with stressed hives—caused by a multiplicity of factors including presence of disease, loss of habitat and access to floral diversity, and contact with pesticides—has also led to increased rates of bee deaths over winter in recent years (Government of Canada, 2014): Canada is increasingly reliant on yearly importation of bees to supplement stock. COVID-19 travel restrictions have revealed this to be a vulnerability of the industry, with delays in bee supply putting pollination services and honey production at risk (Malbeuf, 2020).

To further contribute to the protection of bee populations, Health Canada's Pest Management Regulatory Agency has imposed restrictions on the use of three neonicotinoids, commonly used pesticides implicated in bee deaths (Government of Canada, 2020). Evidence of attentiveness to the plight of bees in Canada is also apparent in the naming of nine bee species on the nation's "Species at Risk" register, including four wild species listed as endangered and the implementation of targeted "recovery strategies" for some of these (Government of Canada, 2019; Helmick, 2017).

Web 1.0: Slow Data

We turned away from dynamic social media environments in favor of the more static ecology of Web 1.0 websites and hyperlink networks. This choice has drawbacks, such as the prevalence of dead links, as pointed out by Rogers (2019): "Websites as well as weblogs are only occasionally edited, lie fallow or have been taken by a domain reseller. Link lists . . . are not up to date" (p. xiii). Yet, this lethargic state of affairs presents analytical opportunities. It is trivial on social media to connect to actor-actants and issue-actants because of the ease of use provided by "like" or "retweet" buttons. In contrast, creating a hyperlink on a Web page requires a degree of technical skill, however small, as well as the administrative authority to perform this operation. The resources necessary to set up and update Web page content means discursive and connective choices (or the absence thereof) have a much longer "shelf life" than connections and discourses in social media, which are easily created and soon swept away by new discourses and connections (O'Neil & Ackland, 2019a). Specific keywords being included multiple times on an organizational website

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[3] https://www.planthealthaustralia.com.au/national-programs/national-bee-pest-surveillance-program/

thus indicate a strong connection between actor-actants and issue-actants. In addition, platform bias in Web 1.0, such as the opacity of Google's search algorithm (which we used to collect our initial list of websites or "seed set"), can be minimized, and we detail the steps taken to do so in our next section.

Method

Building the Australian/Canadian Hyperlink Network

Constitution of the Seed Set

Data for this research were collected in 2015. Hyperlinks and text data were extracted using a Web crawler that is a component of the Virtual Observatory for the Study of Online Networks (VOSON; Ackland, 2010). To find the initial group of websites from which to build our network (our seed set), we performed search engine crawls of keywords. Our query methodology sought to minimize the impact of the researchers' personal history on Google's search engine by employing Web browsers that had never been activated on the computers used for the search. We began querying for Australian and Canadian websites dealing with *urban bees* and *urban beekeeping*, our initial research focus. This provided limited results, so we expanded the search to cover other aspects of beekeeping and bee production by using purposely nonspecific terms such as *bees*, *beekeeping*, and *honey*. After several iterations of this initial search, we reached a "saturation point" (no new sites returned) with a seed set of 138 Australian and Canadian websites.

Websites Crawl and Data Set Pruning

These 138 websites were entered into the VOSON Web crawler, which collected the hyperlink network data by following the links from the seed set sites. VOSON collects both inbound and outbound links (Ackland, 2010). This data collection or "crawl" produced a network of 3,638 websites connected by 5,018 hyperlinks. The Web crawler collected this data set based on the seed set and followed a criterion set by the research team (as an input variable to the crawler) as well as another criterion internal to the crawling program. The criterion set by the research team was the maximum number of outbound links, set to 1,000, a reasonably high number for each seed site. The criterion set by the crawler concerns the depth of crawling, which was set to 1, signifying that the crawler only collected direct links from the seed site and did not crawl found websites to collect their outbound links. Marres and Moats (2015) justify the removing of some websites from their batch by arguing that (for example) firefox.com is "purely technical." We manually checked our entire list of websites and in addition to "purely technical" websites such as adobe.com, we removed websites that had no association with bees or beekeeping. These were mainly non–bee-related commercial sites, such as alocasia.com.au/ (Web development), toptropicals.com/ (rare plant seller), weather.9news.com.au (Australian weather forecast), afaa.com.au/ (group fitness certification), omlet.co.uk/ (chicken coop seller), and fotosearch.com (stock photography). After pruning, the network comprised 3,562 websites and 4,814 edges or connections.

Categorization of Issue-Actants

Website content was categorized qualitatively following a thematic analysis approach (Boyatzis, 1998) whereby codes and themes were developed inductively, based on trends and concepts encountered in the data: After a detailed examination of websites, we mapped the substantive content by listing significant terms. Intercoder reliability was incorporated by cross-checking a subsection of websites to verify that terms were consistently classified. The collected content was then condensed thematically to develop a reduced list of issue-actants and associated key terms. These terms were the most used keywords denoting an issue (see Table 1). In our view, the likelihood of an issue-actant being featured on a website without these keywords being present was so low as to be almost nonexistent.

Table 1. Issue-Actants and Keywords.

Issue-actants	Keywords (used in website searches)
biodiversity-sustainability	*biodiversity* OR *sustainability*
biosecurity	*biosecurity*
climate-weather	*climate* OR *weather*
colony collapse	*colony_collapse*
health-parasites	*health* OR *parasite* OR *varroa_mite*
organics-permaculture	*organic* OR *permaculture*
pesticides-toxicity	*pesticide* OR *toxicity* OR *neonic*
urban agriculture-urban bees	*urban_agriculture* OR *urban_bee* OR *urban*

Coding Issue-Actants in Websites

The mapping of issues onto websites was conducted in two stages. In both cases, if a keyword or paired keywords were detected on a website at least three times, it was deemed that there existed a connection between an actor-actant and an issue-actant. In the first stage, we manually coded the first 100 websites in the data set. The Google single site search string was employed to manually query for the keywords inside each website, using "_" to join associated words such as *colony collapse* where necessary. This method produced viable results (keywords were being found in websites); however, undertaking a manual coding for the remainder of the 3,562 websites did not represent a reasonable avenue for several reasons, such as limitations in resources and the fact that manual coding at scale is error-prone given that humans can make mistakes. In a second phase, automatic coding was therefore performed using Google's search application program interface (API), known as "Custom Search JSON API."[4] This API allows automatic retrieval of search results from the Google search engine in JSON (JavaScript object notation) format. We created a simple Python script for automating this coding, which queried the Google search API with the keywords developed in the previous steps, retrieved the results (in JSON format), and computed the coding for each website using the threshold of three mentions developed in the manual coding phase.

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[4] https://developers.google.com/custom-search/v1/overview

Creation of a Subset

Online researchers are sometimes confronted with networks that are so large as to be almost unreadable, and so elect to reduce their size. We also created a subset of our large data set for our comparative analysis, but not because it was too large. We reduced it to remove the nodes that were not contributing to the analysis, such as nodes that had unknown values for their attributes, indicating that they had no connection to issues. Another reason for reducing the network was to render it manageable for the next step in our data preparation: our manual coding of organizational type and of country.

Of the original data set, we excluded websites that satisfied both of these criteria: (1) The issue code was unknown (missing value), and (2) the website was connected to only one other website in the network. Because we were investigating the existence of connections between websites and issues, we focused on websites featuring at least three mentions of an issue. And because we are also interested in issue diffusion, we removed websites connected with only one other website (degree = 1), indicating a minimal level of connection to the network. Using these two criteria, we constructed a subset comprising 673 websites.

Coding of Country and Organizational Type

Two other coding processes were performed manually. Whereas the country code was picked up automatically by the VOSON software for some websites, this was not the case for the majority. We checked all non-ccTLD coded websites and coded them as Australian, Canadian, or other. At the same time, we also coded each website into one of six organizational types, as detailed in the next section.

Classifying Websites

If classification was not performed by the Web crawler (e.g., "gov" and "gouv" are automatically classified as government), we coded the subset manually. The primary means of doing this was checking the "About Us" section on websites. Sites were then curated into one of six categories based on their stated purpose: (1) bee/honey production and sale, (2) growth/business not directly related to bees, (3) government, (4) nonprofit, (5) research, and (6) mainstream media. Some sites appeared to straddle more than one category. For example, the Centre de Référence en Agriculture et Agroalimentaire du Québec[5] combines research, business training, government–industry coordination, and interest group advocacy. Nonetheless, it is clear that the Centre de Référence's overarching concern is the growth of agribusiness, so it was classified as Category 2 (growth/business not directly related to bees). To limit the number of categories, we divided interest groups, lobbying groups, and professional associations such as farmers' federations in two: Those with a growth and business agenda were placed in Category 2 (business); those with a clearly stated progressive orientation were placed in Category 4 (nonprofit). We now provide a more detailed description of our categories.

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[5] https://www.craaq.qc.ca/

Category 1 (association) comprises entities that grow and sell honey/bees for a living and the organizations that represent them such as the Saskatchewan Beekeepers Development Commission, the American Beekeeping Federation, and the Canadian Association of Professional Apiculturists, among others. Category 2 (business) encompasses profit-oriented entities whose income is indirectly connected to bee cultivation: Examples include Croplife (supporting the Australian plant science industry), Farm Credit Canada (financing), *Bee Culture* ("The Magazine of American Beekeeping"), and the Canadian Federation of Agriculture (lobby group). Category 3 (government) comprises entities such as the Alberta Agriculture and Forestry Ministry and Plant Health Australia. Category 4 (nonprofit) gathers entities with noncommercial aims, including *Common Dreams* (independent media), the Community Food Security Coalition ("a North American coalition of diverse people and organizations working from the local to international levels to build community food security"), the National Farmers Union-Ontario ("We work toward progressive agricultural policy that sustains family farmers"), and Heavy Petal (a Canadian gardening blog). Category 5 (research) comprises university-based researchers as well as private individuals. Category 6 (mainstream media) includes both broadcasters (ABC, CBS) and newspapers (*The Guardian*, *La Presse*).

Table 2 provides a breakdown of categories in each country according to their relative number. Numbers are similar for medium-size categories such as nonprofit (Australia: 0.21, Canada: 0.25) and small categories such as association, research, and mainstream media (in the 0.04–0.09 range). However, wide differences can be observed when it comes to the numerically dominant categories in each country, namely business (Australia: 0.45, Canada: 0.24) and government (Canada: 0.36, Australia: 0.13).

Table 2. Website Category by Country.

Country	Website category							Total
	Association	Business	Government	Nonprofit	Research	Mainstream media	Unknown	
Australia	0.05	0.46	0.13	0.21	0.08	0.06	0.00	1.00
Canada	0.04	0.21	0.36	0.25	0.09	0.04	0.02	1.00
Other	0.04	0.16	0.09	0.22	0.08	0.11	0.30	1.00

Note. Numbers are percentages of row total.

Findings

Network Characteristics: Clustering, Centrality, and Density

The visual representation of the whole network (see Figure 1) shows a clear division between an Australian and a Canadian cluster: Websites from each country are more likely to link with websites from the same country than with the other. The entire network constitutes one component as isolates are not shown.
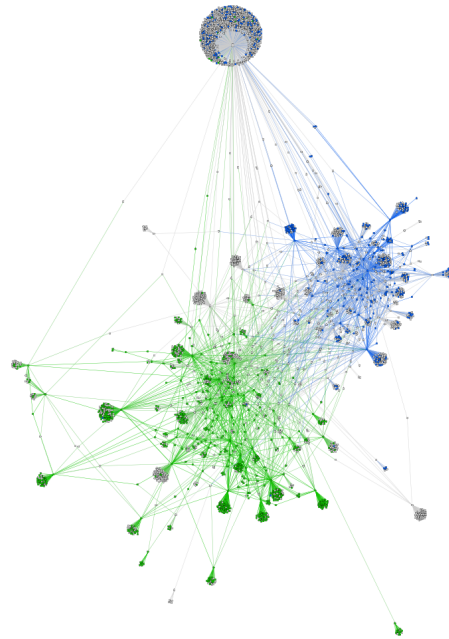
Figure 1. The whole network visualization. Node color indicates country. Green = Australia;
blue = Canada; gray = other. Top: cluster around Cityfarmer.org.

       Table 3 presents the characteristics of the entire network, including the number of nodes (first row) and of edges among these nodes (second row). Other metrics include average degree (the extent to which a node is connected to others), network density (number of connections in relation to maximum possible number of connections), and connected components (connected pairs of nodes that are otherwise isolated).

***Table 3. Characteristics of Networks by Country.***

Variable	Whole network	Australia	Canada
Network size	3,562	784	466
Number of edges	4,814	986	294
Average degree	1.35	1.26	0.63
Density	0.001	0.002	0.001
Connected components	15	94	261
Number of isolated nodes	3	84	260
Clustering coefficient	.031	.035	.04

       The Australian network's average degree and density are both almost double those of the Canadian network, which indicates a higher level of interconnection. The clustering coefficients, showing the overall tendency of websites to cluster, are quasi-identical. The number of connected components is significantly higher in the Canadian network owing to the larger number of isolates, also indicating a higher level of connectivity in the Australian network. In sum, Australian websites are more connected to each other than

Canadian websites, so one would expect a stronger likelihood of issue-actants spreading in the Australian network. Figures 2 and 3 show the two full networks, this time including isolates.
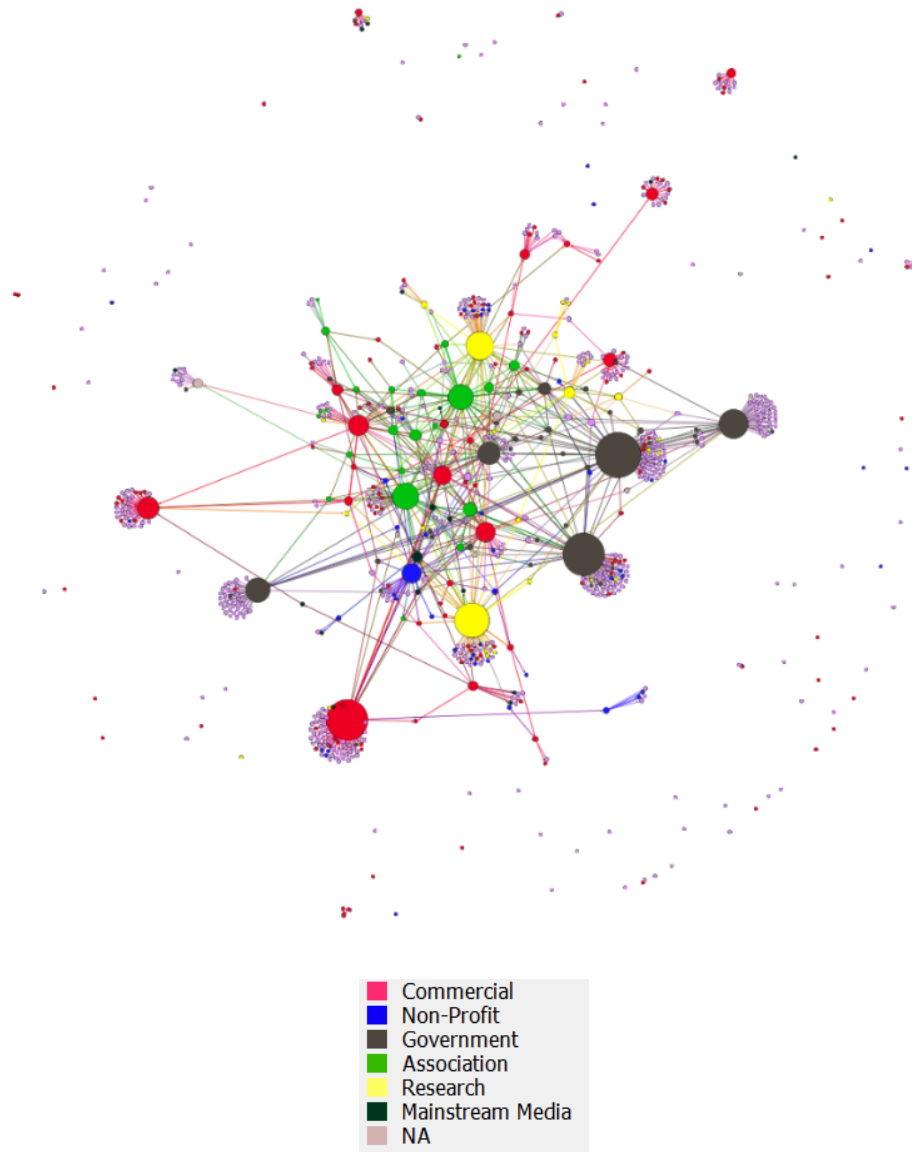
Figure 2. Australian network visualization.
Node size = node degree centrality in the Australian network.

Commercial
Non-Profit
Government
Association
Research
Mainstream Media
NA
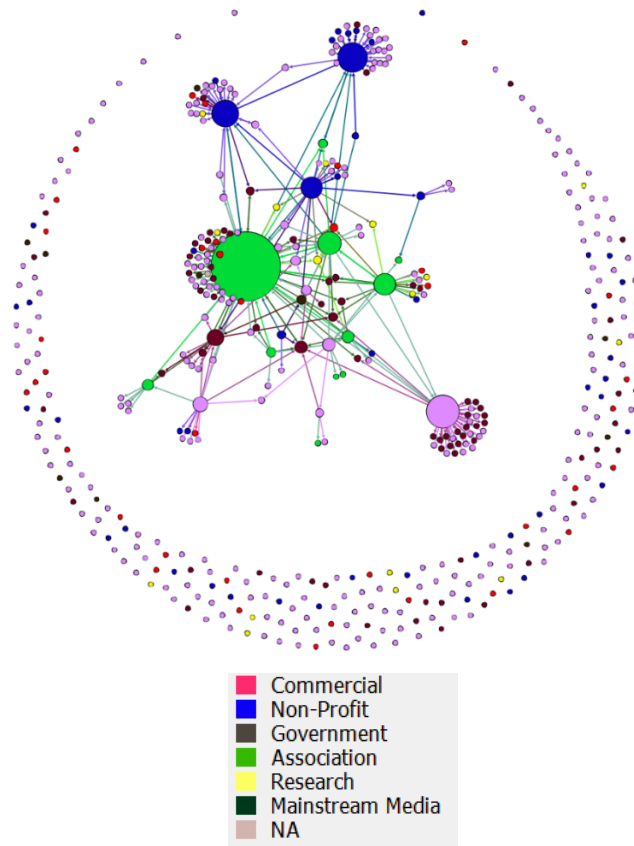
Figure 3. Canadian network visualization.
Node size = node degree centrality in the Canadian network.

There is some evidence of clustering based on website category for both networks. Overall, the Canadian network exhibits clearer categorical clustering than its Australian counterpart, possibly indicating a more pronounced tendency to behave homophiliously (linking to others like oneself).

Issue-Actant Adoption: Top Actor-Actants

It is a mainstay of social network analysis that individual centrality in a network is strongly associated with leadership (Freeman, 1979) and influence (Brass & Krackhardt, 1999). Highly connected actants can help diffuse information and shape perception of what matters. Table 4 shows a significant difference between the first top actor-actant in terms of number of connections and the rest of the list.

Table 4. Top 10 Actor-Actants Based on Connections in the Whole Network.

Website	Degree centrality	Website category	Country	Adopted issues (of 8)	Nonadopted issues
http://www.cityfarmer.org/	1,161	Nonprofit	Canada	7	biosecurity
http://www.honeycouncil.ca/	203	Association	Canada	8	none
http://www.ontariobee.com/	138	Association	Canada	8	none
http://www.rooftophoney.com.au/	137	Business	Australia	5	colony collapse, biosecurity, pesticides-toxicity
http://www.backyardbees.ca/	114	Nonprofit	Canada	6	biosecurity, pesticides-toxicity
http://www.naturalbeekeeping.org.au/	112	Nonprofit	Australia	6	colony collapse, biosecurity
http://www.becsbeehive.com.au/	110	Business	Australia	4	biodiversity-sustainability, colony collapse, biosecurity, urban ag-urban bees
http://www.agriculture.gov.au/	110	Government	Australia	0	All
http://www.aussiebee.com.au/	109	Research	Australia	3	colony collapse, organics-permaculture, biosecurity, pesticides-toxicity, urban ag-urban bees
http://www.aussieapiaristsonline.net/	105	Association	Australia	3	colony collapse, health-parasites, biosecurity, pesticides-toxicity, urban ag-urban bees

A famous explanation for this imbalance is the "Matthew effect," known in network science terms as "preferential attachment" (Barabási, 2002): New entrants tend to connect to established actants, so that the "rich keep getting richer." A "supernode" in the whole network of Australian and Canadian websites concentrates indegrees, or incoming links: Cityfarmer.org, which has the highest number of connections (1,161 connections), is the website of a Vancouver organization that was created in 1994,supporting the preferential attachment thesis.[6] The top 10 websites with the most connections are evenly distributed across different categories; apart from mainstream media, all of the categories are included in this list, although nonprofit, association, and business are prominent.

Table 4 also shows which issue-actants have been adopted by these top sites. Among the top 10 most influential sites, honeycouncil.ca and ontariobee.com (both Canadian) have adopted all of the issues, whereas conversely agriculture.gov.au has not adopted any. The most adopted issues are climate-weather (adopted by 9/10), biodiversity-sustainability (8/10), health-parasites (8/10), and organics-permaculture (8/10). The least adopted issues are biosecurity (adopted by only 2/10), colony collapse (4/10), and pesticides-toxicity (5/10). This could be because of the relative point in time at which these issue-actants were introduced in the network; additional historical research would establish whether this is the case. A striking finding is that all of the influential Canadian websites had adopted colony collapse, in contrast to the influential Australian websites, none of which had connected to the issue.

Issue-Actant Adoption: All Actor-Actants

Table 5 provides additional insights into how Australian and Canadian bee-related websites connect to issues. Wide differences can be observed when it comes to the numerically dominant categories in each country (Table 2 shows that business websites are the most numerous in Australia [46% of sites vs. 24% in Canada], whereas government websites dominate in Canada [36% vs. 13% in Australia]).

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[6] See also Figure 1.

Table 5. Issue-Actants by Country and Website Category.

Issue	Association	Business	Government	Nonprofit	Research	Mainstream media	Unknown	Total
Biodiversity-sustainability								
Australia	0.05	0.19	0.20	0.23	0.10	0.12	0.11	1.00
Canada	0.04	0.10	0.38	0.21	0.10	0.06	0.12	1.00
Pesticides-toxicity								
Australia	0.06	0.18	0.25	0.12	0.11	0.16	0.12	1.00
Canada	0.09	0.09	0.49	0.09	0.07	0.02	0.16	1.00
Climate-weather								
Australia	0.01	0.15	0.20	0.30	0.16	0.18	0.00	1.00
Canada	0.04	0.14	0.35	0.22	0.08	0.05	0.13	1.00
Colony collapse								
Australia	0.01	0.16	0.19	0.31	0.14	0.18	0.00	1.00
Canada	0.02	0.15	0.35	0.21	0.08	0.05	0.14	1.00
Health-parasites								
Australia	0.02	0.06	0.16	0.22	0.18	0.36	0.00	1.00
Canada	0.15	0.03	0.28	0.15	0.15	0.13	0.13	1.00
Organics-permaculture								
Australia	0.04	0.25	0.20	0.22	0.09	0.08	0.13	1.00
Canada	0.02	0.16	0.34	0.21	0.07	0.05	0.14	1.00
Biosecurity								
Australia	0.01	0.19	0.21	0.23	0.09	0.13	0.14	1.00
Canada	0.01	0.12	0.34	0.23	0.09	0.06	0.15	1.00
Urban ag-urban bees								
Australia	0.04	0.21	0.22	0.21	0.11	0.11	0.11	1.00
Canada	0.01	0.14	0.38	0.17	0.08	0.06	0.16	1.00

Note. Numbers are percentages of row total. *N* = 673.

Government websites are prominent in adopting all issues among Canadian websites, followed by nonprofits. For Australian websites, nonprofits come first, playing their expected role in raising awareness of matters of concern. They are followed by government, mainstream media, and business.

Discussion: The Case for Asymmetry

Species extinction represents an extreme example of the emergence of issues that actor-actants care strongly about. The disappearance of bees, caused by their forced enrollment in networks of food production and human-induced environmental change, and known since 2006 as colony collapse disorder, is widely acknowledged, with *The New York Times* announcing in November 2018 that "The Insect Apocalypse Is Here" (Jarvis, 2018). The proposed "symmetrical" hypothesis was that differences between Australian and Canadian geographies and biosecurity regimes would be matched by variations in the

emergence of the disappearance of bees as a matter of concern (we are not positing a causal relationship; it would be more accurate to speak of correlation). Our hypothesis was confirmed: We found strongly contrasting rates of connection to the issue-actant in the two national networks. Despite the Australian network being more densely connected, none of the top Australian influential actor-actants in networks of bee-related websites, representing a wide array of organizational types (government, business, nonprofit, research, and association), featured language about the catastrophic decline of bee populations and bees becoming extinct (colony collapse). In contrast, all influential online Canadian actor-actants (either nonprofit or association) in equivalent Web 1.0 networks connected to this issue-actant during the same period.

A symmetrical reading of the gathering of actants that results in the emergence of matters of concern would view local biosecurity regulations and government campaigns as components of the network: Actants connect to other actants in their local environment, and all of these actants play an equal role in the emergence of the matter of concern. Our findings suggest that another analytical world is possible based on the premise that actants have unequal capacities. It is uncontroversial to note that mainstream media play a key role in spreading issues of public interest; to put it differently, mainstream media discourse tends to be more visible than discourse produced by the other categories of actor-actants in our data set. It is therefore notable that the Australian mainstream media Web pages we collected exhibited significantly higher rates of connection to environmental issue-actants such as biodiversity-sustainability and climate-weather than their Canadian counterparts (twice or three times as many).

Furthermore, examining in Table 5 the connections to issue-actants most directly relevant to the extinction of bees (in addition to colony collapse, we can highlight health-parasites and pesticides-toxicity) shows that the Australian websites connected to these issues are very diverse, with one exception: Mainstream media is the only category that is always present among the top three adopters. Although Australian bees are arguably less at risk from extinction than their Canadian counterparts, threats to bee survival were regularly featured in Australian mainstream media Web pages connected to online bee networks. However, top Australian bee-related websites did not connect to these issues, as shown in Table 4. An asymmetrical approach to gathering would read these influential actor-actants' failure to connect to colony collapse as a sign that they did not care about this issue-actant.

We offer two suggestions as to why this is the case. First, we may recall that Australia and Canada scored quasi-identically in five of six of Hofstede's (2001) cultural dimensions. The one exception was "long-term orientation" (Australia: 21, Canada: 36), which arguably includes the welfare of nonhuman actor-actants; this trait may be augmented by the prominence of business actor-actants, primarily focused on short-term profit, in the Australian network. Second, actor-actants only care about issue-actants they know about, and here we must refer to the role of an asymmetrically influential Australian actor-actant: Rupert Murdoch's News Corp Australia, which together with Fairfax Media, dominates the local news media landscape. Murdoch-owned news media promote ultraconservative views, with clear effects on their audiences. Transnational survey data show that the proportion of climate deniers in Australia is among the highest across the 40 countries surveyed (Park et al., 2020). Specifically, 49% of skynews.com.au readers view climate change as a "not at all serious," "not very serious," or "somewhat serious" issue. These figures are also high for readers of Murdoch-owned tabloids such as Melbourne's *Herald Sun* (39%) or Sydney's *Daily Telegraph* (34%) and of Murdoch's "quality" daily newspaper *The Australian* (31%). By way of

comparison, the figures are 18% for readers of Fairfax's Melbourne-based *The Age* and *The Sydney Morning Herald*, and 14% for *Guardian* readers (Jericho, 2020). It seems fair to assume that the fate of bees is covered in a similar fashion, or not covered at all, by News Corp Australia.

This leads us to our central concern: the ethics of caring about dominated actants. The analytical benefits of including nonhuman actants in social networks are clear, but this innovation of actor–network theory is beset by a negative corollary: actor–network theory's refusal to distinguish among categories of actants. The fact is that hashtags cannot associate themselves to a tweet of their own accord, just as bees cannot transport themselves in trucks to pollinate distant crops; both actions mandate the agency of other actants.[7] In an article written in defense of actor–network theory's purpose, Sayes (2014) contends that "morality and politics" are outside actor–network theory's parameters: Actor–network theory was never meant to account for power, and thus the theory should not be critiqued on those grounds. Yet, as Davis (2020) points out, "Critics would say that power and politics are part and parcel of existing social systems [so that] frameworks with parameters that exclude politics and power are inherently flawed" (p. 54). In the wake of the unfolding environmental crisis, Latour (2018) adopts a more critical stance, as evidenced by his book *Down to Earth*, which denounces climate change deniers and their corporate backers.

It is unclear whether this political awakening addresses actor–network theory's main analytical "trouble" (Davis, 2020): the absence of symmetry in agency between issues on the one hand, and the persons, organizations, or (arguably) "bots" that connect to them on the other. For Schraube (2009), people maintain a distinct responsibility for the production and use of technological objects.[8] Schraube concurs with Latour that subjects and objects mutually shape one another, writing that "it is not only the subjects that do something with the things; the things also do something with the subjects" (p. 25). Yet, agency only concerns humans: "It would be misleading to speak of an object really 'acting.' Action is an intentional human activity accessible to consciousness and concerned with issues of freedom, reasons, and responsibility" (p. 26).

To this we add: If agency is an exclusively human property, it has a moral or normative dimension— Should an action be undertaken, or not? This question applies to research as well. By definition, a purely descriptive approach does not enable an evaluation of the morality of the absence of concern for the survival of bees by actor-actants in online bee networks. The recognition that some actants (e.g., objects or issues) have reduced levels of agency in comparison to humans reminds us that the rights of living dominated actants need to be taken into account to a much greater degree—all the more so when these actants' enrollment into human–nonhuman assemblages is not only involuntary, but cataclysmal.

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[7] Nor should algorithms that orient interactions in online networks and platforms be treated as "just another actant": Nonalgorithmic actors have no say as to how algorithms affect them, so search, news, and feed algorithms should be understood as online governance institutions (O'Neil & Ackland, 2019a).

[8] We thank Jenny Davis for bringing Schraube's work to our attention.

Conclusion

Our article's theoretical aim was to explore asymmetries in agency among actants when forming, maintaining, and dissolving connections. In contrast to Latour (2005), for whom "there is no society . . . but there exist translations between mediators that may generate traceable associations" (p. 108), we have argued that the capacity to make connections represents a form of power. Similarly, in the information and computer science fields, Mika (2005) proposes to advance modeling methods by adding social actors into semantic networks of objects, referred to as "ontologies": Objects are connected to concepts or instances (e.g., books and tags) because of the social actors who have made the connection (e.g., a person tags a book). In the sociology field, Castells (2011) advances a complex nomenclature, distinguishing among "networking power" (the power of the actors and organizations included in the networks that constitute the core of the global network society over human collectives and individuals who are not included in these global networks), "network power" (the power resulting from the standards required to coordinate social interaction in the networks), "networked power" (the power of social actors over other social actors in the network), and "network-making power" (the power to program specific networks according to the interests and values of the programmers). Chateauraynaud (2014) sought to resolve the epistemic contradiction between network mapping and the analysis of arguments located close to the discursive activity of actors by referring to discursive regimes that emerge with controversies, are organized around semantic knots, and operate through a series of oppositions. Issue diffusion can then be thought of as arguments that are oriented and reoriented by people across distinct social spaces, leading to the notion of "issue ballistics": Issues have trajectories, from the elaboration of a public cause to its conclusion, which involve processes of transformation, translation, evolution, and reformulation.

In this article, we operationalized the gathering of participants to form matters of concern as connections between actor-actants and issue-actants in two Web 1.0 networks, using a social network analytic methodology. We outlined two ways of reading these connections: from a symmetrical perspective— all actants have equal capacities—the local environment explains how networks comprising similar clusters of actor-actants (Australian and Canadian bee-related websites) connected in very different ways to issue-actants such as colony collapse. An asymmetrical perspective reads the results as indicating that some actants have the capacity to care about and connect to issues, whereas others do not. This led us to highlight the lack of care implied by leading Australian bee-related websites failing to connect to the disappearance of bees, a disaster that is well documented locally and internationally.

A key theoretical contribution of this article to the analysis of online sociality has been to define and illustrate the different capacities for care and action of actor-actants and issue-actants. This accords with Schraube's (2009) call for a "materialized action approach," which contrasts technological *efficacy* (technologies do things) and technological *agency*: Agency is an exclusive property of human subjects. For Davis (2020), this distinction between agency and efficacy and the related asymmetry in human–technology relations open the door to critical analysis: "Placing agency exclusively with human actors positions producers and consumers as responsible parties. The effects of technology, both good and bad, can be traced back to cultural norms, corporate directives, state interests, and other claims makers and stakeholders" (p. 57). When it comes to the analytical dimension of our research question—why matters of concern fail to emerge—both symmetrical and asymmetrical factors no doubt play a role. In ethical terms,

denying that some actor-actants have agency over other actants means it is impossible to form a moral opinion about connections, absolving powerful actor-actants of the responsibility for caring about issue-actants such as the rights of dominated actor-actants. Ultimately, this leads us to ask, "What is the purpose of social research?" In the face of widespread species extinction, tracing networks of relations without evaluating their moral significance appears to be an inadequate response.

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