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Article

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The cultivation of opinions. How did the press cover the last 16 years of experience with GMOs in Canada?

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Abstract: The media debate on agricultural biotechnology (ag-biotech) in Canada engages active supporters and opponents. At the same time, Canadian citizens are found to be polarized with regard to Genetically Modified Organisms (GMOs). Studies suggest that this is partly a result of the biased coverage of the media. I used two widely read national newspapers and examined their stories on GMOs from the years 2000 to 2015. First, I examined whether the stories were biased in evaluations towards GMOs and I then looked at the dynamics of this bias. My results suggest that the press coverage on GMOs in Canada is not biased since representatives from both sides of the debate were found in the press. However, one might see this as an "artificial balance" because the representatives themselves were found to express opinions that could be characterized as biased. I conclude that the press exposure can have a cultivation effect, letting the public reflect what they find in press instead of the real world, and leading to polarized public perceptions on GMOs. This work presents the first effort to understand the levels of media bias that leads to public polarization on ag-biotech. The results add to the literature of public understanding of the media by presenting the ways in which the representatives of the media can express opinions that are biased.

Subjects: Technology; Social Sciences; Arts & Humanities

Keywords: media bias; cultivation effect; GMOs; public polarization; Canada

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PUBLIC INTEREST STATEMENT

The media plays an important role in how people think about the world, especially on controversial topics. Studies show that there is something that is called "cultivation effect", and it refers to situations where people base their judgments on what they see in the media, rather than on what exists in real life. This study looks at the effect that the newspapers might have had on how people think now about Genetically Modified Foods (GMFs). The study refers to the Canadian audience, where when asked, people say they either like or dislike GMOs. I find that the figures who appear in the media can be equally in favor or against the use of technology in our foods. However, the opinions of these representatives are biased. These suggest that there might be a "cultivation effect" coming from a variety of people who carry biased opinions on GMOs, and might explain why Canadians are polarized on the issue.

1. Introduction

When it comes to media bias, the story is as easy as it gets: the "News is reported by people (who think subjectively) and is listened to by people (who listen subjectively)" (Herbert, 2015, p. 65). Even though measuring the effects of the media's coverage on how people think or behave is much more complicated than that, it is plausible to look at how the media covers their stories on specific issues. By looking at the way the media present their stories on a given topic—positively or negatively—one can grasp persistent trends of representations that are connoted with the topic discussed. Moreover, examining the media coverage on a specific topic over extended periods of time can lead to more consolidated representations over the topic. This means that if the media has been positively or negatively biased for decades on its coverage on a topic, they might offer only two kinds of opinions to the readers/listeners. It is hard to distill whether those readers/listeners can be similarly biased if their media are. However, when one looks on extended periods of time, you might come across a cultivation effect of the media, which can lead to polarized public opinion on a given topic.

In the early 1970s Gerbner and Gross introduced the idea of the "cultivation effect." This effect reveals itself in two levels: after a long time, media exposure cultivates general beliefs about the world and then it nurtures specific attitudes. If the media is negative for long time on a topic, one can expect the people to think about it in a negative way (Curtis, McCluskey, & Swinnen, 2008; Lusk & Coble, 2005). Likewise, if the media are positive on a given topic, most likely people will carry the same positive opinion about the topic in question. If the media is biased, one might expect biased audiences. Even though media bias is an issue that can be examined empirically, the same does not apply for examining the audiences. For instance, one can measure and see how biased are the media on covering climate change. But then, it is hard to measure how biased people are on the same issue. One could, however, measure and see how polarized people are. Therefore, even though there are many other important factors to consider, and being biased does not mean being polarized, the terms can be used at some degree equivalently. This can be true especially if one has access to either the long-time coverage or the status of the public opinion on a topic: if the media covers only opinions that are biased, isn't it easy for the people who consume these news stories every day for decades to develop polarized opinions on those same topics?

According to political scientists, "polarization" is the divergence of the public opinion to ideological extremes, especially within certain groups (Baldassarri & Gelman, 2008; DiMaggio, Evans, & Bryson,1996; Fiorina & Abrams, 2008;) and it occurs in a society where two parties with strong views over a particular topic fail to find a common ground, and disagree vehemently over time. Estimates indicate that the public in Canada has developed polarized opinions towards Genetically Modified Organisms (GMOs) (Canadian Biotechnology Secretariat, 2005; Canada, Eurobarometer, 2006; May, 2000). Previous studies in North America record different public attitudes towards GMOs: sharply half of Canadians have been found to report that they would support biotechnology and accept minor risks if new products will be brought to the market, while more than 35 percent of the population would not accept any of these products if 100 percent risk free was not guaranteed (Environics Research Group, 2001; found in Blaine, Kamaldeen, & Powell, 2002).

My aim was to see whether the two fundamental public views towards GMOs could be found in the press of Canada. I asked the questions: Does the press cover GMOs in a positive or a negative way? Then, I asked the question of whether the articles that were positive only or negative only shared a common language that was biased towards GMOS. If so, then what were the conditions of these biases?

There are many reasons why the public can be polarized on any issue: education, age, history, and culture. Media coverage is just one more aspect of how one tends to develop opinions about anything in life. Additionally, having access to tremendous amounts of news stories, one can see how the specific news narratives accumulate over the years and say that a special type of narrative might have cultivation effects to the people who read them.

This study argues that because of the cultivation effect of the media, the biased press is one of the reasons why the Canadian public opinion is polarized towards GMOs. If that is really the case, then the cultivation effects, long examined by mass communication researchers for TV exposure, are also present in the press, and have similar impact on the development of public perceptions on important issues like GMOs. GMOs are reported as a controversial topic, and just bringing up the name raises strong opinions, both from the proponent or the opponent sides (Gilbert, 2013).

2. Research context and literature review

2.1. Mass media bias

The mass media, and especially the print press, facilitates an important role in our civic society: they inform both the public and the other media outlets about events around the world. However, their ability to inform their audiences is burdened because they are run by humans who have biases of their own (Bovitz, Druckman, & Lupia, 2002). Even in a dreamy objective world of media coverage, there will always be some degree of bias because the generators of the news stories will select, slant, and decide how much attention to give to each news item (Posner, 2005). Moreover, most commercial media, around the world, are privately owned. But even for those that are not, as organizations, the mass media channels have commercial objectives (Mullainathan & Shleifer, 2005), which in turn may often lead to irrational or disproportional news coverage on specific topics that are generally popular in demand.

Therefore, there is both a supply and demand aspect of the news that leads to a mediated reality that is biased (Galata, Karantininis, & Hess, 2014; McCluskey, Swinnen, & Vandemoortele, 2015). When the media covers topics related to new technology like GMOs, the risk communication from the media's side often surges the positive side of the coverage (Bonfadelli, Dahinden, & Leonarz, 2002; Gaskell et al., 2000; Hagedorn & Allender-Hagedorn, 1997; Lewison, 2007; Marks, Kalaitzandonakes, Wilkins, & Zakharova, 2007). This bias is established by the "absence of balance resulting in one side of a story receiving unwarranted attention" (Baron, 2006, p. 4) or just mentioning one side of the story and omitting the other one (Groseclose & Milyo, 2005). This "systematic bias" has been long studied by researchers who find that what one sees most often reported by the media is quite different from what the experience and science might suggest. For example, even though the science and research behind GMOs is backed by numerous studies by the scientific community suggesting that GM crops are safe, cause no more risk than their counterparts, have increased biodiversity and food production, while decreasing soil erosion, food prices, etc. (Brookes & Barfoot, 2016; Clive, 2012; Klümper & Qaim, 2014; Lucht, 2015; National Academies of Sciences, Engineering, & Medicine, 2016), little or anything of these can be found in the media.

2.2. Cultivation effect of mass media

Cultivation theory "clearly posits that the cultivation effect occurs only after long-term, cumulative exposure to television" (Cohen & Weimann, 2000). This means that after a long-time exposure of watching television, the viewers tend to believe that what occurs in social reality is also true. Moreover, even though most of research of cultivation theory focuses heavily on TV as a media channel for cultivation effects (Gerbner, 1972, 1994, 1998; Gerbner & Gross, 1976), there are some studies reporting cultivation outcomes with respect to different media genres like newspapers (Grabe & Drew, 2007). For instance, there was a hypothesis according to which those who spend more time on the TV will be the most affected. This was validated by the cultivation effects of newspapers for predicting implicit estimates in Arendt's study (2015), where people being the most exposed to negative evidence were more likely to develop negative behavior. In fact, using the Dose-Response (DR) model, Arendt managed to empirically identify the exact size of the media effect—where an exposure of 5–7 articles at a time was found to have the most effect. This evidence, showing a causal effect of newspaper coverage and attitudes was confirmed in Liska and Baccaglini's (1990) study, where the local homicides reported in the news press were associated with increased fear. According to the same study, the rates of fear tended to drop when homicides were reported on a non-local level due to the feelings of safety that the comparison caused (p. 367). The authors said that people not only

tended to associate themselves and their environment relative to what they heard and saw, but the paradigmatic diversity in conceptions was powerful. A study conducted in the late 1980s showed that heavy readers of newspapers tended to develop crime perceptions that were more congruent with the newspapers' content than with the FBI's statistics (O'keefe & Reid-Nash, 1987). Last, extended literature shows that as the general consumption of risk and crime increases, so does the fear of crime or "the tendency of locking doors and windows to protect themselves" (Chiricos, Eschholz, & Gertz, 1997, found in Grabe & Drew, 2007; Romer, Jamieson, & Aday, 2003).

In the agro-biotechnology realms two researchers, Besley and Shanahan (2005), extended the work of Chaffee and Schleuder (1986) and confirmed that using specific variables (attention and exposure measures) in ag-biotech communication patterns can help to predict the support levels.

2.3. Polarization theory and public opinion in Canada

Broadly speaking, there are two basic distinctions on the polarization of the public opinion. One argues that polarization can prevail only on specific issues, while the society is not divided on other ideological issues (Bafumi & Shapiro, 2009; Greenberg, 2004). The second theory argues that a polarized public opinion is characterized by a public that is divided on a broad set of issues (Abramowitz & Saunders, 2005; DiMaggio et al., 1996; Fiorina, Abrams, & Pope, 2005). I followed the first polarization approach because the ideological polarization that takes place in Canada, appears mostly on specific issues, e.g. on GMOs, while not as much over others, e.g. politics, climate change.

3. Empirical analysis and methods

My hypothesis was that the articles that talk only in a positive way about GMOs and those that talk only in a negative way about GMOs embody a type of communication that is biased and, as such, could produce biased audiences. This means that while one can find articles that are positioned in both positive and negative ways towards GMOs, there are also other articles that are entirely positive or entirely negative. If the two categories of articles being positive and negative represent the majority of the press, then we could argue that they deliver biased opinions. My argument to show this bias stands on the premise that when someone presents always one side of a story, they persistently highlight specific traits of how good or bad GMOs are. However, by ignoring or not mentioning the other aspects that might exist in same story, they are being biased.

I tested this hypothesis empirically and asked the following questions:

RQ1: Does the press cover stories on Genetically Modified Organisms in a positive or a negative way?

RQ2: What are the dimensions of this bias?

3.1. Data selection and classification

The data of this paper came from a 16-year examination of the coverage of 2 widely read newspapers of Canada, the *Toronto Star* (TS) and *The Globe and Mail* (GM). The articles were found through the LexisNexis system using the codes (genetically modified AND food) or (genetically modified AND crop*) OR gmo OR agro-biotechnology OR (agribusiness AND food). Afterwards, the original articles were separated from those that were not addressing GMOs or agro-biotechnologies directly, but were just mentioning the terms through the passage. The remaining articles were 125, from January 2000 through December 2015.

I used manual and electronic content analysis using Wordstat software from QDA Provalis. Content analysis is used not only for making the text measurable, but also to compare a specific piece of text with another one. For this reason, one can find multiple studies applying content analysis in the coverage of the newspapers (elite or popular newspapers online or in print) (Holsti, 1962; Krippendorff, 2012), but also content analysis in social media studies (Twitter, Facebook, and more) (Antony & Thomas, 2010; Bayerl & Stoynov, 2016; Bilić, 2015; Hopkins & King, 2010).

Then, a dictionary was developed for the articles. Three coders read more than 1,000 articles from 3 English-speaking countries (Canada, USA, and UK) and then categorized the words and phrases that were associated with either positive or negative meaning for GMOs into their own dictionary. The terms that were most used by all coders were all collected together and incorporated into the QDA Miner and Wordstat. Then, this manual dictionary was combined with the Word Sentiment Dictionary (WSD) that can be found in the software and the text was automatically analyzed. Based on the dictionaries, the software gave frequencies for both positive and negative counts and, using the keyword-in-context (KWIC) feature, the coders manually checked each instance for accuracy. For example, a positive count of an article would be one that talked about how well have GMOs served the society. This would include terms like "higher yields," "oil rich," "alleviate hunger," "health benefit," "cheaper food," etc. On the other hand, a negative count of an article would be any one that had terms like "contamination," "health/environmental risk," "resistance to herbicides," etc. The analysis was one count (positive or negative) for one article.

In measuring how the mass media cover GMOs, one can find categories of no evaluation at all, positive evaluation, negative evaluation, and both positive and negative evaluation. In this work, the term of "bias" was used as in DeRosier et al. (2015) and meant that an "overemphasis" of either the benefits or risks was found in an article. As such, the articles that included both positive and negative terms were excluded from the analysis. This was because the purpose of the study was to explore the levels of bias between the positive and negative opinions expressed in the articles. Articles that included both positive and negative aspects of GMOS would not offer any insight for the study. Given the context of my study, I take as a face value the fact that a news story that cites positive and negative aspects of same topic is assumed to be unbiased.

3.2. Dynamics of polarization

A storyline that showed signs of bias was one that was narrated only in positive or only in negative way.

The two categories were then examined under:

(1) The spokesperson or representative group (sources), which referred to the speaker of the news story, or the cited sources statements: NGOs, Media, Scientists, Industry, etc.

(2) The type of the impact (theme): risk of health, quality improvement, benefit for the world, higher yields, etc.

4. Results

4.1. Positive vs. negative coverage

First, I examined the way that the articles talked about GMOs. I examined 16 years of *the Globe and Mail* (GM) and the *Toronto Star* (TS) and their articles that explicitly talked about the impact of GMOs. The two newspapers covered GMOs heavily, but only the articles that talked explicitly about the impact of GMOs were selected. Then the articles were screened out to only two categories: those which saw the impact in a Positive Only (PO) way and those that saw it in a Negative Only (NO) way. Due to the purpose of the current study, the articles that talked in both positive and negative way or did not mention any impact were excluded from my analysis.

Articles that included both positive and negative evaluations accounted for almost 20 percent of all articles and the ones that did not mention any evaluation were less than 4 percent. In total 125 articles were collected: 72 articles were talking about the negative effect that GMOs have had, while 53 articles were found to evaluate GMOs in a positive way. Figure 1 presents the overall coverage in combination with how the overall frequency of the press on GMOS was developed through the 16 years. The coverage has gone down. However, the number of positive articles has gone up. More specifically, if one compares 2000 with 2015, there is a decrease of more than 80 percent in the frequency of coverage. This goes along with a slight increase in the trend of positive articles after the year 2006.

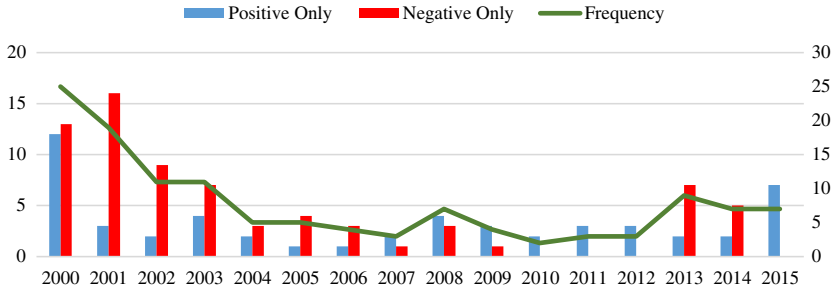

Figure 1. Positive and Negative coverage in Canada, the numbers represent counts per article.

Notes: Total for positive: 53, total for negative 72. The frequency shows how often an article covered explicitly the impact of GMOs in both *The Globe and Mail* (GM) and *Toronto Star* (TS), during last 16 years, number of articles altogether 125.

The debate over these 16 years opens with a clear balance between the two types of articles, about one positive article is written after one negative article. Then, the negative articles gain noticeably more space in the press (sometimes reaching almost six negatives to one positive article), until the end of the year 2007. Right before the world experienced its worst post-industrialized food crisis, the debate transformed: except for the last two years (2013 and 2014), the media press was surged with positive coverage, with an average ratio of one negative to three positive articles. During 2015, the coverage, in these two newspapers, became entirely positive.

There has been a decrease in coverage on GMOs that goes along with a decrease in negative only articles. The positive articles have just passed the negative in the most recent media coverage.

4.2. Dimensions of polarization

Here, I examined the dimensions of the differences of the two categories of articles. Whom were the people cited or interviewed the most in each evaluation category? Did they overlap? What were the impacts that the two type of articles mentioned the most?

In the positive articles, the sources mostly interviewed or cited were the "Media" and the "Scientists." "Scientists" were independent, coming from academia or industry and government affiliated organizations or individuals. The "Media" group consisted of journalists, editors, writers, or other types of media. For the negative only coverage, the "Media" and "Non-Governmental Organizations" (NGOs) were the two top representatives. Figures 2 and 3 show the four most referenced representatives for each type of articles.

Two out of four representatives in the top four list overlapped. For example, the category "Universities" was found to be in the top list in both the positive and negative articles. However, the list of "Universities" appraising the impact of GMOs in the positive group was longer and more diversified—the Universities were many and were based in different countries. The "Universities" category that talked in a negative way about the impact of GMOs represented a niche of academics or Universities, and referenced one or two specific studies about the impact of GMOs (i.e. the Pusztai affair). The last top-four category was the "Letter to the Editor," which refers to a section that some newspapers have, where readers can send their views on previous articles and their reviewed posts are published as an article.

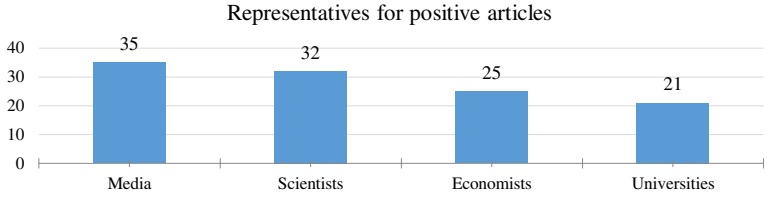

Figure 2. The top-four representatives when positive impact of GMOs is reported in positive articles, the numbers refer to counts, total 171.

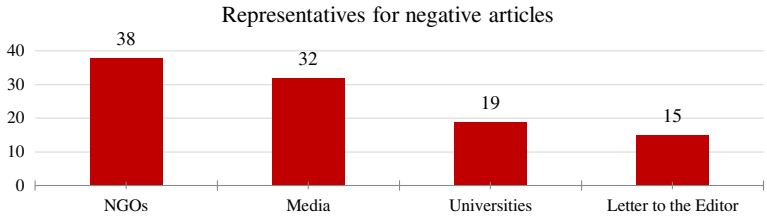

Figure 3. The top-four representatives when negative impact of GMOs is reported in negative articles, the numbers refer to counts, total 142.

I then took a closer look on the relationship between the two types of representatives. My data were not normal (many values were zero), so I used the Spearman's correlation coefficient to examine the correlation between the two types of impacts and the representatives of the articles. The latter is a robust measure for non-parametric statistic studies (Hauke & Kossowski, 2011). The Spearman's correlation showed a positive correlation between the supporters and opponents, even though moderate ($\rho = .6$). This meant that when one sees representatives who speak favorably about GMOs, they will also see representatives who are against GMOs.

Then, I looked at the specific benefits or risks that the positive and negative articles and their representatives linked with GMOs. There could be more than one benefit in same positive article and more than one risk mentioned in each negative article. Figure 4 shows that when an article was positive towards GMOs, the majority of the sources would mention either "Quality Improvement," "Benefit for all," "Higher Yields," or "Economic Benefits" as the impact that GMOs had brought to the society based on their impact on the farm level. The "Economic Benefits" were mostly found in the early years, interchangeably with the "Higher Yields." The need to bring impact to the wider society using ag-biotech practices became more evident during the middle of the past decade. In more recent years, most positive articles have seen GMOs as a solution of sustainable agricultural practice and as a source of feeding the growing population.

In the negative articles, there was a category that received the lion's share. Most risks were associated with the environment and human health. The "Corporate control," "Seed contamination," and "More regulation needed" were the other top three categories that accounted for the impacts that negative articles mentioned the most.

I found a fine contrast in judging the benefits and the risks of GMOs from the articles. There were no concurrences between the top four judgments from the positive or negative articles. In fact, the impacts of GMOs did not agree not even once with anything positive when the speakers were negatively disposed to GMOs. The group of positive representatives, however, was found to mention some potential risks that could occur in the future (i.e. weed resistance). Moreover, the correlation between the benefits and risks mentioned in the two types of articles (positive and negative) was strong and negative ($\rho = -.98$). Though the correlations above do not communicate anything about whether one variable moves in response to another, the Spearman's correlation does indicate an association between the coefficients.

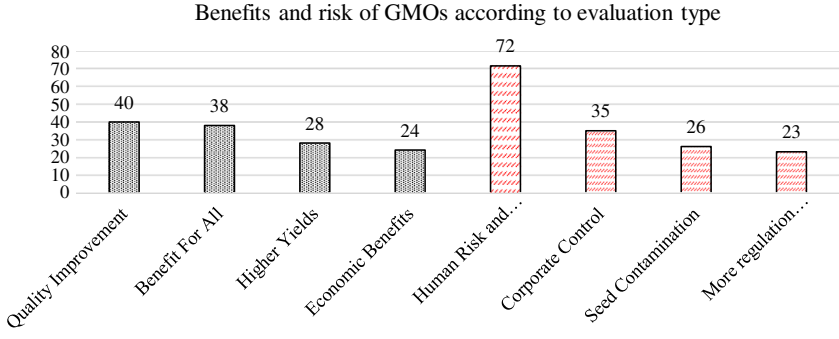

Figure 4. Benefits and risks of GMOs according to the positive or negative evaluation in Canadian press news-stories.

Notes: Numbers represent counts, total benefits in positive articles 137, and total risks in negative articles 217.

The spokespersons were biased in the impacts that GMOs were described to have had. Also, the specific impacts that each group assigned to GMOs were systematically different. This means that we might be able to see a balance of representatives from both sides of the GMO debate, however, the arguments presented are biased.

5. Discussion

The positive correlation between the negative and positive representatives suggests that both groups are equally seen in the press. This means that there is no media bias with regard to who appears in the debate to talk about the impact of GMOs. However, the representatives themselves were found to express biased opinions.

In journalism, there is something that is called "artificial balance." This practice refers to journalists when they try to produce objective stories, and to do so, they cite sources that come from different points of view. However, this effort of "fair" selection might lead to superficial balance of the debate (D'Alessio & Allen, 2000). For example, if a journalist is writing a story on whether the EU's GMO ban is legitimate or not, they will present a list of reasons why the use of ag-biotech has led to productivity growth, rise in rural incomes, the decline in soil erosion, and so on. In most cases, they will continue with a counter-list of why the technology could be harmful. This type of coverage of superficial counter-argument leaves the reader with the impression of a debate that is equally weighed (Oreskes, 2004). That would not be a concern, if only the credibility of the sources or the validity of the arguments were not under question. This type of balance often originates when producers and editors try to eliminate bias, so recognizing the fact that it exists could encourage better research from their part.

This study suggests the bias levels of the press by conducting content analysis to the text. But we know that bias and polarization are much more complicated and dynamic than just the collection and analysis of written language. Researchers have tried to combat this limitation. Zajonc and Markus (1985) measured the real effects of political communication of news, using the Orientation-Stimulus-Orientation-Response (O-S-O-R) model, and calculating the initial orientations, along with the changes in orientations after the stimuli of exposure of different types of news media. Moy and Pfau (2000) used the O-S-O-R model and came across cultivation effects of viewing media for prolonged time periods. Likewise, the cultivation effects of the TV exposure of scientific and biotech stories have been examined empirically (Hornig, 1990; Long & Steinke, 1996; Nisbet et al., 2002), but there is still room for studies that look at how communication patterns in print media affect public perceptions and measure the outcomes empirically. This will help us producers and editors to make more accurate accounts that match with evidence, and to better understand how public's attitudes are affected by the media coverage, and eliminate confusion.

6. Conclusion

In this study, I tested whether the Canadian press covered the impact of GMOs during the last 16 years in a biased way. I examined two national newspapers under their positive only and negative only stories and then looked at how different the stories and the spokespeople were for each category. Though there was a faint trend of increase of positive stories, overall, the negative stories surpassed the positive ones. The frequency of news stories on GMOs has declined overall and increased only during the most recent years.

The most cited sources were the "Media," the "NGOs," and the "Scientists." The representatives of negative and positive stories appeared weakly correlated and somehow well balanced. However, the positive and negative impacts were negatively correlated. This means that what one group assigned as an impact to GMOs (i.e. positive) was consistently different from what the other group assigned as an impact of GMOs (i.e. negative), while the impacts remained unchanged within the groups. The most mentioned impacts referred on how GMOs have contributed to "Quality Improvement" in agricultural systems, and their transcending effect to "Benefit the world," referring especially to the

developing countries. The most negative impacts referred to the risk that they could have to the humans or the environment, and the concentration of the biotech market.

The press in Canada presented both sides and was generally not biased on the representatives seen in the press. However, the representatives expressed positive and negative opinions that were systematically biased. Therefore, due to the cultivation effect that the persistent press can have to its audiences, I conclude that the potential artificial balance on the GMO debate and the biased opinions expressed may be the reason why we see polarized opinions on GMOs in Canada.

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