Diffusion of News about Research

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Analysis of media coverage of articles published in four elite scholarly journals, and the frequency of subsequent citation of those journal articles by other scholars, found evidence of news diffusion of the research to scientists. Breaking news coverage by twenty-four daily newspapers of articles from the Journal of the American Medical Association, Nature, *the* New England Journal of Medicine, *and* Science *was associated with more frequent citations; coverage by network television was not. Breaking news coverage by the* New York Times, *when considered with coverage by television and other newspapers, was unrelated to citation rates.*

Keywords: *diffusion of innovation; medical research; newspapers; journals*

An integral element of the scientific method is building on scholarly research by other scholars. A researcher may rely on others' work for the theoretical basis of a research project, for data to build on, or even for counterpoints that can be challenged or overturned.

Scholars keep abreast of such new research in a variety of ways, such as conferences, journals, and informal exchanges (Garvey 1979). A potential source of such information about scientific developments is the popular news media, which routinely report on findings that have been newly published in scientific journals.

Researchers do appear to learn about scholarly findings through the mass media, at least occasionally. For example, the quick and energetic responses by scientists to media reports of important developments such as purported

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"cold fusion" indicate a role for the mass media in diffusion of news about scientific research (Lewenstein 1995). Also, when asked in a 1991 survey about nonspecialist sources of information that are important for their work, 57 percent of participating Dutch biologists listed national newspapers, as did 45 percent of Dutch engineers. Thirty percent of the biologists said they relied on Dutch television, as did 20 percent of the engineers (Willems and Woudstra 1993). Indeed, scholarly publishers often seek to regulate the timing of mass media dissemination of scientific and medical research, to attempt to guarantee that scientists and physicians learn about such research from peer-reviewed publications and not from the mass media (Kiernan 1997).

Of course, scientists do not seek to simply learn about research by other scholars; in some cases, they seek to adopt and utilize those developments in their own work. One way in which scientists utilize newly published research is by citing it in their own papers and books (Garvey 1979). Analysis of citation patterns therefore is a tool for studying the diffusion of research findings (de Solla Price 1965). For example, Brooks (1990) used citation data to track the development of research into superconductivity, and Callaham, Wears, and Weber (2002) found that frequency of citations of published research in emergency medicine was unrelated to the quality of the research. Phillips et al. (1991) demonstrated that twenty-five research articles in the *New England Journal of Medicine* that had been covered by the *New York Times* were cited by scholars more frequently during the decade after publication than thirty-three control articles in the same medical journal that the *Times* did not cover. The difference in citation rates was strongest in the first year after publication but continued for the subsequent nine years that Phillips et al. examined.

However, Phillips et al. (1991) did not address the possibility that coverage by other media might also inform scientists about new research and influence their subsequent reliance on such research. Indeed, Phillips et al. ascribed an elite status to *Times* coverage of scholarly research that may not exist: daily newspapers across the United States cover research extensively, and their coverage usually appears simultaneously with that of the *Times*, thanks to an elaborate system of embargoes, under which science journalists around the world are given as much as a week's advance access to journal papers, on the condition that they not disseminate news coverage until the same time—a time set by the journal. Moreover, television coverage of journal findings—though much less common than coverage by newspapers—usually is broadcast before articles appear in the *Times* and other newspapers: the timing of the embargo's expiration, generally in midafternoon to late afternoon on the U.S. East Coast, is designed to maximize the prospects for

coverage by evening television news broadcasts by giving them the first chance to report the research findings (Kiernan 1997).

The preceding discussion suggests a hypothesis and a research question regarding the impact of news coverage on scholars' subsequent citations of research published in scholarly journals:

Hypothesis: Journal articles that are covered by the *New York Times* will be cited by scholars more frequently than journal articles that are not covered by the *Times*. This hypothesis essentially attempts to replicate the central finding of Phillips et al. (1991) and to extend it to other elite journals that the *Times* covers.

Research Question: What is the relative effect of coverage by the *New York Times*, other daily newspapers, and national network television on citation rates of published research? This research question aims at broadening the line of analysis of Phillips et al. (1991) by taking into account news coverage by media other than the *New York Times*.

Method

The hypothesis and research question were explored by comparing news coverage of four journals that are commonly covered by the general media—*Journal of the American Medical Association*, *Nature*, *New England Journal of Medicine*, and *Science*—with the rates at which articles published in those journals were subsequently cited in other scholarly works.

The analysis included breaking news coverage of the four journals by the *New York Times*, twenty-four other daily newspapers,[1] and the evening broadcasts of the ABC, CBS, and NBC television networks. The author selected the newspapers to be included in the content analysis from those that were available to the author in full-text online databases. Cable news networks were excluded because they could be expected to produce repeated and repetitive coverage of a story throughout the day, rather than the unitary coverage that is featured in evening network news broadcasts.

Newspaper coverage was drawn from one sample year, the twelve-month period from June 1997 through May 1998. To gather stories from each newspaper and television network, the author used the Dialog and Nexis full-text databases. Databases for each newspaper and network were searched for all articles containing the titles of each journal during the sample year. Because such a search could return articles that were not of interest—such as those that used the word *science* or *nature* in contexts other than the name of a journal—all articles initially were gathered in a format known as "keyword in context," which includes only a small portion of the article's text, including

the search's target word. The author examined each such excerpt and identified the articles that did quote one of the four journals of interest. The analysis was limited to peer-reviewed research articles published in the journals. News coverage of other types of content published in the journals—such as editorials, commentaries, letters to the editor, and news articles—was excluded from the analysis.

Because the aim of this research project was to examine the impact of breaking news coverage on scientists' subsequent citations of journal articles, the study included only those articles that were published on the release date for each journal—Wednesday for newspaper coverage and Tuesday evening for television coverage of the *Journal of the American Medical Association*, Thursday for newspaper coverage and Wednesday evening for television coverage of the *New England Journal of Medicine* and *Nature*, and Friday for newspaper coverage and Thursday evening for television coverage of *Science*. News coverage of journal articles for which the journal had lifted or shortened the embargo also was excluded because these stories represented exceptions to routine coverage. Editorials, letters to the editor, and other items published by the newspapers that were not breaking news stories also were excluded.

For each journal article during the sample year, three news coverage variables were constructed:

- the number of words published by the *New York Times* about the given journal article,
- the total number of words published by the other twenty-four newspapers about the journal article, and
- the total number of words broadcast by the three networks about the journal article.

The number of words for each newspaper article or television broadcast was extracted from the computer file for each article or broadcast transcript.

Citation data for all articles published in the four journals during the sample year were gathered in June 2002 from Web of Science (http://isiknowledge.com), which provides access to article citation information compiled by the Science Citation Index and the Social Science Citation Index. For this study, data from both indexes were used, to provide the fullest possible picture of the frequency with which scholars cited the articles in the four journals. Because both the word counts and citation figures were manifest in nature, no intercoder reliability tests were performed.

Hierarchical linear regression analysis was used to examine the relationship between news coverage and citation rates, with the latter as the

TABLE 1
Descriptive Statistics (*N* = 2,655)

Variable	M	SD
Number of citations	96.02	132.51
Publication in *Nature* (0 = no, 1 = yes)	0.43	0.50
Publication in the *New England Journal of Medicine* (0 = no, 1 = yes)	0.12	0.32
Publication in *Science* (0 = no, 1 = yes)	0.34	0.47
Coverage by the *New York Times*	35.53	171.84
Coverage by other newspapers	433.14	1351.39
Coverage by television	6.82	64.70

NOTE: This table presents data describing 2,655 articles that were published in the *Journal of the American Medical Association*, *Nature*, the *New England Journal of Medicine*, or *Science* between June 1997 and May 1998. Citations refer to the number of citations of the article through June 2002. The three publication variables are each 1 if the article was published in the relevant journal and 0 otherwise. The *Times* coverage variable refers to the number of words of breaking news coverage devoted to the article by the *New York Times*. Similarly, the other newspaper and television coverage variables indicate the number of words of coverage by the twenty-four other daily newspapers and the three broadcast networks, respectively.

dependent variable. In the first step, dummy variables representing publication in *Nature*, the *New England Journal of Medicine*, and *Science* were entered. In the second step, *Times* coverage was entered; this step was intended to address the hypothesis. In the third step, television coverage and other newspaper coverage were entered in addition to *Times* coverage, to address the research question.

Results

A total of 2,655 articles was published in the four journals. In addition, 140 articles from the *New York Times* were identified, as well as 2,703 articles from the other twenty-four newspapers and sixty-four television reports. Descriptive statistics for the variables in this study are reported in Table 1, and correlations are reported in Table 2. Coverage by the *Times* and the other twenty-four newspapers was highly correlated, but television coverage was less strongly correlated with each of the two newspaper variables. Each of the media coverage variables was positively correlated with citation rates.

The 563 journal articles that had been covered by at least one newspaper or network broadcast in the study received a mean of 116.46 citations (*SD* = 158.15). By comparison, the 2,092 journal articles that had received no news

TABLE 2
Correlations (*N* = 2,655)

Variable	*2*	*3*	*4*	*5*	*6*	*7*
1. Number of citations	–.01	.06**	.03*	.09***	.11***	.05**
2. Publication in *Nature*		–.32***	–.63***	–.11***	–.17***	–.08***
3. Publication in the *New England Journal of Medicine*			–.26***	.11***	.12***	.14***
4. Publication in *Science*				–.03*	–.03*	–.07***
5. Coverage by the *New York Times*					.74***	.21***
6. Coverage by other newspapers						.32***
7. Coverage by television						

NOTE: This table shows the correlations between each pair of variables in the analysis.
*p < .05. **p < .01. ***p < .001.

coverage were cited a mean of 90.52 times (*SD* = 124.18, difference significant at $p < .001$).

Results of the regression analysis are presented in Table 3. The first step of the analysis, which compared articles published in the *Journal of the American Medical Association* to articles published in the other three journals, indicates that articles published in the *Journal of the American Medical Association* were cited less frequently than articles published in the other three journals. The second step of the analysis shows that even taking into account the differences in citation rates among the four journals, coverage by the *New York Times* was associated with an increased citation rate. Specifically, each additional one hundred words of *Times* coverage was associated with seven additional citations of that journal article.

However, that association was lost in the third step of the analysis, which added the effects of coverage by other newspapers and by television. In this step, other newspaper coverage had a statistically significant association with citation rates, with each additional 100 words of newspaper coverage of a journal article associated with one additional citation of that journal article. In this step of the analysis, coverage by television and the *New York Times* did not have significant associations with citation rates.

Variance inflation factors were used to evaluate the extent of multicollinearity among the independent variables. The highest value was 2.96, below the value of 10 that is a rule of thumb as an indication of extreme multicollinearity (Neter et al. 1996). Extreme multicollinearity also is indicated by a mean variance inflation factor that is considerably greater than 1; the mean in the present study was 2.34, further suggesting that extreme multicollinearity is absent.

TABLE 3
Hierarchical Regression Analysis for Predicting Article Citation Rates

Variable	B	SE B	Δ	R^2	ΔR^2
Step 1				.01	.01***
Publication in *Nature*	30.96	8.65	.12***		
Publication in the *New England Journal of Medicine*	54.22	10.75	.13***		
Publication in *Science*	39.03	8.89	.14***		
Step 2				.02	.01***
Publication in *Nature*	36.91	8.70	.14***		
Publication in the *New England Journal of Medicine*	54.89	10.70	.13***		
Publication in *Science*	43.97	58.91	.16***		
Coverage by the *New York Times*	0.07	0.02	.10***		
Step 3				.03	.01***
Publication in *Nature*	43.53	8.82	.16***		
Publication in the *New England Journal of Medicine*	57.10	10.70	.14***		
Publication in *Science*	49.34	8.98	.18***		
Coverage by the *New York Times*	0.01	0.02	.01		
Coverage by other newspapers	0.01	0.00	.11***		
Coverage by television	0.04	0.04	.02		

NOTE: Data report a regression analysis for predicting an article's citation rates from the variables in this analysis. The first step examines the effects of the journal of publication on citation rates; each journal is compared to articles published in the *Journal of the American Medical Association*. The second step adds the effect of coverage by the *New York Times*, and the third step adds the effects of coverage by other daily newspapers and broadcast networks.
***$p < .001$.

Discussion

The hypothesis—that journal articles that are covered by the *New York Times* will be cited by scholars more frequently than journal articles that are not covered by the *Times*—was supported. In the second step of the regression analysis, coverage rates and *Times* coverage exhibited a correlation of .10. This finding is consistent with the work of Phillips et al. (1991).

However, when coverage by television and other newspapers was taken into account, *Times* coverage was not significantly correlated with citation rates of journal articles. This finding suggests that—contrary to the role often attributed to it by scientists, journal publishers, public affairs officers, and science journalists—the *Times* does not have unique influence as a disseminator of news about research to scholars. This conclusion accords with common sense: the *Times* potential power in disseminating news about

scientific research is limited by the circulation of its national edition, while local newspapers across the country each reach many more individuals (among them, scientists and scholars interested in news about new research).

Coverage by the *New York Times* could also influence citation rates to the extent that other newspapers publish *Times* coverage that has been distributed through syndication. However, in this study, the *New York Times* was identified as the source of only 105, or 4 percent, of the stories published by the twenty-four daily newspapers besides the *Times*, which suggests that this indirect influence, if it exists, is modest at most.

In addition, network television broadcasts, which also have large audiences, lacked any significant association with citation rates of journal articles. One possible explanation may lie in the fact that the content of television broadcasts is remembered less well than the content of newspapers (DeFleur et al. 1992; Graber 1988; Robinson and Levy 1986). Scientists, like others, may be more likely to remember research news that is presented to them in print, and that difference in recall could translate into a subsequent difference in the frequency of citation of that research. Alternatively, or in combination with such a news recall effect, scientists may watch television less frequently than they read newspapers and so would have fewer opportunities to be influenced by televised reports of new research. More research into scholars' use and recall of news media would be required to investigate these potential explanations.

A study such as the present one cannot prove the validity of what Phillips et al. (1991) termed the "publicity hypothesis" (i.e., that media coverage truly increases citation rates for an article) over the "earmark hypothesis" (that news coverage simply identifies significant articles that would have been frequently cited even without news coverage). Phillips et al. themselves demonstrated the validity of the publicity hypothesis by comparing ordinary *Times* coverage of the *New England Journal of Medicine* with coverage during a 1978 strike at the paper. Journal articles that were covered during that period—when researchers were unable to read the *Times*—were cited no more frequently than other journal articles. Although the present study does not disprove the earmark hypothesis, the results do cast doubt on the hypothesis: many articles published in the four journals were frequently cited by scholars even though they received no news coverage at all. If science and medical journalists and their news organizations are earmarkers, they are not very good at it.

Conclusions

Overall, this study suggests an association between newspaper coverage of new scholarly research and scientists' subsequent citations of that research. However, media coverage is far from a complete explanation of scientists' citation behaviors; the regression analysis explained a very low proportion of variance in citation rates, so other factors are clearly at play as well. In addition, this study examined only news coverage that was published as breaking news about scientific research; other types of coverage, such as in-depth features, might well exhibit a different relationship with citation patterns.

Furthermore, this study represents only one snapshot in time of citation patterns, four to five years after publication of the journal articles. It is possible that the association between news coverage and citation rates could change with time; for example, journal articles that received no press coverage could "catch up" with articles that had been covered, as scientists learn about the uncovered articles from other scholars, such as by seeing the uncovered articles cited in other scholars' papers. Longitudinal research would be required to address such questions.

Nevertheless, the results of the present study raise important policy and research issues regarding the transmission of scientific findings through the popular media. Does the news media's coverage of scientific developments influence not only what research findings scholars choose to cite but also what research directions to pursue? Laurel Richardson Walum, a sociologist, raised such concerns in 1975 after the *New York Times* ran an article about her research on rituals related to passing through a door. In response to the coverage, she received about three hundred letters from colleagues, many requesting copies of her paper, leading Walum (1975) to worry that the press coverage could skew the process by which her (and others') ideas were processed and assimilated by peers.

> To the extent that the press coverage *itself* prejudices the sociological jury (either positively or negatively) regarding a paper, and to the extent that they allow the norms of journalism to decide for them the value of a work, the norms of science are endangered. (P. 30)

In addition, there are public health implications to influence by the popular media on diffusion of research news to scientists. The *Journal of the American Medical Association* and the *New England Journal of Medicine*, for example, have been shown to underemphasize research into methods for preventing disease rather than treating disease (Woolf and Johnson 2000). News

coverage of research published in these journals may help steer researchers into treatment-related research, perpetuating what some see as an underemphasis on preventive research in medicine.

If the popular media do influence the scientific process, another important question that bears greater scrutiny by communication researchers is how science and medical journalists select the research findings that they will cover. The publishers of the four journals examined in this study use a variety of techniques to encourage news coverage of their papers. Notable among these is an elaborate system of press releases and embargoes, under which science journalists are given as much as a week's advance access to journal papers, on the condition that they not disseminate news coverage until a time set by the journal. The *Journal of the American Medical Association*, *Nature*, and *Science* all distribute embargoed press releases to participating journalists; the press releases highlight certain research papers and effectively downplay others (Kiernan 1997). One recent study found that press releases issued by seven medical journals exaggerate the importance of published research, raising the possibility that scholars may be getting a distorted sense of the significance of the research reported by the mass media (Woloshin and Schwartz 2002). Because the press releases distributed by scholarly journals tend to shape journalists' work and thus indirectly scientists' perceptions of published research, communication scholars may wish to investigate more thoroughly how these press releases are constructed and how they reflect scholarly inquiry and research.

Note

1. Newspapers included in the analysis were *Anchorage Daily News*, *The Arizona Republic*, *The Atlanta Journal-Constitution*, *The Boston Globe*, *The Charlotte Observer*, *Chicago Tribune*, *Christian Science Monitor*, *The Columbus Dispatch*, *Los Angeles Times*, *The Miami Herald*, *Newsday*, *The Orlando Sentinel*, *The Palm Beach Post*, *The Philadelphia Inquirer*, *Pittsburgh Post-Gazette*, *Richmond Times-Dispatch*, *The Sacramento Bee*, *San Francisco Chronicle*, *San Jose Mercury News*, *St. Louis Post-Dispatch*, *The Sun* of Baltimore, *The Times-Picayune* of New Orleans, *USA Today*, and *The Washington Post*.

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