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Abstract

Several studies have found that mentions of research articles in public media can have substantial effects on the articles' later citation counts and altmetrics. However, little attention so far went into investigating the potential relationship between qualitative properties of press texts that promote research and the research's impact. In this research in progress, we set out to manually analyze and compare the press releases published on *EurekAlert!* to promote a sample of 120 research articles, 60 of which later performed remarkably well concerning selected article-level metrics, while the remaining 60 articles later performed comparatively poorly. As a preliminary result, qualitative differences could be found regarding the press releases' structure, linguistic accessibility and the existence of narratives. First applications of our in-development codebook suggest associations between press releases with poor structure or accessibility and promoted research articles' metrics performance. We conclude with indications towards numerous promising paths for continuations of this study.

Introduction: Motivation and Related Work

In surveys on researchers' perceptions of bibliometric and altmetric indicators, a frequently encountered suspicion is that they might primarily capture visibility or curiosity, and therefore often ultimately the amount of effort made to advertise respective publications (Lemke et al., 2019; Nicholas et al., 2020). Besides efforts of *internal* science communication (i.e., communication primarily targeting other researchers, like for instance a presentation at an academic conference), this also includes the promotion research receives in channels of *external* science communication, e.g., by being featured in newspapers, podcasts, or television. Various studies analyzed the relationship between research publications' media visibility around the time of their publication and their later metrics, most often focusing on citation counts. For instance, several studies found newspaper coverage to be associated with substantially higher later citation rates for featured research articles (Phillips et al., 1991; Kiernan, 2003; Fanelli, 2013). Similarly, Chapman, Nguyen & White (2007) examined the association between articles published in the journal *Tobacco Control* receiving promotion in press releases and their later citations and usage metrics, finding the articles with accompanying press releases to be more likely to get cited, as well as to receive more downloads and web hits than similar articles without press releases. Lemke (2020) compared the citations and five prevalent altmetrics of a treatment group of 10,483 journal articles that were featured in press releases in 2016 to those of a similarly structured control group without known press release promotion, finding the treatment group to perform substantially better regarding all six examined indicators.

So while several previous studies revealed correlations between presence in different formats of external science communication and respective research articles' later metrics, it remains uncertain which processes and causalities explain these findings. Phillips et al. (1991) propose two hypotheses, the 'publicity hypothesis' and the 'earmark hypothesis'. The publicity hypothesis argues that it is the increase of visibility achieved by press release- or newspaper coverage that leads to more potential citers reading the featured articles and therefore increases their likelihood of receiving citations. The earmark hypothesis on the other hand suggests that the journalists selecting publications to cover and the researchers selecting publications to cite just independently of each other arrive at similar judgments regarding which literature suits their needs best. The citation advantage of a publication featured in mainstream media would

therefore be the result of its own quality and not depend on the increased visibility. The results by Phillips et al. (1991) themselves provide a strong argument for the publicity hypothesis, as they found research articles featured in issues of the *New York Times* that had not been distributed due to a strike to receive considerably less citations than research articles featured in regular issues of the *New York Times*. However, the effects proposed by publicity hypothesis and earmark hypothesis are not necessarily mutually exclusive.

Despite the substantial number of studies evidencing an association between research articles' coverage in external science communication and later metrics, the 'hows' and 'whys' behind this association remain mostly unanswered. One reason for this could be most past studies' focus on purely quantitative relationships between mentions in external science communication and later citations, which typically regarded an article receiving press promotion as a numerical value or even as a binary event (i.e., without differentiation between promoting material's qualities). Potential structural or content-related properties of the actual press texts that promoted different articles on the other hand were mostly neglected so far.

This research in progress aims to address this gap through the qualitative analysis of press releases promoting research articles. By retrospectively analyzing press releases issued for journal articles that later received particularly high metrics and comparing these to press releases for journal articles published around the same time that later received comparatively low metrics, we aim to examine whether qualitative differences between the two groups of press releases are distinguishable. Our endeavor is guided by the hypothesis that PR activities, such as press releases, and press coverage can substantially affect research's overall impact, and that examining qualitative properties of said PR's and press coverage's individual instances could lead to a better understanding of the circumstances under which this is the case. As this article describes a study that is still in progress, its main purposes are twofold: (1) it intends to shed light on promising avenues for further research on the subject (and more specifically outline subsequent steps our own research will take), and (2) it shall give first insights into noteworthy observations we made during the manual coding of press releases to scholarly articles so far.

Within the framework of the news value theory, a substantial body of research already discussed the question which factors increase the likelihood for a topic to receive coverage in public media (see Badenschier and Wormer (2012) for a brief review of such works, as well as for a model explaining news factors for the particular case of science topics). Such factors (e.g., a topic's range, actuality, or surprise factor) explain why certain topics and therefore research articles might be selected for press releases in the first place. To complement this existing research, our main focus is on further properties of the press releases that should be largely independent of the promoted research's topic. In particular, we investigate whether particularly 'impactful' articles' press releases vary from others regarding their structure, linguistic accessibility, and the way they use emotionally engaging narratives to report the featured research's findings. Thus, our main interest is to describe how external science communicators, e.g., press officers of research institutions, publishers, or journals, might exert an influence over an article's later impact through the accompanying press releases they issue. It should be noted that such influence would obviously only constitute one component of a multifaceted and highly complex mélange of factors that affect research articles' impact metrics (Tahamtan et al., 2016).

For many research institutions and scholarly publishers, press releases constitute the quintessential instrument for marketing new knowledge (Autzen, 2014). As Carver (2014, p. 2) describes it, the press release is "essentially a short news article written in a journalistic style that explains a newly published scientific result in a common and not too specialized language". The arguably most important international platform for the dissemination of press releases on science is *EurekAlert!*, set up by the *American Association for the Advancement of Science* in 1996. According to Vrieze (2018), with over 5,000 active public information officers and more

than 14,000 registered journalists from over 90 countries, the platform has become for scientific press and news releases "what *Google* is for searching and *Amazon* for online shopping".

Methods & Data

We use press release data provided directly by *EurekAlert!*. The data contains a comprehensive list of 11,110 unique DOIs of research publications for which at least one press release was published on *EurekAlert!* in 2016, 10,859 of which refer to journal articles according to the *Crossref* REST API. To be able to identify the articles with comparatively high and those with comparatively low metrics among the set, we obtain altmetric data for the 10,859 journal article DOIs promoted on *EurekAlert!* in 2016 from *Altmetric.com* as well as citation counts from the CCB databases[1] via the respective services' APIs. Metrics data was retrieved in October 2020.
As a starting point for this research in progress, we focus on articles with particularly high or low impact regarding the six types of indicators which Lemke (2020) found to be associated with press release promotion: *Web of Science* citation counts, tweet mentions, *Facebook* mentions, blog mentions, mainstream media mentions, and *Mendeley* readership counts.
Using the method of characteristic scores and scales introduced by Glänzel and Schubert (1988), out of our 10,859 journal article DOIs we extract 2 subsets of articles for each of these six indicators: one set of articles performing remarkably and one set of articles performing poorly regarding said indicator. This provides us with 12 subsets of articles. From each of these 12 sets we draw 10 random articles, for which we then retrieve the respective press releases that promoted them from *EurekAlert!*. This leads to a set of 124 press releases to analyze.
The press releases are then coded manually by two coders with an inductive approach, meaning the iterative coding of subsets to continuously develop a codebook of properties that might be helpful in the explanation of different press releases' varying promotional effects for the featured research articles. Starting points for which structural and content-related characteristics to expect from press releases to research articles exist in the form of guidelines on how to write them.[2] Each round of coding consists of thorough reading and simultaneous notetaking. These notes are iteratively reviewed by both coders to identify relevant properties and ranges of values these properties can take. The revised codebook is then again applied to the dataset.

Preliminary Results & Discussion

In the following subsections, we first briefly describe our dataset and then summarize preliminary findings regarding properties in which the coded press releases differ from each other, which might also affect their (and promoted research articles') later uptake.

Article properties

In total, the 120 articles whose 124 press releases we analyzed were published in 72 different journals from 21 publishers, *Science* and *Nature* being the most strongly represented journals (with 14/12 articles respectively). We manually identified the articles' disciplines by reading their press releases (which should enable more accurate article-level mappings than consulting publishing journals' *Web of Science* subject categories), finding most of them to be related to medicine (56 press releases) or biology (28 press releases), followed by psychology, chemistry, economics, archeology, and geology. The dominance of life science topics, both in public media's science coverage in general as well as on *EurekAlert!* in particular, is in line with findings from previous studies (e.g., Elmer, Badenschier & Wormer, 2008; Hahn & Lemke,

[1] CCB refers to the German *Competence Centre for Bibliometrics*, an institution hosting annually updated citation databases built on data from *Web of Science*. The citation data used in this study reflects a state from April 2020.
[2] For examples, see https://www.cbsnews.com/news/how-to-write-a-press-release-with-examples/, https://esahubble.org/about_us/scientist_guidelines/, https://www.asbmb.org/education/science-outreach/how-to-write-a-press-release, or https://service.prweb.com/resources/article/editorial-guidelines/.

2020). The majority (116) of the 120 journal articles were published in the same year as their respective press release, 2016, two were published towards the end of 2015, the remaining two early in 2017. Table 1 describes the 60 remarkably performing and the 60 poorly performing articles regarding the six article-level indicators considered in this study, as well as their publishing journals' impact factors in 2016.
Of the 124 associated press releases, 83 (46 for high, 37 for low performing articles) had been submitted to *EurekAlert!* by institutes conducting research, e.g., universities, laboratories, or hospitals, 41 (17 for high, 24 for low performing articles) by scholarly publishers.

Table 1. Indicator-related statistics of both article groups

	Poorly perf. articles			Remarkably perf. articles		
	Mean	Median	SD	Mean	Median	SD
Citations	22.1	15	23.9	136.2	127	118.7
Mainstream media mentions	12.0	8	14.5	68.9	52.5	63.9
Blog mentions	1.2	1	1.8	11.1	10	8.5
Tweet mentions	17.5	8	24.5	282.2	179	291.1
Facebook mentions	1.2	1	1.7	14.4	10.5	17.2
Mendeley readership counts	79.0	54	89.5	450.7	386	408.9
Journal Impact Factor (2016)	8.337	4.259	9.948	24.130	16.761	14.110

Structure of press releases

Press release texts were analyzed for whether they follow a clearly discernible structure that supports a comprehensible line of argumentation. Ultimately, the coders evaluated a press release's structure as *clear*, *slightly unclear*, or *unclear*. A *clear* buildup could for instance start with a concise problem statement and a brief snapshot of the research, followed by definite paragraphs with comprehensible individual functions, e.g., more detailed descriptions of the research's methods, added value, and further implications. An *unclear* structure on the other hand might merge several diverse parts of information within few, long paragraphs. Another indicator for a structure not being *clear* might be the existence of unnecessary repetitions. Overall, most (96) of the press releases were evaluated as having a clear structure. Another 17 press releases stood out as having an unclear structure, for instance because of sudden jumps in their lines of argumentation or the connection between problem statement and the reported results being vague. Only 5 of those 17 press releases belonged to articles from the remarkably performing group, while the remaining 12 promoted articles which performed poorly.

Accessibility of press releases

Another aspect in which coded press releases differed is their accessibility due to their linguistic or technical complexity. Coders differentiated between *good*, *medium* and *bad* accessibility, depending on whether they deemed the press release understandable for readers that are no experts in the related field of research. A *bad* accessibility could for example result from the press release containing a high number of unexplained technical terms that an average reader would likely have to look up. Most (100) press releases were found to have *good* accessibility. Only 13 press releases were evaluated as having *bad* accessibility, most often because they were written in a highly technical language without sufficient explanations. In this case, 9 of these 13 belonged to articles from the indicator-wise poorly performing group of articles.

Engaging narrative

As another step, coders assessed the press releases' use of engaging narratives to report findings. Primarily, this refers to the press release's author's writing style and not to the promoted research's topic. We do however note that as certain topics will be more suitable for an engaging or emotional style, this category will be affected more significantly by the

promoted article's content than the press release´s structure or linguistic accessibility. Coders assessed the degree to which a press release contained an emotionally engaging style on a five-level Likert scale from *low* (1) over *medium* (3) to *high* (5). *High* emotionality can be the result of a narrative that creates tension, or one that particularly effectively depicts research findings' relevance. *Low* emotionality on the other hand is indicated by an austere writing style dominated by technical information. Most press releases were found to have a *low* (58) or *low-medium* (21) level of engaging narratives, a *medium* score was assigned 19 times, *medium-high* 12 times, and *high* 14 times. Across all scores the two article groups were represented in almost perfectly equal shares. Thus, the degrees to which press releases were found to vary regarding their use of narratives does not seem to correlate with articles' performance concerning metrics.

Our finding of comparatively large shares of poorly performing articles among those with badly structured or linguistically inaccessible press releases suggests that there might be some association between an article's metrics performance and certain qualities of its press releases. However, we need to keep in mind two limitations of our preliminary results: first, our approach (for now) suffers from a small sample size, hindering any observations' generalizability. Second, we cannot make statements about potential associations' directionalities yet. Just as high metrics could (partially) result from the visibility generated by well-made press texts, bad press texts could (partially) be the result of 'bad source material'. As hinted at earlier, the ease with which an engaging narrative can be found to report about an article's findings certainly depends on its topic, and even press releases' structural or linguistic properties might not be independent from the promoted article's content. Thus, the latter's inherent flaws could at the same time be part of the reason for the article receiving lower metrics, as well as for its press releases to be more likely to be perceived as inaccessible or poorly structured.
Furthermore, the quality of press releases could be strongly connected to the publishing journal or institution, just like metrics are strongly affected by the journal an article is published in. Perhaps part of particularly prominent journals' success can be explained by their superior PR, which produces more accessible and better structured press texts than their competitors do. These are questions we aim to tackle in more detail in our research project's subsequent steps.

Conclusion & Outlook

First results from our coding revealed several inherent properties regarding which press releases to scholarly articles differ from each other. Also, the quantitative findings may suggest associations between some of these factors and a promoted article's later metrics. This research is still in an early stage and follow-up studies could take numerous directions.
The next steps in this study will consist of consolidating the observations made during coding to a reusable codebook, its validation through its application by 'blind' raters, which were not involved in its conception, and its subsequent formal assessment in terms of inter-rater-reliability. Regarding further manual coding, it could be insightful to additionally assess press releases regarding their extent of research content, i.e., the degree of detail with which the research itself is presented in them. It might also be interesting to complement raters' judgments of press releases' accessibility with automatically calculated measures of readability, e.g., Coleman-Liau index. Furthermore, upcoming efforts will go into analyzing correlations between properties' manifestations, individual types of metrics, and external factors like the press release's publisher or the promoted article's journal. Moreover, it could be worthwhile to retrieve full texts of news media reporting on the articles from our sample as well as other research articles that cited them to examine the whole alleged chain *research article – press release – media coverage – citation*. Such a comprehensive look might shed light on how certain qualities are carried over (or lost) between different formats and help to better explain the mechanisms behind the association between press coverage and increased article impact.

In later steps, machine learning methods could be applied to make the coding scalable for larger samples of press releases. Another in-depth content analysis could investigate how homogeneous press releases behave across individual journals or publishers – such a study could both enhance the effectiveness of a machine learning-based application of the codebook, as well as provide insights into how individual promotional activities of major players in the world of scholarly publishing shape external science communication.

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