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ARTICLE

The evidence citation patterns of video creators and their relationships with other science communicators

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Abstract

This study explores how YouTube content creators integrate scientific evidence into their videos by analyzing citation patterns across disciplines. The role of other alternative metrics is also considered. We apply Principal Component Analysis (PCA) to compare the citation count of 12,005 research articles from Biotechnology, Psychology, Astrophysics, and Ecology published between 2014 and 2023, including citations sourced from YouTube videos. Our findings provide a characterization of two principal components in evidence citation employed by various science communication stakeholders. The first component enhances a paper's visibility by driving social attention, while the second focuses on its social influence and impact, determined by the paper's quality and scientific relevance.

Keywords

Science and media; Visual communication; Digital science communication

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1 ▪ Context

Scientific research has value not only in terms of its scientific impact, typically measured by citation metrics, but also in terms of its broader societal impact. Societal impact, or impact on society, includes the impact of research on all sectors of society (possibly excluding the impact of research on science). In a study by Wilsdon et al. [2015], the societal impact of research was defined as its impact on education, society, culture, or the economy. One approach is alternative metrics, which provides a quantitative means of measuring the broader impact of publications, as highlighted by the NISO Alternative Assessment Metrics [NISO, 2016].

With the emergence of new data sources that allow for the collection of information on how the results of scientific research are used, there has been a significant shift in how the societal impact of scholarly research is assessed. This has resulted in a more diverse approach to research evaluation, encompassing a wider range of scholarly publications and creative communication methods [see surveys by Bornmann, 2013; de Rijcke et al., 2016; Bornmann & Haunschild, 2019]. To assess the impact of research being conducted at higher education institutions, the UK implemented the Research Excellence Framework [REF, 2021]. Within this framework, the evaluation of impact beyond the scientific realm holds significant weight, accounting for 25% of the total assessment. This includes measuring the influence of research on public policy, services, economy, society, culture, health, environment, and overall quality of life [Khazragui & Hudson, 2015].

Alternative metrics are indicators that are used to evaluate the impact and influence of scholarly research beyond traditional citation-based measures. They include data such as mentions in news articles, policy documents, social media, blogs, and online reference managers (such as Mendeley), as well as other digital platforms. They aim to provide a broader and more immediate picture of how research is disseminated, discussed, and used in society, offering insights into wider engagement and societal impact.

The research community is increasingly recognizing the need to reconsider alternative metrics concerning impact [Spaapen & van Drooge, 2011; Joly et al., 2015; Morton, 2015; Dorta-González & Dorta-González, 2023]. Rather than functioning as direct indicators of impact, recent studies suggest that alternative metrics are better understood as tools for analyzing how research engages with society and how knowledge circulates beyond academic boundaries [Haustein et al., 2016; Ravenscroft et al., 2017]. This view is further reinforced by scholars advocating for a rethinking of alternative metrics [Robinson-Garcia et al., 2018; Wouters et al., 2019], with ongoing research continuing to refine this evolving framework [Costas et al., 2021; Alperin et al., 2024; González-Betancor & Dorta-González, 2023].

As a complementary metric, the inclusion of scientific articles in policy documents demonstrates the impact of research on society [Yu et al., 2023]. Furthermore, citing research in policy documents enhances the credibility of policies among the target population [Bornmann et al., 2016] and provides valuable insights into the intersection of academic research and policymaking. Similarly, citing research articles in patent documents highlights the impact of academic research on innovation. Oldham [2022] highlights the relationship between research and innovation, emphasizing its importance in revealing the assimilation of scientific knowledge into patents.

Research mentions on social networks such as X have been studied for their underlying motivations [Dorta-González, 2023]. However, there is a lack of research on the use of scientific evidence in video channels. YouTube creators, particularly those with academic backgrounds, often incorporate scientific studies to bolster discussions, enhancing credibility and providing valuable insights [Shaikh et al., 2023].

Disciplines such as Biotechnology, Psychology, Astrophysics, and Ecology are prime examples of areas where content creators frequently draw on published research to inform their discussions [Shaikh et al., 2023]. The inclusion of citations and references in the descriptive metadata of their videos reflects a commitment to transparency and intellectual integrity, allowing viewers to access the sources and further explore the topics discussed [Welbourne & Grant, 2016]. By engaging with the scholarly literature in this way, content creators not only enrich the educational value of their videos but also contribute to the dissemination of evidence-based information and critical thinking within their respective communities [Amarasekara & Grant, 2019; Shaikh et al., 2023].

Some authors suggest that using video as a tool for scholarly dissemination and knowledge transfer can increase the visibility of research papers, leading to increased citations [Shaikh et al., 2023]. Nevertheless, there may be a reciprocal relationship between citations in videos and citations in other sources. In other words, it is plausible that videos don't drive citations alone, but that papers with higher citations are selected for video production, or that both aspects influence each other [Kohler & Dietrich, 2021].

2 ▪ Objective

While previous studies have mainly examined the effect of videos on citations, this research takes a novel approach by investigating how the dissemination of science through alternative communication channels is associated with the creation of videos. To achieve this objective, we use principal component analysis (PCA) to identify patterns of interrelated evidence citation among key players in science and to characterize the principal components of science communication through videos.

3 ▪ Literature review

3.1 ▪ *YouTube and the dissemination of scientific knowledge*

YouTube and online science communication have attracted considerable attention in recent years due to their significant impact on audience engagement and dissemination of scientific knowledge [Hutchinson, 2017; Tafradzhiyski, 2025]. Since its creation in 2005 and subsequent acquisition by Google in 2006, YouTube has rapidly become the second-largest website globally [Sui et al., 2022; Tafradzhiyski, 2025], with an immense user base and high levels of daily activity [O'Neil-Hart & Blumenstein, 2016]. Notably, YouTube enjoys substantial usage across various demographic groups, particularly among 18- to 49-year-olds, wherein eight out of ten individuals watch videos monthly [GMI Research Team, 2025].

In the landscape of YouTube content, science and technology emerge as prominent categories, comprising approximately 4% of all video uploads and ranking seventh among all categories [Hutchinson, 2017; Amarasekara & Grant, 2019]. While the popularity of science-themed channels on YouTube is evident from their vast subscriber base and viewership metrics [Agarwal, 2025], the extent to which scientific communicators are present and engaged on the platform remains relatively understudied. Efforts to understand the utilization of YouTube by scientific communicators have yielded mixed findings. While some surveys indicate infrequent usage among scientific communicators [Collins et al., 2016], others suggest a more substantial presence, with nearly half of the surveyed scientific communicators utilizing media sharing sites like YouTube and Flickr at least weekly [Nikiphorou et al., 2017]. Additionally, investigations into the motivations and patterns of science-related content dissemination on YouTube remain scarce, presenting a notable gap in the literature [Science, Media, and the Public Research Group (SCIMEP), 2016; Amarasekara & Grant, 2019].

3.2 ▪ *User engagement with science content on YouTube*

The engagement of users with online science videos, particularly on YouTube, has garnered significant attention from scholars aiming to understand the dynamics that influence audience interaction. Yang et al. [2022] examined various factors impacting user engagement with online science videos. Their study emphasized the significance of factors such as content quality, relevance, and presentation style in attracting and retaining viewers. Similarly, Welbourne and Grant [2016] investigated the factors influencing the popularity of science communication channels and videos on YouTube. Their findings underscored the importance of factors such as video length, production quality, and presenter expertise in garnering audience attention.

In a related study, Velho et al. [2020] explored how different factors correlate with and affect the viewership of science-related YouTube videos. Their research highlighted variables including video length, title clarity, and header image as influential elements in generating video views. Additionally, Velho and Barata [2020] delved into the profiles, challenges, and motivations of science YouTubers, shedding light on the diverse characteristics and aspirations of content creators within this domain.

Huang and Grant [2020] focused on the storytelling components that contribute to the popularity of science videos on YouTube. Their analysis identified narrative structure, emotional appeal, and visual storytelling as key factors shaping audience engagement with science content. Furthermore, Dubovi and Tabak [2021] examined the interplay between emotional and cognitive engagement with science videos on YouTube, elucidating the intricate mechanisms underlying viewer perceptions and responses to such content.

Together, these studies clarify various factors affecting user engagement with science videos on YouTube, including content quality, presentation style, narrative techniques, and emotional resonance. Grasping these dynamics is crucial for science communicators and content creators aiming to disseminate scientific knowledge effectively and foster meaningful interactions with online audiences. Thus, these aspects should be considered when referencing scientific content.

3.3 ▪ *Video channel citations and impact on science dissemination*

Citing research papers in video channels like YouTube can enhance the visibility and impact of scientific research. Videos on platforms such as YouTube often include citations of research articles in their descriptions, which can play a significant role in disseminating research findings to a broader audience [Shaikh et al., 2023]. The inclusion of citations in video content can also contribute to the credibility and informational value of the videos, potentially leading to increased trust among viewers [Welbourne & Grant, 2016].

Research articles in fields such as Medical and Health Sciences, Biological Sciences, and Psychology and Cognitive Sciences are among the most frequently cited in YouTube videos, indicating a higher level of public interest and engagement with these topics [Shaikh et al., 2023]. The popularity of science communication videos on YouTube can be influenced by various content factors. Understanding these factors can help increase video popularity and, consequently, the citation of the papers featured within them [Welbourne & Grant, 2016].

Moreover, the use of video as a medium for research dissemination can shorten the time it takes to bring evidence into practice, as videos allow for the rapid sharing of research findings online. This can be particularly effective when videos are designed to be engaging and contain emotional content that encourages sharing [Kiriya, 2016].

The citation of papers in video channels can significantly contribute to the dissemination and impact of scientific research [Kousha et al., 2012; Ross-Hellauer et al., 2020]. By leveraging the reach of platforms like YouTube, researchers can increase the visibility of their work, potentially leading to greater societal and scholarly impact [Smith, 2020; Feo et al., 2021].

People cite research papers on video channels for various reasons, as identified through content analysis and, in some cases, interviews or surveys with content creators [Kousha et al., 2012; Yang et al., 2022; Shaikh et al., 2023]. These studies examine citation practices to better understand motivations such as enhancing credibility, explaining complex topics or supporting arguments.

4 ▪ Methods

4.1 ▪ *Data*

To construct a comprehensive dataset, data was retrieved from the Altmetric document search interface in February 2024. The focus was on research articles published between 2014 and 2023 to capture recent trends while maintaining historical context, particularly for citations that typically have a longer gestation period, such as those found in policy documents, patents, and Wikipedia. The search was restricted to 'research articles' to ensure the inclusion of scientific publications that make a substantive contribution to their respective fields.

To ensure relevance to specific fields known for frequent video communication, the Field-of-Research (FoR) code system was used. Although there are other classification systems for papers specified by researchers or journals, Altmetric.com uses a system based on artificial intelligence. It is important to note that this field classification system is imperfect, as it is AI-driven, and its accuracy is uncertain.

The FoR codes used, such as 3206 (Medical Biotechnology), 5203 (Clinical and Health Psychology), 5101 (Astronomical Sciences) and 3103 (Ecology), cover a wide range of disciplines that are relevant to our research objectives. They originate from the Australian and New Zealand Standard Research Classification (ANZSRC) system. While these codes are not international, they are widely used in Australia and New Zealand to categorize research outputs by field for funding, reporting and analysis purposes. Despite being region-specific, the structured taxonomy is frequently referenced in academic and institutional contexts beyond these countries, thanks to its comprehensive and systematic approach to classifying research disciplines.

We consider these four disciplines to be appropriate for this study. This selection is because they encompass four key areas of knowledge: medicine, the physical sciences, the natural sciences, and the social sciences. Furthermore, these are fields in which videos are commonly produced and sources are cited within them. The volume of papers and the average number of citations in videos can be seen in Table 2.

During the data collection process for YouTube, Altmetric.com utilizes a content tracking mechanism that focuses on specific, curated YouTube channels. These channels are chosen based on their relevance to scholarly output and research dissemination. Once a video is posted on one of the tracked channels, the YouTube collector scans the video's description section for any direct links to scholarly outputs.

4.2 ▪ *Variables and tools*

A description of the different variables used in this study is presented in Table 1. Although classifications are always open to question, Table 1 simply provides a structured way of presenting the information, based directly on the findings of this study.

The media play an important role in communicating science to a non-specialized audience. One way to quantify media attention is to determine the number of mentions that scientific

Table 1. Types of references to research papers: description of quantitative variables.

Type	*Measure*	*Variable*	*Description*	*Source*
Influence	Scientific impact	Citations	Number of citations in scholarly publications	Dimensions[1]
	Technological impact	Patent	Number of citations in patent documents	Altmetric
	Impact on policies	Policy	Number of citations in policy documents	Altmetric
	Impact on Readers	Readers	Number of times a paper has been saved in bibliographic reference managers	Mendeley[1]
Attention	Media attention	News	Number of times a paper has been cited in digital newspapers	Altmetric
	Blogging attention	Blog	Number of times a paper has been cited in blogs	Altmetric
	Social media attention	Twitter/X, Facebook	Number of conversations in social networks	Altmetric
	Encyclopedic attention	Wikipedia	Number of references in pages of Wikipedia	Wikipedia[1]
	Video attention	YouTube	Number of times a paper has been cited in video channels of YouTube	YouTube[1]

[1] Altmetric was used as an indirect or secondary source of information.

publications receive in the main digital newspapers. However, the mentions or the times a scientific publication is shared on social media may reflect the public interest or the debate it sparks. On the other hand, the most relevant platform with an encyclopedic approach is Wikipedia. Encyclopedic attention aims to inform and educate the public through well-organized content. This type of attention differs from the others because it focuses on providing accurate and comprehensive information on various topics, with an educational and referential purpose.

In terms of statistical methodology, this research employs Spearman correlation rather than Pearson correlation, primarily due to the characteristics of the data. Spearman correlation is a non-parametric measure of association that assesses the strength and direction of monotonic relationships between two variables. Unlike Pearson's correlation, Spearman's correlation does not assume a normal distribution or linear relationships, making it suitable for variables that may not fulfill these assumptions. As a result, Spearman's correlation provides a robust measure of association that does not depend on these assumptions and is better suited to the aims of this research.

Principal Component Analysis (PCA) is a method used to identify patterns in high-dimensional datasets by reducing their dimensionality. Spearman's PCA, employed here, assesses monotonic associations between variables and is particularly beneficial when dealing with nonlinear relationships between variables or when the data distribution is not normal.

5 ▪ Results

Table 2 provides a description of the dataset analyzed. It includes a total of 12,005 research articles from four different subject categories published between 2014 and 2023. All articles were referenced at least once in YouTube videos, representing 1.42% of the total number of articles published in the same years and fields. As observed, Astrophysics stands out as the discipline with the highest proportion of articles referenced in YouTube videos (2.16%), followed by Psychology (1.40%), Ecology (1.29%), and finally Biotechnology (1.17%). However, when looking at the frequency with which these papers were cited in YouTube videos, it is Biotechnology that has the highest average number of mentions per article, with each article being cited an average of 2.7 times. This is followed by Psychology, with 1.7 citations per article, and finally Astrophysics and Ecology, with an average of 1.5 citations per article.

Table 3 shows various statistics for the dataset. Comparing the mean and the median, the data distributions are highly skewed towards zero. The presence of significant skewness and a preponderance of zero values in the dataset necessitates the application of specialized analytical approaches to ensure an accurate and reliable interpretation of the results. This skewness is a common feature of bibliometric data and requires the use of Spearman correlations. Spearman correlations are less affected by extreme values and non-normality. As shown in Table 4, the number of news items and blog entries exhibit a high correlation of 0.8. Likewise, a similar correlation of 0.8 exists between the number of readers in Mendeley and the number of citations in the Dimensions database.

As can be seen in Table 5, with only three components, it is possible to capture approximately two-thirds of the total variability in the data (ranging from 60.6% to 67.2% depending on the field). This highlights the efficiency of the dimensionality reduction

Table 2. Subject categories, research articles in the Dimensions database from 2014 to 2023, and number of citations in YouTube.

Subject category	*FoR Code*	*Number of papers*	*Papers with some citation in video*	*Percentage of papers with some citation in video*	*Total citations in video*	*Citations in video per paper*
Biotechnology	3206 Medical Biotechnology	127,399	1,487	1.17%	4,013	2.70
Psychology	5203 Clinical and Health Psychology	197,339	2,772	1.40%	4,676	1.69
Astrophysics	5101 Astronomical Sciences	117,386	2,538	2.16%	3,799	1.50
Ecology	3103 Ecology	402,776	5,208	1.29%	7,627	1.46
Total		844,900	12,005	1.42%	20,115	1.68

Table 3. Statistics for research articles with some citation in video (N = 12,005).

Variable	*Mean*	*SE*	*Median*	*SD*	*min*	*max*
News	25.45	0.57	3	62.45	0	1,303
Blog	3.48	0.07	1	7.16	0	262
Policy	0.17	0.01	0	1.25	0	56
Patent	0.25	0.03	0	3.22	0	210
Twitter	101.85	4.02	19	440.74	0	23,686
Facebook	2.91	0.22	0	24.36	0	2,435
Wikipedia	3.15	0.12	0	12.76	0	747
YouTube	1.68	0.07	1	7.22	1	593
Readers	134.91	2.71	53	297.12	0	5,766
Citations	79.14	2.11	27	231.13	0	9,352

Table 4. Proximity matrix (Spearman correlation coefficient) for N = 12,005.

	News	Blog	Policy	Patent	Twitter	Facebook	Wikipedia	YouTube	Readers	Citations
News	1	0.799	0.110	0.043	0.650	0.539	0.433	0.363	0.217	0.247
Blog	0.799	1	0.092	0.015	0.650	0.555	0.468	0.326	0.158	0.248
Policy	0.110	0.092	1	0.074	0.112	0.102	0.046	0.040	0.303	0.276
Patent	0.043	0.015	0.074	1	0.029	0.072	0.002	0.075	0.239	0.228
Twitter	0.650	0.650	0.112	0.029	1	0.608	0.473	0.301	0.240	0.208
Facebook	0.539	0.555	0.102	0.072	0.608	1	0.419	0.302	0.294	0.279
Wikipedia	0.433	0.468	0.046	0.002	0.473	0.419	1	0.281	0.088	0.157
YouTube	0.363	0.326	0.040	0.075	0.301	0.302	0.281	1	0.155	0.154
Readers	0.217	0.158	0.303	0.239	0.240	0.294	0.088	0.155	1	0.805
Citations	0.247	0.248	0.276	0.228	0.208	0.279	0.157	0.154	0.805	1

Table 5. Summary of Principal Component Analysis (PCA): importance of the top five components out of a total of ten.

Subject category		*F1*	*F2*	*F3*	*F4*	*F5*
Biotechnology	Variance (%)	43.1	11.7	9.5	8.8	7.1
	Cumulative (%)	43.1	54.8	64.3	73.1	80.2
Psychology	Variance (%)	40.1	10.9	9.6	8.5	7.8
	Cumulative (%)	40.1	51.0	60.6	69.1	76.9
Astrophysics	Variance (%)	43.2	13.7	10.3	9.2	7.0
	Cumulative (%)	43.2	57.0	67.2	76.5	83.5
Ecology	Variance (%)	39.8	17.6	9.7	8.7	7.2
	Cumulative (%)	39.8	57.5	67.2	75.9	83.1

achieved by PCA, where a significant proportion of the variance in the dataset is captured in a relatively small number of principal components.

Visual analysis of Figure 1 reveals distinct patterns in the distribution of societal influence and societal attention across different scientific fields. The horizontal axis, F1, appears to capture the level of attention paid by society, while the vertical axis, F2, would capture the level of influence on society not explained by attention. Thus, the slope of the line for each variable would represent the relationship between both factors, F2/F1, which is the level of influence or impact on society relative to the attention it generates (influence/attention ratio). Hence, a higher positive slope indicates greater influence relative to attention, and conversely, a lower positive slope indicates less influence relative to the attention generated. For example, cites in patents and in policies are generally the variables representing greater social influence or impact relative to the limited attention of society.

Variables measuring mainly societal influence, including scientific citations, patents and policy, are particularly closely clustered in the first quadrant (top right), especially in fields such as Ecology and Biotechnology. This proximity suggests a robust correlation between these variables within these fields, indicating their interconnectedness and potentially reinforcing the importance of their societal impact. Conversely, variables measuring mainly societal attention predominantly occupy the fourth quadrant (bottom right), with the notable exception of Wikipedia, whose position fluctuates between both quadrants depending on the specific academic field. For example, in Psychology, Wikipedia is closely aligned with societal influence, while in Ecology it tends towards the broader cluster of societal attention variables. Notably, in scientific and technological disciplines such as Astrophysics and Biotechnology, Wikipedia's position lies close to the border between the two quadrants, suggesting a nuanced interplay between its role as a disseminator of knowledge and its alignment with more scientific pursuits. This fluctuation in Wikipedia's positioning across disciplines suggests different profiles among its contributors, possibly reflecting a spectrum ranging from scientifically oriented editors in Psychology to those wishing to popularize content in Ecology, with a broader mix of profiles in scientific and technological fields. In essence, the observed distribution highlights the dynamic relationship between societal impact and societal attention within different academic fields, shaped by the diverse profiles and motivations of contributors to platforms such as Wikipedia.

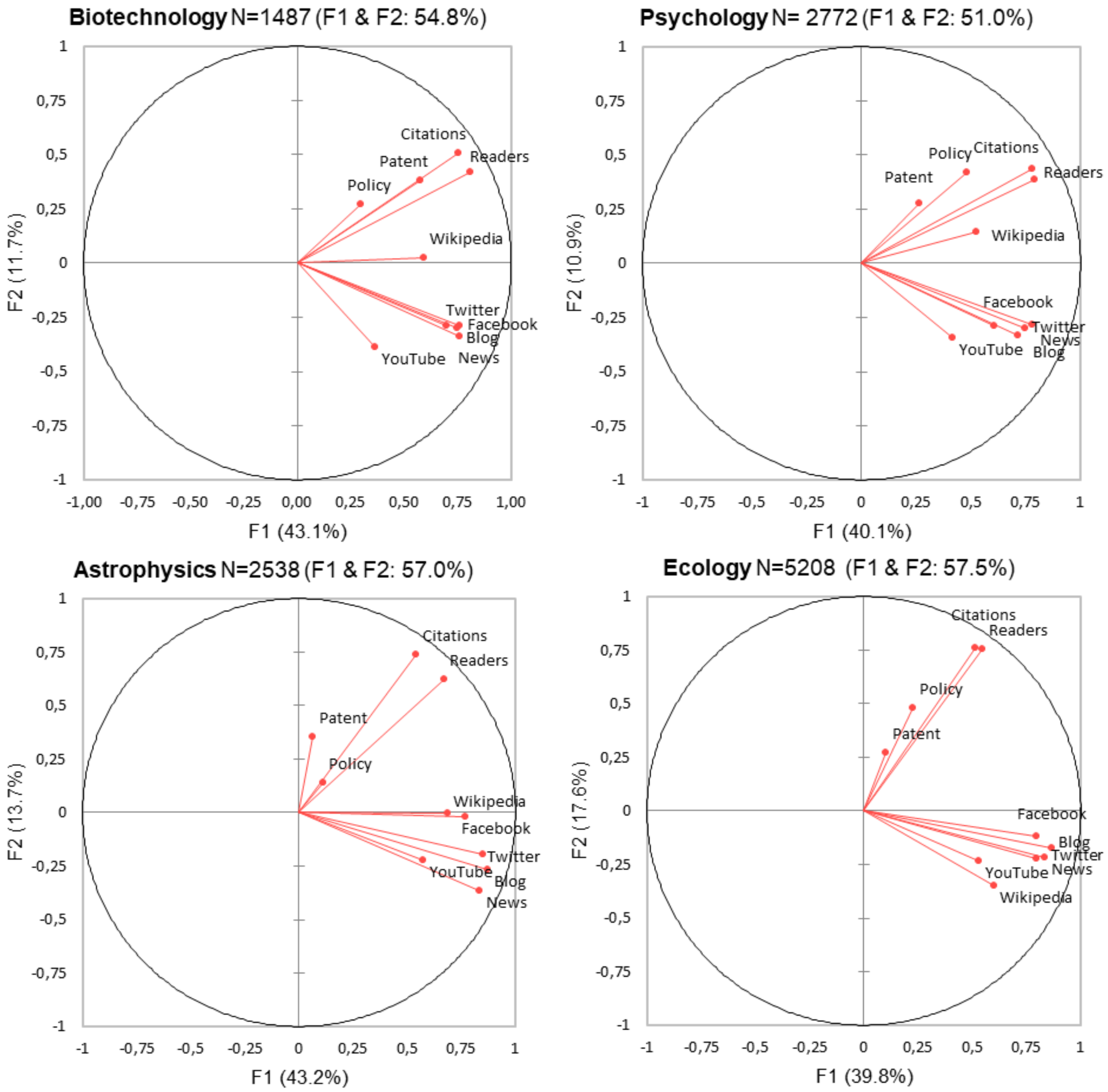

Figure 1. Biplot showing the contribution of the variables to the first two principal components.

Figure 1 further illustrates interesting dynamics within specific fields, providing deeper insights into their unique characteristics. In Biotechnology, the overlapping lines of citations and patents show a robust correlation, suggesting that researchers often wear dual hats as both contributors to scientific discourse and creators of intellectual property. This phenomenon underscores a common practice in which Biotechnology researchers often patent their groundbreaking findings, thereby aligning their academic pursuits with commercial endeavors. In contrast, Ecology presents a nuanced scenario in which policies and patents share a comparable relationship, albeit one that is more complex and difficult to decipher. The intertwining of these variables suggests a complex interplay between regulatory frameworks and innovation in ecological research. Meanwhile, Astrophysics emerges as a distinctive domain where the profiles of patents and policies diverge significantly, suggesting different influences shaping these aspects of scientific activity.

In addition, the Biotechnology landscape is characterized by a high degree of diversity, with four distinct groups from top to bottom. These include a cluster of policies, citations, and patents, reflecting the intersection of academic rigor and practical application within the field. Wikipedia occupies a separate niche, bridging scholarly discourse and the public dissemination of knowledge. Social media, news, and blogs form another discernible cluster, indicating the widespread engagement with Biotechnology across different media platforms. Videos with YouTube as a prominent representative, stand out from the broader societal attention, suggesting a differentiated mode of communication and engagement within the Biotechnology landscape. A parallel trend can be seen in Psychology, albeit with less clarity. Here, the delineation between different profiles is somewhat less pronounced, but the presence of distinct clusters remains evident. These findings highlight the multifaceted nature of scholarly activity and societal engagement within different academic fields and shed light on the complex interplay between research, technology, policy and public discourse.

Figure 1 also provides insight into the importance of variables within the PCA, as indicated by the length of the lines representing the cos 2 values. These values reflect the contribution of each original variable to the formation of the principal components and serve as a metric of the quality of representation within this reduced space. Specifically, it quantifies the proportion of variance in an original variable that is explained by its corresponding principal component. A high cos 2 value, close to 1, indicates a strong correlation between the variable and the principal component, and thus its substantial contribution to the formation of the component. Conversely, a low cos 2 value, close to 0, indicates a weak correlation and minimal contribution to the component. Looking at the results for Ecology and Psychology in Figure 1, there is a notable trend where the cos 2 values for the variable policy are significantly higher than for the other disciplines. This implies that politics plays a more influential role in shaping the principal components within these fields. Conversely, in Astrophysics, variables such as policy and patent have the lowest contributions to the principal components, followed by YouTube and Wikipedia. This suggests that these variables have relatively less influence on the overall structure of data within Astrophysics.

Table 6 presents the loadings of the first five components or factors, which represent the weights assigned to each factor when expressed as a linear combination of the variables. As shown in this table, F1 appears to capture the level of attention paid by society, while F2 would capture the level of influence on society not explained by attention. The remaining three components capture aspects that are less prominent in the first two, albeit varying across different domains: patents, policy, Wikipedia, and YouTube. In essence, this analysis allows for the identification of underlying factors that explain the observed variability in the data, providing valuable insights into the structure and dynamics of the variables under study. By identifying these latent dimensions, stakeholders can gain a deeper understanding of the complex relationships and patterns within this data, enabling more informed decisions.

6 ▪ Discussion

YouTube content creators, especially those with academic or research expertise, often include references to scientific studies to support their arguments and enrich discussions of concepts, theories, discoveries, or practical applications. Disciplines such as Biotechnology, Psychology, Astrophysics and Ecology are particularly reliant on published research and often

Table 6. Matrix loading of the top five components out of a total of ten.

Subject category	*Variable*	*F1*	*F2*	*F3*	*F4*	*F5*
Biotechnology	News	0.76	-0.34	-0.01	-0.01	-0.04
	Blog	0.76	-0.29	-0.01	-0.27	0.06
	Policy	0.30	0.27	0.87	-0.07	-0.19
	Patent	0.57	0.38	-0.31	0.12	0.15
	Twitter	0.75	-0.30	-0.04	-0.24	-0.19
	Facebook	0.70	-0.29	-0.04	-0.18	-0.11
	Wikipedia	0.59	0.03	0.23	0.03	0.73
	YouTube	0.36	-0.39	0.11	0.83	-0.09
	Readers	0.81	0.42	-0.11	0.10	-0.15
	Citations	0.75	0.51	-0.13	0.09	-0.16
Psychology	News	0.78	-0.28	-0.07	-0.07	-0.06
	Blog	0.75	-0.30	-0.10	-0.08	-0.15
	Policy	0.48	0.42	-0.17	0.29	-0.33
	Patent	0.26	0.28	0.86	-0.30	-0.12
	Twitter	0.71	-0.33	-0.05	-0.19	-0.19
	Facebook	0.60	-0.29	0.04	-0.23	0.03
	Wikipedia	0.52	0.14	0.12	0.44	-0.43
	YouTube	0.42	-0.34	0.36	0.60	0.44
	Readers	0.79	0.39	-0.14	-0.11	0.34
	Citations	0.78	0.44	-0.13	-0.08	0.31
Astrophysics	News	0.83	-0.37	0.08	0.08	-0.17
	Blog	0.87	-0.27	0.03	0.05	-0.16
	Policy	0.11	0.14	0.78	-0.59	-0.07
	Patent	0.06	0.35	0.57	0.73	0.02
	Twitter	0.85	-0.20	0.00	0.03	-0.13
	Facebook	0.77	-0.02	-0.03	0.03	-0.16
	Wikipedia	0.69	-0.01	-0.03	-0.04	0.06
	YouTube	0.57	-0.23	0.09	-0.02	0.77
	Readers	0.67	0.62	-0.17	-0.07	0.02
	Citations	0.54	0.74	-0.21	-0.12	0.04
Ecology	News	0.84	-0.22	-0.06	0.13	-0.16
	Blog	0.86	-0.17	-0.05	0.10	-0.14
	Policy	0.23	0.48	-0.12	0.75	0.37
	Patent	0.10	0.27	0.93	0.15	-0.17
	Twitter	0.80	-0.22	-0.05	0.13	-0.16
	Facebook	0.80	-0.12	-0.02	0.02	-0.14
	Wikipedia	0.60	-0.35	0.08	-0.10	0.17
	YouTube	0.53	-0.24	0.25	-0.28	0.66
	Readers	0.55	0.75	-0.10	-0.26	-0.05
	Citations	0.51	0.76	-0.09	-0.30	0.01

cite scientific papers in their video descriptions to underline their solid academic foundation [Shaikh et al., 2023].

We analyzed the differences in the citation patterns of scientific papers on YouTube compared to other communication channels using Principal Component Analysis. A dataset of 12 thousand papers from the years 2014 to 2023 from the four disciplines indicated above, with any mention in videos, was used.

As the primary outcome, we presented a characterization of the two principal components in evidence citation used by various science communication stakeholders:

(F1) Capturing social attention. F1, or social attention, refers to the visibility of a paper in terms of media coverage, its virality on social networks, and its public dissemination. These factors can increase the visibility of a paper, but do not necessarily reflect its quality or scientific impact. For example, a study on a controversial or sensational topic may receive a lot of attention in the media and on social networks, but this does not guarantee that the study is rigorous or that its findings are scientifically significant. Furthermore, media coverage and virality can be influenced by non-scientific considerations, such as the popularity of the author or the ability of the paper's title to generate clicks.

(F2) Measuring social influence/impact. On the other hand, F2 focuses on the social influence and impact of the paper in terms of its quality and scientific relevance, as reflected in the number and type of scientific, policy, and patent citations it receives. A highly influential paper may generate less social debate because its content is supported by solid evidence and widely accepted by the scientific community. For example, a study that introduces a new approach to the treatment of a common disease that has been validated by subsequent studies and adopted by medical professionals could have a significant impact on clinical practice but may generate less discussion in the media or on social networks because its validity has already been established.

In summary, while F1 may increase the visibility of a paper through social attention, F2 focuses on its social influence and impact based on its quality and scientific relevance. Papers with high social attention may generate more public debate, but this does not necessarily translate into greater recognition or scientific impact. On the other hand, papers with high social influence and impact may generate less social debate because their quality and relevance are already well-established in scientific and policy communities.

This study has several limitations. There are substantial differences among the scientific disciplines analyzed in terms of citation practices, communication patterns, and levels of public exposure. These disciplinary specificities hinder the generalization of the results to other fields of knowledge not included in the study, particularly those with markedly different dynamics of dissemination or scientific visibility. Moreover, while YouTube currently stands as the most widely used and globally accessible video platform, it is not the only channel through which scientific communication in audiovisual format takes place. Platforms such as TikTok, Instagram Reels, and even Vimeo also host scientific content and may exhibit different citation patterns or interaction dynamics. Therefore, the findings presented here should be interpreted with caution and within the specific context of the platforms and disciplines considered.

7 ▪ Conclusions

The use of video as a tool for scholarly dissemination and knowledge transfer can increase the visibility of research papers, thereby increasing citations. In addition, video abstracts are more attractive to readers, facilitate the understanding of the paper's content, and are associated with a higher reading rate of the article. However, there may be an inverse or bidirectional relationship between citations in videos and citations in other sources. For this reason, this study examined the association among different communication channels.

We proposed a characterization of the two principal components in evidence citation used by various science communication stakeholders. While the first component increases a paper's visibility through social attention, the second component emphasizes its social influence and impact based on quality and scientific relevance. Papers with high social attention may spark more public debate, but this doesn't necessarily lead to greater recognition or scientific impact. Conversely, papers with high social influence and impact may provoke less social debate, as their quality and relevance are already well recognized within the scientific and policy communities.

The findings of this study may be of interest to researchers, academics, and professionals specializing in science communication and outreach, particularly those interested in how scientific research is disseminated and received across different media and platforms. The findings may also be relevant to science journal editors, policymakers, and science communicators who wish to understand the relationships between citations in YouTube videos, traditional media such as news outlets and Wikipedia, and social media engagement. For example, journal editors could use this information to decide whether to encourage or require authors to produce video abstracts as part of their submission process. Similarly, policymakers may consider including multimedia dissemination in research evaluation frameworks, recognizing social media engagement or video citations as additional indicators of broader societal impact. These findings have important implications for how research is assessed and communicated in an increasingly digital, multi-platform environment.

References

Agarwal, A. (2025, July 19). 100 Science YouTubers in 2025. *FeedSpot*. https://blog.feedspot.com/science_youtube_channels/

Alperin, J. P., Fleerackers, A., Riedlinger, M., & Haustein, S. (2024). Second-order citations in altmetrics: a case study analyzing the audiences of COVID-19 research in the news and on social media. *Quantitative Science Studies*, *5*(2), 366–382. https://doi.org/10.1162/qss_a_00298

Amarasekara, I., & Grant, W. J. (2019). Exploring the YouTube science communication gender gap: a sentiment analysis. *Public Understanding of Science*, *28*(1), 68–84. https://doi.org/10.1177/0963662518786654

Bornmann, L. (2013). What is societal impact of research and how can it be assessed? A literature survey. *Journal of the American Society for Information Science and Technology*, *64*(2), 217–233. https://doi.org/10.1002/asi.22803

Bornmann, L., & Haunschild, R. (2019). Societal impact measurement of research papers. In W. Glänzel, H. F. Moed, U. Schmoch & M. Thelwall (Eds.), *Springer handbook of science and technology indicators* (pp. 609–632). Springer. https://doi.org/10.1007/978-3-030-02511-3_23

Bornmann, L., Haunschild, R., & Marx, W. (2016). Policy documents as sources for measuring societal impact: how often is climate change research mentioned in policy-related documents? *Scientometrics*, *109*(3), 1477–1495. https://doi.org/10.1007/s11192-016-2115-y

Collins, K., Shiffman, D., & Rock, J. (2016). How are scientists using social media in the workplace? *PLoS ONE*, *11*(10), e0162680. https://doi.org/10.1371/journal.pone.0162680

Costas, R., de Rijcke, S., & Marres, N. (2021). "Heterogeneous couplings": operationalizing network perspectives to study science-society interactions through social media metrics. *Journal of the Association for Information Science and Technology*, *72*(5), 595–610. https://doi.org/10.1002/asi.24427

de Rijcke, S., Wouters, P. F., Rushforth, A. D., Franssen, T. P., & Hammarfelt, B. (2016). Evaluation practices and effects of indicator use — a literature review. *Research Evaluation*, *25*(2), 161–169. https://doi.org/10.1093/reseval/rvv038

Dorta-González, P. (2023). Factors that influence how scientific articles and reviews are mentioned on Twitter. *Journal of Scientometric Research*, *12*(3), 577–584. https://doi.org/10.5530/jscires.12.3.055

Dorta-González, P., & Dorta-González, M. I. (2023). The funding effect on citation and social attention: the UN Sustainable Development Goals (SDGs) as a case study. *Online Information Review*, *47*(7), 1358–1376. https://doi.org/10.1108/oir-05-2022-0300

Dubovi, I., & Tabak, I. (2021). Interactions between emotional and cognitive engagement with science on YouTube. *Public Understanding of Science*, *30*(6), 759–776. https://doi.org/10.1177/0963662521990848

Feo, E., Mareen, H., Burssens, S., & Spanoghe, P. (2021). The relevance of videos as a practical tool for communication and dissemination in Horizon2020 thematic networks. *Sustainability*, *13*(23), 13116. https://doi.org/10.3390/su132313116

GMI Research Team. (2025, June 5). YouTube statistics 2025 (demographics, users by country & more). *GMI*. https://www.globalmediainsight.com/blog/youtube-users-statistics/

González-Betancor, S. M., & Dorta-González, P. (2023). Does society show differential attention to researchers based on gender and field? *Journal of Informetrics*, *17*(4), 101452. https://doi.org/10.1016/j.joi.2023.101452

Haustein, S., Bowman, T. D., & Costas, R. (2016). Interpreting 'altmetrics': viewing acts on social media through the lens of citation and social theories. In C. R. Sugimoto (Ed.), *Theories of informetrics and scholarly communication* (pp. 372–405). De Gruyter Saur. https://doi.org/10.1515/9783110308464-022

Huang, T., & Grant, W. J. (2020). A good story well told: storytelling components that impact science video popularity on YouTube. *Frontiers in Communication*, *5*, 581349. https://doi.org/10.3389/fcomm.2020.581349

Hutchinson, A. (2017, September 14). Mind-blowing YouTube stats, facts and figures for 2017 [Infographic]. *SocialMediaToday*. https://www.socialmediatoday.com/social-business/mind-blowing-youtube-stats-facts-and-figures-2017-infographic

Joly, P.-B., Gaunand, A., Colinet, L., Larédo, P., Lemarié, S., & Matt, M. (2015). ASIRPA: a comprehensive theory-based approach to assessing the societal impacts of a research organization. *Research Evaluation*, *24*(4), 440–453. https://doi.org/10.1093/reseval/rvv015

Khazragui, H., & Hudson, J. (2015). Measuring the benefits of university research: impact and the REF in the UK. *Research Evaluation*, *24*(1), 51–62. https://doi.org/10.1093/reseval/rvu028

Kiriya, J. (2016). *Shortening the time to bring evidence into practice: dissemination of research findings using on-line videos* [Ph.D. Thesis]. London School of Hygiene & Tropical Medicine. https://doi.org/10.17037/PUBS.02544330

Kohler, S., & Dietrich, T. C. (2021). Potentials and limitations of educational videos on YouTube for science communication. *Frontiers in Communication*, *6*, 581302. https://doi.org/10.3389/fcomm.2021.581302

Kousha, K., Thelwall, M., & Abdoli, M. (2012). The role of online videos in research communication: a content analysis of YouTube videos cited in academic publications. *Journal of the American Society for Information Science and Technology*, *63*(9), 1710–1727. https://doi.org/10.1002/asi.22717

Morton, S. (2015). Progressing research impact assessment: a 'contributions' approach. *Research Evaluation*, *24*(4), 405–419. https://doi.org/10.1093/reseval/rvv016

Nikiphorou, E., Studenic, P., Ammitzbøll, C. G., Canavan, M., Jani, M., Ospelt, C., & Berenbaum, F. (2017). Social media use among young rheumatologists and basic scientists: results of an international survey by the Emerging EULAR Network (EMEUNET). *Annals of the Rheumatic Diseases*, *76*(4), 712–715. https://doi.org/10.1136/annrheumdis-2016-209718

NISO. (2016). *Outputs of the NISO Alternative Assessment Metrics Project. A recommended practice of the National Information Standards Organization* [NISO RP-25-2016]. National Information Standards Organization. https://doi.org/10.3789/niso-rp-25-2016

Oldham, P. (2022). Chapter 6: Patent citations. In *The WIPO patent analytics handbook*. GitHub. https://wipo-analytics.github.io/handbook/

O'Neil-Hart, C., & Blumenstein, H. (2016, April). The latest video trends: where your audience is watching. *Think with Google*. https://www.thinkwithgoogle.com/consumer-insights/video-trends-where-audience-watching/

Ravenscroft, J., Liakata, M., Clare, A., & Duma, D. (2017). Measuring scientific impact beyond academia: an assessment of existing impact metrics and proposed improvements. *PLoS ONE*, *12*(3), e0173152. https://doi.org/10.1371/journal.pone.0173152

REF. (2021). *United Kingdom Research Excellence Framework (REF) to evaluate research quality in higher education institutions*. Retrieved November 6, 2023, from https://www.ref.ac.uk/

Robinson-Garcia, N., van Leeuwen, T. N., & Ràfols, I. (2018). Using altmetrics for contextualised mapping of societal impact: from hits to networks. *Science and Public Policy*, *45*(6), 815–826. https://doi.org/10.1093/scipol/scy024

Ross-Hellauer, T., Tennant, J. P., Banelytė, V., Gorogh, E., Luzi, D., Kraker, P., Pisacane, L., Ruggieri, R., Sifacaki, E., & Vignoli, M. (2020). Ten simple rules for innovative dissemination of research. *PLoS Computational Biology*, *16*(4), e1007704. https://doi.org/10.1371/journal.pcbi.1007704

Science, Media, and the Public Research Group (SCIMEP). (2016, September). *Scientists and social media, 2016*. University of Wisconsin-Madison, Department of Life Sciences Communication. http://scimep.wisc.edu/projects/reports/

Shaikh, A. R., Alhoori, H., & Sun, M. (2023). YouTube and science: models for research impact. *Scientometrics*, *128*(2), 933–955. https://doi.org/10.1007/s11192-022-04574-5

Smith, A. A. (2020). Broadcasting ourselves: opportunities for researchers to share their work through online video. *Frontiers in Environmental Science*, *8*, 150. https://doi.org/10.3389/fenvs.2020.00150

Spaapen, J., & van Drooge, L. (2011). Introducing 'productive interactions' in social impact assessment. *Research Evaluation*, *20*(3), 211–218. https://doi.org/10.3152/095820211x12941371876742

Sui, W., Sui, A., & Rhodes, R. E. (2022). What to watch: practical considerations and strategies for using YouTube for research. *Digital Health*, *8*. https://doi.org/10.1177/20552076221123707

Tafradzhiyski, N. (2025, February 26). YouTube revenue and usage statistics (2025). *Business of Apps*. https://www.businessofapps.com/data/youtube-statistics/

Velho, R. M., & Barata, G. (2020). Profiles, challenges, and motivations of science YouTubers. *Frontiers in Communication*, *5*, 542936. https://doi.org/10.3389/fcomm.2020.542936

Velho, R. M., Mendes, A. M. F., & Azevedo, C. L. N. (2020). Communicating science with YouTube videos: how nine factors relate to and affect video views. *Frontiers in Communication*, *5*, 567606. https://doi.org/10.3389/fcomm.2020.567606

Welbourne, D. J., & Grant, W. J. (2016). Science communication on YouTube: factors that affect channel and video popularity. *Public Understanding of Science*, *25*(6), 706–718. https://doi.org/10.1177/0963662515572068

Wilsdon, J., Allen, L., Belfiore, E., Campbell, P., Curry, S., Hill, S., Jones, R., Kain, R., Kerridge, S., Thelwall, M., Tinkler, J., Viney, I., Wouters, P., Hill, J., & Johnson, B. (2015). *The metric tide: report of the independent review of the role of metrics in research assessment and management*. Higher Education Funding Council for England (HEFCE). https://doi.org/10.13140/RG.2.1.4929.1363

Wouters, P., Zahedi, Z., & Costas, R. (2019). Social media metrics for new research evaluation. In W. Glänzel, H. F. Moed, U. Schmoch & M. Thelwall (Eds.), *Springer handbook of science and technology indicators* (pp. 687–713). Springer. https://doi.org/10.1007/978-3-030-02511-3_26

Yang, S., Brossard, D., Scheufele, D. A., & Xenos, M. A. (2022). The science of YouTube: what factors influence user engagement with online science videos? *PLoS ONE*, *17*(5), e0267697. https://doi.org/10.1371/journal.pone.0267697

Yu, H., Murat, B., Li, J., & Li, L. (2023). How can policy document mentions to scholarly papers be interpreted? An analysis of the underlying mentioning process. *Scientometrics*, *128*(11), 6247–6266. https://doi.org/10.1007/s11192-023-04826-y

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