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# Information vs. Presentation: Three Different Approaches to Media Organizations' Science Communication on Instagram

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**Abstract:** As science journalism is growing in importance and reader interest, the social media platform Instagram provides new opportunities for media organizations to distribute scientific content. The growing danger of fake news and misinformation, as well as the ongoing pandemic and trends in media consumption patterns, make it increasingly necessary for science journalists to deliver reliable content in a well-designed manner on digital platforms. This study investigates how German media companies and individual journalists inform lay audiences on new publications, findings, and developments in sciences, using the platform Instagram. A representative quantitative content analysis of Instagram posts ( $n = 2.605$ ) of nine wide-ranging German accounts related to science journalism shows that the three analyzed groups (public service media outlets, private outlets, and individual journalists) pursue significantly different approaches in how they communicate scientific content on Instagram—ranging from informative to entertaining posts—varying in their text length, the complexity of the media elements used, and the tone of voice. The results shed light on a diversification of journalistic approaches to communicating scientific content on Instagram, as well as which approaches seem fruitful. Thereby, the nature of the media organization influences the complexity, design, and purpose of their science communication on Instagram.

**Keywords:** Instagram; journalists; media organization; science communication; science journalism; social media



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## 1. Introduction

In order to stay competitive and innovative on the media market and to reach new audiences, media outlets are required to distribute content on social media platforms like Instagram (Könneker 2020). Through different options of displaying content and interacting with users, this platform substantially influences the era of visual storytelling (Kobilke 2019).

One especially important topic for which these new influences must be considered is the COVID-19 pandemic. The need for communication about the science behind the pandemic, as well as possible efforts to control it, exemplify the importance of effective science journalism communication (Marsman and van Hout 2021, p. 17).

While in the pre-Internet era, dedicated science departments were only affordable for established newspapers with high resources (Könneker 2020), the social media world provides new opportunities for all media organizations and individuals to distribute scientific content. While science journalism is growing in importance and reader interest (Berg 2018), this development is accompanied by the danger of the publication of undifferentiated, unreliable facts on social media by non-professionals (Könneker 2020). These circumstances make it even more necessary for science journalists to deliver high-quality, reliable content on the popular platform Instagram, which requires strategic communicative approaches.

This study hence considers the intersection between the technological affordances of a social media platform and specific science journalism content. The existing qualitative case studies have provided exemplary insights into how journalists in the newsrooms think about the platform, how Instagram is used in local journalism, and how media organizations use the story-function (e.g., [Graßl et al. 2020](#); [Planer et al. 2022](#); [Schützeneder et al. 2020](#)). Insights into scientific journalism specifically, however, are missing. Further, little is known about the different approaches to the actual presentation of the posts. These shortcomings are therefore the purpose of the given study: it investigates *how German media companies and individual journalists communicate scientific content on Instagram, in a quantitative manner*.

## 2. Literature

### 2.1. The Development of Science Journalism

The beginning of the communication of scientific content dates back to the 17th and 18th centuries, when scientific endeavors mainly occurred behind academic doors. As this entailed a clear distinction between the scientific community and the lay audience ([Weingart 2006](#)), a specific kind of communication was required to translate complex scientific knowledge and discoveries for said unknowing public ([Berg 2018](#), p. 7). This communication was facilitated by the then increasingly relevant mass media ([Weingart 2006](#)), leading to the emergence of a new subcategory of journalism. Science journalism is the communication of scientific information, such as information on medicine or technology ([Guenther 2019](#)), by journalists, to a lay audience: “[P]rofessional science journalists should analyze and interpret scientific discoveries, guide the public about the trustworthiness of scientific information and its sources, and inform readers about the motives of research funders” ([Ginosar et al. 2022](#), p. 4). In Germany, science journalism experienced a first structural embedment in the form of science departments in daily newspapers during this period ([Berg 2018](#), p. 7).

Over time, with increasing professionalization and development, the two areas—journalism and science—became two independent fields of society ([Blöbaum 2017](#), p. 223). While science journalism initially stood in the service of science ([Berg 2018](#), p. 8) and communicated scientific knowledge directly from scientists to the people, science journalists now function as observers of science, who sometimes even control or criticize it ([Berg 2018](#), p. 11).

Though said professionalization is still evident today, new developments in the increasingly fast-paced online media systems are worsening the working conditions for science journalism and journalists ([Schäfer 2017](#), p. 51). Even though many larger newsrooms have developed dedicated science departments and smaller newsrooms have integrated their scientific output into other existing departments, the overall department of science journalism is still a comparatively small one, at least in traditional newspapers ([Berg 2018](#), p. 13). Further, as audiences increasingly turn to online sources for (scientific) information, media outlets face economic difficulties which could decrease the number of desks dedicated to specialist science reporting even further, opposing this positive trend ([Schäfer 2017](#), pp. 52f.). Research shows that demands for fast-paced, high-quality science communication with a shrinking workforce increase the workload for individual science journalists ([Schäfer 2017](#), p. 53f.; [Massarani et al. 2021](#), p. 7; [Bauer et al. 2013](#), p. 14).

Further, new risks emerge within an online environment like social media: Discussions about scientific content can become highly emotional, and communities mobilize and potentially radicalize quickly ([Könneker 2020](#), p. 25). Furthermore, when illustrations and infographics do not display differentiated sources ([Könneker 2020](#), p. 33), this can easily lead to incorrect interpretations, and ultimately, to the distribution of fake information. The latter is part of a larger crisis of credibility, which increasingly leads to an image loss for the role of science and research ([Schnurr and Mäder 2020](#), p. V).

On the contrary, the upsides of new technology allow journalists and media organizations to turn towards social media platforms to explore new audiences, stay competitive,

and consider the increasing influence of their audiences and monitor them, as well as to monitor contents and discourses (Neuberger et al. 2019; Tandoc and Vos 2016). Further, new actors, new attention and traffic streams, and new economic possibilities for journalistic outlets arise in the online environment (Könneker 2020, p. 25). Science journalists increasingly build their own personal brands (Dunwoody 2021, p. 23), rendering neutral reporting less of a focus, and instead increasing the amount of critical, analytical publications (Fahy and Nisbet 2011, p. 785). In addition, there is a chance for legacy media to function as an alternative to fast pace social media publications, such as on Twitter, by publishing explanatory, analytical scientific articles (Dunwoody 2021, p. 21).

Simultaneous to developing a personal brand, however, time pressures could in turn lead journalists to publish more uncritical, PR-like, source-dependent, and episodic science communication (Williams 2015, p. 13; Dunwoody 2021, p. 19; Schäfer 2017, p. 56). Other outside developments which increase the urgency of scientific communication, such as the COVID-19 pandemic, could further these developments (Dunwoody 2021, p. 20). The twofold impacts of the online environment heighten the need for research on science journalism.

Further, this interest in knowledge on scientific communication online is also influenced by global and national occurrences. For example, the COVID-19 pandemic sparked a global interest in scientific content. The need for clearly distinguishable, high-quality science journalism opposed to science-pr began to rise, while science journalism simultaneously remained underfunded (Wormer 2020, p. 467). Newsrooms were forced to develop infographics and deliver the latest numbers and figures, as well as background facts about the virus. The pandemic “has underscored the need for this type of information, especially in relation to context (e.g., timing and intensity of interventions) and epidemiology (e.g., spatially resolved and age-specific case counts)” (Desai et al. 2021, p. e619). At present, an increasing number of newsrooms are hiring data journalists, which also serves a specific branch of science journalism: “previously considered tech-savvy outsiders, they have repeatedly been described as their own closed community” (Haim 2022, p. 1). Also, students in journalism schools are prepared to work within a data-intensive environment (Gutounig et al. 2022, p. 335), and the pandemic made scientists become more available to talk to again, for most journalists (Massarani et al. 2021, p. 8). Beyond the pandemic, other topics, such as climate change, the decline of insects, or new medical developments, must enter mainstream society’s agenda (Dunwoody 2021, p. 14).

Hence, the necessity for high-quality online science journalism is pressing. Overall, while research on science journalism as a form of journalistic communication is growing, considerations on what specifically constitutes effective science communication is a research gap (Wicke 2023, p. 418). As current debates such as the ongoing public need for information on the COVID-19 pandemic and an increasing interest in science journalism by audiences generally (Berg 2018, p. 13) elucidate, filling said research gap is of timely and societal relevance, and is therefore the aim of this paper. To consider the “different shapes of science journalism, and their boundaries, in changing science media ecosystems” (Schäfer 2017, p. 56)—and as it has been found that online science journalists have a collaborative relationship with their audiences and sources (Fahy and Nisbet 2011, p. 778), which is enhanced by the affordances of social media platforms, such as communication, interaction, participation, and collaboration—the focus of this paper is specifically on the social media platform Instagram.

## 2.2. Science Journalism on Instagram

The social media platform Instagram is a relevant research object for a number of reasons: it has only been investigated through the academic lens in recent years; before, the focus lay predominantly on its equivalents, Facebook and Twitter (Hermida and Mellado 2020). While “the visual platform Instagram has [therefore] received comparatively little attention” (Maares and Hanusch 2020, p. 262), scholars have addressed certain areas of the field already. Empirical studies of a qualitative nature, for example, provide insights into how journalists in the newsrooms evaluate the platform, how Instagram is used in local

journalism, and how media organizations use Instagram's story-function (e.g., [Graßl et al. 2020](#); [Planer et al. 2022](#); [Schützeneder et al. 2020](#)). Further studies explore the strategies and perspectives of the topic from both research and practice, ranging from questions of quality, trust, and ethics to national and international case studies to classifications and experiences from journalists working in the field ([Schützeneder and Graßl 2022](#)). The research conducted thus far highlights the necessity of increasingly taking journalism on Instagram into serious consideration.

In addition to being a platform that offers potentials for research in journalism studies, the platform's affordances and specific usage metrics make it especially interesting for the consideration of how science content can effectively be communicated: Instagram is one of the most popular social media platforms worldwide, second only to Facebook ([Dixon 2022b](#)), with especially large percentages of users between 18 and 34 years old ([Dixon 2022a](#)). It is this age group that is increasingly using social media to consume news ([UNICEF 2021](#), p. 8), though research contests that the platform largely distributes general, human-interest stories and news, which are mostly positive and not as focused on hard news ([Al-Rawi et al. 2021](#), p. 305). While social media has been functioning as the most important source of information on COVID-19 vaccines, for example, the overwhelming "infodemic" brought on by large amounts of information on the pandemic led to young generations no longer seeking to inform themselves ([Blandi et al. 2022](#), p. 10). How relevant, hard science news can be communicated effectively on Instagram, especially given the pressing circumstances of the global pandemic, is therefore relevant. Research in the field, however, is scarce.

Additionally, as visual media can leave lasting impressions and visual aids can be used to break down complex information more easily, Instagram is chosen as a research object instead of Facebook and Twitter, which are more text-based platforms. Instagram, in contrast to its competing platforms, offers potential for both. Via the predominantly visual platform, photos and visuals can be uploaded; however, this "does not necessarily mean that a post of a journalist on Instagram cannot include or even prioritize text in specific situations and contexts" ([Hermida and Mellado 2020](#), p. 867). In contrast to Twitter, Instagram works towards capturing and keeping the audience where they are, and less towards being a "transit node" ([Hermida and Mellado 2020](#), p. 869). Concerning design and aesthetics, the idea of snapshots draws back to a "Polaroid aesthetic" ([Hermida and Mellado 2020](#), p. 870), even though filters can be used to alter and manipulate the visuals. Instead of being a quick and on-the-go medium as initially thought, Instagram posts are, at present, usually carefully crafted and edited. Overall, "visual aesthetics, then, serve as a form of identity on Instagram" ([Hermida and Mellado 2020](#), p. 871), which raises the necessity for science journalists to create visually appealing content. This simultaneously gives science journalism the chance to succeed through these visuals and create the reputation of a digitally-savvy, modern branch.

Concerning the platform's affordances for rhetoric and content, Instagram provides the opportunity to add text below the visuals and makes use of hashtags to "shape the interpretation of a post" ([Hermida and Mellado 2020](#), p. 876). Content can be shared with others, commented on, and replied to in Instagram stories, which also makes for multiple options of interaction with users. As science journalism could be developing into more critical, opinion-shaped, and engaged reporting ([Fahy and Nisbet 2011](#), p. 785), this makes the platform even more interesting for research on how science information is communicated.

Lastly, the ongoing technological advances in the distribution of visual fake news, on the one hand, heighten the need for research on effective and high-quality science journalism on Instagram further: While social media has been considered a catalyst for the spread of misinformation generally, new synthetic visual media generated using Artificial Intelligence (AI) technology, such as deepfakes, could worsen these conditions ([Botha and Pieterse 2020](#)). On the other hand, the technology could also be implemented to advance new forms of visual journalism. (Science) Journalism could make use of the potential of



AI technology such as deepfake software for creating and editing fake but highly realistic audio-visual content (Godulla et al. 2021; Seibert 2023) to personalize information for users (WDR Innovation Hub 2021). This could help users to better select information sources in the discussed abundance of information online, which otherwise leads to an avoidance of news (Blandi et al. 2022, p. 10). In particular, media organizations, but also individuals and influencers with a rather small budget, might benefit from the usage of deepfakes for content creation (WDR Innovation Hub 2021).

Having laid out the necessity of high-quality scientific content on Instagram, as well as the platform's opportunities concerning visual presentation and content distribution, this study aims to take a close, yet quantitative, look at how science journalism has diversified on Instagram. The study focuses on the German market only, due to its characteristics.

The media market in Germany could both combat and enhance the trends apparent in science journalism. On the one hand, public service news outlets were trusted during the pandemic (Newman et al. 2020, p. 71), which could hinder individualization trends in science reporting. Simultaneously, the consumption of news on Instagram, on the other hand, is popularizing and growing (Newman et al. 2020, p. 71; Horz-Ishak and Thomass 2021, p. 249), which could enhance it. "From a German perspective, there is some evidence that the crisis—and its accompanying 'infodemic'—has, above all, accelerated and made more visible existing developments and deficits as well as an increased need for funding of science journalism" (Wormer 2020, p. 467). Considering how different media organizations (public service and commercial outlets as well as individual science journalists' posts) try to communicate scientific information effectively is therefore relevant. The approaches must be considered separately, as how journalists represent and view their role in online environments is not fixed (Bossio 2021, p. 14), meaning that they might differ.

Various private and public service media accounts and TV channels in Germany turned to the use of Instagram to communicate scientific content a couple of years ago. For example, ZDF Info, a popular channel of the public service media in Germany, started posting content on Instagram on 16 July 2018, and has since generated more than 600,000 followers. The overall goal of this study is to investigate how science journalism departments of German media companies and individual science journalists communicate scientific content on Instagram.

### 3. Methodology

To answer this research question, a representative quantitative content analysis of Instagram posts ( $n = 2.605$ ) of nine wide-ranging German Instagram accounts related to science journalism (public service and private media organizations and individual journalists, see Table 1) was carried out. The project took place within the realms of a seminar of the master's program in Journalism (M.A.) at Leipzig University during the summer term of 2021 and was a collaborative project of 14 students and two instructors. The nine Instagram accounts were sampled in a multi-step process: First, the basic population, meaning all German science journalism Instagram accounts with at least 5,000 followers who had been active in the past four weeks, was assessed. The cut-off point of 5,000 followers was set to make the number of accounts included in the basic population more feasible for the given study, and to ensure that patterns possibly found on the accounts in science communication are effective enough to entail at least some sort of traction on the platform. Further, accounts had to have posted in the past four weeks to ensure that the patterns analyzed in this study are representative of the current trends in Instagram science communication. In addition, the accounts had to have a clear journalistic claim. The basic population included all scientific public-service media accounts ( $n = 36$ ), all scientific accounts of private media ( $n = 16$ ), and all individual journalists posting about science journalism ( $n = 8$ ) that could be found. The accounts fulfilling the criteria were ranked according to their total follower numbers. The three accounts with the highest number of followers per group were used for analysis (see Table 1). The three accounts per group<sup>1</sup> which were ranked in places four through six regarding their number of followers were used for a pre-test of the codebook.

**Table 1.** Overview of the sample.

Public Service Media		Private Media		Individual Journalists	
Quarks	Follower: 1 Mio. Following: 21 1st Post: 13 March 2018	Geomagazin	Follower: 199.000 Following: 271 1st Post: 1 June 2014	Drjuliafischer	Follower: 36.600 Following: 601 1st Post: 12 February 2015
ZDF Info	Follower: 415.000 Following: 166 1st Post: 16 July 2018	Galileo	Follower: 233.000 Following: 13 1st Post: 14 January 2014	Mrwissen2go-geschichte	Follower: 158.000 Following: 134 1st Post: 01 June 2019
TerraX	Follower: 398.000 Following: 344 1st Post: 19 April 2016	Katapultmagazin	Follower: 352.000 Following: 266 1st Post: 13 April 2017	Dirksteffens	Follower: 45.000 Following: 48 1st Post: 13 September 2015
n = 964		n = 994		n = 647	

The quantitative codebook contained detailed instructions on the coding process and began with formal variables concerning the coder and the coded account. The subsequent content-related variables were built based on the theoretical concepts introduced above, focusing on both the content as well as the design and Instagram-specific aesthetics of the posts. Starting with the content of the post, aspects such as the post's specific topic, the displayed persons, the timeliness, and the potential aim of the post were analyzed (Hermida and Mellado 2020; Pera and Viglia 2016; Tenenboim-Weinblatt and Neiger 2018). When it came to the design of the posts, the occurrence of the specific media elements was depicted (Godulla and Wolf 2018), the aesthetics were analyzed in terms of corporate design, and the text of the posts was analyzed; for example, in terms of the number of words, tonality, and language, as well as provided references and the use of emojis (Emde et al. 2016; Hermida and Mellado 2020). Furthermore, the use of hashtags and links was analyzed (Hermida and Mellado 2020; Krumsvik 2018).

The total number of posts was collected for all accounts, with a total of 15.263 posts. Next, a random sample was drawn for each account (using the tool Randomizer) to generate a representative number of posts per account. The generated random numbers were checked against the list of posts of the accounts, starting with the first post of the respective account. For example, if the number "5" was provided by the random number generator, the fifth post of an account was included in the sample and its content was coded. The total number of posts can be seen in Table 1.

In the next step, a pre-test was carried out to ensure the functionality of the codebook. Thereby, 54 posts were each coded by two different coders independently. The results were compared manually, and categories with unequal results were eliminated or altered. Afterwards, the data were coded by the 14 students of the master's seminar. After conducting the pre-test and validating and refining the codebook, the posts were coded. The majority of the variables were coded dichotomous to guarantee a smooth and fast coding process. For example, for coding the post's usage of media elements, the different elements were coded for their occurrence. Each main category was outfitted with examples in order to ensure an easier identification. All categories were operationalized by deducting variables from the respective literature. Finally, the data analysis was conducted using the statistics software SPSS.

#### 4. Results

In the following, the results are displayed concerning the differences in text length, numbers of likes and comments, media elements used, and aspects of corporate design, as well as their main topics, tonality, and presumed goals.

First, the results of the quantitative content analysis show differences in the text length and in the average number of likes and comments of the posts of public service media, private media, and individual journalists' accounts (see Table 2). The results revealed that individual journalists used about 151 words and 16 hashtags per post on average, whereas private media posts only consisted of 54 words and 5 hashtags on average, and public service media's posts were in-between, with about 94 words and 14 hashtags per post.

**Table 2.** Average number of words, hashtags, likes, and comments used per post and account type.

Variable	Category	Mean	SD	N
Words	Public service	93.7	74.5	964
	Private	54.1	50.1	994
	Individuals	150.8	121.3	647
Hashtags	Public service	13.9	13.9	964
	Privat	4.5	7.6	994
	Individuals	15.8	9.9	647
Likes	Public service	6781.8	9487.1	964
	Private	3353.1	14,246.1	994
	Individuals	1483.3	1735.7	647
Comments	Public service	186.7	319.4	964
	Privat	57.0	120.6	994
	Individuals	28.2	41.3	647

Changing the perspective to the reach and traffic of the posts, individual journalists' accounts were the least successful. While their posts achieved about 1483 likes and 28 comments on average, posts of private media accounts achieved about twice as many (3353 likes; 57 comments). Even more likes and comments were achieved by the posts of public service media accounts (6782 likes; 187 comments).

Second, an ANOVA and Games-Howell test showed that these differences in the average number of words, hashtags, likes, and comments per post differ significantly regarding the account type (see Table 3). Based on the posts from individual journalists' accounts, their average number of words and hashtags, as well as likes and comments, were compared with those of the posts from public service media and private media accounts. The results indicate that posts from individual journalists' accounts include a significantly higher average number of words than those from public service media and private media accounts ( $F(2,602) = 275.2, p < 0.001$ ). In addition, individual journalists' accounts use a significantly higher average number of hashtags per post compared to public service media and private media accounts ( $F(2,602) = 272.3, p < 0.001$ ). Thus, for example, posts of individual journalists' accounts are about 97 words longer on average than those of private media accounts and use about eleven hashtags more than those of private media accounts.

**Table 3.** Mean differences in the number of words, hashtags, likes, and comments used per post.

Variable	Category	Mean Difference	ANOVA
Words	Individuals → Public service	57.1 ***	$F(2,602) = 275.2$ ***
	Private	96.7 ***	
Hashtags	Individuals → Public service	1.9 ***	$F(2,602) = 272.3$ ***
	Private	11.3 ***	
Likes	Individuals → Public service	-5298.5 ***	$F(2,602) = 53.4$ ***
	Private	-1869.8 ***	
Comments	Individuals → Public service	-158.5 ***	$F(2,602) = 142.0$ ***
	Private	-28.2 ***	

Note: The mean differences are based on the mean value for individual journalist accounts; \*\*\* for  $p < 0.001$ .

In contrast, the results indicate that the average number of likes for posts of individual journalists is significantly lower than those for posts of public service media or private media accounts ( $F(2,602) = 53.4, p < 0.001$ ). Similar results are also observed regarding the

number of comments, as the posts by individual journalists had significantly less comments than the posts of public service media or private media accounts ( $F(2,602) = 142.0, p < 0.001$ ), on average. Thus, for example, the posts of the individual journalists' accounts reached about 5300 likes and about 159 comments less, on average, than those of the public service media accounts.

Third, the usage of media elements in the posts of the three account types were analyzed using Chi<sup>2</sup>-test and Cramer's V (see Table 4). The results show that the usage of all media elements significantly differs between the posts of individual journalists, private media, and public service media. The posts by the latter are characterized by the usage of multiple media elements, such as figures and illustrations (43.2%), visualized text (43.0%), single photos (33.6%), and videos (30.4%), as well as data visualizations (14.9%) and photo galleries (10.3). These media elements were used slightly less frequently in the posts of private media accounts. Here, accounts often used single photos (41.4%), followed by visualized text (25.4%) and figures and illustrations (21.5%). Less frequently used elements were videos (13.5%), data visualizations (9.5%), and photo galleries (2.7%).

**Table 4.** Media elements used in the Instagram posts by account type.

Variable		Public Service	Private	Individuals	Chi <sup>2</sup> (2)/Cramer's V
Single photo	yes	324 (33.6)	412 (41.4)	385 (59.5)	107.5 ***/0.20
	no	640 (66.4)	582 (58.6)	262 (40.5)	
	total	964 (100)	994 (100)	647 (100)	
Photo gallery	yes	101 (10.5)	27 (2.7)	100 (15.5)	85.2 ***/0.18
	no	863 (89.5)	966 (97.3)	547 (84.5)	
	total	964 (100)	993 (100)	647 (100)	
Data visualization	yes	144 (14.9)	94 (9.5)	0 (0)	104.2 ***/0.20
	no	820 (85.1)	900 (90.5)	647 (100)	
	total	964 (100)	994 (100)	647 (100)	
Figure/illustration	yes	416 (43.2)	214 (21.5)	35 (5.4)	303.6 ***/0.34
	no	548 (56.8)	780 (78.5)	612 (94.6)	
	total	964 (100)	993 (100)	647 (100)	
Visualized text	yes	415 (43.0)	252 (25.4)	23 (3.6)	311.2 ***/0.35
	no	549 (57.0)	742 (74.6)	624 (96.4)	
	total	964 (100)	993 (100)	647 (100)	
Video	yes	293 (30.4)	134 (13.5)	114 (17.6)	90.3 ***/0.19
	no	671 (69.6)	860 (86.5)	533 (82.4)	
	total	964 (100)	993 (100)	647 (100)	

Note: Relative frequencies by column for each variable; \*\*\* for  $p < 0.001$ .

Another significant difference when looking at the posts of individual journalists is that this account type most frequently used single photos (59.5%), followed by videos (17.6%) and photo galleries (15.5%). Other elements, such as figures and illustrations (5.4%), visualized text (3.6%), and data visualizations (0.0%), were used only very rarely or never. Comparing the three account types with each other, significant, medium effects become visible for the media elements of figures and illustrations ( $\text{Chi}^2(2) = 303.6, p < 0.001, V = 0.34$ ) and data visualizations ( $\text{Chi}^2(2) = 311.2, p < 0.001, V = 0.35$ ). The usage of all the other media elements according to the account types are characterized by a significant weak relationship.

In addition, possible corporate designs, as well as linking-habits, of the posts of the three account types were analyzed using Chi<sup>2</sup>-test and Cramer's V (see Table 5). Looking at the corporate design and linking habits of the analyzed posts it is apparent that public service media accounts most often used a consistent design regarding the color (70.1%) and font (67.6%). In contrast, posts by both private media and individual journalists show a less frequent use of consistent corporate designs. About one third of the posts of the private media accounts included a consistent color, and in more than half of the posts,



a consistent font was used. For individual journalists, a consistent color and font was used in about half of these posts each. The corporate design of these account types is characterized by significant differences: a medium relationship for the use of a consistent color ( $\text{Chi}^2(2) = 271.5, p < 0.001, V = 0.32$ ), and a weak relationship regarding the use of a consistent font ( $\text{Chi}^2(2) = 66.8, p < 0.001, V = 0.16$ ).

**Table 5.** Corporate design and linking used in the Instagram posts by account type.

Variable		Public Service	Private	Individuals	Chi <sup>2</sup> (2)/Cramer's V
Consistent color	yes	676 (70.1)	329 (33.1)	306 (47.3)	271.5 ***/0.32
	no	288 (29.9)	665 (66.9)	341 (52.7)	
	total	964 (100)	994 (100)	647 (100)	
Consistent font	yes	618 (67.6)	575 (57.8)	304 (47.0)	66.8 ***/0.16
	no	296 (31.4)	419 (42.2)	343 (53.0)	
	total	914 (100)	994 (100)	647 (100)	
Linking to own channels	yes	216 (22.4)	450 (45.3)	57 (8.8)	281.7 ***/0.33
	no	748 (77.6)	544 (54.7)	590 (91.2)	
	total	964 (100)	994 (100)	647 (100)	

Note: Relative frequencies by column for each variable; \*\*\* for  $p < 0.001$ .

Lastly, the occurrence of linking in the posts was examined. It was found that primarily private media accounts use linking to their own channels (45.3%), whereas public service media (22.4%) and individual journalists (8.8%) make much less use of it. This difference is characterized by a significant medium relationship ( $\text{Chi}^2(2) = 281.7, p < 0.001, V = 0.33$ ).

Diving into the actual contents of the posts, the topics of the publications were analyzed to take into consideration how far the general trend of softer news coverage on Instagram is continued in science communication. Here, multiple codes could be selected, meaning that percentages do not equate to 100% of the postings, but rather are relative only to each other. Both public service outlets (39.8%) and private media accounts (34.6%) predominantly reported on environmental/climate related scientific content, while individual journalists focused on communicating new findings and discoveries generally (60%). For the public service (22.5%) and private media accounts (28.9%), this category made up the second most frequent type of posting. Further, while public service media, possibly influenced by the ongoing pandemic, reported on health and medical scientific topics (21.3%) frequently, this category was less pronounced in the private media (12.5%) and individual journalists' (17.2%) postings. Instead, these two account types informed on societal debates (private media accounts: 17%; individual journalists' accounts: 24.3%). While all accounts therefore also depict hard news, another difference is found in the reporting patterns on art/culture and lifestyle topics among outlets: while public service media hardly covered these topics (art/culture: 5.9%; lifestyle 5.9%), individual journalists in particular focused on lifestyle topics (18.9%), and private media on art/culture (12.6%).

Finally, the posts were analyzed concerning their tonality and assumed goals (see Table 6).

For tonality, we distinguished between formal and informal/colloquial speech, as well as a mix of both. For example, if a caption were to describe a scientific finding its depicting as "fresh" rather than "new", the post might be considered more informal. Among the posts of public service media, it is apparent that the majority of the posts are formal in nature (40.9%), but almost as many posts are informal (39.2%). In contrast, most of the posts from private media accounts and individual journalist accounts are informal in tone (61.5%; 62.3%), and their proportions of formal posts are much lower than those of public service media accounts (27.2%; 11.8%). These differences represent a significant weak relationship ( $\text{Chi}^2(2) = 222.3, p < 0.001, V = 0.21$ ).

**Table 6.** Tonality and goals of the Instagram posts by account type.

Variable		Public Service	Private	Individuals	Chi <sup>2</sup> (2)/Cramer's V
Tonality	formal	393 (40.9)	269 (27.2)	76 (11.8)	222.3 ***/0.21
	informal	378 (39.2)	608 (61.5)	402 (62.3)	
	mix	191 (19.9)	111 (11.3)	167 (25.9)	
	total	962 (100)	988 (100)	645 (100)	
Presumed goal: informing	yes	926 (96.1)	591 (59.5)	444 (68.6)	371.9 ***/0.38
	no	38 (3.9)	402 (40.5)	203 (31.4)	
	total	964 (100)	993 (100)	647 (100)	
Presumed goal: entertaining	yes	193 (20.0)	441 (44.4)	227 (35.1)	132.7 ***/0.23
	no	771 (80.0)	553 (55.6)	420 (64.9)	
	total	964 (100)	994 (100)	647 (100)	
Presumed goal: advertising	yes	83 (8.6)	252 (25.4)	74 (11.4)	115.5 ***/0.21
	no	881 (91.4)	742 (74.6)	573 (88.6)	
	total	964 (100)	994 (100)	647 (100)	

Note: Relative frequencies by column for each variable; \*\*\* for  $p < 0.001$ .

In addition, clear differences can be seen in terms of the posts' assumed goals. The publications were coded as either entertaining (e.g., quizzes or satire) or informing in nature, or as including advertisements. While almost all of the public service media posts were informing in nature (96.1%), this was only the case in about two out of three posts by private media and individual journalists. As shown in Table 6, this difference is a significant medium relationship ( $\text{Chi}^2(2) = 371.9$ ,  $p < 0.001$ ,  $V = 0.38$ ). Regarding the entertaining nature of the posts, the posts of private media accounts (44.4%) and individual journalists (35.1%) in particular were found to seem to pursue this goal. Contrary to this, only one fifth of the posts of public service media accounts presumably aimed to entertain. Again, a significant weak relationship was identified for these differences ( $\text{Chi}^2(2) = 132.7$ ,  $p < 0.001$ ,  $V = 0.23$ ).

Lastly, the suspected goal of advertising was considered in the analysis. The results show that of all three account types, the posts from private media primarily contained advertising elements (25.4%), whereas, in comparison, only every tenth post of the public service media and individual journalists' accounts contained said elements. A significant weak relationship was found for this difference ( $\text{Chi}^2(2) = 115.5$ ,  $p < 0.001$ ,  $V = 0.21$ ).

The impressions gained from the analysis show three different trends in the reporting styles, which can be characterized as outlined below. These characterizations are, however, not definite categories, but rather summaries of the trends found across the publications of each of the three types of analyzed media accounts. In particular, the presumed aim of the publications of type one and two are not surprising, as public service media are generally not as focused on generating traffic to their own channels compared to private media accounts as they are financed through public licensing fees, while private media depend on advertising revenues. This could also explain the larger focus of private media accounts on art/culture and lifestyle topics, compared to the predominance of hard news on public service media accounts. However, the respective topics are not considered in the below typology, as they are subject to change based on current events. In addition to the presumed goals of the publications, the typologies further consider the posts' respective text-lengths and usage of media elements, as well as their design, and tonality (see Table 7).

**Table 7.** Account types and their science communication approaches.

Account Type	Description
Public service media accounts: Conceptually embedded informants	<p>Posts from public service media accounts receive, on average, about 6782 likes and 187 comments and are characterized by the usage of medium-length text, with an average of 94 words and 14 hashtags per post. In addition, the posts of these accounts often use complex media elements. Almost every second post contains figures and illustrations or visualized text, and about every third post contains individual photos or video elements. Further, about every tenth post contains data visualizations or photo galleries. In addition, followers of public service media accounts can expect a consistent design in terms of color and font (apparent in more than two-thirds of their posts). The approaches of these accounts also include linking to their own channels, which is evident in about every fifth post. Finally, the posts attributed to this approach aim to deliver informative content in a professional manner. Followers can expect a formal but also informal address, which is found in more than every third post. In this context, almost all of the posts by these accounts are of an informative nature, while it is less common to entertain their followers (evident in almost every fifth post) or to include advertisements (evident in less than every tenth post).</p>
Private media accounts: Conceptually versatile entertainers	<p>Posts from private media accounts receive, on average, about 3353 likes and 57 comments, and are characterized by the usage of short-length text, with an average of 54 words and 5 hashtags per post. In addition, the posts of these accounts often use medium-complex media elements. Nearly every second post contains single photos and about every fourth post contains visualized text or figures and illustrations. In contrast, only about every tenth post consists of data visualizations or video elements, and only a fraction of the posts consists of photo galleries. In addition, the posts by these accounts show a rather flexible design in terms of color and font. Followers of private media accounts can expect a consistent use of colors in only about every third post and a consistent use of fonts in more than every second post. Moreover, the posts attributed to this approach aim to generating traffic on their own channels, which is evident in almost every second post. Finally, the posts of private media accounts often aim to inform, but also to entertain and advertise, in an informal manner. Hence, the followers of private media accounts are predominantly confronted with informal addresses (in two out of three posts) and a mix of perceived goals. While about two out of three posts might aim to inform their followers, almost every second post has the perceived aim to entertain, and every fourth post to advertise their followers.</p>
Individual journalists: Conceptually independent individuals	<p>Posts from individual journalists receive, on average, about 1483 likes and 28 comments and are characterized by the usage of long-length text, with an average of 151 words and 16 hashtags per post. In addition, the posts by these accounts are characterized by the usage of rather simple media elements. Their design is characterized, in particular, by single photos (in almost two-thirds of all posts), but also by videos and photo galleries (each in about every fifth post). In contrast, visualized text, as well as figures and illustrations, can be expected less frequently (about every 20th post), and data visualizations do not occur at all. In addition, the followers of individual journalists can expect a mixed design in terms of color and font. The posts by these accounts show consistent colors and fonts in only about every second post. Further, links to the account's own channels are mentioned less often compared to the other account types (in almost every tenth post). Finally, the posts of this approach aim to inform and entertain in an informal manner. Followers of individual journalists can expect a predominantly informal address (in about two out of three posts), but partly also a mix of informal and formal address (in about every fourth post). In addition, the perceived main goal of the posts is to inform their followers, as can be observed in more than two out of three posts. Nevertheless, a noteworthy percentage of posts also aim to entertain their followers, which occurs in approximately one out of three posts, while advertisements appear very rarely (in about every tenth post).</p>

Note: Boundaries of the trend summaries are floating, and it is not set in stone that, for example, public service media always communicate in their typical way (Type 1). Instead, the different types show the magnitude of possibilities of displaying scientific content on Instagram and all are each necessary to provide audiences with high-quality content.

## 5. Discussion

The results shed light on how the platform Instagram accounts for a digital transformation of media organizations, especially in terms of a diversification of their approaches to communicating scientific content. There is not a one and only way of presenting scientific

information on the visual platform; rather, as it was pointed out in the literature section, the posts are carefully crafted, which involves strategic decisions that can be more or less strict. By measuring the success of the publications in numbers of likes and comments, however, differences can be seen.

Throughout the analysis, it appeared that the nature of the media organization influences the complexity, design, and purpose of the scientific communication on Instagram. Public-service outlets, which usually have higher resources at their disposal, indicate more strategic guidelines and a consistent, elaborate design of the posts and media elements, while less resources, in the cases of commercially oriented accounts or individual science journalists, account for more flexibility in the conceptualization of scientific content. A strict corporate design, for example, can help an account and its posts to appear more professional and raise its recognition value, while a looser corporate design has a higher scope for experimentation. The previous findings of visual aesthetics serving as a form of identity on Instagram (Hermida and Mellado 2020, p. 871), however, are therefore confirmed.

In the case of individual science journalists, they may aim to achieve visibility through the use of long-length text and a lot of hashtags, but they are less popular when measured by the numbers of likes and comments. This circumstance could, however, be a result of the “creator economy”, meaning that as individual journalists might not have personal websites to traffic users to, instead of using links to redirect, they could be aiming to build a presence on Instagram. Further, the focus on text could be an indicator for the individualization-trend previously found in science journalism (Dunwoody 2021, p. 23). As the tone of the texts was more entertaining than neutrally professional, it is also possible that reporting might have become more critical (Fahy and Nisbet 2011, p. 758). However, more research on the tone of the posts, using a wider array of variables, is necessary to confirm or deny this finding. Nonetheless, the textual focus of individual science journalists does highlight the affordances of Instagram as a platform where both visuals and text can be prioritized (Hermida and Mellado 2020, p. 867). Overall, to increase the new economic possibilities given by Instagram (Könneker 2020, p. 25), placing greater focus on carefully crafting visuals in an appealing manner might help individual science journalists to attract new users and increase their reach.

In that regard, a more complex conceptualization might be an indicator of success, at least in terms of reach in likes and comments. However, it needs to be mentioned here that some corporate designs of well-known media houses might not have been a specific invention for the platform Instagram, but might have been in use for years in other media channels, such as TV. Hence, a general publicity and an already established corporate identity of a media organization might also help its scientific Instagram account to flourish. Additionally, as previously stated, in the wake of the COVID-19 Pandemic, the reach of public service outlets across Germany generally increased (Newman et al. 2020, p. 71), meaning that a different research time frame might change the results.

To draw back to the question of how scientific content can be communicated to an increasingly overwhelmed, young audience during critical moments such as the pandemic, this therefore means that while individualized approaches work, scientific content on Instagram should be presented in a professional, recognizable, and continuous corporate design. Further, captions should not be too long, and links to further information (or own channels) could be added.

Future research could further analyze the success of an Instagram account by analyzing users’ attitudes and preferences; for example, through conjoint analysis comparing different conceptualizations, text-length, media elements goals, and tonality, as well as considering the users’ sociodemographic background, media usage, and previous knowledge of the media brand. Additionally, the users’ perception of the trustworthiness of the posts and accounts can be measured according to different stylistic combinations; similarly, the perception of the journalistic quality could be assessed. In addition, research on a larger sample of Instagram accounts is needed. While the deliberate selection of accounts allowed the first insights into communicative strategies of science journalism on Instagram, patterns

need to be confirmed using a larger spectrum of exemplary Instagram accounts. Further, changes in the nature of the platform must be researched in the future: while originally an image focused platform which includes textual elements, as argued in this paper, the rise of competing platforms such as TikTok has increased Instagram's focus on short video postings (Lorenz 2022), meaning that science journalists across media account-types are now facing the challenge of needing to publish a new kind of (audio-)visual science journalism. As this could further worsen the workload and working conditions taken on by individual science journalists (Schäfer 2017, pp. 51; 53ff.), interview studies with science journalists across platforms could be insightful.

Moreover, it is this new audiovisual science journalism, in particular, that must be re-evaluated in a media environment, where what is being seen in videos is no longer necessarily reflective of what has happened, and media trust is increasingly becoming a new form of currency. Recent developments in AI could, on the one hand, aid conspiracy theorists and the like in distributing believable false information. However, thus technology could also enable journalists to access a whole new array of visual aids, allowing for higher quality, more personalized journalism (Godulla et al. 2021; Seibert 2023; WDR Innovation Hub 2021), especially in the increasingly audiovisual environment. Media organizations, as well as individuals and influencers with a rather small budget, might benefit from the usage of deepfakes for content creation (WDR Innovation Hub 2021). Given the different patterns of science communication discovered across the outlets in this study, research considering the possibilities of AI implementation across different types of news outlets (on a visual platform like Instagram) could be productive. Interview studies with journalists could also allow for such a perspective.

Overall, this study builds a basis for analyzing which scientific content should be displayed in which manner to generate traffic, and, pursuing the journalistic idea, informing as many people as possible, truthfully and comprehensively. When it comes to the variety of journalistic approaches to communicating scientific content on Instagram, the hypothesis could be formed that users do not necessarily need high-end, elaborately created visualization, as all nine accounts were successful in their areas despite the varying approaches. The journalistic idea behind the content might be more important than the perfect visualization of it, as Ginosar et al. (2022) put it: to analyze, interpret, and guide the audience (p. 4). Hence, despite all the focus on the platform's affordances of displaying content, the focus on the content itself should not be neglected—an issue that holds true and relevant for all kinds of digital platforms and outlets. Nevertheless, visual and audio-visual content will always be at the center of the platform Instagram; thus, an investment in journalistic professionalization in that regard cannot be a waste.

## 6. Conclusions

This study aimed to explore the communication styles of German science journalism accounts on the social media platform Instagram. In analyzing the design, structure, and content of nine German Instagram accounts related to science journalism, three different patterns of science communication on Instagram for public service (embedded informants), private (versatile entertainers), and individual science journalists' (conceptually independent) media accounts were deducted. The three approaches differ in how professionally, formally, and flexibly they design their scientific posts on Instagram. The findings add quantitative and representative insights into the current state of German science communication on Instagram; however, the social media platforms are subject to constant technological development, and when new features and options arise, they must also be explored journalistically. Hence, this field is an ever-changing field, with audience preferences changing and adapting to new affordances. Science journalism continues to be of high relevance, hence: "...further efforts must be made to explore ways to educate journalists, scientists, and other communicators in the craft of science reporting" (Allan 2011, p. 774).



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## Note

- <sup>1</sup> Die Sendung mit der Maus, DLF Nova, Punkt.Erde, National Geographic, Zeit Wissen, Spektrum Verlag, Maithink, marc\_raschke, echonaut\_science.

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