Laura Di Ferrante

(Re)presenting Science in Research Articles and Press Releases

A Contrastive Analysis of Titles and Headlines

Abstract

Science communication is a powerful supplier of scientific knowledge for the public (see Harmatiy 2021; Kueffer and Larson 2014). While popularization discourse has been explored in depth (see for example, Calsamiglia and Van Dijk 2004; Garzone 2014, 2020; Gotti 2014; Luzón 2013; Myers 2003), the ways specific linguistic strategies impact content and the communication of science still need to be fully explored. The general purpose of this study is to explore how titles of scientific articles are transformed to be turned into headlines of press releases. Specifically, it aims first to identify recurring discursive patterns in the adaptation of titles in scientific discourse to headlines in science communication. Second, it investigates whether these patterns have an impact on the way scientific knowledge is presented. Two matching corpora were used: one of titles of research articles and one of headlines of research-based university press releases. The unique feature of these two corpora is that they have a bijective relation, so that each of the 210 titles of scientific papers matches one of the 210 university press release headlines. Results show that many linguistic strategies in science journalism are the mirror image of scientific discourse: three strategies were identified that contribute to two different representations of science, as an ongoing process in academic titles and a conclusive fact in press releases' headlines: 1) the validity-endorsement strategy; 2) the V-ing construction; 3) the opposition between unspecified association vs. explicit relation.

Keywords: *science communication, titles, headlines, press releases, academic discourse*

1. Introduction

Fake news, fact-checking, and *bias* have been central key words of public discourse in these recent years, particularly because the Covid-19 pandemic has triggered the increase of scientific research, the interest of the general public towards science findings, and consequently the spread of science-related information which is generated and disseminated through a variety of communication channels, including news venues, blogs, and social media (e.g., through posts and links to news articles and press releases on Facebook, Twitter, LinkedIn,

etc.). In other words, the public has been consuming scientific content in a form that is not the original scientific paper as it was written by the scholars who carried out the study: it is transformed and made more accessible to non-experts. However, such transformation is not unproblematic in terms of accuracy. The language of science is known to be mostly characterized by monoreferentiality, which favors definiteness devoid of ambiguity (Garzone 2020; Gotti 2003). In scientific texts, precision prevails, along with specificity and explicit cautious formulation which is expressed through multiple means, such as: limitation sections, subgroup-restricted statistical representations, hedging devices (e.g., modal verbs), etc. Conversely, the language of information tends to be as accessible as possible to the wider public, by avoiding technical vocabulary, by using metaphors, reformulations, simplification, concrete examples, engagement with the audience (e.g., second person pronouns) which are often inevitably contaminated by inaccuracy, overgeneralization, infidelity, and lack of rigor.[1]

In this context, an additional element to consider is that people often only read the headline of news reporting on scientific findings and often share these articles on social media without even reading the body of the text (see Gabielkov et al. 2016).[2] This makes headlines particularly crucial means of communication, not only as marketing tools, but also as fundamental paratextual elements to convey the core of scientific knowledge. Titles are often the first part of an article that reaches the readers; they can determine the readers' decision to keep reading, the information they expect to learn about, and the perspective through which the title is interpreted. In this sense, titles have a function that is somewhat separated from the rest of the article (Blom and Hansen 2015; Dor 2003).

This paper focuses on the titles of research articles (henceforth RA) and the headlines of university press releases (henceforth PR) published to disseminate the content of the scientific articles to the wider public. The two corpora are compared with the purpose of identifying the differences between RA titles and PR headlines as they are reflected in recurrent linguistic

[1] Focusing on papers related to Covid-19, Saitz and Schwitzer (2020, 443) list a series of specific failures occurred in science communication: "(1) a focus on single study results without the context of other studies or acknowledgment that single studies are rarely definitive; (2) overemphasis on results, particularly relative effects, without recognition of important limitations; and (3) communications based on incomplete reports of studies and reports of studies that have not been adequately reviewed."

[2] In a study on news articles and how they are clicked and shared on social media, Gabielkov et al. (2016, 185) found that "59% of the shared URLs are never clicked or, as we call them, silent. Note that we merged URLs pointing to the same article, so out of 10 articles mentioned on Twitter, 6 typically on niche topics are never clicked."

patterns used to turn RA titles into headlines and to highlight how scientific knowledge is presented in each corpus.

Typically, the analysis of scientific discourse implies an underlying implicit or explicit reference to everyday common language, lay discourse: for instance, describing it as formal indicates a higher level of formality in comparison to everyday discourse. Scientific discourse is generally compared to a discourse which is less technical and less specialized (Flowerdew and Peacock 2001); hence, it is on the basis of such a touchstone that it is usually analyzed. In science communication, this perspective is reversed. Here, scientific discourse is the reference against which different types of discourse and texts are explored. When looking at texts that are "re-presented" (see Sarangi 1998, 307) beginning with scientific texts and then transitioning into a different context, it should be taken into consideration that the resulting text possibly bears the imprint of any component of scientific discourse.

After a review of the relevant literature on science communication and titles, the two sub-corpora of RA titles and PR headlines are explored through a discourse analytical approach: headlines and titles are compared to see the extent to which pragmatic functions are impacted by specific linguistic strategies. The goal of the analysis is to answer the following research questions:

RQ1: What are some recurring rhetorical and linguistic patterns in the transformation from the titles of the research articles to the headlines of the press releases?

RQ2: Can the differences in such linguistic patterns be associated with different representations of scientific knowledge?

2. Literature review

In this paper, titles from two different registers are analyzed. A register is here referred to as "a variety associated with a particular situation of use (including particular communicative purposes)" (Biber and Conrad 2019, 6) and, in this sense, research articles and press releases are different registers, but those analyzed in this study are related in that the press releases are non-expert-friendly recounts of the findings presented in the scientific papers. In this Section, some of the ways science is communicated to the wider public are examined and relevant research on titles analyzed through the lenses of linguistics is explored.

2.1 From science to science communication

"Although people can choose not to do science, they cannot choose to ignore it. The products of science permeate their lives" observed Fischhoff (2013, 14033) in a very enjoyable paper on the

Science of Science Communication, making the point that each one needs scientific information to understand things and to make decisions; he clarifies:

> Without some grasp of the relevant science, it is hard to make informed decisions about these issues. Those include private decisions, such as whether to choose fuel-efficient vehicles, robot-guided surgery, or dairy products labeled as 'produced by animals not treated with bovine growth hormone—not known to cause health effects.' And they include public decisions, such as whether to support politicians who favor fuel efficiency, lobby for disclosing the risks of medical devices, or vote for referenda limiting agricultural biotechnology. (Fischhoff 2013, 14033)

It is true that so many people, at some point, need to learn about some science; however, the bulk of science is published in books and academic journals which not only are often hard to access because of the paywall and the niche venues, but the accessibility is also difficult because of the way they are written. The language used in scientific publications is a type of "scholar-to-scholar written communication" (Biber 2006, 8), which is used for specific purposes and is characterized by specialized lexicon, distinctive grammar features, syntax, rhetorical structures, etc. To access the type of discourse used in academic articles familiarity with its register, and the specific contents of the disciplinary field of the article is required, which makes this so-called expert-to-expert type of communication often very hard to access by non-experts. It turns out that science communication works as a bridge between science and non-experts (see, for example, Luzòn 2013; Mahrt and Puschmann 2014). Fischhoff (2013) even points out that multiple professionals are needed to make the bridge:

> Communications are adequate if they reach people with the information that they need in a form that they can use. Meeting that goal requires collaboration between scientists with subject matter knowledge to communicate and scientists with expertise in communication processes—along with practitioners able to manage the process. (Fischhoff 2013, 14038)

Because a large amount of science today is made within universities, these are privileged places to bridge the gap between experts and the public. With the spread of blogs and social media on the internet where content is published and everyone can access it, it is difficult to identify the context of the information and decide whether it can be trusted. This scenario has been defined as "context collapse" (see Puschmann 2015): it is often unclear who says what in which context and based on what authority or expertise, particularly if information is decontextualized from its original source and distributed through social media. In this sense, these academic institutions are places where knowledge is generated and they have the people and resources to

facilitate the dissemination of complex, scientific concepts to the public. Moreover, science also contributes to universities' reputation: as a matter of fact, the standing and the prestige of a university in the academic and broader communities are determined, among other things, by its excellence in science, research output, and the expertise of its faculty. It turns out that universities are more and more disseminating research findings from their laboratories, classrooms, and research projects to inform the public and at the same time promote themselves (Di Ferrante et al. 2021; Petrocelli et al. 2022): dissemination is achieved through various means such as public lectures, open access webinars, workshops, and media presence, including institutional press releases. Universities, just like companies, have a section on their websites dedicated to press releases, which are universities' specific tools for science communication (see Autzen 2014). These texts are targeted to both journalists and the general public. While their being a hybrid genre between news articles and advertisements has been fully explored (see Catenaccio 2008; Garzone 2014; McLaren and Gurău 2005), their use within the academia has contributed to transforming them in ways which have not been systematically examined yet. For example, the use of press releases as a tool to disseminate research content is transforming the structure itself of press releases: the press-release caption (Catenaccio 2008; Tessuto 2021) has disappeared[3] in many university press releases, to be substituted by different labels as ambiguous as *news release, news story, story, news* (Petrocelli et al. 2022) and while press releases in general are traditionally preformulated to be news articles looks-alike, this aspect has increased in university press releases to the point where the website sections have names that resemble those of newspapers and magazines (e.g., Berkeley News, MIT News, Penn Today, Illinois News Bureau, etc.). Moreover, university press releases mainly present published research carried out by scholars employed by the university issuing the press release, and while the published scientific study is the main topic of the press release, the whole text is permeated by multiple efforts to increase the reputation of the university, the departments, laboratories, and affiliated scholars (see Di Ferrante et al. 2021).

These communicative efforts of informing about the research and promoting the university to the wider public are made through the use of specific linguistic choices that on the one hand make the text more accessible and easier to understand, but on the other hand influence and have an impact on the conveyed content.

[3] It should be noted that the press/news release caption is one of the peripheral moves of corporate press releases found by Catenaccio (2008) as being always present (Catenaccio 2008, 24), hence characterizing the genre. Its removal defies the typical structure itself of press releases.

2.2 Titles

The two terms, *title* and *headline,* are typically used with reference to different types of texts: *Title* tends to be used for books, films, songs, essays, or academic articles, while *headline* is the preferred term for news articles in newspapers, magazines, and tabloids. Titles and headlines share the position in the texts and their relationship with the text they lead:

> The literary work consists, exhaustively or essentially, of a text, that is to say (a very minimal definition) in a more or less lengthy sequence of verbal utterances more or less containing meaning. But this text rarely appears in its naked state, without the reinforcement and accompaniment of a certain number of productions, themselves verbal or not, like an author's name, a *title*, a preface, illustration […] This accompaniment, of varying size and style, constitutes what I once christened elsewhere […] the paratext of the work. (Genette and Maclean, 1991, 261, emphasis added)

Titles and headlines, though, often have different functions; for example, in most cases news headlines are associated with a "short, attention-getting and effective" style (Reah 2002, 15), presenting verbs like *hit* or *grab,* and with events on the foreground of the agenda of the media collocating with verbs like *capture, dominate, hog*. Reviewing the literature, one aspect that more strongly emerges in reference to headlines compared to titles is *sensationalism* (see Molek-Kozakowska 2013), a characteristic that places the readers right in the center of the process of headline creation, to the point where headlines are seen as "negotiators between stories and readers" and "relevance optimizers" (Dor 2003, 720): in other words, one objective of a headline is to attract the readers' attention and engage them, ensuring that they are persuaded to read the entire piece.

"Why must a title have a similar style to that of other titles?" was the question asked by Umberto Eco in the appendix on the journalistic language of a 1971 book dedicated to print newspapers in Italy. He observed that it is through titles that the newspaper's fundamental messages reach the public.

> The headline determines the interpretation of the article. The case is not uncommon of the journalist who sends a piece, a news report, an editorial on a given topic; they are respected for their opinions, but are contradicted by the headline. That is, the headline acts as a "code" for the article. When it doesn't replace it—meaning that the reader receives the information given by the title and overlooks the article—it shapes the way the article will be read. (Eco 1971, 354, my translation[4])

[4] Original Italian version: "Il titolo decide dell'interpretazione dell'articolo. Non è raro il caso del giornalista che manda un pezzo, un servizio, un fondo su un argomento, viene rispettato nelle proprie opinioni, ma viene confutato attraverso il titolo. Il titolo funge cioè da 'codice' per il resto

In Eco's idea, then, the title is like a lens through which a text can be interpreted, a device. More scholars (for example, Kumar 2013; Swales 1990) underlined the fundamental role of titles in determining readers' decision to access the rest of the content and even more so when related to research articles: "with the prevalence of online publication, researchers often search for studies pertinent to their research by surveying the table of contents of prestigious journals in the discipline" (Cheng et al. 2012, A-1). In addition, with their study, Mabe and Amin (2002) demonstrated that a scholar reads almost 100 articles per year and over 1000 titles.

In the study of titles, linguistic analysis has been complemented by discourse analysis which led to notice that promotional instances have been shown to play a role in the construction of papers' titles; Ball (2009, 668) argues that over the years, marketing needs influenced the shape of titles in articles in some hard science disciplines: "in times of scientific mass production, scientific articles are also subject to the competition for attention."

It turns out that not only titles are very important elements that may impact on the readability of an article, but they are also important information and marketing tools. These elements clearly weigh on the pragma-linguistic choices made to create them.

3. Method

The analysis focuses on both the headlines of press releases (PRET corpus) and on the titles of the research articles (ACAT corpus) upon which the press releases were based: since each of the PRs is based on one and one only RA, the corpus is bijective in nature.

The press releases were all collected from 89 university websites (see Appendix 1), in the section dedicated to press releases and news stories, from the years 2019, 2020, 2021, and 2022. The RAs were all collected from 141 different scientific journals, which are listed in Appendix 2. The titles were manually extracted and then collected in two separate sub-corpora: ACAT (academic titles) and PRET (press releases' titles).

As shown in Table 1, each sub-corpus includes 210 titles, with a total 420 titles overall. For the analysis, a bottom-up approach was used. Initially, each pair, consisting of a title and a headline, was closely and thoroughly read and compared to other pairs. The goal was to identify linguistic phenomena. Subsequently, the phenomena identified were systematically tagged across the entire corpus to investigate potential patterns and their prevalence and consistency throughout the dataset.

dell'articolo. Se non lo sostituisce, nel senso che il lettore riceve l'informazione data dal titolo e trascura l'articolo, determina tuttavia il modo in cui l'articolo sarà letto" (Eco 1971, 354).

Year of publication of the articles	Number of titles of academic articles	Number of titles of press releases
2019	38	34
2020	66	66
2021	64	64
2022	42	42
Total	210	210

Tab. 1: The corpus—titles and years publication of the texts

4. Results

In this Section, some findings are presented from the analysis and comparison of the two corpora of titles and headlines. It seems worth mentioning that only in one case are the titles of the press release and the scientific article a perfect match: *Zoom Disrupts the Rhythm of Conversation*. In all the other instances, the headlines present a complete transformation compared to the titles of research articles. The analysis of the transformations revealed multiple communicative and linguistic strategies. However, many of those are beyond the scope of this paper. Below, three patterns are presented of linguistic strategies that were identified and analyzed closely. The examples examined below serve as representative instances of commonly occurring strategies, and their extent is indicated by the frequency number of titles employing these strategies.

4.1 The framing clauses as a validating-endorsement strategy

Study is the most occurring word in the PRET corpus with 63 occurrences in total; in particular, 28 out of 63 times it collocates with *finds*. *Study* was then examined based on its position in the text and on its collocates and co-text, as it is shown in Table 2.

Table 2 shows some of the instances for the noun *study*[5] in PRET. It is apparent that in most cases, its immediate collocates are verbs. *Study* and its collocates are consistently placed at the end or at the beginning of the headlines, and only in very few cases in this corpus, in the middle. Both the position and the content of the collocates *study* + [active verb in the present simple tense] or [name of the university] or [new] + *study* + verb are typical of the language of headlines,

[5] On the collocation and role of the noun *study* in university press releases see also Petrocelli et al. 2022.

as reported by Chovanec (2003, 90)[6]: "the conventional present tense is used in the main clause of the headline, expressing the major event which is being reported." Headlines ending with this structure, resemble the headlines of newspaper reports. Here, we borrow the concept of *framing clause*, used in the area of reported speech studies, which indicates a clause used to frame the direct speech and "contains a reference to the quoted speaker and a verb of saying, and this clause either precedes, interrupts or follows the quote" (Nordqvist 2001, 58). As it is shown below, the framing clauses in these headlines vary slightly from the definition above because since the subject of the verb is often an inanimate subject, it is followed by several different verbs other than those of saying—in some cases the verb is omitted (see examples 6-9 below). In the PRET corpus, *study* is one very frequent inanimate subject which is used as the source of the statement, as if it were the reported speaker, and acts as the subject of the present tense verbs conveying research finding: *finds, says, shows, explores, suggests, identifies, IDs.*

Advertising Continues To Reinforce Gender Stereotypes	**Study Finds**
Angry Politicians Make Angry Voters	**New Study Finds**
Paris Climate Agreement Goal Still Within Reach	**Suggests New Cu Boulder Study**
Digital Detoxing Doesn't Necessarily Improve Personal Well-Being	**New Study Finds**
Pandemic Caused 'staggering' Economic, Human Impact In Global South,	**Study Says**
Body Positive' Social Media Content Can Lift Body Image and Mood	**New Study Finds**
Augmented Reality Can Improve Online Shopping,	**Study Finds**
Bots Less Bother on Twitter Than Celebs	**Study Finds**
Cigarettes With Pro-Environment Marketing Perceived As Less Harmful	**Stanford Study Finds**
New Study Explores	The Link Between Obesity And Gum Disease
Climate Change Has Worsened Global Economic Inequality	**Stanford Study Shows**
Climate Change Is Hurting Children's Diet	**Global Study Finds**
Climate Now Biggest Driver of Migration	**Study Finds**
Food System Offer Huge Opportunities to Cut Emissions	**Study Finds**
Study Finds	Marijuana Use Increasing among Pregnant Individuals with HIV
Social Media Use Driven by Search for Reward, Akin to Animals Seeking Food,	**New Study Shows**
Texas A&M Study:	Worldwide Urban Expansion Causing Problems
Study IDs	Four Things That Make People Feel Good About Using Chatbots
Study Reveals	Intensive Grassland Management Hampers The Recovery of Soil Food Webs from Drough

Tab. 2: Instances of co-text of the noun *study in PRET*

[6] Chovanec (2003) reports this construction as co-occurring with the use of the past simple in the subordinate sentence.

This observation led to a more in-depth analysis of this phenomenon, and it turned out that almost half (99 out of 210) of the headlines of the press releases in the corpus present this structure: they usually consist of a statement and a framing clause, usually placed right before or after the statement, which contextualizes the statement within a scientific framework. The following are typical examples of this construction using nouns different from *study:*

(1) Pitt mathematicians explain how some fireflies flash in sync

(2) Our ancestors swapped pieces of ostrich eggshell jewelry 30,000 years ago in the same way that we trade Facebook and Twitter likes, or friendship bracelets, experts claim

Although *study* characterizes the vast majority of these constructions, it is not the only inanimate subject used in these clauses. Instances like *research, analysis,* and *scale* were also found—see examples 3-5:

(3) Causes of loneliness differ between generations, research says

(4) Twitter analysis finds national lockdown announcement helped minimise Covid-19 misinformation.

(5) Scale identifies who is water insecure globally

In a number of cases, the titles are framed by just one word, placed at the beginning of the headline and followed by a colon, or at the end of the headline and preceded by a colon:

(6) Study: Safe Drinking Water Remains Out of Reach for Many Californians

(7) Texas A&M Study: Worldwide Urban Expansion Causing Problems

(8) Data Breach Fixes Could Impact Patient Care: Study

(9) Parechovirus Epidemic Affecting Infants Needs Action: Experts

This type of framing clearly mirrors the reported speech structure where the speaker is mentioned followed or preceded by a colon as in the examples above to report their words. In the same way, *study* (with its premodifiers) and *experts* report on the research findings.
The framing clauses in the headlines seem to have the function of validating the reporting statement with an authoritative endorsement. This conveys credibility, communicating that the

statement is both official and conclusive as it derives its trustworthiness from a scientific study. In sum, what is stated in the title is to be trusted and deemed as official because it stems from science, it is a demonstrated fact backed by empirical evidence. This sort of validity endorsement is present in 99 of the 210 headlines, almost 50% of the total. However, while the constructs with *study* are the most frequent, other formulas are also used to enhance the trustworthiness of the statement, by indicating its basis in a scientific study. In the following examples, some of the alternative uses are shown.

(10) Don't be fooled by pretty food, new USC research warns

(11) Howard University researcher traces loss of smell and Covid-19

(12) Young teens should only use recreational internet and video games one hour daily, Rutgers research suggest

(13) New research from NYU Stern and Uber Eats shows how digital platforms helped support SMB restaurants during the COVID-19 pandemic

(14) New Landmark Study at UM School of Medicine finds aspirin use reduces risk of death in hospitalized COVID-19 patients

(15) Is Five Days of COVID Isolation Enough? New BU Study Has Some Answers

(16) Why does COVID-19 seem to spare children? Vanderbilt University Medical Center study offers an answer

(17) University of Chicago scientists discover material that can be made like a plastic but conducts like metal

In examples (10)-(17) similar constructs as those with *study* are used, but they are all enriched by the names of the universities where the studies took place. University names used as premodifiers or prepositional phrases strengthen the authoritativeness of the validity endorsement: the institution's reputation bolsters the study's credibility and validity, amplifying its value. Incidentally, notice that this might work as a mechanism of reciprocity: while the university's reputation validates the study, the relevance of the study reinforces the reputation of the university. In the majority of the examples the verbs collocate with *research* or *researchers*, at the opening or closing of the headline. These come with a variety of predicates: verbs like *warn* (10), *trace* (11), *suggest* (12), *show* (13), *find* (14), *have* (15), *offer* (16), and *discover* (17) are used.

Finally, the placement of this construction within the headlines was examined. The corpus was analyzed to identify whether the construction appeared at the beginning, end, or in the middle of the sentence. The distributions are shown in Table 3 below:

Position	Frequency
beginning	48
end	48
middle	3
N/A	111

Tab. 3: Position of the framing clause in the headlines

The position of the framing clause resulted to be equally distributed between the beginning and the end of the headline; in three instances—which are listed below—the validating-endorsement strategy is placed in the middle of the headline and the verb is followed either by a direct object, and objective clause:

(18) The Strategic Stockpile Failed; Experts Propose New Approach to Emergency Preparedness

(19) Is Five Days of COVID Isolation Enough? New BU Study Has Some Answers

(20) Framing food: Stanford study shows that teens heed food rules that prioritize health

In conclusion, the presence of the framing clause in almost half of the headlines of the PRET corpus, make it a characterizing feature of these headlines. It consists of the identification of the source of the statement, which is either animate (e*xperts, researchers, mathematicians, scientists*, etc.) or inanimate (*study, research, scale)*. In most cases it is followed by verbs, always in the active voice. The source is often further specified with the name of the University, school, laboratory in which the research was carried out. The frequency of occurrence of the framing clause, together with the fact that the source of the statement is explicit and always linked to scientific research, make it a strategy with and endorsement validating function, which is entrusted in the idea of science as reliable: the audience is more likely to accept the statement, given its deriving from a rigorous and evidence-based approach inherent in the scientific method.

4.2 The V-ing construction

As mentioned before, the idea of science as a conclusive truth of a demonstrated fact in the PR headlines is contrasted by the idea of an ongoing process portrayed in the academic titles. In the ACAT corpus, 34 out 210 (16%) titles of the RA start with a V-ing form, which is strictly connected with the idea of ongoing processes: In his study on procedural discourse, Farkas (1999) stated that gerunds are the "classic choice" for titles to "procedures or procedure topics" as they "convey a sense of process" (Farkas 1999, 46). Moreover, Cheng et al. (2012) further clarify the idea of a process as it is conveyed by V-ing in academic articles' titles:

> A V-ing phrase is a phrase based on the –ing form of a verb and thus expresses a process or activity. It often contains modifier(s) and/or (pro)noun(s) or noun phrase(s) functioning as its objects or complements. An RA [research article] title using this structure tends to highlight the V-ing, that is, the research activity. The modifiers, objects, or complements then serve to provide specific information about the study. For instance, *Defining the Zone of Proximal Development in US Foreign Language Education* emphasizes the activity of *Defining* the term *Zone of Proximal Development* in the context of *US Foreign Language Education*. (Cheng et al. 2012, A-4)

This sense of a process is apparent when looking at examples from the corpus of academic titles. It seems relevant to stress that despite the frequency of these V-ing titles, none of their corresponding press releases' headlines kept the V-ing form and completely new headlines were formed. By analyzing these titles and headlines as pairs, it seems that while the academic titles portray a sense of ongoing process, a work in progress expressed by the V-ing form, on the other hand, the press releases' titles seem to state a final fact.

Most of the instances present V-ing forms associated with verbs that characterize the type of method or procedure used in the study. This clearly (re)presents science as an evolving process, which is constantly in the making: it appears to be discursively construed as challenging the portrayal of science findings as monolithic; science is instead conveyed as a developmental process, subject to being revised and transformed.

(21) ACAT: Considering the ethical implications of digital collaboration in the Food Sector
PRET: The ethics of digital technology in the food sector-the future of data sharing

(22) ACAT: Modeling lung perfusion abnormalities to explain early COVID-19 hypoxemia
PRET: Three Reasons Why COVID-19 Can Cause Silent Hypoxia

(23) ACAT: Assessing COVID-19 Risk, Vulnerability and Infection Prevalence in Communities
PRET: Researchers map Houston areas most vulnerable to COVID-19

In the three examples above (21-23) different verbs are associated with the V-ing form, but they all depict a process which is typical of the scientific approach to the subject matter: for instance, *considering,* in Example (21), refers to the cognitive process of critically analyzing various factors and perspectives related to a given aspect of reality. Similarly, the verb *modeling* in Example 22 refers to the methodological process—possibly mathematical or computational—of creating a simulation, usually based on patterns, to allow a better understanding of the phenomenon under analysis. Moreover, in Example (23), the verb *assess* is connected to the overall research activity of systematically examining and evaluating data according to established methodologies and statistical evidence.

In all these cases, the reader has a sense of a scientific process which is happening and developing. Some other verbs used in the ACAT corpus to portray this idea are for example, *finding, combating, responding to, testing, exploring, catalyzing, evaluating, characterizing, examining, deciphering, comparing,* etc. Finally, examining the matching headlines (PRET) it is apparent how the V-ing form is dropped and the titles are completely reformulated in a way that the concept of a developmental process disappears in the headline. An additional example of the different strategies used is the pair (24) below:

(24) ACAT: Building long-term empathy: A large-scale comparison of traditional and virtual reality perspective-taking
PRET: Virtual reality can help make people more compassionate compared to other media, new Stanford study finds

The reference to a process in (24) ACAT is conveyed by the V-ing form, but also by the verb itself, *to build*, which implies action and a dynamic process; such a sense of development is visible through an additional element, stated after the colon, the procedure of comparing. In the corresponding press release title (PRET), *Building long-term empathy* is substituted by *make people more compassionate*, which is presented as an outcome of the research and is thus represented as concluded rather than in-progress or as a part of a larger process. Additionally, Example (25) may further elicit this mechanism:

(25) ACAT: How Much Is Too Much? Examining the Relationship Between Digital Screen Engagement and Psychosocial Functioning in a Confirmatory Cohort Study
PRET: Moderate Use of Screen Time Can Be Good For Your Health, New Study Finds

In Example (25), which starts with a question, *How much is too much?*, the second part of the title presents itself as the attempt to carry out a process (*Examining the relationship*...) in order to establish how long digital screens should be used. Conversely, in the PR headline, the process seems to be concluded and the finding is that digital screen use should be moderate. In other words, while these RA titles present the readers with the actions that have been carried out to obtain answers, the PR headlines tend to provide conclusive answers.
This is partly due to the stylistic characteristics of headlines, which follow requirements of brevity, and partly to marketing demands, which prioritize sensationalism and clickbait dynamics. These factors nurture a discursive tendency which emphasizes the findings and (practical) outcomes, whose effects and implications can be better understood by the general audience of non-experts. These observations are also present in Fahnestock (1998) and very well explained:

> instead of simply reporting facts for a different audience, scientific accommodations are overwhelmingly epideictic; their main purpose is to celebrate rather than validate. And furthermore they must usually be explicit in their claims about the value of the scientific discoveries they pass along. They cannot rely on the audience to recognize the significance of information" (Fahnestock 1998, 333-334)

Most of these titles do not have a main clause and appear to have three main types of structure: 1) they consist of one sentence (Example 26); 2) they have a V-ing sentence preceded by a question (Example 27); and 3) they are two-part titles, where the two parts are separated by a colon (Example 28).

(26) ACAT: Identifying Manipulative Advertising Techniques in XR Through Scenario Construction
PRET: XR Advertising Could Be a Consumer Threat if Left Unchecked

This typology usually consists of the V-ing clause including the V-ing form and its object and a prepositional phrase which usually identifies the context or the type of method/analysis used in the study.

(27) ACAT: Is Sunshine the Best Disinfectant? Evaluating the Global Effectiveness of the Extractive Industries Transparency Initiative (EITI)
PRET: Clean and clear: How Being More Transparent over Resources Helps Cut Carbon Emissions

The second typology, which is the least frequent in the corpus, is characterized by a question in the first part and the second part is dedicated to the procedure selected to answer it. The V-ing form in the titles with this structure is always placed right after the question. Although questions are also typical of headlines, this construction seems different. First, usually, those headlines made of questions do not have a second part; second, questions are also very typical of academic discourse since hypotheses are often expressed in the form of research questions.
Finally, the last typology, also includes two parts: these titles are usually characterized by a clause containing a brief overview of the objective of the study and a more explanatory sentence, placed after the colon, where the methodology or the type of study/approach are better specified:

(28) ACAT: Building Brands for the Emerging Bicultural Market: The Appeal of Paradox Brands
PRET: Paradox Brands' Hold Strong Appeal for Bicultural Consumers

As shown in this section, titles starting with a V-ing form are frequent in the corpus and in many cases portray a representation of scientific research as developmental and non-conclusive. The matching headlines do not preserve the linguistic and discursive structure, tending toward a journalistic style. In the headlines, the focus is given to conclusive outcomes which are more accessible and understandable for the general public.

4.3 Unspecified association vs. explicit relation

The analysis of the two corpora elicited a third strategy that supports the opposition between the representation of science as an ongoing process of understanding as conveyed by the scientific titles and a fact, based on finished studies' results, presented in the titles of the press releases. Observing both the titles and the headlines, it is apparent that usually two elements are presented, but the relation between the two elements seems to comply with different patterns in the RAs and in the PRs. This is clearer when examining the following examples:

(29) ACAT: Artificial Intelligence and Reduced Smes' Business Risks. A Dynamic Capabilities Analysis During the COVID-19 Pandemic.
PRET: AI Helped Protect Businesses From COVID-19 Risks.

In Example (29) the RA title proposes, through a strictly nominal style, a relation between two entities, *Artificial Intelligence* and *Reduced Business Risks*, but the nature of such relation is not clarified; what is made explicit, instead, it is the type of analysis undertaken to explore such relationship. On the contrary, the headline of the press release reveals the outcome of the analysis, *AI Helped Protect* and hence the nature of that relationship is displayed. Moreover, in the press release's title, the verb is used in the past simple, which reinforces even more the idea of a sure fact, a result obtained by a concluded study.

This mechanism by which two entities are presented as juxtaposed or related with no specification about the nature of such relation in the academic titles, and then correlated through an explicit relation in the press releases is overwhelmingly frequent in the corpus analyzed in this work, with 89 instances out of 210. The following examples are analyzed to elicit some of the mechanisms through which this discursive pattern is realized.

In some cases, the elements are juxtaposed in the research article, connected by the conjunction *and* without further explanation about the type of relationship.

(30) ACAT: Mental Health and Behavior of College Students During the Early Phases of the COVID-19 Pandemic: Longitudinal Smartphone and Ecological Momentary Assessment Study
PRET: COVID-19 Increased Anxiety, Depression for Already Stressed College Students

In Example (30), it is apparent how *mental health* and *behavior of college students* are juxtaposed in the ACAT title: the reader is informed that a relation exists between the two entities, but it is not specified; rather, the focus of the title is on the type of method used to carry out the analysis. On the contrary, the headline of the press release clarifies that some mental health issues (anxiety and depression) increased for college students.

The identical mechanism of juxtaposition or unspecified association vs. explicit relation can be observed also in the following pair:

(31) ACAT: Marijuana, Opioid, and Alcohol Use Among Pregnant and Postpartum Individuals Living With HIV in the US
PRET: Study Finds Marijuana Use Increasing Among Pregnant Individuals with HIV

In the ACAT title the use of marijuana is related with pregnant women with HIV, but the nature of such relation is only explicit in the PRET title.

In some instances, the entities are not merely juxtaposed: a verb or a noun connect them, but they are typically neutral, indicating that a change in the relations has occurred without

specifying to what extent: the headline instead, clarifies the nature of the relationship. In the titles of the ACAT corpus, several neutral words were found, including *shift, effect, influence, impact, relationship, role, examining, assessing, evaluating.* These words are neutral in that although informing about the link between the two entities they fail to specify its nature. The examples below elicit this mechanism:

(32) ACAT: Global Lake Thermal Regions Shift under Climate Change
PRET: Climate Change Has Worsened Global Economic Inequality, Stanford Study Shows.

Just like in (31), also in Example (32) the scientific title hints to a relation between two entities, a shift, but the neutrality of meaning of "shift" does not allow for further understanding. From the title of the press release, the reader learns instead that the shift consisted of a worsening of economic inequality. It is apparent that not only is the relational tie made explicit, but it is also presented as an established fact, strengthened by the employment of a finite verb, used transitively, in the present perfect tense: *has worsened.* Among the neutral words used to relate to entities, the noun "effect" occurs more than once, as shown in the following pairs:

(33) ACAT: The Effects of Remote Work on Collaboration among Information Workers.
PRET: When Everyone Works Remotely, Communication and Collaboration Suffer, Study Finds.

The use of the noun "effects" in the research articles' titles informs the reader that one of the entities had some kind of influence on the other entity, but the type of influence is not explicit. The word *effects* is not used in the press release headline of example 33 where it is replaced by the verb "suffer" which makes the type of influence clear. The very same mechanism is present in example (34):

(34) ACAT: The Effect of Large-Scale Anti-Contagion Policies on the COVID-19 Pandemic
PRET: Emergency COVID-19 Measures Prevented More Than 500 Million Infections, Study Finds

In Example (34), the RA title presents two entities, the *policies* and the *pandemic*: the reader is informed that the first has an *effect* on the latter, with no further specification; on the contrary, the nature of such an effect that associates the two entities is directly unveiled by the PR headline, which explained that the *measures*, a meronym for policies, *prevented,* a finite, transitive verb in the past simple tense, the *pandemic* to spread more.

It turns out that the mechanism described so far results in a systematic pattern that clearly emerges from the comparison between the pairs of titles. This pattern has been named *unspecified association vs. explicit relation,* where the former is concerned with RA titles and the latter with the PR headlines.

5. Conclusions

In this paper, a corpus of research articles' titles was analyzed and compared with a corpus of press releases' headlines. The two corpora have a bijective relation in that each of the press releases was written to present the findings of each of the scientific articles. Because of this unique relation between the two corpora, it was possible to look very closely at the transformations that scientific discourse undergoes to become accessible to a public of non-experts. Moreover, because of their brevity, titles are texts (or paratexts) very suitable to this type of contrastive analysis. Scientific language varies within specific disciplinary fields, but it was conceptualized here for its macro-characteristics. Such approach made it possible to identify recurring patterns, which will be tested in future developments of this study.

As a matter of fact, one aspect that clearly emerged from the comparison between the two corpora is that, on the one hand, research article titles appear to mostly represent the study at hand as an ongoing process, as one of the many building blocks to be added to form part of scientific knowledge, which seems to be conceived as an interminable conversation, resonating with the metaphor of the Burkean parlor. On the other hand, the titles of the press releases tend to present the readers with a finished cycle, a fact, not a process. They are presented as a definitive, monolithic finding, a truth, a final fact, a practical piece of knowledge endorsed by the authoritative stamp of science.

The stamp is represented by recursive constructions in the text, which have been labeled as the *validity-endorsement strategy* in the press releases. This is the first of three strategies contributing to different representations of scientific knowledge between research articles' titles and press releases headlines.

The second strategy is named the *V-ing construction,* used in the academic articles' titles without a main verb to stress the idea of research as an ongoing process. This construction systematically disappears in the press releases.

The last strategy is the one which opposes *unspecified association* to *explicit relation:* two elements, usually objects of study, are associated in the academic titles without further clarification, which is, in spite, provided in the press releases.

The rationales behind these strategies are partly rooted in the distinct stylistic requirements of the two registers. On the one hand, press releases' headlines are affected by the need to engage the readers, motivate them to click and read the whole piece, hence the use of engaging language and content that conveys conclusive answers and their practical significance. These answers are supported by an endorsement clause, in order to establish credibility and keep at bay the risk of being mistaken as fake news. On the other hand, research article titles need to clearly convey the study's subject and need to contain keywords which are relevant for the research field and which would facilitate discoverability through academia-oriented search engines. Furthermore, the way research articles' titles and press releases' headlines reach their respective public is very different. Scholars, students, and experts, who are the main readers of research articles, usually deliberately look for them through very specific keywords and search engines, while press releases are published on universities' websites together with other news articles about different topics of university life, so they typically *happen* to be found and need to motivate the readers to read them.

Finally, in this resulting picture where the titles of research articles seem to prioritize informativeness and science is presented in the making, there is a matter of expectations. Research articles are expected to be cautious, to use hedges, to communicate results with prudence, as the scientific method, by definition, implies that hypotheses can (and should) be re-tested, verified, re-assessed under different circumstances and with different methods. This is the very nature of science, which, rightly so, shapes the language through which it is conveyed. The expectations for press releases are very different: the readers know that there might be some degree of sensationalism and even that sometimes the headlines and the content of the pieces are not perfectly aligned—Eco (1971) referred to this as a false relationship between the title and the text. As Garzone (2014, 27) puts it, "criteria of newsworthiness prevail over the rigour and trustworthiness that would have to be inherent properties of the dissemination of science. […] It is the ideology of journalism that prevails over the need for accuracy and completeness." It turns out that headlines ambiguously avoid caution to sensationally present scientific findings as conclusive truths while at the same time use scientific research as validating endorsements. Conversely, research article's titles preserve, and rightly so, the idea of science as a developmental process, open to the possibility of being challenged. In other words, titles and headlines absorb both the language and the style of the running text they dominate, and the result is science respectively presented in the making and re-presented as a sensational final fact. It turns out that this significantly impacts on how the public perceives science.

Laura Di Ferrante *is from Naples (Italy) and currently lives in Milan. She holds the position of Assistant Professor of English Language and Linguistics at the University of Milan, in the Department of International, Legal, Historical and Political Studies. Additionally, since 2013, she is the co-founding editor and editor in chief of* E-JournALL, EuroAmerican Journal of Applied Linguistics and Languages. *Her academic and professional background encompasses experiences in both Italy and the United States. Her main research interests focus on accessibility as it applies to workplace and media discourse, intercultural pragmatics, and applied linguistics.*

Works cited

Autzen, Charlotte. "Press Releases – The New Trend in Science Communication." *Journal of Science Communication* 13.3 (2014): C02.

Ball, Rafael. "Scholarly Communication in Transition: The Use of Question Marks in the Titles of Scientific Articles in Medicine, Life Sciences and Physics 1966–2005." *Scientometrics* 79.3 (2009): 667-679.

Biber, Douglas. *University Language: A Corpus-Based Study of Spoken and Written Registers*. Amsterdam/Philadelphia: John Benjamins Publishing, 2006.

Biber, Douglas, and Susan Conrad. *Register, Genre, and Style*. Cambridge: Cambridge University Press, 2019.

Blom, Jonas Nygaard and Kenneth Reinecke Hansen. "Click Bait: Forward-Reference as Lure in Online News Headlines." *Journal of Pragmatics* 76 (2015): 87-100.

Calsamiglia, Helena and Teun A. Van Dijk. "Popularization Discourse and Knowledge About the Genome." *Discourse & Society* 15.4 (2004): 369-389.

Catenaccio, Paola. "Press Releases as a Hybrid Genre: Addressing the Informative/Promotional Conundrum." *Pragmatics* 18.1 (2008): 9-31.

Cheng, Stephanie W., Chih-Wei Kuo and Chih-Hua Kuo. "Research Article Titles in Applied Linguistics." *Journal of Academic Language and Learning* 6.1 (2012): A1-A14.

Chovanec, Jan. "The Uses of the Present Tense in Headlines." *Theory and Practice in English Studies* 1 (2003): 83-92.

Di Ferrante, Laura, Giulia Lattanzi and Emilia Petrocelli. "Those Who Get Lost in Communication Science. Promotion and Downplay in University Press Releases." *Discursive Perspectives on Knowledge Dissemination in Corporate and Professional Communication: Focus on Ethical and Ideological Aspects.* Edited by Giuliana Garzone, Walter Giordano and Sergio Pizziconi. Timişoara: Editura Politehnica, 2021. 31-56.

Dor, Daniel. "On Newspaper Headlines as Relevance Optimizers." *Journal of Pragmatics* 35.5 (2003): 695-721.

Eco, Umberto. "Appendice: Guida all'Interpretazione del Linguaggio Giornalistico." *La Stampa Quotidiana in Italia*. Edited by Vittorio Capecchi and Marino Livolsi. Milano: Bompiani, 1971. 333-377.

Fahnestock, Jeanne. "Accommodating Science: The Rhetorical Life of Scientific Facts." *Written communication* 3.3 (1998): 275-296.

Farkas, David K. "The Logical and Rhetorical Construction of Procedural Discourse." *Technical Communication* 46.1 (1999): 42-54.

Fischhoff, Baruch. "The Sciences of Science Communication." *PNAS – Proceedings of the National Academy of Sciences* 110.3 (2013): 14033-14039.

Flowerdew, John and Matthew Peacock. *Research Perspectives on English for Academic Purposes*. Cambridge Applied Linguistics. Cambridge: Cambridge University Press, 2001.

Gabielkov, Maksym, Arthi Ramachandran, Augustin Chaintreau, and Arnaud Legout. "Social Clicks: What and Who Gets Read on Twitter?" *Proceedings of the 2016 ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Science*, 2016. 179-192.

Garzone, Giuliana E. "News Production and Scientific Knowledge: Exploring Popularization as a Process." *The Language of Popularization*. Edited by Bongo, Giancarmine and Giuditta Caliendo. Lausanne: Peter Lang, 2014. 73-107.

---. *Specialized Communication and Popularization in English*. Roma: Carocci. 2020.

Genette, Gérard and Marie Maclean. "Introduction to the Paratext." *New literary history* 22.2 (1991): 261-272.

Gotti, Maurizio. *Specialized Discourse: Linguistic Features and Changing Conventions*. Lausanne: Peter Lang, 2003.

Gotti, Maurizio. "Reformulation and Recontextualization in Popularization Discourse." *Ibérica* 27 (2014): 15-34.

Harmatiy, Olha. "Science Coverage: What Does the Audience Want and Really Need? Exploring Media Consumption in Ukraine." *Journal of Creative Communications* 16.1 (2021): 97-112.

Kueffer, Christoph and Brendon MH Larson. "Responsible Use of Language in Scientific Writing and Science Communication." *Bioscience* 64.8 (2014): 719-724.

Kumar, M. Jagadesh. "Editorial Commentary: Making Your Research Paper Discoverable: Title Plays the Winning Trick." *IETE Technical Review* 30.5 (2013): 361-363.

Luzón, María José. "Public Communication of Science in Blogs: Recontextualizing Scientific Discourse for a Diversified Audience." *Written Communication* 30.4 (2013): 428-457.

Mabe, Michael A. and Mayur Amin. "Dr Jekyll and Dr Hyde: Author-Reader Asymmetries in Scholarly Publishing." *Aslib Proceedings* 54.3 (2002): 149-157.

Mahrt, Merja and Cornelius Puschmann. "Science Blogging: An Exploratory Study of Motives, Styles, and Audience Reactions." *Journal of Science Communication* 13.3 (2014): A05.

Molek-Kozakowska, Katarzyna. "Towards a Pragma-Linguistic Framework for the Study of Sensationalism in News Headlines." *Discourse & Communication* 7.2 (2013): 173-197.

Myers, Greg. "Discourse Studies of Scientific Popularization: Questioning the Boundaries." *Discourse Studies* 5.2 (2003): 265-279.

Nordqvist, Asa. "The Use of Direct and Indirect Speech By 1 ½-To 4-Year-Olds." *Psychology of Language and Communication* 5.1 (2001): 57-66.

Petrocelli, Emilia, Laura Di Ferrante and Elisa Ghia. "Multi-Word Combinations in Science Communication: A Corpus-Driven Study of University Press Releases." *Online Journal of Communication and Media Technologies* 12.4 (2022): 1-19.

Puschmann, Cornelius. "A Digital Mob in the Ivory Tower? Context Collapse in Scholarly Communication Online." *Discourse in and Through the Media: Recontextualizing and Reconceptualizing Expert Discourse.* Edited by Marina Bondi, Silvia Cacchiani, Davide Mazzi. Cambridge: Cambridge Scholars, 2015. 22-45.

Saitz, Richard and Gary Schwitzer. "Communicating Science in the Time of a Pandemic." *JAMA* 324.5 (2020): 443-444.

Sarangi, Srikant. "Rethinking Recontextualization in Professional Discourse Studies: An Epilogue." *Text & Talk* 18.2 (1998): 301-318.

Swales, John. *Genre Analysis: English in Academic and Research Settings.* Cambridge: Cambridge University Press, 1990.

Tessuto, Girolamo. "Making Sense of Web-Based European Court of Justice Institutional Press Releases: Context, Structure *and* Replicable Genres." *Ibérica* 42 (2021): 219-244.

Appendix 1

The press releases were retrieved from the official websites of the following universities, listed in alphabetical order.

1	Anglia Ruskin University	45	University of Arizona
2	Boston University	46	University of Bath
1	Brown University	47	University of Birmingham
2	Carnegie Mellon University	48	University of Buffalo
3	Case Western Reserve University	49	University of California - Berkeley
4	Columbia University	50	University of California - Riverside
5	Cornell University	51	University of Cambridge
6	Dartmouth College	52	University of Chicago
7	Durham University	53	University of Colorado Boulder
8	George Washington University	54	University of Florida
9	Georgia State University	55	University of Georgia
10	Harvard Graduate School of Education	56	University of Glasgow
11	Harvard T.H. Chan School of Public Health	57	University of Illinois, Urbana - Champaign
12	Harvard University	58	University of Iowa Health Care
13	Imperial College London	59	University of Leeds
14	Indiana University	60	University of Liverpool
15	Kansas State University	61	University of Maryland
16	Lancaster University	62	University of Massachusetts Amherst
17	Massachusetts Institute of Technology	63	University of Michigan
18	Michigan State University	64	University of Michigan School of Public Health
19	NC State University	65	University of Minnesota
20	New York University	66	University of Notre Dame
21	Northwestern University	67	University of Nottingham
22	Portland State University	68	University of Oxford
23	Princeton University	69	University of Pennsylvania
24	Purdue University	70	University of Pittsburgh
25	Queen Mary University of London	71	University of Queensland
26	Rice University	72	University of Reading
27	Rockefeller University	73	University of Sussex

28 Rutgers, The State University of New Jersey.	74 University of Tennessee Health Science Center
29 St. Jude Children's Research Hospital	75 University of the West of England
30 Stanford University	76 University of the Witwatersrand, Johannesburg.
31 Texas A&M University	77 University of Toronto
32 The Ohio State University	78 University of Vermont
33 The Pennsylvania State University	79 University of Virginia
34 The University of British Columbia	80 University of Waterloo
35 The University of Edinburgh	81 University of York
36 The University of Manchester	82 University of Zurich
37 The University of Melbourne	83 USC University of Southern California
38 The University of North Carolina at Chapel-Hill	84 Utrecht University
39 The University of Nottingham	85 Vanderbilt University
40 The University of Queensland	86 Washington State University
41 The University of Sidney	87 Yale
42 The University of Texas at Austin	88 Yale School of Medicine
43 UCLA	89 York University
44 University of Aberdeen	

Appendix 2

List of academic journals where the research articles were published.

1	ACS Biomaterials Science & Engineering	72	Journal of Macromarketing
2	ACS Pharmacology & Translational Science	73	Journal of Marketing
3	Aggressive Behavior	74	Journal of Marketing Research
4	Aging Clinical and Experimental Research	75	Journal of Medical Internet Research
5	American Economic Review	76	Journal of Promotion Management
6	American Journal of Clinical Pathology	77	Journal of Public Health
7	American Journal of Preventive Medicine	78	Journal of Research on Adolescence
8	American Journal of Public Health	79	Journal of Sustainable Tourism
9	Anesthesia & Analgesia	80	Journal of Technology In Behavioral Science
10	Anesthesia and Analgesia	81	Journal of the Academy of Marketing Science
11	Animal Behaviour	82	Journal of the American Academy of Child & Adolescent Psychiatry
12	Annals of Neurology	83	Journal of the National Comprehensive Cancer Network
13	Big Data & Society	84	Journal of the Royal Society Interface
14	BMC Pregnancy and Childbirth	85	Journal of Travel Research
15	BMJ Global Health	86	Journal of Urban Economics
16	British Dental Journal	87	Journal of Urban Health
17	British Journal of Clinical Psychology	88	Journalism & Mass Communication Quarterly
18	Cell	89	Journalism Studies
19	Clinical Infectious Diseases	90	Landscape and Urban Planning
21	Clinical Toxicology	91	Manufacturing & Service Operations Management
22	Communication & Sport	92	Marketing Letters
23	Communication Monographs	93	Medical Journal of Australia
24	Computers In Human Behavior	94	Modern Pathology
25	Conservation Biology	95	Nature
26	Culture, Health & Sexuality	96	Nature Climate Change
27	Current Psychology	97	Nature Communications

28	Cyberpsychology, Behavior, and Social Networking	98	Nature Human Behaviour
29	Digital Government: Research and Practice	99	Nature Nanotechnology
30	Earth's Future	100	New Media & Society
31	Emerging Microbes & Infections	101	Npj Urban Sustainability
32	Emotions	102	Open Mind
33	Energy Research & Social Science	103	Organizational Behavior and Human Decision Processes
34	Environmental Research Letters	104	Patterns
35	Environmental Science & Policy	105	Pediatrics
36	Environmental Science & Technology Letters	106	Personality and Social Psychology Bulletin
37	Ethnic and Racial Studies	107	Philosophical Transactions of the Royal Society B
38	Evolutionary Biology	108	Plos Medicine
39	Forest Policy and Economics	109	Plos One
40	Frontiers In Climate	110	PNAS
41	Frontiers In Immunology	111	Political Research Quarterly
42	Frontiers In Psychology	112	Preventive Medicine
43	Global and Planetary Change	113	Proceedings of the 2021 CHI Conference on Human Factors In Computing Systems
44	Health Affairs	114	Proceedings of the International AAAI Conference on Web and Social Media
45	Health Services Research	115	Proceedings of the National Academy of Sciences of the United States of America
46	Humanities and Social Sciences Communications	116	Psychological Medicine
47	IEEE Open Journal of Engineering In Medicine and Biology	117	Psychological Science
48	IEEE Transactions on Microwave Theory and Techniques	118	Psychology of Popular Media Culture
49	Information & Management	119	Public Health Nutrition
50	Information Systems Frontiers	120	Remote Sensing
51	Information Systems Journal	121	Resources, Conservation and Recycling
52	International Interactions	122	Science

53	International Journal For Equity In Health	123	Science Advances
54	International Journal of Environmental Research and Public Health	124	Science Immunology
55	Iscience	125	SCIENCE ROBOTICS
56	JAMA	126	Science Translational Medicine
57	JAMA Health Forum	127	Scientific Reports
58	JAMA Network Open	128	Social Network Analysis and Mining, 2022•Springer
59	JMIR Public Health and Surveillance	129	Social Science & Medicine
60	Journal of Broadcasting & Electronic Media	130	Socius
61	Journal of Business Research	131	Stat
62	Journal of Computer-Mediated Communication	132	Sustainability
63	Journal of Consumer Culture	133	Technology, Mind, and Behavior
64	Journal of Consumer Psychology	134	The Journal of Allergy and Clinical Immunology: In Practice
65	Journal of Consumer Research	135	The Journal of Clinical Investigation
66	Journal of Experimental Psychology: General	136	The Lancet Infectious Diseases
67	Journal of Experimental Social Psychology	137	The Lancet Planetary Health
68	Journal of Exposure Science & Environmental Epidemiology	138	The Milbank Quarterly
69	Journal of Fashion Marketing and Management: An International Journal	139	Transparency Initiative
70	Journal of Happiness Studies	140	Vaccine
71	Journal of Health Communication	141	Young Consumers