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Titles in research articles: changes across time and discipline

Abstract

Titles are a crucial feature of research papers and have become increasingly important with changes in publishing practices and the explosion of published research. As a result, novice writers seeking to get their work noticed in international journals might benefit from a clear understanding of the features of research titles and an awareness of the relationship between language and disciplinary context. In this study, we explore this relationship and the impact of changing contexts on titles across the last 60 years on the length, form and content of 36,000 titles from the ten leading journals from six disciplines spread along a soft-hard science continuum. Our results show a considerable increase in the length of titles coupled with more interrogative and compound titles in almost all disciplines. There has also been a growing mention of methods in the titles of hard knowledge papers with more frequent inclusion of results in the softer domains. These diachronic changes can be attributed to different characteristics of the fields and of the changing dynamics of the publishing context. Our findings have important implications for early career academics seeking to publish in English and contribute to studies of diachronic analysis of academic discourse.

Keywords: academic publishing; research titles; diachronic change; disciplinary differences

1. Introduction

Titles are an important feature of virtually all formal academic genres from blogs to conference presentations, but they are perhaps most central to the research article. While titles have always been with us as an indication of the article's content, online searches and the emergence of 'article-based publishing' has increased their significance dramatically (Author 2 & Author 1, 2019). Today almost all the major publishers have prioritised the quicker delivery and easier searching of individual papers, relegating the volume/issue shell of journals to archiving¹. Publication is thus geared towards discrete articles, available online as they are ready without waiting for an issue to be compiled, allowing faster publication and citation (Author 2 & Other, 2022). As a result, titles have come to play a more central role in facilitating searches and promoting research visibility, providing "content signposts" of papers (Cargill & O'Connor, 2013, p. 19).

In a context where careers depend heavily on performance metrics, an arresting title can function as 'the highway billboard' of an article (Belcher, 2021: 282), attracting attention and gaining readers (Jacques & Sebire, 2010; Jamali & Nikzad, 2011; Milojević, 2017). Writers therefore use various means to make their titles both informative and engaging "to attract readers who may go on to read, cite and make use of their research" (Author 2 & Other, 2022, p. 1). Hudson (2016), for example, suggests using short titles since long ones are "more difficult to digest and may reduce the attraction factor" (p. 878), while question titles have been found to produce more downloads but less citations than other forms (Jamali & Nikzad, 2011).

Given the prominence of titles, novice and student writers seeking to publish in international, high profile journals might benefit from a better understanding of the linguistic features of research titles and a rhetorical awareness of the relationship

¹<https://www.elsevier.com/about/press-releases/archive/science-and-technology/elsevier-introduces-article-based-publishing-to-increase-publication-speed>

between language and disciplinary context. Our study also contributes to the literature which seeks to build a picture of academic writing by relating practice to disciplinary and diachronic contexts, revealing the ways that writers are influenced in their persuasive choices. The study therefore sets out to explore how titles have changed over time in different disciplines by answering the following questions:

1. What is the typical length of titles in published articles?
2. What formal patterns characterise titles in research articles?
3. What are the content foci of these titles?
4. Do these features vary over time and by discipline?

2. Titles in research papers

Research titles “mirror a set of requisites that are crucial to the construction, communication, and progress of new knowledge” (Soler, 2007, p. 91). They indicate the field of the research, stimulate interest and facilitate keyword-based search and retrieval. Their importance means there is no shortage of advice on writing attractive titles in style guides and journal instructions. Most sources recommend that writers keep their titles short, avoid irony, jargon and humour and aim to make them clear, informative and specific (e.g. Grant, 2013; Gustavil, 2012; Hays, 2010; Hartley, 2005). Hartley (2008), for example, suggests titles should be short and accurate but without acronyms and abbreviations; Cargill and O'Connor (2013) also advise brevity and informativity; while Gastel and Day (2016) recommend avoiding compound titles (those divided into two parts) and questions.

Many observers provide only vague advice, such as to avoid ‘broad’, ‘dense’, ‘ambiguous’ or ‘clever’ titles (e.g. Belcher, 2021) or to “provide as much relevant information as possible but be concise” (Cargill & O'Connor, 2013: 61). Journals themselves also often specify title requirements, so *Cell*² instructs authors to supply titles which provide an overall view of the paper’s significance for a broad audience in

² https://www.cell.com/pb-assets/journals/research/matter/Matter_IfA.PDF

no more than 10-12 words. Such discussions of titles, however, tend to be short, prescriptive and impressionistic (Author 2 & Other, 2022; Author 1 & Author 2, 2020; Soler, 2007).

Computer-assisted text analysis enables quantifying the extent to which actual texts correspond with these admonishments, providing more reliable guidance for writers. Soler (2007) and Author 2 and Other (2022) for example, found a more frequent use of long and compound titles in soft knowledge fields while Lewison and Hartley (2005) and Morales et al. (2020) showed that compound constructions separated with a colon, generate more citations (Jacques & Sebire, 2010; Moore, 2010). Furthermore, although question marks might assist an effective presentation of results (Ball, 2009), they were found to diminish with increasing author numbers and lead to less citations than declarative forms (Hudson, 2016). So while a great deal of the research seeks to correlate title features with citation counts, it often assumes a uniform practice across disciplines.

There has, however, been research on the disciplinary variation of titles. Hartley (2007) and Haggan (2004), for instance, found a greater use of colons in soft than hard sciences. Author 2 and Other (2022) concur, showing colons to comprise over 65% of titles in linguistics, education and history journals compared with less than 25% in maths, biology and engineering. Nagano (2015) and Milojević (2017) further suggest that the length of titles is also a disciplinary variable, being longer in natural and life sciences than social sciences. Looking at the structure of titles, Soler (2007) identified a prevalence of nominal group titles in the science papers and a strong preference for full-sentence titles in biology. Wang and Bai (2007) have confirmed this, finding that 99% of titles in the *New England Journal of Medicine* comprise nominal phrases. In terms of content, Kerans et al. (2020) observed remarkable disciplinary variation in the mention of methods in titles and different preferences between general and more specific journals for including results.

Overall, previous studies are mainly concerned with the way titles are organised and how they are differentiated by topic, journal and discipline. Titles have to be sufficiently appealing to grab attention and appropriately descriptive of the article's content to be detected by information retrieval systems. But to our knowledge, the ways that the massive changes in publishing and writing practices in recent years has impacted writers' choices has not been studied. Such a study would provide valuable information on the relationship between persuasion and context and the evolving practices of disciplinary writing. It would, in addition, have significant practical value to those who use English as an additional language (EAL) and the academic writing instructors, translators, and authors' editors who support them during the writing and publishing processes. We now turn to our corpus and methods.

3. Corpus and analysis

To address these issues we built three corpora, extracting titles from journal articles published in the same 10 journals in each of six disciplines at three periods over the past 60 years: 1960, 1990 and 2020. A total of 60 journals. To overcome the fact that publishing changes, that journals come and go and are replaced by new ones over time (Author 2 & Author 1, 2019), we selected the longest-standing journals which had achieved the highest ranking in their discipline according to the five-year impact factor in 2020. As the quality of papers is customarily judged by the journals they appear in, we feel this offers a better representativeness of what the discipline regards as good research papers than inclusion of titles from random journals of varying quality and uncertain value in the field.

Additionally, we also sought to include a broad range of disciplines with an extensive history and spread along a broad continuum of academic activity (Biglan, 1973; Becher & Trowler, 2001). Biglan (1973), for example, proposes a clustering of disciplines along three dimensions based on faculty questionnaire data and published outputs: hard-soft, life-nonlife and pure-applied. Our choices of disciplines in this system are as follows:

- Economics (soft/applied/nonlife)
- Psychology (soft/pure/life)
- Mathematics (hard/pure/nonlife)
- Biology (hard/pure/life)
- Medicine - (hard/applied/life)
- Engineering (hard/applied/nonlife)

We focused only on empirical research articles, excluding systematic reviews and clinical trials, for example, whose titles are often influenced by guidelines such as those issued by Consort and PRISMA statements. We also ignored editorials, commentaries, letters, etc. We took 200 titles at random from each of the 10 established journals in each discipline from each target year, so the corpus consists of 1,000 titles from each discipline in each target year, totalling 6,000 titles per year and 36,000 titles overall of over 420,000 words. Table 1 shows the characteristics of the corpus ordered by the greatest change in length.

Table 1 Total words at each period in the research titles corpus

Discipline	1960	1990	2020	% change
Economics	15397	19354	27503	78.63
Psychology	16994	21450	29986	76.45
Medicine	21114	25803	36399	72.39
Engineering	19816	21336	28695	44.81
Mathematics	17060	18598	21993	28.92
Biology	22524	28583	28708	27.46
Overall	99468	117760	147801	48.59

To explore the titles in more detail, we first counted word length, and then examined the form and content of titles. Like Hudson (2016) and Paiva et al. (2012), we considered titles with 10 or fewer words as short and otherwise as long. We then followed Author 2 and Other (2022) in distinguishing ‘indicative’ and ‘interrogative’ forms according to their syntax and as either a single sentence or a ‘compound’, comprising two parts separated by a colon or other punctuation. Like Kerans et al. (2020) and Author 2 and Other (2022), we also categorised titles according to whether they mentioned the topic, method or results of the paper. We saw this as offering the most

concrete and measurable means of distinguishing titles in order to describe changing preferences. Table 2 summarises these distinctions.

Table 2 Categorisation of length, content and form of research titles

Focus	Categories	Details
Word length	short	10 words or less
	long	More than 10 words
Form	indicative	single
		compound
	interrogative	single
		compound
Content	topic	research topic or context
	method	research design or methods
	result	research findings or conclusion

The titles were linguistically analysed using the computer program *Linguistic Inquiry and Word Count (LIWC)* (Boyd et al., 2022), which calculates the length of each text and the percentages of words associated with different categories out of the total number of words in a set of texts. These categories include lexical (e.g. nouns and adjectives) and function words (e.g. prepositions and articles) as well as colons, hyphens, question and exclamation marks. We used this facility to determine the length of titles, grouping them by time periods and disciplines, and the percentage of each form of the total words. Both authors then worked independently to manually code examples according to the model above, achieving an inter-rater agreement of 98% on the form and 96% on the content before resolving disagreements.

Our discussion of results in the following sections, constrained by journal word limits, focuses on variations along disciplinary groupings, particularly hard-soft and pure-applied categories. This approach has been used extensively by authors such as Aditomo (2018), Dang (2018), Author 2 (2004) and others, and helps to reveal the impact of domain-specific disciplinary cultures on discursive practice. Where findings are substantially specific to a singly discipline, we have given attention to this.

4. Changes in title length

Title length matters to the retrieval, and thus the eventual uptake and possibly citation, of articles. Longer titles provide a more comprehensive description of the study and thus are more likely to be identified in online literature searches (Habibzadeh & Yadollahie, 2010; Jacques & Sebire, 2010). However, a longer title may be clumsy and “reduce its readability and attractiveness” (Hudson, 2016, p. 872). The evidence is contradictory. Jamali and Nikzad (2011) and Paiva et al. (2012) found that short-titled articles garnered more hits and citations than those with longer titles. In contrast, Jacques and Sebire (2010) and van Wesel et al. (2014) found a positive correlation between length and impact. There seems to be a disciplinary factor at work here as Milojevic (2017), for example, found the same length/citation correlation in astronomy and ecology but not in mathematics, robotics and economics. Overall, the average length of titles seems to be strongly discipline-dependent (Author 2 & Other, 2022; Milojevic, 2017), with longer titles produced by larger teams (White, 1991).

In this study we found both disciplinary and diachronic differences in the length of titles, with a substantial increase in all disciplines over the period (Table 1). It seems that titles in these target fields are about 50% longer than they were in 1960, a change in line with Milojević’s (2017) findings. Economics and psychology, at the ‘softer’ end of our continuum, recorded the biggest rise of 78%. The need to provide greater detail to distinguish one’s work from others in an increasingly crowded and specialised market is a likely driver of this change (Author 2 & Author 1, 2019b). Interestingly, maths and biology, disciplines in the hard/pure quadrant of Biglan’s categorisation, recorded the lowest rises, with a considerable number remaining under 10 words:

- (1) Some uniqueness theorems on Riemannian manifolds with boundary.
(1960, Maths)
- (2) On the σ -length of maximal subgroups of finite σ -soluble groups.
(2020, Maths)

As stated above, we regarded titles with 10 words or less as short and otherwise as long. We did, however, go on to explore diachronic differences in disciplinary titles by a further distinction of five word gaps. Table 3 shows that economics, psychology, engineering and mathematics all increased from short to long titles while medicine and biology consistently favoured long titles. The reason for these disciplinary differences is unclear, but it may be because of the rapidly evolving discoveries and increasing technicality in the life sciences. Equally, it may be a result of large numbers of researchers competing to be noticed in more densely explored and contested areas who are seeking to spell out what is distinctive about their study compared with others:

(3) Psychometric characteristics of the Croatian and the Serbian versions of the oral health impact profile for edentulous subjects, with a pilot study on the dimensionality (2020, Medicine)

(4) Tripartite combination of candidate pandemic mitigation agents: Vitamin D, Quercetin, and Estradiol Manifest properties of medicinal agents for targeted mitigation of the COVID-19 pandemic defined by genomics-guided tracing of SARS-CoV-2 targets in human cells (2020, Biology)

Table 3 Changing length of research titles by disciplines

	Economics			Psychology			Medicine			Engineering			Maths			Biology		
	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020
1-5	557	236	61	475	156	42	265	93	31	212	153	21	419	272	134	187	84	28
6-10	1081	1023	438	988	879	343	834	591	277	1031	933	364	1055	1050	837	798	434	358
11-15	303	602	825	432	712	802	606	766	616	573	692	852	437	553	776	662	736	907
16-20	47	120	522	76	224	558	214	406	562	150	169	590	71	110	210	255	472	535
21-25	10	17	134	22	26	181	61	108	262	26	35	150	15	11	39	78	200	126
26-30	1	2	16	6	3	43	14	21	100	6	13	19	2	2	3	13	50	39
>30	1	0	4	1	0	31	6	15	152	2	5	4	1	2	1	7	24	7

It is also notable that all disciplines, with the exception of mathematics, most frequently preferred titles of between 11 and 15 words, with medicine and psychology reporting more titles over 26 words than others. The results contradict some previous studies which suggest titles tend to be longer in hard than soft sciences (e.g. Soler, 2007;

Nagano, 2015). Our results suggest that all writers are under similar pressures towards visibility and the trend towards longer titles is probably the result of a desire to clearly expound what is distinctive about a study, irrespective of field, to distinguish it from the herd and appeal to wide readership (5) and (6).

(5) Effects of six-year biochar amendment on soil aggregation, crop growth, and nitrogen and phosphorus use efficiencies in a rice-wheat rotation (2020, Engineering)

(6) Salesperson social media use in business-to-business relationships: An empirical test of an integrative framework linking antecedents and consequences (2020, Economics)

As Author 2 and Other (2022) observe, topic is likely to play a role in title length as in newly emerging areas or those with little activity, shorter titles are better able to capture the broad scope of the paper, although this risks narrowing the potential audience for a paper and so minimising its impact.

5. Forms of titles: changing ways of presenting research

5.1 Syntactic types: indicative or interrogative?

Creating an effective title is more than a matter of length and writers have other choices to make in representing their research. Various models have been proposed with Hartley (2008) listing 13 different formats and Kerans et al. (2020) ten. Soler (2007) identified four different types in an analysis of 570 titles in the biological and social sciences: nominal group, full sentence, compound, and question, and Wang and Bai (2007) distinguished between ‘uni-head’, ‘bi-head’ and ‘multi-head’ structures in nominal groups. Jamali and Nikzad (2011), in contrast propose a three part categorisation of titles: declarative, introducing the main findings; descriptive, stating the bare subject of the article; and interrogative, presenting the topic as a question.

Author 2 and Other (2022), however, believe “these categorisations often tend to confuse form with content and fail to show the connections between them” (p.6) and we follow their coding which distinguishes form and content. Formally they recognise only indicative or interrogative (as in Table 2): statements and questions. Table 4 shows the diachronic changes of these types across disciplines.

Table 4 Changes in title forms by discipline (raw frequency)

	Economics			Psychology			Medicine			Engineering			Mathematics			Biology		
	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020
Indicative	1951	1898	1785	1953	1912	1783	1980	1960	1913	1993	1990	1966	1981	1956	1927	1978	1973	1966
Interrogative	49	102	215	47	88	217	20	40	87	7	10	34	19	44	73	22	27	34
Total	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000

As we can see, titles are overwhelmingly indicative, but interrogative types are increasingly used in all fields. The advantage of indicative titles is that they give a clear and unambiguous expression of the topic of the paper, either briefly (7) or with lengthy elaboration (8):

(7) Additional evidence on equity ownership and corporate value

(1990, Economics)

(8) Rapid genetic identification and mapping of enzymatically amplified ribosomal DNA from several *Cryptococcus* species (1990, Biology)

The usually straightforward and accessible form of indicative titles can “minimises processing effort and will not confuse algorithmic searches” while conforming to “the firm admonishments of key journals, publishers and style guides to ensure brevity and informativity” (Author 2 & Other, 2022, p. 6). While this helps explain their prevalence in our corpora, interrogatives also have their attractions. Questions exploit the interactivity of conversational discourses and can grab the reader at the outset with an arresting directness, demanding attention with a striking expression (Author 2, 2002).

(9) Needs and Facebook addiction: How important are psychological well-being and performance-approach goals? (2020, Psychology)

(10) Is Vestibular Meniere's Disease Associated With Endolymphatic Hydrops? (2020, Medicine)

Perhaps for these reasons, Jamali and Nikzad (2011) found articles with interrogative titles were downloaded more than other types. Clearly, questions not only structure titles to promote an article's content, but can also to stimulate interest in the paper, by engaging potential readers. Ball (2009, p.677) worries that they are often vague and can mislead readers, but they can appeal by representing the writer as someone with an insider's understanding of what constitutes a real issue and who has a plausible response to it (Author 2, 2002). For this reason their use has climbed steadily as a proportion of titles overall, so that they account for over 10% of those in economics and psychology. Author 2 (2004) suggests that these fields generally have a more heterogeneous and uncertain readership and a greater diversity of research outcomes than in the sciences so writers cannot report research with the same confidence of shared assumptions. Methods and results are often more open to question and readers need to be more explicitly hooked (11) and (12).

(11) Measuring Entrepreneurship: Do Established Metrics Capture Schumpeterian Entrepreneurship? (2020, Economy)

(12) Is the "Minimally Conscious State" Patient Minimally Self-Aware? (2020, Psychology)

5.2 Formats: single or compound?

In addition to selecting either an indicative or interrogative title, authors have two format options: single, describing the article in one sentence; or compound, with two or more parts separated by punctuation, usually a colon. Table 5 presents diachronic changes of single and compound formats over the period.

Table 5 Changes in single and compound titles by discipline (raw frequency)

	Economics			Psychology			Medicine			Engineering			Mathematics			Biology		
	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020
Single	1675	1428	1176	1756	1163	991	1765	1458	1077	1940	1771	1585	1960	1891	1797	1878	1600	1598
Compound	325	572	824	244	837	1009	235	542	923	60	229	415	40	109	203	122	400	402
Total	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000

Similar to Author 2 and Other (2022), we found that compound titles were more often used by disciplines towards the softer end of the cline with more single forms in the hard sciences. Single titles normally provide readers with a direct and explicit representation of what they will find in the accompanying article. Their effectiveness lies in their transparency and this can be unequivocally straightforward and usefully minimalistic:

(13) Weak maximum principle for biharmonic equations in quasiconvex

Lipschitz domains (2020, Mathematics)

(14) Does the pathogenesis of SARS-CoV-2 virus decrease at high-altitude?

(2020, Biology)

The impact of single titles therefore lies in their directness, an unadorned representation which can appeal to readers and facilitate easier automated searches. As also noted by Haggan (2004) and Hartley (2007), this may also suggest a stylistic preference by scientists who typically address a relatively better defined community of peers than writers in the social sciences. As Kuhn (1996) observed, knowledge in ‘normal science’ is produced through steady cumulative growth, where new findings are produced in a relatively linear fashion and within a relatively well-established framework of knowledge. Thus scientists can refer to this using single titles with some confidence of being understood.

However, although they are more frequent in soft disciplines, we cannot overlook the considerable increase in compound titles in the harder sciences. Presumably, this is because canny writers are able to pack more keywords into compounds, making it easier for searches to locate their papers (Moore, 2010). Further, Van Wesel et al. (2014) argue that a colon can help stimulate readers' interest, enabling the authors to strike a better balance between the twin goals of being both informative and intriguing. Therefore, compounds allow scientists to "enliven their title" (Author 2 & Other, 2022, p. 8) and gain greater attention in the competitive publishing field.

Another reason why compounds are more common in the soft fields is because of different authorship patterns, as Lewison and Hartley (2005), for example, found that single authors tend to use more colonic titles than multiple authors. More likely, however, is the nature of research in different fields. Where research and audiences are more diverse and outcomes less certain, writers are not only under greater pressure to attract and inform readers of what they might expect from a paper, but also to elaborate their distinctive take on a topic:

(15) Portfolio selection: a fuzzy-ANP approach (2020, Economics)

(16) Alternative psychotherapies: Conceptual elucidation and
epidemiological framework (2020, Psychology)

Here we see writers closing down alternatives to specify their own contribution more explicitly after the colon.

6. Content of titles: highlighted aspects of the paper

Another choice authors have in constructing titles concerns the aspect of their paper they wish to foreground. Hartley's (2008) 13 types, for example, include those which highlight the general subject, the findings, the methods, etc. but also possible strategies for gaining attention, such as puns, comparisons, shocks, allusion, etc. Kerans et al.'s (2020) analysis of titles in clinical medicine found that those mentioning methods were more common in general journals while specialised journals tended to prefer titles with

results. We focused on the three key aspects of topic, methods and results (Author 2 & Other, 2022) with reference to the most salient information each title seeks to foreground. We then grouped each title into one of the three types (without overlap) and produced the disciplinary and diachronic results shown in Table 6.

Table 6 Change in the content of titles across time (%)

	Economics			Psychology			Medicine			Engineering			Mathematics			Biology		
	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020	1960	1990	2020
Topic	73.1	69.2	64.9	53.7	42.3	29.8	34.9	35.7	37.7	36.5	38.7	44.3	78.5	79.1	80.2	31.2	34.7	39.2
Method	14.7	12.3	10.3	22.0	27.1	33.8	33.1	33.8	34.3	44.6	43.2	38.0	11.3	12.4	13.9	31.1	31.4	32.0
Result	12.2	18.5	24.8	24.3	30.6	36.4	32.0	30.5	28.0	18.9	18.1	17.7	10.2	8.5	5.9	37.7	33.9	28.8
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

As can be seen, titles mentioning topic predominate all disciplines. With automated keyword searches, it is important that the title captures the main focus of the paper. Certainly, some journals prescribe topic-oriented titles in their instructions to authors, recommending that they be “concise, specific, and informative” (Kerans et al., 2020: 135). While this requirement might discourage writers from adding greater detail, such admonishments seem to be rare and more informative details are increasingly added. Methods, for example, are mentioned increasingly in all the science titles except engineering.

This preference in the hard sciences for titles to include the methodology used in the study was also found by Author 2 and Other (2022) and Morales et al. (2020). This may be especially useful in attracting readers who may be using the same method or looking for innovative approaches to a shared problem. Writers often increased the promotional value of including the method with the addition of a choice evaluative adjective such as *new*, *novel*, *enhanced*, *efficient*, *comprehensive*, *intelligent*, *robust* and *unique* as in (17) and (18).

- (17) A nanostrategy for efficient imaging-guided antitumor therapy through a stimuli-responsive branched polymeric prodrug. (2020, Biology)

(18) A novel gene expression test method of minimizing breast cancer risk in reduced cost and time by improving SVM-RFE gene selection method combined with LASSO (2020, Medicine)

In contrast, the mention of results in titles has declined in all hard science papers, despite the advice of journals such as *Nature*³ and online style guides⁴. In fact, this is somewhat controversial in the biological sciences with some journals such as *Cell* encouraging results in titles (Rosner 1990) while others banning their mention (McGowan & Tugwell, 2005). One reason for this may be to encourage readers to download the entire paper before they discover the results. In the soft fields, however, results have shown a strong increase, particularly in economics (Table 6), perhaps to encourage readers to engage with unexpected findings. Author 2 and Other (2022), for example, attribute the fronting of results in titles to the efficacy of “creating a dissonance in the reader’s expectations” and “forcing readers to reflect for a moment” (p.10). This rhetorical tactic may be helpful when addressing a less convergent readership in the soft fields.

7. Conclusion

Research article titles present writers with a rhetorical challenge: to facilitate searching by providing sufficient information about the accompanying paper and to whet the curiosity of readers by encouraging them to read and perhaps go on to cite the article. Our study of how titles have changed across time and by discipline shows a remarkable increase in the length of titles in all disciplines and indicates that now they are generally between 11 and 15 words. We attribute this increase to the advent and growth on online search algorithms and the explosion of publishing driven by the impact of metrics in career decisions and the equating of personal value with publishing productivity. The rewards and penalties of academic life are now closely tied to where work is published and how many citations it receives.

³ <https://www.natureindex.com/news-blog/how-to-write-a-good-research-science-academic-paper-title>

⁴ <https://blog.wordvice.com/best-title-for-journal-manuscript>

We also found that while indicative titles are overwhelmingly the most common, interrogative types are increasingly used in all fields, especially towards the softer end of the scientific spectrum. In these times of intense competition for academic attention, questions can invest titles with an added attraction to enliven a topic or intrigue potential readers “with suggestive and tantalisingly enigmatic hints of the delights that follow” (Haggan, 2004, p. 313). Authors’ responsiveness to this competitive market can also be seen in the increased mention of methods in the titles of some science fields.

In addition to the pressures of the growing competition for publishing success, titles also seem sensitive to the epistemic differences of disciplines and what community members regard as the best ways to persuade peers of their work. This helps to explain the greater use of compound titles in the soft sciences while single forms registered a higher frequency in the hard sciences. The soft disciplines also seem to be making increasing use of results in titles to ensure their potentially more heterogeneous audiences can make better sense of the “story” the paper tells. Together, these results suggest that authors do not construct their titles from an infinite range of options but select from a relatively restricted sub-set which indicate how they understand their communities. Titles are designed to attract particular readers, whether specialist insiders or broader audiences, anticipating how those readers might respond most positively by taking steps to read the paper itself. The choices writers make from these options, then, are disciplinary practices as much as individual decisions.

Our textual evidence for disciplinary and diachronic change in the form and content of titles also points to contradictions between the advice of journal instructions and style guides with actual practice. We therefore feel it is worthwhile for authors to be familiar with the titles of papers in target journals to maximise the appeal of their papers. Both title scanning and writing are regular activities of our daily academic lives, and these skills can contribute to the writer’s awareness of titles and how to write effective ones. Similarly, we hope our analyses are useful to novice researchers and those teachers and

supervisors who assist them. Equally, we encourage researchers to take this work further and explore users' preferences and practices in other fields. We believe this is important as while the title is often a neglected area of research writing, it plays an increasingly important role in knowledge construction by encouraging readers to notice, and perhaps subsequently read and cite, new research.

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