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Active voice vs passive voice: current landscape in science writing

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Although the active voice has gradually secured its place in scientific writing, there has been no systematic research to assess the current status of its use across disciplines. Therefore, this paper examined the discipline dependency for the use of the active/passive voice in scientific writing in 22 influential journals from science-related disciplines. The analysis revealed that 72% either strongly recommended or preferred the use of the active voice, whereas only 0.3% instructed to solely use the passive voice. The study also revealed that such preferences depended on the academic disciplines and the views of the publishers.

1. Introduction

The use of the active versus passive voice in scientific writing has been a long-standing debate; however, the use of the passive voice is significantly higher in scientific writing than in other writing genres[1, 2], with the high passive voice frequency seen as "one of the most salient grammatical features"[3] in science and technology.

Historically, science research article writing has employed the passive voice since the early 19th century to reflect an "object-centered" rather than an "author-centered" perspective[4]. Therefore, this practice has sometimes been called the "scientific passive" because it is a product of "scientific objectivity," which is presumably shared by members of the scientific community[5].

However, later, the excessive use of the passive voice in science and technology has been criticized; for example, Day[6] commented that "perhaps this bad habit results from the erroneous idea that it is somehow impolite to use first-person pronouns," and others describe it as an effort to "make their work sound scholarly and scientific"[7]. Some even question the assumed objectivity in science, remarking that "(the use of the passive voice) is presumably to give an illusion of total objectivity, whereas in fact the particular personal skills and ideas of a scientist do play a role in his work, which would be honestly acknowledged by using active constructions with first-person subject"[8]. Many researchers now regard the use of the passive voice in scientific writing to be a past tradition[9].

Therefore, this paper seeks to answer the following questions: Is it true that the present scientific community encourages the use of the active voice? If so, how exactly did this shift happen? Is it simply because researchers tend to follow the trend in scientific writing, or is the preference for the active voice stipulated elsewhere? If the latter is the case, the most obvious places to search are the journal author guidelines and writing guides. Some writing guides have been found to encourage the use of the active voice[6, 10, 11, 12]; however, to date, there has been no systematic cross-disciplinary research conducted on the use of the passive/active voice.

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Writing styles in science are generally discipline-dependent, that is, the use of the passive voice differs by discipline. For example, Rhode examined the incidence of the use of the passive voice in psychology, botany, and chemistry/physics, and found that, of the 12 articles reviewed in each discipline, the passive voice frequency was highest in chemistry/physics (43%), followed by botany (35%) and psychology (24%)[13].

This divergence is not surprising because of the diversity of academic fields. As each academic field has its own history and community, each has developed distinct communication practices[14,15]. As a written discourse convention in each of these disciplines is the key to ensuring "smooth and efficient communication among discourse community members"[3], young scientists are encouraged to master their specific fields' communication styles in their early academic life[16, 17]. This discipline-based discourse diversity is possibly why there is no recommended universal writing guide for all disciplines and why there is an insufficient consensus in the use of the active/passive voice across disciplines[18].

Examining scientific writing styles requires reviewing a potentially huge dataset because of the competitive nature of science. The publish or perish culture in science pushes researchers to widely publish even nonsignificant research[19], which gave rise to the idea of the "least publishable unit"[20] or "salami slicing"[21], which has in turn led to the emergence of "predatory journals"[22]. This competitive culture has undeniably contributed to an increase in the number of predatory and non-predatory scientific journals over the last century[23]. However, as the significance and impact of each journal greatly differs, being cautious when planning a systematic journal analysis to extrapolate the discipline-dependent features is necessary to ensure that the selected sets are a proper representation of each discipline.

This study sought to reveal the discipline dependencies associated with the use of the active/passive voice in scientific writing by examining the journal instructions, the publisher guidelines, and the recommended style manuals. When an active/passive voice preference was stated, the reasons were further examined. Then, a systematic analysis was conducted of the top 50 influential journals in each of 22 disciplines to elucidate the current status of the journals' views on voice.

2. Methods

The SCImago Journal Rank indicator, a publicly available platform that ranks journals based on their influence in their respective field, was used to review journals across disciplines. A total of 50 top journals from each of 22 fields in 2018, that is, 1,100 journal titles, were finally selected.

Several of the selected journal titles appeared in multiple fields. For example, Molecular Systems Biology, a journal published by EMBO Press, was ranked in the top 50 in five different fields: Computer Science; Mathematics; Agricultural and Biological Sciences; Immunology and Microbiology; and Biochemistry, Genetics, and Molecular Biology. Consequently, after excluding the overlaps, 849 journals were examined in this study.

Each journal's online author guidelines were examined to investigate whether the active or passive voice was specifically mentioned. It was found that, for journals from certain publishers, such as Nature Research and Wiley-Blackwell Publishing, authors were asked to also follow the publisher guidelines, and some journals

stipulated that the writing should follow certain style manuals, such as The Chicago Manual of Style and the American Medical Association Manual of Style. In these cases, both the publisher guidelines and the style manuals (Table 1) were consulted, and when the publication year or version was not mentioned, the latest version was consulted. If the use of the active/passive voice was specifically mentioned in (1) the journal author guidelines, (2) the publisher guidelines, or (3) the style manuals, the descriptions were further examined to identify the reasons.

Table 1. List of Publisher Guidelines and Style Manuals

Title (abbreviation)	Publisher	Year of Publication	Edition
The ACS style guide: Effective communication of scientific information (ACS style guide)	American Chemical Society	2006	-
The ACS Guide to Scholarly Communication (ACS communication)	American Chemical Society	2020	-
AMA manual of style: a guide for authors and editors (AMA 10th)	American Medical Association	2007	10th
Publication manual of the American Psychological Association (APA 6th)	American Psychological Association	2009	6th
Publication manual of the American Psychological Association (APA 7th)	American Psychological Association	2019	7th
The Chicago Manual of Style (Chicago 17th)	University of Chicago Press	2017	17th
The Chicago Manual of Style* (Chicago 16th)	University of Chicago Press	2010	16th
Scientific style and format: the CSE manual for authors, editors, and publishers (CSE 8th)	University of Chicago Press	2014	8th
Scientific style and format: the CSE manual for authors, editors, and publishers* (CSE 7th)	University of Chicago Press	2006	7th
Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers* (CBE 6th)	Cambridge University Press	1994	6th

*The use of active/passive voice was not specified in these style manuals.

3. Results and Discussion

3.1. Do journals, publishers, and style manuals specify the use of the active/passive voice?

The analysis revealed that 16 journal author guidelines, 4 publisher guidelines, and 7 style manuals mentioned the use of the active/passive voice, which was relatively low considering the number of journals reviewed (849 journals). However, the publisher guidelines and style manuals were applicable to many journals, whereas the individual journal author guidelines only applied to that journal alone. For example, the four publisher guidelines and seven style manuals applied to 244 and 130 journals, respectively; therefore, there was a stipulation for the use of the active/passive voice in 390 journals[*1] or 46% of the journals examined.

The further examination revealed that these descriptions could be categorized into five different types. In the first type, the use of the active voice was strongly recommended.

- "Avoid the use of the passive voice." (Ecography)
- "Use the active voice, not the passive voice, when possible." (Springer)

The second type recommends the use of the active voice, but the instruction implies that the use of the passive voice is also acceptable in certain situations or for specific purposes.

- "Both the active and passive voices are permitted in APA Style, but many writers overuse the passive voice. Use the active voice as much as possible to create direct, clear, and concise sentences……The passive voice is acceptable in expository writing when focusing on the object or recipient of the action rather than on the actor." (APA 7th)
- "The active voice is preferred because the sentence structure is more direct and the meaning of the sentence is easier for the reader to understand. The passive voice is best used when the emphasis is on a process taking place." (CSE 8th)

In the third type, which was only found in Wiley-Blackwell publisher guidelines, the use of the active/passive voice depends on the author's preference; however, the authors are reminded that "[T]he tendency to present scientific text in the passive voice is fading," which seems to encourage the use of the active voice.

- "The tendency to present scientific text in the passive voice is fading. Most Wiley-Blackwell journals and readers now accept the use of the active voice. Unless the journal has a strict requirement for the active or passive voice, follow the authors' preference, as long as this is consistent within the manuscript." (Wiley-Blackwell)

The fourth type specified situations or reasons for when the active/passive voice should be used, without

declaring an overall preference.

- "Use the active voice when it is less wordy and more direct than the passive…Use the passive voice when the doer of the action is unknown or not important or when you would prefer not to specify the doer of the action." (ACS style guide/ACS communication)
- "Describe experimental procedures, treatments, and results in passive tense. All else should be written in an active voice." (Journal of Prosthetic Dentistry)

Unlike other types, the fifth type specifically requested the passive rather than the active voice; however, one case was found, the Laser and Photonics Reviews[*2], with the instruction being limited to the abstract section.

- "Abstracts… Please use impersonal or passive style instead of the active "we" form. Please also submit an abstract text for the Table of Contents. It should be a maximum of 70 words, and should be written in impersonal or passive style." (Laser and Photonics Reviews)

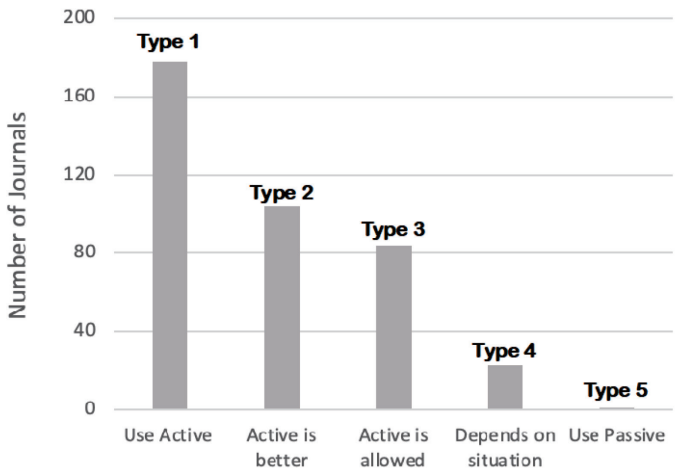

Figure 1 Number of journals categorized in type 1-5

The analysis categorized the journals in each type as follows: type 1, 178; type 2, 104; type 3, 84; type 4, 23; and type 5, 1. (Figure 1). The results therefore revealed that, when journals specify the use of voice, they tend to recommend or prefer the active voice.

When the use of the active/passive voice was mentioned in more than one resource, such as two or more of the journal author guidelines, publisher guidelines, or style manuals, the descriptions were prioritized in the following order: journal author guidelines > publisher guideline > style manual. This decision reflected the several descriptions in some publisher guidelines or style manuals, which prioritize the journal requirements: "unless the journal has a strict requirement for the active or passive voice, follow the authors' preference…."

(Wiley-Blackwell)

3.2. What is behind the voice preference?

As summarized in the previous section, the use of the active voice was strongly recommended in type 1, which was found in 15 sources (13 journals, 2 publishers), 5 of which simply stated a preference for the active voice without providing a reason, as exemplified in the following quotes.

- "We prefer the manuscript be written in active rather than passive voice." (Genome Research)
- "Use active voice whenever possible." (Global Environmental Politics)

Some commonalities were found when reasons were stated. The top three most frequent keyword reasons were "clear" (six sources), "concise" (four sources), and "direct" (three sources). Besides these keywords, one journal also emphasized "accessibility," and another stressed being "strong/powerful," as exemplified in the following examples (underlining by the author):

- "Write in clear and concise English, using active rather than passive voice." [International Journal of Project Management]
- "Manuscripts should be written in first person using the active voice. Writing should be concise and direct." (International Journal of Sports Physiology and Performance)
- "It is crucial that the language used should be as clear and accessible as possible throughout…." (Frontiers in Ecology and the Environment)
- "Sentences written in a direct and active voice are generally more powerful and shorter than sentences written in the passive voice." (Journal of Endodontics)

In contrast, in the type 2 examples, although active voice was still the overall preference, the use of the passive voice was also acceptable depending on the situation. Such cases were found in seven sources (two journals, one publisher, and five style manuals). When promoting the active voice, the keywords from type 1 also appeared: "clear" (three sources), "concise" (two sources), and "direct" (three sources).

However, in type 2, authors were asked to consider the sentence focus, with the use of the active voice considered appropriate when the focus was on the actor. On the contrary, when the focus is on a process, event, or object, they are encouraged to use the passive voice, as exemplified in the following:

- "Unlike the active voice, the passive voice emphasizes a process or event leading to results more than the actor." (Astronomy and Astrophysics)
- "Passive sentences often do not identify who is performing the action… You might also use passive when it doesn't matter who is doing an action." (CDC)
- "The passive voice is acceptable in expository writing and when you want to focus on the

object or recipient of the action rather than on the actor." (APA 6th & 7th)

- "The passive voice is best used when the emphasis is on a process taking place [as in the materials and methods section of a report] rather than on who is performing the action." (CSE 8th)
- "The choice between active and passive voice may depend on which point of view is desired. For instance, the mouse was caught by the cat describes the mouse's experience, whereas the cat caught the mouse describes the cat's." (Chicago 17th)

Three sources also stipulated that the methods sections in manuscripts would be an appropriate place for such a use.

- "For example, a description of the experimental setup in the methods section might read, "the speakers were attached to either side of the chair," which appropriately emphasizes the placement of the speakers, not who placed them." (APA 7th, and a similar description was also found in APA 6th)
- "The passive voice is best used when the emphasis is on a process taking place [as in the materials and methods section of a report] rather than on who is performing the action." (CSE 8th)

Type 3 was unique as it only reflected a description from a single publisher, in which the author is reminded that use of the passive voice was a past custom; otherwise, they do not specify any situation where the use of the active/passive voice is recommended.

When the use of the active/passive voice was mentioned in type 4, no particular preference for one over the other was given. Only three sources were included in this category [one journal, two style manuals with identical descriptions].

- "Describe experimental procedures, treatments, and results in passive tense. All else should be written in an active voice." (Journal of Prosthetic Dentistry)
- "Use the active voice when it is less wordy and more direct than the passive…Use the passive voice when the doer of the action is unknown or not important or when you would prefer not to specify the doer of the action." (ACS style guide, ACS communication)

The keyword "direct" also appeared in the ACS style guide and the ACS communication as the benefit of using the active voice, and "less wordy" is considered to be equivalent to "concise." Therefore, it appears that the recommended occasions for the active or passive voice were identical in types 2 and 4.

3.3. Preference for the use of the active/passive voice: does it depend on disciplines?

To further examine whether the use of the active/passive voice depends on disciplines, the distribution of the five types in the 22 academic fields was analyzed, from which it was found that the voice preference varied depending on the academic field (Figures 2 and 3.)

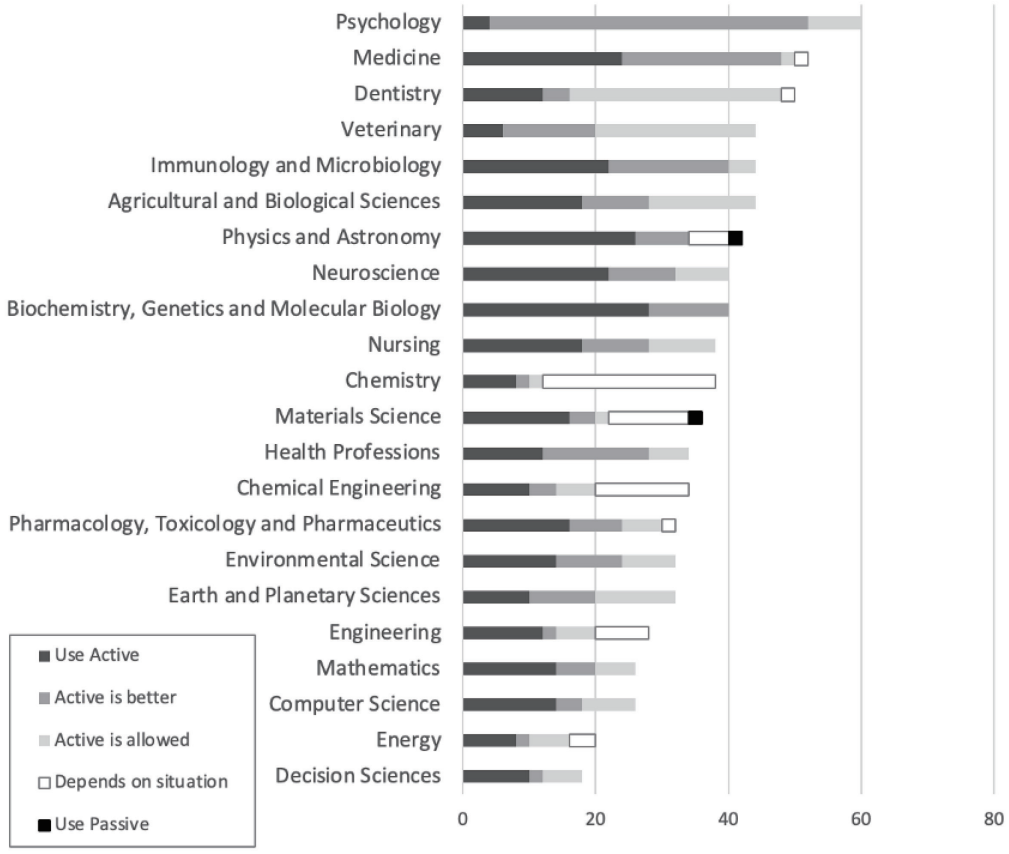

Figure 2 Number of journals specifying the use of voice in each academic field

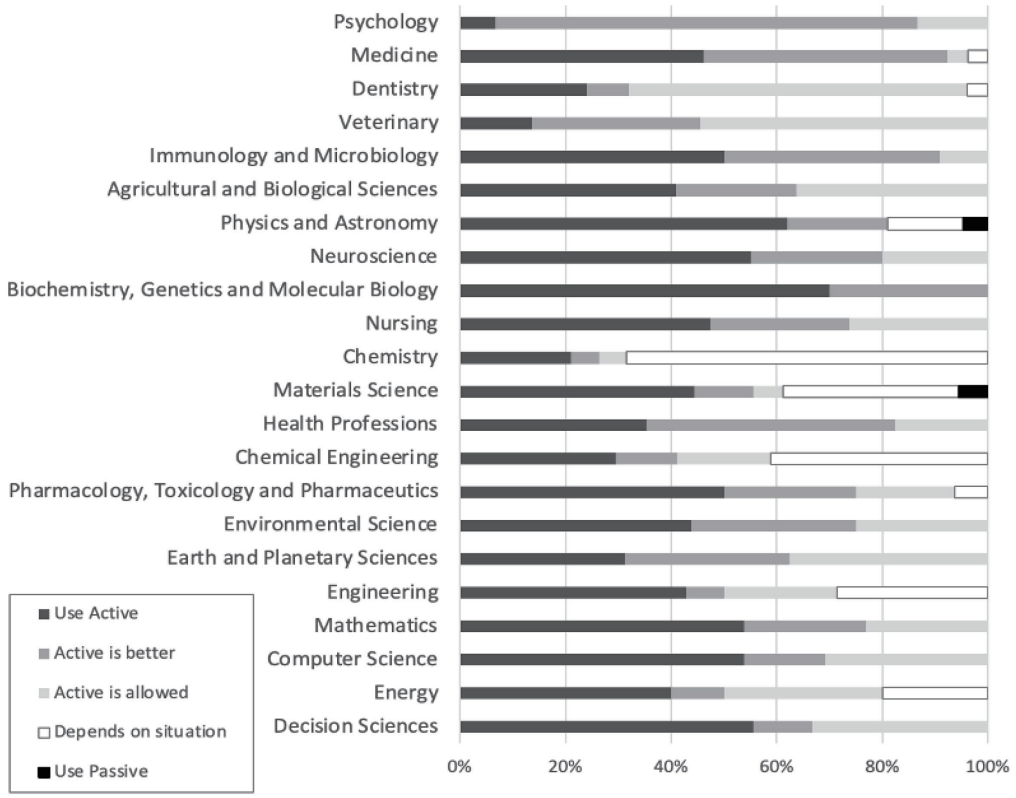

Figure 3 Percentage of journals specifying the use of voice in each academic field

Of the psychology-focused journals (72% within discipline), 36 mentioned the use of the active/passive voice, but only 10 journals (20%) in Decision Science and Chemistry mentioned the use of the active/passive voice.

When instructed, the type of voice recommended within each discipline also differed. The active voice was preferred or recommended over the passive in some types 1 and 2 journals, which included 90%[*3] in two Natural Science disciplines (Biochemistry, Genetics, and Molecular Biology (96%) and Medicine (92%)) but less than 50% in several other fields such as Chemical Engineering (47%), Veterinary (46%), Dentistry (32%), and Chemistry (30%).

The reasons for these trends differed. In Chemical Engineering and Chemistry, the percentages for type 4 were comparatively high at 37% and 65%, respectively, which lowered the relative percentages of the other types; however, both in Veterinary and Dentistry, type 3 accounted for 54% and 64%, respectively.

These differences in the preferred voice (or lack of preference) were attributed to a single reason: the desire of the publishers. Type 4, which was frequently seen in Chemical Engineering and Chemistry, was exclusively guided by the ACS style guide or the ACS communication, which were both ACS publications. In contrast, type 3, which was commonly seen in Veterinary and Dentistry, was described only by Wiley-Blackwell, which tended to indicate the strong influence that publishers had over the active/passive preference in scientific articles.

Another interesting case was found in Psychology. As shown in Figure 3, in this particular field, type 2, which encourages the use of the active voice, accounted for 72%, which was very high compared to the second highest at 50% for Health Professions and third highest at 48% for Medicine. This dominance could be mainly attributed to the heavy reliance by Psychology on the Publication Manual of the American Psychological Association or APA Style (both APA 6th and 7th), which is a well-recognized style manual for academic writing. Of the 30 journals that adopted the APA style in this study, 22 belonged to this particular academic field.

3.4. Publishers impact

Publishers normally publish more than one journal, with larger publishers often publishing many journals in several disciplines and a wide range of fields. Therefore, the voice preferences of the major publishers can significantly influence the voice preferences. To elucidate the possible influence of publishers on voice preference, the numbers of journals published by certain publishers in each discipline were examined.

The four largest publishers were Elsevier, Nature Research[*4], Wiley-Blackwell, and Springer, of which Elsevier was the largest, publishing 229 journals in all 22 academic fields, followed by Nature Research (88 journals, 20 academic field), Wiley-Blackwell (80 journals, 20 academic field), and Springer (55 journals, 17 academic fields). As shown in Figure 4, the ratio of each publisher differed across the academic fields/disciplines. Other relatively large publishers were Annual Reviews (31 journals, 17 academic fields), Taylor & Francis Group (30 journals, 16 academic fields), Cell Press, Oxford University Press (25 journals, 14 academic fields), and The Royal Society (21 journals, 10 academic fields).

As stated, voice preference depended on the publisher. Nature Research, Wiley-Blackwell, and Springer each had their own house guides, in which the preference for either active/passive voice (details provided in section 1) were given. In Annual Reviews, the use of voice was guided by the Chicago 17th and CSE 8th style guides. The other publishers listed did not declare any active/passive voice preferences.

Although publishers usually target multiple academic fields, they also tend to have certain niches. Many of journals from Nature Research were generally in the natural/health sciences discipline such as Biochemistry, Genetics, and Molecular Biology (12 journals) and Medicine (10 journals) but had none for Veterinary and Health Professions. In contrast, only a few journals from Elsevier were in the natural/health sciences such as Biochemistry, Genetics, and Molecular Biology (1 journal) and Medicine (2 journals), as they tended to focus more on the Applied Sciences academic fields such as Energy (24 journals), Chemical Engineering (19 journals), and Engineering (18 journals). Nature Research prefers the active voice (type 1), but Elsevier expresses no preference.

The publisher impact on voice preference was one of the key findings of this study. To date, several researchers have analyzed the impact of academic publishers from various perspectives. For example, McCabe examined the merger of publishers and found a subsequent increase in the price of academic journals[24], and Allahar discussed the landscape of academic publishing upon the emergence of open access publishing and the possible impact on the research community and traditional publishers[25]. However, to my knowledge, the

publishers' impact on writing styles has never been discussed.

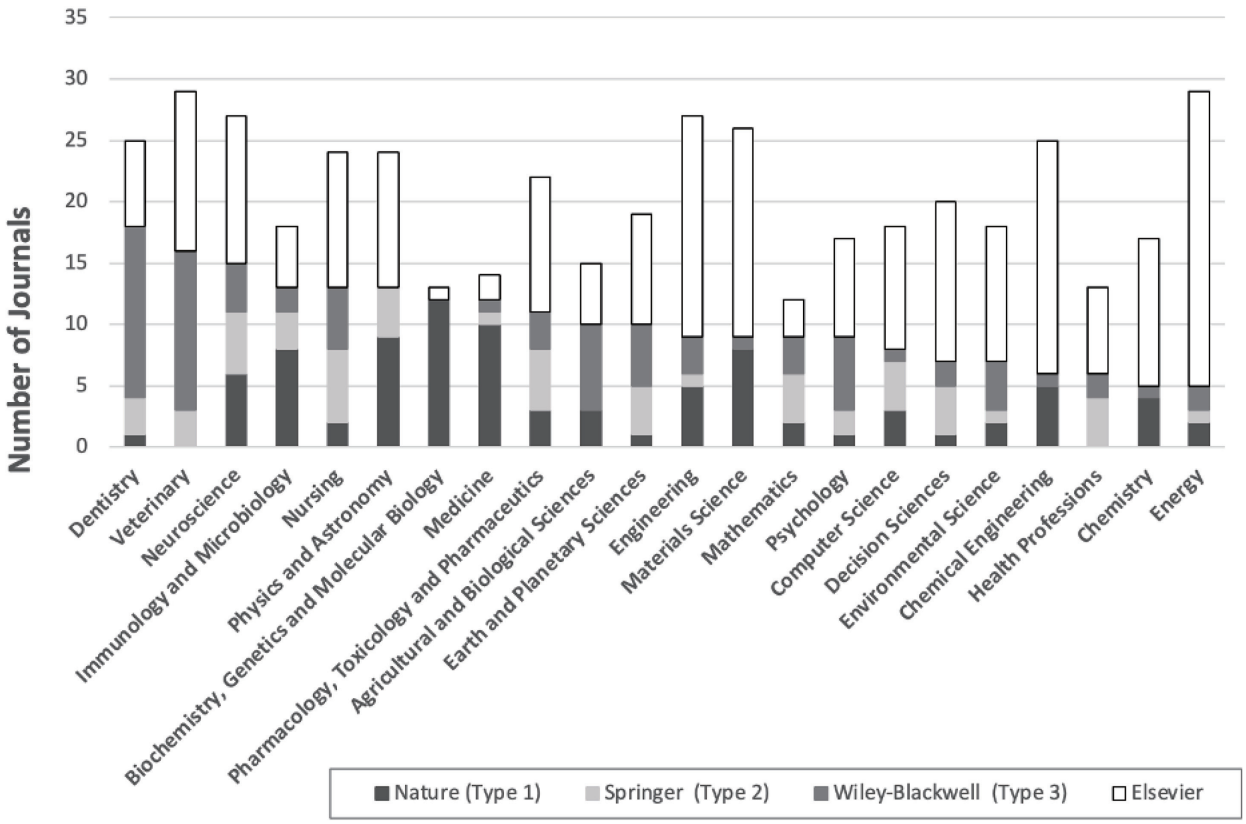

Figure 4. Number of journals from major publishers

The lack of any voice preference by other publishers may have some potential impacts in the future. For example, if Elsevier, the largest publisher examined in this study, decides to stipulate the use of the active/passive voice in its instructions and is categorized as type 1, the current voice preferences across disciplines could dramatically change (Figure 4).

3. Conclusion

This research aims to reveal the discipline dependency for the use of the active/passive voice in scientific writing. Top journals from various science-related disciplines were selected, and the journal guidelines, publisher guidelines, and style manuals were examined.

The analysis revealed that, of the 849 journals investigated, 46% expressed their own views on the use of the active/passive voice, 72% of which strongly recommended or preferred the use of the active voice, and only 0.3% preferred the sole use of the passive voice. The other journals either allowed the use of the active voice (22%) or the choice was dependent on the context (6%). Overall, the study revealed that a majority of

current scientific journals prefer the use of the active over passive voice.

However, even when the use of the active voice was favored, some exceptions existed. Several journals and style manuals preferred or justified the use of the passive voice in methods sections and especially when the emphasis was on an object or a process, which is reflected in most current scientific papers. For example, Alvin analyzed 48 articles across disciplines and found that 30% of all clauses were written in the passive voice, with the use being most common in the methods sections[9]. Similar results were obtained in discipline-specific studies, such as in Dumin's studies in the botany field[18].

Although the use of the active voice was preferred in the science-related disciplines, these preferences greatly varied across academic fields. For instance, the preference for the active voice was much less emphasized in the Applied Sciences disciplines such as in Chemistry and Chemical Engineering. The further analysis revealed that prominent publishers across the wide and various science fields generally determine the scientific writing voice.

While providing unprecedented findings, this study does not sufficiently answer the key question, *why the preferences regarding active/passive voice differ depending on the field*. The followings are the major reasons. First, several journals/style manuals specified the use of active/passive voice with no clear explanation. Second, even when they do, they offered general reasons, such as "writing should be concise and direct" or "the passive voice is best used when the emphasis is on a process taking place"; none of them seem to offer "discipline-specific" reasons. Therefore, to answer this crucial question, other research approaches are awaited.

Notes

*1: Some journals were regulated by multiple sources, such as by an author guideline of journal and by a style manual.

*2: Laser and Photonics Reviews appears in two disciplines, "Materials Science" and "Physics and Astronomy."

*3: Calculation is based on the journals that mentioned the voice type.

*4: Nature Research and Springer (Springer Science+Business Media) are both separate divisions of Springer Nature, which was established in 2015, after the merger of Nature Publishing Group, Springer, Palgrave Macmillan, and Macmillan Education. However, even after the merger, Nature Research and Springer still maintain their separate house guides. For this reason, in this research, I will treat Nature Research and Springer as two distinct sources.

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