ANZJS Style Guide for Authors

Highlights

Recent and not-so-recent changes to Journal style policies and protocols:

- Title of paper to appear in sentence case (see page 8).
- Names of the authors to appear in regular Roman font (see page 8).
- Citing papers with multiple authors simplified (see page 13).
- Captions of tables more consistent with captions of figures (see page 15).
- Lines of the submission are to be numbered (see page 7).
- Names of journals in the References are not to be abbreviated (see page 12).
- Tables (and figures) must fit *vertically* on a page (see page 15).
- Revision (reversal) of policy on the use of single and double quotes (see page 6).

The first five style issues are handled automatically for you if you make appropriate use of LaTeX and of the `anzsauth` document class.

Some of the changes referred to above have been in effect for a substantial amount of time; some are relatively recent (as of 03/03/2017).

Colour figures:

Authors need to be aware that there is a *charge* that they must pay in order to have figures appear in colour in the *print* version of the paper. Colour figures can however appear in the online version of the paper for *free*. See Section 5.1 for more detail.

1 Introduction

This document consists of an amalgamation of various previously available sources of information for prospective authors of papers to appear in the *Australian and New Zealand Journal of Statistics*. The intent in creating this document is to consolidate these sources of information, to eliminate redundancies, to resolve inconsistencies and to update the stated policies so as to make them consistent with current practice.

The Journal has exacting standards, not only in respect of the quality of statistical science in the papers that it publishes but also in respect of the quality of presentation of that science. Authors of papers that are accepted by the Journal must carefully comply with the Journal's rules and conventions, which are set out in the material that follows. These cover the format and structure of papers, notation, the form of many common abbreviations, spelling and other matters.

Although it is really only necessary for the *final* submission of a paper to conform to all of the Journal's conventions, it is probably most efficacious (and less work in the long run) for authors to follow these conventions from the beginning of the writing process. Authors are **STRONGLY URGED** to make use of LaTeX, the `anzsauth` document class, BibTeX and the `anzsj` bibliography style. Following the conventions will be much easier, in fact to a large extent automatic, if this is done. The file `protoType.pdf` contains guidance on how to make effective use of the `anzsauth` document class and the `anzsj` bibliography style. This file (i.e. `protoType.pdf`) is to be found in the zip archive from which the document that you are currently reading was obtained.

There is considerable overlap between the `protoType.pdf` material and that found in the current document. Nevertheless you would be well-advised to read both documents. Even if you do not choose to use LaTeX and the `anzsauth` document class, you will find some useful insights and helpful advice in the material in `protoType.pdf`.

We emphasise that the Journal has very high and stringently enforced standards in respect of quality of exposition and the correct use of the English language. Authors should be very much aware that *even if a paper has been accepted* (on the basis of its scientific content) after being considered by referees and and Associate Editors, it may *still be rejected* at some further stage of the editing process if the quality of writing is found to be inadequate.

2 Writing style

Next of course to the actual content of a paper, the quality of writing of that paper is of paramount importance. Not only must the writing be correct with respect to grammar, spelling and punctuation, it must also be *lucid*. The ideas must be grouped in an organised manner, and there must be a logical flow to the order in which they are presented. If you are not absolutely confident that your writing fully satisfies these requirements, then you must have your manuscript checked and thoroughly edited by a suitably qualified person. Failure to do so may result in the paper not being evaluated any further. If you need assistance with English-language editing, please visit

`http://authorservices.wiley.com/bauthor/english_language.asp`

Authors should be aware that there is a monetary charge for the services offered on that web page.

As was stated above, even when contributions or revised contributions have been assessed as being acceptable for publication on the basis of scientific content, the Journal reserves the right to reject the contribution at a later stage in the editing process if the requirements for a high quality of exposition have not been met. It also reserves the right to modify contributions so as to eliminate ambiguity and repetition and otherwise improve the exposition. Any such changes will be discussed with authors *where fea-*

sible. If extensive alterations are required, or if mathematical or statistical errors are discovered, the manuscript may be rejected outright or it may be returned to the author for further revision, after which a new formal decision on publication will be made.

Papers should be kept as short as is possible without sacrificing clarity. Only in exceptional situations will the Journal accept papers that are over 24 pages in length when typed in double-space with 27 lines per page, excluding references, tables and figures. Authors should also note that prolix manuscripts tend to receive strongly negative reports from reviewers.

Manuscripts should be written in a clear, concise, and direct style. Use the passive voice sparingly; it is frowned upon, with some justification, by many who are considered to be authorities on matters of style. The passive voice can sometimes have the effect of weakening the impact of the ideas being developed. If you use the passive voice, be sure that you are using it judiciously and for a good reason.

2.1 Some particular stylistic conventions

In general, terms should not be abbreviated unless they are used repeatedly and the abbreviation is helpful to the reader. Initially use the word or phrase in full, followed by the abbreviation in parentheses. Thereafter use the abbreviation only. Abbreviation of author names, for example as in Hall and Heyde (HH), should be avoided.

Do not begin sentences with symbols (mathematical or otherwise). A sentence *must* begin with a *word* that can be capitalised. You cannot capitalise a symbol! Instead of using the sentence '$\Phi(x)$ is a cumulative distribution function ...', insert an introductory English phrase that *can* be appropriately capitalised, for instance 'The function $\Phi(x)$ is a cumulative distribution function ...'. Do not begin sentences with letters that represent mathematical quantities. Even though they are letters they are still mathematical symbols. Thus say 'The quantity X is a random variable ...' rather than 'X is a random variable ...'.

Care must be taken with the tense of verbs. Use the past tense when describing something that was done in the past! In particular simulations

should be described in the past tense. For example say 'We generated 1000 data sets from our parametric model ...' and not 'We generate 1000 data sets ...'. However use the present tense when discussing the conclusions to be drawn from simulations: 'The results of these simulations indicate that ...').

Use the past tense when referring to results from existing literature. For example, use 'Nurk & Bloggs (2007) showed that two plus two equals four', not 'Nurk & Bloggs (2007) show that ...'. Use the present tense in referring to the content of the paper that you are writing: 'In this paper we show that the convergence rate is $o_P(n^{-2/3})$.' (Not 'we showed that ...'.)

Avoid clichés. In particular eschew phrases such as 'it is obvious that' or 'it is easily shown that'. Only use such phrases if the assertion *really is* easy to demonstrate! Rather than saying 'it is interesting to note that', it is better to say why the issue in question is interesting.

The Journal uses British (rather than American) spelling conventions. Authors should follow the latest edition of the Concise Oxford Dictionary. In particular use neighbourhood, modelling, generalise, parameterise, minimise, behaviour, centre, metre, ... and *not* the corresponding American variants.

In a similar vein, note that in British English the past participle of the verb 'fit' is 'fitted' (and *not* 'fit' as in American English).

The Journal has no official policy on the use of the 'Oxford comma'; its use is left to individual taste. That being said, most authors have an unfortunate tendency to over-use commas. Consequently it may be considered sound advice to use the Oxford comma only if its omission induces ambiguity. When in doubt, leave it out. The Journal reserves the right to delete commas that are deemed to be unnecessary and to cause the material to read awkwardly. In particular the all-too-frequently used constructions 'Then, ...' and 'Hence, ...' are almost always inappropriate. On the other hand, judicious use of commas can help to make written material flow smoothly and to clarify meaning. There is no easy rule governing the use of commas.

Do not use the 'let ... then' construction. E.g. *do not* say things like 'Let X be a standard normal random variable. Then X^2 has a chi-squared distribution with one degree of freedom.' A 'then' should follow an '*if*'. Thus the foregoing incorrect expression should be rephrased as 'If X is a standard normal random variable, then X^2 has a chi-squared distribution with one

degree of freedom.'

Do not use the phrase 'monotone increasing' (or 'monotone decreasing'). The word 'monotone' means *either* increasing *or* decreasing. Hence 'monotone increasing' is encumbered with a redundancy. Just say 'increasing' (or possibly 'strictly increasing' if that is indeed what you mean). Use of the phrase 'monotone increasing' is an indication that you are not thinking carefully about what you are saying.

You may use either 'data set' or 'dataset' to refer to a set of data but you must use one form or the other consistently throughout the paper. Likewise you may use either 'formulae' or 'formulas' as the plural of 'formula' but again you must be consistent throughout the paper. Remember that 'data' is a *plural* noun (and not, as some would have it, a 'mass noun'). Thus say 'The data are described in ...', not the 'The data is described in ...'.

It is necessary to distinguish between the hyphen: '-', the endash: '–' and the emdash: '—'. These look similar but are of different lengths and serve different punctuation purposes. In LaTeX they are rendered by `-`, `--` and `---` respectfully.

Care is needed with some common abbreviations. Use 'i.e.' rather than 'ie' and 'e.g.' rather than 'eg'. Use 'cf.' and not (the incorrect!) 'c.f.' for 'compare'. Do *not* italicise 'i.e.', 'e.g.' 'cf.' or 'et al.'. The abbreviation 'w.r.t.' for 'with respect to' is not considered to be 'common'. If you use it, *define* it at its first occurrence, and use this abbreviation *only* if its use is genuinely called for.

Use *single* quote marks to indicate quoted material except when there is a quote-within-a-quote. In this latter case, enclose the internal quote in double quote marks and the outer quote in single quote marks. E.g.:

Zephod said 'Ford Prefect asked me "Are you going to Magrathea today?" but I never answered him.'

However please note that in LaTeX you **must** form the double quotes as *matching pairs* of single quotes, i.e as a *pair* of 'grave' accents for the initial double quote and a *pair* of 'acute' accents for the final double quote. Don't *ever* use the double quote symbol from the keyboard (i.e. `"`, the shift of the forward-sloping single quote or 'acute accent', `'`.) Compare 'It was a dark

and stormy night.' (which is correct) with "It was a dark and stormy night." (which is incorrect).

Use ith rather than i-th, ith, i^{th}, ..., to indicate ordinal numbers.

Please do not use the phrase 'begs the question' when you mean 'raises (or invites) the question'. The correct meaning of 'to beg the question' is *to assume the assertion that one is claiming to demonstrate*. Admittedly the incorrect use of 'begs the question' has become ubiquitous and is (sad to say) much more common than the correct usage. However the ubiquity of the incorrect usage is no excuse, and the Journal expects better of its authors.

Finally we emphasise the injunction, found also in Section 3.1, that footnotes to the text are in general *not allowed*. Footnotes may only appear on the title page for the purpose of providing authors' addresses etc. Any material that you are inclined to include as a footnote should be incorporated into the text as parenthetical matter.

3 Structure of the paper

To a large extent the overall structure and format of your paper will automatically conform to the Journal's requirements if, as is ***strongly*** recommended, you use LaTeX and the `anzsauth` document class. If you do not use LaTeX, please look at a recent issue of the Journal and endeavour to match the Journal's style as closely as possible. Conformity to style requirements is particularly important when you are preparing the final version of your submission.

In particular it is important that your submitted document be *double spaced* and rendered in *12 point* font. You should begin your `*.tex` source file with the command `\documentclass[times,doublespace]{anzsauth}` to handle these considerations if you use LaTeX and the `anzsauth` document class. An example of this construction is to be found in the template `protoType.tex`, on which you are encouraged to base the construction of your LaTeX source file.

Authors are likewise requested to *number* the lines of their document so as to make it easier for referees and technical editors to specify where

corrections are required. If you use LaTeX, the desired effect is achieved by placing `\usepackage{lineno}` and `\linenumbers` in the preamble. See `protoType.tex`.

There are effectively four components to a paper: The title page, the actual text (main body) of the paper, appendices (if any) and the list of references. We shall now deal with each of these in turn.

3.1 Title page

The title page should contain the title of the paper (in bold face Roman font, in sentence case) and the full names of the authors (in regular Roman font) with their affiliations displayed immediately below. If an author has multiple affiliations then only the 'primary' affiliation should be given here. The remaining affiliations should be given in the footnotes (see below). The 'affiliations' should consist only of the *names* of the institutions at which the work in question was carried out. Detailed addresses should be given in the footnotes. In the display of authors' names the corresponding author should be clearly indicated.

The title page should also include a *summary* of the paper, a set of *keywords* and, in *footnotes*, the postal addresses of the authors (with an email address being given for the corresponding author). Remember that *only* the title page may contain footnotes.

It may be prudent to provide (in the footnotes) facsimile and telephone numbers for the corresponding author, especially if that author is not a frequent user of email. These facsimile and telephone numbers are for use during the production process, and will not appear in the published version of the paper. The footnotes may also be used to indicate affiliations of authors other than than their primary affiliation, or that the work of particular authors was carried out at addresses different from those of the present institutions of those authors.

Any *acknowledgements* should be included in the footnotes on the title page. Such acknowledgements may include those directed to organisations that provided funding for the research discussed. Usually grant numbers should *not* be given.

If you do not use the `anzsauth` LaTeX document class, please refer to a recent issue of the Journal to see how the title page, including the footnotes referred to above, are presented, and follow the same structure.

The title of the paper should be informative and short, but should *not* contain abbreviations. If the title is longer than 40 characters, provide a short running title of not more than 40 characters. (A simple mechanism to facilitate doing this is available with the `anzsauth` document class; see the template `protoType.tex`.)

The paper must have a brief, self-contained summary of at most 250 words, under the heading, '**Summary**' (*not* 'Abstract'). It should indicate the major points and the principal conclusions of the paper. It should also draw attention to the major contributions of the paper and their significance, preferably using special cases and/or examples. It must contain no mathematical symbols, no definitions or abbreviations and no citations. You can mention the work of 'Nurk et al.' but *do not* refer to 'Nurk et al. (1984)'. In such cases 'Nurk et al. (1984)' should appear as a citation somewhere in the body of the paper.

Several key words or phrases, separated by semi-colons, should be supplied below the Summary in alphabetical order. Do not use words or phrases that are to be found in the title. Except for proper names and certain abbreviations, key words should *not* be capitalised.

3.2 Main body of the paper

The text should be organised into an introductory section (numbered '1') conveying the background and purpose of the paper, and then into numbered sections (and possibly subsections) identified with headings. It is essential that the introduction be accessible to the broad readership of the Journal. The introduction should discuss the motivation and context for the paper, relate it to the literature, particularly the recent literature on the subject, and it should explain the nature of the problem studied, preferably in a non-mathematical way, using examples and special cases.

It is desirable to mention, in the introduction, a real set of data that motivates the study undertaken in the paper. This data set may be used to

construct a worked example in a later section. (See Section 7 for considerations related to data sets analysed in the paper.) Furthermore, it is desirable to discuss special cases of the general results for illustrative purposes. Finally, the significance of the results should be indicated briefly so as to place the main contribution of the article in the context of the current literature.

The introduction will be followed by a number of sections and subsections constituting the main body of the paper. The nature and organisation of the material will differ depending on whether the paper is intended for the **Theory and Methods** component of the Journal or for the **Applications** component.

For papers in the Theory and Methods component:

(i) it must be made clear how the paper advances statistical science,

(ii) the proposed new method must be evaluated and compared with competing methods,

(iii) the significance of the contribution should be discussed, preferably in a section under the heading 'Discussion', and

(iv) the advantages and disadvantages of proposed methods must be explained.

A data example will usually be needed to illustrate the new method. (See Section 7.)

For papers in the Applications component, the substantive problem and the data should constitute the focus of the exposition. The steps in the analysis of the data should be carefully explained and justified. Authors should be honest about any choices they may have made in the analysis. Where possible, the description of the analysis should be supported by carefully constructed graphics. Overall, the analysis and the presentation of the analysis should be considered, relevant and insightful. The results of the analysis should be interpreted and discussed in the context of the substantive problem under consideration. The relevance of the new ideas to empirical studies from other areas should be discussed

Sufficient details of the data analysis must be included to enable readers to replicate the analyses, both on the data studied by the authors and on other

data sets. The data used by the authors must be available to readers (e.g. in the 'Supporting and Supplementary Material'; see Section 7). Software necessary for such replication should also be readily available. If specialised software had to be written in order to conduct the analysis then, as for the data used, this software must be made available in the 'Supporting and Supplementary Material' (see Section 7).

3.3 Appendices

These should be placed at the end of the main body of the paper, before the References. If there is a single appendix it should be headed simply 'Appendix'. If there is more than one they should be numbered in Roman numerals and headed 'Appendix I', 'Appendix II' etc. Appendices should be referred to (at least briefly; 'see Appendix II') in the text. If an appendix is not referred to, then it should not be included. If an appendix is written by a person other than the authors of the main text, then the writer's name should be included below the 'Appendix' heading.

3.4 References

If you use BibTeX and the `anzsj` bibliography style, most of the following considerations are taken care of automatically.

Items in the list of references (or 'bibliography') should be presented in alphabetical order according to the Harvard (author, date) system. Include the names of all authors when there are six or fewer; if there are seven or more, include only the first three followed by 'et al.' (This rule is *not* handled automatically by the `anzsj` bibliography style. It is necessary that you structure your `*.bib` file appropriately.)

The list of references may not include a paper 'submitted for publication' or a 'personal communication'. The essential criterion for inclusion in the reference list is that any such reference must be obtainable by a reader: thus a Technical Report is OK and a paper accepted for publication is OK. It is acceptable (although not recommended) to put into the text a kind of acknowledgement of the form '(Fred Nurk, *pers. comm.*)' but this reference

to Fred Nurk should *not* appear in the list of references. References to unpublished data should not appear in the bibliography but should be cited in the text only (e.g. 'F. Nurk, unpublished data, 2000'). (This is another rule that is *not* handled automatically by the `anzsj` bibliography style.)

With the foregoing exceptions, all citations mentioned in the text, tables or figures must be listed in the reference list. Conversely, a work must not appear in the reference list if it is not cited in the text.

Authors are responsible for the accuracy of the reference list. Please look at a recent issue to see how the Journal sets out this list. Authors' names appear in small capitals. For example, 'Chernoff, H. (1980)'. For journals, include only volume numbers, and *not* issue numbers. Please do not abbreviate the names of journals. (Note that this is a change — reversal — as of February 2016, of the Journal's former policy.) Use an ampersand '&', not 'and', to separate the names of authors in the list of references and when citing these references. The location of the publisher of a book should appear before the publisher's name; e.g., 'New York: Wiley'. For the page range, use the endash –, as in 65–78; in LaTeX this is obtained by juxtaposing two hyphens.

Titles of journal articles should appear in the list of references in 'ordinary' Roman (not italic!) font and should be in 'sentence case', i.e. no capitals except for proper nouns. The names of the journals themselves, and the titles of books should appear in italic font and should be in 'title case', i.e. all 'major words' (essentially words excluding connectives and prepositions) should be capitalised.

Herewith are some examples of appropriate format for the References section:

- Journals:

  Hollander, M., Park, D.H. & Proschan, F. (1986). A class of life distributions for aging. *Journal of the American Statistical Association* **81**, 91–95.

- Books:

  John, J.A. & Williams, E.R. (1995). *Cyclic and Computer Generated Designs*, 2nd ed. London: Chapman & Hall.

- Chapter in a book:

  Chernoff, H. (1981). An analysis of the Massachusetts Numbers Game. *In Statistics and Related Topics*, M. Csörgo, D.A. Dawson, J.N.K. Rao, & A.K.M.E. Saleh eds., 23–37. New York: North-Holland.

4 Citing references

Authors must adhere to the Journal's rules and conventions concerning the way in which citations are formed. If (as is ***strongly*** recommended) you make use of the 'anzsauth' document class and use the `\cite` command and its variants, the citations will automatically be rendered in the correct format. If you insist on 'doing things your own way' (thereby vastly increasing your work load and making your writing much more prone to error) please take careful note of the following requirements:

1. The standard Journal-style citation is of the form 'Mingdinkler (1999)'. That is, the citation is formed as the author's name followed by the year in parentheses.

2. When referring to a paper with two authors use the form 'Bloggs & Irving (1993)'. **N.B.** As is the case for the list of references, you *must* use an ampersand ' & ' *not* ' and ' as the connective between authors' names. This rule will automatically be followed if you use the `anzsauth` document class. This is another good reason to use this document class; one less thing to worry about.

3. When referring to a paper with three authors, use all three names as in 'Nurk, Mingdinkler & Putin (2001)'.

4. When referring to a paper with four or more authors (e.g. Trump, Rubio, Cruz, Bush, Kasich and Carson) use the names of the first

author followed by 'et al.'. That is, use the form 'Trump et al. (2021)'. Again this is handled automatically for you if you use the `anzsauth` document class.

5. Do not use authors' initials in a citation: thus 'Mingdinkler (1999)' rather than 'M. Q. Mingdinkler (1999)'. There *can* be exceptions to this rule, e.g. with the not-too-uncommon Chinese name 'He'. Something like 'He (1994) developed a semi-parametric approach to this problem' sounds funny. One tends to interpret 'He' as a personal pronoun. So it is better to include an initial, as in 'W. He (1994) developed ... .')

6. Do not use conventions such as 'ibid.' or 'op cit.'.

Finally, more of a request or plea rather than a requirement: Where you have referred to a book, or even a long paper, please give some indication (for example, a page number or a section number) to help your readers locate precisely the relevant material. (This is a particular instance of the general desideratum 'Have a little consideration for your readers.')

References to specific pages, sections or theorems from a paper or a book should take the form Nurk & Bloggs (2004, Section 2.4). Similarly: 'Howard (1996, p. 47)', or 'Dallwitz (1993, Chapter 4)'. Thus you should refer to Milligan (1991 Theorem 4.1) *rather than* to 'Theorem 4.1 of Milligan (1991)'. If you use LaTeX this is handled for you automatically via the optional first ('[...]') argument of the `\cite{...}` command. E.g. use `\citet[Section 2.4]{NurkBloggs2004}` (where `NurkBloggs2004` is the — arbitrary — label that you have chosen to associate with the Nurk & Bloggs paper in your bibliography) to get the appropriate form as shown in the first example above. See the document contained in the file `protoType.pdf` for further discussion of the issues involved. You may use 'p. 47' or 'page 47' (and likewise 'pp. 29–63' or 'pages 29–63') as you choose, but you should stick with one style or the other consistently throughout the paper.

5 Tables and Figures

Tables and figures often constitute an important part of the material of a paper, and some time, thought and effort should be devoted to getting their

presentation right. Each such type of display should be numbered in consecutive order throughout the text (including in appendices): Table 1, Table 2, Table 3, ...; Figure 1, Figure 2, Figure 3, ... These displays should *not* be numbered 'within sections'. (See also item 10 in Section 6.)

Tables and figures may be included in the text of the paper in the text at the appropriate locations if the authors so choose. However it is likely to be less work and less time-consuming to leave the task of making the appropriate adjustments to the Journal's highly skilled production staff who will produce the published form of the paper. If you choose to follow this latter course, group figures and tables together in separate sections at the end of the paper with their appropriate locations indicated in the text. These locations should be indicated, for example, by:

TABLE 1 ABOUT HERE

Tables and figures must always be referred to in the text, even if only very briefly. I.e. there must at least be something like 'see Figure 4'. If there is no such reference, then the corresponding table or figure must not be included in the paper.

Tables and figures must fit vertically on the page. (See the document contained in the file `protoType.pdf` for related discussion.) This been a requirement in respect of the Journal's style for some time, but unfortunately has not actually been enforced. From now on (as of 06/11/2016) this requirement *will* be enforced **strictly**.

In general, captions for tables and figures should be left justified and not centred. However if the text of the caption fits on a single line then the caption should be centred. If you use (as you should!) LaTeX and the `anzsauth` document class, the left justification of multi-line captions and the centring of single line captions is handled automatically.

Somewhat idiosyncratically, the caption of a table should appear above the table, whereas the caption of a figure should appear below the figure. The word 'Table' in the caption of a table and the word 'Figure' in the caption of a figure should appear in ordinary Roman font and should constitute part of the first line of the caption. See `protoType.pdf` for examples.

Numbers in tables should be suitably rounded. For reporting estimates, the

number of digits used must be reasonable in respect of the standard errors. For example, an estimate of 1.752417 (se = 0.12567) could be presented as 1.75 (0.13).

All illustrations (including line drawings and photographs) are classified as figures. All axes must be labelled and units of measurement should be given where appropriate. A figure together with its legend should be understandable without reference to the text. Define and explain any non-standard abbreviations and units of measurement.

For accepted papers figures must also be supplied at high resolution (at least 300 d.p.i.) in separate individual files — preferably `*.eps` or `*.pdf` files, with `*.tif` files being acceptable. Do not use `*.png` files for figures; these are known to cause problems and are therefore deemed *not* to be acceptable. Make sure that the figures are of high quality, in their construction as well as in their resolution. Figures are best produced using the R programming environment. *Avoid* producing figures with Excel^{TM}.

5.1 Colour figures in the online version of the paper

Figures appear in the print version of the paper *only* in black-and-white (and greyscale) unless authors make a special request for colour figures and are *willing to pay a charge* to cover the extra cost that is thereby induced. This charge is, roughly speaking, $350 USD per figure. (The rule by which the actual charge is calculated is somewhat complicated; the details will not be gone into here.) On the other hand, colour figures can appear in the online version of the paper for *free*.

The Journal only produces a single version of the text of a paper; i.e. the text is the *same* in both the print and online versions. Thus figure *captions* and references to figures in the text must be phrased in such a way as to make sense in respect of both the black-and-white figures in the print version and the colour figures in the online version (given that the online version uses colour). Note that for the black-and-white print version, categories of points and lines must be distinguished by using different plotting symbols and different line types (solid, dashed, dotted, ...) since they cannot be distinguished by colour. It is necessary to construct colour figures for the online version, and to phrase references to categories, in such a way that

these references will make sense to readers of the online version as well as to readers of the print version.

If authors wish to have colour figures in the online version of the paper they must supply two versions of each figure that is to appear in colour online. Figures must *not* be supplied in colour only. Figures that are prepared in colour and then converted to black and white in the printing process look awful! Consequently the Journal does not countenance this practice. The figure files must be named in such a way as to make it clear which is the black-and-white (print) version and which is the colour (online) version. For example, use names something like `quakeMagBW.pdf` and `quakeMagCol.pdf`.

6 Mathematical & statistical style

The Journal has some strict rules about mathematical and statistical notation. These rules must be followed diligently. Authors might consider such rules to be an unnecessary encumbrance that only serves to increase the amount of work required to produce a paper. However there is a good reason for these rules, which is simply *consistency*. One and only one convention must be followed, otherwise the result is a visually unpleasant hodge-podge. The choice of convention is usually arbitrary, but a single choice must be made and used consistently. The choice is made by the Journal; authors must follow it. The Journal's rules are as follows:

1. Fonts, random variables, vectors and matrices:

   (i) Scalar random variables should generally be denoted by upper case letters in mathematics (italic) font: $X, Y, \ldots$. Non-random quantities should be denoted by lower case letters (likewise in mathematics font). Realisations or observed values of random variables are denoted by the corresponding lower case letters, in mathematics font. An observed value of Y would be denoted by y.

   Obviously there are many contexts in which this rule (more of a desideratum than a rule) cannot be adhered to. For instance parameter estimates (see item 6) are usually denoted by adding circumflex accents to Greek letters. Such estimates may consti-

tute either random variables or observed values of these, and it is futile to try to distinguish the two cases notationally.

(ii) Vectors quantities should be indicated by bold face mathematics font — $\boldsymbol{y}$ — and *not* by e.g. $\underset{\sim}{y}$, or $\underline{y}$ or $\vec{y}$. Vectors of observations should be presented as (bold, italic) lower case letters, whereas vectors of random variables should be presented as bold italic upper case letters: $\boldsymbol{Y}$. Matrices should also be presented as bold italic upper case letters: $\boldsymbol{M}$.

(iii) Avoid using bold font for super- or subscripts, transposes, carets etc.

(iv) Vectors are considered to be column vectors. A vector may be rendered 'in-line' in the form $\boldsymbol{x} = (x_1, x_2, \ldots, x_n)^\top$ (see item 2) or possibly $\boldsymbol{x}^\top = (x_1, x_2, \ldots, x_n)$. In a displayed equation, vectors may be rendered in the form $\boldsymbol{x} = (x_1, x_2, \ldots, x_n)^\top$ or

$$\boldsymbol{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix},$$

as is appropriate.

(v) Similarly use $\boldsymbol{A} = (\boldsymbol{A}_1, \boldsymbol{A}_2, \ldots, \boldsymbol{A}_n)^\top$ or

$$\boldsymbol{A} = \begin{bmatrix} A_1 \\ A_2 \\ \vdots \\ A_n \end{bmatrix}$$

to denote a 'row-partitioned' matrix. Use $\boldsymbol{A} = [\boldsymbol{A}_1, \boldsymbol{A}_2, \ldots, \boldsymbol{A}_n]$ to denote a 'column-partitioned' matrix.

(vi) The identity matrix is denoted by I. *Do not* use a subscript (e.g. n) to indicate its dimensionality unless this is necessary to eliminate ambiguity.

2. Operators

   (i) Use Pr (rendered in LaTeX by `\Pr`) for the probability function or operator. *Do not use pr*, pr, P, $\mathbf{P}$, $\mathbb{P}$, ...

   (ii) Use E, in Roman font, (and *not* E or $\mathcal{E}$ or $\boldsymbol{E}$ or $\mathbb{E}$ ...) as the expectation operator.

   (iii) Use var in Roman font for variance (and *not* Var or Var or *var* or **var** ...).

   (iv) Use cov in Roman font for covariance (and *not* Cov or Cov or *cov* or **cov** ...).

   (v) The arguments of all of these functions or operators should usually be enclosed in parentheses, as in $\mathrm{E}(X)$.

   (vi) The transpose operator must be represented as a sans-serif $\top$, which is most easily rendered in LaTeX by `\top`. For instance, we can express the fundamental mathematical formula for the least squares estimate of the coefficients in a linear model as

$$\widehat{\boldsymbol{\beta}} = (\boldsymbol{X}^\top \boldsymbol{X})^{-1} \boldsymbol{X}^\top \boldsymbol{Y} \ ,$$

   (where $\boldsymbol{X}$ is the design matrix and $\boldsymbol{Y}$ is the response vector). It is worth remarking that the choice of $\top$ as the symbol for the transpose operator is a choice of convention that has more than arbitrary whim to recommend it. The other common choice, the 'prime' symbol ($\prime$) is ambiguous (and consequently confusing) in that it is usually used to indicate taking a derivative.

   In MS Word™ (the use of which is strongly discouraged) the transpose operator may be represented by means of a T in a sans-serif font such as Arial.

   (vii) Do *not* use the symbols '$\forall$' and $\exists$. Use *words* — 'for each' or 'for all' and 'there exist(s)'.

3. Common statistical distributions

   (i) To indicate in symbols that a random variable has a normal (Gaussian) distribution use notation of the form $X \sim \mathrm{N}(\mu, \sigma^2)$. Note that the 'N' should be in Roman font (not in italic or 'maths' or ... font).

(ii) Likewise, to indicate in symbols that a random variable has a multivariate normal distribution use notation of the form $X \sim \mathrm{N}(\boldsymbol{\mu}, \boldsymbol{\Sigma})$ (where $\boldsymbol{\Sigma}$ represents a covariance matrix. See item 5.) Again the 'N' should be in Roman font. *Do not* append a subscript (e.g. n) to the N to indicate its dimensionality, unless this is absolutely necessary to eliminate ambiguity.

(iii) To indicate in symbols that a random variable has a chi-squared distribution use notation of the form $X \sim \chi^2_k$ (where k represents the degrees of freedom). When referring to this distribution in words use the term 'chi-squared' (*not* 'chi-square').

(iv) To indicate in symbols that a random variable has a Student's t distribution use notation of the form $X \sim \mathrm{t}_k$. (where k represents the degrees of freedom). Note that the 't' should be in Roman font (not in italic or 'maths' or ... font).

(v) To indicate in symbols that a random variable has an F distribution use notation of the form $X \sim \mathrm{F}_{k_1,k_2}$. (where k_1 and k_2 represent the numerator and denominator degrees of freedom respectively. Again the 'F' should be in Roman font.

4. Significance and confidence levels

(i) The symbol for the significance level or 'size' of a hypothesis test is usually α. If a numeric value is given for this quantity, it should be a number between 0 and 1 (e.g. $\alpha = 0.05$) and *not* a percentage.

(ii) The confidence level of a confidence interval should be given as a percentage, e.g. $100(1-\alpha)\%$ or 95%.

5. Moments, cumulants, covariance matrices and correlation

(i) The mean of a random variable X may be denoted by μ, or possibly μ_X (as well as by $\mathrm{E}(X)$).

(ii) Likewise the variance of a random variable X may be denoted by σ^2, or possibly σ^2_X (as well as by $\mathrm{var}(X)$).

(iii) Other moments of a random variable are usually denoted in the form μ_k or $\mu_k(X)$.

(iv) Likewise cumulants of a random variable are usually denoted in the form κ_k or $\kappa_k(X)$.

(v) The covariance matrix of a multivariate random variable is usually denoted by $\mathbf{\Sigma}$. Always refer to such a matrix as a *covariance* matrix (and not as a 'variance-covariance' matrix or 'variance' matrix). Variance is a special case of covariance, the covariance of a scalar random variable with itself, so 'variance-covariance matrix' involves a redundancy and 'variance matrix' a deficiency.

(vi) The population value of a correlation coefficient is usually denoted by ρ. A sample correlation coefficient is often denoted by r or by $\hat{\rho}$.

6. Parameters

(i) Model parameters are usually denoted by Greek letters, e.g. θ.

(ii) Estimates of parameters are often indicated by putting a 'hat' (circumflex accent) above the letter: $\hat{\theta}$. There may of course be circumstances where it is inconvenient or impossible to adhere to this convention.

(iii) Estimates of parameters may also be represented in the form $\tilde{\theta}$ or $\breve{\theta}$ or $\check{\theta}$, ..., particularly if it is necessary to distinguish between the results of using different estimators.

(iv) If the symbol for a parameter being estimated is in some sense 'large', it is often preferable to use wide versions of 'hat' or 'tilde'. These are rendered in LaTeX by `\widehat` and `\widetilde` E.g. $\widehat{\mathbf{\Sigma}}$ looks much better than $\hat{\mathbf{\Sigma}}$.

7. Parentheses, brackets and braces

(i) Use (round) parentheses to denote open intervals: $(a, b) = \{x : a < x < b\}$.

(ii) Likewise use (square) brackets to denote closed intervals: $[a, b] = \{x : a \leq x \leq b\}$.

(iii) Denote half-open intervals by $(a, b]$ or $[a, b)$. *DO NOT* use '$]a, b]$' or '$[a, b[$'!

(iv) Make an effort to be consistent in your use of nested 'enclosure symbols'. Ideally you should always use either nested parentheses (only), $(((\ldots)))$ or braces, brackets, parentheses, $\{[(\ldots)]\}$ in that order. Previously the Journal's guidelines *insisted* that you should use one form or the other and never mix the two. This is however

unnecessarily pedantic and adhering strictly to this convention could result in awkward constructions. You should *try* to use one form or the other consistently and not to mix the two forms in the same paper, but if this restriction is inconvenient don't sweat it too much. Note that it is probably most important to strive for consistency when the enclosing symbols are expanded to accommodate 'large content' which tends to happen in the context of displayed equations.

8. Number systems:

   (i) The set of real numbers is denoted by $\mathbb{R}$.

   (ii) The set of integers is denoted by $\mathbb{Z}$.

   (iii) The set of positive integers ('natural numbers') is denoted by $\mathbb{N}$. (Use $\mathbb{N} \cup \{0\}$ to denote the non-negative integers, awkward though this may be.)

   (iv) The set of rational numbers is denoted by $\mathbb{Q}$.

   (v) The set of complex numbers is denoted by $\mathbb{C}$.

9. Fractions and multi-line formulae

   (i) Do not insert multi-line formulae in the text. Subscripted and superscripted symbols such as x_1 and x^2 are acceptable in 'in-line' text, but the binomial coefficient

   $$\binom{m}{n}$$

   is an example of a multi-line expression that should appear only in a displayed equation.

   (ii) In in-line text, use the a/b form for fractions. Do *not* write

   $$\frac{x}{y} \quad \text{or} \quad \frac{dx}{dy}$$

   in text.

   (iii) In displayed equations fractions should usually be rendered in the form

   $$\frac{a}{b} \ .$$

(iv) Even in displayed equations, avoid using multiple levels of characters. For example, use '$\exp(x)$' rather than e^x if x, the power of e, has several levels.

10. Numbering

(i) Equations should be numbered (1), (2), ..., sequentially within the paper. The numbering sequence should continue through the Appendices (if there are any and if these contain numbered equations.) I.e. *do not* number 'within sections'. In other words *do not* use forms such as 1.1, 1.2, ... for equation numbers).

(ii) Equation numbers must appear on the right hand side of the page. (This is the default in LaTeX.)

(iii) Number *only* those equations which are referred to in the text. Many equations will thereby remain un-numbered. See the document contained in the file `protoType.pdf` for discussion of how to effect appropriate equation numbering when you use LaTeX.

(iv) When referring to equations, refer to (e.g.) '(2)' rather than to 'equation (2)' or to 'Eq (2)'.

(v) Similarly to equations, Tables and Figures must be numbered sequentially throughout the paper and must *not* be numbered 'within sections'. (See Section 5.)

(vi) Likewise if you have Theorems, Propositions, Lemmas, Definitions etc. these should be designated Theorem 1, Theorem 2, ..., Proposition 1, Proposition 2, ...

11. Miscellaneous:

(i) Decimal numbers between 0 and 1 should have a leading zero: thus use 0.1892 rather than .1892.

(ii) Do not use $:=$ and $\equiv$; use a simple equals sign '$=$'.

(iii) Avoid the use of $a \cdot b$ to denote multiplication. Instead use simple juxtaposition: ab. In desperate cases (e.g. when there must be a line break between the two factors) use $a \times b$.

(iv) To indicate plurality of quantities (particularly those represented by indexed symbols) use e.g. 'x_is' rather than 'x_i's'.

(v) A minus sign is rendered in LaTeX as a hyphen '-' inside a mathematics environment (e.g. between two $ signs).

(vi) In LaTeX use `\ldots` for a list: $x_1, \ldots, x_n$. Use `\cdots` when you require dots between operators as in $x_1 + \cdots + x_n$.

(vii) Do not use ambiguous mathematics. For example, you may write '$1/(ab)$', but not '$1/ab$'.

(viii) Define any unconventional symbols that you use.

(ix) 'Superstructure symbols' (such as `\overline`, `\widehat` and `\widetilde` in LaTeX) that span more than one character, as in $\widehat{a+b}$ and $\widetilde{abc}$, should be avoided as far as possible.

It is easy to facilitate adherence to many of the foregoing style requirements if you use LaTeX and avail yourself of the facilities provided, such as the `newcommand` facility and related LaTeX constructions. See the document `protoType.pdf` for some further discussion of this issue.

7 Supporting and supplementary material

The Journal provides facilities for making 'Supporting and Supplementary Material' available, in online form, to readers. Appendices containing long mathematical proofs, additional figures or tables, data sets and computer code, can (and in some instances *must*) be made available in this form instead of appearing in the printed version of the Journal. Such material must accompany the initial submission of the article. Any such material submitted after acceptance of the main article will be referred to the Editor for approval and may delay publication.

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It was previously emphasised in this document that data sets that are analysed in a paper must be accessible to the reader. The Editor may require that these data be published in the online repository of 'Supporting and Supplementary Material'. If confidentiality issues prevent this being done, this fact must be drawn to the attention of the Editor upon *initial submission* of the paper. The Editor will determine whether, in these circumstances, the paper can be considered for publication.

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8 Revising papers

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9 Various

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