ARTICLE TEMPLATE

# Application of Semantic Web technologies to Knowledge-assisted Visualization of Urban Mobility Data

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**ABSTRACT**
This template is for authors who are preparing a manuscript for a Taylor & Francis journal using the LaTeX document preparation system and the `interact` class file, which is available via selected journals' home pages on the Taylor & Francis website.

**KEYWORDS**
data visualization; urban mobility data; semantic web technologies; ontologies

## 1. Introduction

Intelligent Transportation Systems and ubiquitous computing generate data that allows one to better understand mobility dynamics of cities. Since the last decade, transportation researchers have developed novel interactive visualization tools to explore spatiotemporal (S-T) urban mobility data. In practical contexts, technical obstacles might still hinder the application of data visualization techniques. Examples of such obstacles include data integration from various sources, often heterogeneous, and definition of appropriate visual encodings and metaphors. Currently, there is a scarcity of visualization tools that aim at reducing the technical burden to transportation analysts (domain users) and facilitating exploratory data analysis (EDA).

Other domains of knowledge attempt to address those obstacles by proposing Knowledge-assisted Visualization Tools (KVT). The typical use case of a KVT begins with the definition of analytical tasks, i.e. questions about data, e.g. "ridership of stops in downtown area during peak hours". The tool then suggests one or more candidate visualization techniques based on various information, e.g. structure of analytical tasks, and previous records of users' preferences, profiles and previous ratings given to each technique. We define those records as expert knowledge henceforth. More elaborate tools may continuously ask for user feedback to improve accuracy of recommendations over time.

Knowledge-assisted visualization tools require a formal knowledge representation (KR) model to describe domain data, visualization techniques, and expert knowledge, with mutually intelligible semantics, i.e. capable of being understood by computers. To the best of our knowledge, the application of KVTs to urban mobility analysis remains unexplored. Existing KR models in transportation, e.g. ontologies, can de-

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scribe mobility concepts to a certain extent, but cannot fully describe S-T data, such as vehicle trips or ticket validations. Those models also do not provide the necessary constructs for exploring visualization and expert knowledge. We argue that such visualization tools could encourage transportation agencies and stakeholders of growing cities to make frequent use of data visualization. However, it is firstly necessary to build a semantic foundation that serves the purpose of a KVT.

In this article, we show how ontologies and Semantic Web technologies can assist the development of KVTs for S-T urban mobility data. The core contribution is the Visualization-oriented Urban Mobility Ontology (VUMO). Ontologies and Semantic Web technologies have solid open standards and form a powerful approach to problems that involve data integration, including those unrelated to the context of the World Wide Web.

VUMO formalizes the (a) description of S-T instance data in terms of transportation concepts, (b) annotation of visualization techniques' components, e.g. input variables and available interaction tasks, and (c) annotation of expert knowledge. We defined a set of inference rules to extract knowledge from instance data and analytical tasks. Such features can assist, through recommendation algorithms, the identification of appropriate visualization techniques for an analytical task and system users. Within the scope of VUMO, we also introduce a formal definition of compatibility between analytical tasks and visualization techniques.

The structure of VUMO accounts for scalable reusability, i.e. researchers and practitioners can extend the ontology to meet other contexts' requirements. Moreover, the available constructors for annotation of expert knowledge do not constrain the types of recommendation algorithms to be applied, e.g. content-based or collaborative-filtering techniques.

The practical demonstration (refer to Section **??**) illustrates the tasks (a), (b) and (c), and makes use of data from the public transportation system of Porto (Portugal) and Boston (USA), and expert knowledge from domain users who belong to the same context. The demonstration is supported by two prototypical visualization techniques and an *ad hoc* recommendation algorithm. The discussion about the advantages of a particular type of recommendation algorithm is outside the scope of this article.

Section **??** surveys the applications of visualization and Semantic Web technologies to some topics of urban mobility analysis. Section **??** introduces a formal model for the various facets of a KVT for S-T data, and describes the VUMO ontology, which materializes the aforementioned formal model. Section **??** provides a practical demonstration of our approach. Section **??** concludes this article and states future research directions.

### 1.1. *The* Interact *class file*

The `interact` class file preserves the standard LaTeX 2$_\varepsilon$ interface such that any document that can be produced using `article.cls` can also be produced with minimal alteration using the `interact` class file as described in this document.

If your article is accepted for publication it will be typeset as the journal requires in Minion Pro and/or Myriad Pro. Since most authors will not have these fonts installed, the page make-up is liable to alter slightly with the change of font. Also, the `interact` class file produces only single-column format, which is preferred for peer review and will be converted to two-column format by the typesetter if necessary during preparation of the proofs. Please therefore do not try to match the typeset format exactly, but use

the standard LATEX fonts instead and ignore details such as slightly long lines of text or figures/tables not appearing in exact synchronization with their citations in the text: these details will be dealt with by the typesetter. Similarly, it is unnecessary to spend time addressing warnings in the log file – if your .tex file compiles to produce a PDF document that correctly shows how you wish your paper to appear, such warnings will not prevent your source files being imported into the typesetter's program.

## 1.2. Submission of manuscripts prepared using LATEX

Manuscripts for possible publication should be submitted to the Editors for review as directed in the journal's Instructions for Authors, and in accordance with any technical instructions provided in the journal's ScholarOne Manuscripts or Editorial Manager site. Your LATEX source file(s), the class file and any graphics files will be required in addition to the final PDF version when final, revised versions of accepted manuscripts are submitted.

Please ensure that any author-defined macros used in your article are gathered together in the preamble of your .tex file, i.e. before the `\begin{document}` command. Note that if serious problems are encountered in the coding of a document (missing author-defined macros, for example), the typesetter may resort to rekeying it.

## 2. Using the `interact` class file

For convenience, simply copy the `interact.cls` file into the same directory as your manuscript files (you do not need to install it in your TEX distribution). In order to use the `interact` document class, replace the command `\documentclass{article}` at the beginning of your document with the command `\documentclass{interact}`.

The following document-class options should *not* be used with the `interact` class file:

- `10pt`, `11pt`, `12pt` – unavailable;
- `oneside`, `twoside` – not necessary, `oneside` is the default;
- `leqno`, `titlepage` – should not be used;
- `twocolumn` – should not be used (see Subsection 1.1);
- `onecolumn` – not necessary as it is the default style.

To prepare a manuscript for a journal that is printed in A4 (two column) format, use the `largeformat` document-class option provided by `interact.cls`; otherwise the class file produces pages sized for B5 (single column) format by default. The `geometry` package should not be used to make any further adjustments to the page dimensions.

## 3. Additional features of the `interact` class file

### 3.1. Title, authors' names and affiliations, abstracts and article types

The title should be generated at the beginning of your article using the `\maketitle` command. In the final version the author name(s) and affiliation(s) must be followed immediately by `\maketitle` as shown below in order for them to be displayed in your PDF document. To prepare an anonymous version for double-blind peer review, you can put the `\maketitle` between the `\title` and the `\author` in order to hide the

author name(s) and affiliation(s) temporarily. Next you should include the abstract if your article has one, enclosed within an `abstract` environment. The `\articletype` command is also provided as an *optional* element which should *only* be included if your article actually needs it. For example, the titles for this document begin as follows:

```
\articletype{ARTICLE TEMPLATE}

\title{Taylor \& Francis \LaTeX\ template for authors (\textsf{Interact}
layout + American Psychological Association reference style)}

\author{
\name{A.~N. Author\textsuperscript{a}\thanks{CONTACT A.~N. Author.
Email: latex.helpdesk@tandf.co.uk} and John Smith\textsuperscript{b}}
\affil{\textsuperscript{a}Taylor \& Francis, 4 Park Square, Milton
Park, Abingdon, UK; \textsuperscript{b}Institut f\"{u}r Informatik,
Albert-Ludwigs-Universit\"{a}t, Freiburg, Germany} }

\maketitle

\begin{abstract}
This template is for authors who are preparing a manuscript for a
Taylor \& Francis journal using the \LaTeX\ document preparation system
and the \texttt{interact} class file, which is available via selected
journals' home pages on the Taylor \& Francis website.
\end{abstract}
```

An additional abstract in another language (preceded by a translation of the article title) may be included within the `abstract` environment if required.

A graphical abstract may also be included if required. Within the `abstract` environment you can include the code

```
\\\resizebox{25pc}{!}{\includegraphics{abstract.eps}}
```

where the graphical abstract is to appear, where `abstract.eps` is the name of the file containing the graphic (note that `25pc` is the recommended maximum width, expressed in pica, for the graphical abstract in your manuscript).

### *3.2. Abbreviations*

A list of abbreviations may be included if required, enclosed within an `abbreviations` environment, i.e. `\begin{abbreviations}`...`\end{abbreviations}`, immediately following the `abstract` environment.

### *3.3. Keywords*

A list of keywords may be included if required, enclosed within a `keywords` environment, i.e. `\begin{keywords}`...`\end{keywords}`. Additional keywords in other languages (preceded by a translation of the word 'keywords') may also be included within the `keywords` environment if required.

### 3.4. Subject classification codes

AMS, JEL or PACS classification codes may be included if required. The `interact` class file provides an `amscode` environment, i.e. \begin{amscode}...\end{amscode}, a `jelcode` environment, i.e. \begin{jelcode}...\end{jelcode}, and a `pacscode` environment, i.e. \begin{pacscode}...\end{pacscode} to assist with this.

### 3.5. Additional footnotes to the title or authors' names

The \thanks command may be used to create additional footnotes to the title or authors' names if required. Footnote symbols for this purpose should be used in the order * (coded as $^\ast$), † ($\dagger$), ‡ ($\ddagger$), § ($\S$), ¶ ($\P$), ‖ ($\|$), †† ($\dagger\dagger$), ‡‡ ($\ddagger\ddagger$), §§ ($\S\S$), ¶¶ ($\P\P$).

Note that any `footnote`s to the main text will automatically be assigned the superscript symbols 1, 2, 3, etc. by the class file.[1]

## 4. Some guidelines for using the standard features of LaTeX

### 4.1. Sections

The Interact layout style allows for five levels of section heading, all of which are provided in the `interact` class file using the standard LaTeX commands \section, \subsection, \subsubsection, \paragraph and \subparagraph. Numbering will be automatically generated for all these headings by default.

### 4.2. Lists

Numbered lists are produced using the `enumerate` environment, which will number each list item with arabic numerals by default. For example,

(1) first item
(2) second item
(3) third item

was produced by

```
\begin{enumerate}
  \item first item
  \item second item
  \item third item
\end{enumerate}
```

Alternative numbering styles can be achieved by inserting an optional argument in square brackets to each `item`, e.g. \item[(i)] first item to create a list numbered with roman numerals at level one.

Bulleted lists are produced using the `itemize` environment. For example,

- First bulleted item
- Second bulleted item
- Third bulleted item

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[1] If preferred, the `endnotes` package may be used to set the notes at the end of your text, before the bibliography. The symbols will be changed to match the style of the journal if necessary by the typesetter.
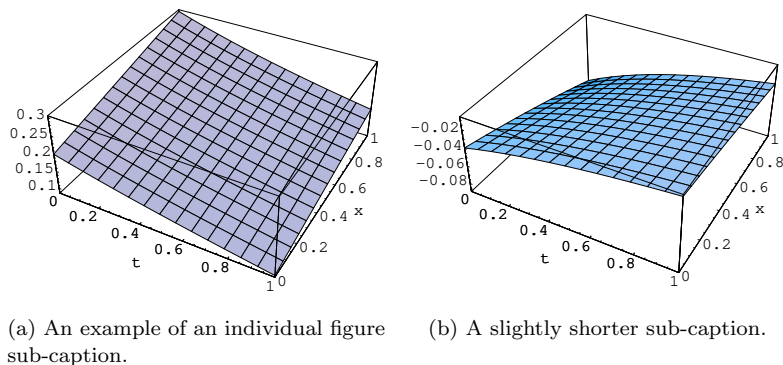
(a) An example of an individual figure sub-caption.

(b) A slightly shorter sub-caption.

**Figure 1.** Example of a two-part figure with individual sub-captions showing that captions are flush left and justified if greater than one line of text.

was produced by

```
\begin{itemize}
  \item First bulleted item
  \item Second bulleted item
  \item Third bulleted item
\end{itemize}
```

### 4.3. Figures

The `interact` class file will deal with positioning your figures in the same way as standard LaTeX. It should not normally be necessary to use the optional `[htb]` location specifiers of the `figure` environment in your manuscript; you may, however, find the `[p]` placement option or the `endfloat` package useful if a journal insists on the need to separate figures from the text.

Figure captions appear below the figures themselves, therefore the `\caption` command should appear after the body of the figure. For example, Figure 1 with caption and sub-captions is produced using the following commands:

```
\begin{figure}
\centering
\subfloat[An example of an individual figure sub-caption.]{%
\resizebox*{5cm}{!}{\includegraphics{graph1.eps}}}\hspace{5pt}
\subfloat[A slightly shorter sub-caption.]{%
\resizebox*{5cm}{!}{\includegraphics{graph2.eps}}}
\caption{Example of a two-part figure with individual sub-captions
 showing that captions are flush left and justified if greater
 than one line of text.} \label{sample-figure}
\end{figure}
```

To ensure that figures are correctly numbered automatically, the `\label` command should be included just after the `\caption` command, or in its argument.

The `\subfloat` command requires `subfig.sty`, which is called in the preamble of the `interactapasample.tex` file (to allow your choice of an alternative package if preferred) and included in the Interact LaTeX bundle for convenience. Please supply any additional figure macros used with your article in the preamble of your .tex file.

**Table 1.** Example of a table showing that its caption is as wide as the table itself and justified.

| Class | Type | | | | | |
|---|---|---|---|---|---|---|
| | One | Two | Three | Four | Five | Six |
| Alpha[a] | A1 | A2 | A3 | A4 | A5 | A6 |
| Beta | B2 | B2 | B3 | B4 | B5 | B6 |
| Gamma | C2 | C2 | C3 | C4 | C5 | C6 |

[a]This footnote shows how to include footnotes to a table if required.

The source files of any figures will be required when the final, revised version of a manuscript is submitted. Authors should ensure that these are suitable (in terms of lettering size, etc.) for the reductions they envisage.

The `epstopdf` package can be used to incorporate encapsulated PostScript (.eps) illustrations when using PDFLaTeX, etc. Please provide the original .eps source files rather than the generated PDF images of those illustrations for production purposes.

## 4.4. Tables

The `interact` class file will deal with positioning your tables in the same way as standard LaTeX. It should not normally be necessary to use the optional `[htb]` location specifiers of the `table` environment in your manuscript; you may, however, find the `[p]` placement option or the `endfloat` package useful if a journal insists on the need to separate tables from the text.

The `tabular` environment can be used as shown to create tables with single horizontal rules at the head, foot and elsewhere as appropriate. The captions appear above the tables in the Interact style, therefore the `\tbl` command should be used before the body of the table. For example, Table 1 is produced using the following commands:

```
\begin{table}
\tbl{Example of a table showing that its caption is as wide as
 the table itself and justified.}
{\begin{tabular}{lcccccc} \toprule
 & \multicolumn{2}{l}{Type} \\ \cmidrule{2-7}
 Class & One & Two & Three & Four & Five & Six \\ \midrule
 Alpha\textsuperscript{a} & A1 & A2 & A3 & A4 & A5 & A6 \\
 Beta & B2 & B2 & B3 & B4 & B5 & B6 \\
 Gamma & C2 & C2 & C3 & C4 & C5 & C6 \\ \bottomrule
\end{tabular}}
\tabnote{\textsuperscript{a}This footnote shows how to include
 footnotes to a table if required.}
\label{sample-table}
\end{table}
```

To ensure that tables are correctly numbered automatically, the `\label` command should be included just before `\end{table}`.

The `\toprule`, `\midrule`, `\bottomrule` and `\cmidrule` commands are those used by `booktabs.sty`, which is called by the `interact` class file and included in the Interact LaTeX bundle for convenience. Tables produced using the standard commands of the `tabular` environment are also compatible with the `interact` class file.

### 4.5. Landscape pages

If a figure or table is too wide to fit the page it will need to be rotated, along with its caption, through 90° anticlockwise. Landscape figures and tables can be produced using the `rotating` package, which is called by the `interact` class file. The following commands (for example) can be used to produce such pages.

```
\setcounter{figure}{1}
\begin{sidewaysfigure}
\centerline{\epsfbox{figname.eps}}
\caption{Example landscape figure caption.}
\label{landfig}
\end{sidewaysfigure}

\setcounter{table}{1}
\begin{sidewaystable}
 \tbl{Example landscape table caption.}
  {\begin{tabular}{@{}llllcll}
    .
    .
    .
  \end{tabular}}\label{landtab}
\end{sidewaystable}
```

Before any such float environment, use the `\setcounter` command as above to fix the numbering of the caption (the value of the counter being the number given to the preceding figure or table). Subsequent captions will then be automatically renumbered accordingly. The `\epsfbox` command requires `epsfig.sty`, which is called by the `interact` class file and is also included in the Interact LaTeX bundle for convenience.

Note that if the `endfloat` package is used, one or both of the commands

```
\DeclareDelayedFloatFlavor{sidewaysfigure}{figure}
\DeclareDelayedFloatFlavor{sidewaystable}{table}
```

will need to be included in the preamble of your .tex file, after the `endfloat` package is loaded, in order to process any landscape figures and/or tables correctly.

### 4.6. Theorem-like structures

A predefined `proof` environment is provided by the `amsthm` package (which is called by the `interact` class file), as follows:

**Proof.** More recent algorithms for solving the semidefinite programming relaxation are particularly efficient, because they explore the structure of the MAX-CUT problem. □

This was produced by simply typing:

```
\begin{proof}
More recent algorithms for solving the semidefinite programming
relaxation are particularly efficient, because they explore the
structure of the MAX-CUT problem.
\end{proof}
```

Other theorem-like environments (theorem, definition, remark, etc.) need to be defined as required, e.g. using `\newtheorem{theorem}{Theorem}` in the preamble of your .tex file (see the preamble of `interactapasample.tex` for more examples). You can define the numbering scheme for these structures however suits your article best. Please note that the format of the text in these environments may be changed if necessary to match the style of individual journals by the typesetter during preparation of the proofs.

### 4.7. Mathematics

#### 4.7.1. Displayed mathematics

The `interact` class file will set displayed mathematical formulas centred on the page without equation numbers if you use the `displaymath` environment or the equivalent `\[...\]` construction. For example, the equation

$$\hat{\theta}_{w_i} = \hat{\theta}(s(t, \mathcal{U}_{w_i}))$$

was typeset using the commands

```
\[
 \hat{\theta}_{w_i} = \hat{\theta}(s(t,\mathcal{U}_{w_i}))
\]
```

For those of your equations that you wish to be automatically numbered sequentially throughout the text for future reference, use the `equation` environment, e.g.

$$\hat{\theta}_{w_i} = \hat{\theta}(s(t, \mathcal{U}_{w_i})) \tag{1}$$

was typeset using the commands

```
\begin{equation}
 \hat{\theta}_{w_i} = \hat{\theta}(s(t,\mathcal{U}_{w_i}))
\end{equation}
```

Part numbers for sets of equations may be generated using the `subequations` environment, e.g.

$$\varepsilon \rho w_{tt}(s,t) = N[w_s(s,t), w_{st}(s,t)]_s, \tag{2a}$$

$$w_{tt}(1,t) + N[w_s(1,t), w_{st}(1,t)] = 0, \tag{2b}$$

which was typeset using the commands

```
\begin{subequations} \label{subeqnexample}
\begin{equation}
    \varepsilon \rho w_{tt}(s,t) = N[w_{s}(s,t),w_{st}(s,t)]_{s},
    \label{subeqnparta}
\end{equation}
\begin{equation}
    w_{tt}(1,t)+N[w_{s}(1,t),w_{st}(1,t)] = 0,    \label{subeqnpartb}
\end{equation}
\end{subequations}
```

This is made possible by the `amsmath` package, which is called by the class file. If you put a `\label` just after the `\begin{subequations}` command, references can be made to the collection of equations, i.e. '(2)' in the example above. Or, as the example also shows, you can label and refer to each equation individually – i.e. '(2a)' and '(2b)'.

Displayed mathematics should be given end-of-line punctuation appropriate to the running text sentence of which it forms a part, if required.

### 4.7.2. Math fonts

**4.7.2.1. Superscripts and subscripts.** Superscripts and subscripts will automatically come out in the correct size in a math environment (i.e. enclosed within `\(...\)` or `$...$` commands in running text, or within `\[...\]` or the `equation` environment for displayed equations). Sub/superscripts that are physical variables should be italic, whereas those that are labels should be roman (e.g. $C_p$, $T_{\text{eff}}$). If the subscripts or superscripts need to be other than italic, they must be coded individually.

**4.7.2.2. Upright Greek characters and the upright partial derivative sign.** Upright lowercase Greek characters can be obtained by inserting the letter 'u' in the control code for the character, e.g. `\umu` and `\upi` produce μ (used, for example, in the symbol for the unit microns – μm) and π (the ratio of the circumference of a circle to its diameter). Similarly, the control code for the upright partial derivative ∂ is `\upartial`. Bold lowercase as well as uppercase Greek characters can be obtained by `{\bm \gamma}`, for example, which gives $\gamma$, and `{\bm \Gamma}`, which gives $\boldsymbol{\Gamma}$.

**Acknowledgement(s)**

An unnumbered section, e.g. `\section*{Acknowledgements}`, may be used for thanks, etc. if required and included *in the non-anonymous version* before any Notes or References.

**Disclosure statement**

An unnumbered section, e.g. `\section*{Disclosure statement}`, may be used to declare any potential conflict of interest and included *in the non-anonymous version* before any Notes or References, after any Acknowledgements and before any Funding information.

**Funding**

An unnumbered section, e.g. `\section*{Funding}`, may be used for grant details, etc. if required and included *in the non-anonymous version* before any Notes or References.

**Notes on contributor(s)**

An unnumbered section, e.g. `\section*{Notes on contributors}`, may be included *in the non-anonymous version* if required. A photograph may be added if requested.

**Nomenclature/Notation**

An unnumbered section, e.g. `\section*{Nomenclature}` (or `\section*{Notation}`), may be included if required, before any Notes or References.

**Notes**

An unnumbered 'Notes' section may be included before the References (if using the `endnotes` package, use the command `\theendnotes` where the notes are to appear, instead of creating a `\section*`).

## 5. References

### 5.1. References cited in the text

References should be cited in accordance with American Psychological Association (APA) style, i.e. in alphabetical order separated by semicolons, e.g. '(Bandura, 1977; Piaget, 1988; Von Ledebur, 2007)' or '...see Smith (1985, p. 75)'. If there are two or more authors with the same surname, use the first author's initials with the surnames, e.g. '(I. Light, 2006; M. A. Light & Light, 2008)'. If there are three to five authors, list all the authors in the first citation, e.g. '(Ganster, Schaubroeck, Sime, & Mayes, 1991)'. In subsequent citations, use only the first author's surname followed by et al., e.g. '(Ganster et al., 1991)'. For six or more authors, cite the first author's name followed by et al. For two or more sources by the same author(s) in the same year, use lower-case letters (a, b, c, ...) with the year to order the entries in the reference list and use these lower-case letters with the year in the in-text citations, e.g. '(Green, 1981a,b)'. For further details on this reference style, see the Instructions for Authors on the Taylor & Francis website.

Each bibliographic entry has a key, which is assigned by the author and is used to refer to that entry in the text. In this document, the key `Nas93` in the citation form `\citep{Nas93}` produces '(Nash, 1993)', and the keys `Koc59`, `Han04` and `Cla08` in the citation form `\citep{Koc59,Han04,Cla08}` produce '(Clay, 2008; Haney & Wiener, 2004; Koch, 1959-1963)'. The citation `\citep{Cha08}` produces '(Chamberlin, Novotney, Packard, & Price, 2008)' where the citation first appears in the text, and '(Chamberlin et al., 2008)' in any subsequent citation. The appropriate citation style for different situations can be obtained, for example, by `\citet{Ovi95}` for 'Oviedo (1995)', `\citealp{MPW08}` for 'Marshall-Pescini & Whiten, 2008', and `\citealt{Sch93}` for 'Schwartz 1993'. Citation of the year alone may be produced by `\citeyear{Sch00}`, i.e. '2000', or `\citeyearpar{Gra05}`, i.e. '(2005)', or of the author(s) alone by `\citeauthor{Rit74}`, i.e. 'Ritzmann'. Optional notes may be included at the beginning and/or end of a citation by the use of square brackets, e.g. `\citep[p.~31]{Hay08}` produces '(Haybron, 2008, p. 31)'; `\citep[see][pp.~73-{77}]{PI51}` produces '(see Piaget & Inhelder, 1951, pp. 73–77)'; `\citep[e.g.][]{Fel81}` produces '(e.g. Feller, 1981)'. A 'plain' `\cite` command will produce the same results as a `\citet`, i.e. `\cite{BriIP}` will produce 'Briscoe (in press)'.

11

## 5.2. The list of references

References should be listed at the end of the main text in alphabetical order, then chronologically (earliest first), with full page ranges (where appropriate) and issue numbers (essential for journals paginated by issue). If a reference has more than seven named authors, list the first six names, followed by an ellipsis (...), then the last author's name (see for example Gilbert et al., 2004). The following list shows some sample references prepared in the Taylor & Francis APA style.

## References

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\end{thebibliography}
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Each entry takes the form:

```
\bibitem[short list of authors' surnames(date of publication)long list
 of authors' surnames]{key}
Bibliography entry
```

where 'long list of authors' surnames' is the *optional* 'long' list of three, four or five names which enables them all to appear where the bibitem is first cited in the text (if the long list is missing, the short list will be used instead), and 'key' is the tag that is to be used as an argument for the \cite commands in the text of the article. 'Bibliography entry' is the material that is to appear in the list of references, suitably formatted. The commands

```
\usepackage[longnamesfirst,sort]{natbib}
\bibpunct[, ]{(}{)}{;}{a}{,}{,}
\renewcommand\bibfont{\fontsize{10}{12}\selectfont}
```

need to be included in the preamble of your .tex file in order to generate the citations and bibliography as described above.

Instead of typing the bibliography by hand, you may prefer to create the list of references using a BibTeX database. For this we suggest using Erik Meijer's `apacite` package, which is available via CTAN if you do not already have it. The `apacite.sty`, `apacite.bst` and (if your paper is written in English) `english.apc` files need to be in your working folder or an appropriate directory, the commands

```
\usepackage[natbibapa,nodoi]{apacite}
\setlength\bibhang{12pt}
\renewcommand\bibliographytypesize{\fontsize{10}{12}\selectfont}
```

included in the preamble of your .tex file instead of the `\usepackage[]{natbib}`, `\bibpunct` and `\renewcommand\bibfont` commands described above, and the lines

```
\bibliographystyle{apacite}
\bibliography{interactapasample}
```

included where the list of references is to appear, where `interactapasample.bib` is the bibliographic database included with the Interact-APA LaTeX bundle (to be replaced with the name of your own .bib file). The `[natbibapa]` option has to be added to `\usepackage{apacite}` in order to enable citation commands of the type `\citep` and `\citet`. LaTeX/BibTeX will extract from your .bib file only those references that are cited in your .tex file and list them in the References section.

Please include a copy of your .bib file and/or the final generated .bbl file among your source files if your .tex file does not contain a reference list in a `thebibliography` environment.


## 6. Appendices

Any appendices should be placed after the list of references, beginning with the command `\appendix` followed by the command `\section` for each appendix title, e.g.

```
\appendix
\section{This is the title of the first appendix}
\section{This is the title of the second appendix}
```

produces:

### Appendix A. This is the title of the first appendix

### Appendix B. This is the title of the second appendix

Subsections, equations, figures, tables, etc. within appendices will then be automatically numbered as appropriate. Some theorem-like environments may need to have their counters reset manually (e.g. if they are not numbered within sections in the main text). You can achieve this by using `\numberwithin{remark}{section}` (for example) just after the `\appendix` command.

Note that if the `endfloat` package is used on a document containing any appendices, the `\processdelayedfloats` command must be included immediately before

the `\appendix` command in order to ensure that the floats belonging to the main body of the text are numbered as such.

## Appendix A. Troubleshooting

Authors may occasionally encounter problems with the preparation of a manuscript using LaTeX. The appropriate action to take will depend on the nature of the problem:

  (i) If the problem is with LaTeX itself, rather than with the actual macros, please consult an appropriate LaTeX $2_\varepsilon$ manual for initial advice. If the solution cannot be found, or if you suspect that the problem does lie with the macros, then please contact Taylor & Francis for assistance (`latex.helpdesk@tandf.co.uk`), clearly stating the title of the journal to which you are submitting.
 (ii) Problems with page make-up (e.g. occasional overlong lines of text; figures or tables appearing out of order): please do not try to fix these using 'hard' page make-up commands – the typesetter will deal with such problems. (You may, if you wish, draw attention to particular problems when submitting the final version of your manuscript.)
(iii) If a required font is not available on your system, allow TeX to substitute the font and specify which font is required in a covering letter accompanying your files.

## Appendix B. Obtaining the template and class file

### B.1. Via the Taylor & Francis website

This article template and the `interact` class file may be obtained via the 'Instructions for Authors' pages of selected Taylor & Francis journals.

Please note that the class file calls up the open-source LaTeX packages booktabs.sty, epsfig.sty and rotating.sty, which will, for convenience, unpack with the downloaded template and class file. The template optionally calls for natbib.sty and subfig.sty, which are also supplied for convenience.

### B.2. Via e-mail

This article template, the `interact` class file and the associated open-source LaTeX packages are also available via e-mail. Requests should be addressed to `latex.helpdesk@tandf.co.uk`, clearly stating for which journal you require the template and class file.