ExcavatorVR - Simulating an Excavator in Virtual Reality

Sebastian Gradwohl

Fig. 1: In the Clouds: Vancouver from Cypress Mountain. Note that the teaser may not be wider than the abstract block.

Abstract—Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum. A free copy of this paper and all supplemental materials are available at `https://OSF.IO/2NBSG`.

Index Terms—Radiosity, global illumination, constant time

1 INTRODUCTION

This template is for papers of VGTC-sponsored conferences such as IEEE VIS, IEEE VR, and ISMAR which are published as special issues of TVCG. The template does not contain the respective dates of the conference/journal issue, these will be entered by IEEE as part of the publication production process. Therefore, **please leave the copyright statement at the bottom-left of this first page untouched**.

2 AUTHOR DETAILS

You should specify ORCID IDs for each author (see `https://orcid.org/` to register) for disambiguation and long-term contact preservation. Use `\authororcid{Author Name}{0000-0000-0000-0000}` for each author, replacing the "Author Name" and using the 16-digit (hyphenated) ORCID ID for the second parameter. The template shows an example without ORCID IDs for two of the authors. ORCID IDs should be provided in all cases.

Each author's affiliations have to be provided in the author footer on the bottom-left corner of the first page. It is permitted to merge two or more people from the same institution as long as they are shown in the same order as in the overall author sequence on the top of the first page.

- *Sebastian Gradwohl is with the University of Applied Sciences Upper Austria - Hagenberg E-mail: s2310307057@fhooe.at*

For example, if authors A, B, C, and D are from institutions 1, 2, 1, and 2, respectively, then it is ok to use 2 bullets as follows:

- A and C are with Institution 1. E-mail: {a | c}@i1.com.
- B and D are with Institution 2. E-mail: {b | d}@i2.org.

3 HYPERLINKS AND CROSS REFERENCES

The style uses the `hyperref` package which can typeset clickable hyperlinks using `\href{...}{...}`, hyperlinked URLs using `\url{...}`, and turns references into internal links.

The style also uses `cleveref` to automatically and consistently format cross references. We recommend that you use the `\cref{label}` and `\Cref{label}` calls instead of `Figure~\ref{label}` or similar. `\Cref` should be used when starting a sentence to spell out the reference (e.g. "Section") while `\cref` should be used when referencing within a sentence to abbreviate (e.g. "Sec."). Here are examples for use within a sentence: Fig. 3, Tab. 1, Secs. 6 and 7, Eq. (1). The following sentences all start with a reference, so use `\Cref`. Figure 3 is a `figure` environment. Table 1 is a `table` environment. Sections 6 and 7 are `section` environments. Equation (1) is an `equation` environment.

4 FIGURES

4.1 Loading figures

The style automatically looks for image files with the correct extension (eps for regular LaTeX; pdf, png, and jpg for pdfLaTeX), in a set of given subfolders defined above using `\graphicspath`: figures/, pictures/, images/. It is thus sufficient to use `\includegraphics{CypressView}` (instead
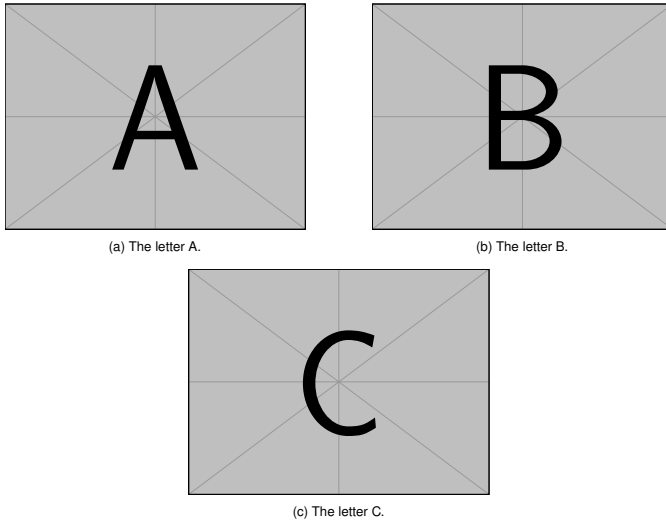
(a) The letter A.

(b) The letter B.

(c) The letter C.

Fig. 2: Example of adding subfigures with the subcaption package.

Table 1: VIS/VisWeek accepted/presented papers: 1990–2016.

year	Vis/SciVis	SciVis conf	InfoVis	VAST	VAST conf	TVCG @ VIS	CG&A @ VIS	VIS/VisWeek incl. TVCG/CG&A	VIS/VisWeek w/o TVCG/CG&A
2016	30		37	33	15	23	10	148	115
2015	33	9	38	33	14	17	15	159	127
2014	34		45	33	21	20		153	133
2013	31		38	32		20		121	101
2012	42		44	30		23		139	116
2011	49		44	26		20		139	119
2010	48		35	26				109	109
2009	54		37	26				117	117
2008	50		28	21				99	99
2007	56		27	24				107	107
2006	63		24	26				113	113
2005	88		31					119	119
2004	70		27					97	97
2003	74		29					103	103
2002	78		23					101	101
2001	74		22					96	96
2000	73		20					93	93
1999	69		19					88	88
1998	72		18					90	90
1997	72		16					88	88
1996	65		12					77	77
1995	56		18					74	74
1994	53							53	53
1993	55							55	55
1992	53							53	53
1991	50							50	50
1990	53							53	53
sum	**1545**	**9**	**632**	**310**	**50**	**123**	**25**	**2694**	**2546**

of \includegraphics{pictures/CypressView.jpg}). Figures should be in CMYK or Grey scale format, otherwise, colour shifting may occur during the printing process.

4.2 Vector figures

Vector graphics like svg, eps, pdf are best for charts and other figures with text or lines. They will look much nicer and crisper and any text in them will be more selectable, searchable, and accessible.

4.3 Raster figures

Of the raster graphics formats, screenshots of user interfaces and text, as well as line art, are better shown with png. jpg is better for photographs. Make sure all raster graphics are captured in high enough resolution so they look crisp and scale well.

4.4 Alt texts

Add alternative texts that describe the content of the image to all figures.

4.5 Figures on the first page

The teaser figure should only have the width of the abstract as the template enforces it. The use of figures other than the optional teaser is not permitted on the first page. Other figures should begin on the second page. Papers submitted with figures other than the optional teaser on the first page will be refused.

4.6 Subfigures

You can add subfigures using the subcaption package that is automatically loaded. Inside a figure environment, create a subfigure environment. See Fig. 2 for an example. You can reference individual figures, either fully using \cref (Figs. 2a and 2b) or by letter using \subref. E.g., (b), (c). Note that \subref only works for one label at a time.

4.7 Figure Credits

In the Figure Credits section at the end of the paper, you should credit the original sources of any figures that were reproduced or modified. Include any license details necessary, as well as links to the original materials whenever possible. For credits to figures from academic papers, include a citation that is listed in the **References** section. An example is provided below.

5 EQUATIONS AND TABLES

Equations can be added like so:

$$\sum_{j=1}^{z} j = \frac{z(z+1)}{2} \tag{1}$$

Tables, such as Tab. 1 can also be included.

6 SUPPLEMENTAL MATERIAL INSTRUCTIONS

In support of transparent research practices and long-term open science goals, you are encouraged to make your supplemental materials available on a publicly-accessible repository. Please describe the available supplemental materials in the Supplemental Materials section. These details could include (1) what materials are available, (2) where they are hosted, and (3) any necessary omissions.

7 REFERENCES

An example of the reference formatting is provided in the **References** section at the end.

7.1 Include DOIs

All references which have a DOI should have it included in the bibTeX for the style to display. The DOI can be entered with or without the https://doi.org/ prefix.

7.2 Narrow DOI option

The -narrow versions of the bibliography style use the font PTSansNarrow-TLF for typesetting the DOIs in a compact way. This font needs to be available on your LaTeX system. It is part of the paratype package, and many distributions (such as MikTeX) have it automatically installed. If you do not have this package yet and want to use a -narrow bibliography style then use your LaTeX system's package installer to add it. If this is not possible you can also revert to the respective bibliography styles without the -narrow in the file name. DVI-based processes to compile the template apparently cannot handle
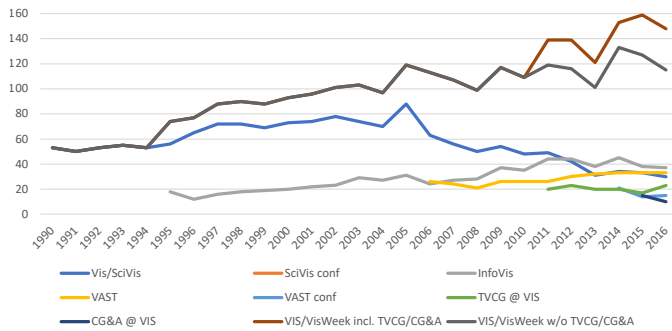
Fig. 3: A visualization of the 1990–2016 data from Tab. 1, recreated based on Fig. 1 from [**?**].

the different font so, by default, the template file uses the `abbrv-doi` bibliography style.

7.3 Disabling hyperlinks

To avoid adding hyperlinks to the references (the default) you can use `\bibliographystyle{abbrv-doi}` instead of `\bibliographystyle{abbrv-doi-hyperref}`. By default, the DOI field in a bibTEX entry is turned into a hyperlink.

See the examples in the bibTEX file and the bibliography at the end of this template.

7.4 Guidelines for bibTeX

- All bibliographic entries should be sorted alphabetically by the last name of the first author. This LATEX/bibTEX template takes care of this sorting automatically.

- Merge multiple references into one; e. g., use [**?**, **?**] (not [**?**] [**?**]). Within each set of multiple references, the references should be sorted in ascending order. This LATEX/bibTEX template takes care of both the merging and the sorting automatically.

- Verify all data obtained from digital libraries, even ACM's DL and IEEE Xplore etc. are sometimes wrong or incomplete.

- Do not trust bibliographic data from other services such as Mendeley.com, Google Scholar, or similar; these are even more likely to be incorrect or incomplete.

- Articles in journal—items to include:

    - author names
    - title
    - journal name
    - year
    - volume
    - number
    - month of publication as variable name (i.e., {jan} for January, etc.; month ranges using {jan #{/}# feb} or {jan #{--}# feb})
    - series. E.g., "TVCG", "TVCG/VIS" for special issue VIS papers, "EuroVis", "CGF/EuroVis".

- Use journal names in proper style: correct: "IEEE Transactions on Visualization and Computer Graphics", incorrect: "Visualization and Computer Graphics, IEEE Transactions on"

- Papers in proceedings—items to include:

    - author names
    - title
    - abbreviated proceedings name: e.g., "Proc.\ CONF_ACRONYNM" without the year; example: "Proc.\ CHI", "Proc.\ 3DUI", "Proc.\ Eurographics", "Proc.\ EuroVis"

    - year
    - series. E.g., "VIS" and "EuroVis" for short papers, "CHI"...

- Article/paper title convention: refrain from using curly brackets, except for acronyms/proper names/words following dashes/question marks etc.; example:

The paper "Marching Cubes: A High Resolution 3D Surface Construction Algorithm" should be entered as "{M}arching {C}ubes: A High Resolution {3D} Surface Construction Algorithm" or "{M}arching {C}ubes: A high resolution {3D} surface construction algorithm". It will then be typeset as "Marching Cubes: A high resolution 3D surface construction algorithm".

- For all entries:

    - DOI can be entered in the DOI field as plain DOI number or as DOI url.
    - "pages" or "articleno": Provide full page ranges AA--BB, OR, if an article number is available like recent ACM conferences, use that instead. E.g., see the entry for Panavas et al. [**?**].

- When citing references, do not use the reference as a sentence object; e.g., wrong: "In [**?**] the authors describe . . . ", correct: "Lorensen and Cline [**?**] describe . . . "

8 APPENDICES

Appendices can be specified using `\appendix`. For example, our Troubleshooting instructions in Sec. B.

Note that the paper submission has to end after the **References** section and within the page limit of the conference you are submitting to. Any version of Appendices or the paper with Appendices included has to be submitted separately as supplementary material. You can use the `hideappendix` class option to remove everything after `\appendix`. We encourage you to submit a full version of your paper to a preprint server with any appendices included.

You can use the `\iflabelexists` macro to cross reference an appendix from the main text, but only if that label (i.e. the appendix) actually exists. For example, above we use

```
\iflabelexists{appendix:troubleshooting}
  {\cref{appendix:troubleshooting}}
  {the appendix of the full paper at
  \url{https://osf.io/XXXXX}}.
```

in order to cross-reference to the appendix with `\cref` if it exists, but if the appendix is commented out then we will simply create a hyperlinked URL to it.

9 FILLER TEXT TO FLUSH OUT THE PAPER

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

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a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

SUPPLEMENTAL MATERIALS

Refer to the instructions for this section (Sec. 6). Below is an example you can follow that includes the actual supplemental material for this template:

All supplemental materials are available on OSF at `https://doi.org/10.17605/OSF.IO/2NBSG`, released under a CC BY 4.0 license. In particular, they include (1) Excel files containing the data for and analyses for creating Tab. 1 and Fig. 3, (2) figure images in multiple formats, and (3) a full version of this paper with all appendices. Our other code is intellectual property of a corporation—Starbucks Research—and there is no feasible way to share it publicly.

FIGURE CREDITS

Refer to the instructions for this section (Sec. 4.7). Here are the actual figure credits for this template:

Figure 1 image credit: Scott Miller / Special to the Vancouver Sun, January 22, 2009, page A6.

Figure 3 is a partial recreation of Fig. 1 from [**?**], which is in the public domain.

A ABOUT APPENDICES

Refer to Sec. 8 for instructions regarding appendices.

B TROUBLESHOOTING

B.1 ifpdf error

If you receive compilation errors along the lines of `Package ifpdf Error:  Name clash, \ifpdf is already defined` then please add a new line `\let\ifpdf\relax` right after the `\documentclass[journal]{vgtc}` call. Note that your error is due to packages you use that define `\ifpdf` which is obsolete (the result is that `\ifpdf` is defined twice); these packages should be changed to use `ifpdf` package instead.

B.2 pdfendlink error

Occasionally (for some LATEX distributions) this hyper-linked bibTEX style may lead to **compilation errors** (`pdfendlink ended up in different nesting level ...`) if a reference entry is broken across two pages (due to a bug in `hyperref`). In this case, make sure you have the latest version of the `hyperref` package (i.e. update your LATEX installation/packages) or, alternatively, revert back to `\bibliographystyle{abbrv-doi}` (at the expense of removing hyperlinks from the bibliography) and try `\bibliographystyle{abbrv-doi-hyperref}` again after some more editing.