Global Illumination for Fun and Profit

Josiah S. Carberry, Ed Grimley, and Martha Stewart



Figure 1: Dramatic evening clouds. 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. 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 .

- *Josiah Carberry is with Brown University. E-mail: jcarberry@example.com*
- *Ed Grimley is with Grimley Widgets, Inc. E-mail: ed.grimley@example.com.*
- *Martha Stewart is with Martha Stewart Enterprises at Microsoft Research. E-mail: martha.stewart@example.com.*

Manuscript received xx xxx. 202x; accepted xx xxx. 202x. Date of Publication xx xxx. 202x; date of current version xx xxx. 202x. For information on obtaining reprints of this article, please send e-mail to: reprints@ieee.org. Digital Object Identifier: xx.xxxx/TVCG.202x.xxxxxxx

3 Hyperlinks and Cross References

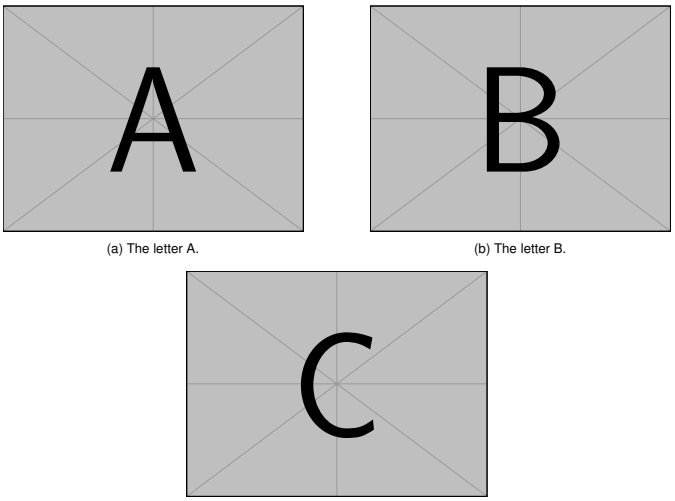
The style uses the `hyperref` package which can typeset clickable hyperlinks using `\href{...}{...}`, hyperlinked URLs using `\url{...}`, and turns references into internal links.

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 8, 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 8 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{clouds}` (instead of `\includegraphics{figs/clouds.jpg}`). Figures should



(a) The letter A. (b) The letter B.

(c) The letter C.

Figure 2: Example of adding subfigures with the `subcaption` package.

be in CMYK or Grey scale format, otherwise, colour shifting may occur during the printing process.

4.2 Vector figures

Vector graphics like `pdf` and `eps` (can be generated from a `svg`) 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:

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

Table 1: VIS/VisWeek accepted/presented papers: 1990–2025, data from vispubdata [2].

year	VIS (from 2021)	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
2025	131						75	12	218	131
2024	124						65	12	201	124
2023	133						60	9	202	133
2022	119						67	18	204	119
2021	109						50	11	170	109
2020		32		64	51	10	41	12	210	157
2019		25		53	42	9	47	12	188	129
2018		32		47	41	7	42	12	181	127
2017		23		39	37	15	21	8	143	114
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	**616**	**1657**	**9**	**835**	**481**	**91**	**591**	**131**	**4411**	**3689**

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 Reporting of User Studies

Please note that for the reporting of any experimental results that involve human participants you are **required** to "include a statement in the article that the research was performed under the oversight of an institutional review board or equivalent local/regional body, including the official name of the IRB/ethics committee, or include an explanation as to why such a review was not conducted. For research involving human subjects, authors shall also report that consent from the human subjects in the research was obtained or explain why consent was not obtained" [1, Section 8.1.1.E]. Ideally, for an IRB approval or similar, you include the case number under which the permission was granted.

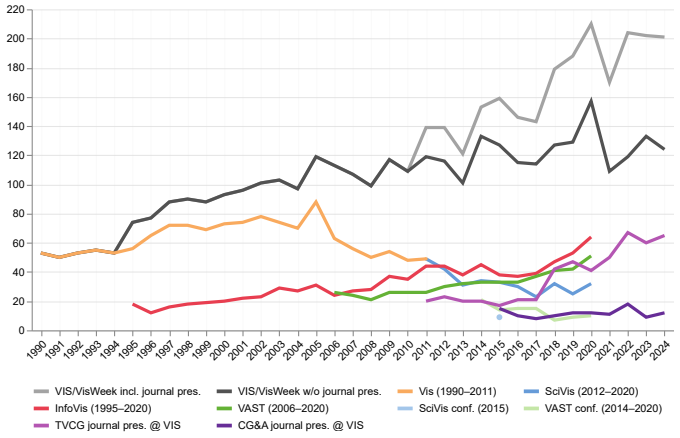


Figure 3: A visualization of the 1990–2024 data from Tab. 1, recreated based on Fig. 1 from [2].

For instance: "Our experiment was approved by our university's IRB (No. 12345678). [...] At the start of the experiment, we obtained informed consent from all participants, who filled in and signed a consent form (which we share in our additional materials)."

8 References

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

8.1 Include DOIs

All references which have a DOI (which are virtually all entries of a list of references today), by default, should have it included in the bibTeX file such that they are displayed in the list of references (as a courtesy for your reviewers and your readers). The DOI can be entered with or without the `https://doi.org/` prefix. Note that you can also use short DOIs; for these use the interface from `shortdoi.org` to obtain a short version of any valid DOI, as showcased in the example **References** section at the end of the template.

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

8.3 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.

8.4 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 [3, 5] (not [3] [5]). 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
  - (optionally) month of publication as variable name (i.e., `{jan}` for January, etc.; month ranges using `{jan #{/}# feb}` or `{jan #{--}# feb}`)
- Use journal names in proper style: correct: "`IEEE Transactions on Visualization and Computer Graphics`", incorrect: "`Visualization and Computer Graphics, IEEE Transactions on`", also incorrect: "`IEEE transactions on visualization and computer graphics`". You can also (consistently) use the ISO4 abbreviation standard for journal names. In this case TVCG would be "`IEEE Trans Vis Comput Graph`". You can search for ISO4 abbreviations at `journal-abbreviations.library.ubc.ca` or at `woodward.library.ubc.ca/woodward/research-help/journal-abbreviations` (if the full journal name is not available, search for its individual words).
- 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
- 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 (or short DOI, see Sec. 8.1) can be entered in the DOI field as plain DOI number or as DOI url.
  - "`articleno`" plus "`numpages`" or "`pages`": Provide full page ranges `AA--BB`. Alternatively, if an article number is available like for recent ACM conference publications, use that plus the corresponding number of pages instead (e.g., see the entry for Panavas et al. [6]).
- When citing references, do not use the reference as a sentence object; e.g., wrong: "In [4] the authors describe ...", correct: "Lorensen and Cline [4] describe ..."

9 Appendices

Appendices can be specified using `\appendix`. For example, our Troubleshooting instructions in Appx. 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 (not that, for IEEE VIS starting in 2026, you can optionally also submit an additional full version including the appendices). 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.

10 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.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque 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 `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 and Copyrights

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

Figure 1 image credit: Dominik Moritz, licensed under CC0. Figure 3 is a partial recreation of Fig. 1 from [2]. The new image is from `github.com/pisenberg/vispubdata` and we use it under a CC BY 4.0 license. All other figures (in particular, Fig. 2) remain under the authors' own copyright, with the permission to be used here. We also share them under a CC BY 4.0 license at `osf.io/2nbsg`.

Acknowledgments

The authors wish to thank A, B, and C. This work was supported in part by a grant from XYZ (# 12345-67890).

References

[1] IEEE Publications. *IEEE Publication Services and Products Board Operations Manual 2025*. IEEE, New York, 2025. 2

[2] P. Isenberg, F. Heimerl, S. Koch, T. Isenberg, P. Xu, C. Stolper et al. vispubdata.org: A metadata collection about IEEE visualization (VIS) publications. *IEEE Trans Vis Comput Graph*, 23(9):2199–2206, Sept. 2017. doi: 10/ggwwrv 2, 3, 4

[3] Kitware, Inc. *The Visualization Toolkit User's Guide*, Jan. 2003. 3

[4] W. E. Lorensen and H. E. Cline. Marching Cubes: A high resolution 3D surface construction algorithm. *ACM SIGGRAPH Comput Graph*, 21(4):163–169, Aug. 1987. doi: 10/ft9gsh 3

[5] N. Max. Optical models for direct volume rendering. *IEEE Trans Vis Comput Graph*, 1(2):99–108, June 1995. doi: 10/fm2mw5 3

[6] L. Panavas, A. E. Worth, T. Crnovrsanin, T. Sathyamurthi, S. Cordes, M. A. Borkin et al. Juvenile graphical perception: A comparison between children and adults. In *Proc. CHI*, art. no. 138, 14 pp. ACM, New York, 2022. doi: 10/nvzd 3

A About Appendices

Refer to Sec. 9 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). If this package update does not fix the error for you, you can use the `documentclass` option `protectagainstpdfendlink` such as as follows:

```
\documentclass[journal]{vgtc,protectagainstpdfendlink}
```

to set the LaTeX/bibTeX processing to avoid breaking reference entries in the list of references. Alternatively, you can revert back to `\bibliographystyle{abbrv-doi}` (at the expense of removing hyperlinks from the bibliography) and then to try `\bibliographystyle{abbrv-doi-hyperref}` again after some more editing.