



# Social Acceptance of Nomadic Virtual Reality

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## ABSTRACT

A clear and well-documented  $\LaTeX$  document is presented as an article formatted for publication by ACM in a conference proceedings or journal publication. Based on the “acmart” document class, this article presents and explains many of the common variations, as well as many of the formatting elements an author may use in the preparation of the documentation of their work.

## CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

## KEYWORDS

virtual reality, social acceptance, nomadic, field study

## ACM Reference Format:

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## 1 INTRODUCTION

New presentation methods like VR experience a growing trend as alternatives to conventional screens in different terminals like tablets or mobile phones. These devices are always improving in measurements, functionality, and appearance because of this, to accommodate the mobility of modern life. Although the development process of them is still far away from being finished VR devices might be prospectively used in the same way we already use mobile phones today, at

any time and everywhere. To achieve a broad utilization, it is not only important to focus on the unique user and establish hardware with high usability for the users themselves, but also something that fits all the tangentially involved people and their needs for well-being, comfort, and privacy. The most important issue to start with, which also is the topic of this paper, is the question about the current state of social acceptance of VR devices in public spaces. Before spreading out this type of gear and gaining the possibility of high sales output it is essential to find out if those devices are already accepted by society and which impacts they have on society.

In the paper “Virtual reality on the go?: a study on the social acceptance of VR glasses”[1] several researchers already tried to investigate this potential issue by showing pictures and videos of people wearing VR devices in public spaces to a group of test persons under laboratory conditions to find out more about their opinions, feelings, and reactions confronted with this subject. As we all know it is hard to put oneself in a position you only see on pictures. With the inspection of images, people will always keep a certain emotional distance to the context shown. The spontaneous confrontation with a previously completely unexpected situation in daily life might have another effect on their emotional acceptance. VR devices might be fully accepted by society, but it can also be that they evoke discomfort because people are not used to not see each other’s eyes while passing by or sitting next to them on the bench. Sunglasses of course act similar but since today’s VR goggles still, cover almost half of the wearers face it cannot be generalized and needs to be examined more accurate. In this paper, the mentioned issue will be reexamined using a field study to achieve a high validity not only in the laboratory but also in the open field.

## 2 RELATED WORK

As noted in the introduction, the “acmart” document class can be used to prepare many different kinds of documentation — a double-blind initial submission of a full-length technical paper, a two-page SIGGRAPH Emerging Technologies abstract, a “camera-ready” journal article, a SIGCHI Extended Abstract, and more — all by selecting the appropriate *template style* and *template parameters*.

This document will explain the major features of the document class. For further information, the *LaTeX User’s*

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*Guide* is available from <https://www.acm.org/publications/proceedings-template>.

## Template Styles

The primary parameter given to the “acmart” document class is the *template style* which corresponds to the kind of publication or SIG publishing the work. This parameter is enclosed in square brackets and is a part of the `documentclass` command:

```
\documentclass[STYLE]{acmart}
```

Journals use one of three template styles. All but three ACM journals use the `acmsmall` template style:

- `acmsmall`: The default journal template style.
- `acmlarge`: Used by JOCCH and TAP.
- `acmtog`: Used by TOG.

The majority of conference proceedings documentation will use the `acmconf` template style.

- `acmconf`: The default proceedings template style.
- `sigchi`: Used for SIGCHI conference articles.
- `sigchi-a`: Used for SIGCHI “Extended Abstract” articles.
- `sigplan`: Used for SIGPLAN conference articles.

## Template Parameters

In addition to specifying the *template style* to be used in formatting your work, there are a number of *template parameters* which modify some part of the applied template style. A complete list of these parameters can be found in the *LaTeX User’s Guide*.

Frequently-used parameters, or combinations of parameters, include:

- `anonymous, review`: Suitable for a “double-blind” conference submission. Anonymizes the work and includes line numbers. Use with the `\acmSubmissionID` command to print the submission’s unique ID on each page of the work.
- `authorversion`: Produces a version of the work suitable for posting by the author.
- `screen`: Produces colored hyperlinks.

This document uses the following string as the first command in the source file:

```
\documentclass[sigchi]{acmart}
```

## 3 STUDY: ACCEPTANCE OF NOMADIC VIRTUAL REALITY

As already mentioned VR devices represent a potential upcoming alternative to conventional screens in the mobile context. The specific target of this study was to examine more about the current state of social acceptance in the open field by confronting unprepared pedestrians with this topic

in different real life scenarios. This was done with the help of a field study because of our hypothesis that the procedure under laboratory conditions will have another result due to emotional distances.

## Study Design

The design of the study was a two-factorial within-subject design and conducted with the help of the three independent variables GENDER, WEARING OF VR-GOGGLES and PERFORMING GESTURES. The usage of VR devices does not only include the actual wearing of the goggles. Gesture control with the help of connected VR controllers is essential for the use of VR devices of any kind. Since performing those gestures might have a big impact on the acceptance this also was a very important issue to test to find out more about the general acceptance and how people react when being confronted with this situation. It is also important to investigate whether the gender of the wearer has an influence on the results or not.

## Stimuli

In earlier researches pictures and videoclips have been used for probing [1]. Since we wanted to extend those results and test their external validity we used confrontations in real life situations in the open field rather than representations of it. The first important stimuli was the gender. We wanted to find out if the gender itself plays an important role with the acceptance of such devices in general. Both genders have been tested without using any VR tools to get a baseline for upcoming steps and procedures. Another stimuli we used was the fact that both our actor and our actress will wear a VR goggle to test its influence on the pedestrians. Last but not least we tested the goggles in combination with controllers and gesture controls which is our final stimuli. In this study we combined those three stimuli to receive as much information as possible about peoples reactions on different types of situations.

## Survey Procedure

After handing out the informed consent, the randomly chosen participants obtained a short demographic questionnaire in which we request allegations to gender, age and job. Afterwards we handed out another Questionnaire to measure the acceptability of wearable devices [X]. The so-called WEAR Scale is a questionnaire that consists of several items to find out how acceptable a device is with regard to e.g. aesthetic itself, the wearers charisma it awakes and the own attitude towards the gadget. Subsequent each participant received a little thank-you gift.

## Participants

Because this study has not been researched under laboratory conditions it was not possible to recruit test persons. Another reason for us to not hire subjects was, that this would have not lead to the result we were looking for. We wanted to examine this Acceptance Rating by collection real life reactions and the opinions they might bear on. For this type of field study it was essential to blindside pedestrians in their daily life to receive an unbiased output.

## 4 TYPEFACES

The “acmart” document class requires the use of the “Liberation” typeface family. Your  $\TeX$  installation should include this set of packages. Please do not substitute other typefaces. The “lmodern” and “limes” packages should not be used, as they will override the built-in typeface families.

## 5 TITLE INFORMATION

The title of your work should use capital letters appropriately – <https://capitalizemytitle.com/> has useful rules for capitalization. Use the title command to define the title of your work. If your work has a subtitle, define it with the subtitle command. Do not insert line breaks in your title.

If your title is lengthy, you must define a short version to be used in the page headers, to prevent overlapping text. The title command has a “short title” parameter:

```
\title[short title]{full title}
```

## 6 AUTHORS AND AFFILIATIONS

Each author must be defined separately for accurate meta-data identification. Multiple authors may share one affiliation. Authors’ names should not be abbreviated; use full first names wherever possible. Include authors’ e-mail addresses whenever possible.

Grouping authors’ names or e-mail addresses, or providing an “e-mail alias,” as shown below, is not acceptable:

```
\author{Brooke Aster, David Mehldau}
\email{dave,judy,steve@university.edu}
\email{firstname.lastname@phillips.org}
```

The authornote and authornotemark commands allow a note to apply to multiple authors – for example, if the first two authors of an article contributed equally to the work.

If your author list is lengthy, you must define a shortened version of the list of authors to be used in the page headers, to prevent overlapping text. The following command should be placed just after the last `\author{}` definition:

```
\renewcommand{\shortauthors}{McCartney, et al.}
```

Omitting this command will force the use of a concatenated list of all of the authors’ names, which may result in overlapping text in the page headers.

The article template’s documentation, available at <https://www.acm.org/publications/proceedings-template>, has a complete explanation of these commands and tips for their effective use.

## 7 RIGHTS INFORMATION

Authors of any work published by ACM will need to complete a rights form. Depending on the kind of work, and the rights management choice made by the author, this may be copyright transfer, permission, license, or an OA (open access) agreement.

Regardless of the rights management choice, the author will receive a copy of the completed rights form once it has been submitted. This form contains  $\LaTeX$  commands that must be copied into the source document. When the document source is compiled, these commands and their parameters add formatted text to several areas of the final document:

- the “ACM Reference Format” text on the first page.
- the “rights management” text on the first page.
- the conference information in the page header(s).

Rights information is unique to the work; if you are preparing several works for an event, make sure to use the correct set of commands with each of the works.

## 8 CCS CONCEPTS AND USER-DEFINED KEYWORDS

Two elements of the “acmart” document class provide powerful taxonomic tools for you to help readers find your work in an online search.

The ACM Computing Classification System — <https://www.acm.org/publications/class-2012> — is a set of classifiers and concepts that describe the computing discipline. Authors can select entries from this classification system, via <https://dl.acm.org/ccs/ccs.cfm>, and generate the commands to be included in the  $\LaTeX$  source.

User-defined keywords are a comma-separated list of words and phrases of the authors’ choosing, providing a more flexible way of describing the research being presented.

CCS concepts and user-defined keywords are required for all short- and full-length articles, and optional for two-page abstracts.

## 9 SECTIONING COMMANDS

Your work should use standard  $\LaTeX$  sectioning commands: section, subsection, subsubsection, and paragraph. They should be numbered; do not remove the numbering from the commands.

Simulating a sectioning command by setting the first word or words of a paragraph in boldface or italicized text is **not allowed**.

Table 1: Frequency of Special Characters

Non-English or Math	Frequency	Comments
Ø	1 in 1,000	For Swedish names
π	1 in 5	Common in math
\$	4 in 5	Used in business
Ψ <sup>2</sup> <sub>1</sub>	1 in 40,000	Unexplained usage

10 TABLES

The “acmart” document class includes the “booktabs” package — <https://ctan.org/pkg/booktabs> — for preparing high-quality tables.

Table captions are placed *above* the table.

Because tables cannot be split across pages, the best placement for them is typically the top of the page nearest their initial cite. To ensure this proper “floating” placement of tables, use the environment **table** to enclose the table’s contents and the table caption. The contents of the table itself must go in the **tabular** environment, to be aligned properly in rows and columns, with the desired horizontal and vertical rules. Again, detailed instructions on **tabular** material are found in the *LaTeX User’s Guide*.

Immediately following this sentence is the point at which Table 1 is included in the input file; compare the placement of the table here with the table in the printed output of this document.

To set a wider table, which takes up the whole width of the page’s live area, use the environment **table\*** to enclose the table’s contents and the table caption. As with a single-column table, this wide table will “float” to a location deemed more desirable. Immediately following this sentence is the point at which Table 2 is included in the input file; again, it is instructive to compare the placement of the table here with the table in the printed output of this document.

11 MATH EQUATIONS

You may want to display math equations in three distinct styles: inline, numbered or non-numbered display. Each of the three are discussed in the next sections.

Inline (In-text) Equations

A formula that appears in the running text is called an inline or in-text formula. It is produced by the **math** environment, which can be invoked with the usual `\begin . . . \end` construction or with the short form `$ . . . $`. You can use any of the symbols and structures, from  $\alpha$  to  $\omega$ , available in  $\text{\LaTeX}$  [22]; this section will simply show a few examples of in-text equations in context. Notice how this equation:  $\lim_{n \rightarrow \infty} x = 0$ , set here in in-line math style, looks slightly different when set in display style. (See next section).

Display Equations

A numbered display equation—one set off by vertical space from the text and centered horizontally—is produced by the **equation** environment. An unnumbered display equation is produced by the **displaymath** environment.

Again, in either environment, you can use any of the symbols and structures available in  $\text{\LaTeX}$ ; this section will just give a couple of examples of display equations in context. First, consider the equation, shown as an inline equation above:

$$\lim_{n \rightarrow \infty} x = 0$$

(1)

Notice how it is formatted somewhat differently in the **displaymath** environment. Now, we’ll enter an unnumbered equation:

$$\sum_{i=0}^{\infty} x + 1$$

and follow it with another numbered equation:

$$\sum_{i=0}^{\infty} x_i = \int_0^{\pi+2} f$$

(2)

just to demonstrate  $\text{\LaTeX}$ ’s able handling of numbering.

12 FIGURES

The “figure” environment should be used for figures. One or more images can be placed within a figure. If your figure contains third-party material, you must clearly identify it as such, as shown in the example below.



Figure 1: 1907 Franklin Model D roadster. Photograph by Harris & Ewing, Inc. [Public domain], via Wikimedia Commons. (<https://goo.gl/VLCRBB>).

Your figures should contain a caption which describes the figure to the reader. Figure captions go below the figure. Your

Table 2: Some Typical Commands

Command	A Number	Comments
<code>\author</code>	100	Author
<code>\table</code>	300	For tables
<code>\table*</code>	400	For wider tables

figures should **also** include a description suitable for screen readers, to assist the visually-challenged to better understand your work.

Figure captions are placed *below* the figure.

The “Teaser Figure”

A “teaser figure” is an image, or set of images in one figure, that are placed after all author and affiliation information, and before the body of the article, spanning the page. If you wish to have such a figure in your article, place the command immediately before the `\maketitle` command:

```
\begin{teaserfigure}
\includegraphics[width=\textwidth]{sampleteaser}
\caption{figure caption}
\Description{figure description}
\end{teaserfigure}
```

13 CITATIONS AND BIBLIOGRAPHIES

The use of  $\text{\LaTeX}$  for the preparation and formatting of one’s references is strongly recommended. Authors’ names should be complete — use full first names (“Donald E. Knuth”) not initials (“D. E. Knuth”) — and the salient identifying features of a reference should be included: title, year, volume, number, pages, article DOI, etc.

The bibliography is included in your source document with these two commands, placed just before the `\end{document}` command:

```
\bibliographystyle{ACM-Reference-Format}
\bibliography{bibfile}
```

where “bibfile” is the name, without the “.bib” suffix, of the  $\text{\LaTeX}$  file.

Citations and references are numbered by default. A small number of ACM publications have citations and references formatted in the “author year” style; for these exceptions, please include this command in the **preamble** (before “`\begin{document}`”) of your  $\text{\LaTeX}$  source:

```
\citestyle{acmauthoryear}
```

Some examples. A paginated journal article [2], an enumerated journal article [8], a reference to an entire issue [7], a monograph (whole book) [21], a monograph/whole book in a series (see 2a in spec. document) [15], a divisible-book such as an anthology or compilation [11] followed by the same example, however we only output the series if the volume

number is given [12] (so Editor00a’s series should NOT be present since it has no vol. no.), a chapter in a divisible book [33], a chapter in a divisible book in a series [10], a multi-volume work as book [20], an article in a proceedings (of a conference, symposium, workshop for example) (paginated proceedings article) [3], a proceedings article with all possible elements [32], an example of an enumerated proceedings article [13], an informally published work [14], a doctoral dissertation [6], a master’s thesis: [4], an online document / world wide web resource [1, 26, 34], a video game (Case 1) [25] and (Case 2) [24] and [23] and (Case 3) a patent [31], work accepted for publication [28], ‘YYYYb’-test for prolific author [29] and [30]. Other cites might contain ‘duplicate’ DOI and URLs (some SIAM articles) [19]. Boris / Barbara Beeton: multi-volume works as books [17] and [16]. A couple of citations with DOIs: [18, 19]. Online citations: [34–36]. Artifacts: [27] and [5].

14 ACKNOWLEDGMENTS

Identification of funding sources and other support, and thanks to individuals and groups that assisted in the research and the preparation of the work should be included in an acknowledgment section, which is placed just before the reference section in your document.

This section has a special environment:

```
\begin{acks}
...
\end{acks}
```

so that the information contained therein can be more easily collected during the article metadata extraction phase, and to ensure consistency in the spelling of the section heading.

Authors should not prepare this section as a numbered or unnumbered `\section`; please use the “acks” environment.

15 APPENDICES

If your work needs an appendix, add it before the “`\end{document}`” command at the conclusion of your source document.

Start the appendix with the “appendix” command:

```
\appendix
```

and note that in the appendix, sections are lettered, not numbered. This document has two appendices, demonstrating the section and subsection identification method.

## 16 SIGCHI EXTENDED ABSTRACTS

The “sigchi-a” template style (available only in  $\text{\LaTeX}$  and not in Word) produces a landscape-orientation formatted article, with a wide left margin. Three environments are available for use with the “sigchi-a” template style, and produce formatted output in the margin:

- sidebar: Place formatted text in the margin.
- marginfigure: Place a figure in the margin.
- margintable: Place a table in the margin.

## ACKNOWLEDGMENTS

To Robert, for the bagels and explaining CMYK and color spaces.

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## A RESEARCH METHODS

### Part One

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi malesuada, quam in pulvinar varius, metus nunc fermentum urna, id sollicitudin purus odio sit amet enim. Aliquam ullamcorper eu ipsum vel mollis. Curabitur quis dictum nisl. Phasellus vel semper risus, et lacinia dolor. Integer ultricies commodo sem nec semper.

### Part Two

Etiam commodo feugiat nisl pulvinar pellentesque. Etiam auctor sodales ligula, non varius nibh pulvinar semper. Suspendisse nec lectus non ipsum convallis congue hendrerit vitae sapien. Donec at laoreet eros. Vivamus non purus placerat, scelerisque diam eu, cursus ante. Etiam aliquam tortor auctor efficitur mattis.

## B ONLINE RESOURCES

Nam id fermentum dui. Suspendisse sagittis tortor a nulla mollis, in pulvinar ex pretium. Sed interdum orci quis metus euismod, et sagittis enim maximus. Vestibulum gravida massa ut felis suscipit congue. Quisque mattis elit a risus ultrices commodo venenatis eget dui. Etiam sagittis eleifend elementum.

Nam interdum magna at lectus dignissim, ac dignissim lorem rhoncus. Maecenas eu arcu ac neque placerat aliquam. Nunc pulvinar massa et mattis lacinia.