Package paracol:
Yet Another Multi-Column Package to Typeset Columns in *Parallel*

Hiroshi Nakashima
(Kyoto University)

翻译:virhuiai
(福建师范大学)

version 1.35: 2018/12/31

摘要

This package provides a LaTeX environment named `paracol` in which you may *switch* and *synchronize* columns by a command `\switchcolumn` and by internal environments `column`, `nthcolumn`, `leftcolumn` and `rightcolumn`. See p. 63 for the table of contents of this manual.

本宏包提供了一个名为 `paracol` 的 LaTeX 环境，在其中你可以通过命令 `\switchcolumn` 和内部环境 `column`、`nthcolumn`、`leftcolumn` 和 `rightcolumn` 来切换和同步列。请参考第 63 页的本手册目录。

1 Introduction 介绍

```
\columnratio{0.3,0.42,0.28}
\begin{paracol}{3}[\section{Introduction\hfill 介绍}]
\begin{Verbatim}
左侧源码
\end{Verbatim}
\switchcolumn
This document..
\switchcolumn
本文档..
\switchcolumn[1]
Suppose ...
\switchcolumn
假设...
\end{paracol}
```

This document describes the usage of yet another multi-column package named paracol. The unique feature of the package is that columns are typeset *in parallel.*

本文档介绍了另一个名为 paracol 的多栏排版宏包的使用方法。该宏包的独特特点是可以将栏以并行的方式排版。

Suppose you are writing a bilingual document whose left column is written in a language, say English, and right column has the translation of the left column in another language, e.g., Japanese. With the paracol package you may write an English part of arbitrarily length and then *switch* to its Japanese counterpart to place both parts side by side. Of course you may return to the English writing similarly.

假设你正在撰写一份双语文档，左栏使用一种语言（如英语），右栏则是左栏的另一种语言（如日语）的翻译。使用 paracol 宏包，你可以先写任意长度的英文部分，然后切换到对应的日文部分，将两部分并排放置在一起。当然，你也可以类似地返回到英文撰写。

The *column-switching* is always allowed when you complete an outermost level paragraph. You may be unaware whether a column is broken into multiple pages before switching because the package automatically goes back and forward to the correct page and vertical position when you switch the column. Moreover, you may *synchronize* columns so that the tops of the first paragraphs after switching in all columns are vertically aligned. At a synchronization point, you may give a single-column text, for example a common section header, optionally. You may also switch single-column and multi-column in a page arbitrary.

在外层段落完成后，总是允许使用 *column-switching* 命令。在切换之前，你可能不知道栏是否被分成多个页面，因为当你切换栏时，宏包会自动回到正确的页面和垂直位置。此外，你可以通过 *synchronize* 命令来使列对齐，这样在切换后，所有列中第一个段落的顶部会垂直对齐。在 synchronization 点，你可以选择给出单栏文本，例如一个公共的章节标题。你还可以随意在页面上切换单栏和多栏排版。

This manual itself is an example of two-column documents typeset by paracol. Since the author is not familiar with languages other than English and Japanese and the latter should be hardly understood by most of readers, the right column is the translation of the left English column into a computational language. That is, the right column is the LaTeX source code of the left column[1].

该手册本身是使用 paracol 排版的双栏文档的一个示例。由于作者对英语和日语以外的语言不熟悉，并且后者可能很难被大多数读者理解，所以右栏是左侧英文栏的计算语言翻译。也就是说，右栏是左栏的 LaTeX 源代码[1]。

[1] Not really but its essence is shown.

[1] 虽然不完全准确，但其本质得以展示。virhuiai 在翻译时，做成了三栏，第一栏是源代码，第二栏是英文，第三栏是中文。

2 Basic Usage

基本用法

```
\section{Basic Usage\hfill 基本用法}
\columnratio{0.2,0.48}
\begin{paracol}{3}
\begin{Verbatim}
左侧源码
\end{Verbatim}
\switchcolumn
Loading..
\switchcolumn
加载...
\switchcolumn[1]*
The fundamental...
\switchcolumn
并列...
\end{paracol}
```

Loading the package is very simple. What you have to do is `\usepackage{paracol}` in the preamble. Note that paracol can be used with LaTeX 2$_\varepsilon$ and does not work with LaTeX 2.09.

加载该宏包非常简单。在导言区使用 `\usepackage{paracol}` 命令即可。请注意，paracol 可以与 LaTeX 2$_\varepsilon$ 一起使用，不支持 LaTeX 2.09。

The fundamental means of parallel-column typesetting are the environment `paracol` and the command `\switchcolumn`. The `paracol` environment needs an argument to specify the number of columns. Thus the following is the basic construct for two-parallel-column documents.

并列栏排版的基本手段是使用 `paracol` 环境和命令 `\switchcolumn`。`paracol` 环境需要一个参数来指定栏的数量。因此，以下是两栏并列文档的基本结构。

```
\begin{paracol}{2}
left column text
\switchcolumn
right column text
\switchcolumn
left column text
\switchcolumn
right column text
\switchcolumn
        ⋮
\end{paracol}
```

```
\begin{paracol}{2}
左栏文本
\switchcolumn
右栏文本
\switchcolumn
左栏文本
\switchcolumn
右栏文本
\switchcolumn
        ⋮
\end{paracol}
```

The `\switchcolumn` command may have an optional argument to specify the column number (zero origin) to start. That is, `\switchcolumn[0]` means to switch to the leftmost column, `\switchcolumn[1]` is to start the second column and so on. Thus the `\switchcolumn` without the optional argument may be considered as `\switchcolumn[`$i+1 \bmod n$`]` where i is the ordinal of the column you are leaving from and n is the number of columns given to `paracol` environment.

`\switchcolumn` 命令可以带有可选参数来指定从第几栏（从零开始计数）开始切换。也就是说，`\switchcolumn[0]` 表示切换到最左边的栏，`\switchcolumn[1]` 表示从第二栏开始，依此类推。因此，不带可选参数的 `\switchcolumn` 可以视为 `\switchcolumn[`$i+1 \bmod n$`]`，其中 i 是你离开的栏的序号，n 是给定给 `paracol` 环境的栏数。

3 Column Synchronization

栏同步

```
\columnratio{0.3,0.42,0.28}
\begin{paracol}{3}
第 1 栏
\switchcolumn
第 2 栏
\switchcolumn
第 3 栏

\switchcolumn[0]*
同步 ...
\switchcolumn
...
\end{paracol}
```

The `\switchcolumn` command may also be followed by a '`*`' to *synchronize* columns. After you switch from a column to another by `\switchcolumn*` (or `\switchcolumn[`i`]*`), all the columns are vertically aligned at the bottom of the *deepest* one preceding the command. For example, the previous section has three `\switchcolumn*` commands at which left and right columns are vertically aligned.

`\switchcolumn` 命令后面可以加上 '`*`'，用来同步栏。当你使用 `\switchcolumn*`（或 `\switchcolumn[`i`]*`）从一栏切换到另一栏时，所有栏都会垂直对齐在该命令之前最深的栏的底部。例如，前一节使用了三个 `\switchcolumn*` 命令，使左右两栏垂直对齐。

The *starred* version of `\switchcolumn` may have an optional argument to specify a single-column *spanning text* whose bottom is the vertical alignment point of columns. For example, `\section` commands in this manual are given as optional arguments of `\switchcolumn*` like;
`\switchcolumn*[\section{Basic Usage}]`

带星号版本的 `\switchcolumn` 命令可以带有可选参数，用来指定一个单栏的同步文本，其底部作为栏的垂直对齐点。例如，本手册中的 `\section` 命令作为 `\switchcolumn*` 的可选参数给出，如下所示：
`\switchcolumn*[\section{基础用法}]`

The `paracol` environment may also start with a spanning text by specifying it as the optional argument of `\begin{paracol}`. For example, at the beginning of this document, the author put;

`paracol` 环境也可以以一个 spanning text 开始，将其指定为 `\begin{paracol}` 的可选参数。例如，在本文档的开头，作者使用了以下代码：

```
...
\begin{column*}[\section{Environments for Columns}]
...
\end{column*}
\begin{column}
...
\end{column}
```

```
\begin{nthcolumn*}{1}
\subsection{Environment \texttt{nthcolumn}}
source
\end{nthcolumn*}

\begin{leftcolumn*}
\begin{Verbatim}
左侧源码
\end{Verbatim}
\end{leftcolumn*}
\begin{rightcolumn}
\subsection...
The environments...
\end{rightcolumn}
\switchcolumn
\subsection{...
环境 ...
```

```
\begin{paracol}{2}[\section{Introduction}]
```

4 Environments for Columns

4.1 Environment column

The \switchcolumn is simple but you may prefer to pack the contents of a column in an environment. The column environment is available for this well-structuralization of LaTeX sources for parallel-columned documents. A construct;

```
\begin{column}
text for a column
\end{column}
```

is (almost) equivalent to;

```
\switchcolumn
text for a column
```

The column* environment is also available for the column synchronization and may have an optional argument for spanning text.

4.2 Environment nthcolumn

The \switchcolumn can start an arbitrarily specified column with the column number given through its optional argument, but the column environment cannot do it. If you want to start i-th column, you have to do \begin{nthcolumn}{i} (or nthcolumn* with an optional argument to synchronize).

4.3 Environments leftcolumn and rightcolumn

The environments leftcolumn and rightcolumn (and their starred versions with an optional argument) are available as more convenient means than saying \begin{nthcolumn}{0} to switch to the left(most) column and \begin{nthcolumn}{1} to the right (but may not be rightmost) one.

```
\begin{paracol}{2}[\section{介绍}]
```

栏环境

4.1 column 环境

\switchcolumn 命令很简单，但你可能更喜欢将一个栏的内容封装在一个环境中。column 环境可以用于在 LaTeX 文档中良好地组织并列栏的内容。以下结构：

```
\begin{column}
栏中文字
\end{column}
```

（几乎）等同于：

```
\switchcolumn
栏中文字
```

column* 环境也可用于栏的同步，并且可以有一个可选参数用于跨栏文本。

4.2 nthcolumn 环境

\switchcolumn 可以通过可选参数指定要开始的任意列的列号，但 column 环境不能这样做。若你想要开始第 i 列，你要使用 \begin{nthcolumn}{i}（或带有可选参数的 nthcolumn* 来进行同步）。

4.3 leftcolumn 和 rightcolumn 环境

环境 leftcolumn 和 rightcolumn（以及带有可选参数的星号版本）可作为比使用 \begin{nthcolumn}{0} 切换到最左栏和 \begin{nthcolumn}{1} 切换到右栏 (可能不是最右) 更方便的方法。

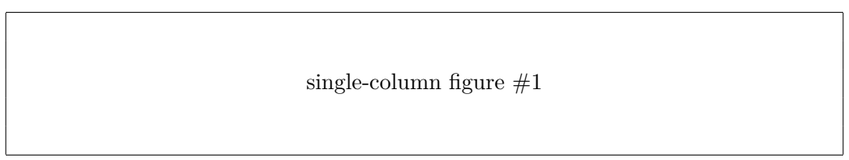

图 2: A Single-Column Figure

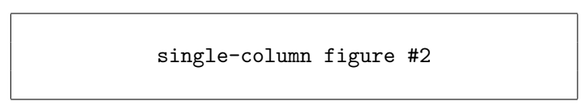

图 3: Another Single-Column Figure

three-column figure #1

图 1: A Three-Column Figure

5 Floats, Footnotes and Counters

```
\switchcolumn[0]*
\begin{figure*}\nosv
\def\arraystretch{0.8}
\centerline{\begin{tabular}[b]{|c|}\hline
    \hbox to.9\textwidth{}\\
    three-column figure \#1\\
    \\\hline
    \end{tabular}}
\caption{A Three-Column Figure}
\end{figure*}

\switchcolumn
\begin{figure}[t]\nosv
\def\arraystretch{0.8}
\centerline{\begin{tabular}[b]{|c|}\hline
    \hbox to.9\columnwidth{}\\\\
    single-column figure \#1\\
    \\\\\hline
    \end{tabular}}
\caption{A Single-Column Figure}
\end{figure}

\switchcolumn
\begin{figure}[t]\nosv
\def\arraystretch{0.8}
\centerline{\begin{tabular}[b]{|c|}\hline
    \hbox to.9\columnwidth{}\\
    \ttfamily single-column figure \#2\\
    \\\hline
    \end{tabular}}
\caption{\ttfamily Another Single-Column Figure}
\end{figure}
```

5.4 Figures and Tables

Double-column figures/tables (or those spanned multiple columns if you have three or more) may be placed by `figure*` and `table*` environments as usual[2].

A single-column figure/table will be placed in the column in which you put `figure` and `table`. For example, the body of a `figure` environment in a `leftcolumn` environment is *always* placed in a left column. That is, even if the column of the *current* page does not have enough room to place the figure, it will not be thrown to the right column but will be placed in the left column of the next page[3].

Another caution about float placement is that you have to be careful when you try to put a top-float explicitly with `t`-option or implicitly without placement option (i.e., `tbp` in most classes) and to synchronize columns. The rule is as follows; after you synchronize columns in a page, the page cannot have top-floats any more. When you synchronize columns, paracol fixes a virtual horizontal line in the page as the synchronization barrier. Thus no top-floats cannot be added above the line[4].

Therefore, the author put two `figure` environments for the figures shown in this page into the `leftcolumn*` and `rightcolumn` environment for the previous section.

5.5 Footnotes and Marginal Notes

Footnotes are also put at the bottom of the column in which `\footnote` commands and their references reside (like this[5]),

as shown in page 1 and this page. Marginal notes behave similarly like what you are seeing in the left margin of this sentence

[2]See Section 11 for the appearance order issue of double-column floats.
[3]Or some farther page if LaTeX cannot solve the placement problem wisely.
[4]Even if you have enough space above, sorry.
[5]Unless you specify to make footnotes *page-wise* as explained in Section 7.6 and 8.

表 1: A Single-Column Table

An	example	of
single	column	table

5.4 图表

双栏图表 (如果有三栏或更多栏，则为跨多栏的图表) 可以像往常一样使用 `figure*` 和 `table*` 环境来放置[2]。

单栏图表将放置在你放置 `figure` 和 `table` 环境的栏中。例如，在 `leftcolumn` 环境中的 `figure` 环境中的内容将始终放置在左栏中。也就是说，即使当前页面的栏没有足够的空间放置图表，它也不会被放置在右栏，而是会放置在下一页的左栏[3]。

关于浮动位置的另一个警告是，当你试图使用 `t` 选项显式地放置一个顶部浮动，或者不使用放置选项隐式地放置 (即，在大多数类中的 `tbp`)，并且要同步列时，你必须小心。规则如下：在你在一个页面中同步列后，该页面不能再有顶部浮动。当你同步列时，paracol 在页面中固定一个虚拟的水平线作为同步屏障。因此，不能在该线以上添加顶部浮动[4]。

因此，作者将在上一节的 `leftcolumn*` 和 `rightcolumn` 环境中放入本页显示的两个 `figure` 环境。

5.5 脚注和边注

脚注也会放置在包含 `\footnote` 命令及其引用的栏的底部 (如本页所示[5])，

如第 1页和本页所示。边注表现类似于你看到的这句话左 margin 中的样式

[2]请参见第 11 节有关双栏浮动体出现顺序问题的内容。
[3]如果 LaTeX 无法明智地解决放置问题，则可能放置在更远的页面上。
[4]即使你在上方有足够的空间，抱歉。
[5]除非你在第 7.6 节和 8 节中指定将脚注按页处理。

An example of marginal note.
一个边注示例。

表 2: `Another Single-Column Table`

Another	example
of	single
column	table

and the right marginal note in this page[6].

[6] If you have three or more columns, marginal notes of the second or succeeding columns are placed in the right margin in default setting. The paracol package solves the placement problem of marginal notes from two or more columns sharing a side margin by moving some of them down if they conflict over the space with each other.

5.6 Local and Global Counters

You probably found that the numbering of figures and tables is *global* while that of footnotes are *local*. That is, the figure in the right column of the previous page has number 3 following its left-column counterpart Figure 2. The tables in the page are also numbered as 1 and 2 crossing the column boundary. However, the footnotes in each column have their own numbering sequence. Moreover, the footnote numbers in left columns are typeset in roman font while those in right columns have italic shapes. Similarly, subsection numbering is local and the headings in right columns have typewriter-face numbers.

```
\globalcounter{figure}
\globalcounter{table}
```

This happens because the author declared the counters `figure` and `table` are *global* in the preamble of this document by saying;

and do nothing about `footnote` and `subsection` counters. By default, all the counters except for `page` are local to columns. The value of a local counter of a column is saved somewhere when you leave the column, and it is restored when you revisit the column. The initial values of the local counters are the values they have at `\begin{paracol}`. After you close the `paracol` environment, the values of the leftmost column are used for the rest of your document until you start new `paracol` environment. On a restart, local counters in a column have the values they had at the last `\end{paracol}`, except for those which have been modified outside the environment because the modifications are *broadcasted* to local counters in all columns. You will see the effect of this inter-environment counter value conservation in the footnote numbers in the right column in page **??** and 8.

This broadcasting of a local counter value can be done explicitly in `paracol` environments by a command `\synccounter{`*ctr*`}`. This command makes *ctr* in all columns have the value of that in the column in which the command appears. In addition, another command `\syncallcounters` performs this broadcasting for all local counters.

If you make a counter global by the command `\globalcounter`, the save/restore operations are not performed to the counter and thus it is globally incremented by `\[ref]stepcounter` or commands such as `\caption` and `\section`.

Note that the value of a global counter depends on the place where it is incremented (or set) in the *source code* rather than where it appears in the output. Thus if the author put a `table` environment here to increment `table` counter, the right-column table at the bottom of page 5 would be Table 3 because its `table` environment does not appear yet in the source code. Note that, however, though the counter `page` is global as expected, its numbering is consistent among all columns as far as you refer to the value by `\pageref{`*label*`}` and/or see the values in table of contents, etc.

Another counter which the author made global in this document is `section`. As explained

以及本页中的右边距注释[6]。

[6] 如果你有三列或更多列，第二列或后续列的边距注释在默认设置中放置在右边距。paracol 包处理来自两个或更多共享侧边距的列的边距注释的放置问题，如果它们在空间上彼此冲突，将其中一些向下移动。

5.6 局部和全局计数器

你可能发现，图表的编号是全局的，而脚注的编号是局部的。也就是说，上一页右栏的图表在其左栏对应的图表之后编号为 3，而页面上的表格也是以 1 和 2 为编号跨越栏边界。然而，每栏中的脚注有自己的编号序列。此外，左栏中的脚注号码以罗马字体排版，而右栏中的脚注号码以斜体形式排版。类似地，小节编号是局部的，右栏标题的编号使用打字机字体。

这是因为作者在文档的导言部分中声明了计数器 `figure` 和 `table` 是全局的，声明首栏所示。

但对于计数器 `footnote` 和 `subsection` 未进行任何处理。默认情况下，除了 `page` 计数器外，所有的计数器都是局部的。当你离开栏目时，栏目的局部计数器值会被保存住，当你再次访问该栏目时，该值会被恢复。在 `paracol` 环境的初始值为局部计数器的值。当你关闭 `paracol` 环境后，剩余部分的文档将使用最左边栏的值，直到你开始新的 `paracol` 环境。重新开始时，栏目中的局部计数器具有最后一个 `\end{paracol}`时的值，除非在环境外进行了修改，因为这些修改会被广播到所有栏的局部计数器中。你将在第**??**页和第 8页中看到这种跨环境计数值保存的效果，表现在右栏的脚注号码上。

可以在 `paracol`环境中通过命令 `\synccounter{`*ctr*`}` 来显式地进行局部计数器值的广播。所有栏中的 *ctr* 都将同步为命令调用所在栏中的值。此外，另一个命令 `\syncallcounters` 可以对所有局部计数器进行这种广播操作。

若用 `\globalcounter` 声明某计数器为全局的，则不会对其执行保存/恢复操作，它会通过 `\[ref]stepcounter` 全局递增。或者诸如 `\caption` 和 `\section` 等命令。

请注意，一个全局计数器的值取决于它在源代码中递增（或设置）的位置，而不是它在输出中出现的位置。因此，如果作者在这里放置了一个 `table`环境来递增 `table`计数器，那么在第 5页底部的右栏表格将被标记为表格 3，因为它的 `table`环境在源代码中尚未出现。请注意，尽管计数器 `page` 是全局的，但只要通过 `\pageref{`*label*`}` 引用该值，或者在目录中查看值等，其编号在所有栏目中是一致的。

在本文档中，作者还将 `section` 计数器声明为全局的。如

in Section 3, an optional spanning text of column-switching is considered as in the leftmost column. Since `\section` commands in this document are always given in spanning texts, so far, it seems unnecessary to make `section` global because it is incremented correctly in the leftmost column. However, the stepping `section` has a side effect to reset its descendent counter `subsection` and referred to from `\thesubsection` command. Thus if `section` were local, the right-column subsections in Section 4 would be numbered as "0.1", "0.2" and "0.3" because the local value of `section` would be zero. Moreover, the right-column subsections of this section would be "0.4", "0.5" and "0.6" because stepping `section` local to the left column would not reset `subsection` local to the right column.

第 3节所述，column-switching的可选 spanning text被视为最左边的栏目。由于本文档中的 `\section` 命令总是在 spanning text中给出，因此目前似乎没有必要将 `section`设置为全局，因为它在最左边的栏目中递增是正确的。然而，递增 `section`会对其子计数器 `subsection` 产生副作用，并且从 `\thesubsection` 命令中引用。因此，如果 `section`是局部的，那么在第 4节中右栏的子章节将被编号为"0.1"、"0.2"和"0.3"，因为 `section` 的局部值将为零。此外，本节的右栏子章节将被编号为 "0.4"、"0.5" 和 "0.6"，因为局部递增的 `section` 不会重置右栏局部的 `subsection`。

You may give a local appearance to a counter *ctr* for the *i*-th column (zero origin) by a command;

`\definethecounter{`*ctr*`}{`*i*`}{`*def*`}`

你可以通过命令给第 *i* 栏目（从零开始计数）的计数器 *ctr* 赋予局部的外观；

where *def* is to be the body of the local definition of `\the`*ctr*. For example, the preamble of this document has the following to give non-default defitions to `\thefootnote` and `\thesubsection` for right columns.

```
\definethecounter{footnote}{1}{%
\textit{\arabic{footnote}}}
\definethecounter{subsection}{1}{%
\texttt{%
\arabic{section}.\arabic{subsection}}}
```

其中 *def* 是局部定义`\the`*ctr* 的内容。例如，本文档的导言部分具有以下内容，为右栏的`\thefootnote`和`\thesubsection`赋予非默认的定义。

6 Closing `paracol` Environment and Page Flushing 关闭 `paracol` 环境和页面刷新

The final example shown here is this single-column text which the author put after the `paracol` environment above is closed. As you are seeing, a `paracol` environment can be finished at any vertical position in a page and can be followed by ordinary single column texts.

这里展示的最后一个例子是在上面关闭的 `paracol` 环境之后，作者放置的这个单栏文本。正如你所见，`paracol` 环境可以在页面的任何垂直位置结束，并且可以跟随普通的单栏文本。

```
\begin{paracol}{2}
\begin{leftcolumn}
The enviro ...
\end{leftcolumn}
\begin{rightcolumn}
source
\end{rightcolumn}
\end{paracol}
Now the aurthor will do ...
```

The environment may also be restarted anywhere you like as shown here.

此处展示了环境可以在任何位置重新开始。

The last issue is to flush a page. The ordinary `\newpage` command works as you expect. If you say `\newpage` in the left column in a page, the contents following it will appear in the left column in the next page. Note that this does not affect the layout of the right column.

最后一个问题是如何换页。`\newpage` 命令按照你的期望工作。如果你在页面的左栏使用 `\newpage` 命令，在它之后的内容将出现在下一页的左栏中。请注意，这不会影响右栏的布局。

To flush all columns in a page, a command `\flushpage` is available. This command in *i*-th column is almost equivalent to;

`\switchcolumn[`*i*`]*[\newpage]`

要在页面中刷新所有栏目，可以使用命令 `\flushpage`。这个命令在第 *i* 栏中几乎等同于：

`\switchcolumn[`*i*`]*[\newpage]`

but more robust[7]. The ordinary page breaking command `\clearpage` may also be used to flush all columns and to start a fresh page, but it has a side effect to put all figures and tables which are not yet output.

但更加健壮 [7] 。普通的换页命令 `\clearpage` 也可以用于刷新所有栏目并开始新的一页，但它会导致尚未输出的所有图表被放置在同一页中。

Now the author will do `\flushpage` shortly to start a real binlingual example from the next page, after showing another example of closing `paracol` environments in this sentence and of restarting in the next one, in which

unbalanced column width is demonstrated using `\columnratio` command shown in Section 7.3.

现在作者将很快使用`\flushpage` 命令，在下一页开始一个真正的双语示例，此前在本句中展示了另一个关闭 `paracol`环境的例子，并在下一句中重新开始，在其中使用了在第 7.3节中展示的 `\columnratio` 命令演示了不平衡的列宽。

```
\columnratio{0.6}
\begin{paracol}{2}
\begin{leftcolumn}
O.K., ...
\end{leftcolumn}
\begin{rightcolumn}
source
\end{rightcolumn}
```

O.K., we have restarted `paracol` environment and we will see the effect of `\flushpage` now!!

好的，我们已经重新开始了 `paracol`环境，现在我们将看到 `\flushpage` 命令的效果!!

[7]For example `\switchcolumn*` may flush a page for the synchronization and thus `\newpage` may leave an empty page.

[7]例如，`\switchcolumn*` 可能会为同步而刷新页面，因此`\newpage` 可能会留下一个空白页。

An Die Freude/To Joy

Friedrich Schiller 弗里德里希・席勒

The following is the libretto of the fourth movement of Beethoven's Ninth Symphony, his adaptation of Schiller's ode "An Die Freude" (or "To Joy" in English). Beethoven's additions and revisions are indicated in italics.

以下是贝多芬第九交响曲第四乐章的歌剧剧本，他改编自席勒的颂歌《致欢乐》(或英文版的《To Joy》)。贝多芬的添加和修订以斜体显示。

O Freunde, nicht diese Töne!
Sondern laßt uns angenehmere anstimmen und freudenvollere[1].

哦，朋友们，不要这样的音调！
让我们唱出更美妙、更充满欢乐的旋律[8]。

Oh friends, no more of these sad tones!
Let us rather raise our voices together
In more pleasant and joyful tones[8].

哦，朋友们，不要再唱这些悲伤的音调了！
让我们一起高声歌唱
用更愉悦和欢乐的音调 [8]。

Freude!
Freude, schöner Götterfunken Tochter aus Elysium,
Wir betreten feuertrunken, Himmlische, dein Heiligtum!
Deine Zauber binden wieder, *Was die Mode streng geteilt;*
Alle Menschen werden Brüder[2], Wo dein sanfter Flügel weilt

喜悦！
喜悦，美丽的神圣火花来自埃利西乌姆的女儿，
我们陶醉于烈焰之中，神圣的，我们踏入你的圣殿！
你的魔力再次将它们连接在一起，那些被世俗严格分开的；
所有的人将成为兄弟[9]，在你柔和的翅膀停留的地方

Joy!
Joy, thou shining spark of God,
Daughter of Elysium,
With fiery rapture, goddess,
We approach thy shrine.
Your magic reunites
That which stern custom has parted;
All humans will become brothers[9]
Under your protective wing.

喜悦！
喜悦，你是上帝的明亮火花，
ß 来自埃利西乌姆的女儿，
带着炽热的狂喜，女神，
我们接近你的圣地。
你的魔力使得
被严厉的习俗所分开的；
所有人将成为兄弟[9]
在你保护的翅膀下团聚。

Wem der große Wurf gelungen, eines Freundes Freund zu sein;
Wer ein holdes Weib errungen, mische seinen Jubel ein!
Ja, wer auch nur eine Seele sein nennt auf dem Erdenrund!
Und wer's nie gekonnt, der stehle weinend sich aus diesem Bund!

谁获得了伟大的机遇，成为朋友的朋友；
谁赢得了一个可爱的女人，让他的欢乐加入进来！
是的，甚至只有一个灵魂在这个世界上称之为自己！
而那些从未做到的人，让他们哭泣着离开这个群体！

Let the man who has had the fortune
To be a helper to his friend,
And the man who has won a noble woman,
Join in our chorus of jubilation!
Yes, even if he holds but one soul
As his own in all the world!
But let the man who knows nothing of this
Steal away alone and in sorrow.

让那些有幸成为朋友的帮助者的人，
和那些赢得高贵女人的人，
加入我们的欢乐合唱！
是的，即使他只拥有一个灵魂
作为他在世界上的归属！
但是，让那些对此一无所知的人
独自悲伤地离开。

[1]If I had been a good student in my German class, I could find the German translation of the right column footnote 8 is "Dieser Teil wurde van Beethoven hinzugefügt" by myself without the kind help from a user.

[2]Original: Was der Mode Schwert geteilt;
Bettler werden Fürstenbrüder,

[8]如果我在德语课上是个好学生的话，我就可以自己找到右栏脚注 8 的德语翻译："Dieser Teil wurde von Beethoven hinzugefügt"，而不需要用户的友好帮助。

[9]原文：被世俗之剑分隔开的；
乞丐将成为王子的兄弟

[8]This part was added by Beethoven.

[9]Original: What custom's sword has parted;
Beggars become princes' brothers

[8]这部分是贝多芬添加的。

[9]原文：被习俗之剑分开的；
乞丐将成为王子的兄弟

Freude trinken alle Wesen an den Brüsten der Natur;
Alle Guten, alle Bösen folgen ihrer Rosenspur.
Küsse gab sie uns und Reben, einen Freund, geprüft im Tod;
Wollust ward dem Wurm gegeben, und der Cherub steht vor Gott.

所有的生物都沐浴在大自然的怀抱中享受喜悦；
所有的善良和邪恶都跟随着她的玫瑰之踪。
她给了我们亲吻和葡萄酒，还有一位在死亡中经受考验的朋友；
欢愉被赐予了蠕虫，而撒拉弗高立在上帝面前。

All the world's creatures drink
From the breasts of nature;
Both the good and the evil
Follow her trail of roses.
She gave us kisses and wine
And a friend loyal unto death;
She gave the joy of life to the lowliest,
And to the angels who dwell with God.

全世界的生物都饮用大自然的乳汁；
善良和邪恶都跟随她的玫瑰足迹。
她给了我们亲吻和美酒，还有一位忠诚到死的朋友；
她给了卑微者生命的喜悦，以及与上帝同在的天使们。

Froh, wie seine Sonnen fliegen durch des Himmels prächt'gen Plan,
Laufet, Brüder, eure Bahn, freudig, wie ein Held zum Siegen.

欢乐，像太阳一样飞翔穿越辉煌的天空，
奔跑吧，兄弟们，你们的轨迹，像英雄一样欢欣地迈向胜利。

Joyous, as his suns speed
Through the glorious order of Heaven,
Hasten, brothers, on your way,
Joyful as a hero to victory.

欢乐，就像他的太阳快速穿越天堂的辉煌秩序，
快走吧，兄弟们，继续你们的道路，
欢欣地迈向胜利，就像一个英雄。

Seid umschlungen, Millionen! Diesen Kuß der ganzen Welt!
Brüder, über'm Sternenzelt muß ein lieber Vater wohnen.

让我们拥抱在一起，亿万人！给全世界一个吻！
兄弟们，在星空之上，一位亲爱的父亲必定居住。

Be embraced, all ye millions!
With a kiss for all the world!
Brothers, beyond the stars
Surely dwells a loving Father.

让亿万人拥抱在一起！给全世界一个吻！
兄弟们，在星空之上，必定居住着一位充满爱的父亲。

Ihr stürzt nieder, Millionen? Ahnest du den Schöpfer, Welt?
Such'ihn überm Sternenzelt! Über Sternen muß er wohnen.

亿万人啊，你们俯首？你能感知到造物主，世界吗？
寻找他超越星空之上！他必定居住在星星之上。

Do you kneel before him, oh millions?
Do you sense the Creator's presence?
Seek him beyond the stars!
He must dwell beyond the stars.

你们亿万人啊，你们跪拜在他面前吗？你们能感受到造物主的存在吗？
超越星空去寻找他！
他必定居住在星星之外。

7 Reference Manual
参考手册

7.1 Environment paracol

paracol 环境

`\begin{paracol}{`*num*`}[`*text*`]` *body* `\end{paracol}`

The environment `paracol` contains *body* typeset in *num* columns in parallel. The optional *text* is put spanning all columns prior to the multi-columned *body*.

环境 `paracol`中包含以 *num* 栏并列排列的 *body*。可选的 *text* 将跨越所有栏之前放置在多栏的 *body* 之前。

- The environment may start from *any* vertical position in a page, i.e., not necessary at the top of a page. The single-column *pre-environment stuff* of the *starting page* in which `\begin{paracol}` lies are naturally connected to the beginning part of *body* in each column, unless the page has footnotes[3] or bottom floats. If these kinds of bottom stuff exist, they are put above the multi-columned *body*, or the spanning *text* if provided, with a vertical skip of `\textfloatsep` separating them if bottom floats exist, or of `\belowfootnoteskip` described in Section 7.6 if only footnotes exist. The *deferred* floats which have not yet appeared in the starting page and thus will appear in the next or succeeding pages are considered as page-wise floats given in the environment.

- 此环境可以从页面的任何垂直位置开始，即不一定在页面顶部。位于 `\begin{paracol}` 所在的 *starting page* 中的单栏 *pre-environment stuff* 自然与每个栏的*body*的开头部分连接在一起，除非页面有脚注[4] ，或底部浮动体。如果存在这些底部内容，则它们将位于多栏的*body*之上，或者位于跨越的*text*之上（如果提供了），并使用垂直间距 `\textfloatsep` 将它们分隔开（如果存在底部浮动体），或者使用在第 7.6节中描述的 `\belowfootnoteskip` （仅当存在脚注时）。尚未出现在起始页面中的延迟浮动体将被视为在环境中给出的 page-wise浮动体，它们将出现在下一页或后续页面中。

- The environment can be enclosed in a `list`-*like environment* such as `enumerate`, `itemize` and `description`. If so, `\items` in each column are typeset using the parameters of the surrounding environment such as `\leftmargin` and `\rightmargin`. following short `paracol` environment is included in an `itemize` for this and other `\items` in this page.

  You are now seeing the switching to/from multi-columned and `itemized` texts are naturally connected with the last and this single-columned sentences. You may feel the space between two columns above is too large but it simply results from the large total `\leftmargin`s of the outer `description` and this `itemize`, which make the right column shifted right. A simple remedy for this large space is to make `\columnsep` narrower, for example 0 pt as shown below.

- 该环境可以被封装在类似于 `enumerate`、`itemize` 和 `description` 的类似列表环境中。如果这样做，每个栏中的 `\item` 将使用周围环境的参数进行排版，如 `\leftmargin` 和 `\rightmargin`。

  您现在看到的切换到/从多栏和 `itemize`文本与上一个和本个单栏句子自然连接在一起。您可能会觉得上面两栏之间的空间太大，但这只是由于外部 `description`和此 `itemize`的总 `\leftmargin` 较大，使得右栏向右偏移。修复这个大空间的简单方法是使 `\columnsep`变窄，例如像下面显示的 0 pt。

  `\columnsep0pt`

  - This `\item` is wider than the last `\item` above because `\columnsep` is 0 pt.

    这个 `\item` 比上面的最后一个 `\item` 更宽，因为 `\columnsep` 是 0 pt。

  - Therefore, this `\item` is shifted left a little bit to make inter-column spece narrower.

    因此，为了使栏间距更窄，这个 `\item` 向左移动了一点。

- All local counters in all columns are initialized to have the values at `\begin{paracol}` on its first occurrence. On the second and succeeding occurrences of `\begin{paracol}`, the local counters in each column have the value at the last `\end{paracol}`, unless they are modified after the `\end{paracol}`. If a counter is modified (or declared by `\newcounter`) after the `\end{paracol}`, the local versions of the counter in all columns commonly have the value at `\begin{paracol}`.

- 所有栏中的局部计数器都被设为`\begin{paracol}`首次出现时的值。在`\begin{paracol}`的第二次及后续出现中，每个栏中的局部计数器都具有上一个`\end{paracol}`处的值，除非在`\end{paracol}`之后对其进行了修改。如果在`\end{paracol}`之后修改了计数器（或通过 `\newcounter` 声明了计数器），所有栏中的局部计数器都通常具有`\begin{paracol}`处的值。

- The environment may end at *any* vertical position in a page, i.e., the *post-environment stuff* being the single-column texts and others following `\end{paracol}` in the *last page* of the environment may not start from the top of a page. If any columns don't have deferred column-wise floats and the most advanced *leading column* at `\end{paracol}`

  该环境可以在页面的任何垂直位置结束，即 *post-environment stuff*是单栏文本，而在环境的*last page*中的`\end{paracol}`之后的其他内容可能不会从页面顶部开始。如果任何栏没有延迟的 column-wise浮动体，并且最后一个`\end{paracol}`处的 *leading column*既没有脚注[6]，也没有底部浮动体，则其底部自然与 post-environment stuff连接在一起。如果 leading column具有

[3] With merged footnote layout shown in Section 7.6, the footnotes in the single-column contents are merged with those in `paracol` environment and are put at the bottom of the starting page together as shown in this page.

[4] 使用在第 7.6节中展示的 merged footnote布局，单栏内容中的脚注与 `paracol`环境中的脚注合并在一起，并一起放置在 starting page的底部，就像本页所示。

has neither of footnotes[5] nor bottom floats, its bottom is naturally connected to the post-environment stuff. If the leading column has these kinds of bottom stuff, they are put above the post-environment stuff, with a vertical skip of `\textfloatsep` separating them if bottom floats exist. All deferred column-wise floats given in the environment are flushed before the post-environment stuff appears, possibly creating *float columns* only with floats. On the other hand, deferred page-wise floats given in the environment are considered as deferred (single-) column-wise floats given just after `\end{paracol}`.

这些类型的底部内容，则它们将位于 post-environment stuff之上，如果存在底部浮动体，则它们之间使用垂直间距 `\textfloatsep` 分隔开。在 post-environment stuff出现之前，环境中给出的所有延迟 column-wise浮动体都会被清除，可能只留下具有浮动体的 *float columns* 。另一方面，环境中给出的延迟 page-wise浮动体被视为在`\end{paracol}`之后立即给出的延迟（单个）column-wise浮动体。

- The values of all local counters in the leftmost column are used as the initial values of them in the post-environment stuff.

- 最左侧栏中所有局部计数器的值被用作后续环境中中对应局部计数器的初始值。

- The `paracol` environment cannot be nested, or you will have an error message of illegal nesting.

- 不能嵌套使用 `paracol` 环境，否则会出现非法嵌套的错误消息。

- The commands `\switchcolumn`, `\synccounter`, `\syncallcounters` and `\flushpage`, and environments `column(*)`, `nthcolumn(*)`, `leftcolumn(*)` and `rightcolumn(*)` are *local* to `paracol` environment and thus undefined outside the environment[7]. The command `\clearpage` is of course usable outside and inside the environment but its function inside is a little bit different from outside.

- 命令 `\switchcolumn`、`\synccounter`、`\syncallcounters` 和 `\flushpage`以及环境 `column(*)`、`nthcolumn(*)`、`leftcolumn(*)` 和 `rightcolumn(*)` 是 `paracol`环境中的局部命令和环境，因此在环境外部是未定义的[8]。

  命令 `\clearpage` 当然可以在环境内外使用，但在环境内部的功能与外部略有不同。

`\begin{paracol}[`*numleft*`]{`*num*`}[`*text*`]` *body* `\end{paracol}`
`\begin{paracol}[`*numleft*`]*{`*num*`}[`*text*`]` *body* `\end{paracol}`

If a `\begin{paracol}` has the optional *numleft* argument to specify the number of leading columns n_l together with the total n given by *num*, columns in the environment are laid out across two adjacent pages. In this *parallel-page* typesetting, the first n_l columns are placed in the *left* page while remaining $n_r = n - n_l$ columns go to the next *right* page. The pair of left and right pages is considered as comprising a virtual *paired* page and thus shares a common page number, unless *non-paired* typesetting is specified by the optional '`*`' following the optional *numleft* argument. In the non-paired parallel-paging, when the leading n_l columns are put in a page p, the trailing n_r columns are in the page $p + 1$.

如果`\begin{paracol}`的可选参数*numleft*用于指定前导列的数量 n_l，同时总列数由*num*给出，那么环境中的列会跨两个相邻的页面进行布局。在这种并行分页排版中，前 n_l 列放置在左侧页面，而剩下的 $n_r = n - n_l$ 列放置在下一个右侧页面。左侧和右侧页面的配对被认为是组成一个虚拟的配对页面，因此它们共享一个相同的页码，除非通过在可选的*numleft*参数后面添加 '`*`' 来指定非配对排版。在非配对的并行分页中，当前导的 n_l 列放置在页面 p 上时，后续的 n_r 列会在页面 $p + 1$ 上。

- All *page-wise stuff*, i.e., pre-environment and post-environment stuff, page-wise floats, spanning text and (merged or non-merged) page-wise footnotes, are placed only in left parallel-pages leaving corresponding regions in right parallel-pages blank[9].

- 所有的 *page-wise stuff*，即 pre-environment和 post-environment stuff，page-wise浮动体，spanning text和（merged或非合并的）page-wise footnote，只会放置在左侧 parallel-pages 中，让右侧 parallel-pages 中相应的区域保持空白[10]。

- A non-paired left parallel-page is not necessary to be even-numbered, though the printing tradition requires so if you naturally want to have a parallel-page pair in a double spread. The page number given to the first left parallel-page is simply the number of the page p_1 in which `\begin{paracol}` reside, and that for the k-th left parallel-page is $p_1 + 2(k-1)$[11]. Therefore, to make it sure p_1 is even, you might need to have an ordinary page of blank, a title, etc., or to let `page` counter have an even number by `\setcounter`, etc., before starting a `paracol` environment.

- 一个没有成对出现的左页不一定是偶数页，尽管印刷传统要求如果你自然地希望在双页中有一个成对的页面。第一个左页的页码只是在`\begin{paracol}`所在的页 p_1 的页码，而第 k 个左页的页码是 $p_1+2(k-1)$[12]。因此，为了确保 p_1 是偶数，你可能需要在开始 `paracol`环境之前有一个普通的空白页、一个标题等，或者通过 `\setcounter` 等方法使 `page`计数器的值成为一个偶数。

- Section 9 shows examples of parallel-paging together with related issues on two-sided typesetting.

- 第 9 节展示了 parallel-pag 的示例，以及双面排版相关问题。

[5] With merged footnote layout shown in Section 7.6, the footnotes in the closing `paracol` environment are merged with those in post-environment stuff and are put at the bottom of the page together as shown in this page.
[6] 使用在第 7.6节中展示的 merged footnote布局，`paracol`环境中的脚注与 post-environment stuff中的脚注合并在一起，并一起放置在页面底部，就像本页所示。
[7] Unless you dare to define them.
[8] 除非你敢于定义它们。
[9] Someday the author could devise an advanced mechanism to exploit the space in right parallel-pages.
[10] 将来作者可能会设计一个高级机制来利用右侧 parallel-pages 中的空间。
[11] Unless you make some change to `page` counter.
[12] 除非你对 `page`计数器进行了一些更改。

7.2 切换栏的命令和环境 Column-Switching Command and Environments

`\switchcolumn[`*col*`]`
`\switchcolumn[`*col*`]*[`*text*`]`

The command switches columns from i to j where i and j is the zero-origin ordinals of the columns from/to which we are leaving/visiting respectively. Without the optional *col*, $j = i + 1 \bmod n$ where n is the number of columns given to `\begin{paracol}`, while $j =$ *col* with the optional argument. If the command (or `[`*col*`]` if specified) is followed by a `*`, the column-switching takes place after synchronization and, if specified, the optional spanning *text* is put.

命令从第 i 列切换到第 j 列，其中 i 和 j 是我们离开/访问的列的零起始序号。如果没有可选参数*col*，则 $j = i + 1 \bmod n$，其中 n 是给定给`\begin{paracol}`的列数，而如果有可选参数，则 $j =$ *col*。如果命令（或如果指定了 `[`*col*`]`）后面跟着一个`*`，则 column-switching将在 synchronization 之后进行，并且如果指定了可选的跨列*text*，则会放置它。

- Using `\switchcolumn` in a `list`-like environment *included* in a `paracol` environment causes an ugly result without any error/warning messages. This caution is effectual for all column-switching environments too.

- 在 `paracol`环境中使用 `\switchcolumn` 命令来切换到包含在 `list`-like 环境中会导致一个不美观的结果，而且没有任何错误或警告信息。同样的注意事项也适用于所有的 column-switching environment。

- If $col \notin [0, n)$, an error is reported and, if you dare to continue, you will switch to the leftmost column 0.

- 如果 $col \notin [0, n)$，将报告错误，并且如果你敢继续，将切换到最左边的列 0。

- The synchronization point is set just below the last line of the leading column in a page p, partly taking deferred floats into account. That is, all deferred floats are put in the pages up to $p - 1$ and at the top of p if possible. Then, if a non-leading column has footnotes and/or bottom floats and they cannot be pushed down below the synchronization point, the point is moved to the next page top[13].

- synchronization 点设置在页 p 的 leading column的最后一行的下方，部分考虑了延迟浮动。也就是说，所有延迟浮动都放在前 $p - 1$ 页和 p 页的顶部（如果可能的话）。然后，如果非 leading column有脚注和/或底部浮动，并且它们不能被推到 synchronization 点以下，那么点就会被移动到下一页的顶部[14]。

- In a page having one or more synchronization points, stretch and shrink factors of all vertical spaces, such as those surrounding sectionning commands, are ignored. Therefore, even if you specify `\flushbottom`, the page is typeset as if `\raggedbottom` were specified.

- 在一个或多个 synchronization 点的页面中，所有垂直空间的拉伸和收缩因子都被忽略，例如围绕节标题命令的空间。因此，即使您指定了 `\flushbottom`，页面的排版也会像指定了 `\raggedbottom` 一样进行。

- After a synchronization point is set, no top floats will be inserted in the page having the point, thus they will be deferred to the next page or further one.

- 在设置了同步点之后，不会在具有该点的页面中插入顶部浮动对象，因此它们将被推迟到下一页或更远的页面。

`\begin{column}` *body* `\end{column}`
`\begin{column*}[`*text*`]` *body* `\end{column*}`

The environment `column` contains *body* for the column next to what we are in just before `\begin{column}`. The starred version `column*` does the same after synchronization and, if specified, the optional spanning *text* is put.

环境 `column` 包含了在 `\begin{column}` 之前我们所在的列旁边的*body*。星号版本 `column*` 在同步之后执行相同的操作，并且如果指定了可选的跨列*text*，则会放置它。

- The environments are almost equivalent to;

- 这些环境几乎等同于：

  `{\switchcolumn` *body* `\par}`
  `{\switchcolumn*[`*text*`]` *body* `\par}`

  except for their first occurrences which don't switch to the column 1 (i.e., right column if two-columned) but stay in the leftmost column 0. More precisely, `\begin{column(*)}` does not make column-switching if it is not preceded by `\switchcolumn` nor other column-switching environments.

  除了第一次出现的情况外，它们不会切换到列 1（即双栏时的右栏），而是保持在最左边的列 0。更准确地说，如果 `\begin{column(*)}` 没有在 `\switchcolumn` 或其他 column-switching environment 之前出现，就不会进行 column-switching。

- The *body* of the environments cannot have `\switchcolumn` nor column-switching environments including `column(*)` themselves, or you will have an error message of illegal use of command/environment.

- 环境的*body*不能包含 `\switchcolumn` 或包含 `column(*)` 本身的 column-switching environment，否则会出现非法使用命令/环境的错误消息。

- Column-switching does not take place at `\end{column(*)}`. Therefore, texts following the environments are put

- 在 `\end{column(*)}` 处不会发生列切换。因此，在环境后面的文本会放置在*body*所在的列

[13] Or below top floats deferred to the page.
[14] 或下推到页面的延迟顶部浮动下方。

in the column in which *body* resides until a column-switching command/environment is given.

中，直到出现 column-switching命令/环境。

`\begin{nthcolumn}{`*col*`}` *body* `\end{nthcolumn}`
`\begin{nthcolumn*}{`*col*`}[`*text*`]` *body* `\end{nthcolumn*}`

The environment `nthcolumn` contains *body* for the column *col*. The starred version `nthcolumn*` does the same after synchronization and, if specified, the optional spanning *text* is put.

环境 `nthcolumn`包含了第*col*列的*body*。星号版本 `nthcolumn*`在 synchronization 之后执行相同的操作，并且如果指定了可选的跨列*text*，则会放置它。

- The environments are equivalent to;

  这些环境等同于：

  `{\switchcolumn[`*col*`]` *body* `\par}`
  `{\switchcolumn[`*col*`]*[`*text*`]` *body* `\par}`

- The *body* of the environments cannot have `\switchcolumn` nor column-switching environments including `nthcolumn`(`*`) themselves, or you will have an error message of illegal use of command/environment.

  环境的 *body* 不能包含 `\switchcolumn` 或包括 `nthcolumn`(`*`) 在内的 column-switching environment，否则会出现非法使用命令/环境的错误消息。

- Column-switching does not take place at `\end{nthcolumn(*)}`. Therefore, texts following the environments are put in the column in which *body* resides until a column-switching command/environment is given.

  列切换不会在 `\end{nthcolumn(*)}` 处发生。因此，环境后的文本会被放在*body*所在的列中，直到出现 column-switching命令/环境为止。

`\begin{leftcolumn}` *body* `\end{leftcolumn}`
`\begin{leftcolumn*}[`*text*`]` *body* `\end{leftcolumn*}`
`\begin{rightcolumn}` *body* `\end{rightcolumn}`
`\begin{rightcolumn*}[`*text*`]` *body* `\end{rightcolumn*}`

The environment `leftcolumn` contains *body* for the leftmost column 0, while `rightcolumn` for the column 1 being the right column in two-column typesetting. The starred versions `leftcolumn*` and `rightcolumn*` do the same after synchronization and, if specified, the optional spanning *text* is put.

环境 `leftcolumn`包含了最左侧列 0 的*body*，而 `rightcolumn` 包含了在双栏排版中作为右侧列的列 1 的*body*。星号版本 `leftcolumn*`和 `rightcolumn*`在 synchronization 之后执行相同的操作，并且如果指定了可选的跨列*text*，则会放置它。

- The environments `leftcolumn`(`*`) are equivalent to;

  环境 `leftcolumn`(`*`) 等同于：

  `\begin{nthcolumn}{0}` *body* `\end{nthcolumn}`
  `\begin{nthcolumn*}{0}[`*text*`]` *body* `\end{nthcolumn*}`

  while `rightcolumn`(`*`) are equivalent to;

  而 `rightcolumn`(`*`) 等价于：

  `\begin{nthcolumn}{1}` *body* `\end{nthcolumn}`
  `\begin{nthcolumn*}{1}[`*text*`]` *body* `\end{nthcolumn*}`

`\thecolumn`

The command gives you the zero-origin ordinal of the column in which this command appears. Therefore, the following code snip;

该命令给出了此命令出现的列的零起始序号。因此，以下代码片段：

```
\begin{paracol}{3}
Column-\thecolumn.\switchcolumn Column-\thecolumn.\switchcolumn Column-\thecolumn.
\end{paracol}
```

gives us the followings.

我们得到了以下结果。

Column-0. Column-1. Column-2.

- The command is *neither* a LaTeX's counter nor `\count` register of native TeX, and thus the value it keeps cannot be modified. However, it can be used wherever an integer number is required or appropriate. Therefore for example,

  该命令既不是 LaTeX 的计数器，也不是原生 TeX 的 `\count` 寄存器，因此它所保存的值无法修改。然而，它可以在需要或适当的地方使用整数值。因此，例如，将列序数赋给计数器

\setcounter{mycounter}{\thecolumn} works well to give the column ordinal to the counter mycounter.

mycounter 只要:\setcounter{mycounter}{\thecolumn}。

\definecolumnpreamble{*col*}{*pream*}

The command is to define the column preamble *pream* for the column *col*, which is inserted at every column-switching to the column. More specifically, the command let \switchcolumn to *col* act as if you sepcify;

该命令用于为列 *col* 定义 column preamble *pream*，该 *pream* 在每次切换到该列时插入。更具体地说，该命令使得 \switchcolumn 到 *col* 的行为与您指定的一样。

\switchcolumn ⟨*pream for col*⟩

and column-switching environments such as nthcolumn act as if you specify;

而 nthcolumn等 column-switching environment则会表现得好像你指定了：

\begin{nthcolumn}{*col*} ⟨*pream for col*⟩

\switchcolumn ⟨*pream for col*⟩

- The optional spanning text of \switchcolumn, column-switching environments and \begin{paracol} is considered to be in a virtual column −1, and thus if you need a preamble for spanning texts do \definecolumnpreamble{-1}{*pream*}.
- The command may appear in a paracol environment and, if so, *pream* is effective from the succeeding column-switching to *col*.
- The definition of *pream* is made globally.

- \switchcolumn命令、换栏环境和\begin{paracol}的可选参数跨栏文本被视为虚拟列 −1 中的内容，因此如果你需要为跨栏文本添加 preamble，请使用 \definecolumnpreamble{-1}{*pream*}。
- 该命令可以出现在 paracol 环境中，如果是这样的话，*pream* 从后续的 column-switching 到 *col* 是有效的。
- *pream* 的定义是全局的。

\ensurevspace{*len*}

The command tells the first synchronizing column-switching command (i.e., \switchcolumn[*col*]*) or environment (i.e., column*, etc.) following this command that the page must be broken before synchronization unless the synchronization point has the space of *len* or more below it in the page. If a synchronization does not have the command after the previous synchronization, it is assumed that \ensurevspace{\baselineskip} is given.

告诉紧随该命令之后的第一个栏同步命令（\switchcolumn[*col*]* 等）或环境（column*等），除非页面中同步点下方有*len*或更多的空间，否则页面必须在同步前被分页。如果前一个同步之后没有该命令，则假定已给出\ensurevspace{\baselineskip}。

- This command is to be used when a synchronization point would be placed near the bottom of a page p and the space below it is not sufficient for a column c to put anything in the page, while another column c' can have a few lines in the page. If this happens, the first line after the synchronization should start at the top of the page $p+1$ in the column c, while that of c' is still in the page p, giving you an impression that the synchronization fails to align the top of all columns below it. The fact is, however, the synchronization point is properly established near at the bottom of the page but the first line of c needs some large space due to, for example, the followings.
  - The line has unusually tall stuff including larger font letters.
  - The line has a footnote reference which is hardly apart from the footnote, and thus the line and the footnote go to the next page together.
  - The parameter \clubpenalty is too large (e.g., 10000) to break the first and second lines into separate pages.
  - The first line follows a vertical space.
- This manual itself has some instances of \ensurevspace command in the page 8 and ?? in which each German stanza is enclosed in verse and then leftcolumn* environments and has \ensurevspace{2\baselineskip} before the \begining of the outer leftcolumn* because the first line of the stanza is preceded by a vertical space inserted by \begin{verse}. In fact without \ensurevspace, the first two lines of the sixth English stanza would be in the page 8, while corresponding German stanza go to the next page ?? as a whole, due to the difference of the height of footnotes in each column, i.e., German ones are taller than English ones to narrow the space for the German column.

- 当同步点位于页面 p 的底部附近，并且其下方的空间不足以容纳列 c 中的内容，而另一列 c' 可以在页面 p 中有几行时，应使用此命令。如果发生这种情况，则同步后的第一行应从页面 $p+1$ 的列 c 顶部开始，而 c' 的第一行仍在页面 p 中，给您一种印象，即同步无法使所有列的顶部对齐。然而，事实是，同步点确实正确地建立在页面底部附近，但由于某些原因，例如以下原因，列 c 的第一行需要一些较大的空间。
  - 该行包含异常高的内容，包括较大字号的字母。
  - 该行有一个脚注引用，与脚注之间几乎没有间隔，因此该行和脚注一起跳转到下一页。
  - 参数 \clubpenalty 太大（例如 10000），导致第一行和第二行无法分开分页。
  - 第一行后面有一个垂直间距。
- 本手册本身在第 8 页和第??页有一些 \ensurevspace 命令的实例，在这些页中，每个德语诗节都被包含在 verse环境和 leftcolumn*环境中,并且在外部 leftcolumn*的 \begin之前有一个 \ensurevspace{2\baselineskip} ,因为诗节的第一行前面有一个由 \begin{verse} 插入的垂直间距。实际上，如果没有 \ensurevspace，第六首英文诗节的前两行将在第 8页，而相应的德文诗节将作为整体移到下一页??，这是因为每列脚注的高度不同，即德文脚注比英文脚注更高，以缩小德文列的空间。

- As the author does in the “An die Freude/To Joy” example, it is a good tactics to have an `\ensurevspace` with some vertical space larger than the default `\baselineskip` if it is sure that a column has a feature shown above regardless of the position of the synchronization point in question, because the point goes up or down with revisions of your document and using an `\ensurevspace` for a synchronization far above the page bottom is perfectly harmless. Similarly, if you find a problem in a synchronization and add an `\ensurevspace` to solve it, keeping the command attached is recommended even when the synchronization point moves up or down to make the command unnecessary.

- 正如作者在“An die Freude/To Joy”示例中所做的那样，如果确定某一列具有上述特征，无论问题点的同步点位置如何变化，使用比默认 `\baselineskip` 更大的一些垂直间距的 `\ensurevspace` 是一个好策略，因为该点随着文档的修订而上下移动，并且在页面底部上方使用 `\ensurevspace` 是完全无害的。同样，如果在同步中发现问题并添加了 `\ensurevspace` 来解决问题，则建议保留该命令，即使同步点上下移动以使命令不再需要。

7.3 用于列和间隔宽度的命令

Commands for Column and Gap Width

`\columnratio{`$r_0, r_1, \cdots, r_k$`}[`$r'_0, r'_1, \cdots, r'_{k'}$`]`

该命令通过分数 r_i 来定义每列的宽度，以指定第 i 列（$i = 0$ 表示最左边的列）所占的比例。具体而言，第 i 列的宽度 w_i 定义如下，其中 W 是 `\textwidth`，S 是 `\columnsep`，n 是传递给 `\begin{paracol}`的列数。

The command defines the width of each column by the fraction r_i to specify the portion which i-th ($i = 0$ for the leftmost) column occupies. More specifically, the width w_i of the i-th column is defined as follows, where W is `\textwidth`, S is `\columnsep`, and n is the number of columns given to `\begin{paracol}`.

$$W' = W - (n-1)S$$
$$w_i = \begin{cases} r_i W' & i \le k \\ \dfrac{(1 - \sum_{j=0}^{k} r_j)W'}{n-(k+1)} & i > k \end{cases}$$

对于具有 parallel-pag 分页的 `paracol`环境，对于左侧 parallel-pag的列，将 n 替换为 n_l，而对于右侧 parallel-pag的列，将 n 和 w_i 替换为 n_r 和 w_{n_r+i}。此外，如果提供了具有 $r'0, r'1, \cdots, r'k'$ 的可选参数，则右侧 parallel-pag的列中的 $wn_r + i$ 由 r'_i 和 k' 确定，而不是由 r_i 和 k 确定。

For a `paracol` environment with parallel-paging, n is replaced with n_l for the columns in left parallel-pages, while n and w_i are replaced with n_r and w_{n_r+i} for those in right parallel-pages. Moreover, if the optional argument having $r'_0, r'_1, \cdots, r'_{k'}$ is provided, w_{n_r+i} for a column in right parallel-pages is determined by r'_i and k' instead of r_i and k.

- 上述方程表明 $k < n-1$，$r_i > 0$ 且 $\sum_{j=0}^{k} r_j < 1$。如果 $k \ge n-1$，则假设 k 为 $n-2$，并忽略所有满足 $i \ge n-1$ 的 r_i。如果 r_i 或其总和不满足条件，你将得到一个带有“Overfull”消息的不美观的结果。

- The equations above imply that $k < n-1$, $r_i > 0$ and $\sum_{j=0}^{k} r_j < 1$. If $k \ge n-1$, k is assumed to be $n-2$ and all r_i such that $i \ge n-1$ are ignored. If r_i or its sum does not satisfy the conditions, you will have an ugly result with “Overfull” messages.

- 参数 $r_0, r_1, \cdots, r_k$ 可以为空，表示 $k = -1$，使得所有列宽默认为 W'/n。

- The argument $r_0, r_1, \cdots, r_k$ can be empty to mean $k = -1$ to let all column widths be W'/n as default.

- 该命令设置的列宽度在命令后的 `paracol` 环境中生效[16]。

  因此，将该命令放在导言区是最自然的方式[18]。

  在两个`paracol` 环境之间放置此命令，即可更改第二个环境的列布局，即使它们在页面中出现，如第 6节所示。

- The setting of column width by the command takes effect in the `paracol` environments following the command[15].

  Therefore, though placing the command in the preamble is the most natural way[17],

  you may place this command between two `paracol` environments to change the column layout for the second one even when they appear in a page as shown in Section 6.

- 在第 i 列中，`\columnwidth` 的值为 w_i，对于列中的最外层段落，`\hsize`的值也为 w_i。至于 `\linewidth`，它的值为 $w_i - (\texttt{\textwidth} - l)$，其中 l 是在`\begin{paracol}`中 `\linewidth` 所具有的值，即如果有的话，是包围 `paracol`的 `list`-like 环境的 `\linewidth`，否则是 `\textwidth`。

- In the i-th column, `\columnwidth` has w_i and, for outermost paragraphs in the column, `\hsize` has w_i as well. As for `\linewidth`, it has $w_i - (\texttt{\textwidth} - l)$ where l is what `\linewidth` had at `\begin{paracol}`, i.e., the `\linewidth` for the `list`-like environment surrounding `paracol` if any, or `\textwidth` otherwise.

- 您可以通过下面的 `\setcolumnwidth` 更详细地指定每列的宽度和每两列之间的间隙的宽

- You can specify width of each column and that of each *gap* between two columns more detailedly by

[15] If the command is in a `paracol` environment, the command does not affect the column widths of the environment but does the next ones, though such usage is very unusual.
[16] 如果该命令在 `paracol` 环境中，该命令不会影响环境的列宽度，而是影响后续的列宽度，尽管这种用法非常不常见。
[17] Or second most to not using it at all, of course.
[18] 当然，第二自然的方式是不使用它。

`\setcolumnwidth` shown below. If your document has both of `\columnratio` and `\setcolumnwidth` prior to a `paracol` environment, the command given later is effective for the environment.

`\setcolumnwidth{`$s_0, s_1, \cdots, s_k$`}[`$s'_0, s'_1, \cdots, s'_{k'}$`]`

The command defines the width of each column and that of each *gap* between two columns by the column/gap specification s_i for the i-th column and the gap between it and the $(i{+}1)$-th column. More specifically, s_i has the form of $\hat{w}_i$ or $\hat{w}_i$ `/` $\hat{g}_i$ where each of $\hat{w}_i$ and $\hat{g}_i$ is a proper glue including a proper dimension, or an empty string to mean $\hat{w}_i =$ `\fill` and $\hat{g}_i =$ `\columnsep`, to determine the width of i-th column w_i and that of i-th gap g_i as follows, where $nat(x)$ is the natural width of the glue x, $str(x)$ is the infinite stretch factor of x, W is `\textwidth`, and n is the number of columns given to `\begin{paracol}`.

$$
\begin{aligned}
W' &= \sum_{i=0}^{n-2} \big(nat(\hat{w}_i) + nat(\hat{g}_i)\big) + nat(\hat{w}_{n-1}) \\
F &= \sum_{i=0}^{n-2} \big(str(\hat{g}_i) + str(\hat{g}_i)\big) + str(\hat{w}_{n-1}) \\
x_i &= \begin{cases} (W/W')nat(\hat{x}_i) & W' \geq W \ \vee \ F \leq 0 \\ nat(\hat{x}_i) + (str(\hat{x}_i)/F)(W - W') & W' < W \ \wedge \ F > 0 \end{cases} \qquad (x \in \{w, g\})
\end{aligned}
$$

That is, if the total of natural widths W' is larger than `\textwidth` W or there are no infinite stretch factors in the specification, given widths are scaled down or up so that the scaled total is equal to W. Otherwise, each width with an infinite stretch factor is extended according to its ratio in the total stretch so that the stretched total is equal to W.

For a `paracol` environment with parallel-paging, n is replaced with n_l for the columns in left parallel-pages, while n, w_i and g_i are replaced with n_r, w_{n_r+i} and g_{n_r+i} for those in right parallel-pages. Moreover, if the optional argument having $s'_0, s'_1, \cdots, s'_{k'}$ is provided, w_{n_r+i} and g_{n_r+i} for a column in right parallel-pages are determined by s'_i instead of s_i.

- In `paracol` environments having n columns, s_i s.t. $i \geq n$ and $\hat{g}_{n-1}$ are ignored. On the other hand if $k < n-1$, it is assumed s_i is an empty string for all $i > k$.
- Finite stretch factors and finite or infinite shrink factors in $\hat{w}_i$ and $\hat{g}_i$ are ignored.
- Unlike TEX's genuine glue addition, all infinite unit `fil`, `fill` and `filll` are not distinguished in the summation for F. Also unlike TEX's genuine scaling of a glue primitive, f`\fill` means 0`pt plus` f`fill` for convenience[19].
- The division W/W' and $str(\hat{x}_i)/F$ can have some arithmetic errors and thus the total of w_i and g_i may not be equal to W exactly but can be a little bit less than W. This small error is, however, equally distributed to g_i in typesetting of a page to make the total width of columns and gaps is exactly W[21].
- All the specifications shown in the table below give us same results for a `paracol` environment having three

[19] In TEX's grammar, f`\fill` means a dimension rather than a glue and is 0`pt` because the natural component of `\fill` is 0.

[21] If we may ignore the arithmetic error inherent in TEX.

[22]

如果我们可以忽略 TEX 中固有的算术误差。

度。如果在 `paracol`环境之前的文档中同时存在 `\columnratio` 和 `\setcolumnwidth`，则后给出的命令对该环境有效。

该命令通过列/间隔规范 s_i 定义每个列和每个间隔的宽度，其中 s_i 是第 i 列和它与 $(i{+}1)$ 列之间的间隔。具体来说，s_i 的形式为 $\hat{w}_i$ 或 $\hat{w}_i, /, \hat{g}_i$，其中 $\hat{w}_i$ 和 $\hat{g}_i$ 都是包含适当尺寸的适当粘连，或者是一个空字符串来表示 $\hat{w}_i =$ `\fill` 和 $\hat{g}_i =$ `\columnsep`，以确定第 i 列 w_i 和第 i 个间隔 g_i 的宽度，其中 $nat(x)$ 是粘连 x 的自然宽度，$str(x)$ 是 x 的无限伸展因子，W 是 `\textwidth`，n 是传递给`\begin{paracol}`的列数。

$$
\begin{aligned}
W' &= \sum_{i=0}^{n-2} \big(nat(\hat{w}_i) + nat(\hat{g}_i)\big) + nat(\hat{w}_{n-1}) \\
F &= \sum_{i=0}^{n-2} \big(str(\hat{g}_i) + str(\hat{g}_i)\big) + str(\hat{w}_{n-1}) \\
x_i &= \begin{cases} (W/W')nat(\hat{x}_i) & W' \geq W \ \vee \ F \leq 0 \\ nat(\hat{x}_i) + (str(\hat{x}_i)/F)(W - W') & W' < W \ \wedge \ F > 0 \end{cases} \qquad (x \in \{w, g\})
\end{aligned}
$$

也就是说，如果自然宽度的总和 W' 大于 `\textwidth` W，或者规范中没有无限伸展因子，给定的宽度将被缩小或放大，使得缩放后的总和等于 W。否则，每个具有无限伸展因子的宽度将根据其在总伸展中的比例进行扩展，以使伸展后的总和等于 W。

对于具有 parallel-pag分页的 `paracol`环境，对于左侧 parallel-pag的列，将 n 替换为 n_l，而对于右侧 parallel-pag的列，将 n，w_i 和 g_i 分别替换为 n_r，w_{n_r+i} 和 g_{n_r+i}。此外，如果提供了具有 $s'0, s'1, \cdots, s'k'$ 的可选参数，则右侧 parallel-pag的列中的 $wn_r + i$ 和 g_{n_r+i} 由 s'_i 确定，而不是由 s_i 确定。

- 在具有 n 列的 `paracol`环境中，忽略满足 $i \geq n$ 和 $\hat{g}_{n-1}$ 的 s_i。另一方面，如果 $k < n-1$，则假设对于所有 $i > k$，s_i 都是一个空字符串。
- 在 $\hat{w}_i$ 和 $\hat{g}_i$ 中，有限的拉伸因子和有限或无限的收缩因子被忽略。
- 与 TEX 的真正粘连添加不同，所有无限单位的 `fil`、`fill` 和 `filll` 在 F 的求和中没有区别。另外，与 TEX 的真正粘连原语的缩放不同，f`\fill` 表示为 $0,$`pt plus` $f,$`fill`，以方便使用[20]。
- 除法 W/W' 和 $str(\hat{x}_i)/F$ 可能存在一些算术误差，因此 w_i 和 g_i 的总和可能不完全等于 W，而可能略小于 W。然而，在页面排版中，这个小的误差被等分给 g_i，以确保列和间隙的总宽度恰好为 W[22]。
- 下表中显示的所有规格都可以得到相同的结果，适用于具有三列的 `paracol`环境，其中

[20] 在 TEX 的语法中，f`\fill` 表示的是一个尺寸而不是粘连，并且是 $0,$`pt`，因为 `\fill` 的自然分量为 0。

columns, providing \textwidth = 360 pt and \columnsep = $S = 20$ pt.

\textwidth = 360, pt 和 \columnsep = $S = 20$, pt。

s_0, s_1, s_2	w_0	g_0	w_1	g_1	w_2 (in pt)
50pt/20pt,100pt/40pt,150pt	50	20	100	40	150
50pt,100pt/2\columnsep,150pt	50	S	100	$2S$	150
50pt/\fill,100pt/2\fill,150pt	50	$(1/3)\cdot 60$	100	$(2/3)\cdot 60$	150
,2\fill/2\columnsep,3\fill	$(1/6)\cdot 300$	S	$(2/6)\cdot 300$	$2S$	$(3/6)\cdot 300$
50pt/20,50pt plus 1fil/40pt,50pt plus 2fil	50	20	$50+(1/3)\cdot 150$	40	$50+(2/3)\cdot 150$
5pt/2pt,10pt/4pt,15pt	$10\cdot 5$	$10\cdot 2$	$10\cdot 10$	$10\cdot 4$	$10\cdot 15$
100pt/40pt,200pt/80pt,300pt	$0.5\cdot 100$	$0.5\cdot 40$	$0.5\cdot 200$	$0.5\cdot 80$	$0.5\cdot 300$

- If your document has both of \columnratio and \setcolumnwidth prior to a paracol environment, the command given later is effective for the environment.

- 如果在 paracol环境之前的文档中同时存在 \columnratio 和 \setcolumnwidth，则后面给出的命令对该环境有效。

7.4 用于双面排版和边注的放置的命令

Commands for Two-Sided Typesetting and Marginal Note Placement

\twosided[$t_1t_2\cdots t_k$]

The command enables a set of two-sided typesetting features $\{t_i \,|\, t_i \in \{\mathtt{p},\mathtt{c},\mathtt{m},\mathtt{b}\},\ 1 \le i \le k\}$ explicitly by the optional argument, or all of the following four features as a whole without the argument, in even-numbered pages.

该命令通过可选参数显式地启用一组双面排版功能 $\{t_i \,|\, t_i \in \mathtt{p},\mathtt{c},\mathtt{m},\mathtt{b},\ 1 \le i \le k\}$，或者在偶数页上作为一个整体启用以下四个功能，而无需参数。

p(*age*) for ordinary two-sided paging, letting the left side margin be \evensidemargin, page headers be different from those in odd-numbered pages with headings or myheadings page style, and \cleardoublepage leave an even-numbered page blank if it is used in an odd-numbered page.

p(*age*) 对于普通的双面分页，左侧边距为 \evensidemargin，页面页眉与奇数页中的 headings 或 myheadings 页面样式不同，并且 \cleardoublepage 在奇数页中使用时会使偶数页保持空白。

c(*olumn*) for *column-swapping* to *print* columns in even-numbered pages in reverse order. This feature is sometimes preferable in typesetting especially with unbalanced parallel columns to make, for example, a wider columns are always *inside* while narrower ones are *outside*.

c(*olumn*) 对于 *column-swapping*来在偶数页上以相反的顺序打印列。这个功能在排版中有时是可取的，特别是在不平衡的并列列中，可以使较宽的列始终位于内部，而较窄的列位于外部。

m(*arginal text*) to place marginal notes in the side margin opposite to that specified by the command \marginparthreshold discussed shortly.

m(*arginal text*) 将边注放置在与命令 \marginparthreshold 指定的相反侧边缘中（稍后会讨论）。

b(*ackground painting*) to make background painting, shown in Section 7.8, *mirrored* so that, for example, a color specified for the left margin is used to paint the right margin instead.

b(*ackground painting*) 为了使 background painting（参见第 7.8节）是 *mirrored* 的，例如，为左边距指定的颜色将用于绘制右边距。

- The feature p is also enabled by the twoside option of \documentclass with almost all classes including article, book, report, etc. Though it is strongly recommended to make both settings by \documentclass and this command consistent, they can be inconsistent resulting in lack of some expected functions. For example, enabling p feature by \twosided without twoside option in \documentclass makes the format of headers and footers in all pages same even with \pagestyle{headings}.

- p 特性也可以通过 \documentclass 的 twoside 选项启用，几乎适用于包括 article、book、report 等在内的所有类。虽然强烈建议通过 \documentclass 和此命令使两个设置保持一致，但它们可能不一致，导致缺少某些期望的功能。例如，通过在 \documentclass 中启用 twoside 选项而不使用 \twosided，会使所有页面上的页眉和页脚的格式相同，即使使用了 \pagestyle{headings}。

- The column-swapping enabled by the feature c is ineffective in non-paired parallel-paging because it is meaningless[23], and thus silently ignored.

- 在 non-pairedparallel-paging 中，由特性 c 启用的 column-swapping是无效的，因为它是没有意义的[24]，因此会被悄悄地忽略。

- In ordinary single-column typesetting, marginal note swapping in even-numbered pages is enabled by the twoside option, while it never takes place in ordinary two-column typesetting. For marginal notes given in paracol environments, however, swapping of them in even-numbered pages is enabled by giving the feature m to \twosided.

- 在普通的单栏排版中，通过twoside 选项启用了在偶数页中交换边注的功能，而在普通的双栏排版中则不会出现这种情况。然而，对于在 paracol 环境中给出的边注，可以通过给予 \twosided 功能特性 m 来在偶数页中启用它们的交换。

[23] Unless somebody tells the author it is meaningful.

[24] 除非有人告诉作者它是有意义的。

- The command has to be outside of `paracol` environments to decide the action in the environments following them. If it appears in a `paracol` environment, you will have a warning message saying it is ignored.
`\twosided[c]\columnratio{0.55}\columnsep0pt`

- 该命令必须位于 `paracol` 环境之外，以决定其后环境中的操作。如果它出现在 `paracol` 环境中，您将收到一个警告消息，指示它被忽略。

- 这是一个列交换的示例。由于此页 18是奇数页，因此带有罗马字体的较宽的列-0 被放置在左侧，因此在开始时位于内部，但现在我们处于一个偶数页，此列位于右侧。

- Here is an example of column swapping. Since this page 18 is odd, this wider column-0 with roman font is placed in left side and thus inside at the begining, but now we are in an even page in which this column is in right side.

- 这个较窄、位于外侧并且斜体的列 *1* 最初在右侧，但页面断页导致其位置改变到左侧。

- *This narrower, outside and italicized column-1 is at first in right side but the page break has changed the position to the left.*

- 在旧版本的 *paracol* 中，即 *1.2* 版本及其小的修订版本 *1.2x* 中，*column-swapping*通过冗长的命令`\swapcolumninevenpages`和`\noswapcolumninevenpages`进行控制。尽管它们仍然可用，并且将永远用于向后兼容性，但建议使用带有或不带有特性`c` 的 `\twosided`。旧版本还存在一个问题，即跨页的 *spanning stuff*在页面断页后放置不正确，但这个问题在 *1.3* 版本中通过修复得到解决。

- *In old versions of paracol, namely 1.2 and its minor revisions 1.2x, column-swapping was controlled by lengthy commmands* `\swapcolumninevenpages` *and* `\noswapcolumninevenpages`. *Though they are still available and will be so forever for backward compatibility, it is recommended to use* `\twosided` *with or without the feature* `c`. *The old versions also have a problem that spanning stuff crossing a page boundary is placed incorrectly after the page break in it, but this problem is solved by a fix incorporated in version 1.3.*

- 必须是 $t_i \in$ `p`, `c`, `m`, `b`，否则会出现非法双面特性的错误消息。

- *It must be* $t_i \in$ {`p`, `c`, `m`, `b`}, *or you will have an error message of illegal two-siding feature.*

- 第 *9*节展示了双面排版的示例，以及与 *parallel-pag*分页相关的问题。

- *Section 9 shows examples of two-sided typesetting together with related issues on parallel-paging.*

`\marginparthreshold{`k`}[`k'`]`

该命令指定了边注放置在右边页边距中的最小列序数 k。也就是说，在列 i 中给出的边注如果 $i < k$，则放置在左边页边距中，而如果 $i \geq k$，则放置在右边页边距中。如果给定可选参数 k'，则用于决定右边 parallel-pages 中的列的边注放置在哪个页边距。默认情况下，假设 $k = 1$，左边最左列-0 的边注放置在左边页边距中，而其他列的边注放置在右边页边距中。

The command specifies the minimum ordinal k of columns whose marginal notes are placed in right margin. That is, marginal notes given in a column-i go to left margin if $i < k$, while they go to right if $i \geq k$. The optional argument k', if given, is for columns in right parallel-pages to decide the margin where their marginal notes are placed. In default, $k = 1$ is assumed to let marginal notes from the leftmost column-0 go to left margin while those from other columns go to right.

- 您可以将 k 指定为 0，使所有边注都放在右侧边距，或者可以给命令一个较大的数，比如 100，将它们全部放在左侧边距。

- You may specify $k = 0$ to let all marginal notes go to right margin, or may give the command a large number, say 100, to place all of them in left margin.

- 上述设置 $k = 0$ 或 $k = 100$ 使得边注从不同的列共享一个侧边距，当一个（并列）页面有三个或更多列时，共享是不可避免的。当一个侧边距被来自两个或更多列的边注共享时，可能会发生两个来自不同列的边注在它们各自要占据的空间上发生冲突的情况。这个冲突通过 paracol 来解决，它会将后面给出的边注推到更低的位置，直到找到一个可用的空间为止。请注意，要被推到下方的边注是由源代码中的位置决定的，而不是打印结果中的位置。同时，请注意 paracol 利用已经放置的两个边注之间的空间，在后面的边注放置时尽可能地在自然位置上放置，或者尽量减少推下的量。

- The setting $k = 0$ or $k = 100$ above makes a side margin *shared* by marginal notes from different columns, and sharing is inevitable when a (parallel-) page has three or more columns. When a margin is shared by marginal notes from two or more columns, it can happen that two marginal notes from different columns conflict over the space to be occupied by each of them. This conflict is solved by paracol to push down the note given later in your source `.tex` until an available space for it is found. Note that the marginal note to be pushed down is determined by the position in the source rather than that in the printed result. Also note that paracol exploits space between two marginal notes having been already placed in the placement of other note coming later to place it at the natural position if possible or to minimize the amount of pushing down otherwise.

- 在确定边注放置的实际边距时，还涉及其他两个因素：`\twosided` 命令的 `m` 特性和页面的奇偶性；以及 LaTeX 的原始命令 `\reversemarginpar`。具体而言，在根据 `\marginparthreshold` 给定的阈值做出第一次初步决策后，我们有以下两个步骤来修改决策；如果 `\twosided` 命令中指定了 `m` 特性，并且边注属于偶数页，决策将被反转为得到第二次初步结果；然后，如果指定了 `\reversemarginpar`，第二个结果将被（再次）反转为得到最终结果。

- In the decision of the real margin in which a marginal note is placed, other two factors are involved; `m` feature of `\twosided` command and the parity of the page; and LaTeX's genuine command `\reversemarginpar`. More specifically, after the first preliminary decision is made according to the threshold given to `\marginparthreshold`, we have the following two steps to modify the decision; if `m` feature has been specified in `\twosided` command and the marginal note belongs to an even-numbered page, the decision is reversed to have the second preliminary result; and then if `\reversemarginpar` has been specified, the second result is reversed (again) to have the final result.

- 在旧版本的 paracol 中（即 1.3 之前的版本），边注的放置不仅无法控制，而且在文档具有

- In old versions of paracol, namely older than 1.3, marginal note placement was not only uncontrollable but also

gave ugly results when your document has three or more columns because the marginal notes from a column not being leftmost or rightmost were placed in the gap following the column rather than a margin. This miserable *gap note* placement does not happen any more, or in other words this is no more available because the author believes nobody loves it.

三列或更多列时会产生丑陋的结果，因为不在最左侧或最右侧的列的边注会放置在列后的间隙中，而不是边距中。这种痛苦的间隙边注放置不再发生，换句话说，不再可用，因为作者认为没有人喜欢它。

- Section 9 shows examples of marginal note placement together with related issues on parallel-paging and two-sided typesetting.

- 第 9节展示了边注放置的示例，以及与 parallel-paging 和双面排版相关的问题。

`\marginnote[`*left*`]{`*right*`}[`*voffset*`]`

You may use the package marginnote and its command `\marginnote` in `paracol` environments as a replacement of `\marginpar`. However, the command is *emulated* with `\marginpar` and paracol's own mechanism of marginal note placement. Therefore, some of marginnote's functionality are not effective in `paracol` environment except for the following features.

您可以在 `paracol` 环境中使用 marginnote 宏包及其命令 `\marginnote` 作为 `\marginpar` 的替代。然而，该命令是通过 `\marginpar` 和 paracol 自身的边注放置机制进行模拟的。因此，在 `paracol` 环境中，除了以下功能外，一些 marginnote 的功能是不起作用的。

- Shifting up/down a marginal note by the optional *voffset*.
- Defining fonts (and others) for marginal notes by `\marginfont`.
- Controlling the holizontal paragraph alignment by `\raggedleftmarginnote` and `\raggedrightmarginnote`.

- 通过可选参数*voffset*将边注上下移动。
- 通过 `\marginfont` 为边注定义字体（和其他样式）。
- 通过 `\raggedleftmarginnote` 和`\raggedright marginnote` 控制水平段落对齐方式。

Note that you will see a warning message "`\margninnote` is emulated by `\marginpar`" at the first in-`paracol` occurrence of the command to let you know the imperfection.

请注意，在第一次使用该命令的 `paracol`环境中，您将看到一个警告消息 "`\margninnote` is emulated by `\marginpar`"，以便让您知道这种不完美的情况。

7.5 计数器的命令

Commands for Counters

`\globalcounter{`*ctr*`}`
`\globalcounter*`

The command `\globalcounter{`*ctr*`}` declares that the counter *ctr* is global to all columns, while `\globalcounter*` does so for all counters. An update of a global counter in a column is seen by any other columns.

命令 `\globalcounter{`*ctr*`}` 声明计数器*ctr*在所有列中是全局的，而 `\globalcounter*` 则对所有计数器都是如此。在某列中更新全局计数器会被其他列看到。

当一个全局计数器被 `\stepcounter` 或 `\refstepcounter` 显式步进，或者通过节标题命令等隐式步进时，其子孙局部计数器的所有列局部值都会被清零。

- All column-local values of a descendant local counter of a global counter are zero-cleared when the global counter is explicitly stepped by `\stepcounter` or `\refstepcounter`, or implicitly by a sectioning command and so on.

- The counter `page` is always global but an explicit update of it by e.g., `\setcounter` in a non-leftmost column is not seen by other columns and is canceled even for the column itself after a column-switching or a page break in the column. Therefore, if you want to make a *jump* of `page`, it must be done in the leftmost column 0. Note that a jump from a page p to q can be seen in other columns even if they have gone beyond p *before* the column 0 makes the jump, as far as `page` having q (or its successor) is referred to by `\pageref` or through *contents* files such as `.toc`[25].

- 计数器 `page`始终是全局的，但是在非最左列中通过 `\setcounter` 进行的显式更新在其他列中是不可见的，并且在该列进行 column-switching或页面断页后，甚至对于该列本身也会被取消。因此，如果要进行 *jump*（即跳转）`page`，必须在最左列 0 中进行。请注意，即使其他列在列 0 进行跳转之前已经超过了页面 p，只要 `page`具有 q（或其后继者）的值，并且通过 `\pageref` 或通过 *contents* 文件（如`.toc`）进行引用，其他列仍然可以看到从页面 p 跳转到 q。[26]

- All counters except for `page` are local by default. This feature may cause a problem with some packages including marginnote and (auto-)pst-pdf having their own counters which must be global. Since it is tough to find the name of such counters from package sources, if you have something wrong with these (or other) packages, try to put `\globalcounter*` in your preamble and use `\localcounter` shown below to localize specific counters which you need to be local.

- 除了 `page`计数器外，默认情况下所有计数器都是局部的。这一特性可能会导致一些包（包括 marginnote 和 (auto-)pst-pdf）出现问题，这些包具有必须是全局的计数器。由于很难从包的源代码中找到这些计数器的名称，如果您在使用这些（或其他）包时遇到问题，请尝试在导言区中使用 `\globalcounter*` 命令，并使用下面显示的 `\localcounter` 命令将需要局部化的特定计数器局部化。

[25] Direct reference to `page` may give an inconsistent result, as you might have in ordinary LaTeX documents.
[26] 直接引用 `page` 可能会导致不一致的结果，就像在普通的 LaTeX 文档中可能遇到的那样。

- 如果一个已经是全局的*ctr*被再次全局化，它会被静默地忽略，而不会有任何警告。

- Globalizing a *ctr* being already global is just ignored without any complaints.

`\localcounter{`*ctr*`}`

这个命令声明计数器*ctr*在每个栏目中都是局部的。

The command declares that the counter *ctr* is local for each column.

- 尽管该命令旨在将一次全局化的*ctr*局部化，但将局部计数器局部化不会引起任何错误，只是被忽略。将永久全局 `page`局部化也只是被忽略，没有任何警告。

- Though this command is intended for localizing a *ctr* which is once globalized, localizing a local counter does not causes any error but is just ignored. Localizing the permanently global `page` is also just ignored without any complaints.

`\definethecounter{`*ctr*`}{`*col*`}{`*rep*`}`

该命令定义 `\the`*ctr* 作为在列 *col* 中的局部使用，其值为 `{`*rep*`}`。也就是说，在列 *col* 中，`\the`*ctr* 的行为就像是通过 `\renewcommand{\the`*ctr*`}{`*rep*`}` 定义的一样。

The command defines `\the`*ctr* being `{`*rep*`}` for the local use in the column *col*. That is, `\the`*ctr* in the column *col* acts as if it is defined by `\renewcommand{\the`*ctr*`}{`*rep*`}`.

`\synccounter{`*ctr*`}`

该命令将出现在的列中的 local counter *ctr*的值向所有其他列中的值进行 *broadcasts*（即广播）。

The command *broadcasts* the value of the local counter *ctr* in the column in which the command appears to the values in all other columns.

`\syncallcounters`

该命令将出现在其中的列中的所有 local counter的值广播到所有其他列中的相应值。

The command broadcasts the values of all local counters in the column in which the command appears to the values in all other columns.

7.6 Page-Wise Footnotes

`\footnotelayout{`*layout*`}`

该命令指定了在 `paracol`环境中脚注的 *layout* $\in$ {`c`, `p`, `m`}，具体如下。

The command specifies the *layout* $\in$ {`c`, `p`, `m`} of footnotes in `paracol` environments as follows.

`c`(*olumn*) 使脚注 *column-wise*（也称为多列脚注）默认在每列底部放置脚注，并将其与 pre-environment 和 post-environment 的脚注分开。

`c`(*olumn*) makes footnotes *column-wise* (aka multi-columned) being default to place footnotes in each column at the bottom of the column and separating them from pre-environment and post-environment footnotes.

`p`(*age*) 将脚注设置为 *page-wise*（也称为单列脚注），以便将所有列中的脚注聚集在一起，跨越所有列进行排版，并放置在它们所在的页面底部，或者放置在它们所属的 `paracol`环境的末尾，以便与 pre-environment和 post-environment脚注分开。

`p`(*age*) makes footnotes *page-wise* (aka single-columned) so that footnotes in all columns are gathered, typeset spanning all columns, and placed at the bottom of the page in which they appear or at the end of the `paracol` environment they belong to, so that they are separated from pre-environment and post-environment footnotes.

`m`(*erge*) 在同一页的环境外但在相同页面中，即 pre-environment和 post-environment stuff中，使用 page-wise footnote和 *merged*创建脚注。

`m`(*erge*) makes page-wise footnotes *merged* with footnotes in outside of the environment but in the same page, i.e., those in pre-environment and post-environment stuff.

- 在第 10 页中可以找到 merged footnote 的一个示例，而在第 8 节中则会看到许多这样的示例[28]。

- An example of merged footnote is found in p. 10 while you will see many of them in Section 8[27].

- 在任何布局中，脚注不会出现分页，即脚注总是作为一个整体放在一页中。这意味着脚注的高度不可能超过 `\textheight`，因此如果您给出一个非常长的脚注，它将打印出超出页面页脚区域（或超出纸张边界）的警告消息。

- In any layouts, a footnote cannot have page breaks in it, i.e., a footnote is always put in a page as a whole. This makes it impossible to have a footnote taller than `\textheight` and thus you will see a warning message if you give a very long footnote which will be printed intruding into the area for page footer (or out of the paper bound).

[27] The left-column footnote 6 in p. 7 looks like a merged footnote because it is at the bottom of the page and the marked text is above the single-column text. However, it is an ordinary column-wise one produced by a trick with `\footnotemark` and `\footnotetext` in different `paracol` environments.

[28] 在第 7 页的左列脚注 6 看起来像是一个合并的脚注，因为它位于页面底部，而标记的文本位于单列文本之上。然而，它是由在不同的 `paracol`环境中使用`\footnotemark`和`\footnotetext`技巧生成的普通 column-wise脚注。

- Choosing the layout page-wise or merged makes `footnote` counter global and `\fncounteradjustment` shown below performed inside `\footnotelayout`. Choosing column-wise let the command do the operations oppositely, i.e., localizes `footnote` and does `\nofncounteradjustment`. Though these settings are usually appropriate for each footnote layout but you can override them by explicitly using commands like `\localcounter{footnote}`.

- 选择布局为page-wise 或merged 会使 `footnote`计数器变为全局，并在 `\footnotelayout` 内执行下面的 `\fncounteradjustment` 操作。选择column-wise 会使命令执行相反的操作，即将 `footnote`局部化并执行 `\nofncounteradjustment`。虽然这些设置通常适用于每个脚注布局，但您可以通过显式使用 `\localcounter{footnote}` 等命令来覆盖它们。

- The command has to be outside of `paracol` environments to decide the action in the environments following them. If it appears in a `paracol` environment, you will have a warning message saying it is ignored.

- 该命令必须放在 `paracol`环境之外，以决定其后的环境中的操作。如果它出现在 `paracol`环境中，你将收到一个警告消息，表示该命令被忽略。

- In old versions of paracol, namely 1.2 and its minor revisions 1.2x, footnote layout was controlled by a set of lengthy commands `\multicolumnfootnotes` for `c`, `\singlecolumnfootnotes` for `p`, and `\mergedfootnotes` for `m`. Though they are still available and will be so forever for backward compatibility, it is recommended to use `\footnotelayout`[29].

- 在旧版本的 paracol 中（即 1.2 版本及其小修订版本 1.2x），脚注布局由一组冗长的命令控制：`\multicolumnfootnotes` 用于 `c`，`\singlecolumnfootnotes` 用于 `p`，`\mergedfootnotes` 用于 `m`。虽然它们仍然可用，并且将永远保持向后兼容，但建议使用 `\footnotelayout`[30]。

- It must be *layout* $\in \{$`c`, `p`, `m`$\}$, or you will have an error message of illegal layout specifier.

- 必须是 *layout* $\in \{$`c`, `p`, `m`$\}$，否则您将收到非法布局说明符的错误消息。

`\footnote*[`*num*`]{`*text*`}`
`\footnotemark*[`*num*`]`
`\footnotetext*[`*num*`]{`*text*`}`

The starred version of `\footnote`, `\footnotemark` and `\footnotetext` are for the adjustment of the footnote numbering, the order of footnote marks in main texts, and the stacking order of footnotes at page bottom. Their usages with various examples are given in Section 8.

`\footnote`、`\footnotemark` 和 `\footnotetext` 的星号版本用于调整脚注编号、主文本中脚注标记的顺序以及页面底部脚注的堆叠顺序。其各种示例的用法详见第 8节。

`\fncounteradjustment`
`\nofncounteradjustment`

The maintenance of `footnote` with the starred footnote commands such as `\footnote*` shown above causes out-of-order progress of the counter to make it hard to have a consistent counter value at `\end{paracol}`. The command `\fncounteradjustment` is to let `\end{paracol}` adjust the value of the counter based on its value at `\begin{paracol}` and the number of footnote commands in the environment. The command `\nofncounteradjustment` is to tell `\end{paracol}` to do nothing as in default.

使用上面展示的带星号的脚注命令（如 `\footnote*` ）来维护 `footnote`会导致计数器的顺序进展混乱，使得很难在`\end{paracol}`处获得一致的计数器值。命令 `\fncounteradjustment` 用于让`\end{paracol}`根据其在`\begin{paracol}`处的值和环境中脚注命令的数量来调整计数器的值。命令 `\nofncounteradjustment` 用于告诉`\end{paracol}`不做任何调整，这是默认情况下的行为。

- Though `\footnotelayout` with `p`(age-wise) or `m`(erged) argument does `\fncounteradjustment` while that with `c`(olumn) does `\nofncounteradjustment` inside of it, you can override these settings by explicitly putting a counter adjustment command after `\footnotelayout`.

- 尽管使用`p`(age-wise) 或`m`(erged) 参数的 `\footnotelayout` 会在其中执行 `\fncounteradjustment`，而使用`c`(olumn) 的 `\footnotelayout` 会执行 `\nofncounteradjustment`，但您可以通过在 `\footnotelayout` 之后显式放置计数器调整命令来覆盖这些设置。

- The effect of `\fncounteradjustment` is shown in Section 8.

- `\fncounteradjustment` 的效果在第 8 节中展示。

`\belowfootnoteskip`

The typesetting parameter specifies the amount of the space inserted below footnotes of single-column pre-environment stuff if it does not have bottom floats. The default amount is 0 pt, i.e., no space is added.

typesetting 参数指定了在单列 pre-environment stuff的脚注下方插入的空间量，如果它没有底部浮动对象。默认的量是 0,pt，即不添加任何空间。

[29] Not only for type saving but also for being familiar with this command which could have some advanced feature, for example to put gathered footnotes into a specific column, someday.
[30] 不仅为了节省输入，还为了熟悉这个命令，它可能具有一些高级功能，例如将收集的脚注放入特定的列中。

7.7 用于着色文本和列分隔线的命令
Commands for Coloring Texts and Column-Separating Rules

`\columncolor[`*mode*`]{`*color*`}[`*col*`]`
`\normalcolumncolor[`*col*`]`

命令 `\columncolor` 声明列的默认颜色为*color*，或者通过与可选的*mode*组合指定的颜色。命令 `\normalcolumncolor` 声明默认颜色为 `\normalcolor` 指定的颜色，即通常为黑色。这些命令的目标列是包含命令的列，或者如果指定了*col*，则为*col*。

- 该命令可以在 `paracol`环境之外使用。如果是这样，并且未提供*col*，则目标列是最左边的列 0。
- 默认的颜色声明是全局的。因此，即使该命令出现在 `paracol`环境中（甚至在其中的某个分组结构中），该声明在`\end{paracol}`之后仍将保持有效，以确定后续 `paracol`环境中指定列的默认颜色。
- 要正确给列中的文本（以及其他内容）着色，您需要加载 color 包或其相关包（例如 xcolor），因为 paracol 中的着色实现依赖于它们。
- 当然可以在 `paracol`环境中使用 `\color[`*mode*`]{`*color*`}` 和其他着色命令。一个注意事项是 `\color` 决定了后续文本的颜色，直到给出其他规范或关闭命令周围的分组。因此，`\switchcolumn` 不会影响着色，但对于给定列中的文本的颜色也会应用于要切换到的列中的文本。下面的示例展示了着色和 column-switching的无关性。

The command `\columncolor` declares that the *default color* of a column is *color* or what it specifies by the combination with the optional *mode*. The command `\normalcolumncolor` declares the default color is what `\normalcolor` specifies, i.e., black usually. The target column of these commands is that in which the commands reside, or *col* if it specified.

- The command may be outside of `paracol` environment. If so and *col* is not provided, the target column is the leftmost 0.
- The default color declaration is *global*. Therefore, even if the command appears in a `paracol` environment (and even in some grouping structure in it), the declaration will be kept effective after `\end{paracol}` to determine the default color of the specified column in succeeding `paracol` environments.
- To give a color to texts (and maybe other stuff) in a column correctly, you need to load color package or its relative (e.g., xcolor) which the implementation of coloring in paracol relies on.
- Coloring with `\color[`*mode*`]{`*color*`}` and other coloring commands in `paracol` environments is of course allowed. One caution is that the `\color` decides the color for following texts until other specification is given or the group surrounding the command is closed. Therefore, `\switchcolumn` does not affect the coloring but a color given to the texts in a column is also applied to the texts in the column to be switched to. This irrelativeness of coloring and column-switching is shown in the example below.

This column is colored blue because
本栏目被着色为蓝色，因为
`\columncolor{blue}`
is specfied. Here we have a `\switchcolumn`.
指定了。接着有一个 `\switchcolumn`命令。

The color of this paragraph is green because we are still in the environment of green coloring, which we are now closing.

这段文字的颜色是绿色的，因为我们仍然处于绿色着色的环境中，而现在我们正在关闭它。

Since the coloring environment has been closed, the color of this paragraph is the default blue. Now we have yet another and the last `\switchcolumn` to the right.
由于着色环境已关闭，这段文字的颜色是默认的蓝色。现在我们有另一个并且是最后一个 `\switchcolumn` 向右切换。

This column is colored red because
本栏目被着色为红色，因为
`\columncolor{red}`
is specified.
被指定了。

Now the color of the right column is changed to green because
现在右栏的颜色被更改为绿色，因为
`\begin{color}{green}`
is given prior to this paragraph. Now we have another `\switchcolumn` to go back to the left.
被指定了。现在我们有另一个 `\switchcolumn`来返回到左侧。

Since this paragraph is outside of the coloring environment, its color is the default red.
由于这段文字在着色环境之外，它的颜色是默认的红色。

The default coloring of columns does not affect anything outside of `paracol` environment of course, and thus this sentence is not colored[31].

默认的栏目着色当然不会影响 `paracol`环境之外的任何内容，因此这个句子没有被着色[32]。

[31] Or colored black as `\normalcolor` specifies.
[32] 或者按照`\normalcolor`的指定，着色为黑色。

```
\normalcolumncolor[0]\normalcolumncolor[1]
```

\coloredwordhyphenated
\nocoloredwordhyphenated

The command \coloredwordhyphenated allows the first word following a coloring command such as \color to be hyphenated, but at the same time make it possible that a line is broken before the word. The command \nocoloredwordhyphenated acts oppositely and thus line breaking before the first word and hyphenating it are inhibited. By default, \coloredwordhyphenated is effective.

命令 \coloredwordhyphenated 允许在着色命令（如 \color）后的第一个单词进行连字符划分，但同时也可能在该单词之前进行换行。命令 \nocoloredwordhyphenated 则具有相反的作用，从而禁止在第一个单词之前进行换行和连字符划分。默认情况下，\coloredwordhyphenated 是有效的。

- The implementation of color package and its relatives makes it impossible that *word* is hyphenated when it appears like {\color{red}*word* ...} or \textcolor{*word* ...}. This inhibition of the hyphenation is sometimes annoying especially when the document is multi-columned and thus a line is narrow and a column is written in a language having long words such as German. Therefore in paracol package, a trick is used to allow the *word* is hyphenated. However this trick being insertion of a null horizontal space has a side effect that the word can have a line break before it. Though this line break is usually unharmful, in a special occasion the break is undesirable and inappropriate by making it possible that the *half-colored* word 'inappropriate' is broken between 'in' and 'appropriate' without hyphenation. Therefore, if you find such a inappropriate break, use \nocoloredwordhyphenated as follows, for example.

  ```
  {\nocoloredwordhyphenated in\textcolor{red}{appropriate}}
  ```

- color 宏包及其相关命令的实现方式使得在类似于 {\color{red}*word* ...} 或 \textcolor{*word* ...} 的情况下，无法对 *word* 进行连字符划分。这种禁止连字符划分的机制有时会令人感到不便，特别是在文档具有多列布局的情况下，当一行较窄且一列使用具有较长单词的语言（如德语）时。因此，在 paracol 宏包中，使用了一个技巧来允许对 *word* 进行连字符划分。然而，这个技巧是插入一个空的水平间距，这会导致单词之前出现一个换行。虽然这种换行通常没有问题，但在特殊情况下，这种换行可能是不可取的，并且不合适，因为它使得半着色的单词 "inappropriate" 在 "in" 和 "appropriate" 之间断开而没有连字符划分。因此，如果您发现这样的不合适的断行，请使用 \nocoloredwordhyphenated，例如以下方式。

\colseprulecolor[*mode*]{*color*}[*col*]
\normalcolseprulecolor[*col*]

The command \colseprulecolor declares the color for *column-separating rules*, being the vertical rules drawn at the center of gaps between columns, is *color* or what it specifies by the combination with the optional *mode*. The command \normalcolseprulecolor declares the color of rules is what \normalcolor specifies, i.e., black usually. If the optional argument *col* is given, these commands specifies the color of the rule in the gap following the column whose ordinal is *col*, rather than all rules.

命令 \colseprulecolor 指定列分隔符的颜色，列分隔符是在列之间的间隙中央绘制的垂直线条。颜色可为特定的颜色，也可以是与可选的模式组合指定的颜色。命令 \normalcolseprulecolor 将列分隔符的颜色设置为 命令指定的颜色，通常为黑色。如果给出可选参数 *col*，这些命令将指定在具有序号 *col* 的列之后的间隙中的分隔符的颜色，而不是所有分隔符的颜色。

- The rules are drawn if LaTeX's typesetting parameter \columnseprule for the rule width has non-zero value, e.g., 0.4pt to obey the standard rule thickness. The rules are *not* drawn on page-wise stuff, i.e., pre-environment and post-environment stuff, page-wise floats or (merged or non-merged) page-wise footnotes of course but also spanning texts. Therefore, if a page has spanning texts, the rules are *broken* by them as shown in the red rule example below.

- 如果 LaTeX 的排版参数 \columnseprule 的线条宽度具有非零值（例如，0.4pt 以遵守标准线条厚度），则会绘制线条。线条不会绘制在 page-wise stuff上，即 pre-environment和 post-environment stuff，page-wise浮动对象或（merged或非合并的）page-wise footnote上，当然也不会绘制在 spanning text上。因此，如果页面上有 spanning text，则它们会打破线条，如下面的红色规则示例所示。

This is a left column paragraph preceding a spanning text. Of cource the rule separating this and the next column starts from the top of this paragraph.

这是一个左列段落，位于 spanning text之前。当然，分隔这个段落和下一列的规则从该段落的顶部开始。

This is a right column paragraph preceding a spanning text given by the \switchcolumn* at its end.

这是一个位于右列的段落，在其末尾由 \switchcolumn* 给出的 spanning text之前。

An Example of Spanning Text Given by \subsubsection* Command

一个由\subsubsection* 命令给出的跨列文本示例

Since we have a spanning text above, the red rule separating this and the next column is broken by the text.

由于上方有一个 spanning text，分隔这一列与下一列的红色分隔线被文本打断。

It is also natural that the rule separating this and the previous column is terminated at the end of this paracol environment.

同样自然的是，分隔这一列与前一列的分隔线在 paracol环境的末尾终止。

- To give a color to rules correctly, you need to load color package or its relative (e.g., xcolor) which the implementation of coloring in paracol relies on.

- Once you give a color to rules in a specific gap with the optional *col*, another `\colseprulecolor` or `\normalcolseprulecolor` without *col* does *not* change the color of the rule in the gap.

- 为了正确给分隔符上色，您需要加载 color 或其相关包（例如 xcolor），因为 paracol 中的着色实现依赖于它们。

- 一旦您使用可选参数 *col* 为特定间隙中的分隔符指定了颜色，再次使用 `\colseprulecolor` 或 `\normalcolseprulecolor`，而没有使用 *col*，不会改变该间隙中的分隔符的颜色。

7.8 Commands for Background Painting

用于背景绘制的命令

`\backgroundcolor{`*region*`}[`*mode*`]{`*color*`}`
`\backgroundcolor{`*region*`(`x_0`,`y_0`)}[`*mode*`]{`*color*`}`
`\backgroundcolor{`*region*`(`x_0`,`y_0`)(`x_1`,`y_1`)}[`*mode*`]{`*color*`}`

The command declares that *background painting* of *region* is performed with *color* or what it specifies by the combination of the optional *mode*. The *region* whose background is painted is one of the following.

该命令声明使用 *color* 或其由可选 *mode* 组合指定的方式来执行 *region* 的 *background painting*。被着色的 background的*region*是以下之一。

`c`(*olumn*) for all columns, or particular one if *region* is `c[`*col*`]` to specify its ordinal *col*.

`c`(*olumn*) 适用于所有列，或者如果*region*为`c[`*col*`]` 时，可以指定特定的列序号*col*。

`g`(*ap*) for all gaps between columns, or particular one if *region* is `g[`*col*`]` to specify the ordinal *col* of the column preceding the gap.

`g`(*ap*) 对于所有列之间的间隙，或者特定的间隙，可以使用*region*参数。如果*region*是`g[`*col*`]`，则可以指定前一个间隙的序号*col*。

`s`(*panning*) for spanning texts.

`s`(*panning*) 用于 spanning text。

`f`(*loat*) for page-wise floats.

`f`(*loat*) 用于 page-wise 浮动体。

`n`(*ote*) for (merged or non-merged) page-wise footnotes.

`n`(*ote*) 用于 (merged 或非合并的) page-wise footnote。

`p`(*re/post*) for pre-environment and post-environment stuff.

`p`(*re/post*) 用于 pre-environment 和 post-environment stuff。

`t`(*op*) for top margin.

`t`(*op*) 用于顶部边距。

`b`(*ottom*) for bottom margin.

`b`(*ottom*) 用于底部边距。

`l`(*eft*) for left margin.

`l`(*eft*) 用于左边距。

`r`(*ight*) for right margin.

`r`(*ight*) 用于右边距。

In addition, capitals of the keys above, i.e., `C`, `G`, …, `L`, are also legitimate for *under painting*. For example, you may specify to paint the background of a region, say top margin, by two `\backgroundcolor` with `t` and `T` and with different color arranging the size of the region of either `t` or `T` (or both of them) by the *extension* option shown below.

此外，上面的键的大写字母，即`C`、`G`、…、`L`，也可以用于下层绘制。例如，您可以通过两个不同颜色的 `\backgroundcolor`（使用`t` 和`T`）和通过 *extension*选项来调整`t` 或`T`（或两者）的区域大小，来指定绘制区域（例如顶部边距）的 background。

The optional `(`x_0`,`y_0`)` is to enlarge the region to be painted shifting its left-top and right-bottom corner outside by the dimension x_0 horizontally and y_0 vertically, or to shrink it with negative dimensions. This *extension* can be asymmetric giving another optional `(`x_1`,`y_1`)` so that it acts on the right-bottom corner while let `(`x_0`,`y_0`)` shift only the left-top corner. Moreover, you may make each extension *infinite* by giving 10000`pt` (about 3.5 m) to x_0, y_0, x_1 and/or y_1 so that the corresponding region edge is shifted to the paper edge. Furthermore, this *infinite extension* can be terminated at the point α inside the corresponding paper edge by giving 10000`pt` $-\ \alpha$ ($\alpha \leq$ 1000`pt`) to an extension parameter x_0, etc.

可选的 `(`x_0`,`y_0`)` 是为了扩大要着色的区域，将其左上角和右下角分别水平和垂直地移出维度 x_0 和 y_0，或者用负维度来缩小它。这个 *extension*可以是不对称的，可以给出另一个可选的 `(`x_1`,`y_1`)`，让它作用于右下角，而 `(`x_0`,`y_0`)` 只移动左上角。此外，您可以通过将 x_0、y_0、x_1 和/或 y_1 设置为 10000,`pt`（约为 3.5,m）来使每个 extension变为无限，从而将相应的区域边缘移动到纸张边缘。此外，通过将扩展参数 x_0 等设置为 10000, `pt` $-\ \alpha$（$\alpha \leq$ 1000, `pt`），这个 *infinite extension*可以在相应的纸张边缘内的点 α 处终止。

- A region whose color is not specified is not painted and thus left blank (or kept as painted by `\pagecolor` if you

- 未指定颜色的区域不会被绘制，因此保持为空白（或者如果您指定了 `\pagecolor`，则保持

specify it).

- Under-painting of columns and gaps by `C` and `G` is made for regions different from those over-painting `c` and `g`. That is, under-painting is done ignoring all page-wise stuff and thus the height of the regions is always `\textheight`+`\maxdepth`. On the other hand, over-painting is only for chunks shrunk or separated by page-wise stuff.

- You may exploit the following painting order, where x_i is the i-th spanning text ($x \in \{\mathtt{s},\mathtt{S}\}$) or i-th chunk followed by the i-th spanning text, m and n is the number of spanning texts and columns in a page respectively, to overlay a preceding region with a succeeding region, if your *printer* allows overlaid color painting.

$$
\begin{aligned}
&\mathtt{T} \to \mathtt{B} \to \mathtt{L} \to \mathtt{R} \to \mathtt{G}[0] \to \cdots \to \mathtt{G}[n-1] \to \mathtt{C}[0] \to \cdots \to \mathtt{C}[n-1] \\
&\quad \to \mathtt{t} \to \mathtt{b} \to \mathtt{l} \to \mathtt{r} \to \mathtt{N} \to \mathtt{n} \to \{\mathtt{F},\mathtt{P}\} \to \{\mathtt{f},\mathtt{p}\} \to \mathtt{S}_1 \to \cdots \to \mathtt{S}_m \\
&\quad \to \mathtt{g}_1[0] \to \cdots \mathtt{g}_1[n-2] \to \mathtt{c}_1[0] \to \cdots \mathtt{c}_1[n-1] \to \mathtt{s}_1 \\
&\quad \to \cdots \\
&\quad \to \mathtt{g}_m[0] \to \cdots \mathtt{g}_m[n-2] \to \mathtt{c}_m[0] \to \cdots \mathtt{c}_m[n-1] \to \mathtt{s}_m \\
&\quad \to \mathtt{g}_{m+1}[0] \to \cdots \mathtt{g}_{m+1}[n-2] \to \mathtt{c}_{m+1}[0] \to \cdots \mathtt{c}_m[n-1]
\end{aligned}
$$

- If you specify `b` feature by `\twosided`, background painting is *mirrored* in even-numbered pages so that `l` and `L` mean right margin, `r` and `R` mean left margin, and asymmetric extensions are applied to right-top and left-bottom corners.

- To give a color for background painting correctly, you need to load color package or its relative (e.g., xcolor) which the implementation of coloring in paracol relies on.

- To paint margins and regions having infinite extension correctly, the parameters `\paperwidth` and `\paperheight` should be set properly by, for example, a paper selection option of `\documentclass`.

- Section 10 shows examples of background painting to give you more intutive explanations of `\backgroundcolor` and its region specifications.

`\nobackgroundcolor{`*region*`}`
`\resetbackgroundcolor`

The command `\nobackgroundcolor` declares that the background of *region* is not painted, where *region* is one of legitimate region specifiers of `\backgroundcolor`. The command `\resetbackgroundcolor` declares no regions are painted and thus gives you the default state.

- If you specified the background painting of `c[`*col*`]` or `g[`*col*`]` by `\backgroundcolor`, the painting is *not* canceled by `\nobackgroundcolor` with `c` or `g` but without `[`*col*`]`. Similarly, once you made declarations of background painting of both `c` and `c[`*col*`]` (resp. `g` and `g[`*col*`]`), `\nobackgroundcolor` with `c[`*col*`]` (resp. `g[`*col*`]`) cancels the painting of `c[`*col*`]` (resp. `g[`*col*`]`) but the region will still be painted by the color you gave to `c` (resp. `g`).

`\pagerim`

This is a (kind of) *length command*[33]

[33] In reality, it is a `\dimen` register rather than a `\skip` register.

为 `\pagecolor` 绘制的颜色)。

- 对于与覆盖`c` 和`g` 不同的区域，通过`C` 和`G` 进行的列和间隙的底层绘制是独立的。也就是说，底层绘制忽略所有 page-wise stuff，因此区域的高度始终为 `\textheight`+`\maxdepth`。另一方面，覆盖绘制仅适用于通过 page-wise stuff缩小或分离的块。

- 您可以利用以下绘制顺序，其中 x_i 是第 i 个 spanning text（$x \in \mathtt{s},\mathtt{S}$）或第 i 个块之后的第 i 个 spanning text，m 和 n 分别是页面上的 spanning text和列的数量，以将前一个区域与后一个区域叠加在一起，如果您的打印机允许叠加颜色绘制。

$$
\begin{aligned}
&\mathtt{T} \to \mathtt{B} \to \mathtt{L} \to \mathtt{R} \to \mathtt{G}[0] \to \cdots \to \mathtt{G}[n-1] \to \mathtt{C}[0] \to \cdots \to \mathtt{C}[n-1] \\
&\quad \to \mathtt{t} \to \mathtt{b} \to \mathtt{l} \to \mathtt{r} \to \mathtt{N} \to \mathtt{n} \to \{\mathtt{F},\mathtt{P}\} \to \{\mathtt{f},\mathtt{p}\} \to \mathtt{S}_1 \to \cdots \to \mathtt{S}_m \\
&\quad \to \mathtt{g}_1[0] \to \cdots \mathtt{g}_1[n-2] \to \mathtt{c}_1[0] \to \cdots \mathtt{c}_1[n-1] \to \mathtt{s}_1 \\
&\quad \to \cdots \\
&\quad \to \mathtt{g}_m[0] \to \cdots \mathtt{g}_m[n-2] \to \mathtt{c}_m[0] \to \cdots \mathtt{c}_m[n-1] \to \mathtt{s}_m \\
&\quad \to \mathtt{g}_{m+1}[0] \to \cdots \mathtt{g}_{m+1}[n-2] \to \mathtt{c}_{m+1}[0] \to \cdots \mathtt{c}_m[n-1]
\end{aligned}
$$

- 如果您通过 `\twosided` 命令指定了`b` 特性，那么在偶数页上 background painting会被 *mirror*反转，这样`l` 和`L` 表示右边距，`r` 和`R` 表示左边距，并且对右上角和左下角应用非对称扩展。

- 要正确给 background painting着色，您需要加载 color 包或其相关包（例如 xcolor），因为 paracol 中的着色实现依赖于它们。

- 为了正确绘制具有无限扩展的边距和区域，`\paperwidth` 和 `\paperheight` 参数应该通过 `\documentclass` 的纸张选择选项正确设置。

- 第 10节展示了 background painting的示例，以便更直观地解释 `\backgroundcolor` 及其区域规范。

命令 `\nobackgroundcolor` 声明*region*的 background不被绘制，其中*region*是 `\backgroundcolor` 的合法区域指示符之一。命令 `\resetbackgroundcolor` 声明没有区域被绘制，从而恢复默认状态。

- 如果您通过 `\backgroundcolor` 指定了 `c[`*col*`]` 或 `g[`*col*`]` 的 background painting，则使用不带 `[`*col*`]` 的 `c` 或 `g` 的 `\nobackgroundcolor` 不会取消绘制。同样，一旦您对 `c` 和 `c[`*col*`]`（或 `g` 和 `g[`*col*`]`）都进行了声明，使用 `c[`*col*`]`（或 `g[`*col*`]`）的 `\nobackgroundcolor` 将取消 `c[`*col*`]`（或 `g[`*col*`]`）的绘制，但区域仍然会使用您给出的颜色进行绘制。

这是一种（某种程度上的）长度命令[34]。

[34] 实际上，它是一个`\dimen`寄存器，而不是`\skip`寄存器。

to have the width of the *rim* area placed at each paper edge to inhibit background painting in the area. That is, the inner edges of the area are considered as virtual paper edges to block painting of all margins and regions having infinite extension to the edges, for example in order to avoid printing troubles caused by painting the rim area too close to the real paper edges. The default value of `\pagerim` is 0 to allow paint anywhere in a paper.

为了使每个纸张边缘的边缘区域的宽度用于抑制该区域内的 background painting。也就是说，该区域的内部边缘被视为虚拟纸张边缘，以阻止所有具有 infinite extension到边缘的边缘和区域的着色，例如为了避免将边缘区域着色过于靠近真实纸张边缘而造成的打印问题。`\pagerim` 的默认值为 0，允许在纸张的任何位置进行着色。

7.9 Control of Contents Output

内容输出的控制

`\addcontentsonly{`*file*`}{`*col*`}`

The command inhibits the output of contents information to *file* ∈ {`toc`, `lof`, `lot`} from columns other than *col*.

该命令禁止除 *col* 外的列将内容信息输出到 *file* ∈ `toc`, `lof`, `lot`。

- For example, this manual has `\addcontentsonly{toc}{0}` to inhibit the contents information output from `\subsection` commands in the right column in Section 4 and **??**, or the table should have duplicated entries of sub-sections.
- 例如，本手册使用 `\addcontentsonly{toc}{0}` 来阻止在第 4节和 **??**节的右列中，由 `\subsection` 命令输出的目录信息，否则表格将会有子节的重复条目。
- It must be *file* ∈ {`toc`, `lof`, `lot`}, or you will have an error message of illegal type of contents file.
- 它必须是 *file* ∈ `toc`, `lof`, `lot`，否则将会收到一个不合法的内容文件类型的错误消息。

7.10 Page Flushing Commands

页面刷新命令

`\flushpage`

The command flushes pages up to the *top page* in which the leading column resides. Deferred floats which can be put in the pages up to the top page are also flushed.

该命令将页面刷新到包含 leading column的 *top page*。也会刷新可以放置在 top page之前的页面上的延迟浮动体。

`\clearpage`

The command does what `\flushpage` does and then flushes all floats still deferred if any. The deferred float flushing beyond the top page takes place at first for column-wise ones creating float columns for them, and then for page-wise ones creating *float pages* only with page-wise floats, as LaTeX's `\clearpage` does outside `paracol` environment.

该命令执行 `\flushpage` 的功能，然后刷新所有延迟的浮动对象（如果有的话）。在 top page之后，延迟的浮动对象刷新首先针对 column-wise的浮动对象，为它们创建 float column，然后针对 page-wise的浮动对象，只创建包含 page-wise浮动对象的 *float page*，就像在 `paracol`环境之外使用 LaTeX 的 `\clearpage` 命令一样。

`\cleardoublepage`

The command does what LaTeX's `\cleardoublepage` does outside `paracol`. That is, it does `\clearpage` always and then leaves a blank page if it is even-numbered and two-sided `p`(age) feature is enabled by `twoside` option of `\documentclass` or `paracol`'s own `\twosided` command shown in Section 7.4.

该命令做的是在 `paracol`之外与 LaTeX 的 `\cleardoublepage` 相同的操作。也就是说，它总是执行 `\clearpage`，然后如果该页是偶数页，并且通过 `\documentclass` 的`twoside` 选项或 `paracol` 的 `\twosided` 命令（见第 7.4 节）启用了双面特性，它会留下一个空白页。

- This command is equivalent to `\clearpage` in `paracol` environments for non-paired parallel-paging because `\clearpage` flushes *both* left and right parallel-pages.
- 在对于 non-paired parallel-paging 的 `paracol`环境中，该命令等效于 `\clearpage`，因为 `\clearpage` 会刷新左侧和右侧的 parallel-pages。

8 Numbering and Placement of Page-Wise Footnotes

页注的编号和位置

Here we have a simple example of page-wise but not-merged footnotes[35].

这里有一个简单的示例，展示了非合并的 page-wise脚注[36]。

`\footnotelayout{p}`

[35]Because of the non-merged typesetting, this footnote is put above the example.

[36]因为不是合并的排版方式，所以这个脚注放在了示例之上。

First left-column 左列第一 paragraph ..... with a footnote[37] ..... in it.

Second left-column 左列第 2 paragraph ..... with a footnote[38] ..... in it.

First right-column paragraph ..... with a footnote[39] ..... in it.

Second right-column paragraph ..... with a footnote[40] ..... in it.

[37]First left-column footnote. 左列第一脚注。

[38]Second left-column footnote. 左列第 2 脚注。

[39]First right-column footnote.

[40]Second right-column footnote. This and all other footnotes above are page-wise and, since footnote typesetting is non-merged, they are put above the post-environment stuff. 右列第二脚注。这个脚注和上面的所有脚注都是 page-wise，由于脚注排版是非合并的，它们放在了 post-environment stuff之上。

As shown above, it is easy to have a reasonable result of footnote numbering and placement as far as your `paracol` environment is completely included in a page and you accept the numbering in left-column-first manner constructing the environment as follows exploiting the fact `footnote` is made global, where b is the value of `footnote` counter at `\begin{paracol}`, i.e., the number given to the footnote just preceding the environment, and thus $b = 36$ in the example above.

如上所示，只要您的 `paracol` 环境完全包含在一页中，并且您接受按左列优先的方式编号和放置脚注，那么脚注编号和放置的结果就会比较合理。可以通过以下方式构建环境，利用 `footnote` 是全局的这一事实，其中 b 是在 `\begin{paracol}`处的 `footnote` 计数器的值，即在环境之前的脚注的编号，因此在上面的示例中 $b = 36$。

`\begin{paracol}{2}`
left-column stuff having n footnotes numbered $b+1$, $b+2$, *...,* $b+n$
`\switchcolumn`
right-column stuff having m footnotes numbered $b+n+1$, $b+n+2$, *...,* $b+n+m$
`\end{paracol}`

The real life is, however, tougher than that, because the assumptions above are too optimistic as described in the following subsections.

然而，现实生活比上面的假设更加艰难，因为如下小节所描述的那样，这些假设过于乐观。

8.1 Multiple `\switchcolumn` in a Page

页面中的多个`\switchcolumn`

Here we have an example with three `\switchcolumn` commands in a page having six footnotes. Hereafter, footnotes are typeset with `\footnotelayout{m}`[41].

下面是一个在页面中使用了三个 `\switchcolumn` 命令的示例，其中包含六个脚注。在此之后，使用 `\footnotelayout{m}`[42]设置脚注样式。

[41]And thus this footnote is merged with those in the `paracol` environment.

[42]这个脚注与 `paracol`环境中的脚注合并了。

`\footnotelayout{m}`

First left-column 左列的第一个 paragraph ..... with a footnote[43] ..... in it.

First right-column 右列的第一个 paragraph ..... with a footnote[45] ..... in it.

[43]First left-column footnote. 左列的第一个脚注。

Second left-column 左列的第二个 paragraph ..... with a footnote[44] ..... in it.
It is followed by a `\switchcolumn`. 它后面跟着一个`\switchcolumn`。

Third and synchronized left-column 左列的第三个（同步的）paragraph ..... with a footnote[46] ..... in it.
It is followed by a `\switchcolumn`. 它后面跟着一个`\switchcolumn`。

It is followed by a `\switchcolumn*`. 它后面跟着一个`\switchcolumn*`。

Second and synchronized right-column 右列的第二个（同步的）paragraph ..... with a footnote[47] ..... in it.

Third right-column 右列的第三个 paragraph ..... with a footnote[48] ..... in it.

[44] Second left-column footnote. 左列的第二个脚注。
[45] First right-column footnote but following the second left-column one. 右列的第一个脚注，但是在第二个左列脚注之后。
[46] Third left-column footnote but following the first right-column one. 左列的第三个脚注，但是在第一个右列脚注之后。
[47] Second right-column footnote but following the third left-column one. 右列的第二个脚注，但是在第三个左列脚注之后。
[48] Third right-column footnote. 右列的第三个脚注。

The example in the previous page should look weird because the order of the third footnote in the left column 46 and the first in the right 45 are reversed in their numbers and in the stack at the page bottom. However, the result is *natural* because they are numbered and stacked in the order of occurrence in the source `.tex` as always done in any documents without paracol and with it but column-wise footnote typesetting. Since the paracol cannot maintain the order automatically[49],

you have to maintain it by yourself.

The problem is partly solved by using `\footnote` with its optional argument `[`*num*`]` to number the first right-column and the third left-column footnotes explicitly, i.e., to give $num = 46$ to the former and $num = 45$ to the latter. One caution is that you have to remember that `\footnote` with the optional *num* does not update `footnote` counter and thus you have to do `\setcounter{footnote}{46}` or `\addtocounter{footnote}{2}` after the third left-column footnote.

This remedy, however, cannot change the stacking order of these two footnotes of course. Therefore, you need another trick with `\footnotemark` and `\footnotetext` to stack the third left-column footnote above the first right-column one. More specifically, you can solve the problem inserting

`\footnotetext[45]{`*text for the third left footnote*`}`

somewhere between `\footnote` commands for the second left-column and the first right-column ones, e.g., at the end of the second left-column paragraph, and attaching its mark to the appropriate word for the footnote by `\footnotemark[45]`, to have the following.

在上一页的示例中，看起来有些奇怪，因为左列中的第三个脚注 46 和右列中的第一个脚注 45 在它们的编号和页面底部的堆栈中的顺序上是颠倒的。然而，这个结果是“自然”的，因为它们按照在源 `.tex` 中出现的顺序进行编号和堆叠，这是任何没有使用 paracol 或使用了 column-wise 脚注排版的文档中都会这样做的。由于 paracol 无法自动维护顺序[50]，

你需要自己维护这个问题。

部分解决这个问题的方法是使用带有可选参数 `[`*num*`]` 的 `\footnote` 命令，来显式地对第一个右列和第三个左列的脚注进行编号，即给前者赋值 $num = 46$，给后者赋值 $num = 45$。需要注意的是，你必须记住，带有可选参数*num*的 `\footnote` 命令不会更新 `footnote`计数器，因此你需要在第三个左列脚注之后使用 `\setcounter{footnote}{46}` 或 `\addtocounter{footnote}{2}`。

然而,这种方法当然无法改变这两个脚注的堆叠顺序。因此,您需要使用 `\footnotemark` 和 `\footnotetext` 来将第三个左列脚注堆叠在第一个右列脚注上面。具体来说，您可以通过插入以下内容来解决这个问题：

`\footnotetext[45]{`*text for the third left footnote*`}`

在第二个左列的 `\footnote` 命令和第一个右列的 `\footnote` 命令之间的某个位置，例如在第二个左列段落的末尾，并通过 `\footnotemark[45]` 将其标记附加到脚注所对应的单词上，可以得到以下效果。

First left-column paragraph ..... with a footnote[51] ..... in it.

Second left-column paragraph ..... with a footnote[52] ..... in it.

It is followed by `\footnotetext[53]{`*text*`}` and a `\switchcolumn`.

Third and synchroized left-column paragraph ..... with a footnote whose mark here[53] ..... is given by `\footnotemark[53]` ..... in it.

It is followed by `\addtocounter{footnote}{2}` and a `\switchcolumn`.

First right-column paragraph ..... with a footnote[54] ..... in it.

It is followed by a `\switchcolumn*`.

Second and synchronized right-column paragraph ..... with a footnote[55] ..... in it.

Third right-column paragraph ..... with a footnote[56] ..... in it.

Though this solution gives a good result, however, it has the following two problems. First, you have to explicitly specify the footnote number through the optional arguments `[`*num*`]` of `\footnote`, `\footnotetext` and `\footnotemark`. This problem is quite severe because, for example, if you add a footnote somewhere preceding the `paracol` environment in question, you have to modify all `[`*num*`]` arguments of footnote-related commands in the environment. This means that when the footnote addition is done in the first page of a 100-page document having `paracol` environments with explicitly numbered footnotes in every page, you have to make the corrections for environments in 99 pages. The other a little bit less severe problem

虽然这种解决方案可以得到一个很好的结果，但它存在以下两个问题。首先，您必须通过`\footnote`、`\footnotetext` 和 `\footnotemark` 命令的可选参数 `[`*num*`]` 显式地指定脚注编号。这个问题非常严重，因为例如，如果您在所讨论的 `paracol`环境之前的某个地方添加了一个脚注，您必须修改环境中所有脚注相关命令的 `[`*num*`]` 参数。这意味着当在一个具有每页都有显式编号脚注的 `paracol`环境的 100 页文档的第一页中进行脚注添加时，您必须对 99 页中的环境进行更正。另一个稍微不那么严重的问题是，您必须通过 `\setcounter`、`\addtocounter` 或 `\stepcounter` 保持 `footnote`计数器具有

[49] So far, because the maintenance is extremely tough. But since it is not impossible, some day you could have an improved version of paracol with the automatic ordering.

[50] 至今为止，因为维护顺序非常困难。但是，既然不是不可能，总有一天您可能会有一个改进版的 paracol，具有自动排序功能。

[51] First left-column footnote.

[52] Second left-column footnote.

[53] Third left-column footnote given by `\footnotetext[53]{`*text*`}` placed at the end of the second left-column paragraph.

[54] First right-column footnote whose number 54 is explicitly given by `\footnote[54]{`*text*`}`.

[55] Second right-column footnote correctly following the first right-column one.

[56] Third right-column footnote.

is that you have to keep `footnote` counter having correct value by `\setcounter`, `\addtocounter` or `\stepcounter` for footnotes following those with explicit numbering so that their numbers are given by the default action of `\footnote`.

To cope with these two problems, paracol provides you with the *starred* versions of `\footnote` and its relatives as introduced in Section 7.6 and detailedly explained in the next Section 8.2.

正确的值，以便对那些具有显式编号的脚注之后的脚注进行默认的编号。

为了解决这两个问题，paracol 为您提供了带星号的 `\footnote` 及其相关命令，如在第 7.6 节中介绍的，并在下一节 8.2 中详细解释。

8.2 Commands `\footnote*` and Relatives

8.2 `\footnote*` 命令及相关命令

`\footnote*[+`*disp*`]{`*text*`}`
`\footnote*[-`*disp*`]{`*text*`}`
`\footnote*[`*disp*`]{`*text*`}`

The command is similar to its non-starred counterpart but the explicit numbering with the optional argument is done in *self-relative* or *base-displacement* style. That is, if the optional argument has a leading '`+`' or '`-`', the number given to the footnote is $f + disp$ or $f - disp$ respectively where f is the value of `footnote` counter, or in other words the number given to the last footnote[57].

Otherwise, i.e., the optional argument is a number without `+/-` sign, the number given to the footnote is $b + disp$ where b is the base value of `footnote` counter at `\begin{paracol}` for the environment in which the command appears, or in other words the number given to the last pre-environment footnote[59].

In addition, unlike the non-starred version, this command updates `footnote` counter with the number given to the footnote, i.e., $f \leftarrow f + disp$, $f \leftarrow f - disp$ or $f \leftarrow b + disp$ is performed, so that following `\footnote` without explicit numbering option have numbers $f + 1$, $f + 2$ and so on with new f.

- If the optional argument is not provided, it is assumed that `[+1]` is given and thus `\footnote*{`*text*`}` acts as `\footnote{`*text*`}`.

该命令与其非星号版本类似，但是使用可选参数进行的显式编号是以自相对或基准位移的方式进行的。也就是说，如果可选参数以 '`+`' 或 '`-`' 开头，给予脚注的编号分别为 $f + disp$ 或 $f - disp$，其中 f 是 `footnote`计数器的值，或者换句话说，是给予最后一个脚注的编号[58]。

否则，即可选参数是一个没有 `+/-` 符号的数字，则给定的脚注编号是 $b + disp$，其中 b 是 `\begin{paracol}` 处的 `footnote` 计数器的基础值，用于包含该命令的环境，或者换句话说，给定的是最后一个 pre-environment 脚注[60]。

此外，与非星号版本不同，该命令使用给定的脚注编号更新 `footnote`计数器，即执行 $f \leftarrow f + disp$、$f \leftarrow f - disp$ 或 $f \leftarrow b + disp$，以便在没有显式编号选项的情况下，后续的 `\footnote`命令具有编号 $f + 1$、$f + 2$ 等，并更新 f 的值。

- 如果没有提供可选参数,则假定提供了`[+1]`,因此 `\footnote*{`*text*`}` 的作用等同于 `\footnote{`*text*`}`。

`\footnotemark*[[+-]`*disp*`]`

This command is a mixture of its non-starred counterpart and `\footnote*`. That is the number for the footnote mark is calculated in the way of `\footnote*` and `footnote` counter is updated.

这个命令是它的非星号版本和 `\footnote`的混合体。即脚注标记的编号是根据 `\footnote*` 的方式计算的，并且 `footnote`计数器会被更新。

`\footnotetext*[[+-]`*disp*`]{`*text*`}`

Without the optional argument `[[+-]`*disp*`]`, this command does what `\footnotetext{`*text*`}` does but in addition increments `footnote` counter before that. With the optional argument, on the other hand, the number given to the footnote *text* is calculated as done in `\footnote`, but the `footnote` counter is not updated.

如果没有提供可选参数 `[[+-]`*disp*`]`，则此命令的作用与 `\footnotetext{`*text*`}` 相同，但在此之前会增加 `footnote`计数器的值。另一方面，如果提供了可选参数，那么给定给脚注*text*的编号将按照 `\footnote` 的方式计算，但 `footnote`计数器不会被更新。

With these starred commands, you can produce the following using the base-displacement mechanism without worrying about the absolute value of `\footnote` counter and its change.

使用这些带星号的命令,您可以使用基础位移机制生成以下内容,而无需担心 `\footnote` 计数器的绝对值及其变化。

First left-column paragraph .... with a footnote[61] ..... in it.

First right-column paragraph .... with a footnote[64] ..... in it.

[57] If it is put by the ordinary `\footnote`.
[58] 如果它是由普通的`\footnote`命令放置的。
[59] Or the last footnote in the previous `paracol` environment, etc.
[60] 或者是前一个 `paracol` 环境中的最后一个脚注，等等。
[61] First left-column footnote.

Second left-column paragraph . . . . . with a footnote[62] . . . . . in it. It is followed by `\footnotetext*[3]{`*text*`}` and a `\switchcolumn`.

Third and synchronized left-column paragraph . . . . . with a footnote whose mark here[63] . . . . . is given by `\footnotemark*[3]` because $63 = 60 + 3$. It is followed by a `\switchcolumn`.

It is followed by a `\switchcolumn*`.

Second and synchronized right-column paragraph . . . . . with a footnote[65] . . . . . in it.

Third right-column paragraph . . . . . with a footnote[66] . . . . . in it.

[62] Second left-column footnote.

[63] Third left-column footnote given by `\footnotetext*[3]{`*text*`}` placed at the end of the second left-column paragraph to have $63 = 60 + 3$.

[64] First right-column footnote whose number 64 is given by `\footnote*[4]{`*text*`}` because $64 = 60 + 4$.

[65] Second right-column footnote produced by `\footnote*[5]{`*text*`}` because $65 = 60 + 5$.

[66] Third right-column footnote produced by `\footnote{`*text*`}` because $66 = 65 + 1$.

The other way to produce the same result except for the absolute footnote numbers is to use the self-relative mechanism and to exploit the progress of `footnote` counter as follows.

另一种产生相同结果的方法（除了绝对脚注编号）是使用自相对机制，并利用 `footnote` 计数器的进展，方法如下：

First left-column paragraph ..... with a footnote[67] ..... in it.

Second left-column paragraph ..... with a footnote[68] ..... in it.
It is followed by `\footnotetext*{`*text*`}` and a `\switchcolumn`.

Third and synchronized left-column paragraph ..... with a footnote whose mark here[69] .....
is given by `\footnotemark*[-1]` because $69 = 70 - 1$. It is followed by a `\switchcolumn`.

First right-column paragraph ..... with a footnote[70] ..... in it.
It is followed by a `\switchcolumn*`.

Second and synchronized right-column paragraph ..... with a footnote[71] ..... in it.

Third right-column paragraph ..... with a footnote[72] ..... in it.

It depends on the structure of your document which of the base-displacement and self-relative is better. If your document has frequent switching between single- and multi-column text typesetting and thus the contents of a `paracol` environment is relatively small, the base-displacement is a good choice because you may concentrate on one base value of `footnote` counter. Otherwise, especially when your document consists of one single and large `paracol` environment, the base-displacement is almost equivalent to maintaining absolute values and thus the self-relative should be preferred.

这取决于你的文档结构，基准位移和自相对哪个更好。如果你的文档经常在单列和多列文本排版之间切换，因此 `paracol`环境的内容相对较小，那么基准位移是一个不错的选择，因为你可以专注于`footnote`计数器的一个基准值。否则，特别是当你的文档由一个单独且较大的 `paracol`环境组成时，基准位移几乎等同于维护绝对值，因此应该优先选择自相对方式。

Note that if the last `\footnote` or `\footnotemark` in a `paracol` environment is starred, the command lets `footnote` counter have some value smaller than that for the last stacked footnote. For example, if the second and third right-column footnotes 71 and 72 are omitted from the example above, the last footnote-related command will be `\footnotemark*[-1]` which makes the counter at `\end{paracol}` 69 rather than 70. You may not worry about this problem, however, because `\end{paracol}` automatically maintains the counter letting it have $b+n$ where n is the number of `\footnote` and `\footnotemark` in the environment, if the maintenance is ordered by the command `\fncounteradjustment` which is automatically executed by `\footnotelayout` with the argument `p` or `m`.

请注意，如果在 `paracol` 环境中的最后一个 `\footnote` 或 `\footnotemark` 带有星号，那么该命令会使 `footnote` 计数器的值小于最后一个堆叠脚注的值。例如，如果上面的示例中省略了第二个和第三个右列脚注 71 和 72，那么最后一个与脚注相关的命令将是 `\footnotemark*[-1]`，它使得在 `\end{paracol}` 处的计数器为 69 而不是 70。然而，您可能不必担心这个问题，因为 `\end{paracol}` 会自动维护计数器，使其为 $b+n$，其中 n 是环境中 `\footnote` 和 `\footnotemark` 的数量，如果维护是由命令 `\fncounteradjustment` 规定的，该命令会在 `\footnotelayout` 中使用参数 `p` 或 `m` 自动执行。

8.3 Page Break 分页

When a `paracol` environment with footnotes lays across a page boundary, you could have some weird result even if the environment have just one `\switchcolumn` as shown below.

当带有脚注的 `paracol`环境跨越页面边界时，即使该环境只有一个 `\switchcolumn`，你可能会得到一些奇怪的结果，如下所示。

First left-column paragraph ..... with a footnote[73] .....

First right-column paragraph ..... with a footnote[75] .....

---

[67] First left-column footnote.
[68] Second left-column footnote.
[69] Third left-column footnote given by `\footnotetext*{`*text*`}` placed at the end of the second left-column paragraph because it follows the second footnote 68.
[70] First right-column footnote whose number 70 is given by `\footnote{`*text*`}` because $70 = 69 + 1$ and `\footnotetext*` for 69 lets `footnote` have the value.
[71] Second right-column footnote produced by `\footnote*[+2]{`*text*`}` because $71 = 69 + 2$.
[72] Third right-column footnote produced by `\footnote{`*text*`}` because $72 = 71 + 1$.
[73] First left-column footnote.

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . in it.

Second left-column paragraph . . . . . .
. . . . . with a footnote[74] . . . . . in it.

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . in it.

Second right-column paragraph . . . . . .
. . . . . with a footnote[76] . . . . . in it.

Since the part of the source `.tex` for this example above is fundamentally same as that in p. 27 at the beginning of this Section 8, footnotes are simply numbered in left-column-first manner without any tricks. However it results in giving an impression that two paragraphs in each of both columns at the bottom of the last page have footnote marks of inconsecutive numbers 73 and 75 due to the second left-column paragraph and the footnote 74 in it. More weirdly, the first right-column footnote 75 is not put in the last page where its mark is shown but is stacked below 74 in this page.

The reason why this happens is that a footnote is not immediately put to the bottom of the page where its mark resides but to the page constructing at the time when the footnote is processed at the end of the paragraph in which the corresponding `\footnote` (or `\footnotetext`) occurs[77].

Therefore, it may happen even in an ordinary single-column document or a `paracol`ed multi-column one with column-wise footnotes that a footnote is thrown to the page $p+1$ next to the page p in which its mark is left, when the mark is placed around the bottom of the page p.

This footnote placement mechanism becomes clearly visible in the example above in which the footnote 75 is processed *after* the second left-column paragraph is processed to complete the last page giving no chance to the footnote placed in the page[79].

Therefore, the solution of this placement problem is to let the first right-column footnote processed *before* the page is broken by the progress of the left-column. That is, in the solution shown below the author inserted `\switchcolumn` after the first left-column paragraph to let the first right-column paragraph and its footnote are processed, and then did `\switchcolumn` again after the right-column paragraph to go back to the left-column.

由于上述示例的源代码部分与本节开头的第 27 页上的源代码基本相同，因此脚注的编号只是按照左列优先的方式进行，没有任何技巧。然而，由于第二个左列段落和其中的脚注 74，在最后一页的两个列中的每个段落给人的印象是脚注标记的数字不连续，即 73 和 75。更奇怪的是，第一个右列的脚注 75 没有放在最后一页，而是在本页的 74 下方堆叠。

这是因为脚注不会立即放置在其标记所在的页面底部,而是在处理包含相应的 `\footnote`（或 `\footnotetext`）的段落末尾时，放置在正在构建的页面上。[78]

因此，即使在普通的单栏文档或使用 `paracol`进行多栏排版的文档中，当脚注标记位于页面底部附近时，脚注可能会被放置在标记所在的页面 p 的下一页 $p+1$ 上。

在上面的示例中，脚注 75是在处理第二个左栏段落之后才处理的，这样才能完成最后一页，并且没有机会将脚注放置在该页上[80]。

因此，解决此放置问题的方法是在左列的进展导致页面分割之前，让第一个右列的脚注被处理。也就是说，在下面的解决方案中，作者在第一个左列段落之后插入了 `\switchcolumn`，以便处理第一个右列段落及其脚注，然后在右列段落之后再次进行 `\switchcolumn`，回到左列。

First left-column paragraph . . . . . .
. . . . . with a footnote[81] . . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

First right-column paragraph . . . . . .
. . . . . with a footnote[82] . . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

[74] Second left-column footnote.

[75] First right-column footnote weirdly placed here while the footnoted main text is in the previous page.

[76] Second right-column footnote whose mark in the main text gives impression that footnote numbering jumps from 74 to 76.

[77] More accurately, the footnote is kept in a place in TEX together with other preceding but still unprocessed footnotes and then TEX examines them at the end of a paragraph in which a page break is found to decide whether each of them is included in the page just being completed.

[78] 更准确地说，脚注与其他尚未处理的脚注一起保存在 TEX 中的一个位置，然后当在一个段落末尾找到页面断页时，TEX 会检查这些脚注，决定是否将它们包含在刚完成的页面中。

[79] In fact, even `\footnote` for the footnote is processed after the page break in this case.

[80] 实际上，在这种情况下，即使脚注的`\footnote`也是在分页后处理的。

[81] First left-column footnote.

. . . . . in it.

It is followed by a `\switchcolumn`.

Second left-column paragraph . . . . . with a footnote[83] . . . . . in it.

It is also followed by a `\switchcolumn`.

. . . . . in it.

It is followed by a `\switchcolumn` to go back to the left column.

[82] First right-column footnote which is now placed in this page where its mark 82 resides.

Second right-column paragraph .....
..... with a footnote[84] ..... in it.

Unfortunately, this tactics does not always solve the problem. If a left-column paragraph has a page break in it and a footnote before the break, doing `\switchcolumn` after the paragraph is too late to let right-column footnotes reside in the page just having been broken, while inserting `\switchcolumn` before the paragraph should cause incorrect stacking order.

不幸的是，这种策略并不能始终解决问题。如果左列段落中有一个分页，并且在分页之前有一个脚注，在段落之后执行 `\switchcolumn` 命令太晚了，无法让右列的脚注位于刚分页的页面中，而在段落之前插入 `\switchcolumn` 命令会导致错误的堆叠顺序。

The remedy for this problem is similar to that shown in Section 8.1 to cope with multiple `\switchcolumn` in a `paracol` environment. Here it is shown a little bit more formally. Suppose we have a page in a `paracol` environment in which a page break occurs in p_l-th and p_r-th paragraphs in the left and right columns respectively. Thus we have $p_l - 1$ and $p_r - 1$ completed paragraphs in each of both columns. Let n_l (resp. n_r) be the number of footnotes in the pre-break left-column (resp. right-column) paragraphs, and m_l (resp. m_r) be the number of pre-break footnotes in the p_l-th (resp. p_r-th) paragraph. Thus we have $n_l + m_l$ (resp. $n_r + m_r$) footnotes in the left (resp. right) column of the page before the break. The following construct assures that those footnotes are properly numbered and stacked at the bottom of the page.

解决这个问题的方法类似于第 8.1 节所示的处理在 `paracol` 环境中出现多个 `\switchcolumn` 命令的方法。这里稍微更加正式地展示一下。假设我们在 `paracol` 环境中有一个页面，在左列和右列中分别出现了第 p_l 个和第 p_r 个段落的分页。因此，在每个列中有 $p_l - 1$ 和 $p_r - 1$ 个已完成的段落。设 n_l（分别为 n_r）为分页前左列（分别为右列）段落中的脚注数量，m_l（分别为 m_r）为第 p_l（分别为第 p_r）个段落中分页前的脚注数量。因此，在分页前的页面左列（分别为右列）中有 $n_l + m_l$（分别为 $n_r + m_r$）个脚注。以下构造确保这些脚注在页面底部以正确的编号和堆叠方式显示。

First to $(p_l - 1)$*-th paragraphs with* n_l *footnotes in total given by* `\footnote{`*text*`}`.
`\footnotetext*{`*1st footnote in* p_l*-th paragraph*`}`
…
`\footnotetext*{`m_l*-th footnote in* p_l*-th paragraph*`}`
`\switchcolumn`
First to $(p_r - 1)$*-th paragraphs with* n_r *footnotes in total given by* `\footnote{`*text*`}`.
`\footnotetext*{`*1st footnote in* p_r*-th paragraph*`}`
…
`\footnotetext*{`m_r*-th footnote in* p_r*-th paragraph*`}`
`\switchcolumn`
p_l*-th paragraph whose first footnote mark is given by* `\footnotemark*[-(`m_l+n_r+m_r−1)`]`*, while second to* m_l*-th ones are given by* `\footnotemark` *without* `*` *nor optional* `[`*num*`]`*. The first subsequent footnotes beyond the page break, if any, is given by* `\footnote*[+(`n_r+m_r+1)`]{`*text*`}` *while further subsequent ones are given by* `\footnote{`*text*`}`.
`\switchcolumn`
p_r*-th paragraph whose first footnote mark is given by* `\footnotemark*[-(`m_r+k_l−1)`]` *where* k_l *is the number of left-column footnotes beyond the break, while second to* m_r*-th ones are given by* `\footnotemark`*. The first subsequent footnotes beyond the page break, if any, is given by* `\footnote*[+(`k_l+1)`]{`*text*`}`*, while further subsequent ones are given by* `\footnote{`*text*`}`.

The example shown in the next two pages is for the case of $p_l = p_r = n_l = n_r = m_l = m_r = k_l = 2$.

下面两页中的示例是当 $p_l = p_r = n_l = n_r = m_l = m_r = k_l = 2$ 时的情况。

---

[83] Second left-column footnote whose number 83 follows the right-column footnote 82 in the last page.

[84] Second right-column footnote whose number 84 follows the left-column footnote 83.

First left-column paragraph with two footnotes here[85] by `\footnote{`*text*`}` ..... and here[86] also by `\footnote{`*text*`}` ..... followed by a series of `\footnotetext*{`*text*`}` and then a `\switchcolumn`.

Second left-column paragraph across two pages with two pre-break footnotes ..... here[87] by `\footnotemark*[-5]` because $m_l + n_r + m_r - 1 = 2 + 2 + 2 - 1 = 5$ and thus $87 = 92 - 5$ ..... and here[88] by `\footnotemark` .....

First right-column paragraph with two footnotes here[89] by `\footnote{`*text*`}` ..... and here[90] also by `\footnote{`*text*`}` ..... followed by a series of `\footnotetext*{`*text*`}` and then a `\switchcolumn`.

Second right-column paragraph across two pages with two pre-break footnotes ..... here[91] by `\footnotemark*[-3]` because $m_r + k_l - 1 = 2 + 2 - 1 = 3$ and thus $91 = 94 - 3$ ..... and here[92] by `\footnotemark` .....

[85] First left-column footnote given by `\footnote{`*text*`}`.
[86] Second left-column footnote also given by `\footnote{`*text*`}`.
[87] Third left-column footnote given by `\footnotetext*{`*text*`}`.
[88] Fourth left-column footnote given by `\footnotetext*{`*text*`}`.
[89] First right-column footnote given by `\footnote{`*text*`}`.
[90] Second right-column footnote also given by `\footnote{`*text*`}`.
[91] Third right-column footnote given by `\footnotetext*{`*text*`}`.
[92] Fourth right-column footnote given by `\footnotetext*{`*text*`}`.

. . . . . .
. . . . . .
. . . . . .
. . . . . .
and two post-break footnotes . . . . . .
here[93] by `\footnote*[+5]{`*text*`}` . . . . . .
and here[94] by `\footnote{`*text*`}` . . . . . .
followed by a `\switchcolumn`.

. . . . . .
. . . . . .
. . . . . .
. . . . . .
and two post-break footnotes . . . . . .
here[95] by `\footnote*[+3]{`*text*`}` . . . . . .
and here[96] by `\footnote{`*text*`}` . . . . . .

Note that though the remedy works well as shown above, it is not a good idea to do that when you are writing draft versions of your document because page break points go up and down by your modifications to the document. Therefore, it is recommended to put all footnotes by non-starred `\footnote` until your document becomes perfect except for footnote numbering and placement and then to adjust them by the techique described in this section.

请注意，尽管上述方法可以很好地解决问题，但在撰写文档的草稿版本时，不建议这样做，因为页面分页点会根据您对文档的修改而上下移动。因此，建议您在文档除了脚注编号和位置之外的其他方面完善之前，使用非星号形式的 `\footnote` 命令放置所有脚注，然后再使用本节描述的技巧进行调整。

[93] Fifth left-column footnote given by `\footnote*[+5]` because $n_r + m_r + 1 = 2 + 2 + 1 = 5$ and thus $93 = 88 + 5$.
[94] Sixth left-column foootnote given by `\footnote{`*text*`}`.
[95] Fifth right-column footnote given by `\footnote*[+3]` because $k_l + 1 = 3$ and thus $95 = 92 + 3$.
[96] Sixth right-column foootnote given by `\footnote{`*text*`}`.

9 Two-Sided Typesetting and Parallel-Paging

双面排版和并列分页

这一节和下一节使用 `\twosided` 启用特性 `p`、`c` 和 `m`，以及部分下一节的特性 `b` 进行排版。通过查看此偶数页的内边距，可以看到 `p` 特性的效果，即比前面的页面的内边距更窄，因为作者减小了从 `\evesidemargin` 计算出的有效 right 边距。

由于 75 % 的设置[98]。这个设置使得本页的左边缘或外侧边缘增大了 125 %，以及下一页的右边缘和外侧边缘，由 `\oddsidemargin` 指定的奇数页。

接下来，我们看到以下 `paracol` 环境通过 `\columnratio{0.6}` 和 `\marginparthreshold{0}` 来实现 `c` 和 `m` 特性的效果，使得内部列（在偶数页中的右列）比外部列更宽，并且所有的边注都放在外侧边缘（在偶数页中的左边缘）。

This and the next section are typeset with `\twosided` enabling features `p`, `c` and `m` and also `b` for a part of the next section. The effect of `p` feature can be seen by the right, or in other word inside, margin of this even-numbered page is narrower than that of the previous pages because the author reduced the effective right side margin being calculated from `\evesidemargin` by 75 %[97]. This setting makes the left side or outside margin of this page enlarged by 125 %, as well as the right side and outside margin of the next odd-numbered page specified by `\oddsidemargin`.

Next, we see the effects of `c` and `m` features by the `paracol` environment below for which `\columnratio{0.6}` and `\marginparthreshold{0}` are declared to make the *inside* columns (right ones in even-numbered pages) are wider than the *outside* ones and all marginal notes go to outside (left in even-numbered pages) margins.

First marginal note from column-0.

First marginal note from column-1.

This is the first paragraph in the narrower, italicized and outside column-1. In this paragraph, we shortly have a marginal note, italicized too, which goes to the outside margin shared by all marginal notes from both columns. The marginal note given here is placed its natural position and its first line is aligned to the first line of the second sentence of this paragraph by exploitation of the space between two marginal notes from the column-0, though we already have had three notes from the column.

Now the author puts another marginal note whose first line would be aligned to that of this paragraph, but it is pushed down below the second marginal note from the column-0 because two notes conflict with each other over the space[99]*. Note that since the note from this column is given* after *that from the column-0 was given, the conflict is solved pushing the note from this column down rather than that from the column-0. Now the author puts a few dummy lines to go to the second last line of this page.*

. . . . . .

. . . . . .

Second marginal note from column-0.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Third marginal note from column-1.

This is the third paragraph of the outside column-1, which becomes right shortly by the page break. The third marginal note is given in the first line of this page, but it is pushed down again due to the conflict with the note from the column-0.

This line of the first paragraph of the inside column-0 has a marginal note. Now the author puts a few dummy lines to keep a space below the marginal note.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

This line of the second paragraph of the inside column-0 also has a marginal note. Now the author puts a few dummy lines again but this time to go down to the bottom of the page.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

[97] This document itself does not have `twoside` option in its `\documentclass` but the inconsistency between the option and `\twosided` is not visible because `\pagestyle` is `plain`.

[98] 此文档本身在其 `\documentclass` 中没有 `twoside` 选项，但是选项与 `\twosided` 之间的不一致之处并不可见，因为 `\pagestyle` 是 `plain`。

[99] Since the author is temporarily disabling the warning from marginal note placement mechanism of LaTeX, pushing down the second marginal note from column-1 is silently performed when you process this document.

. . . . . .
. . . . . .

This is the third paragraph of the inside column-0 having a page break in it. Since shortly we will be in an even-numbered page 39 (now), this wider column is now right one keeping it inside, while the marginal note given in the first line of this page goes to left and outside. Now we will have a `\switchcolumn` below this paragraph to go to the column-1 and back to the previous page 38.

Third marginal note from column-0

Marginal note given after `paracol` environment is closed.

Note that the position of the last marginal note in the `paracol` environment which we just have closed affects the marginal note placement in post-environment stuff. For example, the marginal note given in the first line of this paragraph is pushed down.

We will see a few examples of parallel-paging shortly, but before that we will have an intentional black page to make the first page of the example odd-numbered to avoid you have an impression that its layout is incorrect[100] because if it were in an even page you would see the *outside* third and fourth supplementary *columns* at first.

请注意，在我们刚刚关闭的 `paracol`环境中，最后一个边注的位置会影响 post-environment stuff中的边注位置。例如，给出在本段落第一行的边注会被推下去。

不久我们将看到一些 parallel-pag的例子，但在此之前，我们将有一个有意留白的页面，使示例的第一页成为奇数页，以避免给您一种布局错误的印象[101]，因为如果它在偶数页，您将首先看到第三和第四个辅助列的外侧。

[100] At least the author himself had such impression without the blank page.
[101] 至少在没有空白页面的情况下，作者本人也有这样的印象。

(intentionally blanked page)

9.1 Example of Paired Parallel-Paging 并列分页的示例

Shortly we will start a `paracol` environment by `\begin{paracol}[2]{4}` having four columns but two for each of left and right paired parallel-pages. Since the author declares `\columnratio{0.6}[0.5]`, the columns in left pages are made unbalanced while those in right pages are balanced.

不久我们将通过 `\begin{paracol}[2]{4}` 开始一个 `paracol`环境，该环境有四列，但是每个左右pairedparallel-pag中有两列。由于作者声明了 `\columnratio{0.6}[0.5]`，左页中的列是不平衡的，而右页中的列是平衡的。

This is the first paragraph of the leftmost column-0, whose first line has a marginal note placed in the right margin because the setting of `\marginparthreshold` being 0 is still effective and we are in the odd-numbered page 41. Now we have a `\switchcolumn` to the next column-1.

This is the first paragraph of the second and right column-1 in the left parallel-page. We shortly give an italicized marginal note carefully, so that it does not conflict with the marginal note from the column-0. That is, now the author puts the note. Now we have a `\switchcolumn` *to the next column-2.*

Marginal note from column-0.

Marginal note from column-1.

A Spanning Text: though this is wider than the page width, this text does not span the boundary between the left and right parallel-pages.

We have come back to this column-0. The space above the spanning text is due to the synchronization because two paragraphs in the column-2 are significantly taller in total than the paragraphs in other columns. As the spanning text itself says, it cannot extend to the right parallel-page. The author puts dummy lines to go to the page bottom.

We have restarted this column-1. This paragraph has a footnote[102] *as shown below.*

. . . . . .

Now we will have a page break shortly. You could be surprised by seeing this column is not in the left parallel-page after the break but in the right one. This is because the feature `c` is enabled to swap not only columns in a page but also the left and right paired parallel-pages when they are even-numbered. The other feature `p` makes the left outside margins of this right and the previous left pages wider than the right inside margins.

After the page break below, this column also goes to the right page together with the column-0 and is placed outside (left) in the page, as well as the marginal note in this right page but in the outside margin.

Another marginal note from column-1.

Now you are seeing yet another material placed only in the page in which the column-0 resides and thus being the right page now, i.e., this paragraph and the next one in the post-environment stuff. You might be disappointed by the fact the *outside* pages, i.e., left in this page 41 and right in the previous page 41, cannot have page-wise stuff but it is what the author can do now for the version 1.3 and thus you have to wait some future versions in which the author could devise a

现在您正在看到的是仅放置在列-0 所在页面中的另一个材料，因此现在是右侧页面，即本段和下一个段落在 post-environment stuff中。您可能会对这样一个事实感到失望，即外部页面，即本页的左侧（41页）和前一页的右侧（41页），无法使用 page-wise stuff，但这是作者目前版本 1.3 能做的，因此您必须等待未来的版本，届时作者可能会设计一种机制来利用页面上的相应空间[105]。

[102] This footnote is put in the left parallel-page together with another footnote below given in the column-2 in the right parallel-page.

[103] This footnote is *not* put in the right parallel-page though it is given in the column-2 in the right parallel-page and thus its reference is in the column, of course.

This is the first paragraph of the column-2 being the left column of the right parallel-page. Though we are in a page different from that column-0 and 1 reside in, this page is still numbered 41 because the left and right page is paired. Therefore, the left margin of this page is narrower than the right margin because the page number is odd.

You have to notice the first paragraph does not start from the page top but above it we have some space of exactly same size as the pre-environment stuff shown in the left parallel-page. Therefore, the top of the first paragraphs in all columns are aligned. The marginal note given in the first line of this paragraph goes to the right margin of this page because of the `\marginparthreshold` setting and the parity of this page. Now we have a `\switchcolumn` to the next column-3.

We have a few other materials not shown in right parallel-pages. The space above this paragraph is for the spanning text placed in the left parallel-page. The page-wise footnote given here[103] is also not in this page but in the left. Finally, the author has put a page-wise figure spanning columns just before `\switchcolumn` by which we left this column, but it will be in the right page 41 together with column-0 and 1.

. . . . . .

Though the footnote numbered 103 goes to the left page, its space and that of 102 make this and the next columns shorter in the previous page. Similarly, we have a space above for the page-wise figure shown in the right page.

This is the first paragraph in the last rightmost column-3 whose width is equal to that of the column-2. The marginal note given in the first line goes to right and does not conflict with that from the column-2. We are now going back to the column-0 by a `\switchcolumn*` *with a spanning text.*

Marginal note from column-3.

Marginal note from column-2.

As expected, this line is aligned to the first line of the paragraph in the column-2 as well as those in column-0 and 1. It is also consistent the first lines including that of this paragraph are not indented because the spanning text is given by `\subsection*` *which makes first paragraphs unindented.*

. . . . . .

After the page break we will have shortly, this column becomes the leftmost in the left parallel-page, as you are seeing now, but still outermost as well as the marginal note in the outside left margin.

Another marginal note from column-3.

page-wise figure given in column-2

图 4: A Page-Wise Figure

此外，您可能会觉得奇怪的是，`\twosided` 命令的`c` 功能交换了列和配对的页面。然而，这种交换是column-swapping和 pairedparallel-pag的组合的自然结果。因此，您可以简单地禁用`c` 功能（可能与其他功能一起禁用），以获得更直观的结果。

在接下来的第 9.2节中，你将看到另一种 parallel-pag分页方式，即 non-paired分页。在此之前，我们需要一个空白页，以便让 non-paired parallel-pag从偶数页开始，这样左右的页面对就构成一个双页展开。关于空白的下一页的一个简短说明是，它没有右侧对应的 parallel-pag，因为该页位于 `paracol`环境之外，并且不包含来自这些环境的任何部分[107]。

mechanism to exploit the corresponding space in the pages[104].

In addition, you might think it is weird that the `c` feature of `\twosided` swaps columns *and* paired pages. However this swapping is a natural consequence of the combination of column-swapping and paired parallel-paging. Therefore, you can simply disable the `c` feature (maybe together with other features) to have more intuitive results.

In the next Section 9.2, you will see another kind of parallel-paging namely non-paired one. Before that, we need a blank page to let the non-paired parallel-paging start from an even-numbered page so that a left and right page pair comprises a double spread. A short remark on the blank next page is that it does not have a right counterpart parallel-page because the page is outside `paracol` environments and does not have any portion from the environments[106].

[104] You might complain the immaturity of parallel-paging and might claim that it should be included in paracol after the author implements the mechanism. In fact the author himself is frustrated current features of parallel-paging but he dared to release the version 1.3 knowing that there are people who happily typeset their parallel-paged documents with the current limited features.

[105] 您可能会对 parallel-pag 的不成熟感到不满，并声称作者应该在实现该机制后将其包含在 paracol 中。实际上，作者自己对当前 parallel-pag 的功能感到沮丧，但他还是敢于发布版本 1.3，因为他知道有人愉快地使用当前有限的功能来排版他们的 parallel-pag 文档。

[106] To illustrate this fact, the author dares to put a real blank page rather than stepping the page counter.

[107] 为了说明这个事实，作者敢于放置一个真正的空白页，而不是增加 page计数器的值。

(intentionally blanked page)

9.2 Example of Non-Paired Parallel-Paging

非并列分页的示例

这页和接下来的三页是为了展示 non-pairedparallel-pag的示例,其中作者保持了 `\twosided`、`\columnratio` 和 `\marginparthreshold` 的设置不变。用于列填充的`\begin{paracol}`的参数也保持不变，以获得2+2 的配置,但是第一个参数后面跟着`*` 表示进行 non-paired排版。也就是说,下面的环境通过`\begin{paracol}[2]{4}` 开始。环境的内容与前面的第 9.1节几乎相同，但是加粗的单词显示了与 paired排版的区别。

This and following three pages are to show an example of non-paired parallel-paging, in which the author keeps the setting of `\twosided`, `\columnratio` and `\marginparthreshold` unchanged. The arguments of `\begin{paracol}` for column population are also unchanged to have $2+2$ configuration, but the first argument is followed by `*` for non-paired typesetting. That is, the environment below starts by `\begin{paracol}[2]*{4}`. The contents of the environment is also almost same as the previous Section 9.1, while **bold-faced** words show the difference from the paired typesetting.

Marginal note from column-0.

This is the first paragraph of the leftmost column-0, whose first line has a marginal note placed in the **left** margin because the setting of `\marginparthreshold` being 0 is still effective and we are in the **even**-numbered page **44**. Now we have a `\switchcolumn` to the next column-1.

Marginal note from column-1.

This is the first paragraph of the second and right column-1 in the left parallel-page. We shortly give an italicized marginal note carefully, so that it does not conflict with the marginal note from the column-0. That is, now the author puts the note. Now we have a `\switchcolumn` *to the next column-2.*

A Spanning Text: though this is wider than the page width, this text does not span the boundary between the left and right parallel-pages.

We have come back to this column-0. The space above the spanning text is due to the synchronization because two paragraphs in the column-2 are significantly taller in total than the paragraphs in other columns. As the spanning text itself says, it cannot extend to the right parallel-page. The author puts dummy lines to go to the page bottom.

We have restarted this column-1. This paragraph has a footnote[108] *as shown below.*

Now we will have a page break shortly. You **will not** be surprised by seeing this column **is still in the left parallel-page after the break.** This is because the feature `c` is **not effective in non-paired parallel-paging.** The other feature `p` **consistently makes the left outside margins of this and the previous page in which this column resides** wider than the right inside margins.

Another marginal note from column-1.

After the page break below, this column also ***stays in the left page*** *together with the column-0 and is placed* ***inside (right)*** *in the page, as well as the marginal note in this* ***left*** *page* ***still*** *in the outside margin.*

与第 9.1节中的 post-environment stuff一样，本段作为 non-paired个 parallel-pag的 post-environment stuff，只出现在列-0 所属的 parallel-pag中，因此在这种情况下是在左侧的 parallel-pag中。

As the post-environment stuff in Section 9.1 is, this paragraph being the post-environment stuff of the non-paired parallel-pages appears only in the parallel-page in which the column-0 belongs to, and thus in the left parallel-page in this case.

[108] This footnote is put in the left parallel-page together with another footnote below given in the column-2 in the right parallel-page.

[109] This footnote is *not* put in the right parallel-page though it is given in the column-2 in the right parallel-page and thus its reference is in the column, of course.

This is the first paragraph of the column-2 being the left column of the right parallel-page. **Since we are in the page next to** that column-0 and 1 reside in, this page is numbered **44** because the left and right page is **non-paired**. Therefore, the left margin of this page is narrower than the right margin because the page number is odd.

You have to notice the first paragraph does not start from the page top but above it we have some space of exactly same size as the pre-environment stuff shown in the left parallel-page. Therefore, the top of the first paragraphs in all columns are aligned. The marginal note given in the first line of this paragraph goes to the right margin of this page because of the `\marginparthreshold` setting and the parity of this page. Now we have a `\switchcolumn` to the next column-3.

We have a few other materials not shown in right parallel-pages. The space above this paragraph is for the spanning text placed in the left parallel-page. The page-wise footnote given here[109] is also not in this page but in the left. Finally, the author has put a page-wise figure spanning columns just before `\switchcolumn` by which we left this column, but it will be in the **left** page **44** together with column-0 and 1.

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

Though the footnote numbered **109** goes to the left page, its space and that of **108** make this and the next columns shorter in the previous page. Similarly, we have a space above for the page-wise figure shown in the **left** page.

This is the first paragraph in the last rightmost column-3 whose width is equal to that of the column-2. The marginal note given in the first line goes to right and does not conflict with that from the column-2. We are now going back to the column-0 by a `\switchcolumn*` *with a spanning text.*

Marginal note from column-2.

Marginal note from column-3.

As expected, this line is aligned to the first line of the paragraph in the column-2 as well as those in column-0 and 1. It is also consistent the first lines including that of this paragraph are not indented because the spanning text is given by `\subsection*` *which makes first paragraphs unindented.*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

After the page break we will have shortly, this column ***is kept being the rightmost in the right parallel-page****, as you are seeing now,* ***and*** *still outermost as well as the marginal note in the outside* ***right*** *margin.*

Another marginal note from column-3.

page-wise figure given in column-2

图 5: A Page-Wise Figure

10 Examples of Background Painting 背景绘制的示例

10.1 Fundamental Painting

As you undoubtedly notice, this page and a few pages following it are colorfully painted. For this and the next three pages, the author declared the background color of each region as follows.

正如你无疑注意到的，本页和随后的几页都是色彩斑斓的。对于这四页，作者将每个区域的 background颜色声明如下。

```
\backgroundcolor{t}[rgb]{0.7,0,0}       % dark red for top margin
\backgroundcolor{b}[rgb]{0.8,0.6,0}     % dark orange for bottom margin
\backgroundcolor{l}[rgb]{0,0,0.7}       % dark blue for left margin
\backgroundcolor{r}[rgb]{0,0.7,0}       % dark green for right margin
\backgroundcolor{c[0]}[rgb]{1,0.8,1}    % pink for columnn-0
\backgroundcolor{c[1]}[rgb]{1,1,0.8}    % cream yellow for column-1
\backgroundcolor{g}[rgb]{0.8,1,1}       % light blue for the gap
\backgroundcolor{f}[rgb]{0.8,0,1}       % purple for page-wise floats
\backgroundcolor{n}[rgb]{0.8,0.6,1}     % light purple for page-wise footnotes
\backgroundcolor{p}[rgb]{0.8,1,0.6}     % pale green for pre/post-environment
\backgroundcolor{s}[rgb]{0.8,0.8,0.8}   % light gray for spanning texts
```

Therefore, the background of this pre-environment paragraph and other stuff above is painted by pale green.

因此，这个pre-environment 段落以及上面的其他内容的 background被涂成了浅绿色。

Since the author set `\pagerim` to be 5 `pt`, you will see unpainted strips of 5 `pt` wide at all paper edges surrounding painted regions. For this and the next three pages, `\twosided[pcm]` is declared to enable `p`, `c` and `m` features but to disable the `b` feature. Therefore, though this page 45 is even and thus the left outside margin is wider than the right inside one, the backgrounds of `l`(eft) and `r`(ight) margins are painted by dark blue and dark green respectively.

由于作者将 `\pagerim` 设置为 5,`pt`，因此您将在所有围绕着绘制区域的纸张边缘看到宽度为 5,`pt` 的未涂色条纹。在这一页和接下来的三页中，`\twosided[pcm]` 被声明为启用`p`、`c` 和`m` 功能，但禁用`b` 功能。因此，尽管本页 45是偶数页，左外边缘比右内边缘宽，但左边缘和右边缘的 background分别被涂成深蓝色和深绿色。

This column-0 is now right and inside because of the `c` feature of `\twosided` is enabled. On the other hand, the background is this column is painted by pink because `\backgroundcolor` for `c[0]` specifies so. That is, the column ordinals optionally given to `c`(olumn) (and `g`(ap)) regions are *logical* ones not always corresponding to their *physical* positions in a page.

As explained in the right column-0, the background of this left and outside column-1 is painted by cream yellow as `\backgroundcolor{c[1]}` *specifies. Now we have a* `\switchcolumn*` *with a spanning text to show the background painting for it*[110].

The background of this `s`(panning text) region is painted by light gray

This paragraph is to show how the first line of a paragraph just below a spanning text is placed in the painted region.

See the right column for the reason why this paragraph is here.

Now we have a `\flushpage` to see the background painting for a material not shown in the page, i.e., a page-wise float.

See the right column for what we are now doing.

[110] Since the footnotes in this `paracol` environment are page-wise and merged, and `\backgroundcolor{n}` specifies light purple, the background of this (foot)`n`(ote) region is painted by the color.

f(loat) region for this page-wise figure is painted by purple

图 6: A Page-Wise Figure

As expected, the background of this column-1 is still painted by cream yellow.

See the comment in the left column.

Since we are now in an odd-numbered page 46, this column-0 is now a left one and is still painted by pink of course.

This paragraph is to show how the last line of a page without page-wise footnotes is placed in the painted region.

This page is to show how the page without any page-wise stuff looks like.

See the right column for the reason why we have this almost blank page.

Shortly we will close this `paracol` environment in the next page.

See the right column for what will happen shortly.

See the left column for the reason why we are now closing the environment.

Now we are closing this `paracol` environment to show how its post-environment stuff is painted.

The background of this paragraph in p(ost-environment) region is also painted by pale green, because post-environment stuff can be pre-environment stuff at the same time as we see shortly.

这个段落在p(ost-environment) 区域的 background也被涂成了淡绿色，因为正如我们很快会看到的那样，post-environment stuff可以同时是 pre-environment stuff。

Therefore, the author does not have much to say in this column, except for giving a footnote here[111].

This short `paracol` environment illustrates how the pre-environment stuff of this environment, or the post-environment stuff of the last environment in other words, is painted.

Before moving to the next example, one caution is given for background painting of merged footnotes. As the footnote 111 itself says, merged footnotes given in the last page of a `paracol` environment are considered as belonging to post-environment stuff. Therefore, the footnote 111 is painted by pale green as well as another footnote given now[112].

在进入下一个示例之前，对于 merged footnote的 background painting有一个注意事项。正如脚注 111本身所说的那样，在 `paracol`环境的 last page中给出的 merged footnote被认为属于 post-environment stuff。因此，脚注 111将被绘制成浅绿色，以及现在给出的另一个脚注[113]。

[111] Since this footnote is merged with that in the post-environment stuff, it is considered as a part of post-environment stuff and thus painted by pale green rather than light purple.

[112] Since this footnote really belongs to post-environment stuff, its background is painted by pale green naturally.

[113] 由于这个脚注确实属于 post-environment stuff，所以它的 background自然会被绘制成浅绿色。

10.2 Mirrored Painting and Enlarging/Shrinking/Shifting Regions
镜像绘制和放大/缩小/移动区域

At a glance, this and the next three pages look painted similarly to previous four pages, but by a careful examination you should notice two important differences. The first one is found in the colors of left and right margins. As the author enabled all features of `\twosided` including `b` for mirroring and we are now in an even-numbered page 49, the left and outside margin is painted by dark green for the region `r`(ight margin), while the right and inside one is painted by dark blue for `l`(eft margin).

乍一看，这页和接下来的三页看起来与前面的四页的绘画类似，但是仔细观察你应该会注意到两个重要的区别。第一个区别在于左右边距的颜色。由于作者启用了 `\twosided` 的所有特性，包括 mirroring 的`b` 特性，并且我们现在处于一个偶数页 49，左边和外部边距由深绿色绘制，表示`r`(ight margin)，而右边和内部边距由深蓝色绘制，表示`l`(eft margin)。

The other is that regions are enlarged, shrunk or shifted by 4`pt` by the following `\backgroundcolor` commands with extensions.

另一个是通过以下带有扩展的 `\backgroundcolor` 命令，通过 4,`pt` 来扩大、缩小或移动区域。

```
\backgroundcolor{t(0pt,0pt)(0pt,-4pt)}[rgb]{0.7,0,0}   % B up
\backgroundcolor{b(0pt,-4pt)(0pt,0pt)}[rgb]{0.8,0.6,0} % T down
\backgroundcolor{l(0pt,4pt)(-4pt,4pt)}[rgb]{0,0,0.7}   % R left T/B outside
\backgroundcolor{r(-4pt,4pt)(0pt,4pt)}[rgb]{0,0.7,0}   % L right T/B outside
\backgroundcolor{c[0](4pt,4pt)}[rgb]{1,0.8,1}          % all edges outside
\backgroundcolor{c[1](4pt,4pt)}[rgb]{1,1,0.8}          % all edges outside
\backgroundcolor{g(-4pt,4pt)}[rgb]{0.8,1,1}            % L/R inside & T/B outside
\backgroundcolor{f(4pt,4pt)(4pt,-4pt)}[rgb]{0.8,0,1}   % L/R outside & T/B up
\backgroundcolor{n(4pt,-4pt)(4pt,4pt)}[rgb]{0.8,0.6,1} % L/R outside & T/B down
\backgroundcolor{p(4pt,4pt)}[rgb]{0.8,1,0.6}           % all edges outside
\backgroundcolor{s(4pt,-4pt)}[rgb]{0.8,0.8,0.8}        % L/R outside & T/B inside
```

In the comments above, `L`(eft), `R`(ight), `T`(op) and `B`(ottom) mean edges moved by a given extension. Therefore, for example, "`L/R outside & T/B up`" for `f`(loat) region means it is enlarged horizontally and shifted up vertically by the asymmetric extension `(4pt,4pt)(4pt,-4pt)`. These a little bit complicated setting of extensions are to solve the problems in the fundamental example shown in previous four pages, namely too strict definition of the regions to be painted. That is, both vertical edges of regions having texts, e.g., `c`(olumn) regions, should look too close to the first and last letters. Similarly both horizontal edges of those regions seem too close especially when the first line is tall (e.g., the section title in p. 45 and the page-wise figure in p. 46) and the last line of a column is followed by spanning text or post-environment stuff. Therefore, the author made fine tuning moving inside edges of margins outside, and so on. We will come back this issue after exemplifying the effect of the tuning.

在上面的注释中，`L`(eft)、`R`(ight)、`T`(op) 和`B`(ottom) 表示给定扩展移动的边缘。因此，例如，对于`f`(loat) 区域的 "`L/R outside & T/B up`" 意味着它在水平方向上扩大，在垂直方向上通过不对称扩展`(4pt,4pt)(4pt,-4pt)` 向上移动。这些稍微复杂的扩展设置是为了解决前面四页中所示的基本示例中的问题，即对要绘制的区域的定义过于严格。也就是说，具有文本的区域的两个垂直边缘，例如`c`(olumn) 区域，看起来离第一个和最后一个字母太近了。同样，当第一行很高时（例如，在 p. 45中的节标题和 p. 46中的每页图）以及一列的最后一行后面跟着 spanning text或 post-environment stuff时，这些区域的两个水平边缘看起来也太近了。因此，作者对外部边缘内部移动进行了微调等。在示例效果之后，我们将回到这个问题。

By the tuning to enlarge this `c`(olumn) region, this paragraph has comfortable spaces above and below it, as well as at the both side edges.

This paragraph is surrounded by spaces of a small but comfortable amount as well.[114].

The background of this `s`(panning text) region is painted by light gray and enlarged horizontally but shrunk vertically

This paragraph is to show how well the first line of a paragraph just below a spanning text is separated from the boundary of two painted regions.

See the right column for the reason why this paragraph is here.

See the right column for what we are now doing.

shifting up this f(loat) region gives us a small space above the top edge of the rectangle

图 7: A Page-Wise Figure

By enlarging this c(olumn) region and shift the (foot)n(ote) region down, this paragraph has a comfortable amount of space below it.

[114]Shifting this (foot)n(ote) region down a little bit, the space below this footnote and above the top edge of the b(ottom margin) region is enlarged.

Similarly to other paragraphs below page-wise stuff, this paragraph is well separated from the bottom edge of the `f`(loat) region above.

See the comment in the left column for the intention of placing this paragraph here.

As in the case of the line above page-wise footnotes, the last line of this paragraph has a sufficient space separating it from the top edge of the `b`(ottom margin) region.

See the comment in the left column, too.

See the right column for the reason why we have this almost blank page.

This page is to show how the page without any page-wise stuff looks like. As you are seeing, the space above this paragraph is sufficient and comfortable.

See the right column for what will happen shortly.

Shortly we will close this `paracol` environment in the next page.

Now we are closing this paracol environment to show how this paragraph is separated from the boundary of c(olumn) and p(ost-environment) regions.

See the left column for the reason why we are now closing the environment.

The background of this paragraph in p(ost-environment) region is painted by pale green as done in p. 48, but its top and bottom edges *look* shifted down and up to give spaces below and above the last and first paragraphs in paracol environments, respectively.

这个段落在p(ost-environment) 区域的 background被涂成了淡绿色，就像在第 48页上所做的那样，但它的顶部和底部边缘看起来向下和向上移动了，以在 paracol环境的最后一个段落和第一个段落之上和之下留出空间。

This short paracol environment illustrates how the pre-environment stuff of this environment, or the post-environment stuff of the last environment in other words, is painted.

Therefore, the author does not have much to say in this column, except for giving a footnote here[115].

In the setting with \backgroundcolor commands in p. 49, the author carefully moved contacting edges of regions. For example, to enlarge c(olumn) regions, the inside edges of l(eft margin) and r(ight margin) regions are moved outside, and both vertical edges of the g(ap) region shifted toward its inside. As for the horizontal edges, the bottom edges of t(op margin) and f(loat) regions are moved up, the top edges of b(ottom margin) and (foot)n(ote) regions are moved down, and both top and bottom edges of the s(panning text) region are shifted toward its inside.

在设置中，通过在第 49页中使用 \backgroundcolor 命令，作者仔细移动了区域的接触边缘。例如，为了扩大c(olumn) 区域，将l(eft margin) 和r(ight margin) 区域的内部边缘移到外部，并将g(ap) 区域的两个垂直边缘向内移动。至于水平边缘，将t(op margin) 和f(loat) 区域的底部边缘向上移动，将b(ottom margin) 和 (foot)n(ote) 区域的顶部边缘向下移动，将s(panning text) 区域的顶部和底部边缘都向内移动。

These edge shifting could make a region too narrow or too much shifted resulting in a material in it overreaching its boundary, especially in vertical shifting of horizontal edges. However we can exploit some large space automatically or manually inserted above and/or below the material to avoid overreaching. That is the author exploited the following spaces; \headsep below the page head (though it is empty in this document); \dbltextfloatsep below the bottom-most page-wise float; spaces that \subsection* inserts above and below it together with manually inserted \medskip below it; \skip\footins[116]

这些边缘移动可能会使区域过窄或过多移动，导致其中的内容超出其边界，特别是在水平边缘的垂直移动中。然而，我们可以利用自动或手动插入在材料上方和/或下方的一些较大空间来避免超出。也就是说，作者利用了以下空间：页面头部下方的 \headsep（尽管在本文档中为空）；最底部的页面浮动下方的 \dbltextfloatsep；\subsection* 插入的空间以及其上下的手动插入的 \medskip；在第一个脚注上方的\skip\footins[117]，作者临时将其放大了 4pt，用于本节和下一节；以及从文本区域的底边到页码的底边的 \footskip。

above the first footnote which the author enlarged by 4 pt temporarily for this and the next subsections; and \footskip from the bottom edge of text area to that of the page number.

在第一个脚注之上，作者通过临时将其放大 4 pt，为本节和下一节预留了一些空间。此外，\footskip 的高度是从文本区域的底边到页码的底边。

Now you might notice that the explanation above does not mention the p region for pre-environment and post-environment stuff. As you should find in the settings, this region is enlarged horizontally *and vertically* so that its top and bottom edges are moved up and down when the region is at the top or bottom of a page, as you are seeing now and find in p. 49. However, this enlargement of course has a side effect that the region collides against c(olumn) and g(ap) regions also enlarged vertically making them overlapped. This overlap will be invisible with most of *printers* because, as shown in Section 7.8, p region is painted *before* c and g regions are painted. In addition, since relatively large spaces of \bigskip are manually inserted before each \begin{paracol} and after each \end{paracol}, texts in pre-environment and post-environment stuff are well separated from region boundaries.

现在您可能会注意到上面的解释没有提到 pre-environment和 post-environment stuff的p 区域。正如您在设置中找到的那样，这个区域在水平上和垂直上被放大，所以当该区域在页面的顶部或底部时，其顶部和底部边缘会向上和向下移动，就像您现在看到的并且在第 49页中找到的那样。然而，这种放大当然会产生一个副作用，即该区域与垂直放大的c(olumn) 和g(ap) 区域发生碰撞，使它们重叠在一起。这种重叠对于大多数打印机来说是看不见的，因为如第 7.8节所示，p 区域是在c 和g 区域之前绘制的。此外，由于在每个\begin{paracol}之前和每个\end{paracol}之后手动插入了相对较大的 \bigskip 空间，pre-environment和 post-environment stuff中的文本与区域边界之间有很好的分隔。

This overlay painting c and g over p, however, might produce an unexpected result with some printer with which, for example, two colors are *blended* in the thin overlapped strip[118].

然而，这种c 和g 覆盖p 的叠加绘制可能会在某些打印机上产生意外的结果，例如，在细小的重叠条带中混合了两种颜色[119]。

[115] As the footnote 111 in p. 48, this merged footnote is a part of post-environment stuff and thus painted by pale green rather than light purple.

[116] This is a kind of “length command” maybe not widely known.

[117] 这是一种可能不太常见的 “长度命令”。

[118] For example, a dvi previewer dviout produces such a blended result with the default setting of coloring.

[119] 例如，一个 dvi 预览器dviout 在默认的着色设置下会产生这样的混合结果。

Unfortunately, this overlay painting is inevitable in the current version 1.3, but in a future version, hopefully 1.4, more sophisticated *position-dependent* region definition, for example, to shift the top edge of `p` region only when the region is at the top of page, could be introduced.

不幸的是，在当前的 1.3 版本中，这种叠加绘制是不可避免的，但在将来的版本中，希望是 1.4 版本，可以引入更复杂的位置依赖区域定义，例如，仅当区域位于页面顶部时才移动`p` 区域的顶部边缘。

Another remark is that the mirroring specified by the `b` feature of `\twosided` works not only on the colors of side margins but also on their asymmetric shrinkage. That is, the asymmetric shifts of vertical edges of `l` and `r` regions correctly performed irrespective of their physical positions, i.e., even when the `l` (resp. `r`) region is at the right (resp. left) margin and the edge to be shift is the left (resp. right) one rather than right (resp. left).

另一个要注意的是，`\twosided`的`b` 特性所指定的 mirror不仅适用于侧边栏的颜色，也适用于它们的非对称收缩。也就是说，无论左侧（resp. 右侧）的`l`（resp. `r`）区域是否位于右侧（resp. 左侧）边缘，以及待移动的边缘是左侧（resp. 右侧）边缘还是右侧（resp. 左侧）边缘，`l` 和`r` 区域的垂直边缘的非对称移动都可以正确进行。

10.3 Regions with Infinite Extensions 具有无限扩展的区域

You are now seeing another background painting much different from previous two examples. That is, after disabling painting of `t`, `b`, `l`, `r` and `g` regions by `\nobackgroundcolor`, the author gave the followings for painting this and the next pages.

现在你看到了另一个与前两个示例非常不同的 background painting。也就是说，在通过 `\nobackgroundcolor` 禁用`t`、`b`、`l`、`r` 和`g` 区域的绘制之后，作者为绘制本页和下一页给出了以下设置。

```
\backgroundcolor{c[0](4pt,4pt)(0.5\columnsep,4pt)}[rgb]{1,0.8,1}
\backgroundcolor{c[1](0.5\columnsep,4pt)(4pt,4pt)}[rgb]{1,1,0.8}
\backgroundcolor{C[0](10000pt,10000pt)(0.5\columnsep,10000pt)}[rgb]{1,0.8,1}
\backgroundcolor{C[1](0.5\columnsep,10000pt)(10000pt,10000pt)}[rgb]{1,1,0.8}
```

The first two lines above is different from the previous declaration because inside edges of `c[0]` and `c[1]` regions are shifted toward outside of them and thus inside of unpainted `g` region so that the edges are contacted. On the other hand, the last two lines are for *under-painting* of columns and has *infinite extension* to make top, bottom and outside edges of `C` regions reaching to the corresponding paper edges. Since this under-painting is done with colors same as those of over-painting of `c` regions, you will have an impression that the paper is two-toned and page-wise stuff are pasted on the paper[120].

上面的前两行与之前的声明不同，因为`c[0]` 和`c[1]` 区域的内侧边缘向外移动，进入未绘制的`g` 区域，使边缘相接触。另一方面，最后两行是用于对列进行下层绘制，并且具有 *infinite extension*，使`C` 区域的顶部、底部和外部边缘达到相应的纸张边缘。由于此下层绘制使用的颜色与`c` 区域的上层绘制相同，所以你会有一种纸张是双色的，并且 page-wise stuff被粘贴在纸张上的印象[121]。

Though you cannot see, the right edge of this over-painted `c[0]` region is shifted right by 4`pt` to hide the small patch at the right bottom corner of the `p` region above by overlaying.

As explained in the right column, this `c[1]` *region also has an invisible left edge shifted left by* 4`pt`[122].

This `s`(panning text) region could be extended to both side edges of the paper if its extension were `(10000pt,-4pt)`.

The author does not have much to say now for this column chunk.

Little to say as well.

Still nothing to say particular to the page break we will have shortly.

Nothing to say as well.

[120] This footnote is given outside `paracol` environment but its background is painted by light purple because it is merged with the footnote 122.
[121] 这个脚注是在 `paracol`环境之外给出的，但是它的 background被浅紫色绘制，因为它与脚注 122合并了。
[122] This (foot)`n`(ote) region could be extended to both side edges and the bottom edge of the paper if its extension were `(10000pt,-4pt)(10000pt,10000pt)`.

This f(loat) region could be extended to both side edges and the top edge of the paper if its extension were (10000pt,10000pt)(10000pt,-4pt).

图 8: A Page-Wise Figure *Imported* from Pre-Environment

This paragraph is not necessary for keeping alive the environment but is given for consistent view.

This paragraph is just for keeping the paracol environment alive in this page.

Note that overlay painting is inevitable for two-toned page painting, as far as you want to paint background of page-wise stuff.

请注意，如果您希望绘制 page-wise stuff的 background，那么对于双色页面绘制，覆盖绘制是不可避免的。

The last issue of background painting is about painting materials given outside paracol. As you have seen, pre-environment and post-environment stuff are painted but it is done only when they reside in a page having a portion of a paracol environment (maybe) of course. Therefore, the next page is *not* painted because the page does not have any parallel-columned stuff. Therefore, even if you wish to paint the whole of your document including pages without paracol stuff, you cannot do it just with paracol package, at least so far.

background painting的最后一个问题是关于在 paracol之外给出的材料的绘制。正如您所见，pre-environment和 post-environment stuff是被绘制的，但只有当它们位于具有 paracol环境（可能）的页面中时才进行绘制。因此，下一页不会被绘制，因为该页没有任何平行列的内容。因此，即使您希望绘制整个文档，包括没有 paracol内容的页面，至少目前您无法仅使用 paracol 宏包来实现。

On the other hand, some materials given outside paracol environments are painted as if they are given in the environment when they are *imported* into the environment. One category has footnotes given in pre-environment stuff when \footnotelayout{m} is specified for merging, as exemplified by the footnote 121 in the previous page. Note that such a footnote is painted by the color for n region rather than p region even when there are no footnotes in the paracol environment. The other category has ordinary floats given by figure and/or table (i.e., neither figure* nor table*) environments outside paracol and then *deferred* to a page having (a portion of) stuff produced by paracol. Since such a float, e.g., Figure 8 in this page, is considered as a page-wise float given in the paracol environment in this section, its background is painted by the color for the f region, rather than that for the p region which would be used if the float were is placed in the previous page. Note that such a deferred float import could occur not only from the page having \begin{paracol} but also from pages preceding it. For example, if you have three figure environments in a page $p-1$ just preceding the page p in which you start a paracol environment, it could happen that first one is placed in $p-1$ without painting, the second is placed in p and painted by the color for p, and the third is placed in $p+1$ and painted by the color for f.

另一方面，一些在 paracol环境之外给出的材料在被导入到环境中时会被绘制，就好像它们是在环境中给出的一样。一个类别是在 pre-environment stuff中给出的，在指定 \footnotelayout{m} 进行合并时的脚注，例如前一页的脚注 121。请注意，即使在 paracol环境中没有脚注，这样的脚注也会使用n 区域的颜色而不是p 区域的颜色进行绘制。另一类是由 figure和/或 table（即既不是 figure*也不是 table*）环境给出的普通浮动体，然后被延迟到由 paracol产生的（部分）内容的页面。因为这样的浮动体，例如本页的 Figure 8，被认为是在本节的 paracol环境中给出的整页浮动体，所以它的背景会使用f 区域的颜色进行绘制，而不是如果该浮动体放在前一页上时将使用p 区域的颜色。请注意，这样的延迟浮动体导入不仅可能来自具有\begin{paracol}的页面，也可能来自之前的页面。例如，如果在您开始一个 paracol环境的页面 p 的前一页 $p-1$ 中有三个 figure环境，可能发生以下情况：第一个放置在 $p-1$ 中而没有绘制，第二个放置在 p 中并使用p 的颜色进行绘制，第三个放置在 $p+1$ 中并使用f 的颜色进行绘制。

Finally some materials *exported* from a paracol environment are painted as if they are in post-environment stuff. In previous two subsections, we saw merged footnotes (e.g., 111 in p. 48 and 115 in p. 53) are painted by the color of p rather than n. The other kind of exportation is of page-wise floats given in a paracol environment but deferred to the page next to the page having \end{paracol}, or further. For example, Figure 9 is given in the paracol environment above in this page, but its background is not painted because the next page in which the figure is placed does not have any parallel-columned stuff[123].

最后，一些从 paracol环境中导出的材料被绘制，就好像它们在 post-environment stuff中一样。在前两个小节中，我们看到 merged footnote（例如，48页上的 111和 53页上的 115）被绘制为p 区域的颜色，而不是n。另一种导出的类型是在 paracol环境中给出的整页浮动体，但是延迟到\end{paracol}所在页面的下一页或更后面的页面。例如，本页上方的 paracol环境中给出了 Figure 9，但是它的 background没有被绘制，因为放置该图的下一页没有任何平行列的内容[124]。

[123] If it has, the background is painted by the color for p.

[124] 如果有，背景将使用p 区域的颜色进行绘制。

This figure is given in the `paracol` environment closed in the previous page but its background is not painted.

图 9: A Page-Wise Figure *Exported* to Post-Environment

(intentionally blanked page to show this page is *not* painted)

11 Known and Unknown Problems 已知和未知的问题

Here a few problems you could face in the use of paracol are summarized.

在使用 paracol 时可能遇到的一些问题总结如下。

- If your (e.g.,) left column goes ahead too much farther than the right column, LaTeX could stop with the following error message.

  如果你的（例如）左列比右列前进得更远，LaTeX 可能会停止，并显示以下错误消息。

  ```
  ! Package paracol Error: Too many unprocessed columns/floats.
  ```

  This usually means that the internal space to keep materials in the left column is exhausted. More specifically, suppose at some point in your `.tex` the left column is in the page p while the right is in $q < p$. We need $(p - q)$ *boxes* to keep the left column contents in the pages q, $q + 1$, …, $p - 1$ because these pages cannot be *printed* yet until the right column fills them. In addition, we also need two boxes for the left column in p and the right column in q so that you make column-switching between them keeping unprinted contents in them. Therefore, at least we need to have $(p - q) + 2$ boxes, while the number of them provided by LaTeX is only 18[125].

  这通常意味着左列中保存材料的内部空间已经用尽。更具体地说，假设在您的`.tex` 文件的某个点，左列位于页面 p，而右列位于 p 之前的页面 q 中。我们需要 $(p-q)$ 个盒子，以将左列的内容保存在页面 q，$q+1$，……，$p-1$ 中，因为在右列填充它们之前，这些页面不能被打印出来。此外，我们还需要两个盒子，分别用于页面 p 中的左列和页面 q 中的右列，以便您可以在它们之间进行 column-switching，保持其中的未打印内容。因此，至少我们需要有 $(p-q)+2$ 个盒子，而 LaTeX 提供的盒子数量只有 18 个[126]。

  Therefore, paracol cannot continue its work if $(p - q)$ reaches 17. Furthermore, other stuff also consumes the boxes as follows.

  因此，如果 $(p-q)$ 达到 17，paracol 将无法继续工作。此外，其他内容也会按照以下方式消耗盒子。

  - If there are n pages in q, $q + 1$, …, p having pre-environment stuff or page-wise floats, n boxes are consumed by them. Similarly, if m pages in them have page-wise footnotes, m boxes are given to them.

    如果在 q，$q+1$，…，p 中有 n 页具有 pre-environment stuff或按页的浮动体，那么它们会消耗 n 个盒子。同样，如果其中 m 页具有 page-wise footnote，那么它们会获得 m 个盒子。

  - If the left (resp. right) column has column-wise footnotes in p (resp. q), a box is used for them.

    如果左（右）栏在 p（q）中有 column-wise footnote，则会为它们使用一个盒子。

  - If the left (resp. right) column has k floats to be placed in p (resp. q) or to be deferred to $p + 1$ (resp. $q + 1$) or a succeeding page, k boxes are reserved for them.

    如果左（右）栏在 p（q）中有 k 个浮动体需要放置，或者延迟到 $p+1$（$q+1$）或后续页面，则会为它们保留 k 个盒子。

  Therefore, it should be safe to keep $(p - q)$ from exceeding 10 or so placing `\switchcolumn` in both columns fairly frequently.

  因此，在两个列中频繁地使用 `\switchcolumn`，将 $(p-q)$ 保持在不超过 10 左右应该是安全的。

- As discussed in Section 7.2, setting a synchronization point in a page brings the following side effects.

  如第 7.2节所讨论的，将同步点设置在页面中会产生以下副作用。

  - Stretch and shrink factors of all vertical skips in the page are nullified. The nullification of stretch factors could make a sparse column in the page have a vertical space at its bottom as if `\raggedbottom` setting is in effect even with `\flushbottom` one, rather than distributing the amount of the space to the skips so that the bottom line is aligned at the page bottom. As for the nullification of shrink factors, it makes the page have lines a little bit less than that it would have without synchronization because lines above the (last) synchronization point cannot be compressed. The other effect is a little bit subtle because the shrink factors below the last synchronization point are taken care of by TeX's page builder when it examine the appropriateness of each breakable point, but they are nullified when the page is printed. That is, if TeX finds a good break point which needs that the stuff between the synchronization and break points is compressed a little bit, the stuff is printed without compression making its bottom edge a little bit below the page bottom.

[125] Readers who are acquainted with LaTeX implementation will understand that 18 is the cardinality of the set {`\bx@A`, . . . , `\bx@R`} for floats acquired by `\newinsert`. Those who are more familiar with that might know that most LaTeX, based on e-TeX or others having similar extensions, now have 52 `\inserts` {`\bx@A`, . . . , `\bx@Z`, `\bx@AA`, . . . , `\bx@ZZ`} for floats and materials of paracol, since 2015

[126] 熟悉 LaTeX 实现的读者会明白，18 是由`\newinsert`获取的浮动体集合 `\bx@A`, . . . , `\bx@R` 的基数。那些更熟悉的人可能会知道，大多数基于 e-TeX 或其他具有类似扩展的 LaTeX 版本，自 2015 年以来都有 52 个`\insert`，分别用于浮动体和 paracol 的材料 `\bx@A`, . . . , `\bx@Z`, `\bx@AA`, . . . , `\bx@ZZ`。

页面中所有垂直间距的伸缩因子被设为零。伸缩因子的设为零可能会导致页面中的稀疏列在底部具有垂直间距，就好像使用了 设置一样，即使实际使用的是 设置，而不是将空间的量分布到间距中，使得底线与页面底部对齐。至于收缩因子的设为零，这使得页面的行数比没有同步化时少一点，因为同步化点上方的行不能被压缩。另一个效果稍微微妙一些，因为当 TEX 检查可断点的合适性时，位于最后一个同步化点以下的收缩因子由 TEX 的页面构建器处理，但在打印页面时，它们被设为零。也就是说，如果 TEX 找到一个需要将同步化点和断点之间的内容稍微压缩一点的良好断点，那么该内容将以无压缩方式打印，使得其底边略微低于页面底部。

– After a synchronization point is set, columns in the page cannot have top floats any more even if a column has space above the synchronization point and large enough to place the float. Therefore, if you like to exploit the space, you have to place the `figure` or `table` environment in question prior to the column-switching command or environment for the synchronization.

在设置了同步化点之后，即使某一列在同步化点上方有足够的空间放置浮动体，该列也无法再放置顶部浮动体。因此，如果想要利用这个空间，必须在进行同步化之前将相关的 `figure` 或 `table` 环境放置在 column-switching 命令或环境之前。

- As the author did for Section 1 to **??**, sometimes you will make a section header spanning all columns by giving a sectioning command such as `\section`, `\subsection` and `\subsubsection` to the optional argument of `\switchcolumn*` or `\begin` of a synchronizing column-switching environment. These three commands work well and you will have what you intend to have, but you have to be careful with lower-level commands `\paragraph` and `\subparagraph`. Unlike higher-level relatives, these lower-level commands does *not* put the header *immediately* but keep it somewhere[127]
就像作者在第**??**节中所做的那样，有时你会通过将诸如 `\section`、`\subsection` 和 `\subsubsection` 之类的节标题命令放在 `\switchcolumn*` 或 `\begin` 的可选参数中，来使一个节标题跨越所有列。这三个命令可以很好地工作，你会得到你想要的效果，但是你必须小心使用低级命令 `\paragraph` 和 `\subparagraph`。与高级命令不同，这些低级命令并不会立即放置标题，而是将其保存在某个地方[128]。
so that when the paragraph following the command starts it is put as the leading part of the paragraph. Therefore if the spanning text has (e.g.) `\paragraph` only, the header is not put as a spanning text but at the head of the first paragraph of the column to which you switch, leaving an empty spanning text with some large space as follows.
这样，当命令后面的段落开始时，它就会作为段落的开头部分放置。因此，如果 spanning text只有（例如）`\paragraph`，则标题不会作为 spanning text放置，而是放置在您切换到的列的第一个段落的开头，留下一个空的 spanning text，其中包含一些大空间，如下所示。

This left-column paragraph precedes a synchronized column-switching.

A Spanning Text Given by `\paragraph` This left-column paragraph follows the synchronization but is led by `\paragraph` given to the optional argument of `\switchcolumn*` for spanning text.

This right-column paragraph precedes a synchronized column-switching.

This right-column paragraph follows the synchronization with an empty spanning text.

Therefore, unless this is what you intend to do, you have to give some paragraph together with `\paragraph` to the optional argument for spanning text. For example, `\mbox{}` is a good candidate as the paragraph following `\paragraph` because it produces (almost) nothing. By using this technique the example above becomes the followings.
因此，除非这是您打算做的事情，否则您必须将一些段落与 `\paragraph` 一起提供给 spanning text的可选参数。例如，`\mbox{}` 是作为 `\paragraph` 之后的段落的一个好选择，因为它几乎不产生任何内容。通过使用这种技术，上面的示例将变成以下内容。

This left-column paragraph precedes a synchronized column-switching.

A Spanning Text Given by `\paragraph` Followed by `\mbox{}`
This left-column paragraph follows the spanning text above.

This right-column paragraph precedes a synchronized column-switching.

This right-column paragraph follows the spanning text above.

- As shown in Section 8, it is not easy to have good numbering and stacking order of page-wise footnotes even with the supports from `\footnote*` and its relatives. In addition, a footnote in a `paracol` environment cannot be broken into two (or more) pages.

正如第 8节所示，即使使用 `\footnote*` 及其相关命令的支持，也很难获得良好的 page-wise footnote编号和堆叠顺序。此外，在 `paracol`环境中的脚注不能分为两页（或更多页）。

- As the author confessed in Section 9.1, right parallel-pages cannot have page-wise stuff but have blank spaces in the corresponding region for them. The author will try to remove this limitation from a future version of paracol, in the version 1.4 hopefully.

正如作者在第 9.1节中承认的那样，右侧的 parallel-pag不能有 page-wise stuff，但在相应的区域中有空白。作者将努力在未来的 paracol 版本中消除这个限制，希望是 1.4 版本。

- As discussed in Section 10.2, it is desirable that background painting region definition in `\backgroundcolor` has position dependent extensions. The author is fairly optimistic about the incorporation of this advanced feature

[127] For people familiar to TEX's *dangerous bends*, the header is kept in `\everypar`.
[128] 对于熟悉 TEX 的危险弯曲的人来说，标题保存在 `\everypar` 中。

in the version 1.4.

如第 10.2节所讨论的，`\backgroundcolor` 中的 background painting 区域定义应具有位置相关的扩展。作者对将这个高级功能纳入 1.4 版本非常乐观。

- In the release dated 2015/01/10, LaTeX changed its mechanism of the placement of double-column floats (or in our terminology, page-wise floats) to avoid *out-of-order* appearance of them. That is, until the release on 2014/05/01 a double-column float (e.g., `figure*`) can be overtaken by a single-column float of the same category (e.g., `figure`) when they cannot be put into the page in which texts around them are put. In order to cope with the problem, the new version merged two lists to keep *deferred* double- and single-column floats into one so that the appearance order of them is determined by their order in the single list. Though this change should have made people happy when they typeset *ordinary* two-column (or multiple-column) documents, the new feature might not be welcomed by paracol users because your parallel-columns have their own *streams* of floats to be put in the corresponding columns. Therefore, and for the sake of simplicity of paracol's implementation, the author decided to nullify this new feature in `paracol` environments. That is, even with new releases of LaTeX, your page-wise floats given in a `paracol` environment can be overtaken by column-wise floats.

  在 2015/01/10 的版本中，LaTeX 改变了双栏浮动体（或者按照我们的术语，page-wise浮动体）的放置机制，以避免它们出现顺序不正确/的情况。也就是说，在 2014/05/01 之前的版本中，双栏浮动体（例如 `figure*`）可以被同一类型的单栏浮动体（例如 `figure`）超越，当它们不能放置在文本周围的页面中时。为了解决这个问题，新版本将两个列表合并为一个列表，将推迟/的双栏和单栏浮动体放在同一个列表中，以便它们的出现顺序由列表中的顺序确定。虽然这个改变应该使人们在排版普通/的双栏（或多栏）文档时感到满意，但这个新特性可能不被 paracol 的用户所欢迎，因为你的并列栏有它们自己的浮动体流/，要放在相应的栏中。因此，为了简化 paracol 的实现，作者决定在 `paracol`环境中取消这个新特性。也就是说，即使在 LaTeX 的新版本中，给定在 `paracol`环境中的 page-wise浮动体也可能被 column-wise浮动体超越。

In addition to the problems above known to the author, there may be (or should be, honestly speaking) other unknown problems in paracol because it cannot be perfect though the author has made his best effort for testing and debugging it. Particularly, sometimes it is very tough, if not impossible, to make paracol compatible with other packages, especially with those having dark magic as paracol has in it[129].

除了作者已知的上述问题外，paracol 中可能还存在（或者说应该存在）其他未知问题，因为尽管作者已经尽力进行了测试和调试，但它并不是完美的。特别是，有时要使 paracol 与其他包兼容是非常困难的，甚至是不可能的，特别是那些像 paracol 一样具有黑魔法的包[130]。

Therefore, though reporting incompatibleness with a package you use is very welcome[131],

因此，虽然非常欢迎您报告使用的包不兼容的情况[132]，

you should kindly understand the toughness of the compatibility issue.

您应该理解兼容性问题的复杂性。

Furthermore, even without such problematic packages, paracol might produce weird results due to its bug. If your document has something to make unknown bugs visible, you might have one (or more) of the followings which the author encountered in his debugging work.

此外，即使没有这些有问题的宏包，paracol 也可能由于其自身的错误而产生奇怪的结果。如果您的文档中有一些可以显示未知错误的内容，那么您可能会遇到作者在调试工作中遇到的以下问题之一（或多个）。

- A page, a column, a footnote and/or a float disappears[133].

  页面、列、脚注和/或浮动对象消失[134]。

- A page, a column, a footnote and/or a float is duplicated.

  页面、列、脚注和/或浮动对象重复出现。

- A message like "`Overfull \vbox (1.23456pt too high) has occurred while \ouptut is active`" is shown.

  显示类似于 "`Overfull \vbox (1.23456pt too high) has occurred while \ouptut is active`" 的消息。

[129] For example, the author knows it is almost impossible to make paracol compatible with one of the author's own package available in CTAN.
[130] 例如，作者知道几乎不可能使 paracol 与作者自己在 CTAN 上提供的一个包兼容。
[131] For example, paracol is now compatible with color package thanks to a report from a user.
[132] 例如，由于用户的报告，paracol 现在与 color 包兼容。
[133] In fact, a bug fixed in version 1.2 caused page losing though it happens very very rarely but an unlucky user encountered it.
[134] 实际上，在 1.2 版本中修复的一个错误导致页面丢失，尽管这种情况非常非常罕见，但不幸的用户遇到了这个问题。

- A message "`Underfull \vbox (badness 10000) has occurred while \ouptut is active`" is shown. This message, however, does not always mean a bug but may just be a complaint that a column or a page is too sparse to meet your request to align the bottom of all columns and pages by `\flushbottom` setting. Therefore, if you have this message and you cannot be sure whether it means a bug or not, try `\raggedbottom` setting to see if you still have the message, before sending a bug report to the author.

  显示消息 `Underfull \vbox (badness 10000) has occurred while \ouptut is active`"。然而，这个消息并不总是表示一个错误，可能只是在使用 `\flushbottom` 设置时，列或页面太空，无法满足将所有列和页面底部对齐的要求。因此，如果您收到此消息并且无法确定它是否表示一个错误，请尝试使用 `\raggedbottom` 设置，看看是否仍然收到此消息，然后再向作者发送错误报告。

If you encounter anything like them (or whatever you cannot solve by yourself), don't hesitate to report it to the author with minimum source file to produce the problem[135].

如果您遇到类似的问题（或者任何无法自行解决的问题），请不要犹豫，将其报告给作者，并提供最少的源文件以重现该问题[136]。

Acknowledgments 致谢

The author thanks to Yacine Daddi Addoun who gave the author the motivation to write the style for his bilingual document. He also thanks to the following people;

作者感谢 Yacine Daddi Addoun 给予作者编写双语文档样式的动力。他还感谢以下的人；

Robin Fairbairns who kindly invited the style to CTAN after the author's lazy six years failing to upload the style;

Robin Fairbairns 亲切地邀请了作者将这个样式上传到 CTAN，这是在作者懒散六年、未能上传该样式之后的事情。

Joseph G. Rosenstein and Dieter Köhler who suggested the author adding the function of unbalanced column width incorporated in version 1.1;

Joseph G. Rosenstein 和 Dieter K"ohler 建议作者在 1.1 版本中添加了不平衡列宽的功能；

Joaquín Blas who motivated the author to challenge page-wise footnotes;

Joaqu'in Blas 激励了作者挑战按页脚注的能力；

Olivier Vogel who pointed out the compatibility problem with coloring packages;

Olivier Vogel 指出了与着色宏包的兼容性问题；

Heiner Richter who asked for the possibility of swapping unbalanced columns, revealed two bugs in version 1.22 related to coloring and float pages, showed the necessity of `\coloredwordhyphenated`, and finally found the necessity of `\globalcounter*`;

Heiner Richter 提出了交换不平衡列的可能性，并在 1.22 版本中发现了与着色和浮动页面相关的两个错误，展示了 `\coloredwordhyphenated` 的必要性，并最终发现了 `\globalcounter*` 的必要性。

an anonymous user who reported a very rare-case but severe bug in the version 1.1 by which a page can be lost (whoops!);

一个匿名用户在 1.1 版本中报告了一个非常罕见但严重的错误，导致页面丢失（哎呀！）。

Olivier Gerard who found another terrible bug fixed in version 1.21 but hidden in paracol for two years by which a column disappears or moves to a wrong page (another whoops!), suggested to implement `\setcolumnwidth`, `\marginparthreshold` and `\thecolumn` introduced in version 1.3, and kindly proofread this manual;

Olivier Gerard 发现了另一个可怕的错误，在 1.21 版本中得到修复，但在 paracol 中隐藏了两年，导致列消失或移动到错误的页面（另一个哎呀！），他建议实现 `\setcolumnwidth`、`\marginparthreshold` 和 `\thecolumn`，这些功能在 1.3 版本中引入，并且还对本手册进行了校对。

George Kamel who let the author know the coloring function newborn in version 1.2 had a bug fixed in version 1.22 to which he also made a great contribution testing many tentative versions with his own colored documents;

George Kamel 让作者知道在 1.2 版本中新出现的着色功能存在一个错误，在 1.22 版本中得到修复，他还用自己的着色文档测试了许多尝试性版本，对此做出了巨大的贡献。

[135] And with patience because your problem might not be solved quickly.

[136] 还要有耐心，因为您的问题可能不会很快得到解决。

another anonymous user who pointed out version 1.22 had yet another coloring bug fixed in version 1.24;

另一个匿名用户指出 1.22 版本中还有另一个着色错误，在 1.24 版本中得到修复。

Jean Druel who motivated the author to implement an advanced functionality parallel-paging;

Jean Druel 激励作者实现了高级功能并行分页。

Tilo Arens and other patient users who had wished paracol would have the capability of rule drawing in the gaps separating columns and painting backgrounds of columns and so on;

Tilo Arens 和其他耐心的用户希望 paracol 能够具有在分隔列之间绘制规则和绘制列背景等功能。

Michael Bolin who gave the author motivated examples showing the necessity of `\ensurevspace`.

Michael Bolin 给出了作者有动机的例子，显示了 `\ensurevspace` 的必要性。

Tigran Aivazian who reported a memory leak problem fixed in version 1.32;

Tigran Aivazian 报告了一个在 1.32 版本中修复的内存泄漏问题。

Marcus Zelezny and Touhami Mamouni who found an incompatibility with LaTeX itself (2015/01/10 or later) and enlighten the author on the cause of the problem;

Marcus Zelezny 和 Touhami Mamouni 发现了与 LaTeX 本身（2015/01/10 或之后的版本）的不兼容性，并向作者解释了问题的原因。

Manuel Kuehner who reported a bug in text coloring which had hidden for five years until the version 1.34 was released;

Manuel Kuehner 报告了一个文本着色的错误，在 1.34 版本发布之前隐藏了五年。

ZongXian Wang who found that the paracol misbehaves when an environment starts with an unusually tall item;

ZongXian Wang 发现当一个环境以一个异常高的项目开始时，paracol 的行为不正常。

and Frank Mittelbach who pointed out bugs in `\marginpar` implementation and vertical spacing with `\trivlist`-like environments, and suggested new functionality with `\marginnote`, `\belowfootnoteskip` and `\definecolumnpreamble`.

感谢 Frank Mittelbach 指出了 `\marginpar` 实现中的错误，以及与 `\trivlist`-like 环境的垂直间距问题，并提出了关于 `\marginnote`、`\belowfootnoteskip` 和 `\definecolumnpreamble` 的新功能建议。

For the implementation of the style file, the author referred to the base implementations of `\output` and othe many macros of LaTeX 2_ε written by Leslie Lamport, Johannes Braams and other authors. The author also referred to color written by David Carlisle and marginnote written by Markus Kohm to make the package working well with them.

在实现样式文件时，作者参考了由 Leslie Lamport、Johannes Braams 和其他作者编写的 LaTeX 2_ε 的基本实现中的 `\output` 和其他许多宏。作者还参考了 David Carlisle 编写的 color 和 Markus Kohm 编写的 marginnote，以使该包能够与它们很好地配合使用。

目录