The subcaption package*

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Abstract

This package offers an user interface to typeset sub-captions.

At the end of each section, text marked with the mountain symbol will contain background knowledge on how the particular command or environment is actually implemented. If you just want to use this package as it is, you don't have to read or understand them.

Since version 3.1 the caption package offers a low-level interface to typeset sub-captions: `\DeclareCaptionSubType` defines the required counters and internal commands, `\setcaptionsubtype` switches to the sub-caption mode, and `\caption@subtypehook` could be extended to apply own code when a switch to the sub-caption mode is in progress.

This package demonstrates its usage by offering a high-level user interface additionally.

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*This package has version number v1.6.

Contents

1 Loading the package

Load this package using

```
\usepackage[⟨options⟩]{subcaption}   .
```

The options for the subcaption package are the same ones as for the caption package, but specify settings which are used for sub-captions *additionally*. In fact

```
\usepackage[⟨options⟩]{subcaption}
```

is identical to

```
\usepackage{subcaption}
\subcaptionsetup{⟨options⟩}   .
```

The default settings for sub-captions are:

```
margin=0pt,font+=smaller,labelformat=parens,labelsep=space,
skip=6pt,list=false,hypcap=false
```
[1]

2 Setting options

`\subcaptionsetup`
New feature
v1.6

The `\subcaptionsetup` command sets options specifically for sub-captions.

```
\subcaptionsetup{⟨options⟩}
```

sets options valid for all sub-captions.
An example:

```
\subcaptionsetup{font=it}
```

sets the font to “italic” for all sub-captions.

```
\subcaptionsetup[⟨environment⟩]{⟨options⟩}
```

is an alternative syntax to

```
\captionsetup[sub⟨environment⟩]{⟨options⟩}   .
```

---

[1] This means that sub-captions are not listed in the List of Figures or Tables by default, but you can enable it by specifying the option `list=true`.

An example:

```
\subcaptionsetup[table]{labelformat=simple}
```

is identical to

```
\captionsetup[subtable]{labelformat=simple}
```

and sets the labelformat to “simple” for all sub-captions inside tables.

Options specified with `\usepackage[...]{subcaption}` and `\subcaptionsetup{...}` will override the ones specified by `\captionsetup{...}` and `\captionsetup[figure]{...}`, but are again overwritten by `\subcaptionsetup[figure]{...}` (same for ‘table’). So finally we have the following order how settings for sub-captions are applied:

1. Global settings (`\usepackage[...]{caption}` and `\captionsetup{...}`)
2. Environmental settings (`\captionsetup[figure` *-or-* `table]{...}`)
3. Local settings (`\captionsetup{...}` inside `figure` or `table` environment)
4. Default ‘sub’ settings (`margin=0pt,font+=smaller,...`, see above)
5. Custom ‘sub’ settings (`\usepackage[...]{subcaption}` and `\subcaptionsetup{...}`)
6. Environmental ‘sub’ settings (`\subcaptionsetup[figure` *-or-* `table]{...}`)
7. Local ‘sub’ settings (`\captionsetup{...}` inside `subfigure` or `subtable`)

An example:

```
\usepackage[labelsep=quad,indention=10pt]{caption}
\usepackage[labelfont=bf,list=true]{subcaption}
\captionsetup[table]{textfont=it,position=top}
\subcaptionsetup[table]{textfont=sf}
```

causes sub-captions inside `table` environments to be typeset with the settings

```
indention=10pt,position=top,margin=0pt,font=small,
labelformat=parens,labelsep=space,skip=6pt,hypcap=false,
labelfont=bf,list=true,textfont=sf  .
```

3 The `\subcaptionbox` command

`\subcaptionbox` The `\subcaptionbox` command typesets given content and caption. It automatically aligns the sub-figures or sub-tables by their very first caption line.

Its syntax is:

```
\subcaptionbox[⟨list entry⟩]{⟨heading⟩}[⟨width⟩][⟨inner-pos⟩]{⟨contents⟩}
\subcaptionbox*{⟨heading⟩}[⟨width⟩][⟨inner-pos⟩]{⟨contents⟩}
```

The arguments ⟨*list entry*⟩ & ⟨*heading*⟩ will be used for typesetting the `\caption`.

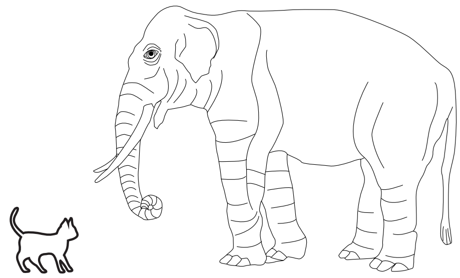
⟨*width*⟩ is the width of the resulting `\parbox`; the default value is the width of the contents.

⟨*inner-pos*⟩ specifies how the contents will be justified inside the resulting `\parbox`; it can be either 'c' (centered, using `\centering`), 'l' (left-justified, using `\raggedright`), 'r' (right-justified, using `\raggedleft`), or 's' (for no special justification). The default is 'c'. (But you can use any justification defined with `\DeclareCaptionJustification` as well, e.g.: '`centerlast`')

When using `\subcaptionbox`, the baseline of the resulting box will be placed right between contents and heading. So usually you don't have to care about the vertical alignment of the sub-figures for yourself. Also the hyperlink anchor is placed properly with respect to the `hypcap=` setting.

An example:

```
\begin{figure}
  \centering
  \subcaptionbox{A cat\label{cat}}
    {\includegraphics{cat}}
  \subcaptionbox{An elephant\label{elephant}}
    {\includegraphics{elephant}}
  \caption{Two animals}\label{animals}
\end{figure}
```



(a) A cat

(b) An elephant

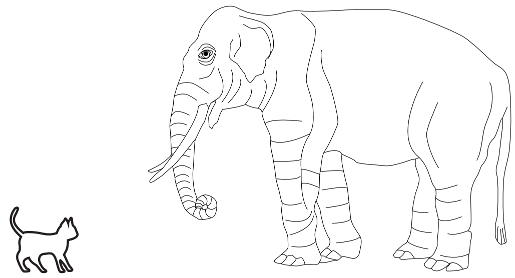
Figure 1: Two animals [2]

As you see the result is not satisfying; the caption below the cat looks ugly because of the small width of the graphic. This can be solved by using the optional arguments of `\subcaptionbox`, increasing the width of the resulting box:

---

[2] The pictures were taken with permission from the LaTeX Companion[1] examples.

```
...
\subcaptionbox{A cat\label{cat}}
  [2.5cm]{\includegraphics{cat}}
...
```

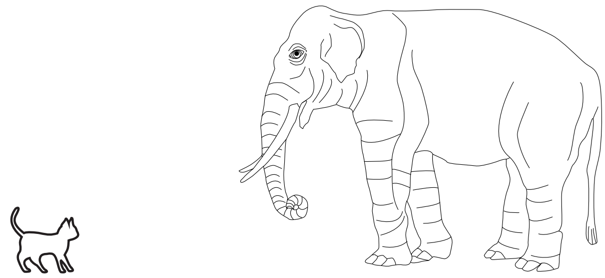


(a) A cat (b) An elephant

Figure 2: Two animals

Furthermore the main caption, which is centered with respect to the `\textwidth`, looks mis-aligned with respect to the sub-captions. This can (again) be solved by using the optional arguments of `\subcaptionbox`, giving both boxes the same width, for example:

```
...
\subcaptionbox{A cat\label{cat}}
  [.4\textwidth]{\includegraphics{cat}}%
\subcaptionbox{An elephant\label{elephant}}
  [.4\textwidth]{\includegraphics{elephant}}
...
```



(a) A cat (b) An elephant

Figure 3: Two animals

▲ The `\subcaptionbox` is a `\parbox` with `\setcaptionsubtype` as first contents line.

3.1 Comparison with `\captionbox`

Both, `\captionbox` (offered by the caption package) and `\subcaptionbox`, put its contents and caption into a `\parbox` of either natural or given width and share the same (mandatory and optional) arguments, but while `\captionbox` uses a regular caption, `\subcaptionbox` uses a sub-caption instead, like “(a)” or “2.1”.

So for example the last example would look like this when using `\captionbox` instead of `\subcaptionbox`:

```
\begin{figure}
  \centering
  \captionbox{A cat\label{cat}}
    [.4\textwidth]{\includegraphics{cat}}%
  \captionbox{An elephant\label{elephant}}
    [.4\textwidth]{\includegraphics{elephant}}
\end{figure}
```

Figure 4: A cat

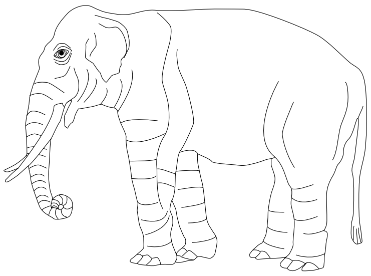


Figure 5: An elephant

4 The `subcaptionblock` environment

`subcaptionblock` (*env.*)

New feature v1.5

The `subcaptionblock` environment makes a box with given width. Inside this box the regular caption commands (like `\caption`, `\phantomcaption`, ...) could be used to typeset sub-captions.

`subcaptionblock` has the same (optional & mandatory) arguments as the `minipage` environment:

```
\begin{subcaptionblock}[⟨outer-pos⟩][⟨height⟩][⟨inner-pos⟩]{⟨width⟩}
  ...
\end{subcaptionblock}
```

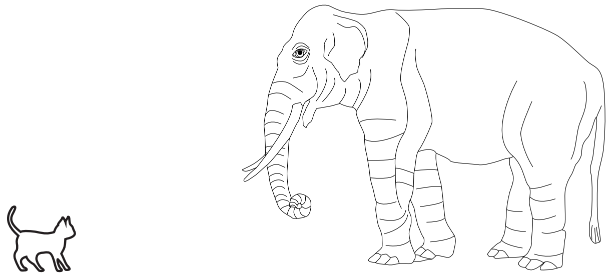
The default value for ⟨*outer-pos*⟩ is either ‘b’ (if no main caption was typeset so far) or ‘t’ (if a main caption was already typeset), and the default value for ⟨*inner-pos*⟩ is ‘s’.

New feature v1.2

Beside the ⟨*outer-pos*⟩ values of ‘c’, ‘t’, and ‘b’, the subcaption package also offers the values ‘T’ and ‘B’ additionally which align the contents at the very top or bottom. (In contrast ‘t’ and ‘b’ align the contents at the top or bottom *baseline*.)

The same example as Figure 3, but this time using the `subcaptionblock` environment instead of `\subcaptionbox`:

```
\begin{figure}
  \centering
  \begin{subcaptionblock}{.4\textwidth}
    \centering
    \includegraphics{cat}
    \caption{A cat}\label{cat}
  \end{subcaptionblock}%
  \begin{subcaptionblock}{.4\textwidth}
    \centering
    \includegraphics{elephant}
    \caption{An elephant}\label{elephant}
  \end{subcaptionblock}%
  \caption{Two animals}\label{animals}
\end{figure}
```



(a) A cat

(b) An elephant

Figure 6: Two animals

Some additional notes:

- You can override the setttings for a specific subcaption with a `\captionsetup` inside the `subcaptionblock`, e.g.:

  ```
  \begin{subcaptionblock}{.4\textwidth}
    \centering
    \includegraphics{owl}
    \captionsetup{skip=3pt}
    \caption{An owl}\label{owl}
  \end{subcaptionblock}
  ```

- Just like `figure` or `table`, a `subcaptionblock` could have multiple captions, e.g.:

  ```
  \begin{subcaptionblock}{.4\textwidth}
    \centering
    \includegraphics{cat}
    \caption{A cat}\label{cat}
  ```

```
    \medskip
    \includegraphics{elephant}
    \caption{An elephant}\label{elephant}
  \end{subcaptionblock}
```

- Hyperlinks targeted to this sub-figure will jump to the beginning of the `subcaptionblock`, and not to the `\caption` inside it (if `hypcap=true` is set for sub-captions). (See section 7.6: *Where do hyperlinks jump?*)

`subfigure` (*env.*)
`subtable` (*env.*)

The `subcaptionblock` environment is also offered as `subfigure` or `subtable`. (And prior version 1.5 of the subcaption package it was only available as `subfigure` or `subtable`.)

There is no difference in them except the environment name should match the current floating environment, i.e. inside a `figure` a `subfigure` should be used, and inside a `table` a `subtable` should be used. Using the wrong sub-environment will cause a warning since v1.5 of the subcaption package.

So if in doubt, or when writing own LaTeX commands which should work in every floating environment, using `subcaptionblock` is the correct choice.

(Note that the default value for ⟨*outer-pos*⟩ has changed from ‘c’ to either ‘b’ or ‘t’ in version 1.5 of the subcaption package.)

The `subcaptionblock`, `subfigure`, and `subtable` environments are `minipage` environments with `\setcaptionsubtype` as first contents line.

`subfigure` and `subtable` are defined with the help of `\ForEachCaptionSubType` offered by the caption package, which executes code for every sub-type declared with `\DeclareCaptionSubType`.

5 The `subcaptiongroup` environment

`subcaptiongroup` (*env.*)
New feature v1.5

The `subcaptiongroup` environment is only switching to the sub-caption mode inside an own TeX group. Inside this environment the regular caption commands (like `\caption`, `\phantomcaption`, ...) could be used to typeset sub-captions.

Its syntax is:

```
\begin{subcaptiongroup}
  ...
\end{subcaptiongroup}
```

There is a starred variant of this environment as well which uses `\setcaptionsubtype*` instead of `\setcaptionsubtype` internally:

```
\begin{subcaptiongroup*}
  ...
\end{subcaptiongroup*}
```

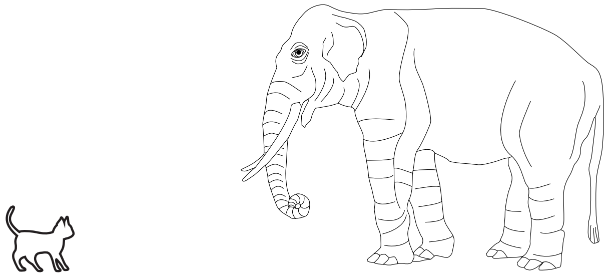
While this gives you great flexibility, it also offers you no help formatting its contents.

The same example as Figure 6, but this time using the `subcaptiongroup` environment instead of `\subcaptionblock`:

```
\begin{figure}
  \centering
  \begin{subcaptiongroup}
    \centering
    \parbox[b]{.4\textwidth}{%
      \centering
      \includegraphics{cat}
      \caption{A cat}\label{cat}}%
    \parbox[b]{.4\textwidth}{%
      \centering
      \includegraphics{elephant}
      \caption{An elephant}\label{elephant}}%
  \end{subcaptiongroup}
  \caption{Two animals}\label{animals}
\end{figure}
```

–or–

```
\begin{figure}
  \centering
  \begin{subcaptiongroup}
    \centering
    \begin{minipage}[b]{.4\textwidth}
      \centering
      \includegraphics{cat}
      \caption{A cat}\label{cat}
    \end{minipage}%
    \begin{minipage}[b]{.4\textwidth}
      \centering
      \includegraphics{elephant}
      \caption{An elephant}\label{elephant}
    \end{minipage}
  \end{subcaptiongroup}
  \caption{Two animals}\label{animals}
\end{figure}
```



(a) A cat

(b) An elephant

Figure 7: Two animals

▲ The `subcaptiongroup` environment is a LaTeX environment with `\setcaptionsubtype` as first contents line.

6 The `\DeclareCaptionSubType` command

`\DeclareCaptionSubType` For using the sub-caption feature of the caption package some commands and counters must be prepared. This is done with

```
\DeclareCaptionSubType[⟨numbering scheme⟩]{⟨type⟩}
\DeclareCaptionSubType*[⟨numbering scheme⟩]{⟨type⟩}
```

For the environments `figure` & `table`, and all the ones defined with `\DeclareFloatingEnvironment` offered by the newfloat package, this will be done automatically, but for other environments (e.g. the ones defined with `\newfloat` offered by the float package or `\DeclareNewFloatType` offered by the floatrow package) this has to be done manually.

The starred variant provides the sub-caption numbering format ⟨*type*⟩`.`⟨*subtype*⟩ (for example '`1.2`') while the non-starred variant simply uses ⟨*subtype*⟩ (for example '`a`').

Own numbering formats can be created by redefining `\thesub`⟨*type*⟩, e.g.:

```
\DeclareCaptionSubType*{figure}
\renewcommand\thesubfigure{\thefigure\alph{subfigure}}
```

would give you sub-caption numbers like '`1b`'.

The default numbering scheme is `alph`, but you can use any LaTeX (or self-defined) command name here which converts a counter to a text value, e.g.: `arabic`, `roman`, `Roman`, `alph`, `Alph`, `fnsymbol`, …

But `\DeclareCaptionSubType` is not only for defining new sub-caption types, you can use this command for re-definitions as well, e.g.:

```
\DeclareCaptionSubType*[arabic]{table}
\subcaptionsetup[table]{labelformat=simple,labelsep=colon}
```

will give you sub-captions in `tables` like these ones:

Table 1: Two tables

1.1: Table one

A	B
C	D

1.2: Table two

E	F
G	H

`\DeclareCaptionSubType` and `\ForEachCaptionSubType` are integral parts of the caption package kernel.

7 Cross Referencing

The macro `\the`⟨*counter*⟩ is not only responsible for the look of the ⟨*counter*⟩, but for the look of the references typeset with `\ref`, too. References will be prefixed by LaTeX with the internal macro `\p@`⟨*counter*⟩.

`\DeclareCaptionSubType` will define both of them for sub-captions (e.g. `subfigure` and `subtable`), and as you have seen in the last section `\DeclareCaptionSubType` will give you some options to control the internal (re-)definition of `\the`⟨*counter*⟩ and `\p@`⟨*counter*⟩.

`\thesubfigure` `\p@subfigure` For example `\thesubfigure` and `\p@subfigure` are (as default) internally defined as

```
\newcommand\thesubfigure{\alph{subfigure}}
\newcommand\p@subfigure{\thefigure}
```

so the label of sub-captions will look like '`a`' (decorated by the selected label format), while references will look like '`1a`' since they are prefixed by `\p@subfigure` = `\thefigure`.

After `\DeclareCaptionSubType*[arabic]{figure}`, `\thesubfigure` and `\p@subfigure` will look like

```
\renewcommand\thesubfigure{\thefigure.\arabic{subfigure}}
\renewcommand\p@subfigure{}
```

But if you want detailed control on how the references will look like, the options of `\DeclareCaptionSubType` are potentially not sufficient. In this case one need to redefine these two macros on his/her own. Some examples:

If you want parentheses around the sub-figure part of the reference, so they will look like '`1(a)`', you may get them this way:

```
\usepackage[labelformat=simple]{subcaption}
\renewcommand\thesubfigure{(\alph{subfigure})}
```

(*Note:* Since `parens` is the default label format you will get double parentheses in sub-captions when not specifiying a different label format, e.g. `simple`.)

But if you want only a closing parenthesis, so references will look like '`1a)`', but the sub-captions itself should still look like '`(a)`', this would be a possible solution:

```
\usepackage{subcaption}
\renewcommand\thesubfigure{\alph{subfigure})}
\DeclareCaptionLabelFormat{opening}{(#2}
\subcaptionsetup[figure]{labelformat=opening}
```

Please note that you need to surround redefinitions of `\p@`⟨*counter*⟩ with `\makeatletter` and `\makeatother`. See `http://tex.stackexchange.com/questions/8351/` for details.

Since October 2019 `\p@`⟨*counter*⟩ could be redefined using `\labelformat` instead, dropping the need to use `\makeatletter` and `\makeatother`. Furthermore not only prefixes could be specified this way, instead the counter representation could be used at any position in the text. So for example

```
\makeatletter
\renewcommand\p@subfigure{\thefigure}
\makeatother
```

(which prefixes the subfigure counter representation with the figure counter representation) could be replaced by

```
\labelformat{subfigure}{\thefigure #1}
```

7.1 The `\subref` command

While `\ref{`⟨*key*⟩`}` (and `\ref*{`⟨*key*⟩`}`, if the hyperref package is used) usually gives a combined result representing the main caption counter and the sub-caption one, it is sometimes useful to have a reference to the sub-caption only. For this purpose you can use

`\subref{`⟨*key*⟩`}`
`\subref*{`⟨*key*⟩`}` [3] .

So for example `\ref{cat}` gives the result '1a' but `\subref{cat}` gives 'a'.

Note: If the sub-caption was (re-)defined with the starred variant `\DeclareCaptionSubType*`, both `\ref` and `\subref` usually gives the same result.

The `\subref` command demonstrates the usage of `\caption@subtypehook` which will be called during `\captionsetup{subtype}`.

7.2 The `subrefformat=` option

`subrefformat=`
New feature
v1.1

By applying `\DeclareCaptionSubType`, or by redefining `\the`⟨*counter*⟩ and `\p@`⟨*counter*⟩, you will change the look of references typeset with `\ref` *and* `\subref`.

But maybe you only want to change the output of `\subref` without affecting the references typeset with `\ref`?

---

[3] Like `\ref*`, `\subref*` is only available if the hyperref package[4] is used.

This is possible, too, by using the option `subrefformat`:

```
\captionsetup{subrefformat=⟨label format⟩}
```

This one will choose a label format (either a pre-defined one, or a one defined with `\DeclareCaptionLabelFormat`) as decorative element to sub-references. The default one is `simple` which has no decorative elements but simply typeset the reference as it is.

For example

```
\captionsetup{subrefformat=parens}
```

will result in references (typeset with `\ref`) like ‘`1a`’ but sub-references (typeset with `\subref`) like ‘`(a)`’.

7.3 Referencing sub-figures without sub-captions

`\phantomcaption` If you don’t want to give a sub-figure a caption (yet), because the picture itself already contains the caption, or for some other reason, you could use the command

```
\phantomcaption
```

instead of `\caption`.

`\phantomcaption` is offered by the caption package since version 3.2 and does not generate any output but increases the sub-figure or sub-table counter and gives you an anchor for a `\label` command which can be placed after it.

An example:

```
\begin{figure}
  \centering
  \begin{subcaptiongroup}
    \includegraphics{cat_with_a}
    \phantomcaption\label{cat}
    \includegraphics{elephant_with_b}
    \phantomcaption\label{elephant}
  \end{subcaptiongroup}
  \captionsetup{subrefformat=parens}
  \caption{Two animals: \subref{cat} a cat,
           and \subref{elephant} an elephant}
  \label{animals}
\end{figure}
```

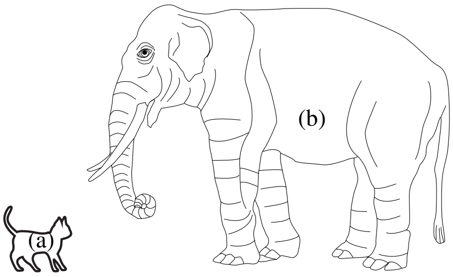


Figure 8: Two animals: (a) a cat, and (b) an elephant

`\captionlistentry` If you don't want to give a sub-figure a caption (yet), because the picture itself already contains the caption, or for some other reason, you could also use the command

```
\captionlistentry{⟨list entry⟩}
```

instead of `\caption`.

`\captionlistentry` is offered by the caption package since version 3.3 and (just like `\phantomcaption`) does not generate any output but increases the sub-figure or sub-table counter and gives you an anchor for a `\label` command which can be placed after it. Additionally to `\phantomcaption` this command puts an entry into the list of figures or tables.

An example:

```
\begin{figure}
  \centering
  \begin{subcaptiongroup}
    \includegraphics{cat_with_a}
    \captionlistentry{A cat}
    \label{cat}
    \includegraphics{elephant_with_b}
    \captionlistentry{An elephant}
    \label{elephant}
  \end{subcaptiongroup}
  \captionsetup{subrefformat=parens}
  \caption{Two animals: \subref{cat} a cat,
           and \subref{elephant} an elephant}
  \label{animals}
\end{figure}
```

7.4 Typesetting sub-captions without generating a (new) reference

The `\caption` command is a multi-purpose command:

1. It increments the sub-figure or sub-table counter and generates an internal reference which could be used with `\label`

2. It puts an entry into the list of figures or tables
3. It finally typesets a caption

When put into a command or into an environment which either evaluates its content more than once or does not like one of the first two actions (for whatever reason), the result could be either an error message or an incorrect result, for example a sub-figure or sub-table counter which was incremented more than once.

`\captiontext` In these cases the `\caption` command could be split into `\phantomcaption` which performs step one only (or `\captionlistentry` which performs steps one and two), and `\captiontext` which performs step three only. This way critical steps could be out-sourced from the target command or environment, for example by prepending `\phantomcaption` and using `\captiontext` inside.

The syntax of `captiontext` is

```
\captiontext[⟨number⟩]{⟨text of sub-caption⟩}
\captiontext*[⟨number⟩]{⟨text of sub-caption⟩}
```

`\captiontext` is offered by the caption package since version 3.6 and as opposite to `\caption` it does not increase the sub-figure or sub-table counter and does not give you an anchor for a `\label` command. It typesets the caption only, using existing counter values unless a ⟨*number*⟩ is given explicitly.

For example code please take a look at section 8: *Captions inside sub-figures*.

7.5 Where to place the `\label` command?

When `\caption` inside a `captionsubblock`, `subfigure`, `subtable`, or `captionsubgroup` environment, the `\label` can be either placed inside the caption text or right after the command, e.g.:

```
\caption{Some text here\label{text}}
...
\caption{Some other text}\label{othertext}
...
\caption{Something completely different}
\label{differenttext}
```

When using `\phantomcaption` or `\captionlistentry` inside a `captionsubblock`, `subfigure`, `subtable`, or `captionsubgroup` environment, the `\label` should be placed right after the command, e.g.:

```
\phantomcaption\label{this}
...
\phantomcaption
\label{that}
```

But when using the `\subcaptionbox` command, the `\label` should be placed inside the caption text, e.g.:

```
\subcaptionbox{A description here\label{todo1}}
              {Some content here}
...
\subcaptionbox[List-of-Figures entry]
              {A description here\label{todo2}}
              {Some content here}
```

Placing `\label` outside the `\subcaptionbox` would produce an incorrect reference.

7.6 Where do hyperlinks jump?

For the `captionsubblock`, `subfigure`, `subtable`, and `captionsubgroup` environments, and for the `\subcaptionbox` command (and all other constructs which use `\setcaptionsubtype`) the hyperlink anchors will be placed in respect to the `hypcap=` setting. While usage of this option is straight-forward for ordinary captions, the usage for sub-captions depends on the setting regarding the main captions.

This table gives you an overview where the hyperlinks will jump:

caption subcaption	`hypcap=false`	`hypcap=true`
`hypcap=false`	sub-caption	figure or table *(default setting)*
`hypcap=true`	sub-figure or sub-table	sub-figure or sub-table

But if the `captionsubgroup*` environment is used (or a different construct which uses `\setcaptionsubtype*`) and `hypcap=true` is set for sub-captions, the subcaption package does not know where the sub-figure or sub-table actually begins, so it will jump to the sub-caption instead.

Remember: If you use the hypcap package[5], it controls the placement of the hyperlink anchors, making the rules above invalid.

(See also the documentation of the caption package, sections about hyperref & hypcap.)

8 Captions inside sub-figures

Nearly all code examples so far have placed the caption either above or below the sub-figure. But it is possible to put the caption inside the sub-figure, too:

- The caption could already be part of the image. (This case is already handled in section 7.3: *Referencing sub-figures without sub-captions*.)
- LaTeX packages like overpic, stackengine, or tikz could be used. Note that the commands or environments offered by these packages usually evaluate their content more than once, resulting in either errors or wrong reference counters. For this reason `\caption` should not be used here, instead `\phantomcaption` or

`\captionlistentry` should be used outside the command or environment and `\captiontext` should be used inside it. See also section 7.4: *Typesetting sub-captions without generating a (new) reference*

- The options `skip=` and `margin=` could be used to place the caption onto the image.

8.1 Using the overpic package

The same example as in section section 7.3: *Referencing sub-figures without sub-captions*, but using the `overpic` environment offered by the overpic package [7] to place the captions inside the pictures:

```
\usepackage{overpic}
...
\begin{figure}
  \centering
  \begin{subcaptiongroup}
    \subcaptionlistentry{A cat}
    \label{cat}
    \begin{overpic}[width=60pt]{cat}
      \put(40,34){\captiontext*{}}
    \end{overpic}
    \subcaptionlistentry{An elephant}
    \label{elephant}
    \begin{overpic}[width=140pt]{elephant}
      \put(58,40){\captiontext*{}}
    \end{overpic}
  \end{subcaptiongroup}
  \captionsetup{subrefformat=parens}
  \caption{Two animals: \subref{cat} a huge cat,
           and \subref{elephant} an elephant}
\end{figure}
```

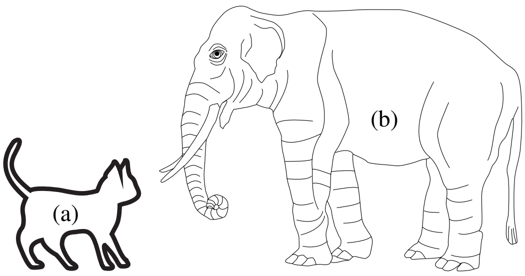


Figure 9: Two animals: (a) a huge cat, and (b) an elephant

If neither a reference to the sub-figures nor an entry in the List of Figures is needed, the usage of `\phantomcaption` or `\captionlistentry` could be dropped. Since this leaves `\captiontext` without a valid sub-figure number value it must be given to it explicitly as optional argument.

Furthermore the usage of the `subcaptiongroup` environment could be dropped here, instead it would be sufficient to replace `\captiontext` with `\subcaptiontext`. (See section 10: *Abbreviatory commands*)

```
\usepackage{overpic}
...
\begin{figure}
  \centering
  \begin{overpic}[width=60pt]{cat}
    \put(40,34){\subcaptiontext*[1]{}}
  \end{overpic}
  \begin{overpic}[width=140pt]{elephant}
    \put(58,40){\subcaptiontext*[2]{}}
  \end{overpic}
  \caption{Two animals: A huge cat and an elephant}
\end{figure}
```

8.2 Using the stackengine package

The same example as in section section 7.3: *Referencing sub-figures without sub-captions*, but using the `\stackinset` command offered by the stackengine package [8] to place the captions inside the pictures:

```
\usepackage{stackengine}
...
\begin{figure}
  \centering
  \begin{subcaptiongroup}
    \subcaptionlistentry{A cat}
    \label{cat}
    \stackinset{l}{25pt}{b}{20pt}{\captiontext*{}}
      {\includegraphics[width=60pt]{cat}}
    \subcaptionlistentry{An elephant}
    \label{elephant}
    \stackinset{l}{80pt}{b}{60pt}{\captiontext*{}}
      {\includegraphics[width=140pt]{elephant}}
  \end{subcaptiongroup}
  \captionsetup{subrefformat=parens}
  \caption{Two animals: \subref{cat} a huge cat,
           and \subref{elephant} an elephant}
\end{figure}
```

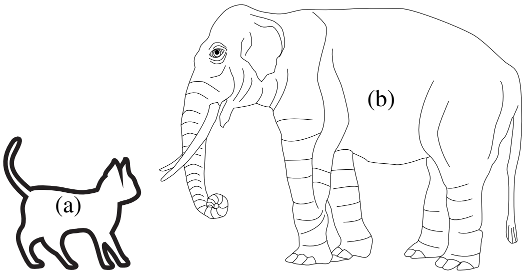


Figure 10: Two animals: (a) a huge cat, and (b) an elephant

If neither a reference to the sub-figures nor an entry in the List of Figures is needed, this code could be simpified to:

```
\usepackage{stackengine}
...
\begin{figure}
  \centering
  \stackinset{l}{25pt}{b}{20pt}{\subcaptiontext*[1]{}}
    {\includegraphics[width=60pt]{cat}}
  \stackinset{l}{80pt}{b}{60pt}{\subcaptiontext*[2]{}}
    {\includegraphics[width=140pt]{elephant}}
  \caption{Two animals: A huge cat and an elephant}
\end{figure}
```

8.3 Using the tikz package

The same example as in section section 7.3: *Referencing sub-figures without sub-captions*, but using the `tikzpicture` environment offered by the tikz package [9] to place the captions inside the pictures:

```
\usepackage{tikz}
...
\begin{figure}
  \centering
  \begin{subcaptiongroup}
    \subcaptionlistentry{A cat}
    \label{cat}
    \begin{tikzpicture}
      \node (cat) at (0,0)
        {\includegraphics[width=60pt]{cat}};
      \node at (0.1,-0.1) {\captiontext*{}};
    \end{tikzpicture}
    \subcaptionlistentry{An elephant}
    \label{elephant}
    \begin{tikzpicture}
      \node (elephant) at (0,0)
```

```
        {\includegraphics[width=140pt]{elephant}};
      \node at (0.5,-0.1) {\captiontext*{}};
    \end{tikzpicture}
  \end{subcaptiongroup}
  \captionsetup{subrefformat=parens}
  \caption{Two animals: \subref{cat} a huge cat,
           and \subref{elephant} an elephant}
\end{figure}
```

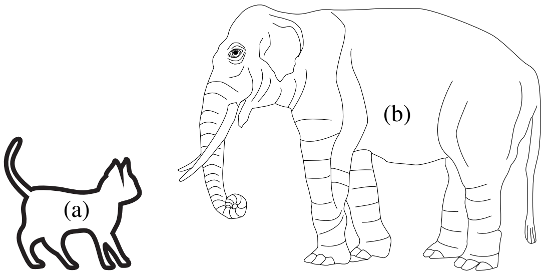


Figure 11: Two animals: (a) a huge cat, and (b) an elephant

If neither a reference to the sub-figures nor an entry in the List of Figures is needed, this code could be simpified to:

```
\usepackage{tikz}
...
\begin{figure}
  \centering
  \begin{tikzpicture}
    \node (cat) at (0,0)
      {\includegraphics[width=60pt]{cat}};
    \node at (0.1,-0.1) {\subcaptiontext*[1]{}};
  \end{tikzpicture}
  \begin{tikzpicture}
    \node (elephant) at (0,0)
      {\includegraphics[width=140pt]{elephant}};
    \node at (0.5,-0.1) {\subcaptiontext*[2]{}};
  \end{tikzpicture}
  \caption{Two animals: A huge cat and an elephant}
\end{figure}
```

8.4 Using the skip and margin options

For a particular sub-caption the `skip=`...could be set to a negative value so it will overlap with the image. Combined with `singlelinecheck=off` (to switch off the centering of short captions) and `margin=`...it could be placed at a specific horizontal position within the image, too.

The same example as in section section 7.3: *Referencing sub-figures without sub-captions*, but using the `skip=`... and `margin=`... options:

```
\begin{figure}
  \centering
  \subcaptionsetup[figure]
    {skip=-28pt,slc=off,margin={25pt,0pt}}
  \subcaptionbox{\label{cat}}
    {\includegraphics[width=60pt]{cat}}
  \subcaptionsetup[figure]
    {skip=-60pt,slc=off,margin={80pt,0pt}}
  \subcaptionbox{\label{elephant}}
    {\includegraphics[width=140pt]{elephant}}
  \captionsetup{subrefformat=parens}
  \caption{Two animals: \subref{cat} a huge cat,
           and \subref{elephant} an elephant}
\end{figure}
```

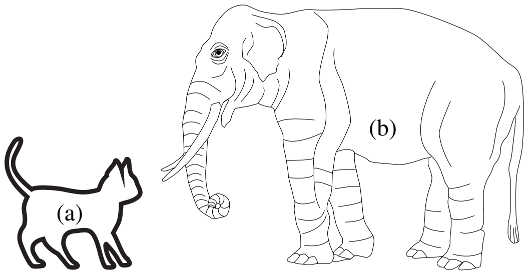


Figure 12: Two animals: (a) a huge cat, and (b) an elephant

9 Numbering

9.1 Pittfall #1: Using multiple main captions

When multiple main captions are used within a figure or table, and sub-captions are used as well, how does the subcaption package know which sub-captions belong to which caption, i.e. what is the main counter value for the sub-captions?

Let's illustrate this problem with an example document:

```
\documentclass{article}
\usepackage{graphicx,subcaption}
\begin{document}
\begin{figure}
  \centering
  \includegraphics[width=4cm]{example-image-c}
  \caption{Caption no. 1}
  \bigskip
  \subcaptionbox
```

```
    {\label{fig:2a}}
    {\includegraphics[width=2cm]{example-image-a}}
  \subcaptionbox
    {\label{fig:2b}}
    {\includegraphics[width=2cm]{example-image-b}}
  \caption{Caption no. 2}
\end{figure}
Look at sub-figures \ref{fig:2a} and \ref{fig:2b}.
\end{document}
```

It's obvious that the sub-captions belong to 2nd caption, and therefore `\ref{fig:2a}` will become "2a", isn't it? But since the subcaption package is only involved when using LaTeX commands either defined or patched by the caption or subcaption package, this is what the caption package is aware of:

```
\usepackage{subcaption}
\begin{document}
\begin{figure}
  \caption{Caption no. 1}
  \subcaptionbox
    {\label{fig:2a}}
    {⟨unknown content⟩}
  \subcaptionbox
    {\label{fig:2b}}
    {⟨unknown content⟩}
  \caption{Caption no. 2}
\end{figure}
\end{document}
```

So from captions point of view it's not easy to decide if the sub-captions belong to the 1st or 2nd main caption since they are placed between them. (Note: The subcaption package is only offering an user interface to the sub-caption feature of the caption package, and therefore this decision is the responsibility of the caption package.)

But how does the caption package makes a decision? If in doubt, it rather clings to the past than to the future, i.e. in this case it decides that the sub-captions belong to the 1st caption and therefore the result of `\ref{fig:2a}` is not "2a" but "1a". If the caption package is unsure about its decision (like in this case), a warning will be issued:

```
Package caption Warning: Ambiguous sub-caption(s),
                         use \nextfloat on input line 15.
See the caption package documentation for explanation.
```

How to fix it? Use `\nextfloat` to tell the caption package where the 2nd figure within the `figure` environment starts:

```
\documentclass{article}
\usepackage{graphicx,subcaption}
\begin{document}
\begin{figure}
  \centering
  \includegraphics[width=4cm]{example-image-c}
  \caption{Caption no. 1}
  \bigskip
\nextfloat
  \subcaptionbox
    {\label{fig:2a}}
    {\includegraphics[width=2cm]{example-image-a}}
  \subcaptionbox
    {\label{fig:2b}}
    {\includegraphics[width=2cm]{example-image-b}}
  \caption{Caption no. 2}
\end{figure}
Look at sub-figures \ref{fig:2a} and \ref{fig:2b}.
\end{document}
```

Note that the `\nextfloat` command was introduced in caption package v3.6. Previous versions of the caption package have bound the decision to the `position=` setting of the floating environment instead, i.e. sub-captions belonged to the caption above if `position=top` was set and they belonged to the caption below if `position=below` was set. While this would be beneficial in this case, there were several cases were it was not and especially it was not always comprehensible to the user why his references got an incorrect numbering.

Furthermore the new decision algorithm always succeeds if there is only one caption within the figure or table (which is the case most of the time) while the old one did not.

If you still prefer the old decision algorithm (for example because you want to process an already existing document), you need to specify the caption package version explicitly, for example:

```
\documentclass{article}
\usepackage{caption}[=v3.5]
\usepackage{graphicx,subcaption}
...
```

See also: section 12: *Required packages*

9.2 Pittfall #2: Expecting `\caption` to increment the counter

Usually `\caption` increments the figure or table counter and therefore it is usally safe to assume that the counter was not incremented yet in code used before `\caption`:

```
\documentclass{article}
\begin{document}
\begin{figure}
  Figure counter before caption: \thefigure
  \caption{Some text}
  Figure counter after caption: \thefigure
\end{figure}
\end{document}
```

Unsurprisingly the results are 0 and 1 for the counter values.

But this happens if we use the subcaption package:

```
\documentclass{article}
\usepackage{subcaption}
\begin{document}
\begin{figure}
  \subcaptionbox{}{some content}
  \subcaptionbox{}{some content}
  Figure counter before caption: \thefigure
  \caption{Some text}
  Figure counter after caption: \thefigure
\end{figure}
\end{document}
```

Here the results are 1 and 1 for the counter values. Why?

Since the caption package assumes that there will be a `\caption` following `\subcaptionbox` it decides that the sub-captions belong to the upcoming main caption and therefore share the same main counter value which needs to be incremented before its use. Therefore the first `\subcaptionbox` in the figure increments the figure counter while the second one and especially the `\caption` does not.

Usually this is no problem at all but keep this in mind if you are doing tricky stuff with the figure or table counter within figures or tables.

10 Abbreviatory commands

`\subcaption`
`\phantomsubcaption`
`\subcaptionlistentry`
`\subcaptiontext`

As we have seen in sections section 8.1: *Using the overpic package*, section 8.2: *Using the stackengine package*, and section 8.3: *Using the tikz package* it's sometimes inconvenient to use the commands and environments described so far.

For example it would be inconvenient to use `captiongroup` just for a single `\captiontext` in this particular case:

```
...
\begin{overpic}[width=60pt]{cat}
  \put(40,34)
    {\begin{captiongroup*}
       \captiontext*[1]{}
     \end{captiongroup*}}
\end{overpic}
...
```

Since `\captiontext` is already used in an extra environment (`overpic`) we don't need an extra `captiongroup*` here, instead using `\setcaptionsubtype*` (which switches into the sub-caption mode without making an hyperref anchor) would be sufficient:

```
...
\begin{overpic}[width=60pt]{cat}
  \put(40,34)
    {\setcaptionsubtype*
```

```
        \captiontext*[1]{}}
    \end{overpic}
    ...
```

But this is still inconvenient when used many times, and therefore the subcaption package defines several extra commands which are prefixed with `\setcaptionsubtype*`:

Regular command	using `\setcaptionsubtype*`	available since
`\caption`	`\subcaption`	v1.0
`\phantomcaption`	`\phantomsubcaption`	v1.1
`\captionlistentry`	`\subcaptionlistentry`	v1.5
`\captiontext`	`\subcaptiontext`	v1.5

This way our code snipped above could be simplified to:

```
    ...
    \begin{overpic}[width=60pt]{cat}
      \put(40,34){\subcaptiontext*[1]{}}
    \end{overpic}
    ...
```

Since `\setcaptionsubtype` should only be used within an extra group or environment, the same applies to these commands as well. (In this case `\subcaptiontext` is encapsulated by the `overpic` environment, so we are ok here.

The `\subcaption` command is just a simple combination of `\setcaptionsubtype*` and `\caption`. Same for all other abbreviatory commands here.

11 The `\subfloat` command

`\subfloat` New feature v1.3 To allow a smoother transition from the subfig package [10] (which is unmaintained for over 16 years) this package also offers `\subfloat` with the same syntax:

```
    \subfloat[⟨list_entry⟩][⟨sub-caption⟩]{⟨body⟩}
```

12 Required packages

New feature v1.4 Starting with version 1.4 the subcaption package requires at least version 3.1 of the caption package and loads it automatically. (Older versions of the subcaption package have required exactly the version of the caption package which was released with it.)

If you need to use a specific version of the caption package you need to load it *before* the subcaption package, e.g.:

```
    \usepackage[...]{caption}[=v3.5]
    \usepackage[...]{subcaption}
```

Note that there are limitations if an older version of the caption package is used:

- The `\phantomsubcaption` command needs at least caption v3.2.
- The `\subcaptionlistentry` command needs at least caption v3.3.
- The `\subfloat` emulation needs at least caption v3.4.
- The `\subcaptiontext` command needs at least caption v3.6.
- The `\subcaptionsetup` command needs at least caption v3.6*l*.

13 Other packages with similar offerings

The subcaption package is not the only one defining sub-figure counters and offering commands or environments to typeset sub-figures. The most established are:

- The memoir document class
- The subfigure package and its successor, the subfig package

New feature v1.6 Prior subcaption version 1.6 an error message was issued if the 'subfigure' or 'subtable' counter was already defined by any of them. Since subcaption version 1.6 the 'subfigure' and 'subtable' counters will only be defined by the subcaption package if they are not defined yet, but the usage of any of the commands or environments described in this document will result in an error message "The counter sub. . . was defined by . . . " if the corresponding counter was not defined by the subcaption package. Equally the commands or environments offered by the above document classes or packages should not be used with counters defined by the subcaption package, this will result in either LaTeX errors or unwanted behaviour.

So the rule of thumb is: If the counter 'subfigure' or 'subtable' is defined by document class or package *xyz*, then the corresponding commands and environments offered by the document class or package *xyz* should be used.

An example document:

```
\documentclass{memoir}
\newsubfloat{table}      % defines the 'subtable' counter
\usepackage{subcaption}  % defines the 'subfigure' counter
\begin{document}
\begin{figure}
\subcaptionbox{...}{...} % <- This is fine
\caption{...}
\end{figure}
\begin{table}
\caption{...}
\subcaptionbox{...}{...} % <- This results in an error,
\end{table}                 \subtop should be used instead
\end{document}
```

14 Beyond this package

For a more advanced usage of the sub-caption feature of the caption package, please take a look at the excellent keyfloat package[6] which provides the environments `keysubfigs`, `keysubtabs`, and `keysubfloats` for typesetting sub-figures and sub-tables.

Furthermore the floatrow package[3] provides the `subfloatrow` environment for typesetting sub-figures.

15 Thanks

I would like to thank Stephen Dalton who helped to make this package a better one.

References

[1] Frank Mittelbach and Michel Goossens:
The LaTeX Companion (2nd. Ed.),
Addison-Wesley, 2004.

[2] Axel Sommerfeldt:
Customizing captions of floating environments,
2022/01/07

[3] Olga Lapko:
The floatrow package documentation,
2007/12/24

[4] Sebastian Rahtz & Heiko Oberdiek:
Hypertext marks in LaTeX,
November 12, 2007

[5] Heiko Oberdiek:
The hypcap package – Adjusting anchors of captions,
2007/04/09

[6] Brian Duun:
The LaTeX keyfloat Package,
2019/09/23

[7] Rolf Niepraschk:
The overpic package,
2020/02/22

[8] Steven B. Segletes:
The stackengine Package,
July 22, 2021

[9] Till Tantau:
The TikZ and PGF Packages,
May 15, 2021

[10] Steven D. Cochran:
The subfig package,
2005/07/05