

# Figures and other floats

JCF

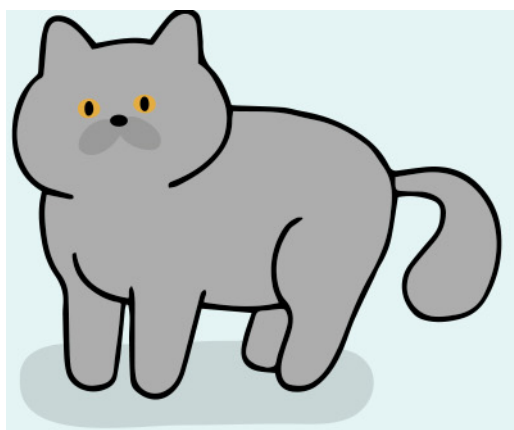
April 7, 2016

## 1 The basics

Source of the images: [www.freepik.com/free-vector/sketchy-cute-cat-breeds\\_835944.htm](http://www.freepik.com/free-vector/sketchy-cute-cat-breeds_835944.htm) (Designed by Freepik).

For TeX, images are just normal boxes. Example:


This is one image `\includegraphics{onecat}` included in the regular text.



This is one image included in the regular text.

Perhaps that was too big. Let's try using some parameters.

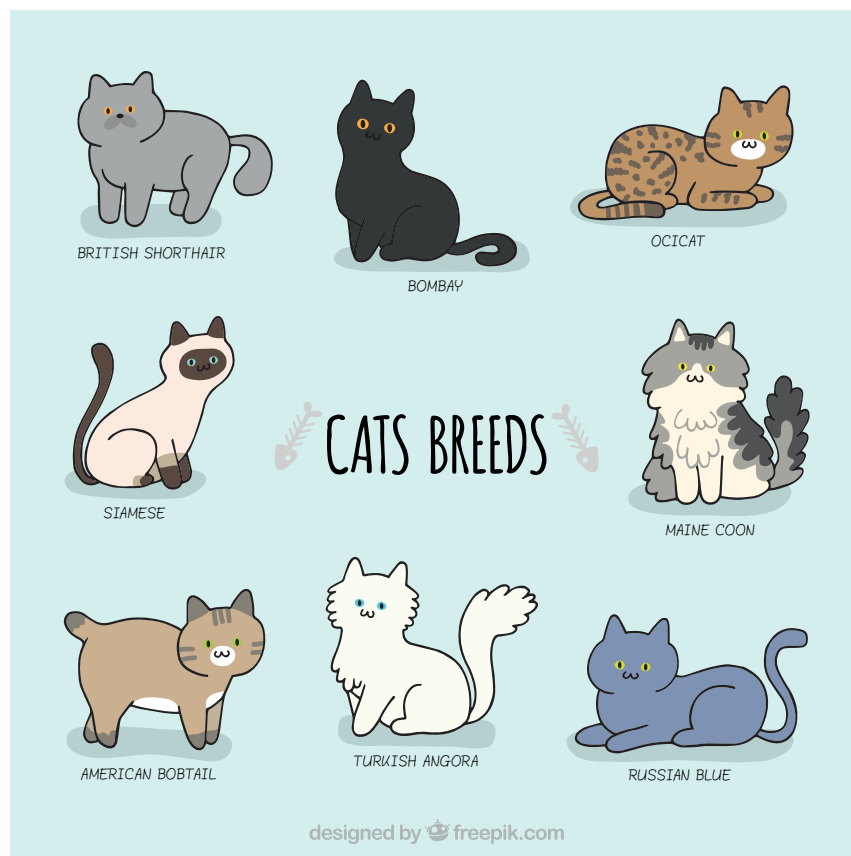
This is one image `\includegraphics[height=1em]{onecat}` included in the regular text.

This is one image  included in the regular text.

The accepted formats depend on the underlying engine. PdfTeX includes PNG, PDF or JPG images; Dvips supports only EPS.

You can use EPS figures with modern configurations of pdftex; otherwise use package epstopdf.

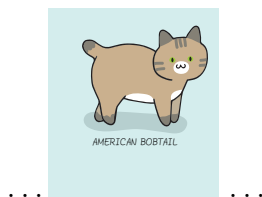
```
\begin{center}  
  \includegraphics[scale=0.4]{allcats.eps}  
\end{center}
```



It will create and use a file called allcats-eps-converted-to.pdf. This uses an external command.

You can select just part of an image:

```
\begin{center}  
\ldots\includegraphics[scale=0.25,  
viewport=0 0 9cm 10cm,clip]{allcats.eps} \ldots  
\end{center}
```



The origin is in the lower left corner. Numbers without units are taken to specify “big points” (bp), i.e., Postscript points.

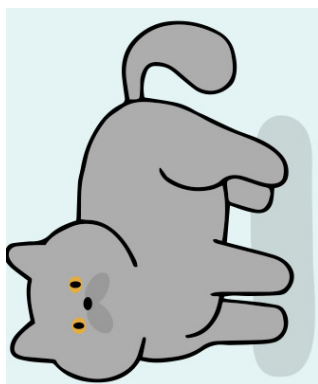
Let’s try some adjustments to the viewport.

```
\begin{center}  
\ldots\includegraphics[scale=0.25,  
viewport=0 2cm 9cm 10cm,clip]{allcats.eps} \ldots  
\end{center}
```



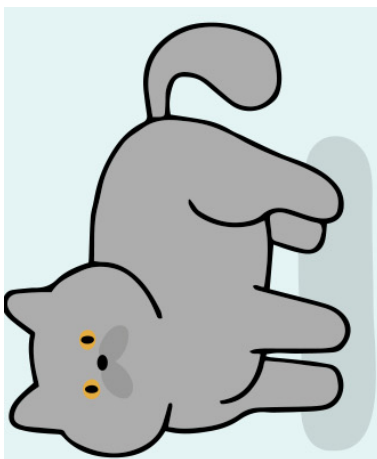
The keys are read left-to-right. First scale to width of 5 cm (keeping the aspect ratio) and then rotate 90 degrees (anti-clockwise), so the height is now actually 5 cm.

```
\begin{center}  
  \includegraphics[width=5cm, angle=90]{onecat.png}  
\end{center}
```



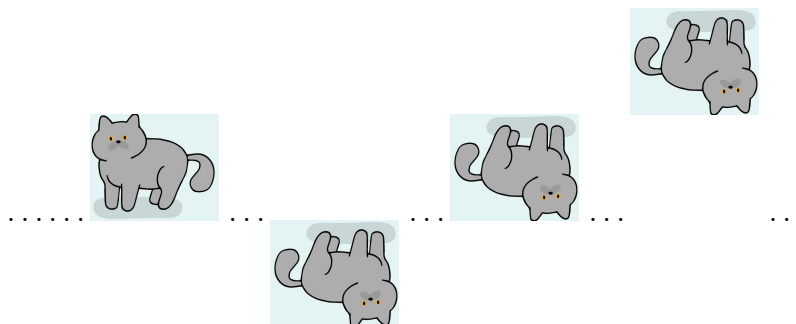
First rotate and then scale: the width is really 5 cm.

```
\begin{center}  
  \includegraphics[angle=90, width=5cm]{onecat.png}  
\end{center}
```



Changing the rotation center:

```
\begin{center}
  \ldots\ldots
  \includegraphics[scale=0.25]{onecat.png}
  \ldots
  \includegraphics[scale=0.25,angle=180]{onecat.png}
  \ldots
  \includegraphics[scale=0.25,angle=180,origin=c]{onecat.png}
  \ldots
  \includegraphics[scale=0.25,angle=180,origin=tr]{onecat.png}
  \ldots
\end{center}
```



The origin may contain one or two letters of the following: `lrctbB`  
(`B`=baseline, `l`=left, `r`=right, `t`=top, `b`=bottom, `c`=center, `bl`=bottom left, ...).

You may also scale and rotate text.

```
\begin{center}
  Normal text scaled horizontally and vertically
  \scalebox{1.5}{with the same scale} and
  \scalebox{1.5}[2]{with different scales}.
\end{center}
```

Normal text scaled horizontally and vertically **with the same scale**  
and **with different scales**.

Another example:

```
\begin{center}
  Normal text followed by
  \rotatebox{45}{rotated text} and text
  \rotatebox[origin=c]{90}{with different rotation}.
\end{center}
```

Normal text followed by *rotated text* and text  
*with different rotation*

Minipages are also just boxes:

```
\begin{center}
  \ldots
  \rotatebox[origin=c]{32}{\begin{minipage}{5cm}
    A smart man makes a mistake, learns from it, and
    never makes that mistake again.
    But a wise man finds a smart man and
    learns from him how to avoid the mistake altogether.
  \end{minipage}}\ldots
\end{center}
```

... A smart man makes a mis-  
take, learns from it, and  
never makes that mistake  
again. But a wise man finds  
a smart man and learns  
from him how to avoid the  
mistake altogether. ...

The package `adjustbox` (available at [www.ctan.org/pkg/adjustbox](http://www.ctan.org/pkg/adjustbox)) provides more ways to manipulate boxes.



Figure 1: Cat breed: British Shorthair

## 2 Figures

Just like `tabular` environments can go inside `table` environments to create a floating, captioned table, so can `\includegraphics` be used inside the `figure` floating environment.

```
\begin{figure}
  \centering
  \includegraphics[scale=0.5]{onecat.png}
  \caption{Cat breed: British Shorthair}
  \label{fig:brshort}
\end{figure}
```

In the text, you can reference the figure like `fig.~\ref{fig:brshort}`.

In the text, you can reference the figure like `fig. 1`.



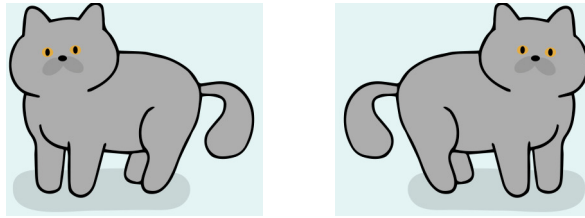


Figure 2: A pair of cats: British Shorthair v1

You can also put more than one image in the figure.

```
\begin{figure}
  \centering
  \includegraphics[scale=0.5]{onecat.png}
  \quad
  \reflectbox{\includegraphics[scale=0.5]{onecat.png}}
  \caption{A pair of cats: British Shorthair v1}
  \label{fig:brshort2}
\end{figure}
```

In the text, you can reference the figure like `fig.~\ref{fig:brshort2}`.

In the text, you can reference the figure like fig. 2.

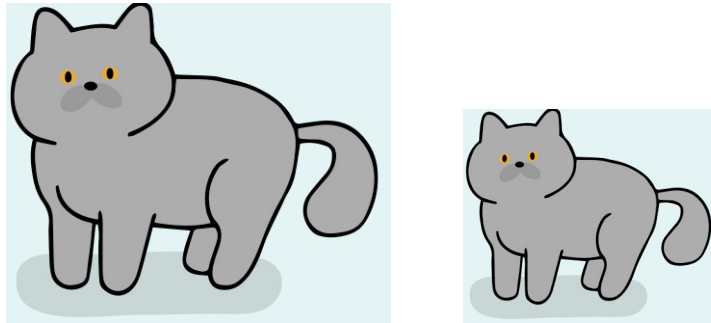


Figure 3: A pair of cats: British Shorthair v2

Some care is necessary to align images of different sizes.

```
\begin{figure}
  \centering
  \includegraphics[scale=0.75]{onecat.png}
  \quad
  \includegraphics[scale=0.5]{onecat.png}
  \caption{A pair of cats: British Shorthair v2}
  \label{fig:brshort3}
\end{figure}
```

In the text, you can reference the figure  
like `fig.~\ref{fig:brshort3}`.

In the text, you can reference the figure like fig. 3.

```
\begin{figure}[b]
  \centering
  \includegraphics[scale=0.75]{onecat.png}
  \quad
  \includegraphics[scale=0.5]{onecat.png}
  \caption{A pair of cats: British Shorthair v3}
  \label{fig:brshort4}
\end{figure}
```

In the text, you can reference the figure like `fig.~\ref{fig:brshort4}`.

In the text, you can reference the figure like fig. 4.

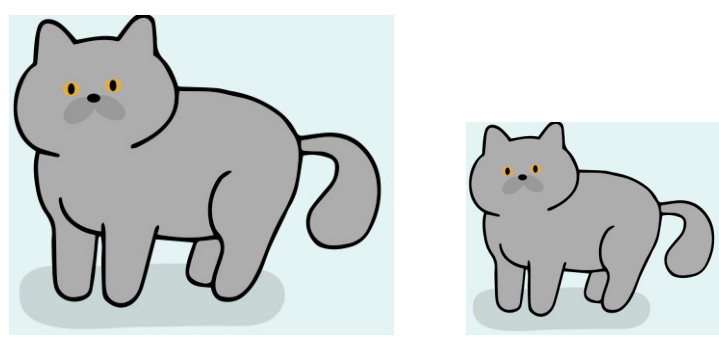
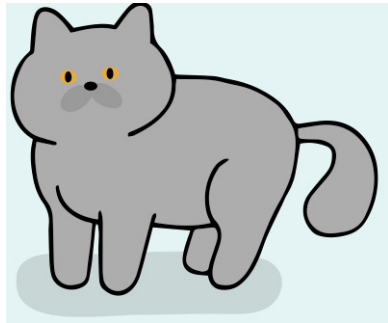


Figure 4: A pair of cats: British Shorthair v3



We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology. *Carl Sagan*

Figure 5: Image and text side-by-side v1

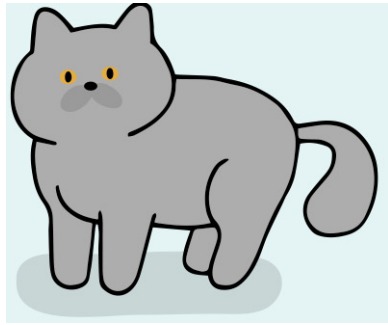
You can also put images and text side by side.

```
\begin{figure}
  \centering
  \includegraphics[scale=0.75]{onecat.png}
  \quad
  \begin{minipage}{5cm}
    We live in a society exquisitely dependent on science and
    technology, in which hardly anyone knows anything about
    science and technology. \textit{Carl Sagan}
  \end{minipage}
  \caption{Image and text side-by-side v1}
  \label{fig:txt}
\end{figure}
```

In the text, you can reference the figure like `fig.~\ref{fig:txt}`.

In the text, you can reference the figure like fig. 5.

Probably, not what you expected!



We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology. *Carl Sagan*

Figure 6: Image and text side by side v2

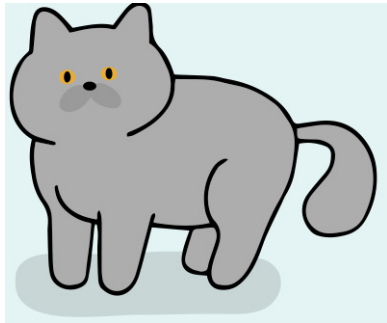
Let's try it this way.

```
\begin{figure}
  \centering
  \includegraphics[scale=0.75]{onecat.png}
  \quad
  \begin{minipage}[b]{5cm}
    We live in a society exquisitely dependent on science and
    technology, in which hardly anyone knows anything about
    science and technology. \textit{Carl Sagan}
  \end{minipage}
  \caption{Image and text side by side v2}
  \label{fig:txt2}
\end{figure}
```

In the text, you can reference the figure  
like fig.~\ref{fig:txt2} on page~\pageref{fig:txt2}.

In the text, you can reference the figure like fig. 6 on page 13.

Better, but still not very flexible!



We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology. *Carl Sagan*

Figure 7: Image and text side by side v3

Alternative: Using two minipages and the `\vspace{0pt}` trick.

```
\begin{figure}
  \centering
  \begin{minipage}[t]{5cm}
    \vspace{0pt}
    \centering
    \includegraphics[scale=0.75]{onecat.png}
  \end{minipage}
  \quad
  \begin{minipage}[t]{5cm}
    \vspace{0pt}
    We live in a society exquisitely dependent
    on science and
    technology, in which hardly anyone knows
    anything about
    science and technology. \textit{Carl Sagan}
  \end{minipage}
  \caption{Image and text side by side v3}
  \label{fig:txt3}
\end{figure}
```

In the text, you can reference the figure like `fig.~\ref{fig:txt3}` on page~\pageref{fig:txt3}.

In the text, you can reference the figure like fig. 7 on page 14.

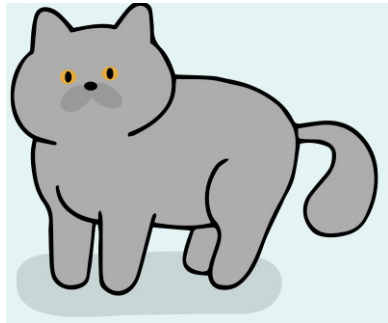


Figure 8: This is one image of a big fat cat

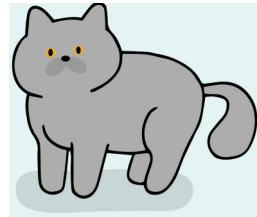
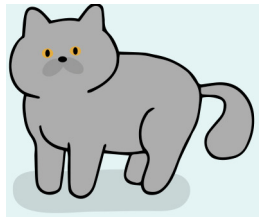


Figure 9: This is another image

The same trick can be used to have two figures with different captions. This trick is fragile (What happens if the captions have a different number of lines?)

```
\begin{figure}
  \centering
  \begin{minipage}[b]{6cm}
    \vspace{0pt}
    \centering
    \includegraphics[scale=0.75]{onecat.png}
    \caption{This is one image of a big fat cat}
    \label{fig:double-a}
  \end{minipage}
  \quad
  \begin{minipage}[b]{5cm}
    \vspace{0pt} \centering
    \includegraphics[scale=0.5]{onecat.png}
    \caption{This is another image}
    \label{fig:double-b}
  \end{minipage}
\end{figure}
In the text, you can reference the figures
like fig.~\ref{fig:double-a} and fig.~\ref{fig:double-b}.
```

In the text, you can reference the figures like fig. 8 and fig. 9.



(a) First.



(b) Second.

Figure 10: These are two very interesting sub-floats. Did you notice that one is part of the other?

The package `subfig` (not `subfigure`!) can help with that. It also uses the `caption` package, which allows more flexible captions.

```
\begin{figure}
  \centering
  \subfloat[First.]{
    \label{fig:first}
    \includegraphics[scale=0.5]{onecat.png}}
  \quad
  \subfloat[Second.]{%
    \label{fig:second}%
    \includegraphics[scale=0.2]{allcats}}
  \caption[Two sub-floats.]{These are two very interesting
    sub-floats. Did you notice that one is part of the other?}
\end{figure}
```

See figures~\ref{fig:first} and \ref{fig:second}.

See figures 10a and 10b.



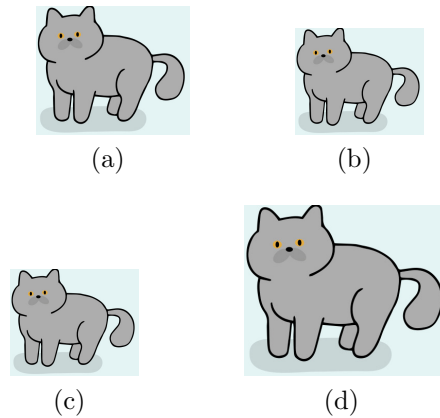


Figure 11: A set of four sub-floats: (a) describes the first sub-float; (b) describes the second sub-float; (c) describes the third sub-float; and, (d) describes the last sub-float.

A more sophisticated example is shown in fig. 11. The biggest cat is in fig. 11d.

```

\begin{figure}
\centering
\subfloat[] []{
\label{fig:ex3-a}
\includegraphics[scale=0.3]{onecat.png}}
\hspace{32pt}
\subfloat[] []{
\label{fig:ex3-b}
\includegraphics[scale=0.25]{onecat.png}}\
\subfloat[] []{
\label{fig:ex3-c}
\includegraphics[scale=0.25]{onecat.png}}
\hspace{32pt}
\subfloat[] []{
\label{fig:ex3-d}
\includegraphics[scale=0.4]{onecat.png}}
\caption[A set of four sub-floats.]{A set of four sub-floats:
\subref{fig:ex3-a} describes the first sub-float;
\subref{fig:ex3-b} describes the second sub-float;
\subref{fig:ex3-c} describes the third sub-float; and,
\subref{fig:ex3-d} describes the last sub-float.}
\label{fig:ex3}
\end{figure}

```

How to produce the images?

Free drawing programs (Windows, Linux, Mac):

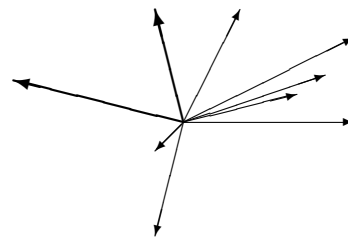
- inkscape : [www.inkscape.org](http://www.inkscape.org) (vector graphics)
- sdraw (part of LibreOffice): [www.libreoffice.org](http://www.libreoffice.org)
- gimp: [www.gimp.org](http://www.gimp.org) (bitmaps)

Special packages:

- Tikz/pgf
  - [www.ctan.org/pkg/pgf](http://www.ctan.org/pkg/pgf)
  - <http://www.texample.net/tikz/>
  - [www.ctan.org/pkg/visualtikz](http://www.ctan.org/pkg/visualtikz)
- pgfplots [www.ctan.org/pkg/pgfplots](http://www.ctan.org/pkg/pgfplots)
- beamer (presentations) [www.ctan.org/pkg/beamer](http://www.ctan.org/pkg/beamer)
- PSTricks [www.ctan.org/pkg/pstricks-base](http://www.ctan.org/pkg/pstricks-base)

The picture environment (try to avoid it):

```
\setlength{\unitlength}{0.75mm}\hspace*{10cm}
\begin{picture}(60,40)
  \put(30,20){\vector(1,0){30}}
  \put(30,20){\vector(4,1){20}}
  \put(30,20){\vector(3,1){25}}
  \put(30,20){\vector(2,1){30}}
  \put(30,20){\vector(1,2){10}}
  \thicklines
  \put(30,20){\vector(-4,1){30}}
  \put(30,20){\vector(-1,4){5}}
  \thinlines
  \put(30,20){\vector(-1,-1){5}}
  \put(30,20){\vector(-1,-4){5}}
\end{picture}
```



### 3 Other floats

The package `float` improves the interface for defining floating objects such as figures and tables, introduces the boxed float, the ruled float and the plaintop float. You can define your own floats.

The package also provides the H float modifier option.

With the H placement modifier, the figure does not float!

```
\begin{figure}[H]
  \centering
  \includegraphics[scale=0.25]{onecat.png}
  \caption{This figure stays put!}
  \label{fig:fixed}
\end{figure}
Here goes more text.
```

With the H placement modifier, the figure does not float!



Figure 12: This figure stays put!

Here goes more text.

You can define new types of floats. For instance, you can use (usually in the preamble):

```
\floatstyle{ruled}
\newfloat{Program}{tbp}{lop}[section]
```

In this case, programs will be renumbered with each section. The default locations are `tbp` (top, bottom, page). The contents of the environment will be stored in a file with extension `lop`.

Afterwards, the corresponding environment can be used as a new float.

```
\begin{Program}[b]
\begin{verbatim}
#include <stdio.h>
int main(void) {return 0;}
\end{verbatim}
\caption[The first program]{The first program.
This is a fantastic algorithm. Note the
ruled float style.}
\end{Program}
```

---

**Program 3.1** The first program. This is a fantastic algorithm. Note the ruled float style.

---

```
#include <stdio.h>
int main(void) {return 0;}
```

---

Title 1	Title 2
item	item
1	3

Table 1: A simple table

You can also change the styles of existing float types (in this case, `table`).

```

\floatstyle{boxed}
\restylefloat{table}

\begin{table}
  \centering
  \caption{A simple table}
  \begin{tabular}{cc}
    Title 1 & Title 2 \\ \hline
    item & item \\
    1 & 3
  \end{tabular}
\end{table}

```

The last supported new float style is `plaintop`. Did you notice its effect? The standard style is called “plain”.

```
\floatstyle{plaintop}
\restylefloat{table}

\begin{table}[b]
  \centering
  \begin{tabular}{cc}
    Title 1 & Title 2 \\ \hline
    item & item \\
    1 & 3
  \end{tabular}
  \caption{Another simple table}
\end{table}
```

Table 2: Another simple table

Title 1	Title 2
item	item
1	3

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