The Black Magic of Floats in LaTeX

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https://github.com/alpenwasser/TeX/

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Abstract

The behavior of floats can often be confusing for the uninitiated, and yield unexpected results. This document gives a brief overview on the subject, primarily based on Leslie Lamport's *LaTeX – A Document Preparation System* [1].

I will not cover every possible edge case, but present some usage examples and common problem one tends to run into while working with floats.

Contents

List of Listings

List of Figures

List of Tables

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Figure 1: A `figure` environment with placeholder text

Table 1: A `table` environment with placeholder text

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56	57	58	59	60	61	62	63
48	49	50	51	52	53	54	55
40	41	42	43	44	45	46	47
32	33	34	35	36	37	38	39
24	25	26	27	28	29	30	31
16	17	18	19	20	21	22	23
8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7

Figure 2: One can place arbitrary content inside a `figure` environment, though this does not usually make much sense.
Note that you can also have linebreaks inside a `caption`, but it requires the `\protect` command before the linebreak, like so: `\protect\\`

1 What Are Floats, Anyway?

Normal text is broken by TEX across lines and pages automatically. For some content, such as images, are not well-suited to being split into pieces. That is what floating environments are for: To provide a way to put such content in a place where it does not need to be broken; a way for it to *float* to a suitable location for an optimal overall result.

Two such floating environments are provided by LATEX by default: The `figure` and the `table` environment. There are packages which define more floating environments (for example, the `listings` packages can let its code listings float, if so desired), or the user may define their own floating environments, if they so wish.

Fundamentally, the only important difference between these environments is how they are captioned and numbered: `figure` environments will get a different caption and number to a `table` environment. However, one may in principle put pretty much anything one desires into either environment. As long as the code itself is valid, LATEX will not complain. Figure 1 and Table **??** demonstrate this by placing some Lorem Ipsum text inside their environments.

The floating behavior can be demonstrated by the fact that, in the source code of this document, 1 and 1 are placed right after this sentence. In the resulting document, they may be placed wherever LATEX deems most suitable (probably at the top of this page[1]).

Because captions are a moving argument (Section 3.5.1 in [1]), fragile commands such as linebreaks inside them must be preceded by `\protect`, as shown in the caption of Figure 2.

[1] LATEX usually tries to place floats either at the top of a page, the bottom of a page, or on a separate page. See 3 for more information.

The `\caption` command can only be used inside a floating environment by default. If you require captions for non-floating arguments, there are packages which provide such facilities, as well as more caption customisation options, see [2, 3] and Chapter 6 of this document.

2 Basic Usage

Listing 2[2] shows the basic code for including an external graphics file inside a `figure` environment.

```
\begin{figure}
    \includegraphics[height=3cm,width=4.5cm]{images/grid8cm.png}
    \caption{A very interesting and slightly distorted picture of a grid}
    \label{fig:distorted-grid}
\end{figure}
```

Listing 1: Code block for includeing a graphics in a figure

It is often desirable to center a table or a picture, in which case we add a `\centering` directive into the environment:
[4]

```
\begin{table}
    \centering
    \begin{tabular}{ll}
        \toprule
        Experiment Input  & Experiment Output        \\
        \midrule
        interesting thing & interesting result!      \\
        boring thing      & mildly surprising result \\
        weird thing       & very unexpected result   \\
        fascinating thing & machine broke            \\
        Xenomorph XX121   & very dead scientists     \\
        \bottomrule
    \end{tabular}
    \caption{Results for an experiment}
    \label{tab:experiment}
\end{table}
```

Listing 2: Centering a `tabular` environment inside a `table` floating environment

[2] Incidentally, Listing 2 is one of those cases where a new type of floating environment has been provided; in this case by the `minted` package.

3 Placement Options

Only use these towards the end of writing.

4 Help, My Floats Are Jinxed!

Too many floats, not enough text, ...

5 LaTeX's Dark Magic

6 Alternatives to Using Floats

7 References

[1] Leslie Lamport, Digital Equipment Corporation, *"LaTeX – A Document Preparation System"*, 2nd Edition, 1994, Addison-Wesley Publishing Company.

[2] Comprehensive TeX Archive Network. *"Package caption – Customising captions in floating environments"*. [Online], http://ctan.org/pkg/caption, [Accessed: 2017-MAR-26].

[3] Comprehensive TeX Archive Network. *"Topic caption"*. [Online], http://ctan.org/topic/caption, [Accessed: 2017-MAR-26].

[4] Enrico Gregorio, *"When should we use* `\begin{center}` *instead of* `\centering`*?"*, [Online], http://tex.stackexchange.com/a/23653, [Accessed: 2017-MAR-26].