

# TikZ annotations for ggplots with the ggtikz package

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## Contents

<b>1</b>	<b>Prerequisites</b>	<b>1</b>
1.1	LaTeX side . . . . .	1
1.2	R side . . . . .	2
<b>2</b>	<b>Basic usage with ggtikz()</b>	<b>2</b>
<b>3</b>	<b>Advanced usage with canvases and annotations</b>	<b>3</b>
3.1	Single-panel plots . . . . .	3
3.1.1	Annotation relative to the whole plot . . . . .	3
3.1.2	Annotation relative to the panel . . . . .	4
3.1.3	Annotation relative to data coordinates . . . . .	5
3.1.4	Mixing panel and data references . . . . .	6
3.1.5	Turning off clipping . . . . .	7
3.2	Multi-panel plots: wrap . . . . .	9
3.2.1	Annotations in separate panels, relative to data or panel coordinates . . . . .	9
3.2.2	Annotations in separate panels, relative to data coordinates	10
3.3	Multi-panel plots: grid . . . . .	11
3.4	Re-using annotations . . . . .	12
<b>4</b>	<b>Using styles defined in the surrounding document</b>	<b>14</b>

## 1 Prerequisites

### 1.1 LaTeX side

As the name implies, `ggtikz` requires `tikz`, which must be loaded in the document's preamble. Furthermore, the `calc` tikz library is required.

Thus, the preamble must contain:

```
\usepackage{tikz}
\usetikzlibrary{calc}
```

## 1.2 R side

The `tikzDevice` package is required to render plots and `ggtikz` annotations to the `tikz` format. We also have to make some base plots, using `ggplot2`.

Here, we set the graphics device to `tikz` – `ggtikz` does not work with any other graphics device!

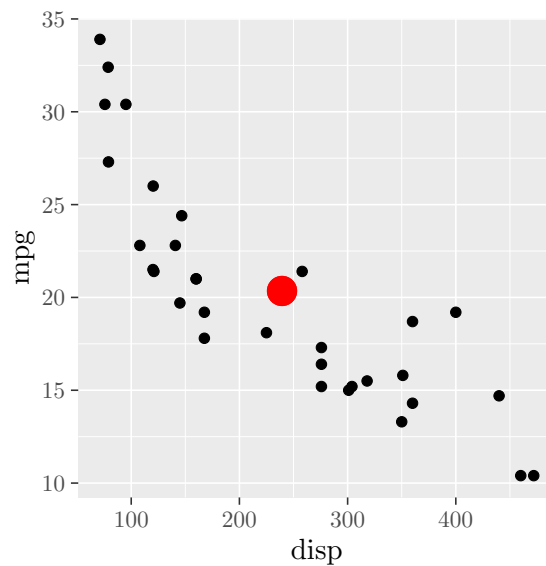
```
library(knitr)
library(ggplot2)
library(ggtikz)
opts_chunk$set(
  dev = "tikz",
  external = TRUE,
  fig.path = "example-vignette-figures/",
  fig.width = 3,
  fig.height = 3,
  fig.align = "center"
)
```

## 2 Basic usage with `ggtikz()`

For simple one-step annotations, the `ggtikz` helper function is available.

It accepts a `ggplot` object as its first argument. Further arguments are passed on to `ggtikzAnnotation` (see section 3).

```
p <- ggplot(mtcars, aes(displacement, mpg)) + geom_point()
ggtikz(p, "\\fill[red] (0.5,0.5) circle (2mm);", xy="plot")
```



## 3 Advanced usage with canvases and annotations

With `ggtikz()`, only a single annotation can be added to a plot. If multiple annotations are needed, then we first need to create a `ggtikzCanvas()`, to which one or more `ggtikzAnnotation()` can be added.

### 3.1 Single-panel plots

Let's create a single-panel plot for annotation.

```
p <- ggplot(mtcars, aes(displ, mpg)) + geom_point()
```

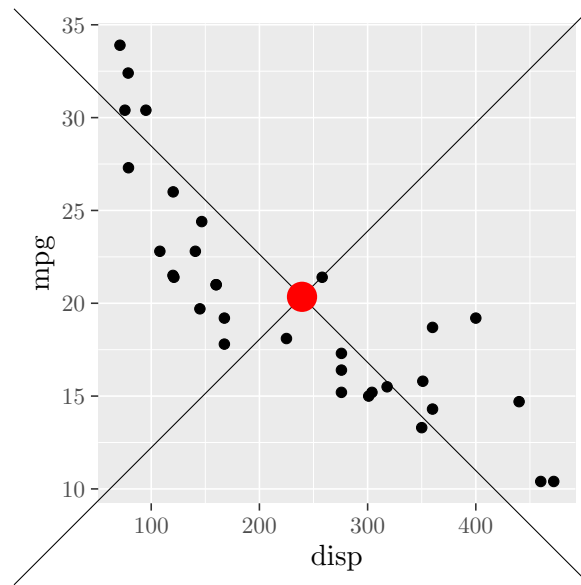
We can then set up an annotation canvas and add tikz annotations. Note that first, we print the base plot to the device <sup>1</sup>, and then the annotation canvas. The annotation canvas does not take care of drawing the annotated plot (the `ggtikz()` helper does handle this with the `draw = TRUE` parameter).

#### 3.1.1 Annotation relative to the whole plot

```
canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation(
  "
  \\draw (0,0) -- (1,1);
  \\draw (0,1) -- (1,0);
  \\fill[red] (0.5,0.5) circle (2mm);
  ",
  xy = "plot"
)
p # first draw the plot
canvas + annotation # then draw the annotations
```

---

<sup>1</sup>no explicit calls to `tikz()` and `dev.off()` are needed, because knitr opens and closes the device automatically.

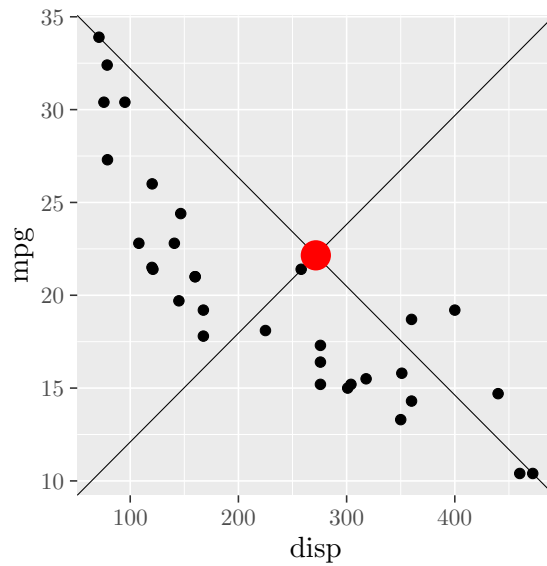


### 3.1.2 Annotation relative to the panel

```

canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation(
  "
  \\draw (0,0) -- (1,1);
  \\draw (0,1) -- (1,0);
  \\fill[red] (0.5,0.5) circle (2mm);
  ",
  xy = "panel",
  panelx = 1, panely = 1
)
p
canvas + annotation

```



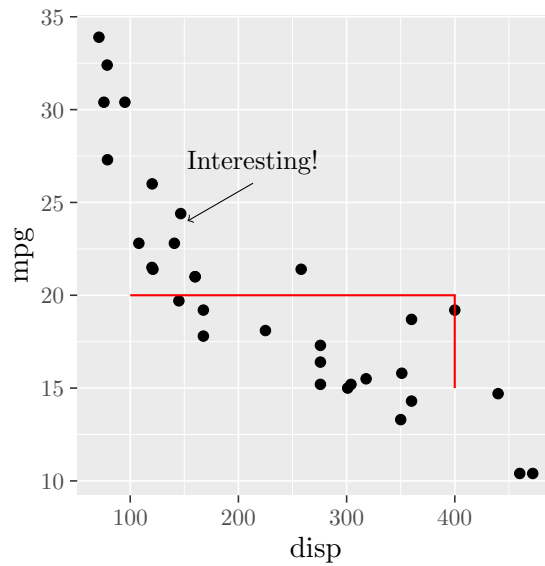
### 3.1.3 Annotation relative to data coordinates

In addition to unitless tikz coordinates, you can also use absolute lengths, such as the 1 cm in the example below.

```

canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation(
  "
  \\draw[thick,red] (100,20) -| (400,15);
  \\draw[<-] (153,24) -- ++(30:1cm) node[at end, anchor=south] {Interesting!};
  ",
  xy = "data",
  panelx = 1, panely = 1
)
p
canvas + annotation

```



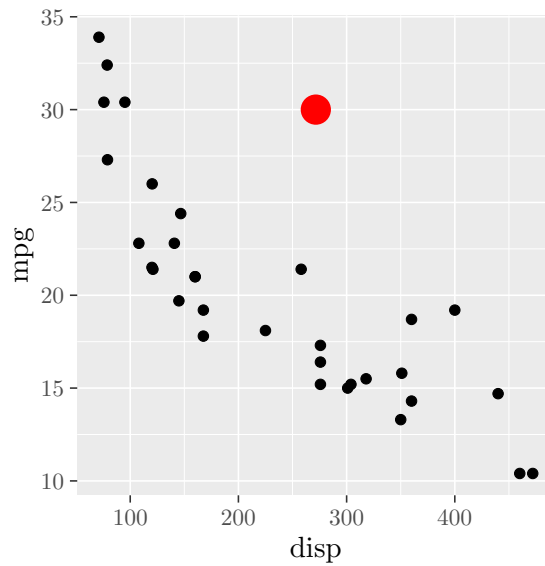
### 3.1.4 Mixing panel and data references

The reference frames for x and y coordinates can be separately assigned as `data` or `panel`. However, note that the `plot` reference frame must be given for both x and y directions (with the `xy` argument), and cannot be mixed!

```

canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation(
  "\\fill[red] (0.5,30) circle (2mm);",
  x = "panel", y = "data",
  panelx = 1, panely = 1
)
p
canvas + annotation

```



### 3.1.5 Turning off clipping

It is possible to turn off clipping for annotations, in order to draw outside of the plot area.

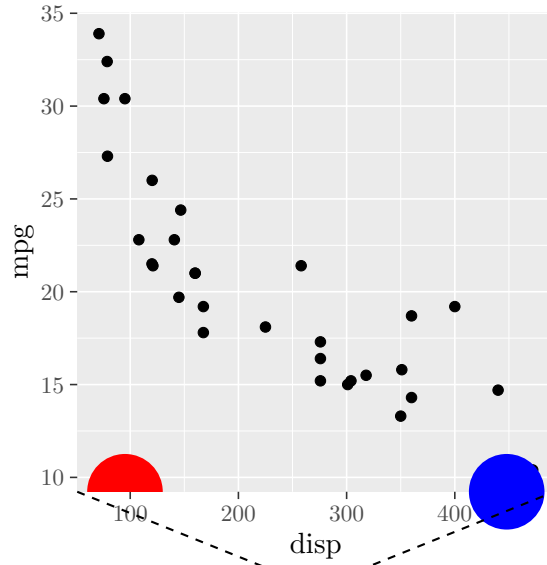
```

canvas <- ggtikzCanvas(p)
annotation_clip <- ggtikzAnnotation(
  "\\fill[red] (0.1,0) circle (5mm);",
  xy = "panel",
  panelx = 1, panely = 1
)

annotation_unclip <- ggtikzAnnotation(
  "\\fill[blue] (0.9,0) circle (5mm);",
  xy = "panel",
  panelx = 1, panely = 1,
  clip = "off"
)

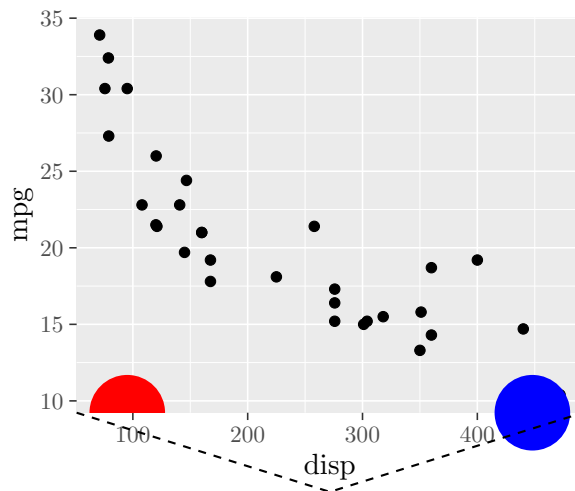
annotation_unclip2 <- ggtikzAnnotation(
  "\\draw[thick, dashed] (0,0) -- (0.5,-0.2) -- (1,0);",
  xy = "panel",
  panelx = 1, panely = 1,
  clip = "off"
)
p
canvas + annotation_clip + annotation_unclip + annotation_unclip2

```



However, note that the surrounding plot area is not automatically unclipped to accommodate for the annotations. This can be alleviated manually by increasing the plot margins.

```
p + theme(plot.margin = margin(t=0.5, b = 1, unit = "cm"))
  canvas + annotation_clip + annotation_unclip + annotation_unclip2
```





## 3.2 Multi-panel plots: wrap

```
p_wrap <- p + facet_wrap(~cyl, scales="free", ncol=2)
```

### 3.2.1 Annotations in separate panels, relative to data or panel coordinates

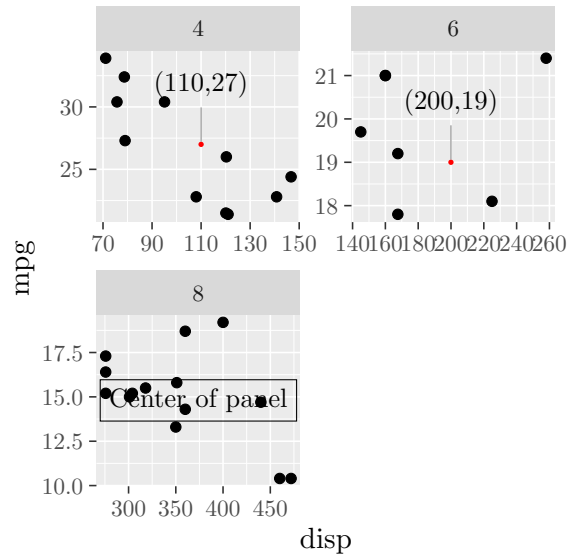
```
canvas <- ggtikzCanvas(p_wrap)

# Relative to data coordinates
annotation1 <- ggtikzAnnotation(
  "
  \\node[pin={90:(110,27)}, circle, fill=red,
    inner sep=0, outer sep=0, minimum size=2pt]
    at (110,27)
    {};
  ",
  xy = "data",
  panelx = 1, panely = 1
)

# Relative to data coordinates
annotation2 <- ggtikzAnnotation(
  "
  \\node[pin={90:(200,19)}, circle, fill=red,
    inner sep=0, outer sep=0, minimum size=2pt]
    at (200,19)
    {};
  ",
  xy = "data",
  panelx = 2, panely = 1
)

# Relative to panel coordinates
annotation3 <- ggtikzAnnotation(
  "
  \\node[draw, anchor=center] at (0.5, 0.5)
    {Center of panel};
  ",
  xy = "panel",
  panelx = 1, panely=2
)
```

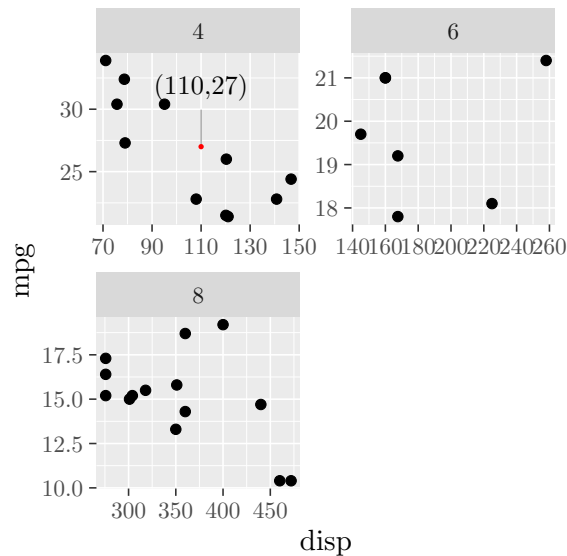
```
p_wrap
canvas + annotation1 + annotation2 + annotation3
```



### 3.2.2 Annotations in separate panels, relative to data coordinates

```
canvas <- ggtikzCanvas(p_wrap)
annotation1 <- ggtikzAnnotation(
  "
  \\node[pin={90:(110,27)}, circle, fill=red,
    inner sep=0, outer sep=0, minimum size=2pt]
    at (110,27)
  {};
  ",
  xy = "data",
  panelx = 1, panely = 1
)
annotation2 <- ggtikzAnnotation(
  "
  \\node[pin={90:(200,19)}, circle, fill=red,
    inner sep=0, outer sep=0, minimum size=2pt]
    at (200,19)
  {};
  ",
  xy = "data",
  panelx = 2, panely = 1
)
)
```

```
p_wrap
canvas + annotation1
```



### 3.3 Multi-panel plots: grid

Annotations can also be made on individual panels of plots faceted with `facet_grid`.

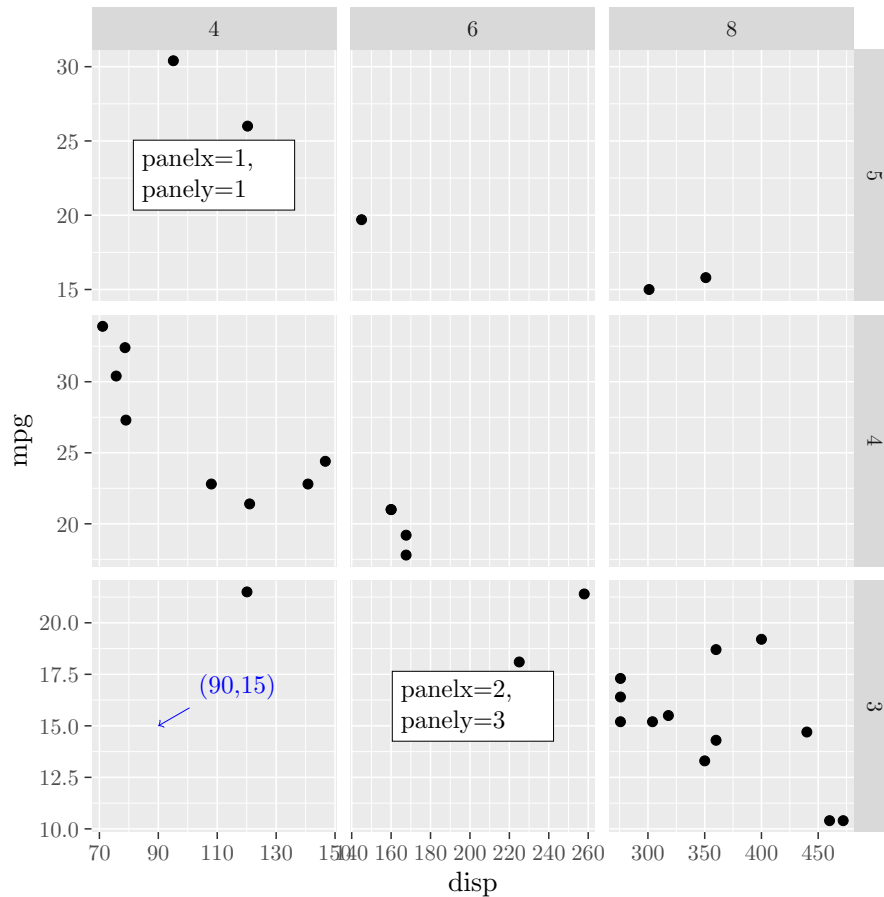
```
p_grid <- p + facet_grid(gear~cyl, scales="free", as.table=FALSE)
```

```
canvas <- ggtikzCanvas(p_grid)
annot_grid1 <- ggtikzAnnotation(
  "\\node[fill=white, draw, text width=2cm] at (0.5,0.5)
    {panelx=1, panely=1};",
  xy = "panel",
  panelx = 1, panely = 1
)
annot_grid2 <- ggtikzAnnotation(
  "\\node[fill=white, draw, text width=2cm] at (0.5,0.5)
    {panelx=2, panely=3};",
  xy = "panel",
  panelx = 2, panely = 3
)
annot_grid3 <- ggtikzAnnotation(
  "
  \\draw[<-, blue] (90,15) -- ++(30:5mm)
    node [at end, anchor=south west] {(90,15)};
```

```

",
  xy = "data",
  panelx = 1, panely = 3
)
p_grid
canvas + annot_grid1 + annot_grid2 + annot_grid3

```



### 3.4 Re-using annotations

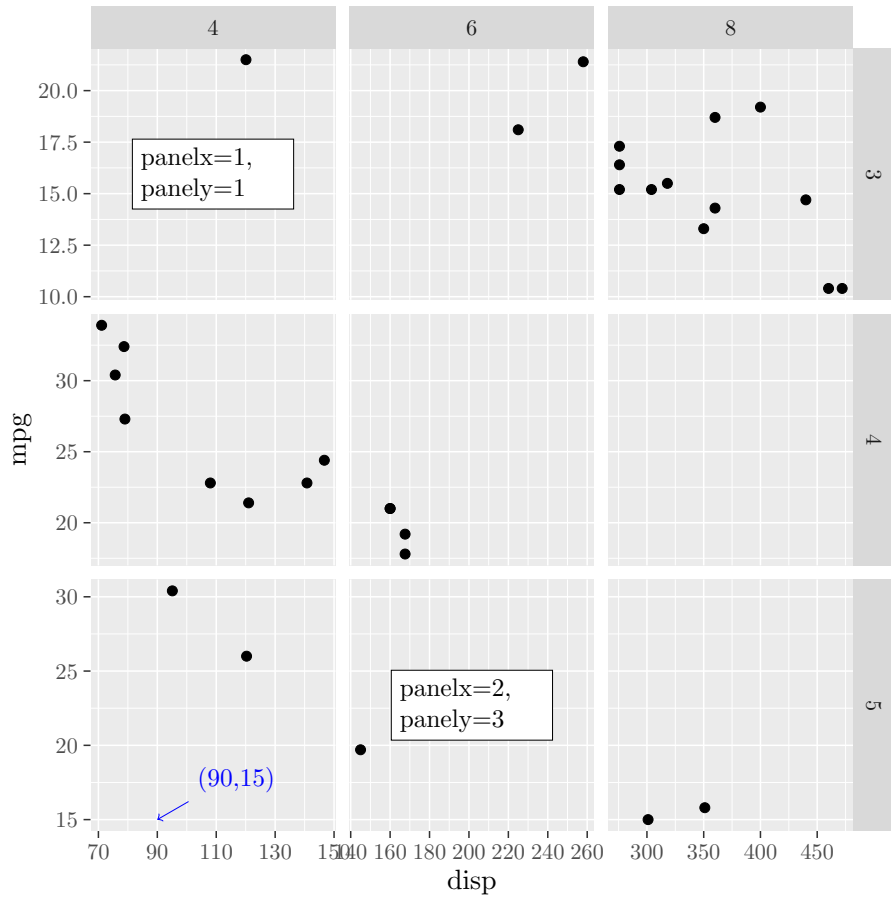
Annotations can be re-used between plots and `ggtikz` canvases. However, be aware that panel position specifications rely on the *visual position* of the panels, and *not on the value of the facet variables*.

```

p_grid2 <- p + facet_grid(gear~cyl, scales="free", as.table=TRUE)
canvas2 <- ggtikzCanvas(p_grid2)

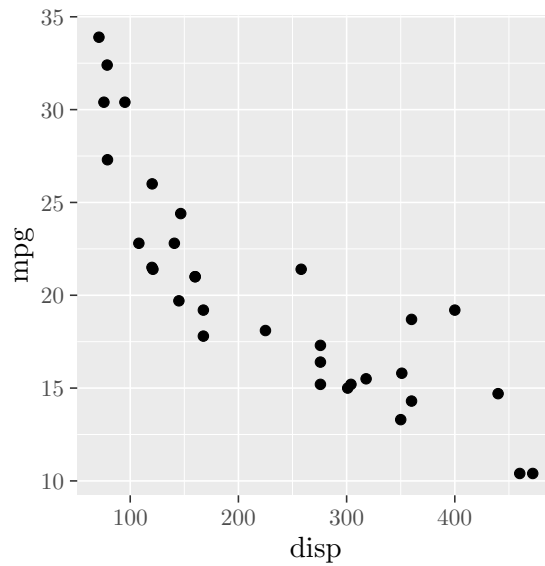
```

```
p_grid2
canvas2 + annot_grid1 + annot_grid2 + annot_grid3
```



It is also not possible to add annotations to a plot for which the requested panels are not available.

p



```

canvas <- ggtikzCanvas(p)
canvas + annot_grid2

## Error in get_annotation_valid.ggtikzCanvas(self, ggtikzAnnotation):
## Annotation wants to be placed in panelx = 2, but the plot only has
## 1.

```

## 4 Using styles defined in the surrounding document

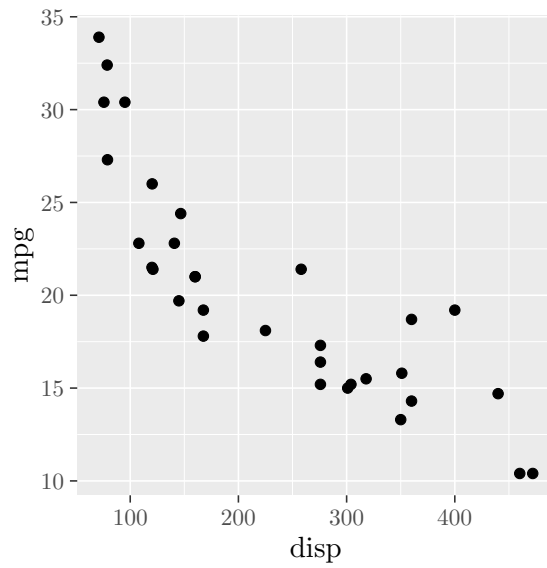
Annotations can access styles which are defined in the containing document before the relevant .tikz file is included, allowing you to re-use global styles. Note that by default, knitr sets the option `external` to `TRUE`. Therefore, tikz graphics are pre-compiled to pdf. In that case, the `tikzDevice` needs to know about these styles, or an error will occur during externalization.

```

\tikzset{loud/.style={
  draw=yellow,
  fill=red,
  text=blue
}}

```

p



```

canvas <- ggtikzCanvas(p)
styled_annot <- ggtikzAnnotation(
  "\\node[loud] at (0.5,0.5) {Look at me!};",
  xy = "plot"
)
p
canvas + styled_annot

```

