The `roundrect` Macros, v2.2

Donald P. Goodman III

February 19, 2016

Abstract

The `roundrect` macros for METAPOST provide extremely configurable, extremely versatile rectangles (including rounded corners), intended primarily for inclusion in documents produced by TEX and friends. The idea was to provide a METAPOST-based replacement for the incredibly versatile `tcolorbox` package; the macros are far from achieving that goal. But they are nevertheless extremely useful.

Contents

1 Introduction

While Ti*k*Z and its many accompanying packages, particularly `tcolorbox`, are wonderful and powerful tools, whenever using them I inevitably feel completely lost, and I exert great effort doing comparatively simple things. Contrariwise, thanks to my experience with the `drm` and `dozenal` packages, writing in METAPOST is quite straightforward for me. So I decided to try to write some generalized macros to provide functionality similar to that of `tcolorbox`. It's not even close

to that kind of flexibility or power, but it's still quite useful and versatile, so I make it available for anyone who might be interested.

This document was typeset in accordance with the `docstrip` utility, which allows the automatic extraction of code and documentation from the same document.

2 Prerequisites and Conventions

Some prerequesites for using this package are METAPOST itself (obviously). If you're using the package with LaTeX, the `gmp` package would probably be helpful; be sure to use the `latex` package option. Finally, the package internally calls `TEX.mp`, so that is also required. All of these should be packaged in any reasonably modern LaTeX system, such as TeXLive or MikTeX.

This documentation assumes nothing about your personal TeX or METAPOST environment. ConTeXt and the various forms of LuaTeX have METAPOST built-in; with pdfLaTeX, the author's choice, one can use the `gmp` package to include the source directly in one's document (that's what's been done in this documentation) or develop a simple script to compile them afterwards and include them in the source via `\includegraphics` (probably the quickest option, since compilation is done in advance). Here, we simply post the plain vanilla METAPOST code, and let you work out those details however you prefer.

3 Shapes and Styles

`roundrect` The core of all the action is the `roundrect` macro; this will set up your rounded rectangle in the plainest way possible. The first argument is the box's height, the second its width, and the third its name, by which you will draw it later:

```
roundrect(1in,2in)(rectangle);
draw rectangle;
```

All the corners don't *have* to be rounded; we can make them square if we want. To do things like this, we use the macro `rrborderrad()`, which takes a single argument giving the border radius we want; that is, how rounded we want

`rrborderrad()`

the corners of our rectangle. Higher values will be more rounded, lower values will be less:

```
rrborderrad(10pt);
roundrect(1in,2in)(rectangle);
draw rectangle;
```

Notice that the corners in this, with `rrborderrad()` set to `10pt`, are much less rounded than the previous example. The default border radius is `40pt`, which is quite rounded.

`rrborderrad()` provides an easy way to set the border radius of all four corners at once; however, we can also control each corner individually, with `rrtoplftborderrad`, `rrbotlftborderrad`, `rrtoprtborderrad`, and `rrbotrtborderrad`, which are parameters rather than macros; that is, we define them using `:=` rather than as an argument in parentheses:

`rrtoplftborderrad`
`rrbotlftborderrad`
`rrtoprtborderrad`
`rrbotrtborderrad`

```
rrtoplftborderrad := 20pt;
rrbotlftborderrad := 40pt;
rrtoprtborderrad := 10pt;
rrbotrtborderrad := 60pt;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

As you can see, this makes it possible to create a large variety of shapes, including the ability to arbitrarily flatten any side of the rectangle desired just by setting the border radius of the appropriate corners to `0pt`:

```
rrtoplftborderrad := 0pt;
rrtoprtborderrad := 0pt;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

Here, we've flattened the top border by setting the top right and top left corners' border radii to `0pt`. This ability to flatten any given side of the rectangle makes it much easier to combine multiple rectangles into interesting forms, which we'll see a bit more about later.

4 Coloring the Parts

The colors of the `roundrect` are extremely configurable, both on the whole and for individual parts. The background color of the `roundrect` is controlled by `rrinnercolor`, while the border is colored by `rrbordercolor()`.

`rrinnercolor`
`rrbordercolor`

```
rrbordercolor(blue);
rrinnercolor := red;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

By default, `rrinnercolor` is white and `rrbordercolor` is black. Notice that `rrbordercolor` is a *macro*, not a parameter; that's because each border can be individually colored, and this macro simply does all of them at once. We'll see more about that later.

`rrnotop`
`rrnobot`
`rrnolft`
`rrnort`

You can also completely suppress the border by using `rrnotop`, `rrnobot`, `rrnolft`, and `rrnort`, which is particularly useful when you want to combine multiple rectangles without making an obvious border between them. You can combine these in any way you like:

```
rrbordercolor(blue);
rrinnercolor := red;
rrnotop := true;
rrnobot := true;
rrborderrad(0pt);
roundrect(1in,2in)(rectangle);
draw rectangle;
```

Here we've squared all the corners to make it easier to see what's going on.

Each border can be colored individually and separately from the others, using the commands you'd expect:

```
rrtopbordercolor := blue;
rrbotbordercolor := green;
rrlftbordercolor := red;
rrrtbordercolor := black;
rrborderrad(20pt);
roundrect(1in,2in)(rectangle);
draw rectangle;
```

There is obviously some difficulty in determining what part of each rounded corner should be colored how; this ability is typically more useful with a single, flattened side, to help it blend in better when combined with other constructs:

```
rrbordercolor(black);
rrbotbordercolor := green;
rrinnercolor := red;
rrborderrad(20pt);
rrbotlftborderrad := 0pt;
rrbotrtborderrad := 0pt;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

`rrborderpen()`

Perhaps you don't like the border; you'd like it thicker, or drawn with a square rather than a circular pen. You're in luck; `rrborderpen()` takes the single argument of the pen you'd like to draw the border with, defined like any other METAPOST pen:

```
rrborderpen(pensquare scaled 3);
roundrect(1in,2in)(rectangle);
draw rectangle;
```

The default border pen is `pencircle scaled 1.5`, so this results in a square pen rather than a circular one, twice as thick. You can also use individual pens for each border, as expected:

```
rrbotlftborderrad := 0pt;
rrbotrtborderrad := 0pt;
rrbotbordercolor := green;
rrbotborderpen := pensquare
    yscaled 6;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

Here we've flattened the bottom border, colored it green, and drawn it with a square pen scaled on the y-axis only by 6. Clearly, there are huge possibilities here.

5 Drop Shadows

`rrdropshadow`

We can also put a *shadow* on the boxes using `rrdropshadow`, a boolean value which defaults to `false`:

```
rrdropshadow := true;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

The drop shadow always mimics the shape of the box itself; there is presently no way to avoid that. If for some reason you want to, you'll have to create a separate `roundrect` and place it manually.

`rrshadowcolor` We can control the size and direction of the drop shadow fairly easily, however, along with its color. Its color is controlled by `rrshadowcolor`, which can be set to any arbitrary METAPOST color:

```
rrdropshadow := true;
rrshadowcolor := blue;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

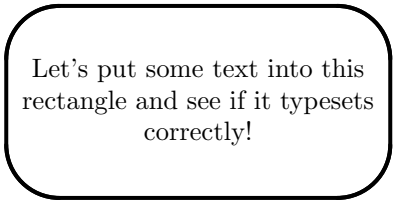
`rrshadowx` `rrshadowy` The position of the drop shadow is governed by `rrshadowx` and `rrshadowy`, which will shift the `roundrect` on the `x` or `y` axis, respectively. By default, these are set to one quarter of the border radius in effect for the bottom left corner:

```
rrdropshadow := true;
rrshadowcolor := blue;
rrshadowx :=
    -rrbotlftborderrad/4;
rrshadowy := rrbotlftborderrad/4;
roundrect(1in,2in)(rectangle);
draw rectangle;
```

6 Including Text

Finally, we can put text in the rectangles; this is as configurable as everything else:

```
rrbodytext := "Let's put some
    text into this rectangle and
    see if it typesets
    correctly!";
roundrect(1in,2in)(rectangle);
draw rectangle;
```



`rrtextfont` `rrtextcolor`

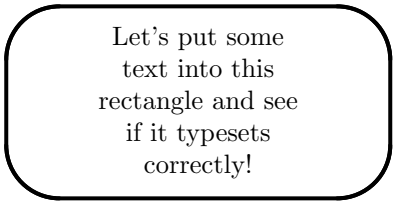
The font and style of the text can be controlled with `rrtextfont`, and the color of the text can be controlled with `rrtextcolor`:

```
rrbodytext := "Text in a label";
rrtextcolor := green;
rrtextalign := "\raggedleft";
rrtextfont := "\fontsize17pt19pt\
    selectfont\ itshape";
roundrect(1in,2in)(rectangle);
draw rectangle;
```

`rrtextalign` We also used, without explaining it first, `rrtextalign`, which allows insertion of text alignment commands. This can also be inserted in the `rrtextfont` variable, but it seemed logical to have a separate parameter for it. It's default is `\centering`.

`rrtextwd` The width of the text is governed by `rrtextwd`, which defaults to the same width as the rectangle with a `3pt` buffer on either side. The buffer is not directly controllable, but the width can be set however you like:

```
rrbodytext := "Let's put some
    text into this rectangle and
    see if it typesets
    correctly!";
rrtextwd := 80pt;
roundrect(1in,2in)(rectangle);
draw rectangle;
```



Finally, to restore all these values to the default, use the `rrrestorevals;` directive. This will clear everything to default so you can have a completely different `roundrect` in the same figure.

7 Using External Packages in Text

Frequently, of course, the `rrtextfont` options will be either insufficient or overly cumbersome for your needs. For example, you might want *all* the text in your labels to be in a different font; to match your main body font, for example.

`rrusepackage` `roundrect` offers `rrusepackage` for this purpose. It is a string, designed specifically for the purpose of including arbitrary LaTeX packages for typesetting text.

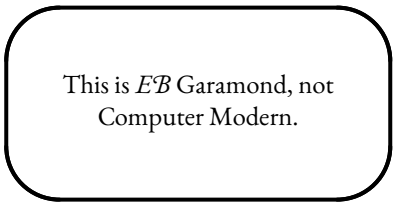
For example, if your main body font is EB Garamond, the easiest way to get your text to match that is to ask METAPOST to use the `ebgaramond` package when it typesets:

```
rrusepackage :=
    "\usepackage{ebgaramond}";

rrbodytext := "This is
    \textsw{EB} Garamond, not
    Computer Modern.";

roundrect(1in,2in)(rectangle);

draw rectangle;
```



Notice that `rrusepackage := "\usepackage{ebgaramond}";` takes care of changing the body font *and* of defining the `\textsw` environment (itself defined in `ebgaramond`), which we would otherwise have to do separately.

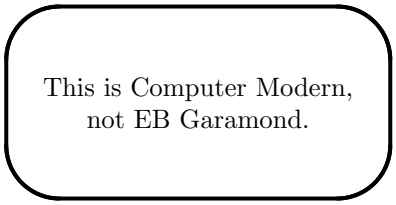
To switch this back, simply reset the string to empty:

```
rrusepackage := "";

rrbodytext := "This is Computer
    Modern, not EB Garamond.";

roundrect(1in,2in)(rectangle);

draw rectangle;
```



Using color commands (e.g., from `color` or `xcolor`) will not throw errors, provided the appropriate package is included; however, it will not work. This seems to be an unavoidable consequence of the way that `TEX.mp` works; TEX `\special` commands are destroyed in the process, and there isn't really a robust way to do it without this effect.

8 Implementation

```
input TEX;
color rrinnercolor; rrinnercolor := white;
numeric rrtoprtborderrad; rrtoprtborderrad := 40pt;
```

```
numeric rrbotrtborderrad; rrbotrtborderrad := 40pt;
numeric rrbotlftborderrad; rrbotlftborderrad := 40pt;
numeric rrtoplftborderrad; rrtoplftborderrad := 40pt;
numeric rrtextwd; rrtextwd := 0;
numeric rrshadowx; rrshadowx := rrbotrtborderrad/4;
numeric rrshadowy; rrshadowy := -rrbotrtborderrad/4;
string rrtextfont; rrtextfont := "\fontsize{10pt}{12pt}\selectfont ";
color rrtextcolor; rrtextcolor := black;
string rrbodytext; rrbodytext := "";
string rrtextalign; rrtextalign := "\centering";
string rrusepackage; rrusepackage := "";
boolean rrnotop; rrnotop := false;
boolean rrnobot; rrnobot := false;
boolean rrnolft; rrnolft := false;
boolean rrnort; rrnort := false;
boolean rrdropshadow; rrdropshadow := false;
color rrtopbordercolor; rrtopbordercolor := black;
color rrbotbordercolor; rrbotbordercolor := black;
color rrlftbordercolor; rrlftbordercolor := black;
color rrrtbordercolor; rrrtbordercolor := black;
color rrshadowcolor; rrshadowcolor := black;
def rrbordercolor(expr x) =
rrtopbordercolor := x;
rrbotbordercolor := x;
rrlftbordercolor := x;
rrrtbordercolor := x;
enddef;
def rrborderrad(expr x) =
rrtoplftborderrad := x;
rrbotlftborderrad := x;
rrtoprtborderrad := x;
rrbotrtborderrad := x;
enddef;
pen rrtopborderpen; rrtopborderpen := pencircle scaled 1.5;
pen rrbotborderpen; rrbotborderpen := pencircle scaled 1.5;
pen rrlftborderpen; rrlftborderpen := pencircle scaled 1.5;
pen rrrtborderpen; rrrtborderpen := pencircle scaled 1.5;
def rrborderpen(expr x) =
rrtopborderpen := x;
rrbotborderpen := x;
rrlftborderpen := x;
rrrtborderpen := x;
enddef;
def rrrestorevals =
rrborderrad(40pt);
rrbordercolor(black);
rrborderpen(pencircle scaled 1.5);
rrinnercolor := white;
rrnotop := false;
rrnobot := false;
```

```
rrnolft := false;
rrnort := false;
rrtextwd := 0;
rrtextfont := "\fontsize{10pt}{12pt}\selectfont ";
rrtextcolor := black;
rrbodytext := "";
rrtextalign; rrtextalign := "\centering";
rrdropshadow := false;
rrshadowcolor := black;
rrshadowx := rrbotrtborderrad/4;
rrshadowy := -rrbotrtborderrad/4;
enddef;
def roundrect(expr rrht, rrwd)(suffix name) =
TEXPRE("%&latex" & char(10) & "\documentclass{article}" & rrusepackage & "\begin{document}");
TEXPOST("\end{document}");
if (rrtextwd = 0):
rrtextwd := rrwd - 12pt;
fi
path rra; path rrb; path rrc; path rrd;
pair a; pair b; pair c; pair d;
a := (0,0) shifted (-rrwd/2,-rrht/2);
b := (0,0) shifted (rrwd/2,-rrht/2);
c := (0,0) shifted (rrwd/2,rrht/2);
d := (0,0) shifted (-rrwd/2,rrht/2);
rra := fullcircle scaled rrbotlftborderrad shifted (xpart a +
(rrbotlftborderrad/2),ypart a + (rrbotlftborderrad/2));
rrb := fullcircle scaled rrbotrtborderrad shifted (xpart b -
(rrbotrtborderrad/2),ypart b + (rrbotrtborderrad/2));
rrd := fullcircle scaled rrtoplftborderrad shifted (xpart d +
(rrtoplftborderrad/2),ypart d - (rrtoplftborderrad/2));
rrc := fullcircle scaled rrtoprtborderrad shifted (xpart c -
(rrtoprtborderrad/2),ypart c - (rrtoprtborderrad/2));
pair f; f := (a--b) intersectionpoint rra;
pair g; g := (a--b) intersectionpoint rrb;
pair h; h := (b--c) intersectionpoint rrb;
pair i; i := (b--c) intersectionpoint rrc;
pair j; j := (c--d) intersectionpoint rrc;
pair k; k := (c--d) intersectionpoint rrd;
pair l; l := (d--a) intersectionpoint rrd;
pair m; m := (d--a) intersectionpoint rra;
picture name;
picture border;
picture rrtext;
pair n; pair o;
path rrtoplftcorner; path rrbotlftcorner;
path rrtoprtcorner; path rrbotrtcorner;
path rrtopborder; path rrbotborder;
path rrlftborder; path rrrtborder;
rrtoplftcorner := l{up}..{right}k;
rrtoprtcorner := j{right}..{down}i;
```

```
rrbotrtcorner := h{down}..{left}g;
rrbotlftcorner := f{left}..{up}m;
rrtopborder := rrtoplftcorner--rrtoprtcorner;
rrbotborder := rrbotrtcorner--rrbotlftcorner;
rrlftborder := rrbotlftcorner--rrtoplftcorner;
rrrtborder := rrtoprtcorner--rrbotrtcorner;
picture rrdropshadowpic;
if (rrdropshadow = true):
rrdropshadowpic := image(fill rrtoplftcorner--rrtoprtcorner--
rrbotrtcorner--rrbotlftcorner--cycle
shifted (rrshadowx,rrshadowy) withcolor
rrshadowcolor);
else:
rrdropshadowpic := currentpicture;
fi
name := currentpicture;
addto name also rrdropshadowpic;
rrdropshadowpic := image(fill rrtoplftcorner--rrtoprtcorner--
rrbotrtcorner--rrbotlftcorner--cycle withcolor
rrinnercolor);
addto name also rrdropshadowpic;
% name := image(fill rrtoplftcorner--rrtoprtcorner--
% rrbotrtcorner--rrbotlftcorner--cycle withcolor
% rrinnercolor);
picture rrtmpborder;
border := currentpicture;
if (rrnotop = false):
rrtmpborder := image(draw rrtopborder withcolor
rrtopbordercolor withpen rrtopborderpen);
addto border also rrtmpborder;
fi
if (rrnobot = false):
rrtmpborder := image(draw rrbotborder withcolor
rrbotbordercolor withpen rrbotborderpen);
addto border also rrtmpborder;
fi
if (rrnolft = false):
rrtmpborder := image(draw rrlftborder withcolor
rrlftbordercolor withpen rrlftborderpen);
addto border also rrtmpborder;
fi
if (rrnort = false):
rrtmpborder := image(draw rrrtborder withcolor
rrrtbordercolor withpen rrrtborderpen);
addto border also rrtmpborder;
fi
addto name also border;
rrtext :=
image(label(TEX("\parbox{"&decimal(rrtextwd)&"bp}{"&rrtextalign&rrtextfont&" "&rrbodytext&"}"),
addto name also rrtext;
```

```
enddef;
```