Tutorial of Wheatmap

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This is a tutorial on the usage of wheatmap for generating complex heatmaps in a procedure way.

A heatmap is easy to generate in R. There are many packages like heatmap2, heatmap3, heatmap.plus and ComplexHeatmaps. But many times, I found myself in a situation of plotting a set of heatmaps in a procedure way. And none-of the above packages are nimble enough to allow multiple heatmaps be positioned arbitrarily. So I wrote this package for that purpose.

Preparation

We start with some data

```
library(devtools)
```

```
## Warning: package 'devtools' was built under R version 3.2.5
```

```
load_all('~/tools/wheatmap/wheatmap/')
```

```
## Loading wheatmap
```

```
m <- cbind(matrix(rnorm(20),nrow=4), 5+matrix(rnorm(8),nrow=4))
m2 <- matrix(1:16,nrow=4)
dimnames(m) <- list(c('w','x','y','z'), c('a','b','c','d','e','f','g'))
row.data <- c(1,2,3,1)
col.data <- c(1:6,6)
m
```

```
##            a          b          c          d          e        f        g
## w  0.1604556  0.6678271  0.1363628 -0.8626832  0.8243224 6.451340 5.412759
## x -0.7874835  0.6616100 -2.0850398 -1.2057088  0.5056968 4.447970 5.805063
##  [ reached getOption("max.print") -- omitted 2 rows ]
```

We perform some clustering

```
cc <- both.cluster(m)
row.data <- row.data[cc$row.clust$order]
col.data <- col.data[cc$column.clust$order]
```

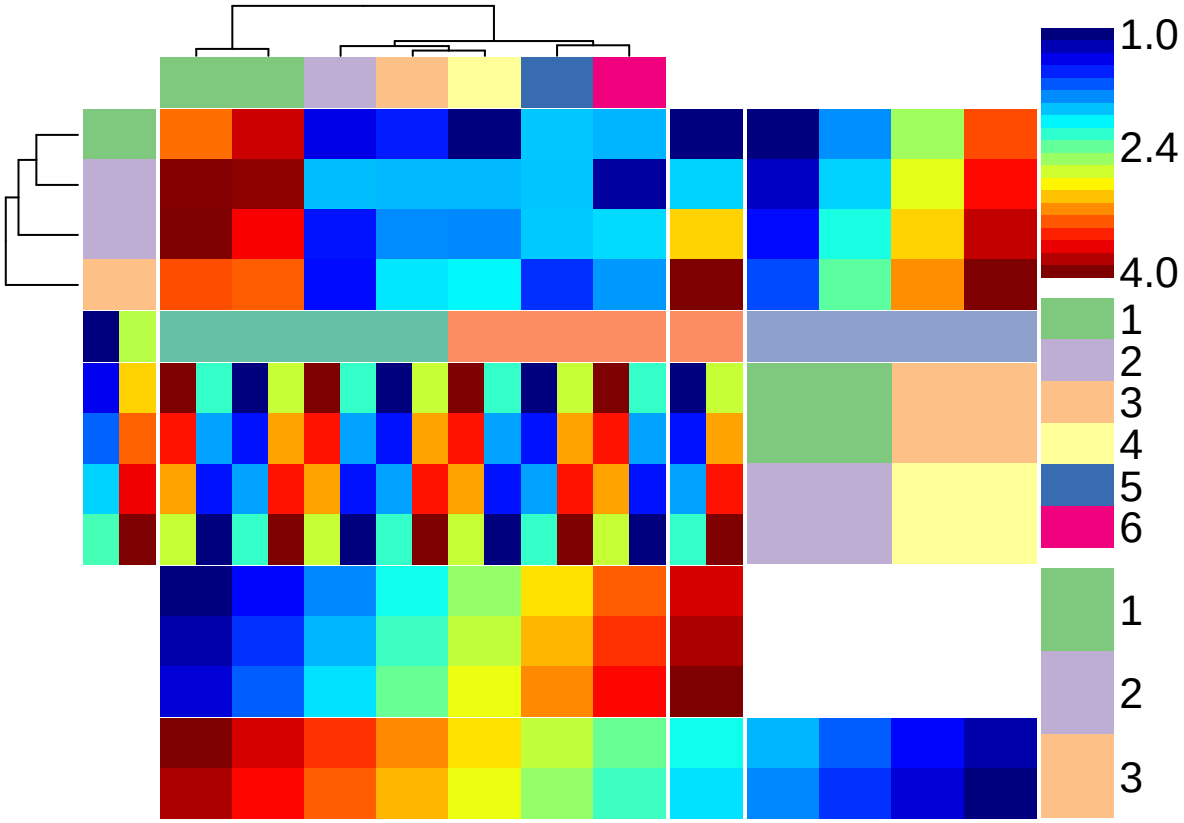
We perform some cleaning to make sure nothing exists before

```
ResetCanvas()
```

Final results

The end result of our tutorial can be done by the "one"-liner

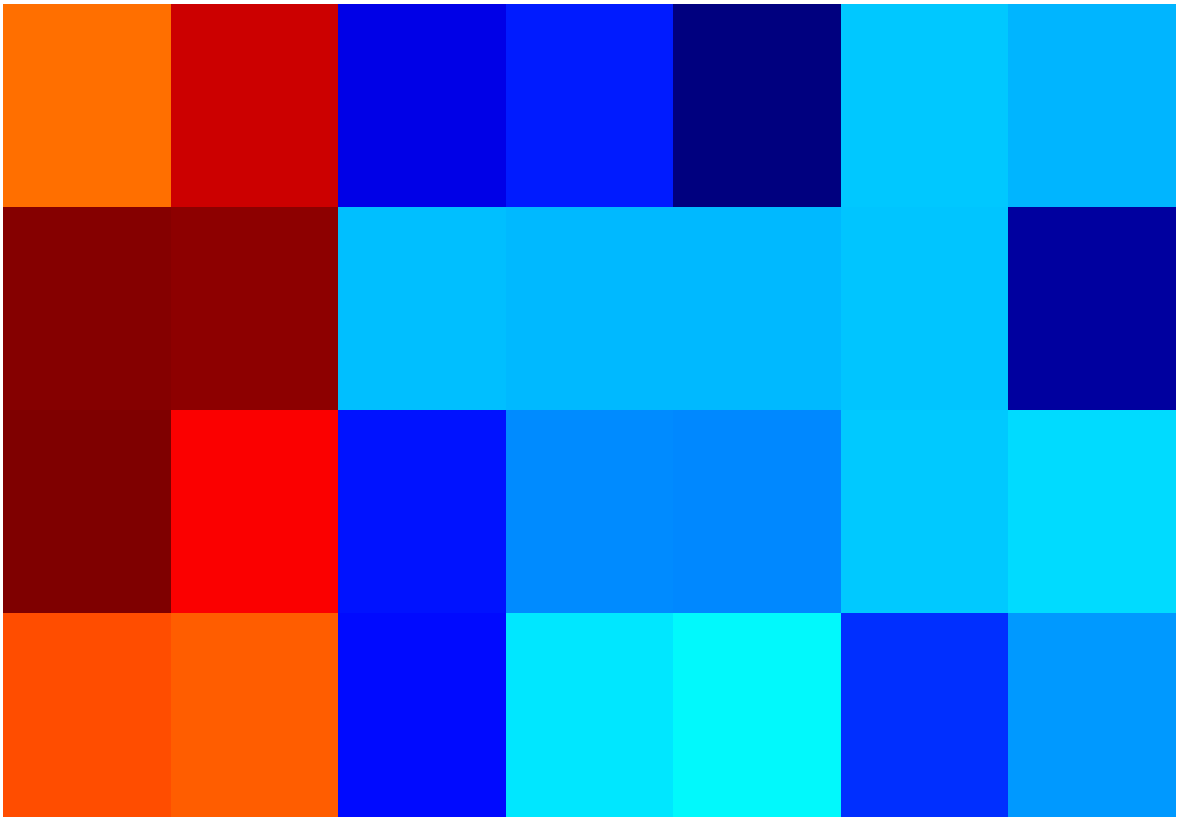
```
WHeatmap(cc$mat, name='h1') +
  WColorBarV(row.data, LeftOf('h1'), 'c1') +
  WColorBarH(col.data, TopOf('h1'), 'c2') +
  WDendrogram(cc$row.clust, LeftOf('c1'), facing='right') +
  WDendrogram(cc$column.clust, TopOf('c2'), facing='bottom') +
  WColorBarV(1:4, RightOf('h1'), 'c3', continuous=TRUE) +
  WHeatmap(m2, RightOf('c3'), 'h2') +
  WColorBarH(rep(c(1,2,3),each=4),
             Beneath(WGroupColumn('h1', 'c3', 'h2')), 'c4',
             cmp=CMPar(brewer.name='Set2'), continuous=FALSE) +
  WHeatmap(matrix(rep(c(8:1,1:8),4),nrow=4),
           Beneath('c4', h.aln=WGroupColumn('h1','c3')), 'h3') +
  WHeatmap(matrix(rep(1:10),ncol=2),LeftOf(WGroupRow('c4.1.1','h3.1.1'))) +
  WHeatmap(matrix(1:4,nrow=2), RightOf('h3', h.scale='h2'), 'h4') +
  WHeatmap(matrix(1:24,nrow=3), Beneath('h3'), 'h5') +
  WHeatmap(matrix(24:1,nrow=2),
           Beneath('h5', h.aln=WGroupColumn('h1','c3','h2')), 'h6') +
  WLegendV('c1', RightOf('h6.1.3'), 'l1') +
  WLegendV('c2', TopOf('l1', pad=0.1), 'l2') +
  WLegendV('c3', TopOf('l2', pad=0.1), n.text=3)
```



Step by step construction

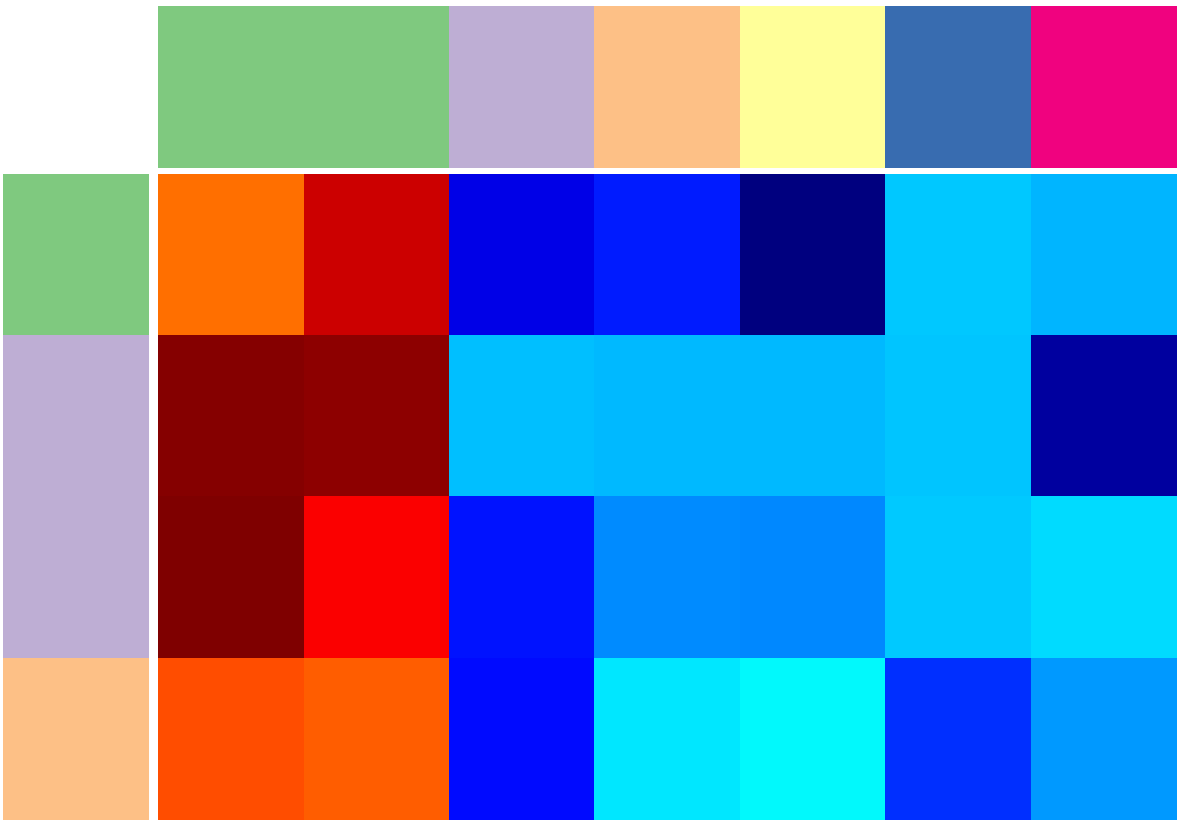
We plot one heatmap first

```
a <- WHeatmap(cc$mat, name='h1')
a
```



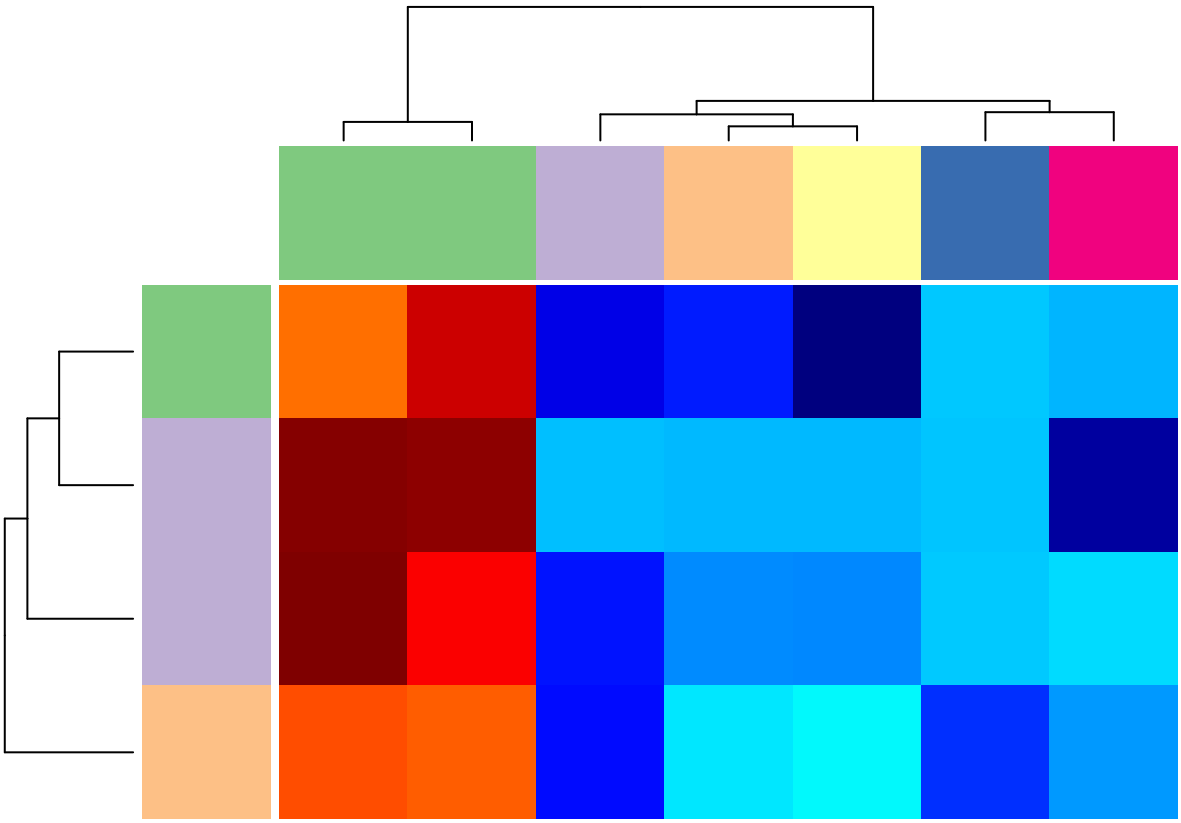
Then we add top and left color bars

```
a <- a + WColorBarV(row.data, LeftOf('h1'), 'c1')
a <- a + WColorBarH(col.data, TopOf('h1'), 'c2')
a
```



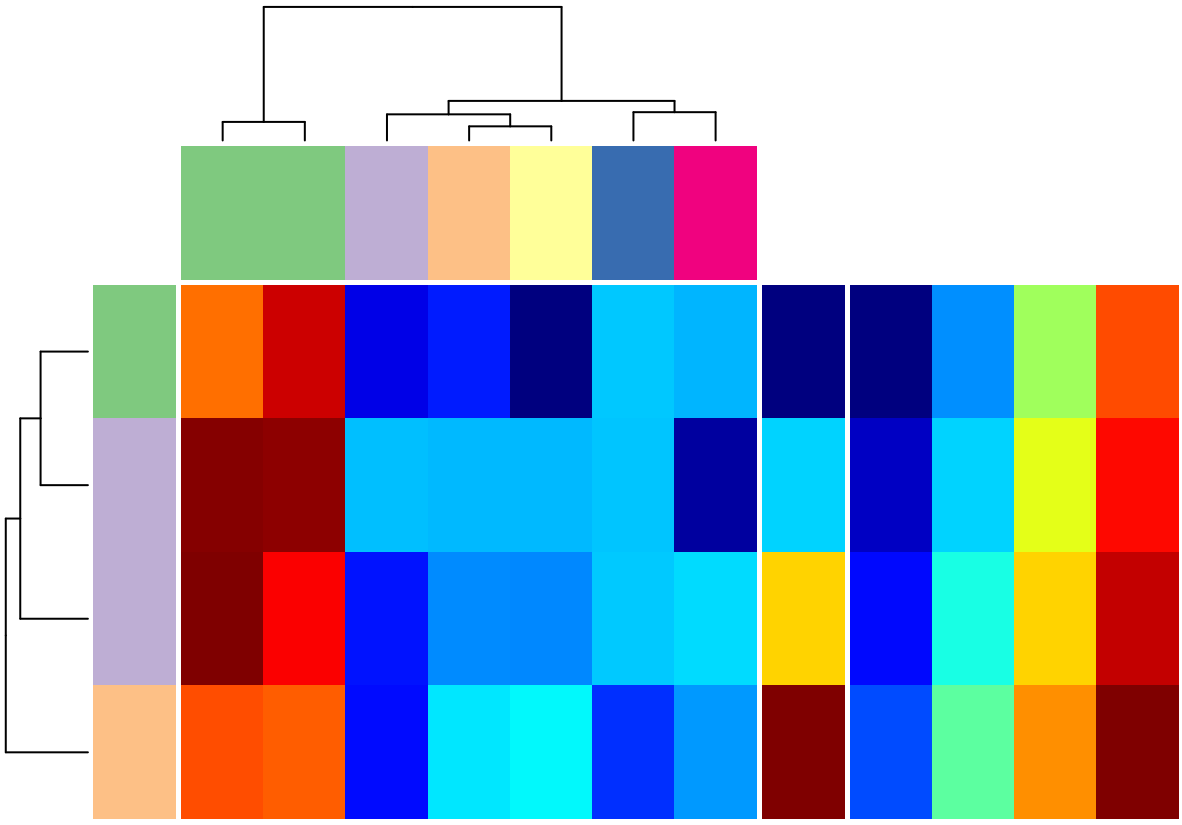
Then the dendrograms

```
a <- a + WDendrogram(cc$row.clust, LeftOf('c1'), facing='right')
a <- a + WDendrogram(cc$column.clust, TopOf('c2'), facing='bottom')
a
```



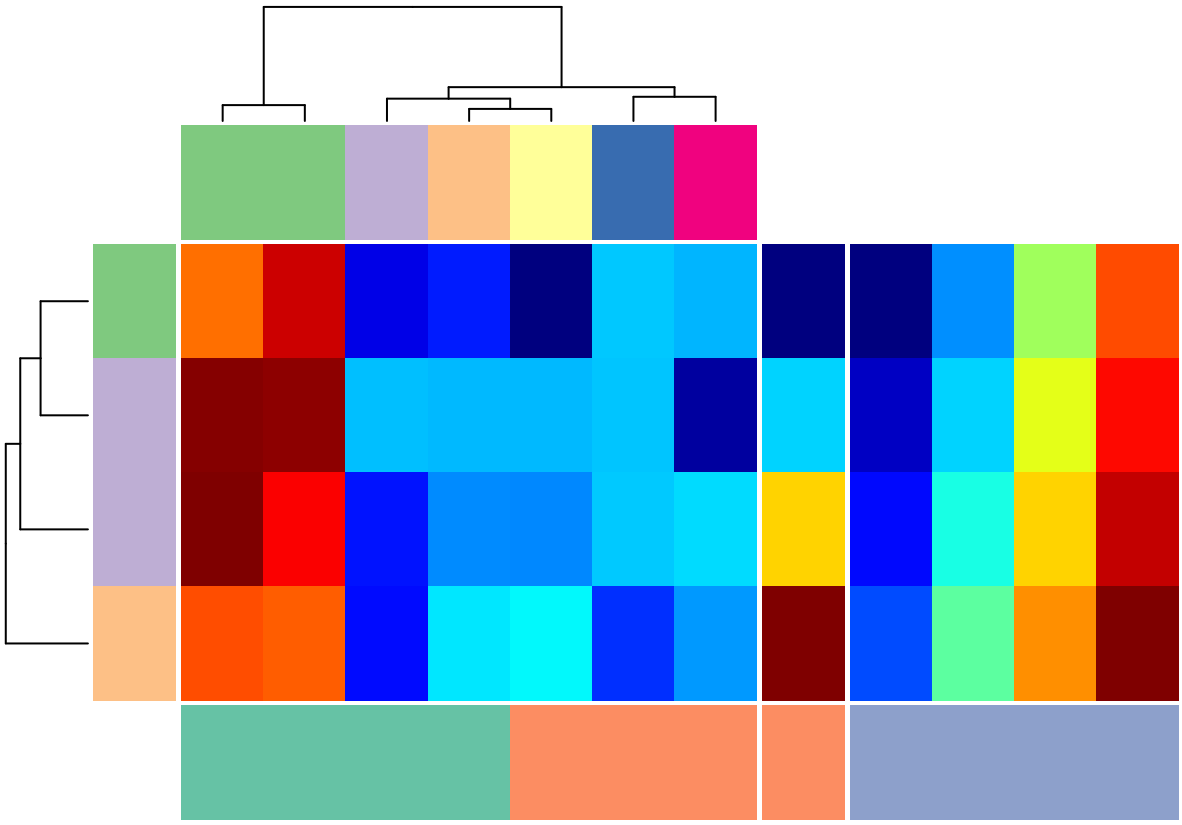
Then another vertical color bar on the right. This one we want to have a continuous scale. Then another heatmap on the further right.

```
a <- a + WColorBarV(1:4, RightOf('h1'), 'c3', continuous=TRUE)
a <- a + WHeatmap(m2, RightOf('c3'), 'h2')
a
```



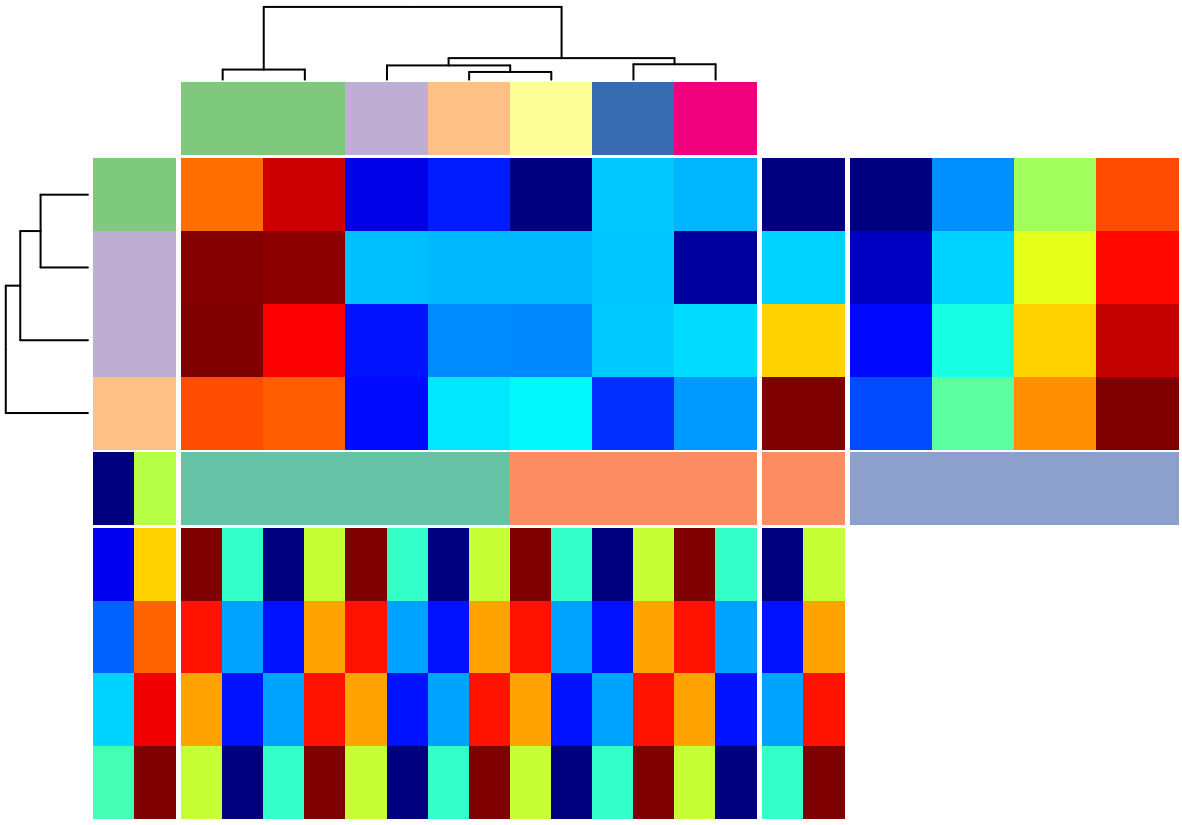
Now we can merge 3 items we plot and add a horizontal bar below. Note wheatmap automatically computes the split for you. It's the users' responsibility however, to make sure data are alignable.

```
a <- a + WColorBarH(rep(c(1,2,3),each=4),
                    Beneath(WGroupColumn('h1', 'c3', 'h2')), 'c4',
                    cmp=CMPar(brewer.name='Set2'), continuous=FALSE)
a
```



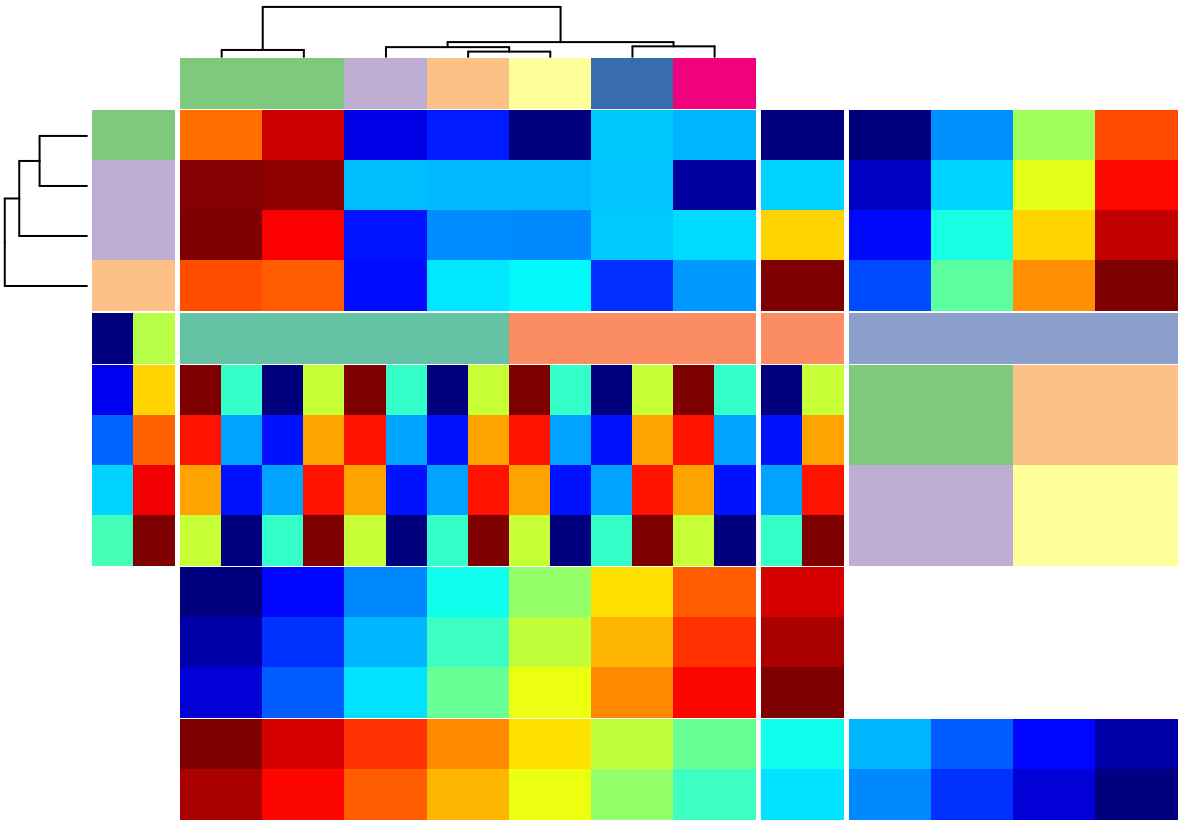
We then add another matrix that span two objects under c4. And a vertial 2-column heatmap on the left that span 2 elements.

```
a <- a + WHeatmap(
  matrix(rep(c(8:1,1:8),4),nrow=4),
  Beneath('c4', h.aln=WGroupColumn('h1','c3')), 'h3')
a <- a + WHeatmap(matrix(rep(1:10),ncol=2),
                  LeftOf(WGroupRow('c4.1.1','h3.1.1')))
a
```



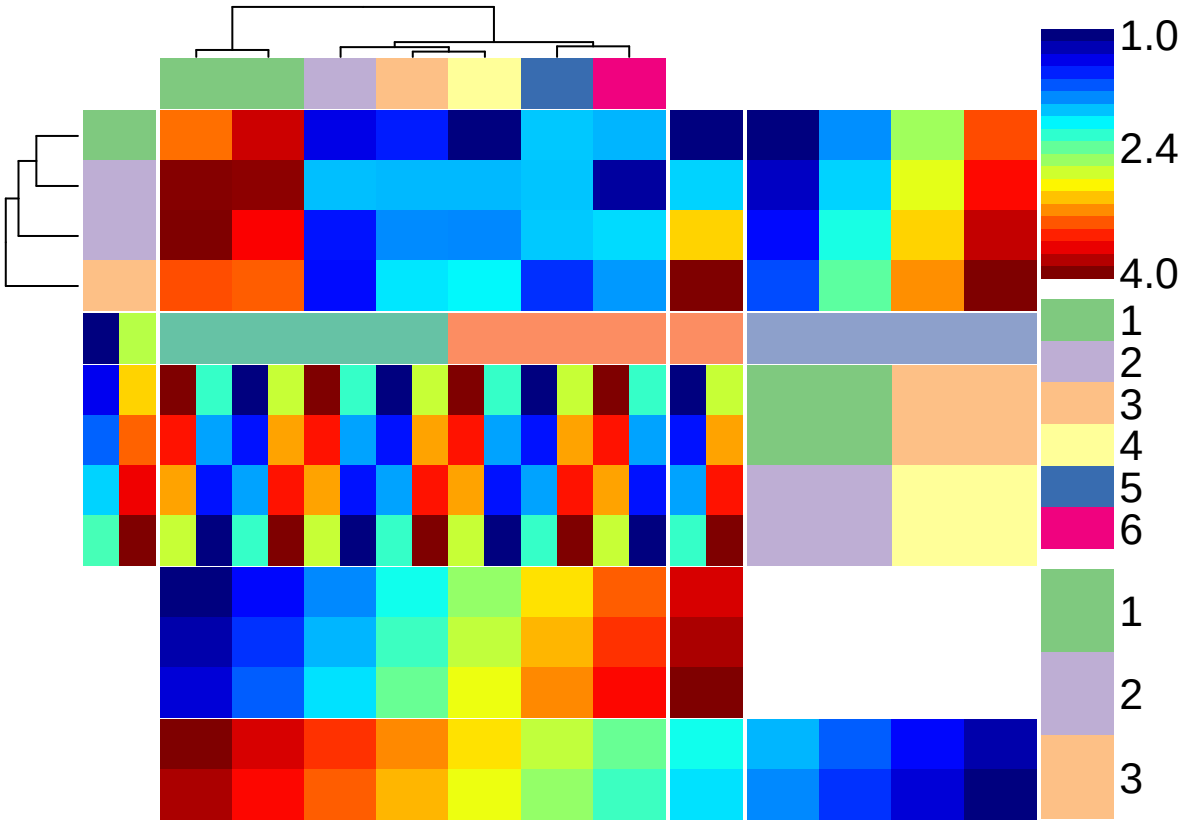
Another to the right of h3

```
a <- a + WHeatmap(
  matrix(1:4,nrow=2), RightOf('h3', h.scale='h2'), 'h4')
a <- a + WHeatmap(
  matrix(1:24,nrow=3), Beneath('h3'), 'h5')
a <- a + WHeatmap(
  matrix(24:1,nrow=2),
  Beneath('h5', h.aln=WGroupColumn('h1','c3','h2')), 'h6')
a
```



Let's add legend

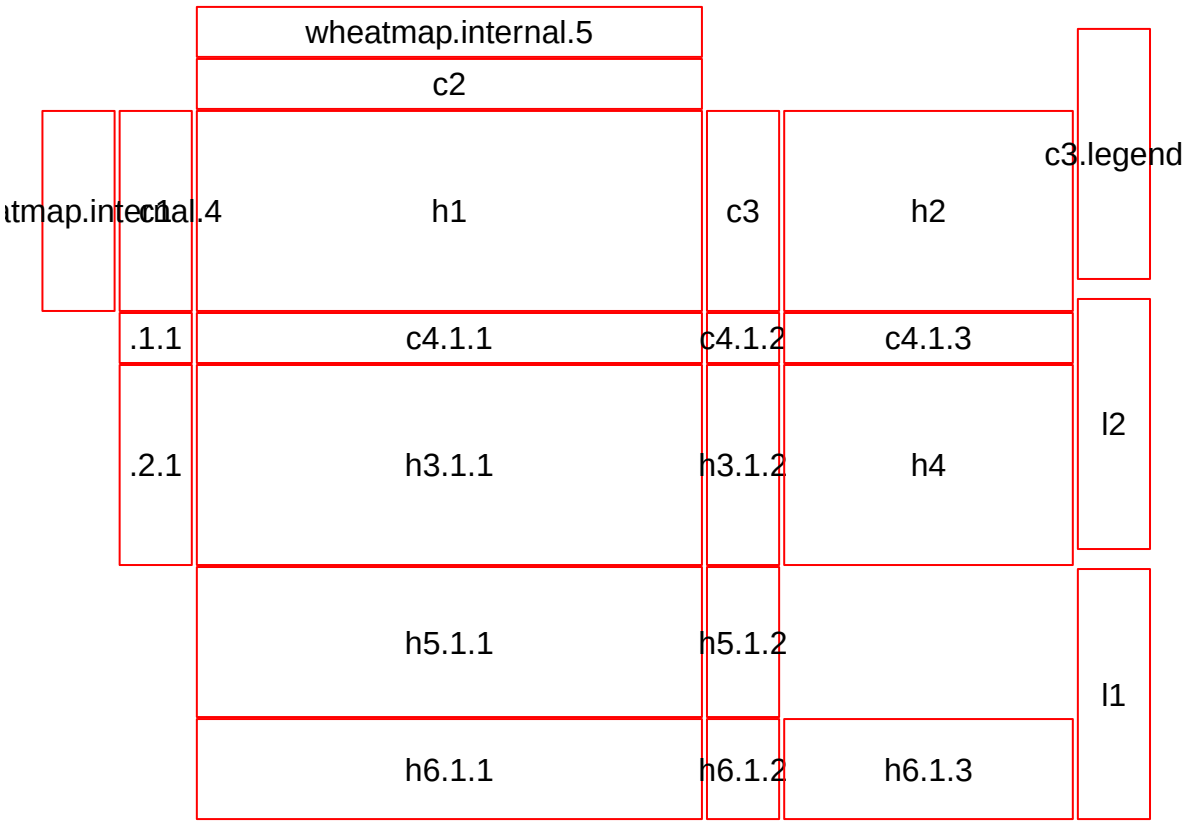
```
a <- a + WLegendV('c1', RightOf('h6.1.3'), 'l1')
a <- a + WLegendV('c2', TopOf('l1', pad=0.1), 'l2')
a <- a + WLegendV('c3', TopOf('l2', pad=0.1), n.text=3)
a
```



Show layout

We can view the internal layout by the providing the `layout.only=TRUE` option. This is useful to see the labeling visually.

```
print(a, layout.only=TRUE)
```



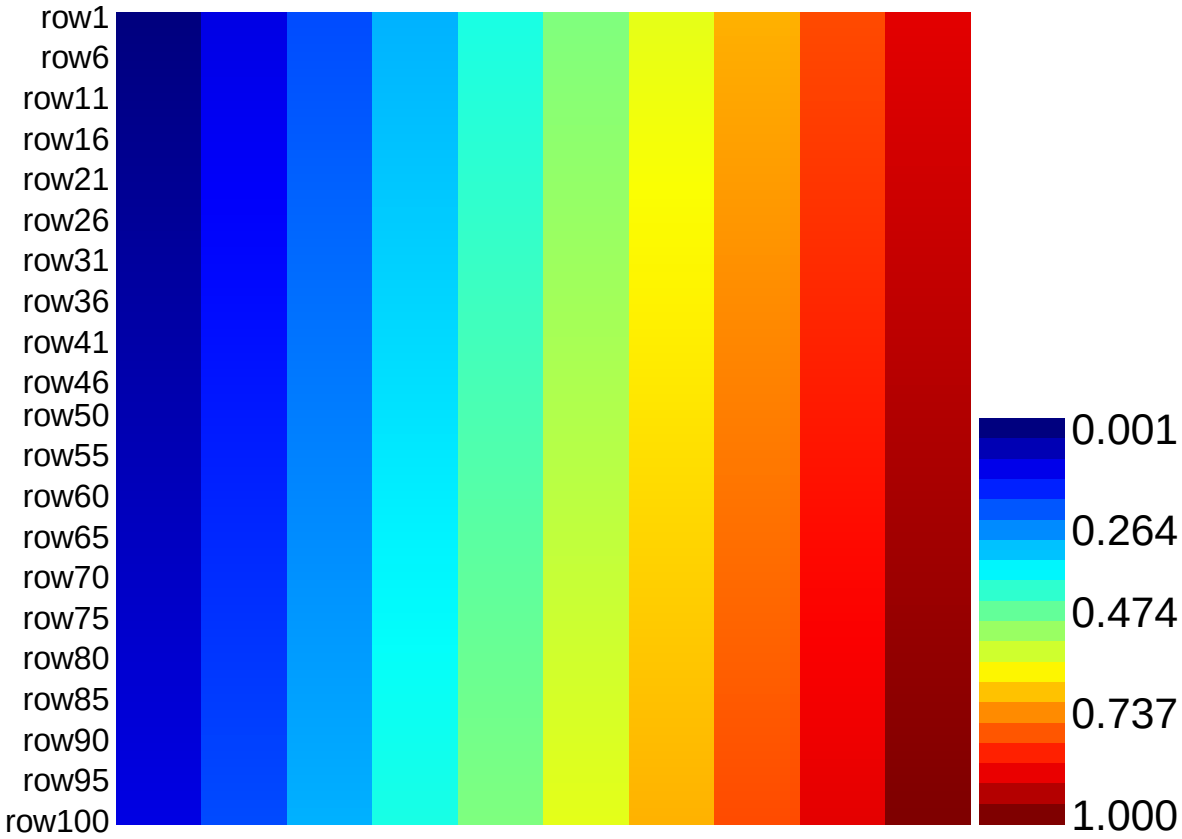
Declutter text labels

Wheatmap automatically de-cluttered the labels when there are too many. Below is an example of too many labels:

```
load_all('~/tools/wheatmap/wheatmap/')
```

```
## Loading wheatmap
```

```
m <- matrix((1:1000)/1000, nrow=100)
rownames(m) <- paste0('row', 1:100)
WHeatmap(m, yticklabels = TRUE) + WLegendV(NULL, RightOf(), height=0.5)
```


row1
row6
row11
row16
row21
row26
row31
row36
row41
row46
row50
row55
row60
row65
row70
row75
row80
row85
row90
row95
row100
0.001
0.264
0.474
0.737
1.000