

TissueDrawing

Technical details and regression checks

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1 The VDedgeDrawn object

A `VDedgeDrawn` object encodes a description of an edge. It has two subclasses, representing polygons and circular segments. Edges are unique. If two set boundaries overlap they are described by a common edge on the overlap. The orientation of an edge is important. An edge whose name starts with a '-' is interpreted as the reversal of the edge with the same name without the '-' (and only the latter is stored in the diagram's list of edges). Edge names are unique.

Most edges form the boundaries of both Faces and Sets. The exception is invisible edges which are added between otherwise disjoint sets to ensure the diagram is not disjoint.

Edges have bounding boxes in the `bb` slot, although I am not sure if these are always correctly updated upon the joining or splitting of edges.

1.1 The VDedgeSector object

A `VDedgeSector` object inherits from a `VDedgeDrawn` one. A sector is a segment of a circle, defined by two points, together with the convention that a right-handed sector goes clockwise (Figure 1). Angles are all interpreted in the same way as `atan2`, ie clockwise from the line $y = 0$. The angles of the beginning θ_f and end θ_t of the segment obey $2\pi \geq \theta_f > 0$ and $\theta_f > \theta_t > -2 * \pi$.

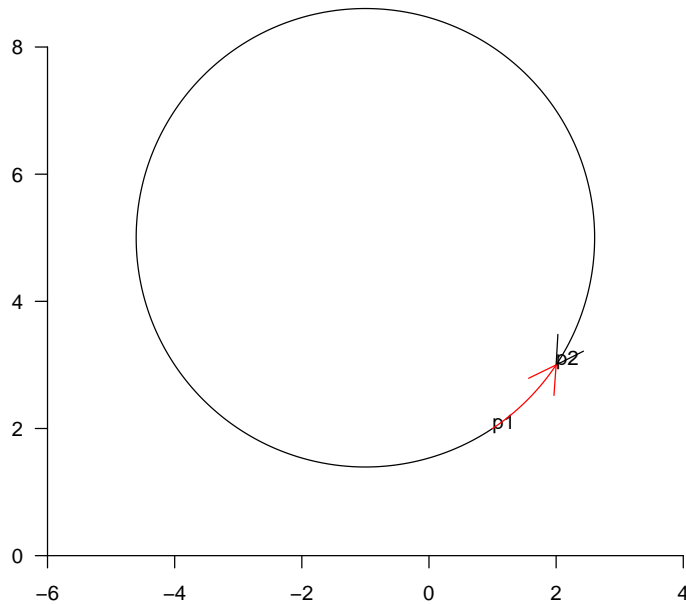


Figure 1: In black, a right-handed edge sector, and in red a left-handed one

1.2 The `VDedgeLines` object

A `VDedgeSector` object inherits from a `VDedgeDrawn` one and describes polygonal edges.

1.3 Edge methods

Edges can be shown, split at a point, converted to xy coordinates, or reversed. It can have a 'midpoint' found on its interior. A point can be tested to see if it lies on an edge. Pairs of edges can be tested for identity, joined together (not much used and barely tested), and crucially can be tested for intersection.

2 Faces

Individual faces within a diagram are stored as a vector of edge names describing an oriented traversal of the face.

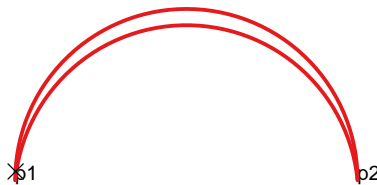


Figure 2: A face which doesn't contain its centroid

3 Joining disjoint faces

```
> .PlotArcs <- function(drawing, edgeNames) {  
+   if (missing(edgeNames)) { edgeNames=names(drawing@edgeList)}  
}
```

```

+         exy <- lapply(drawing@edgeList[edgeNames], Vennerable:::.edge.to.xy)
+         lapply(exy, function(xy){grid.lines(xy[,1],xy[,2],arrow=arrow(),default.units="na
+         }
>

> VD2 <- compute.Venn(Venn(n=2))
> VD3 <- Vennerable:::newTissueFromCircle (centre.xy =c(2,0), radius=.6,Set=3)
> VD23 <- VD2
> VD23@faceList <- c(VD2@faceList,VD3@faceList)
> VD23@edgeList <- c(VD2@edgeList,VD3@edgeList)
> VD23@setList <- c(VD2@setList,VD3@setList)

> grid.newpage()
> pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-2,3),c(-2,2));grid.xaxis();grid.yaxis()
> cejf <- Vennerable:::.create.edge.joining.faces(VD23,"DarkMatter","1")
> VD23 <- cejf$drawing
> PlotSetBoundaries(VD23)
> .PlotArcs(VD23)

$`i24|i23|1`
lines[GRID.lines.5842]

$`i24|i23|2`
lines[GRID.lines.5843]

$`i23|i24|1`
lines[GRID.lines.5844]

$`i23|e25|2`
lines[GRID.lines.5845]

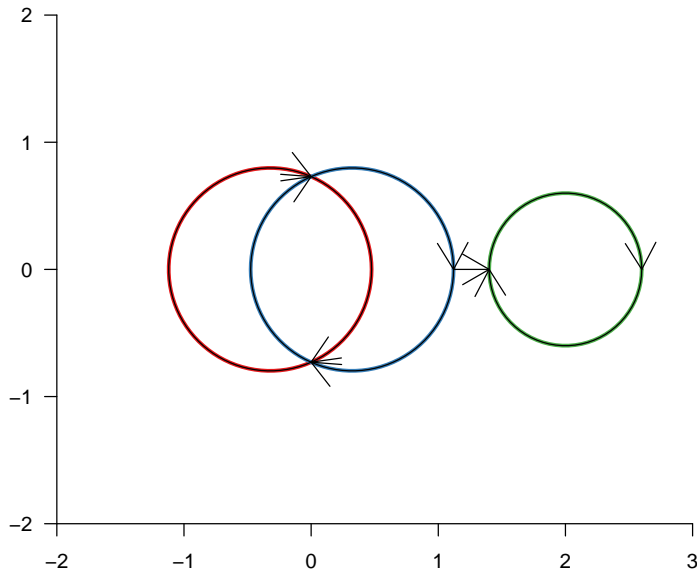
$`e25|i24|2`
lines[GRID.lines.5846]

$`c31|e26|3`
lines[GRID.lines.5847]

$`e26|c31|3`
lines[GRID.lines.5848]

$`e25|e26|invisible`
lines[GRID.lines.5849]

```



4 The TissueDrawing object

First we test constructing them from scratch.

```
> VD.nodeList <- list(p1=matrix(1:2,ncol=2),p2=matrix(2:3,ncol=2),p3=matrix(c(-1,0),ncol=2)
> sectorfromto <- function(sector,from,to,nodeList) {
+   sector@from <- from
+   sector@to <- to
+   from.point<- nodeList[[from]]
+   sector@fromTheta <- Vennerable:::point.xy.to.theta(from.point,sector@centre)
+   sector@toTheta <- Vennerable:::point.xy.to.theta(nodeList[[to]],sector@centre)
+   sector <- Vennerable:::normalise.sector(sector)
+ }
> centre = c(-1,5)
> fromTheta <- Vennerable:::point.xy.to.theta(nodeList[["p1"]],centre)
> toTheta <- Vennerable:::point.xy.to.theta(nodeList[["p2"]],centre)
> lh <- Vennerable:::newEdgeSector(centre=c(-1,5),hand=1,fromTheta=fromTheta,toTheta=toTheta)
> lh <- sectorfromto(lh,"p1","p2",VD.nodeList)
> centre = c(4,0)
> fromTheta <- Vennerable:::point.xy.to.theta(nodeList[["p1"]],centre)
> toTheta <- Vennerable:::point.xy.to.theta(nodeList[["p2"]],centre)
> rh <- Vennerable:::newEdgeSector(centre=c(4,0),hand=1,fromTheta=fromTheta,toTheta=toTheta)
> el <- Vennerable:::newEdgeLines(from="p1",to="p3",xy=matrix(c(1,2,-0.5,0,-1,0),ncol=2,byrow=T))
> VD.edgeList <- list("p1|p2|1"=sectorfromto(lh,"p1","p2",VD.nodeList),
+   "p2|p1|1"=sectorfromto(rh,"p2","p1",VD.nodeList),
```

```

+           "p1|p2|2"=sectorfromto(rh,"p1","p2",VD.nodeList),
+           "p2|p1|2"=sectorfromto(rh,"p2","p1",VD.nodeList),
+           "p1|p3|3"=e1,
+           "p3|p1|3"=Vennerable:::newEdgeLines(from="p3",to="p1",xy=matrix(c(-
+           )
> VD.faceList <- list("100"=c("p1|p2|1","-p1|p2|2"),"110"=c("p1|p2|2","p2|p1|1"),"010"=c("
+ #           "DarkMatter"=c("p1|p2|1","p2|p1|2","p1|p3|3","p3|p1|3"))
+           "DarkMatter"=c("-p3|p1|3","-p1|p3|3","-p2|p1|2","-p1|p2|1"))
> VD.setList <- list("1"=c("p1|p2|1","p2|p1|1"),
+                   "2"=c("p1|p2|2","p2|p1|2"),
+                   "3"=c("p1|p3|3","p3|p1|3")
+                   )
> VD.faceSignature <- lapply(names(VD.faceList),function(x){x}); names(VD.faceSignature) <-
> VD <- new("TissueDrawing",nodeList =VD.nodeList ,
+         edgeList =VD.edgeList ,setList=VD.setList,faceList=VD.faceList,faceSignature=VD.
> Vennerable:::validateDrawing(VD)

Validating a drawing on 3 sets.....done

> VD

      from to      type npoints centre hand
p1|p2|1  p1 p2 VDedgeSector      NA   -1,5   1
p2|p1|1  p2 p1 VDedgeSector      NA   -1,5   1
p1|p2|2  p1 p2 VDedgeSector      NA    4,0   1
p2|p1|2  p2 p1 VDedgeSector      NA    4,0   1
p1|p3|3  p1 p3 VDedgeLines        3  <NA>  NA
p3|p1|3  p3 p1 VDedgeLines        2  <NA>  NA
      X1 X2
p1    1  2
p2    2  3
p3   -1  0

                                faces
100                             p1|p2|1;-p1|p2|2
110                             p1|p2|2;p2|p1|1
010                             p2|p1|2;-p2|p1|1
001                             p1|p3|3;p3|p1|3
DarkMatter -p3|p1|3;-p1|p3|3;-p2|p1|2;-p1|p2|1
                                sig
100                             100
110                             110
010                             010
001                             001
DarkMatter DarkMatter
paste.face..collapse.....
1          p1|p2|1;p2|p1|1
2          p1|p2|2;p2|p1|2
3          p1|p3|3;p3|p1|3

> Vennerable:::checkPointOnEdge(edge=VD@edgeList[["p1|p2|1"]],point.xy=VD@nodeList[["p1"]])
[1] TRUE

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-7,7),c(-5,10))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VD)
> PlotSetBoundaries(VD)
> PlotNodes(VD)

```

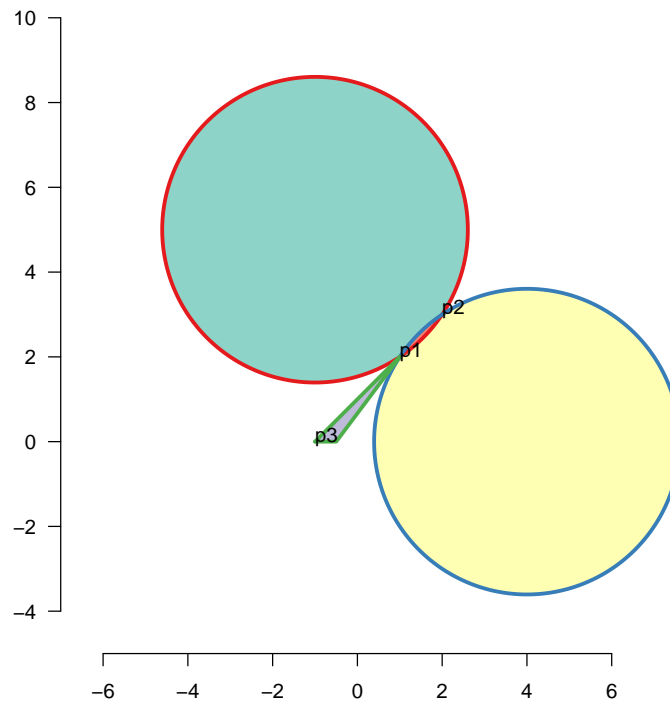


Figure 3: Constructing TissueDrawing objects from scratch

5 Injecting points and edges

We test injecting points

```

> p4 <- matrix(c(7,-2),ncol=2); rownames(p4) <- "p4"
> VD4 <- Vennerable:::injectPoint(drawing=VD,edgeName="p2|p1|2",newPoint=p4)
> Vennerable:::.validateDrawing(VD4)

```

Validating a drawing on 3 sets.....done

```
> VD4
```

	from	to	type	npoints	centre	hand
p1 p2 1	p1	p2	VDedgeSector	NA	-1,5	1
p2 p1 1	p2	p1	VDedgeSector	NA	-1,5	1
p1 p2 2	p1	p2	VDedgeSector	NA	4,0	1

```

p1|p3|3  p1 p3  VDedgeLines      3  <NA>  NA
p3|p1|3  p3 p1  VDedgeLines      2  <NA>  NA
p2|p4|2  p2 p4  VDedgeSector     NA   4,0   1
p4|p1|2  p4 p1  VDedgeSector     NA   4,0   1
  X1 X2
p1  1  2
p2  2  3
p3 -1  0
p4  7 -2

                                faces
100                                p1|p2|1;-p1|p2|2
110                                p1|p2|2;p2|p1|1
010                                p2|p4|2;p4|p1|2;-p2|p1|1
001                                p1|p3|3;p3|p1|3
DarkMatter -p3|p1|3;-p1|p3|3;-p4|p1|2;-p2|p4|2;-p1|p2|1
  sig
100                                100
110                                110
010                                010
001                                001
DarkMatter DarkMatter
  paste.face..collapse.....
1                                p1|p2|1;p2|p1|1
2                                p1|p2|2;p2|p4|2;p4|p1|2
3                                p1|p3|3;p3|p1|3

> p5 <- matrix(c(-3,2),ncol=2); rownames(p5) <- "p5"
> VD4 <- Vennerable:::injectPoint(VD4,edgeName="p1|p2|1",newPoint=p5)
> Vennerable:::.validateDrawing(VD4)

Validating a drawing on 3 sets.....done

> VD4

      from to      type npoints centre hand
p2|p1|1  p2 p1 VDedgeSector     NA   -1,5   1
p1|p2|2  p1 p2 VDedgeSector     NA    4,0   1
p1|p3|3  p1 p3 VDedgeLines       3  <NA>  NA
p3|p1|3  p3 p1 VDedgeLines       2  <NA>  NA
p2|p4|2  p2 p4 VDedgeSector     NA    4,0   1
p4|p1|2  p4 p1 VDedgeSector     NA    4,0   1
p1|p5|1  p1 p5 VDedgeSector     NA   -1,5   1
p5|p2|1  p5 p2 VDedgeSector     NA   -1,5   1
  X1 X2
p1  1  2
p2  2  3
p3 -1  0
p4  7 -2
p5 -3  2

                                faces
100                                p1|p5|1;p5|p2|1;-p1|p2|2

```

```

110                p1|p2|2;p2|p1|1
010                p2|p4|2;p4|p1|2;-p2|p1|1
001                p1|p3|3;p3|p1|3
DarkMatter -p3|p1|3;-p1|p3|3;-p4|p1|2;-p2|p4|2;-p5|p2|1;-p1|p5|1
                sig
100                100
110                110
010                010
001                001
DarkMatter DarkMatter
  paste.face..collapse.....
1    p1|p5|1;p5|p2|1;p2|p1|1
2    p1|p2|2;p2|p4|2;p4|p1|2
3    p1|p3|3;p3|p1|3

```

Then we try injecting single edges

```

> p1p4.line <- Vennerable:::newEdgeLines(from="p1",to="p4",xy=matrix(c(1,2,7,-2),ncol=2,by
> p5p1.line <- Vennerable:::newEdgeLines(from="p5",to="p1",xy=matrix(c(-3,2,1,2),ncol=2,by
> p4p5.line <- Vennerable:::newEdgeLines(from="p4",to="p5",xy=matrix(c(7,-2,7,-4,-3,-4,-3,
> VD6 <- VD4
> VD6@setList[["4"]] <- c("p4|p5|4","p5|p1|4","p1|p4|4")
> VD6@edgeList <- c(VD6@edgeList,list("p1|p4|4"=p1p4.line,"p5|p1|4"=p5p1.line,"p4|p5|4"=p4
> VD6 <- Vennerable:::injectEdge(drawing=VD6,newEdgeList=VD6@edgeList["p1|p4|4"],set2Name=
> VD6 <- Vennerable:::injectEdge(drawing=VD6,newEdgeList=list("p5|p1|4"=p5p1.line),set2Nam
> VD6 <- Vennerable:::injectEdge(drawing=VD6,newEdgeList=list("p4|p5|4"=p4p5.line),set2Nam
> Vennerable:::.is.face.within.set(drawing=VD6,faceName="0101",setName="2")

[1] TRUE

> Vennerable:::.is.face.within.set(drawing=VD6,faceName="1000",setName="2")

[1] FALSE

> Vennerable:::.is.face.within.set(drawing=VD6,faceName="0001",setName="2")

[1] FALSE

> #Vennerable:::validateDrawing(VD6)
> # will fail because not all faces renamed into Vennness
> VD6

```

	from	to	type	npoints	centre	hand
p2 p1 1	p2	p1	VDedgeSector	NA	-1,5	1
p1 p2 2	p1	p2	VDedgeSector	NA	4,0	1
p1 p3 3	p1	p3	VDedgeLines	3	<NA>	NA
p3 p1 3	p3	p1	VDedgeLines	2	<NA>	NA
p2 p4 2	p2	p4	VDedgeSector	NA	4,0	1
p4 p1 2	p4	p1	VDedgeSector	NA	4,0	1
p1 p5 1	p1	p5	VDedgeSector	NA	-1,5	1
p5 p2 1	p5	p2	VDedgeSector	NA	-1,5	1
p1 p4 4	p1	p4	VDedgeLines	2	<NA>	NA

```

p5|p1|4   p5 p1  VDedgeLines      2  <NA>  NA
p4|p5|4   p4 p5  VDedgeLines      4  <NA>  NA

```

```

  X1 X2
p1  1  2
p2  2  3
p3 -1  0
p4  7 -2
p5 -3  2

```

```

                                     faces
110                                 p1|p2|2;p2|p1|1
001                                 p1|p3|3;p3|p1|3
DarkMatter                         -p2|p4|2;-p5|p2|1;-p4|p5|4
0101                                p1|p4|4;p4|p1|2
0100                               -p2|p1|1;p2|p4|2;-p1|p4|4
1001                                p5|p1|4;p1|p5|1
1000                               p5|p2|1;-p1|p2|2;-p5|p1|4
0001      p4|p5|4;-p1|p5|1;-p3|p1|3;-p1|p3|3;-p4|p1|2

```

```

      sig
110      110
001      001
DarkMatter DarkMatter
0101      0101
0100      0100
1001      1001
1000      1000
0001      0001

```

```

paste.face..collapse.....
1   p1|p5|1;p5|p2|1;p2|p1|1
2   p1|p2|2;p2|p4|2;p4|p1|2
3       p1|p3|3;p3|p1|3
4   p4|p5|4;p5|p1|4;p1|p4|4

```

```

> VD8 <- VD6
> p7 <- matrix(c(-2,1),ncol=2); rownames(p7) <- "p7";
> VD8@nodeList[["p7"]] <- p7;
> p8 <- matrix(c(-6,0),ncol=2); rownames(p8) <- "p8";
> VD8@nodeList[["p8"]] <- p8;
> p9 <- matrix(c(-3,0),ncol=2); rownames(p9) <- "p9";
> VD8@nodeList[["p9"]] <- p9;
> p5p7.line <- Vennerable:::newEdgeLines(from="p5",to="p7",xy=matrix(c(-3,2,-2,1),ncol=2,b
> p7p9.line <- Vennerable:::newEdgeLines(from="p7",to="p9",xy=matrix(c(-2,1,-3,0),ncol=2,b
> p9p8.line <- Vennerable:::newEdgeLines(from="p9",to="p8",xy=matrix(c(-3,0,-6,0),ncol=2,b
> p8p5.line <- Vennerable:::newEdgeLines(from="p8",to="p5",xy=matrix(c(-6,0,-3,2),ncol=2,b
> VD8@edgeList[["p5|p7|5"]] <- p5p7.line
> VD8@edgeList[["p7|p9|5"]] <- p7p9.line
> VD8@edgeList[["p9|p8|5"]] <- p9p8.line
> VD8@edgeList[["p8|p5|5"]] <- p8p5.line
> VD8@setList[["5"]] <- c("p5|p7|5","p7|p9|5","p9|p8|5","p8|p5|5")
> VD8@edgeList[["p4|p5|4"]]@xy

```

```

[,1] [,2]

```

```

[1,]    7   -2
[2,]    7   -4
[3,]   -3   -4
[4,]   -3    2

> VD8 <- Vennerable:::injectPoint(drawing=VD8,edgeName="p4|p5|4",newPoint=VD8@nodeList[["p
> VD8@edgeList[["p9|p5|4"]]@xy

      [,1] [,2]
[1,]   -3    0
[2,]   -3    2

> VD8@edgeList[["p4|p9|4"]]@xy

      [,1] [,2]
[1,]     7   -2
[2,]     7   -4
[3,]    -3   -4
[4,]    -3    0

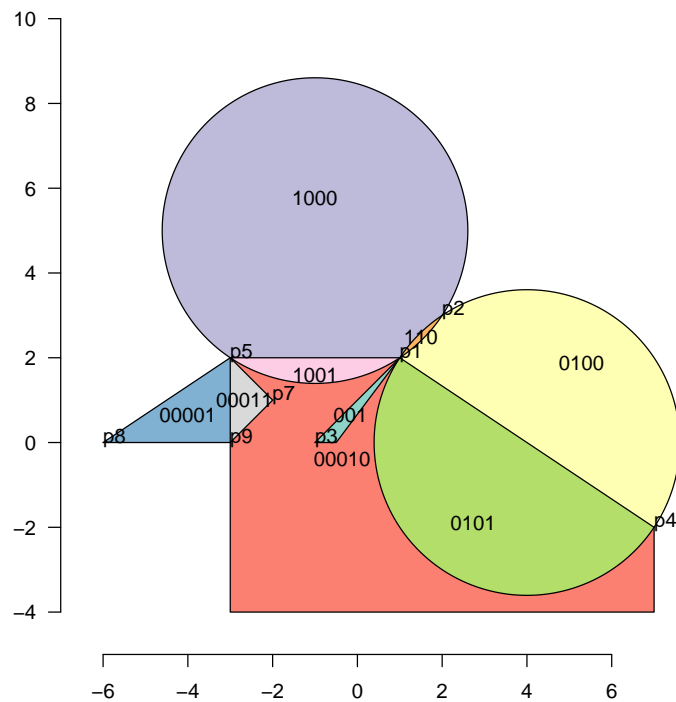
> VD8 <- Vennerable:::injectEdge(drawing=VD8,newEdgeList=VD8@edgeList[c("p5|p7|5", "p7|p9|5
> VD8 <- Vennerable:::injectEdge(drawing=VD8,newEdgeList=VD8@edgeList[c("p9|p8|5", "p8|p5|5
> # will also fail by incompleteness
> #Vennerable:::validateDrawing(VD8)

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-7,7),c(-5,10))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VD8)
> PlotSetBoundaries(VD8,gp=gpar(lwd=2,col=c("red","blue","green","black","orange")))
> Vennerable:::PlotFaceNames.TissueDrawing (VD8)
> PlotNodes(VD8)

```



6 Making a simple drawing from a circle

```

> centre.xy <- c(0,0)
> VDC1 <- Vennerable:::newTissueFromCircle(centre.xy,radius=2,Set=1)
> VDC2 <- Vennerable:::newTissueFromCircle(centre.xy+c(0,1.5),radius=1,Set=2)
> Vennerable:::validateDrawing(VDC2)

```

Validating a drawing on 1 sets.....done

```

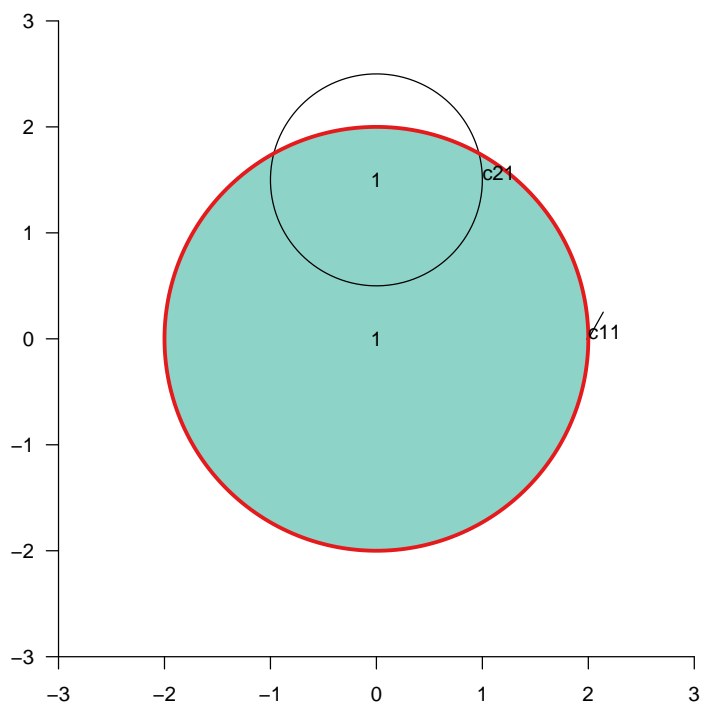
>
>
>

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> xy <- Vennerable:::edge.to.xy(VDC1@edgeList[[1]]); grid.lines(xy[,1],xy[,2],default.uni
> PlotFaces(VDC1)
> PlotFaces(VDC2,gp=gpar(fill="red"))
> PlotSetBoundaries(VDC1)
> Vennerable:::PlotFaceNames.TissueDrawing (VDC1)
> PlotNodes(VDC1)
> PlotNodes(VDC2)
> Vennerable:::PlotFaceNames.TissueDrawing (VDC2)
>

```



7 Circles

```

> r = 0.6; d = 0.4;
> angles <- pi/2-c( 0, 2*pi/3, 4 * pi/3)
> x <- d*cos(angles)
> y <- d*sin(angles)
> r <- rep(r,3)
> centres <- matrix(c(x,y),ncol=2,byrow=FALSE)
> VDC1 <- Vennerable:::newTissueFromCircle(centres[1,],radius=r[1],Set=1);
> VDC2 <- Vennerable:::newTissueFromCircle(centres[2,],radius=r[2],Set=2);

```

```

> TM <- Vennerable:::addSetToDrawing (drawing1=VDC1,drawing2=VDC2,set2Name="Set2")
> VDC3 <- Vennerable:::newTissueFromCircle(centres[3,],radius=r[3],Set=3);
> TM <- Vennerable:::addSetToDrawing (drawing1=TM,drawing2=VDC3,set2Name="Set3")
> Vennerable:::.validateDrawing(TM)

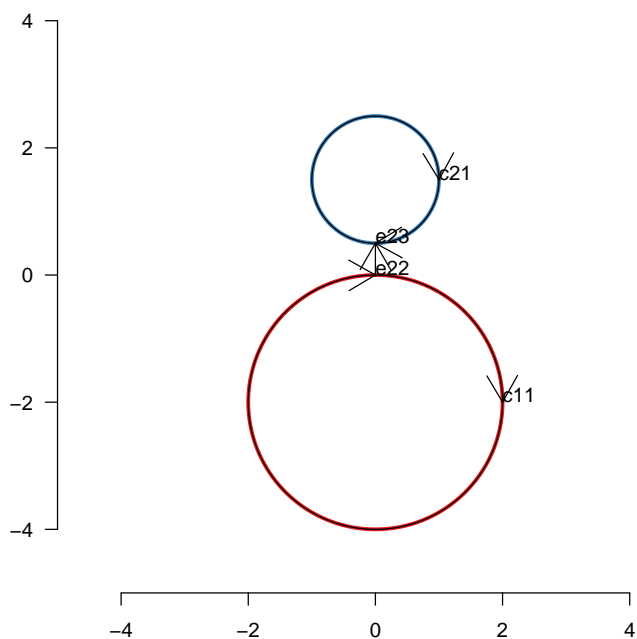
```

Validating a drawing on 3 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-1.5,1.5),c(-1.5,1.5))
> grid.xaxis()
> grid.yaxis()
> PlotSetBoundaries(TM);PlotNodes(TM)
> shoar(TM);

```



7.1 Non overlapping circles

```

> centre.xy <- c(0,-2)
> VDC1 <- Vennerable:::newTissueFromCircle(centre.xy,radius=2,Set=1)
> VDC2 <- Vennerable:::newTissueFromCircle(centre.xy+c(0,3.5),radius=1,Set=2)
> TN2 <- Vennerable:::addSetToDrawing(VDC1,VDC2)
> VDC3 <- Vennerable:::newTissueFromCircle(c(0,-.5),radius=1,Set=3)
> Vennerable:::.validateDrawing(TN2)

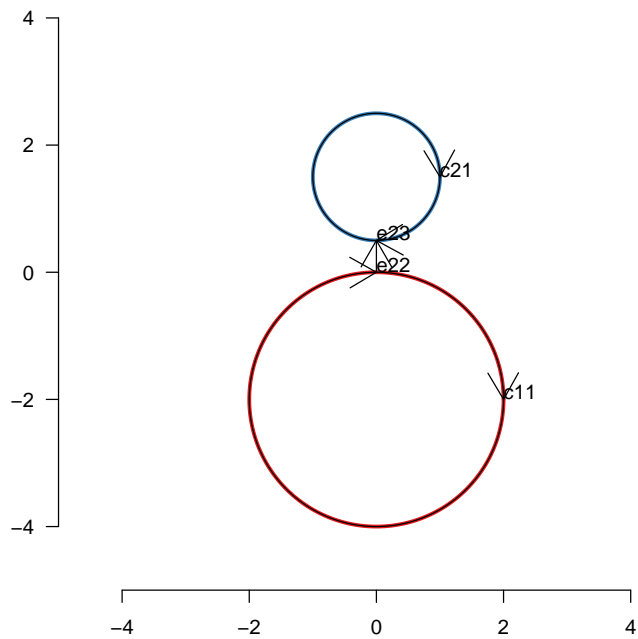
```

Validating a drawing on 2 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-5,5),c(-5,5))
> grid.xaxis()
> grid.yaxis()
> PlotSetBoundaries(TN2);PlotNodes(TN2)
> shoar(TN2);

```



7.2 Example of bug 528

```

> centre.xy <- c(0,-2)
> VDC1b <- Vennerable:::newTissueFromCircle(centre.xy,radius=2,Set=1)
> VDC2b <- Vennerable:::newTissueFromCircle(centre.xy+c(0,3),radius=1,Set=2)
> TN2b <- (Vennerable:::addSetToDrawing(VDC1b,VDC2b))
> TN2b

```

	from	to	type	npoints	centre	hand
c11 i23 1	c11	i23	VDedgeSector	NA	0,-2	1
i23 c11 1	i23	c11	VDedgeSector	NA	0,-2	1
c21 i23 2	c21	i23	VDedgeSector	NA	0,1	1
i23 c21 2	i23	c21	VDedgeSector	NA	0,1	1
	X1	X2				
c11	2	-2				
i23	0	0				
c21	1	1				

faces

```

10                                c11|i23|1;i23|c11|1
DarkMatter -c11|i23|1;-i23|c11|1;-c21|i23|2;-i23|c21|2
01                                i23|c21|2;c21|i23|2
                                sig
10                                10
DarkMatter DarkMatter
01                                01
                                paste.face..collapse.....
Set1                             c11|i23|1;i23|c11|1
Set2                             c21|i23|2;i23|c21|2

```

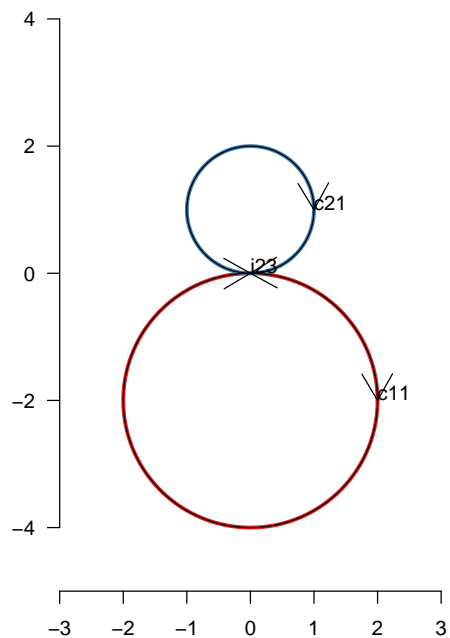
```
> (Vennerable:::validateDrawing(TN2b))
```

```
Validating a drawing on 2 sets.....done
NULL
```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-5,5))
> grid.xaxis()
> grid.yaxis()
> PlotSetBoundaries(TN2b)
> PlotNodes(TN2b)
> shoar(TN2b)

```



7.3 Ellipses

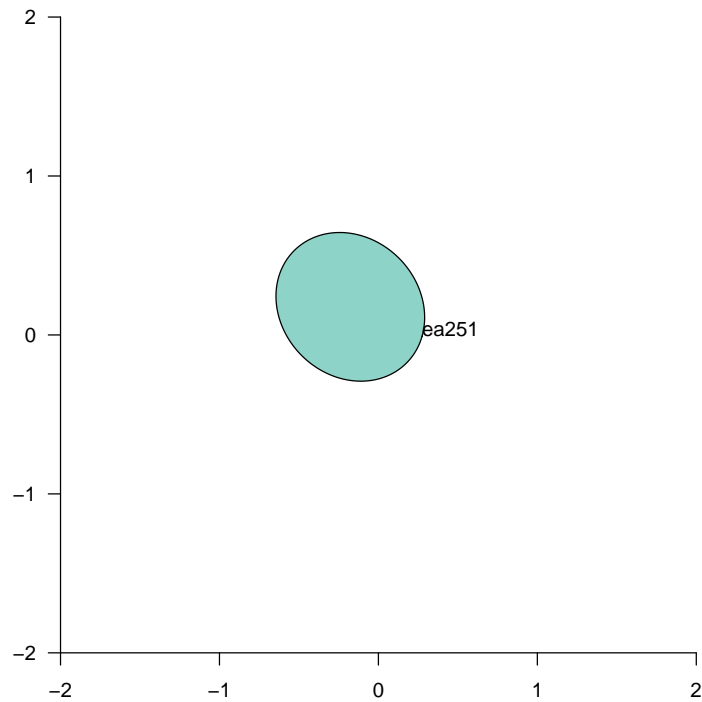
Ellipses could be copied with specially by finding roots of quartics, but don't bother and just generate them as polygons

```
> VE <- Vennerable:::newTissueFromEllipse (f1=c(0,0),phi=pi/4,e=.5,a=0.5,Set=1)
> Vennerable:::validateDrawing(VE)
```

Validating a drawing on 1 sets.....done

>

```
> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-2,2),c(-2,2))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VE)
> PlotSetBoundaries(VE,gp=gpar(lwd=2,col=c("red","blue","green")))
> PlotNodes(VE)
```



```
> phi <- 0.8; dex <- 1.7;dey <- 2.5; a<- 7.6; e<- 0.9
> x0 <- c( -0.9, -5.0)
> VE <- list()
> dx <- 0.2
> VE[[1]] <- Vennerable:::newTissueFromEllipse (x0+c(0,0),-phi ,e,-a,Set=1,dx=dx)
> VE[[2]] <- Vennerable:::newTissueFromEllipse (x0+c(dex,0),phi ,e,a,Set=2,dx=dx)
```

```

> VE[[3]] <- Vennerable:::newTissueFromEllipse (x0+c(-dey,dey),-phi ,e,-a,Set=3,dx
> VE[[4]] <- Vennerable:::newTissueFromEllipse (x0+c(dex+dey,dey),phi ,e,a,Set=4,d
> TM <- VE[[1]]
> TM2 <- Vennerable:::addSetToDrawing(TM,VE[[2]],set2Name=paste("Set",2,sep=""))
> TM3 <- Vennerable:::addSetToDrawing(TM2,VE[[3]],set2Name=paste("Set",3,sep=""))
> TM4 <- Vennerable:::addSetToDrawing(TM3,VE[[4]],set2Name=paste("Set",4,sep=""))
> Vennerable:::validateDrawing(TM4)

```

```

Validating a drawing on 4 sets.....done
sig 0100 duplicated in faces 0100;0100-1
sig 1000 duplicated in faces 1000;1000-1

```

8 Check for the intersection of two edges

```

> centre.xy <- c(0,0)
> VDC1 <- Vennerable:::newTissueFromCircle(centre.xy,radius=2,Set=1);
> #renameFaces(VDC1,oldName=Vennerable:::faceNames(VDC1,onlyVisible=TRUE),"1")
> VDC2 <- Vennerable:::newTissueFromCircle(centre.xy+c(0,1.5),radius=1,Set=2)
> edge1 <- VDC1@edgeList[[1]]
> edge2 <- VDC2@edgeList[[1]]
> Vennerable:::findIntersection (edge1,edge2)

      [,1] [,2]
[1,] -0.9682458 1.75
[2,]  0.9682458 1.75

> edge1 <- VD8@edgeList[["p1|p4|4"]]
> edge2 <- VDC2@edgeList[[1]]
> Vennerable:::findIntersection(edge1,edge2) # no intersections

      [,1] [,2]

> edge1 <- VD8@edgeList[["p1|p4|4"]]
> edge2 <- VD8@edgeList[["p2|p4|2"]]
> Vennerable:::findIntersection(edge1,edge2) # are two intersections

      [,1] [,2]
[1,]    7  -2

> Vennerable:::find.point.within.face(drawing=VD8,faceName="1001")

      [,1]      [,2]
[1,]   -1  1.603431
attr(,"names")
[1] "centroid" NA

> Vennerable:::is.point.within.face (VD8,"DarkMatter",p7)

[1] FALSE

> Vennerable:::is.point.within.face (VD8,"DarkMatter",matrix(c(-100,100),ncol=2))

```

```

[1] TRUE

> edge1 <- VD8@edgeList[["p1|p4|4"]]
> edge2 <- VD8@edgeList[["p1|p3|3"]]
> Vennerable:::.findIntersection(edge1,edge2)

      [,1] [,2]
ict    1    2

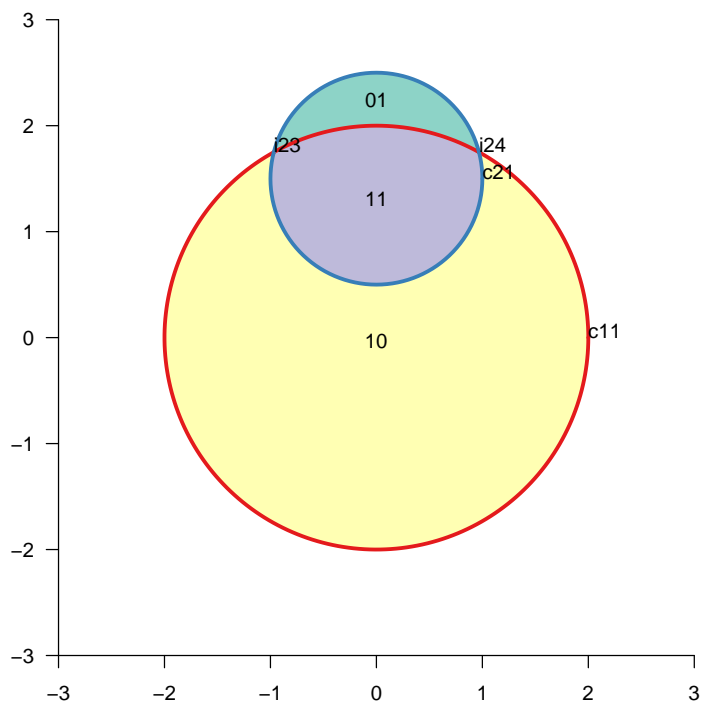
> drawing1 <- VDC1; drawing2 <- VDC2
> VM <- Vennerable:::.addSetToDrawing (drawing1=VDC1,drawing2=VDC2,set2Name="Set2")
> Vennerable:::.validateDrawing(VM)

Validating a drawing on 2 sets.....done

>

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VM)
> PlotSetBoundaries(VM)
> Vennerable:::.PlotFaceNames.TissueDrawing (VM)
> PlotNodes(VM)
>

```



9 Vennerable::**addSetToDrawing** two polygons

```
> d <- 1 ; s1 <- 0.7; s2 <- 0.6
> d <- 0.9146274 ; s1 <- 2.449490 ; s2 <- 2.645751
> l1 <- -d/2-s1/2; l2 <- d/2-s2/2
> r1 <- -d/2+s1/2; r2 <- d/2+s2/2
> poly.1 <- matrix(c(l1,-s1/2,l1,s1/2,r1,s1/2,r1,-s1/2),ncol=2,byrow=TRUE)
> rownames(poly.1) <- paste("s",1:4,sep="")
> poly.2 <- matrix(c(l2,-s2/2,l2,s2/2,r2,s2/2,r2,-s2/2),ncol=2,byrow=TRUE)
> rownames(poly.2) <- paste("s",2:5,sep="")
> VDP1 <- Vennerable::newTissueFromPolygon(points.xy=poly.1,Set=1)
> VDP2 <- Vennerable::newTissueFromPolygon(points.xy=poly.2,Set=2)
> TM <- Vennerable::addSetToDrawing (drawing1=VDP1 ,drawing2=VDP2, set2Name="Set2")
> Vennerable::validateDrawing(TM)
```

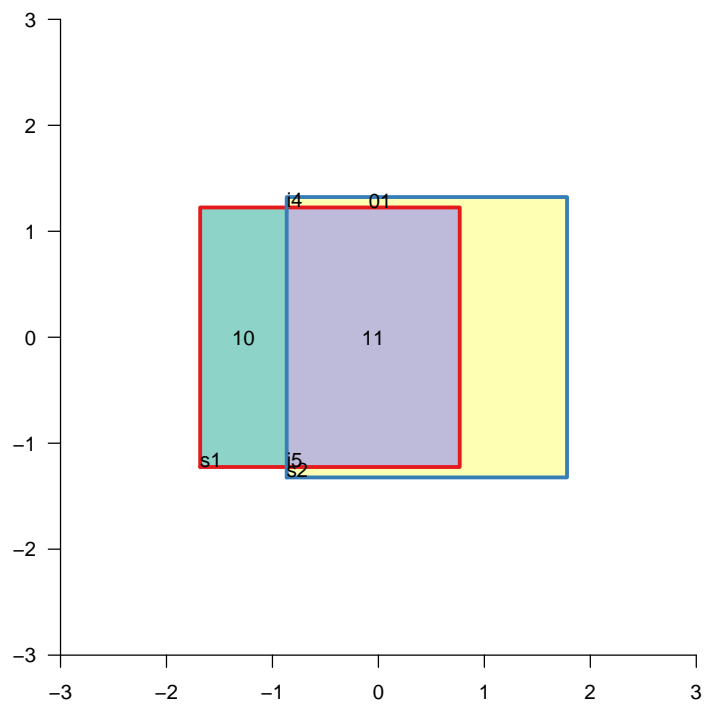
Validating a drawing on 2 sets.....done

```
>
```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TM )
> PlotSetBoundaries(TM )
> Vennerable:::PlotFaceNames.TissueDrawing (TM )
> PlotNodes(TM )
>

```



```

> TMR <- Vennerable:::remove.nonintersectionpoints(drawing=TM)
> Vennerable:::validateDrawing(TMR)

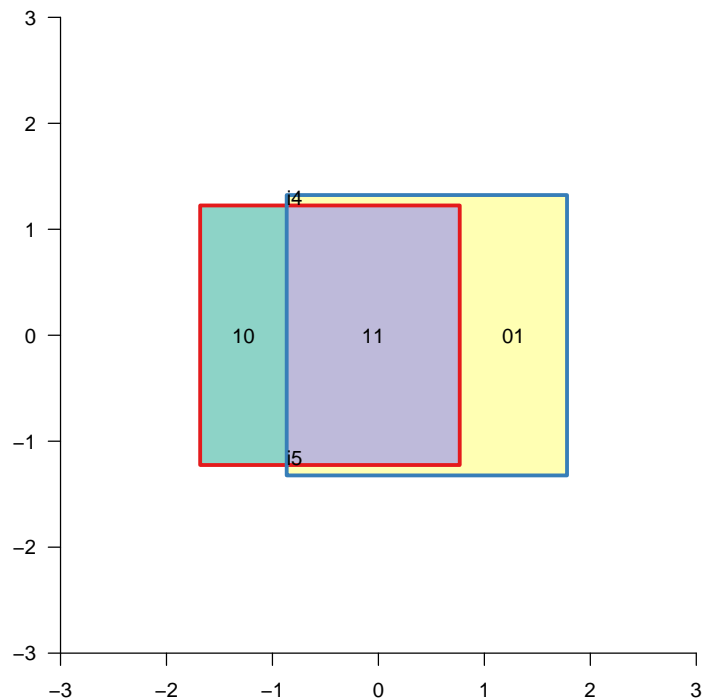
```

Validating a drawing on 2 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TMR )
> PlotSetBoundaries(TMR )
> Vennerable:::PlotFaceNames.TissueDrawing (TMR )
> PlotNodes(TMR )
>

```



10 Vennerable:::addSetToDrawing a polygon and a circle

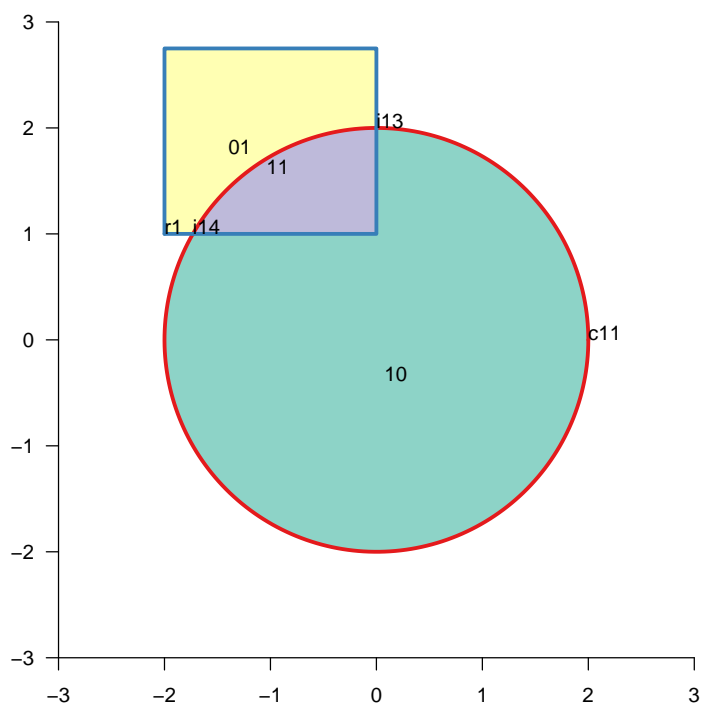
```

> centre.xy <- c(0,0)
> poly.xy <- matrix(c(-2,1,-2,2.75,0,2.75,0,1),byrow=TRUE,ncol=2,
+                 dimnames=list(paste("r",1:4,sep="")))
> VDP1 <- Vennerable:::newTissueFromPolygon(points.xy=poly.xy,Set=2)
> poly2.xy <- -poly.xy
> rownames(poly2.xy) <-sub("r","rx",rownames(poly2.xy))
> VDP2 <- Vennerable:::newTissueFromPolygon(points.xy=poly2.xy,Set=3)
> drawing1 <- VDC1; drawing2 <- VDP1
> VDCPM<- Vennerable:::addSetToDrawing (drawing1=VDC1,drawing2=VDP1,set2Name="Set2")
> #VDCPM <- Vennerable:::remove.nonintersectionpoints(drawing=VDCPM)
> Vennerable:::validateDrawing(VDCPM)

```

Validating a drawing on 2 sets.....done

```
> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))  
> makevp.eqsc(c(-3,3),c(-3,3))  
> grid.xaxis()  
> grid.yaxis()  
> PlotFaces(VDCPM)  
> PlotSetBoundaries(VDCPM)  
> Venerable:::PlotFaceNames.TissueDrawing (VDCPM)  
> PlotNodes(VDCPM)  
>
```

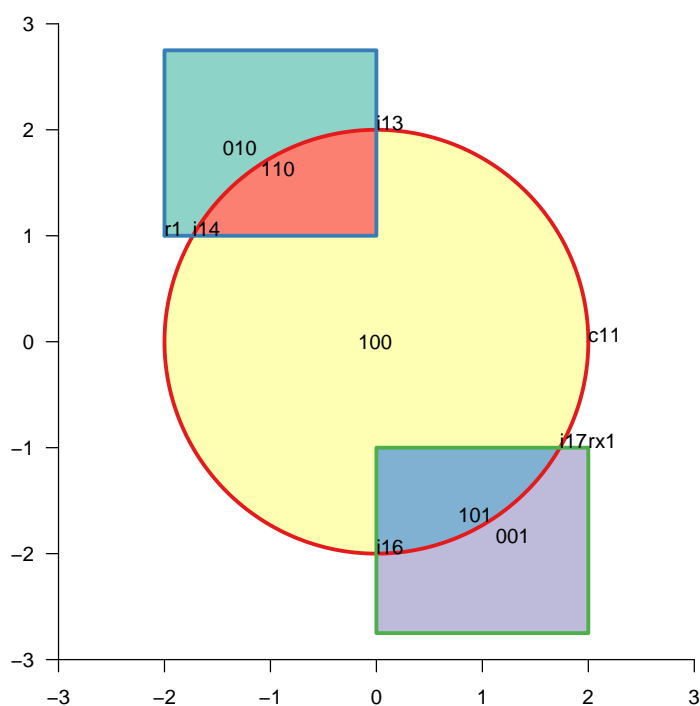


```

> VDCPM2<- Vennerable:::addSetToDrawing (drawing1=VDCPM,drawing2=VDP2,set2Name="Set3")

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VDCPM2)
> PlotSetBoundaries(VDCPM2)
> Vennerable:::PlotFaceNames.TissueDrawing (VDCPM2)
> PlotNodes(VDCPM2)
>

```



11 Invisible edges

```

> centre.xy <- c(0,0)
> VDC3 <- Vennerable:::newTissueFromCircle(centre.xy,radius=2,Set=1)
> VDC4 <- Vennerable:::newTissueFromCircle(centre.xy,radius=1,Set=2)
> VDI <- Vennerable:::addSetToDrawing (drawing1=VDC3,drawing2=VDC4,set2Name="Set2")
> Vennerable:::validateDrawing(VDI)

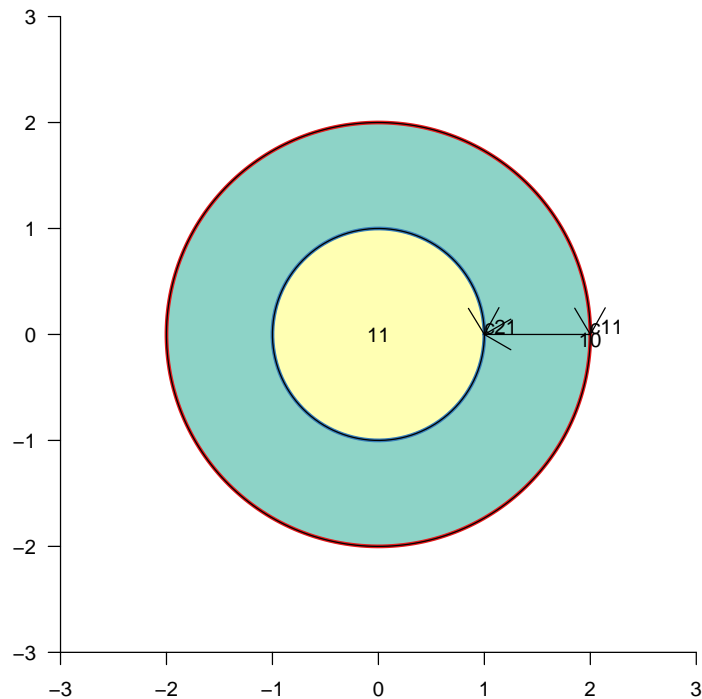
```

Validating a drawing on 2 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VDI)
> PlotSetBoundaries(VDI)
> Vennerable:::PlotFaceNames.TissueDrawing (VDI)
> PlotNodes(VDI)
> shoar(VDI)

```



The code only attempts to inject invisible edges between known points, so we have to give the algorithm a hint by inserting such known points in the right place

```

> centre.xy <- c(-1.5,0)
> VDC5 <- Vennerable:::newTissueFromCircle(centre.xy,radius=1,Set=1)
> VDC6 <- Vennerable:::newTissueFromCircle(centre.xy+c(3,0),radius=1,Set=2)
> VDC6 <- Vennerable:::injectPoint(VDC6,"c21|c21|2",newPoint=matrix(c(0.5,0),ncol=2,dimnames=list(c("c21","2"))))
> VDO <- Vennerable:::addSetToDrawing (drawing1=VDC5,drawing2=VDC6,set2Name="Set2")
> Vennerable:::validateDrawing(VDO)

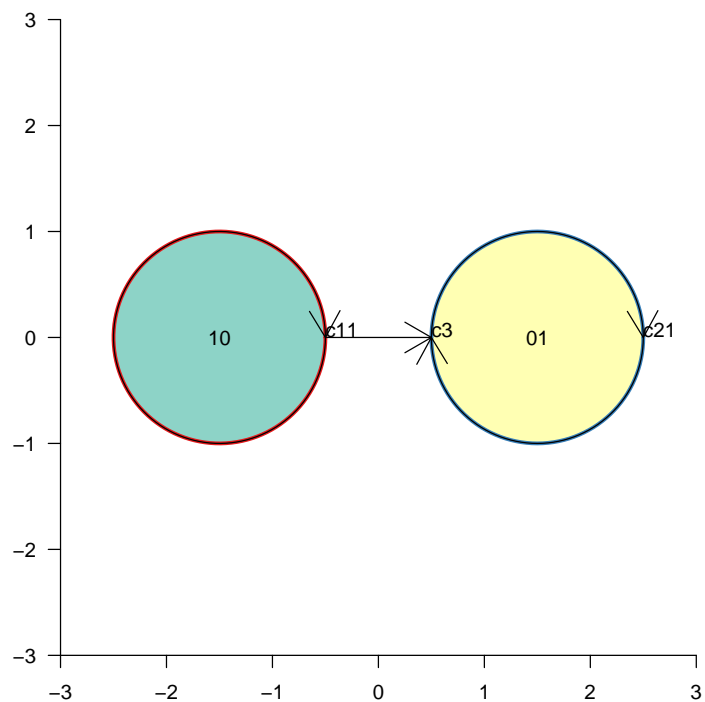
```

Validating a drawing on 2 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VDO)
> PlotSetBoundaries(VDO)
> Vennerable:::PlotFaceNames.TissueDrawing (VDO)
> PlotNodes(VDO)
> shoar(VDO)

```



12 Tangents

```

> centre.xy <- c(0,0)
> VDC7 <- Vennerable:::newTissueFromCircle(centre.xy,radius=2,Set=1)
> VDC8 <- Vennerable:::newTissueFromCircle(centre.xy+c(1,0),radius=1,Set=2)
> VDT <- Vennerable:::addSetToDrawing (drawing1=VDC7,drawing2=VDC8,set2Name="Set2")
> Vennerable:::validateDrawing(VDT)

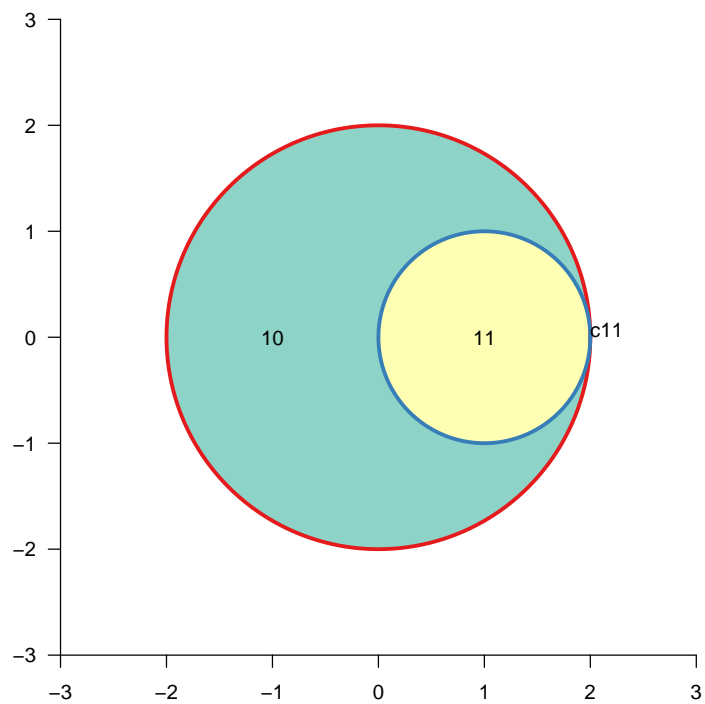
```

Validating a drawing on 2 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VDT)
> PlotSetBoundaries(VDT)
> Vennerable:::PlotFaceNames.TissueDrawing (VDT)
> PlotNodes(VDT)
>

```



```

> centre.xy <- c(0,0)
> VDC9 <- Vennerable:::newTissueFromCircle(centre.xy,radius=1,Set=1)
> VDC10 <- Vennerable:::newTissueFromCircle(centre.xy+c(1,0),radius=2,Set=2)
> VDT2 <- Vennerable:::addSetToDrawing (drawing1=VDC9,drawing2=VDC10,set2Name="Set2")
> Vennerable:::validateDrawing(VDT2)

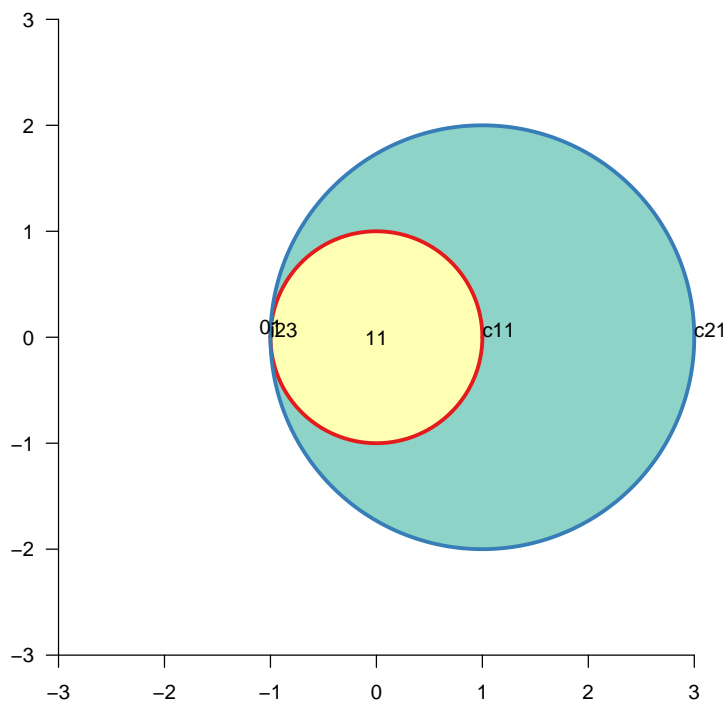
```

Validating a drawing on 2 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(VDT2)
> PlotSetBoundaries(VDT2)
> Vennerable:::PlotFaceNames.TissueDrawing (VDT2)
> PlotNodes(VDT2)
>

```



```

> r1 = 0.797884560802865
> r2 = 0.797884560802865
> d=1.59576912160573
> r=c(r1,r2)
> centres <- matrix(c(-d/2,0,d/2,0),ncol=2,byrow=TRUE)
> #C2 <- TwoCircles(r=c(r1,r2),d=d,V) # d in TwoCircles is distance of centre from origin
>
> VDC1 <- Vennerable:::newTissueFromCircle(centres[1,],radius=r[1],Set=1);
> VDC2 <- Vennerable:::newTissueFromCircle(centres[2,],radius=r[2],Set=2);
> VDT <- Vennerable:::addSetToDrawing (drawing1=VDC1 ,drawing2=VDC2,set2Name="Set2")
> Vennerable:::validateDrawing(VDT)

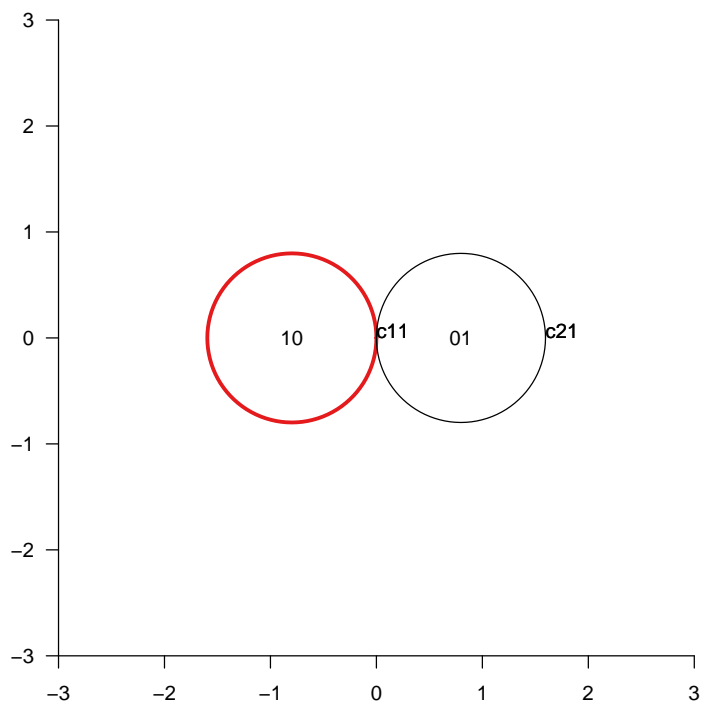
```

Validating a drawing on 2 sets.....done

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> #PlotFaces(VDT)
> #PlotSetBoundaries(VDT)
> PlotSetBoundaries(VDC1);PlotSetBoundaries(VDC2,gp=gpar(col="red"))
> PlotNodes(VDC1)
> PlotNodes(VDC2)
> Vennerable:::PlotFaceNames.TissueDrawing (VDT)
> PlotNodes(VDT)
>

```



```

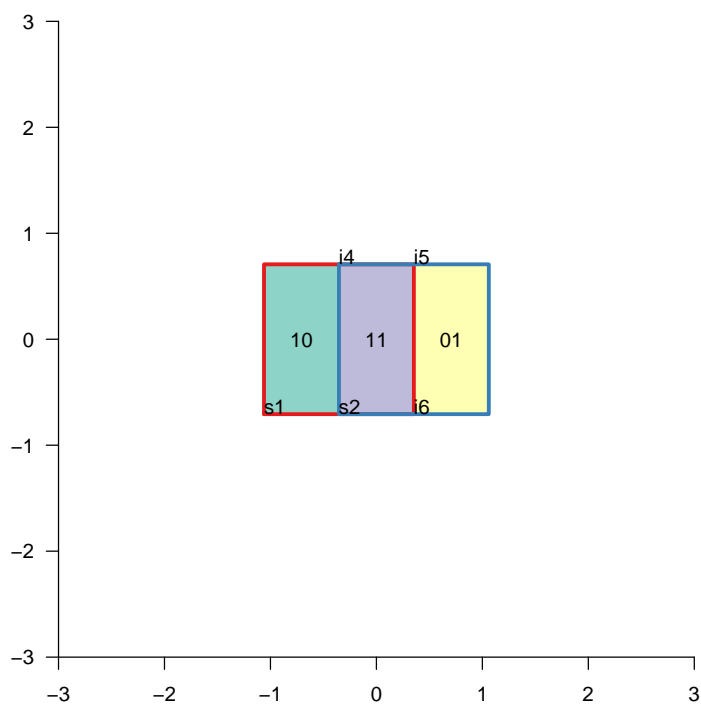
> l1 <- -1.060660; r1 <- 0.3535534 ; l2 <- -0.3535534 ; r2 <- 1.060660
> s1 <-1.414214; s2 <- 1.414214
> poly.1 <- matrix(c(l1,-s1/2,l1,s1/2,r1,s1/2,r1,-s1/2),ncol=2,byrow=TRUE)
>   rownames(poly.1) <- paste("s",1:4,sep="")
>   poly.2 <- matrix(c(l2,-s2/2,l2,s2/2,r2,s2/2,r2,-s2/2),ncol=2,byrow=TRUE)
>   rownames(poly.2) <- paste("s",2:5,sep="")
>   VDP1 <- Vennerable:::newTissueFromPolygon(points.xy=poly.1,Set=1)
>   VDP2 <- Vennerable:::newTissueFromPolygon(points.xy=poly.2,Set=2)
>   TM <- Vennerable:::addSetToDrawing (drawing1=VDP1 ,drawing2=VDP2, set2Na

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TM)
> PlotSetBoundaries(TM)
> Vennerable:::PlotFaceNames.TissueDrawing (TM)
> PlotNodes(TM)
>

```



```

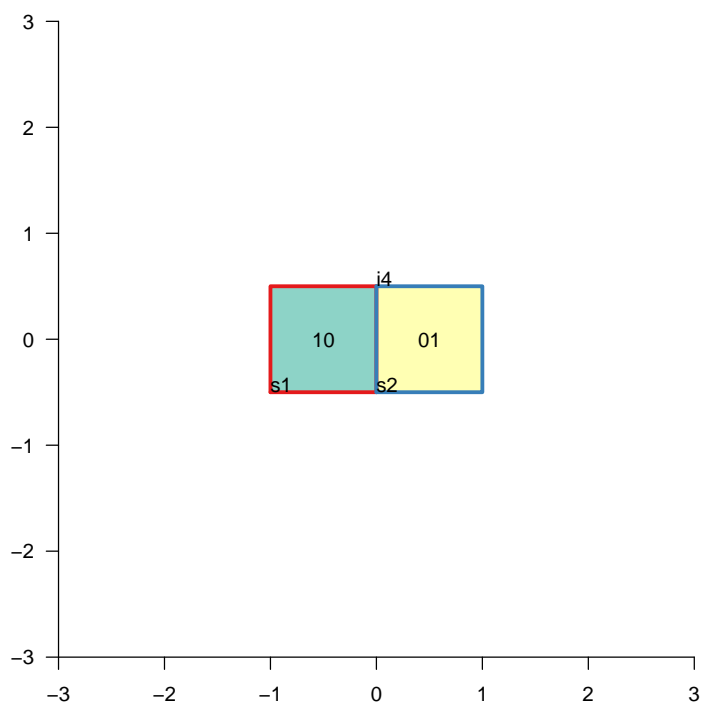
> d <- 1; s1 <- -1; s2 <- -0.5
> l1 <- -d/2-s1/2; l2 <- d/2-s2/2
> r1 <- -d/2+s1/2; r2 <- d/2+s2/2
> poly.1 <- matrix(c(l1,-s1/2,l1,s1/2,r1,s1/2,r1,-s1/2),ncol=2,byrow=TRUE)
> rownames(poly.1) <- paste("s",1:4,sep="")
> poly.2 <- matrix(c(l2,-s2/2,l2,s2/2,r2,s2/2,r2,-s2/2),ncol=2,byrow=TRUE)
> rownames(poly.2) <- paste("s",2:5,sep="")
> VDP3 <- Vennerable:::newTissueFromPolygon(points.xy=poly.1,Set=1)
> VDP4 <- Vennerable:::newTissueFromPolygon(points.xy=poly.2,Set=2)
> TM3 <- Vennerable:::addSetToDrawing (drawing1=VDP3 ,drawing2=VDP4, set2Name="Set2")

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TM3)
> PlotSetBoundaries(TM3)
> Vennerable:::PlotFaceNames.TissueDrawing (TM3)
> PlotNodes(TM3)
>

```



13 Three circles

13.1 Canonical

```

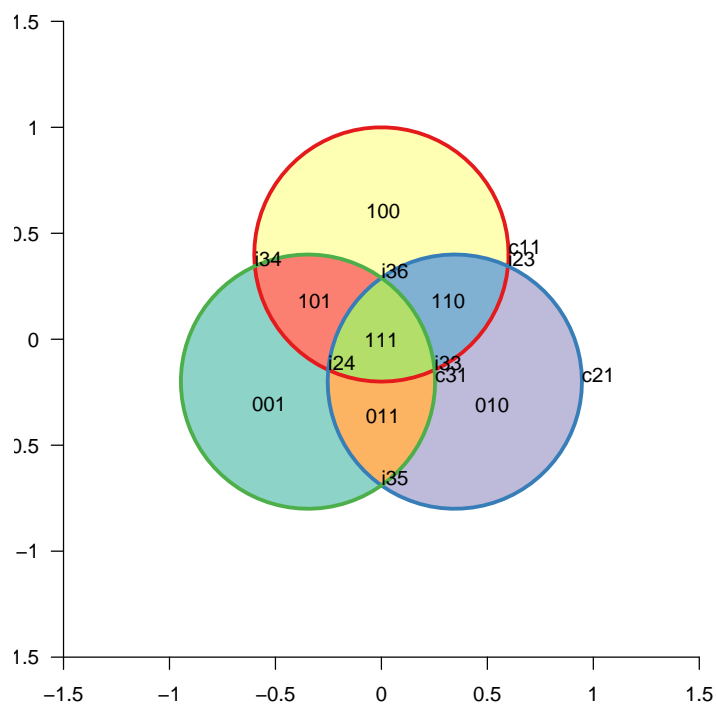
> r <- 0.6; d <- 0.4; angles <- pi/2-c( 0, 2*pi/3, 4 * pi/3)
> x <- d*cos(angles)
> y <- d*sin(angles)
> r <- rep(r,3)
> centres <- matrix(c(x,y),ncol=2,byrow=FALSE)
> VDC1 <- Vennerable:::newTissueFromCircle(centres[1,],radius=r[1],Set=1);
> VDC2 <- Vennerable:::newTissueFromCircle(centres[2,],radius=r[2],Set=2);
> TM3 <- Vennerable:::addSetToDrawing (drawing1=VDC1 ,drawing2=VDC2, set2Name="Set2");
> VDC3 <- Vennerable:::newTissueFromCircle(centres[3,],radius=r[3],Set=3);
> TM3 <- Vennerable:::addSetToDrawing (drawing1=TM3 ,drawing2=VDC3, set2Name="Set3");

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-1.5,1.5),c(-1.5,1.5))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TM3)
> PlotSetBoundaries(TM3)
> Vennerable:::PlotFaceNames.TissueDrawing (TM3)
> PlotNodes(TM3)
>

```



13.2 One tangent point

```

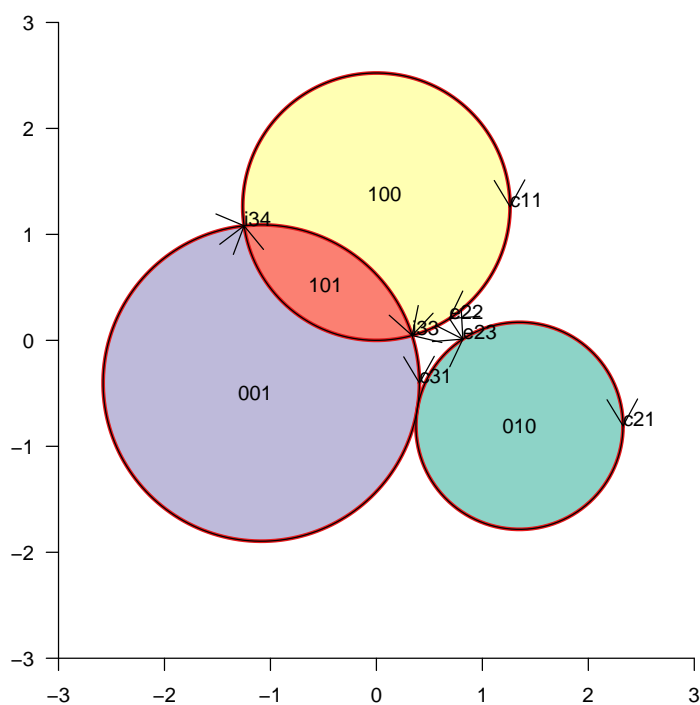
> r <- c( 1.261566 ,0.977205, 1.492705)
> x <- c(0.000000, 1.350138 ,-1.086542)
> y <- c(1.2615663, -0.8066661, -0.4028718)
> centres <- matrix(c(x,y),ncol=2,byrow=FALSE)
> VDC1 <- Vennerable:::newTissueFromCircle(centres[1,],radius=r[1],Set=1);
> VDC2 <- Vennerable:::newTissueFromCircle(centres[2,],radius=r[2],Set=2);
> TM <- Vennerable:::addSetToDrawing (drawing1=VDC1,drawing2=VDC2,set2Name="Set2")
> VDC3 <- Vennerable:::newTissueFromCircle(centres[3,],radius=r[3],Set=3);
> TM <- Vennerable:::addSetToDrawing (drawing1=TM,drawing2=VDC3,set2Name="Set3")

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TM)
> PlotSetBoundaries(VDC1);PlotSetBoundaries(VDC2);PlotSetBoundaries(VDC3);
> #PlotNodes(VDC1);PlotNodes(VDC2);PlotNodes(VDC3);
> Vennerable:::PlotFaceNames.TissueDrawing(TM)
> PlotNodes(TM)
> shoar(TM)

```



13.3 Two circles tangent numerics

```

> r <- c( 1.492705, 0.977205, 1.128379)
> x <- c(0.000000, 1.384666, -1.028597 )
> y <- c(1.49270533, -0.55257134, -0.02662434 )
> centres <- matrix(c(x,y),ncol=2,byrow=FALSE)
> VDC12b <- Vennerable:::newTissueFromCircle(centres[1,],radius=r[1],Set=1);
> VDC22b <- Vennerable:::newTissueFromCircle(centres[2,],radius=r[2],Set=2);
> TM2b <- try( Vennerable:::addSetToDrawing (drawing1=VDC12b,drawing2=VDC22b,set2Name="Set2"))

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis();grid.yaxis()
> PlotSetBoundaries(VDC1b); PlotSetBoundaries(VDC2b)

```

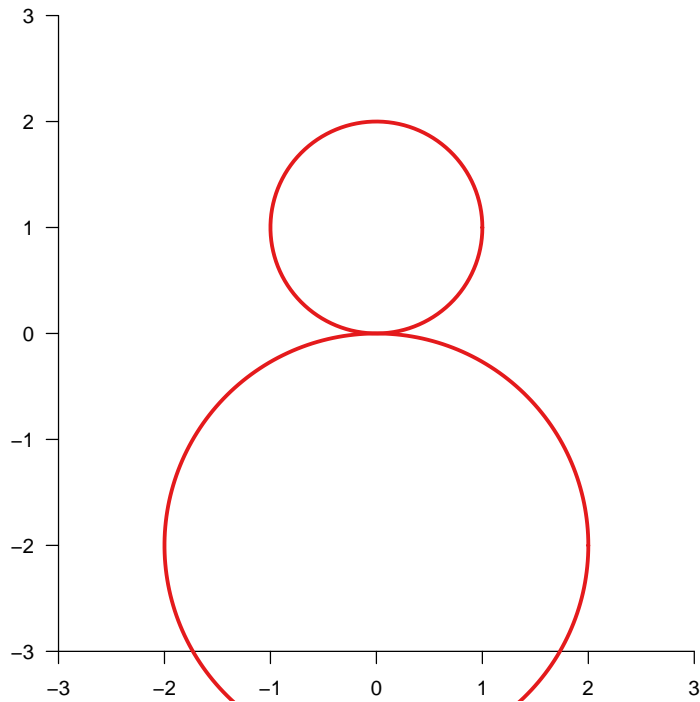


Figure 4: Numerical difficulties cause a bug here

13.4 April May June

```

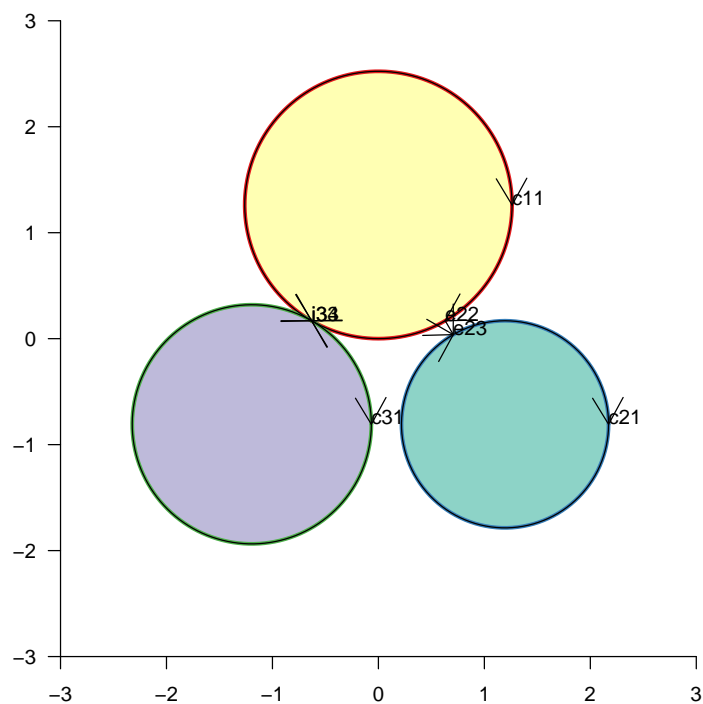
> r <- c( 1.261566261010080, 0.977205023805840, 1.128379167095513)
> x <- c( 0.000000000000000, 1.194972714052796, -1.194972714052796 )
> y <- c( 1.261566261010080, -0.808187193387839, -0.808187193387839 )
> centres <- matrix(c(x,y),ncol=2,byrow=FALSE)
> VDC1c <- Vennerable:::newTissueFromCircle(centres[1,],radius=r[1],Set=1);
> VDC2c <- Vennerable:::newTissueFromCircle(centres[2,],radius=r[2],Set=2);
> TMc <- Vennerable:::addSetToDrawing (drawing1=VDC1c,drawing2=VDC2c,set2Name="Set2");
> VDC3c <- Vennerable:::newTissueFromCircle(centres[3,],radius=r[3],Set=3);
> TM3c <- Vennerable:::addSetToDrawing (drawing1=TMc,drawing2=VDC3c,set2Name="Set3");
> TV3c <- Vennerable:::.merge.faces.invisibly.split(TM3c)

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-3,3),c(-3,3))
> grid.xaxis();grid.yaxis()
> PlotFaces(TV3c)
> PlotSetBoundaries(TV3c)
> PlotNodes(TV3c)
> shoar(TV3c)

```



14 Triangles

```

> .inscribetrangle.compute <- function (wghts) {
+   wa <- wghts[1];wb <- wghts[2]; wc <- wghts[3]
+   stopifnot(Vennerable:::.inscribetrangle.feasible(wghts))
+   pa <- (1-wc)
+   pb <- (wb+wc-wa-1)
+   pc <- wa * (1-wb)
+   sc <- if (wa>0) {
+     (-pb-sqrt( pb^2 - 4 * pa * pc))/(2*pa)
+   } else if (wb+wc<1) {
+     (1-wb-wc)/(1-wc)
+   } else {
+     0
+   }
+   sb <- if (sc>0 ) { 1 - wa/sc } else { wc/(1-wb) }
+ }

```

```

+     sa <- wb/(1-sc)
+     c(sc,sa,sb) # nb order around triangle
+ }
> .inscribetriangle.inscribe <- function(xy,wghts) {
+     scalef <- NA
+
+     isfeasible <- Vennerable:::.inscribetriangle.feasible(wghts)
+     if (!isfeasible) {
+         scalef <- 4 * wghts[1]*wghts[2]*wghts[3]/(1-sum(wghts))^2
+         scalef <- scalef^(1/3)
+         wghts <- wghts / (scalef*1.001)
+         isfeasible <- Vennerable:::.inscribetriangle.feasible(wghts)
+         stopifnot(!isfeasible)
+     }
+     if (!isfeasible) return(list(feasible=FALSE))
+     scab <- .inscribetriangle.compute (wghts)
+     inner.xy <- (1-scab)*xy + scab * (xy[c(2,3,1),])
+     return(list(feasible=TRUE,inner.xy=inner.xy,scalef=scalef))
+ }

>     WeightUniverse <- 18
>     WeightVisible <- 16
>     WeightInvisible <- WeightUniverse-WeightVisible
>     w0ratio <- WeightInvisible/WeightVisible
>     wa <- 0.25
>     wb <- 0.25
>     wc <- 0.25
>     outer.weights <- c(wa,wb,wc)
>     outer.innerw <- 1 - sum(outer.weights)
>     outer.inner.ratios <- outer.weights/outer.innerw # ratio of each wa, wb,wc to p
>     outer.feasible <- Vennerable:::.inscribetriangle.feasible(outer.weights)
>     # the inner triangle
>     wab <- 0.0625
>     wbc <- 0.0625
>     wca <- 0.0625
>     wabc <- 0.0625
>     inner.weights <- c(wab,wbc,wca)
>     inner.innerw <- wabc
>     # we resclae the inner weights...
>     sf <- (sum(inner.weights)+inner.innerw)
>     Weight.Inner <- sf * WeightVisible
>     if (sf>0) {
+         inner.weights <- inner.weights/sf
+         inner.feasible <- Vennerable:::.inscribetriangle.feasible(inner.weights)
+     } else {
+         inner.feasible <- FALSE
+     }
>
>     # whole triangle should have area in Weights
>     side <- sqrt(4 * WeightVisible /(3*sqrt(3)))
>     angles <- pi/2-c(0,2*pi/3,4*pi/3)

```

```

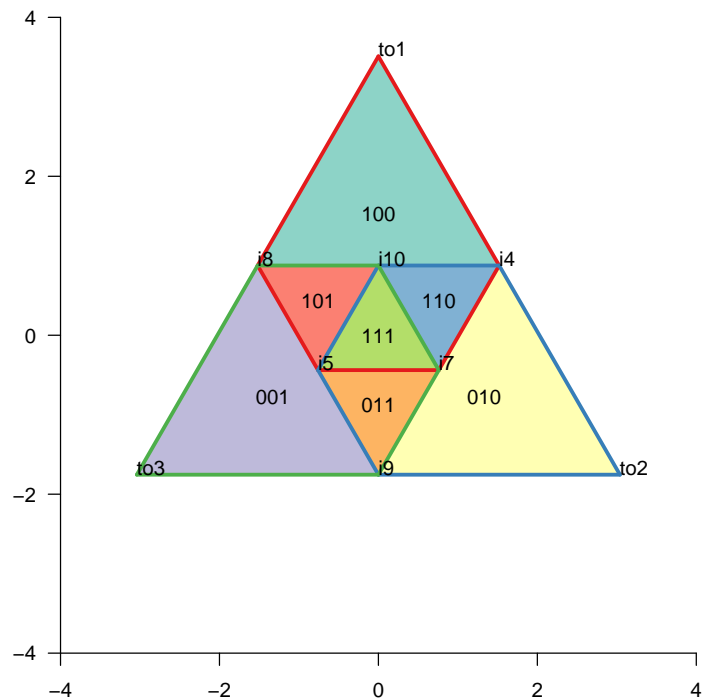
>         outer.xy <- t(sapply(angles,function(a)c(x=side * cos(a),y= side * sin(a)
>         inner <- .inscribetriangle.inscribe(outer.xy,wghts=outer.weights)
>         inner.xy <- inner$inner.xy
>         innest <- .inscribetriangle.inscribe(inner.xy,wghts=inner.weights)
>         innest.xy=innest$inner.xy
>         # finally we construct the outside triangle
>         # outer.xy is equilateral with centre at zero, so just scale
>         # if inner triangle has area A and rim has area A' then scaling
>         # is  $(A'+A)=s^2 A$  so  $s^2=1+A'/A$ .  $A'/A$  is the w0ratio calculated above
>         outest.xy <- outer.xy * sqrt( 1+ w0ratio)
> rownames(outer.xy) <- paste("to",1:3,sep="")
> rownames(inner.xy) <- paste("ti",1:3,sep="")
> rownames(innest.xy) <- paste("tt",1:3,sep="")
> outline.a.xy <- do.call(rbind,list(outer.xy[1,,drop=FALSE],inner.xy[1,,drop=FALSE])
> outline.b.xy <- do.call(rbind,list(outer.xy[2,,drop=FALSE],inner.xy[2,,drop=FALSE])
> outline.c.xy <- do.call(rbind,list(outer.xy[3,,drop=FALSE],inner.xy[3,,drop=FALSE])
> VDP1 <- Vennerable:::newTissueFromPolygon(points.xy=outline.a.xy,Set=1)
> VDP2 <- Vennerable:::newTissueFromPolygon(points.xy=outline.b.xy,Set=2)
> VDP3 <- Vennerable:::newTissueFromPolygon(points.xy=outline.c.xy,Set=3)
> TMT <- Vennerable:::addSetToDrawing (drawing1=VDP1 ,drawing2=VDP2, set2Name="Set2")
> TMT <- Vennerable:::addSetToDrawing (drawing1=TMT ,drawing2=VDP3, set2Name="Set3")

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-4,4),c(-4,4))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TMT)
> PlotSetBoundaries(TMT)
> Vennerable:::PlotFaceNames.TissueDrawing (TMT)
> PlotNodes(TMT)
>

```



```

> WeightUniverse <- 18
> WeightVisible <- 16
> WeightInvisible <- WeightUniverse-WeightVisible
> wOratio <- WeightInvisible/WeightVisible
> wa <- 0.16666667
> wb <- 0.25
> wc <- 0.25
> outer.weights <- c(wa,wb,wc)
> outer.innerw <- 1 - sum(outer.weights)
> outer.inner.ratios <- outer.weights/outer.innerw # ratio of each wa, wb,wc to p
> outer.feasible <- Vennerable:::inscribetriangle.feasible(outer.weights)
> # the inner triangle
> wab <- 0.16666667
> wbc <- 0
> wca <- 0

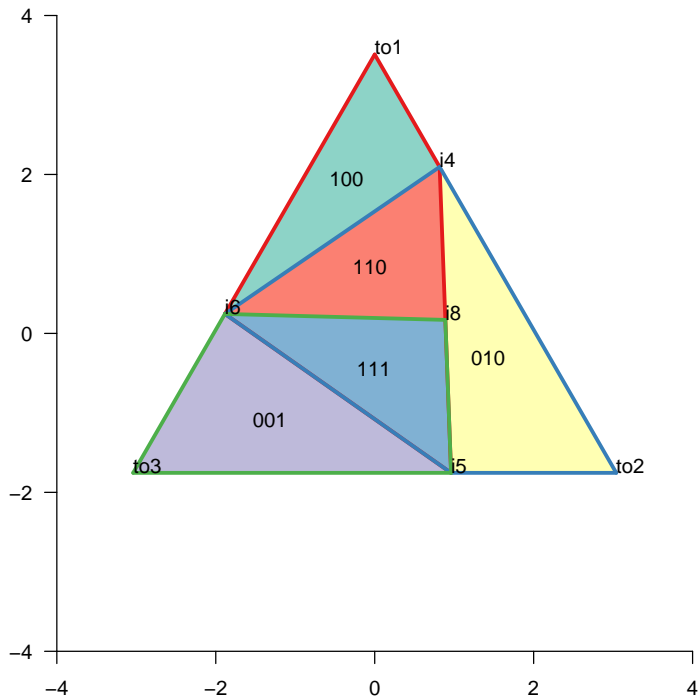
```

```

> wabc <- 0.166666667
> inner.weights <- c(wab,wbc,wca)
> inner.innerw <- wabc
> # we resclae the inner weights...
> sf <- (sum(inner.weights)+inner.innerw)
> Weight.Inner <- sf * WeightVisible
> if (sf>0) {
+     inner.weights <- inner.weights/sf
+     inner.feasible <- Vennerable:::inscribetriangle.feasible(inner.weights)
+ } else {
+     inner.feasible <- FALSE
+ }
> # whole triangle should have area in Weights
> side <- sqrt(4 * WeightVisible / (3*sqrt(3)))
> angles <- pi/2-c(0,2*pi/3,4*pi/3)
> outer.xy <- t(sapply(angles,function(a)c(x=side * cos(a),y= side * sin(a)
> inner <- .inscribetriangle.inscribe(outer.xy,wghts=outer.weights)
> inner.xy <- inner$inner.xy
> innest <- .inscribetriangle.inscribe(inner.xy,wghts=inner.weights)
> innest.xy=innest$inner.xy
> # finally we construct the outside triangle
> # outer.xy is equilateral with centre at zero, so just scale
> # if inner triangle has area A and rim has area A* then scaling
> # is (A**A)=s^2 A so s^2=1+A*/A. A*/A is the w0ratio calculated above
> outest.xy <- outer.xy * sqrt( 1+ w0ratio)
> rownames(outer.xy) <- paste("to",1:3,sep="")
> rownames(inner.xy) <- paste("ti",1:3,sep="")
> rownames(innest.xy) <- paste("tt",1:3,sep="")
> outline.a.xy <- do.call(rbind,list(outer.xy[1,,drop=FALSE],inner.xy[1,,drop=FALSE])
> outline.b.xy <- do.call(rbind,list(outer.xy[2,,drop=FALSE],inner.xy[2,,drop=FALSE])
> outline.c.xy <- do.call(rbind,list(outer.xy[3,,drop=FALSE],inner.xy[3,,drop=FALSE])
> VDP1 <- Vennerable:::newTissueFromPolygon(points.xy=outline.a.xy,Set=1)
> VDP2 <- Vennerable:::newTissueFromPolygon(points.xy=outline.b.xy,Set=2)
> VDP3 <- Vennerable:::newTissueFromPolygon(points.xy=outline.c.xy,Set=3)
> TMT <- Vennerable:::addSetToDrawing (drawing1=VDP1 ,drawing2=VDP2, set2Name="Set2")
> TMT <- Vennerable:::addSetToDrawing (drawing1=TMT ,drawing2=VDP3, set2Name="Set3")

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-4,4),c(-4,4))
> grid.xaxis()
> grid.yaxis()
> PlotFaces(TMT)
> PlotSetBoundaries(TMT)
> Vennerable:::PlotFaceNames.TissueDrawing (TMT)
> PlotNodes(TMT)
>

```



15 Three squares

```

> ss1 <- c(-2.04988805276466,1.41421356237310,1.41421356237309,-1.77228856812726,-1.77228856812726)
> ss2 <- c(-2.25237500351774,3.88908729652601,3.88908729652601,-2.25237500351774,-2.167995)
> ss3 <- c(-1.41421356237310,4.56252232622749,4.56252232622749,2.08764859207457,2.08764859207457)
> SS1 <- matrix(ss1,ncol=2,byrow=FALSE);rownames(SS1)<-paste("sa",1:6,sep="")
> SS2 <- matrix(ss2,ncol=2,byrow=FALSE);rownames(SS2)<-paste("sb",1:4,sep="")
> SS3 <- matrix(ss3,ncol=2,byrow=FALSE);rownames(SS3)<-paste("sc",1:6,sep="")
> VDP1 <- Vennerable:::newTissueFromPolygon(points.xy=SS1,Set=1)
> VDP2 <- Vennerable:::newTissueFromPolygon(points.xy=SS2,Set=2)
> VDP3 <- Vennerable:::newTissueFromPolygon(points.xy=SS3,Set=3)
>
>   TM <- Vennerable:::addSetToDrawing (drawing1=VDP1 ,drawing2=VDP2, set2Name="Set2")
>   TM <- Vennerable:::addSetToDrawing (drawing1=TM ,drawing2=VDP3, set2Name="Set3")
>
>
>
>

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-7,7),c(-5,10))
> grid.xaxis()
> grid.yaxis()
> #PlotFaces(VD4,faceNames="010")
> PlotFaces(TM)
> PlotSetBoundaries(TM,gp=gpar(lwd=2,col=c("green","red")))
> PlotNodes(TM)
> Vennerable:::PlotFaceNames.TissueDrawing(TM)
> PlotSetBoundaries(VDP3,gp=gpar(lwd=2,col=c("green")))
> #.PlotArcs(VD,c("p1|p5|1","p2|p4|2"),arrow=arrow())

```

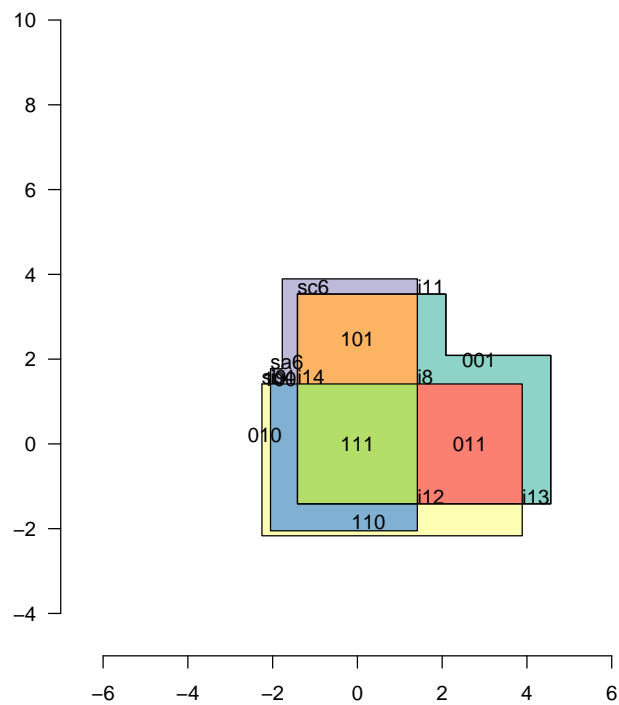


Figure 5: Injecting points

16 Noncontiguous subsets

```

> px1 <- matrix(c(-5,-3,-5,3,5,3,5,-3),ncol=2,byrow=TRUE); rownames(px1) <- paste("pa",1:n)
> px2 <- matrix(c(-3,-5,-3,5,3,5,3,-5),ncol=2,byrow=TRUE); rownames(px2) <- paste("pb",1:n)
> VX1 <- Vennerable:::newTissueFromPolygon(px1,Set=1)
> VX2 <- Vennerable:::newTissueFromPolygon(px2,Set=2)
> TM <- Vennerable:::addSetToDrawing(VX1,VX2,set2Name="Set2")

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-10,10),c(-10,10))
> grid.xaxis();grid.yaxis()
> PlotNodes(TM)
> PlotSetBoundaries(TM,gp=gpar(lwd=2,col=c("green","red","blue")))
> Vennerable:::PlotFaceNames.TissueDrawing (TM)
>
> #.PlotArcs(VD,c("p1|p5|1","p2|p4|2"),arrow=arrow())

```

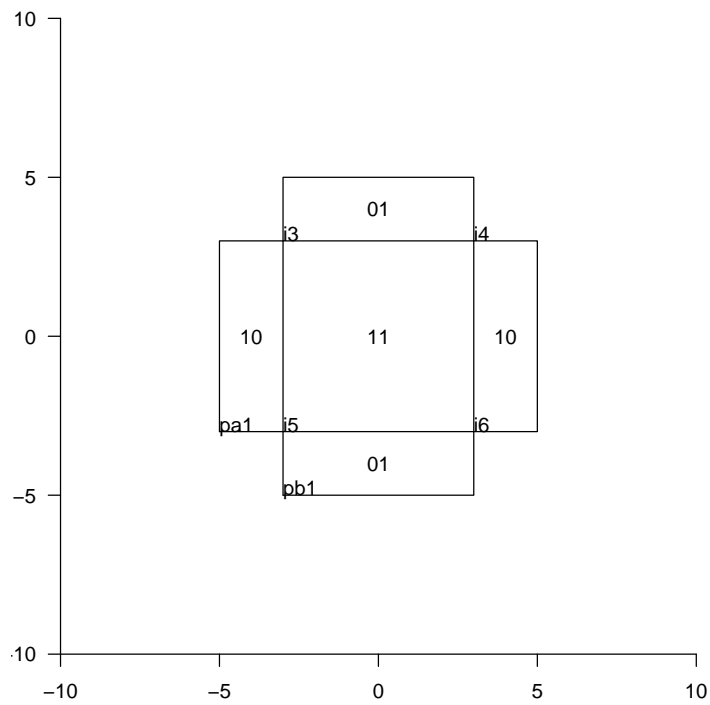


Figure 6: Injecting points

17 Ellipses

```

> phi <- 0.8; dex <- 1.7; dey <- 2.5; a<- 7.6; e<- 0.9
> x0 <- c(-0.9, -5.0)
> E <- list()
> E[[1]] <- Vennerable:::newTissueFromEllipse (f1=x0+c(0,0),phi=-phi ,dx=0.1,e=e,a
> E[[2]] <-Vennerable:::newTissueFromEllipse (x0+c(5+dex,-2),phi ,e,a,dx=0.1,Set=2
> TM <- E[[1]]
> TM <- Vennerable:::addSetToDrawing(TM,E[[2]],set2Name="Set2")

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-10,10),c(-10,10))
> grid.xaxis();grid.yaxis()
> #PlotFaces(VD4,faceNames="010")
> PlotFaces(TM)
> #PlotSetBoundaries(E[[1]],gp=gpar(lwd=2,col=c("green","red","blue")))
> PlotSetBoundaries(E[[2]],gp=gpar(lwd=2,col=c("red","red","blue")))
> PlotNodes(TM)
> Vennerable:::PlotFaceNames.TissueDrawing (TM)
> PlotSetBoundaries(TM,gp=gpar(lwd=2,col=c("green")))
> #.PlotArcs(VD,c("p1|p5|1","p2|p4|2"),arrow=arrow())

```

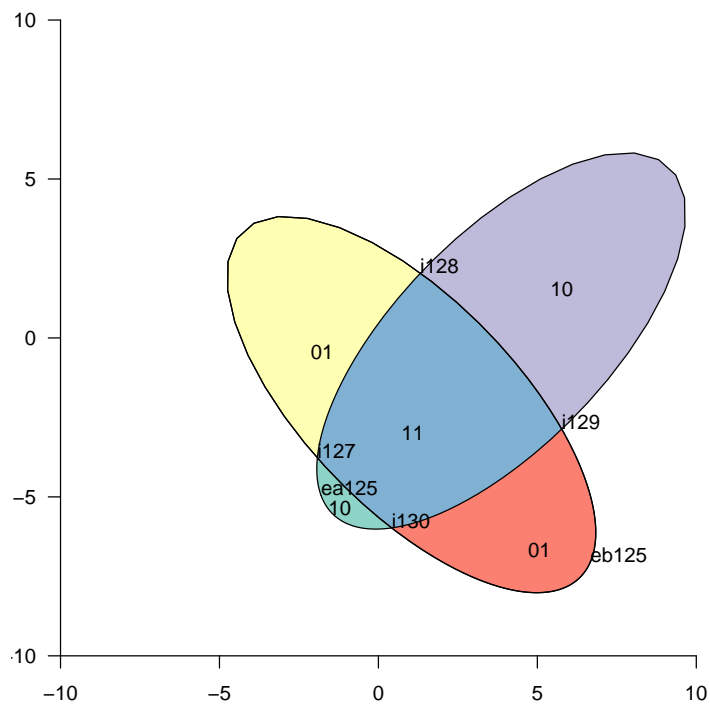


Figure 7: Injecting points

```

> phi <- 0.8; dex <- 1.7;dey <- 2.5; a<- 7.6; e<- 0.9
> x0 <- c( -0.9, -5.0)
> dx <- 0.1
> E <- list()
> E[[1]] <- Vennerable:::newTissueFromEllipse (f1=x0+c(0,0),dx =dx,phi=-phi ,e=e,a
> E[[2]] <-Vennerable:::newTissueFromEllipse (x0+c(dex,0),dx =dx,phi ,e,a,Set=2)
> E[[3]] <-Vennerable:::newTissueFromEllipse (x0+c(-dey,dey),dx =dx,-phi ,e,-a,Set
> E[[4]] <-Vennerable:::newTissueFromEllipse (x0+c(dex+dey,dey),dx =dx,phi ,e,a,Se
> TM <- E[[1]]
> TM <- Vennerable:::addSetToDrawing(TM,E[[2]],set2Name="Set2")

```

```

> grid.newpage();pushViewport(plotViewport(c(1,1,1,1)))
> makevp.eqsc(c(-10,10),c(-10,10))
> #makevp.eqsc(c(-1,1),c(-6,-5.8))
> grid.xaxis();grid.yaxis()
> PlotFaces(TM)
> PlotSetBoundaries(TM,gp=gpar(lwd=2,col=c("green","red","blue")))
> PlotNodes(TM)
> Venerable:::PlotFaceNames.TissueDrawing (TM)
>

```

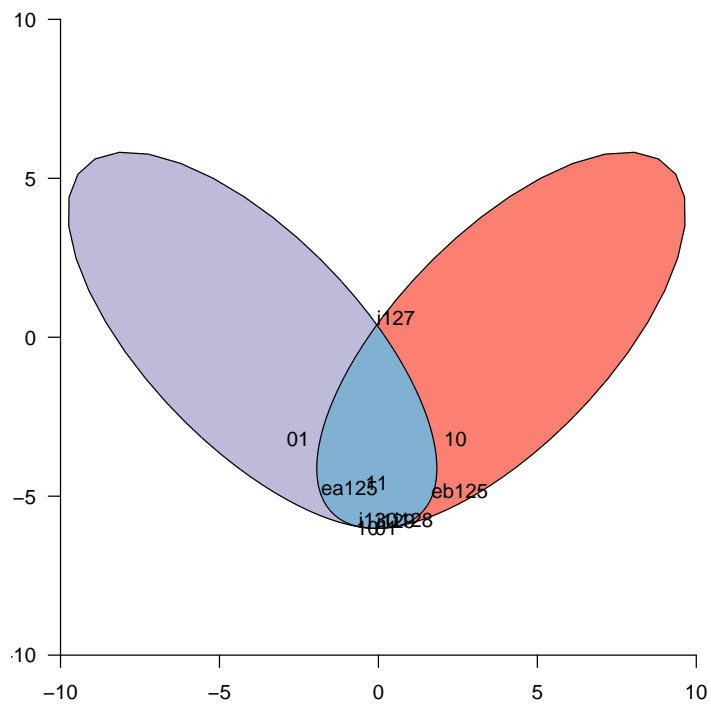


Figure 8: Injecting points

18 Chow Ruskey

18.1 Bug 522

Validating a drawing on 4 sets.....done

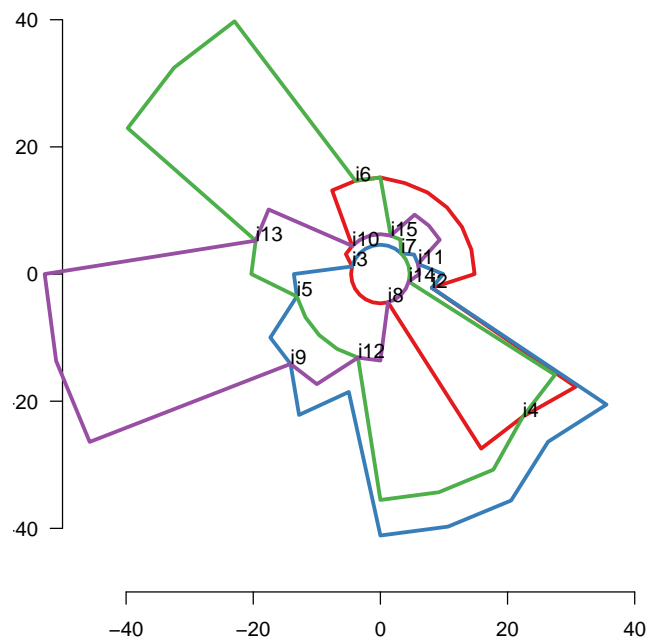


Figure 9: Chow-Ruskey weighted 4-set diagram with smudge warnings

19 This document

Author	Jonathan Swinton
Generated on	21 st May, 2026
R version	R version 4.6.0 (2026-04-24)

[1]

References

- [1] A. W. F. Edwards. *Cogwheels of the Mind: The Story of Venn Diagrams*. The John Hopkins University Press, Baltimore, Maryland, 2004.