

SNA Basics III

Simplifying Networks in R

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Place a header at the top of your scripts that tell you what the script does, what its name is, etc.

```
#####  
# What: Simplifying Networks in R  
# File: snab3.R  
# Created: 02.28.14  
# Revised: 06.12.18  
#####
```

Data

For this exercise, we'll use the Anabaptist Leadership network and its related attribute data, both of which can be found in the zipped file: SNB3 (Data).zip. The dataset includes 67 actors, 55 who were sixteenth century Anabaptist leaders and 12 who were prominent Protestant Reformation leaders (e.g., Martin Luther, John Calvin, Ulrich Zwingli, Martin Bucer, and Philip Melanchthon) that had contact with and influenced some of the Anabaptist leaders included in this dataset. These data build on a smaller dataset (Matthews et al., 2013) that did not include some leading Anabaptist leaders, such as Menno Simons, who is generally seen as the "founder" of the Amish and Mennonites.

Setup

Clear the workspace each time before beginning.

```
rm(list=ls())
```

Set your working directory to where the data are, so you don't have to include the entire path when importing and exporting data, files, etc.

```
setwd("~/Dropbox/Networks and Religion (Book)/Website/Labs/SNA Basics 3")
```

Simplifying Networks in *statnet*

Next, load the libraries we plan to use. The *sna* and *network* libraries are part of the *statnet* package; we'll use *igraph* later, but because *igraph* and *sna* conflict with one another, we can't load them at the same time.

```
# Load libraries  
library(sna)  
library(network)
```

Import the Anabaptist Leadership network and its related attribute data.

```
anabaptist.net <- as.network(read.paj("Anabaptist Leaders.net"),directed=FALSE)  
attributes.mat <- as.matrix(read.csv("Anabaptist Attributes.csv",header=TRUE,  
row.names=1,check.names=FALSE))
```

The following commands create a series of vectors from the attributes file that we can later use with our network. the first six identify whether someone (1) embraced believer's baptism, (2) supported violence, (3)

participated in the Münster Rebellion, (4) held apocalyptic beliefs, (5) was an Anabaptist, and/or (6) was a follower of Melchior Hoffman (i.e., a Melchiorite)

The last two combine other vectors in order to create a new set of attributes. The first creates vector that distinguishes between Anabaptists who didn't participate in the Münster Rebellion, Anabaptists who did, and non-Anabaptists (e.g, Martin Luther, John Calvin). The values of the resulting vector equal "0" for non-Anabaptists, "1" for Anabaptists who didn't participate in the rebellion, and "2" for those who did.

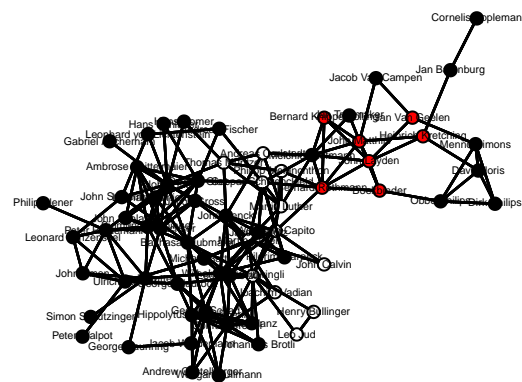
The second creates a vector that distinguishes between Melchiorite Anabaptists, Non-Melchiorite Anabaptists, and non-Anabaptists. The values of the resulting vector equal "0" for non-Anabaptists, "1" for non-Melchiorite Anabaptists, and "2" for Melchiorite Anabaptists.

```
# Create vectors of attributes
baptism.vec <- attributes.mat[,1]
violence.vec <- attributes.mat[,2]
munster.vec <- attributes.mat[,3]
apocalyptic.vec <- attributes.mat[,4]
anabaptist.vec <- attributes.mat[,5]
melchiorite.vec <- attributes.mat[,6]
tradition.vec <- attributes.mat[,15]
origin.vec <- attributes.mat[,16]
operate.vec <- attributes.mat[,17]

anabmunst.vec = anabaptist.vec + munster.vec
anabmelch.vec = anabaptist.vec + melchiorite.vec
```

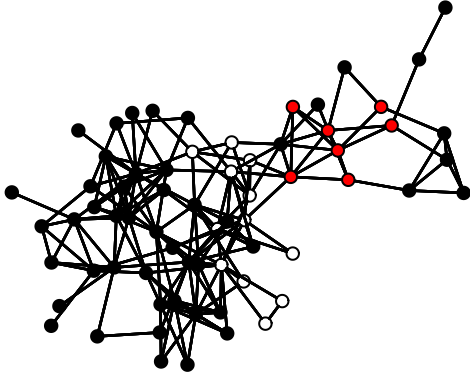
Plot the network where color indicates whether the actor is an Anabaptist who didn't participate in the Münster Rebellion, an Anabaptist who did, or a non-Anabaptist. Black vertices are Anabaptists, red are Anabaptists who participated in the Münster Rebellion, and White are non-Anabaptists. We save the coordinates too.

```
coords <- gplot(anabaptist.net,label=network.vertex.names(anabaptist.net),usearrows=FALSE,
displayisolates=TRUE,label.col="black",label.cex=0.3,label.pos=5,
vertex.col=anabmunst.vec,vertex.cex=1,gmode="graph",mode="kamadakawai")
```



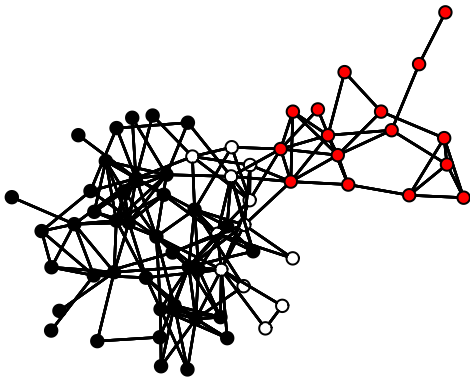
It's a little hard to see the network with the labels, so the next plot doesn't include them.

```
gplot(anabaptist.net,usearrows=FALSE,displayisolates=TRUE,vertex.col=anabmunst.vec,
vertex.cex=1,gmode="graph",coord=coords)
```



This time actor color indicates whether someone is a Melchiorite Anabaptist, a non-Melchiorite Anabaptist, or a non-Anabaptist.

```
gplot(anabaptist.net, usearrows=FALSE, displayisolates=TRUE, vertex.col=anabmelch.vec,
      vertex.cex=1, gmode="graph", coord=coords)
```



Now, let's extract a subnetwork of Anabaptists who are Melchiorites, a subnetwork of non-Melchiorites, and a subnetwork all Anabaptists. First, let's assign the values from the combined Anabaptist and Melchiorite vector to the vertices (actors) themselves

```
# Assign attribute value to the vertices
set.vertex.attribute(anabaptist.net, 'anabmelch', anabmelch.vec)

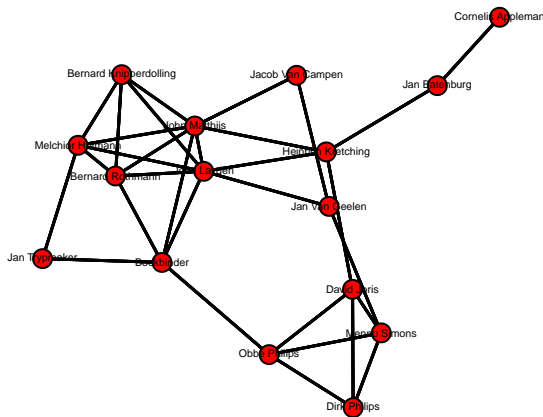
# Melchiorites
melchiorites.net <- get.inducedSubgraph(anabaptist.net, v=which(anabaptist.net
                                                                %v% "anabmelch" == 2))

# Non-Melchiorites
nonmelchiorites.net <- get.inducedSubgraph(anabaptist.net, v=which(anabaptist.net
                                                                    %v% "anabmelch" == 1))

# All Anabaptists
anabaptistsonly.net <- get.inducedSubgraph(anabaptist.net, v=which(anabaptist.net
                                                                    %v% "anabmelch" >= 1))
```

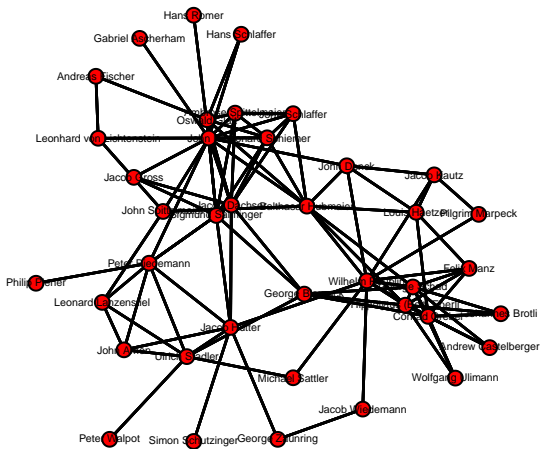
Now, plot the three new networks. First the Melchiorites:

```
gplot(melchiorites.net, usearrows=FALSE, displayisolates=TRUE, vertex.cex=1, gmode="graph",
      label=network.vertex.names(melchiorites.net), label.cex=.3, label.pos=5)
```



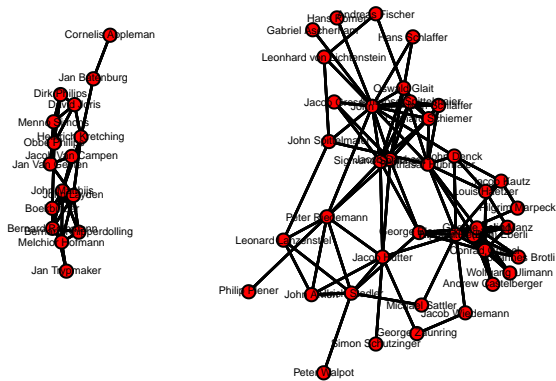
Then, the Non-Melchiorites:

```
gplot(nonmelchiorites.net, usearrows=FALSE, displayisolates=TRUE, vertex.cex=1, gmode="graph",
      label=network.vertex.names(nonmelchiorites.net), label.cex=.3, label.pos=5)
```



And finally both together (but no non-Anabaptists). As you can see, it is the non-Anabaptists (e.g., Martin Luther, John Calvin) who tie together the Melchiorites and non-Melchiorites.

```
coord <- gplot(anabaptistsonly.net, usearrows=FALSE, displayisolates=TRUE, vertex.cex=1,
              gmode="graph", label=network.vertex.names(anabaptistsonly.net), label.cex=.3,
              label.pos=5, vec)
```



For the final graph, let's color the nodes in the last graph by whether they are Melchiorites or not. We need to first create a new vector that's the same size (# of actors) as the new network

scheme of “anabmelch.vec” from “0, 1, 2” to “1, 2, 3” (igraph doesn’t like ids with “0’s”). After shrinking tell R what the labels mean; that is, assign labels to the vertices

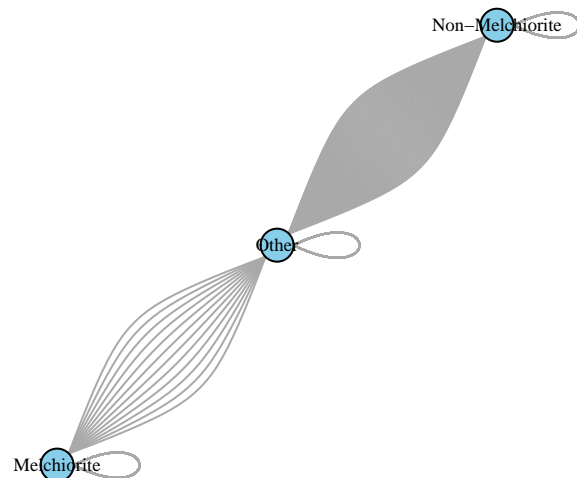
```
# Shrink (Collapse)
table(anabmelch.vec) ## Distribution of values before transformation
## anabmelch.vec
## 0 1 2
## 12 39 16
anabmelch.vec <- anabmelch.vec + 1
table(anabmelch.vec) ## Distribution of values after transformation
## anabmelch.vec
## 1 2 3
## 12 39 16
anagroup.ig <- contract.vertices(anabaptist.ig,anabmelch.vec)

# Assign labels to vertices
anagroup.ig <- set.vertex.attribute(anagroup.ig, "vertex.names",value=c("Other",
"Non-Melchiorite","Melchiorite"))
V(anagroup.ig)$vertex.names
## [1] "Other" "Non-Melchiorite" "Melchiorite"
V(anagroup.ig)$label = V(anagroup.ig)$vertex.names
```

Now plot resulting graph. Note that here we first estimate and then store the layout coordinates as an attribute of the collapsed group. This way, we can use this same layout over and over again. It’s similar to saving the coordinates in *statnet*

```
anagroup.ig$layout <- layout.kamada.kawai(anagroup.ig)

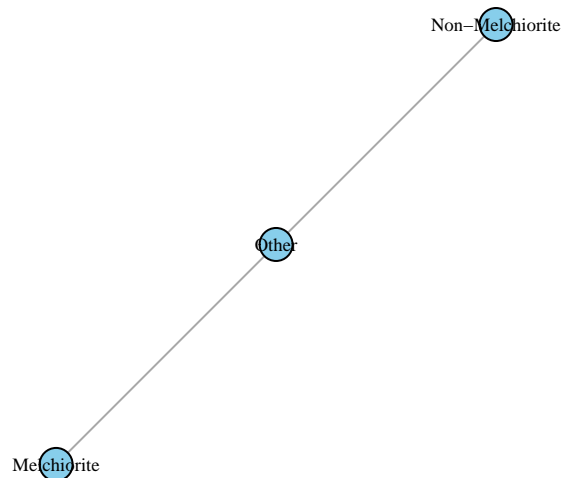
plot(anagroup.ig,vertex.color="Sky Blue",vertex.label.cex=.6,vertex.label.color="black",
edge.arrow.mode=0)
```



Note that there are multiple edges; let’s get rid of those and then replot

```
anagroup.ig <- simplify(anagroup.ig)

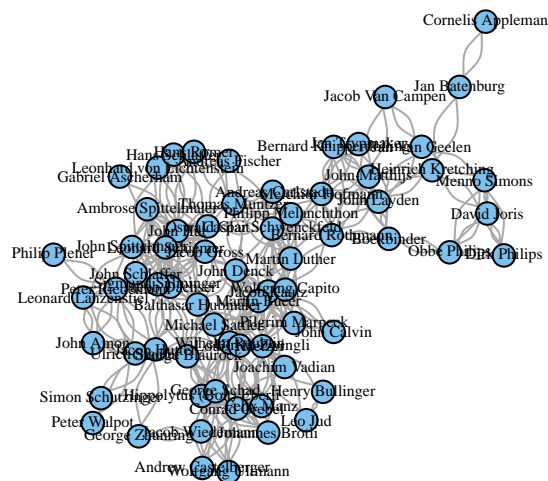
# Plot again
plot(anagroup.ig,vertex.color="Sky Blue",vertex.label.cex=.6,vertex.label.color="black",
edge.arrow.mode=0)
```



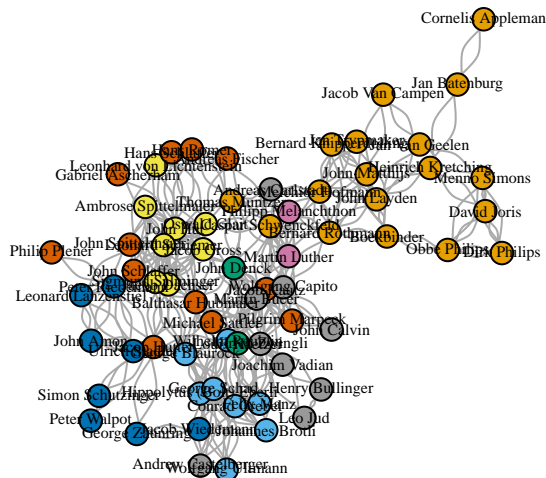
The graph isn't too exciting although it does highlight how the Melchiorites (at least at the leadership level) were only connected to other Anabaptists through non-Anabaptists like Martin Luther.

Now, let's see what happens if we examine and then collapse the network based on religious tradition. First plot the network in *igraph* using the same coordinates as before. Then, vary the color to reflect religious tradition

```
plot(anabaptist.ig,layout=coords,vertex.label.cex=.5,vertex.label.color="black",
     vertex.size=10,vertex.color="Skyblue2")
```



```
plot(anabaptist.ig,layout=coords,vertex.label.cex=.5,vertex.label.color="black",
     vertex.size=10,vertex.color=tradition.vec)
```



Now, let's collapse it by religious tradition the same way as we did above.

```

anatrads.ig <- contract.vertices(anabaptist.ig,tradition.vec)

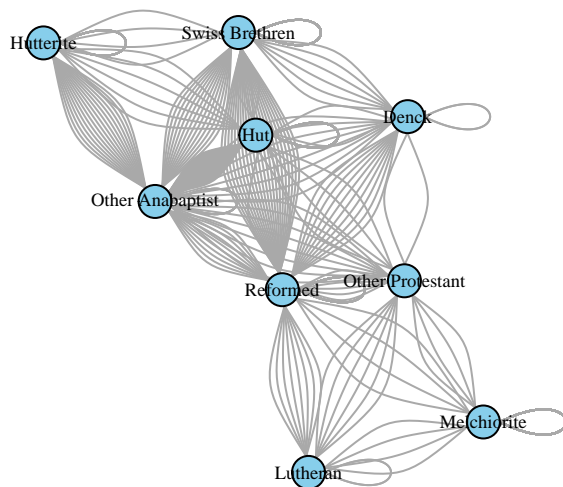
anatrads.ig <- set.vertex.attribute(anatrads.ig, "vertex.names",value=c("Melchiorite",
  "Swiss Brethren","Denck","Hut","Hutterite","Other Anabaptist",
  "Lutheran","Reformed","Other Protestant"))

V(anatrads.ig)$label = V(anatrads.ig)$vertex.names

anatrads.ig$layout <- layout.kamada.kawai(anatrads.ig)

plot(anatrads.ig,vertex.color="Sky Blue",vertex.label.cex=.6,vertex.label.color="black",
  edge.arrow.mode=0)

```



Let's eliminate multiple lines but this time weight edges by sum of multiple lines

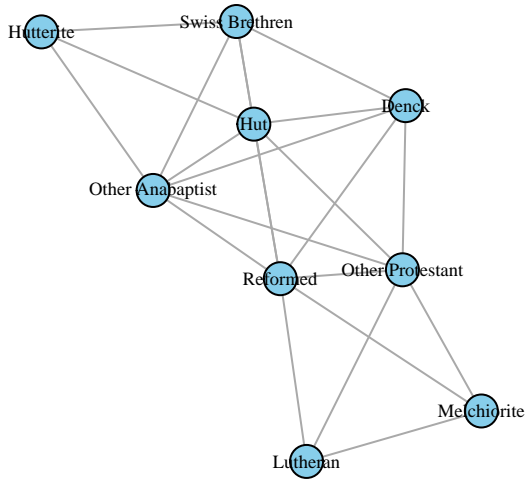
```

anatrads.ig <- simplify(anatrads.ig,edge.attr.comb="sum")

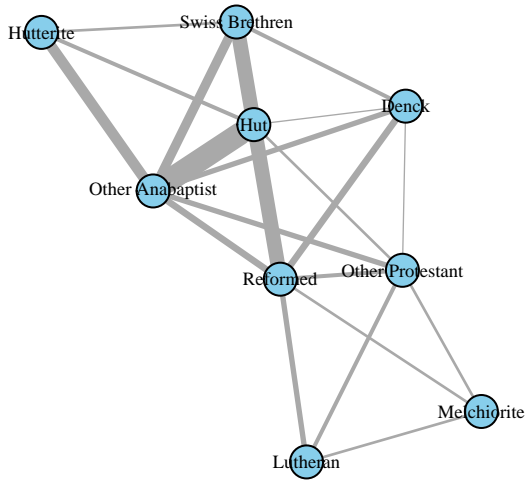
weight.vec <- get.edge.attribute(anatrads.ig,"weight")

plot(anatrads.ig,vertex.color="Sky Blue",vertex.label.cex=.6,vertex.label.color="black",
  edge.arrow.mode=0)

```

```
plot(anatrad.ig,vertex.color="Sky Blue",vertex.label.cex=.6,
     vertex.label.color="black",edge.arrow.mode=0,edge.width=weight.vec/3)
```



That's all for now