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The R spnet package
Plotting social networks on maps

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LIVE^S
Swiss National Centre of Competence in Research

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Motivation

- ▶ Rendering social networks is an efficient way to interpret them
- ▶ Social networks may hold a spatial dimension
- ▶ Social networks may evolve over time

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Goals

- ▶ Rendering social networks
- ▶ Rendering the spatial dimension
- ▶ Tracking network's evolution over time
- ▶ Tracking spatial evolution over time
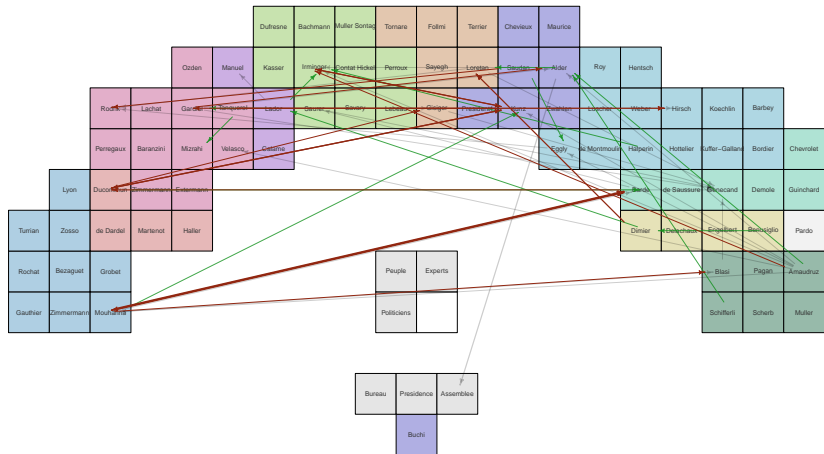- ▶ Straightforward daily use

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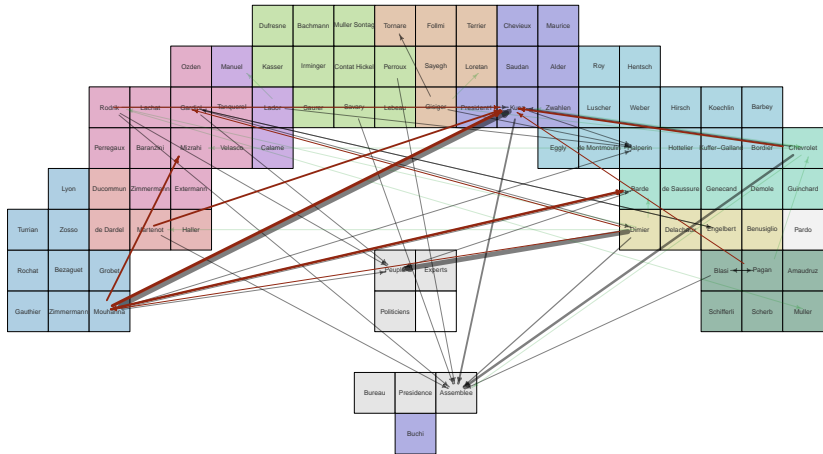Inflows/Outflows of migrants in Switzerland

Measuring the political Debate

- ▶ Data source: Assemblée constituante de Genève
- ▶ Networks of individual references between members of parliament
- ▶ Debate: Extension of political rights for foreigners
- ▶ Year: 2009 to 2012
- ▶ Map: Modelization of the *Concil of Geneva* room, Rousseaux and Deville.

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Individual references: First reading debate

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Individual references: Second reading debate

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Inflows/Outflows of migrants in Switzerland

- Data source: OCDE International migration database (website)
- Scope: worldwide
- Flows derived from population registers
- Year: 2000 to 2011
- World map: TM World Borders Simpl-0.3, by bjørn sandvik

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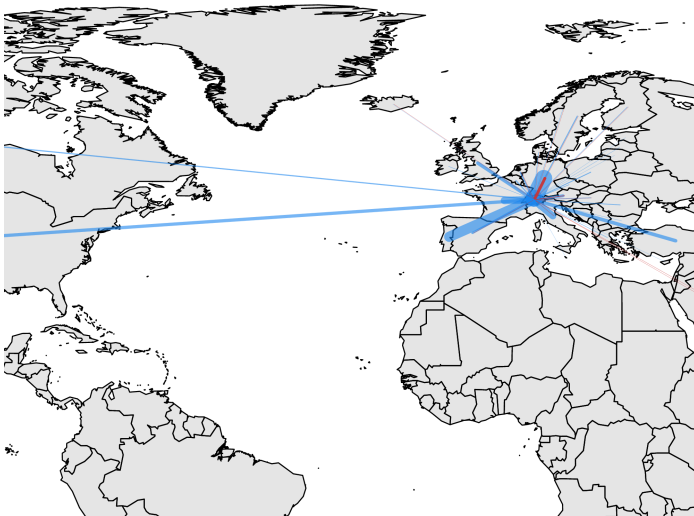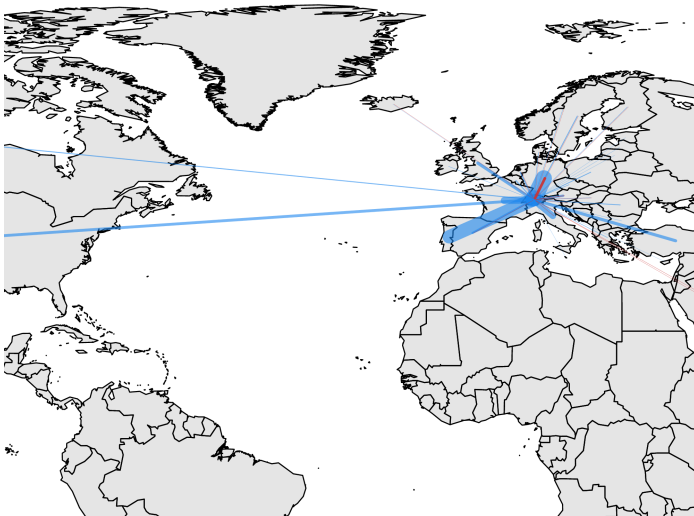Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2000*

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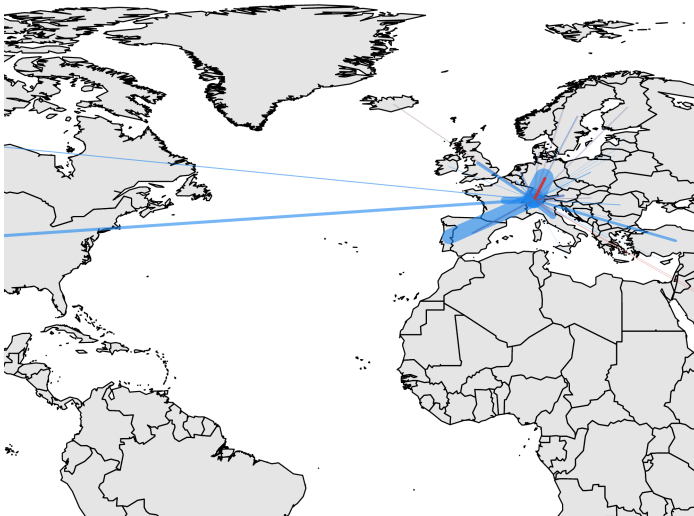Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2001*

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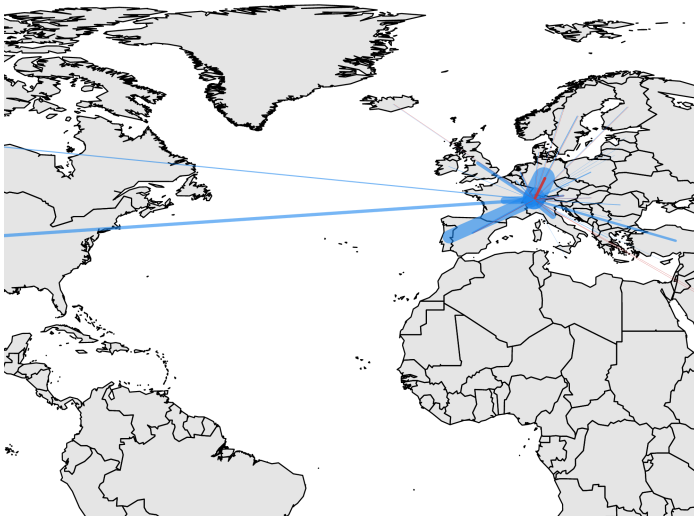Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2002* LIVES

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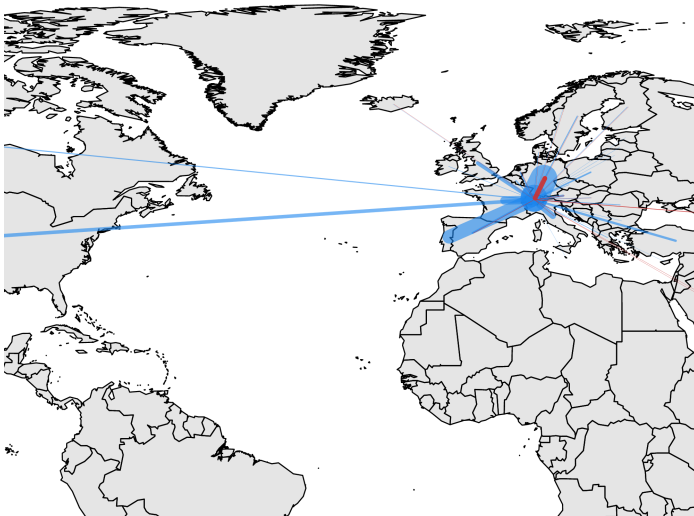Design and functionalities
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Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2003*

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Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2004*

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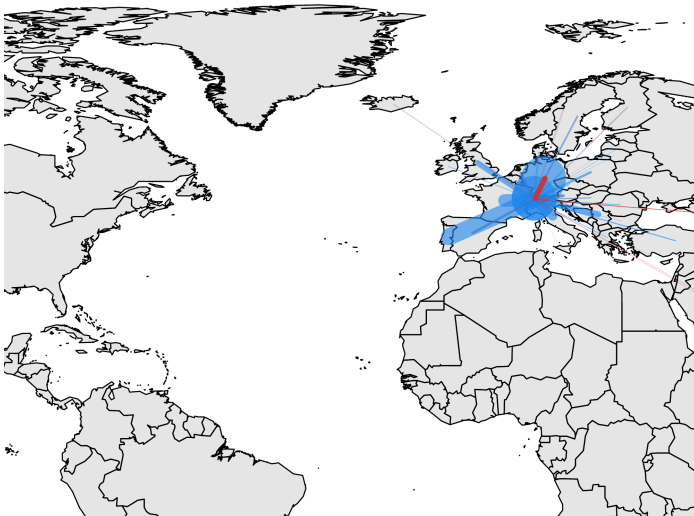Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2005*

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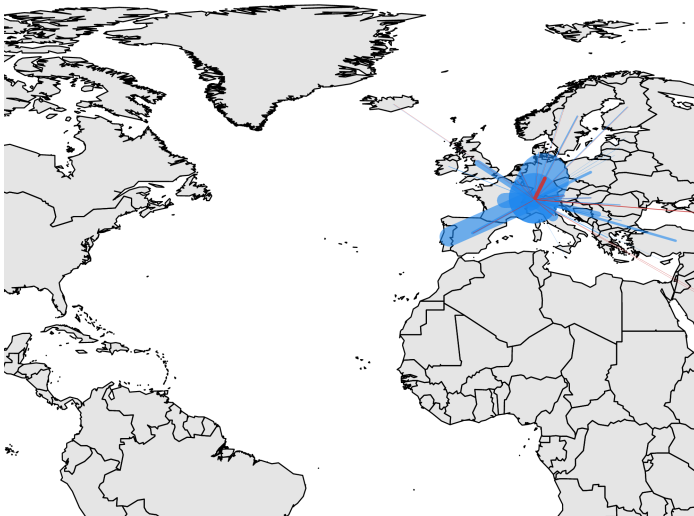Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2006*

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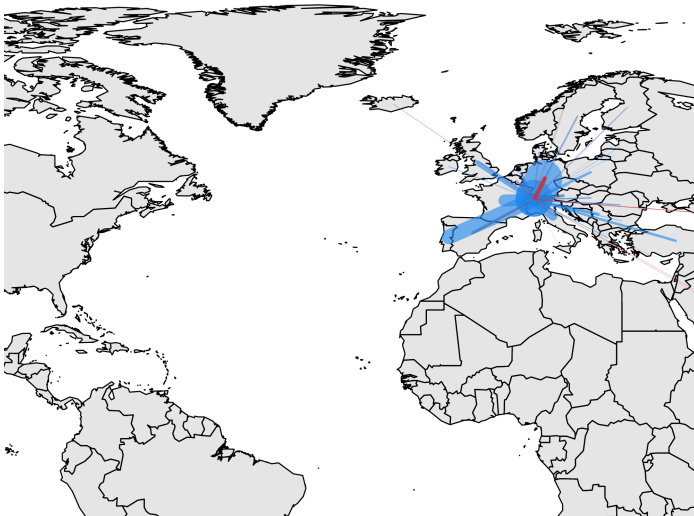**Applications**
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Measuring the political Debate
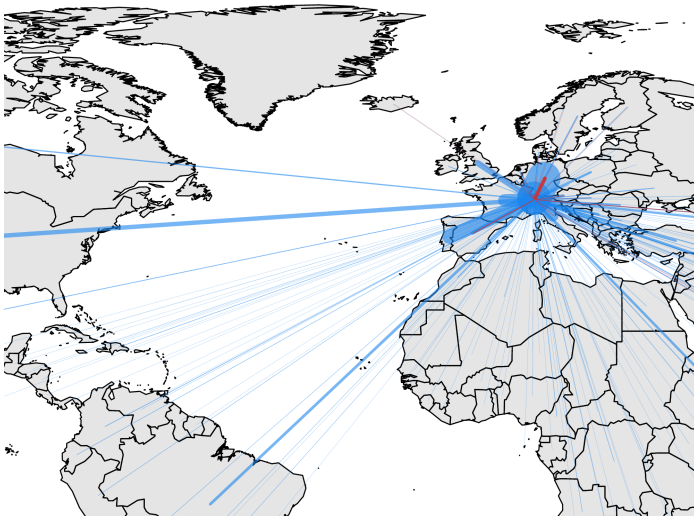Inflows/Outflows of migrants in Switzerland

Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2007* LIVES

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Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2008*

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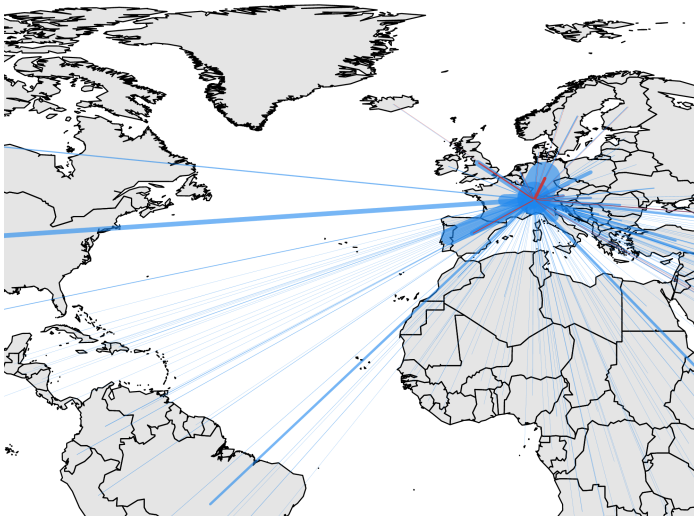Measuring the political Debate
Inflows/Outflows of migrants in Switzerland

Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2009*

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Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2010*

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Figure : *Inflows (blue) / Outflows (red) of migrants in Switzerland, 2011*

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Design

- ▶ The graphical tool is released as a R package (written in S4)
- ▶ Map handling and rendering are based on the `'sp'` package
- ▶ Networks are squared matrix (`igraph` networks support forthcoming)

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```
library(spnet)

mymap <- room.create.u(x=c(6,3,6), out='matrix')
mymap

##      [,1] [,2] [,3] [,4] [,5]
## [1,]    0   -1   -1   -1    0
## [2,]    0   -1   -1   -1    0
## [3,]    0   -1   -1   -1    0
## [4,]    0   -1   -1   -1    0
## [5,]    0   -1   -1   -1    0
## [6,]    0   -1   -1   -1    0
## [7,]   -1    0    0    0   -1
```

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```
node <- c("John", "Elsa", "Brian", "Kate")
position <- c(2,4,6,8)

net1 <- spnet.create(
  data.frame(
    'NODE' =  node,
    'POSITION' = position
  )
)

spnet.map(net1) <- room.create.u(x=c(6,3,6))
spnet.title.main(net1) <- "My network"
```
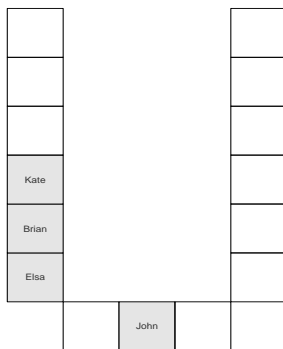
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```
net1

## This is a valid 'SpatialNetwork' object.
##
## - Data: (first rows)
##
##     NODE POSITION
## 1  John        2
## 2  Elsa        4
## 3 Brian        6
## 4  Kate        8
##
## - Map:
##      Length: 15
##
## - Plotting options:
```
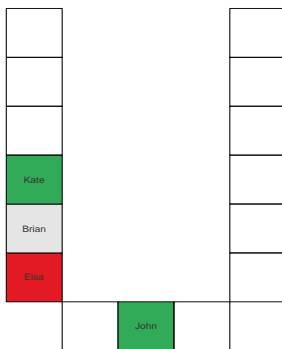
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`plot(net1)`

My network

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```r
net1$parti <- c('vert', 'socialiste', 'autre', 'vert')


spnet.color.variable(net1) <- "parti"
spnet.color.legend(net1) <- c('vert' = "#32AB58", 'socialiste' = "#E31923")
```

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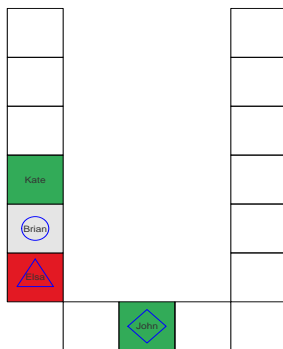Conclusion

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```
net1

## This is a valid 'SpatialNetwork' object.
##
## - Data: (first rows)
##
##    NODE POSITION      parti
## 1  John        2       vert
## 2  Elsa        4  socialiste
## 3 Brian        6      autre
## 4  Kate        8       vert
##
## - Map:
##     Length: 15
##
## - Plotting options:
##     Variable used to colorize: 'parti'
```

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`plot`(net1)

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```
net1$role <- c('Président', 'Chef de groupe',
               'Porteur du projet', 'partisan')


spnet.symbol.variable(net1) <- "role"
spnet.symbol.legend(net1) <- c('Président' = 'square.rotated',
                               'Chef de groupe' = 'triangle.up',
                               'Porteur du projet' = 'circle')
spnet.symbol.cex(net1) <- 6
spnet.symbol.color(net1) <- 'blue'
```

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```
net1

## This is a valid 'SpatialNetwork' object.
##
## - Data: (first rows)
##
##    NODE POSITION      parti              role
## 1  John       2        vert         Président
## 2  Elsa       4 socialiste    Chef de groupe
## 3  Brian      6       autre Porteur du projet
## 4  Kate       8        vert          partisan
##
## - Map:
##      Length: 15
##
## - Plotting options:
##      Variable used to colorize: 'parti'
##      Variable used to draw symbols: 'role'
```

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plot(net1)

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```
network1 <- matrix(
  rep(0, length(node)^2),
  nrow = length(node),
  dimnames = list(node, node)
)
network1['John', 'Elsa'] <- 1
network1['Kate', 'Brian'] <- 2
network1


##      John Elsa Brian Kate
## John    0    1     0    0
## Elsa    0    0     0    0
## Brian   0    0     0    0
## Kate    0    0     2    0
```

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```
spnet.networks.list(net1)$yes$matrix <- network1
net1

## This is a valid 'SpatialNetwork' object.
##
## - Data: (first rows)
##
##     NODE POSITION     parti          role
## 1 John        2       vert      Président
## 2 Elsa        4 socialiste  Chef de groupe
## 3 Brian       6      autre Porteur du projet
## 4 Kate        8       vert       partisan
##
## - Map:
##     Length: 15
##
## - Network data:
##     Number of network(s): 1
##
## - Plotting options:
##     Variable used to colorize: 'parti'
##     Variable used to draw symbols: 'role'
```

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plot(net1)

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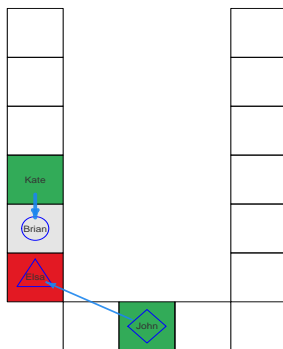
```r
network2 <- matrix(
  rep(0, length(node)^2),
  nrow = length(node),
  dimnames = list(node, node)
)
network2['John', 'Elsa'] <- 1
network2['John', 'Brian'] <- 1
network2['Brian', 'Elsa'] <- 3
network2

##       John Elsa Brian Kate
## John     0    1     1    0
## Elsa     0    0     0    0
## Brian    0    3     0    0
## Kate     0    0     0    0
```

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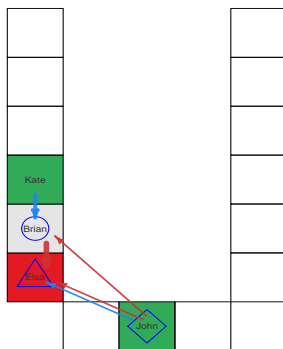Main functionalities

```
spnet.networks.list(net1)$no$matrix <- network2
net1

## This is a valid 'SpatialNetwork' object.
##
## - Data: (first rows)
##
##     NODE POSITION    parti          role
## 1  John        2      vert          Président
## 2  Elsa        4 socialiste   Chef de groupe
## 3  Brian       6     autre Porteur du projet
## 4  Kate        8      vert          partisan
##
## - Map:
##     Length: 15
##
## - Network data:
##     Number of network(s): 2
##
## - Plotting options:
##     Variable used to colorize: 'parti'
##     Variable used to draw symbols: 'role'
```

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plot(net1)

My network

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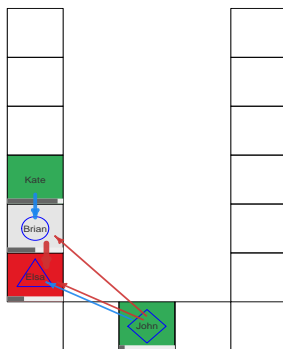Design and functionalities
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```
net1$content <- c(0.1,0.3,0.5,0.9)


spnet.barplot.variable(net1) <- "content"
spnet.barplot.bound.lower(net1) <- c(-0.5,-0.44)
spnet.barplot.bound.upper(net1) <- c(0.5,-0.44)
spnet.barplot.width(net1) <- 6
```

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`plot(net1)`

My network

Outline

Conclusion

- ▶ Efficient tool for rendering social networks on maps
- ▶ A lot of graphical settings
- ▶ Tools for preparing data

Outlook

- ▶ Filtering the social network (frequences, ...)
- ▶ Plot connections one-by-one
- ▶ Enhance comparaison of plots

LIVE^s

Thank you for your attention!