Cycle Simulation

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Simulate cells along cycle

```
## make circle like cell cycle
par(mfrow=c(1,1))
x <- matrix(rnorm(1000),nc=2)
y <- x/sqrt(rowSums(x^2))
## add some jitter
obs <- t(y)
obs <- jitter(obs, amount = 0.1)
## order points counterclockwise
angle <- atan2(obs[2,], obs[1,])
#angle

## double check quandrants
angle[obs[2,]>0 & obs[1,]>0]
```

```
##   [1] 0.419301336 0.510373963 1.328959879 1.195368358 1.305880537 0.713432249
##   [7] 1.491229912 0.194254557 0.768934336 1.061860177 0.144598176 0.257388468
##  [13] 0.399372329 1.088376277 1.009760618 0.415498058 0.698513160 1.391314674
##  [19] 0.563743816 0.865281311 0.111000988 1.201172040 1.036853667 1.087184029
##  [25] 1.079875553 0.075331019 1.520614695 0.964667647 0.848469312 1.018460850
##  [31] 0.623724739 0.391300524 1.262756224 0.009345486 1.245682372 1.039257371
##  [37] 1.000630695 0.801593883 1.229434049 0.837234550 1.477237162 0.296749767
##  [43] 1.004316643 0.318624709 1.009466149 1.557231987 0.604164492 0.468977519
##  [49] 0.323625537 0.569411950 1.532217535 0.485546739 0.625110897 0.010055512
##  [55] 1.236037291 1.266991213 0.055490118 1.217175328 0.088820307 1.022975591
##  [61] 0.680238668 1.462281411 1.473612824 0.516279242 1.275729480 1.522874399
##  [67] 0.700203855 0.169538055 0.814172243 1.269799979 0.807730018 1.275885309
##  [73] 0.725080380 0.199759490 0.576050508 0.705643545 1.242338293 0.778786760
##  [79] 0.401893292 1.371160118 1.239250409 0.171315889 0.140424910 1.249715042
##  [85] 1.567609446 1.152049382 0.436197281 1.195667485 1.473880578 0.934254137
##  [91] 0.799141686 0.669543144 0.134962761 0.223228367 1.535042777 0.501963946
##  [97] 0.283596881 0.450026311 0.570922973 0.625854869 0.360668130 0.574208359
## [103] 1.322139046 1.212605227 0.013641965 1.221629489 0.835063529 0.049607321
## [109] 1.518752745 0.483750081 1.312752933 0.506678508 0.098801804 0.777224290
## [115] 0.435040928 1.552960927 0.209403458 1.166807343 0.404434739 0.216919682
## [121] 1.269785875 1.054340907 1.019721716 1.428411494 0.733946688 0.594788190
## [127] 0.029895612 0.590175609 0.142268256 0.395037708
```

```
angle[obs[2,]>0 & obs[1,]<0]
```

```
##   [1] 1.719860 2.323273 1.930711 1.745753 1.929560 2.110178 2.022937 1.985532
##   [9] 1.724645 2.998721 1.925301 2.224388 2.562929 2.578621 1.678620 3.109149
##  [17] 1.860754 2.412713 1.850680 2.807035 3.110825 1.786768 1.703245 2.395779
```

```
##  [25] 2.730176 1.752798 2.136441 3.117579 3.032598 2.378965 1.681066 1.680784
##  [33] 1.731134 2.699649 1.750325 2.478438 2.175330 2.619054 3.007507 2.413005
##  [41] 2.918241 2.339193 1.925522 2.501327 1.614996 2.494573 2.553052 2.456461
##  [49] 2.276706 3.025615 2.072354 2.220723 2.862102 2.147927 1.912679 2.370075
##  [57] 2.426488 1.935719 1.994893 1.841582 2.886283 1.763799 2.843028 2.702978
##  [65] 2.610799 3.009390 2.377458 2.408532 2.872823 2.783542 1.853542 2.837227
##  [73] 1.589667 2.872627 2.617517 2.560725 2.698224 2.690569 2.151159 1.698008
##  [81] 2.068943 2.513553 1.815287 2.079972 1.585140 2.384125 2.124359 2.291358
##  [89] 1.810735 3.024578 1.962518 2.252376 1.929547 3.101631 2.511534 1.947589
##  [97] 2.136539 2.598776 2.088534 2.678621 1.642935 2.057245 1.830270 1.634577
## [105] 2.750623 2.661333 1.812111 2.824846 2.971548 2.302606 2.198438 2.538612
## [113] 1.838640 1.647992 2.964783 2.396050 2.344155 1.666365 2.862168 1.882226
## [121] 2.132205 2.685806 2.991761 3.101575 3.101693 1.727362 1.838852
```

```
angle[obs[2,]<0 & obs[1,]>0]
```

```
##   [1] -0.07817329 -0.47882988 -0.41680576 -0.98168407 -0.39786297 -0.69886401
##   [7] -0.78816207 -0.09193992 -1.41203507 -0.09299389 -1.18266845 -0.67117140
##  [13] -0.38322607 -0.54520942 -0.64711695 -1.34813448 -0.10714310 -1.45785344
##  [19] -0.52117052 -0.48091740 -0.50405354 -0.25699832 -1.20090917 -1.51075668
##  [25] -0.63813395 -1.34788685 -1.10294151 -1.12869469 -1.48022303 -0.57158149
##  [31] -0.25108616 -0.25192563 -1.14586245 -0.22828948 -0.85465897 -1.43147192
##  [37] -1.00286167 -0.24914503 -1.51675858 -0.25911191 -0.21977334 -0.72804419
##  [43] -0.51014673 -0.20994363 -0.14536349 -0.25099660 -0.99215681 -1.23817310
##  [49] -0.26095589 -0.98527681 -1.47251124 -1.39114391 -0.70955738 -0.49244439
##  [55] -0.67440328 -0.73634925 -1.29483776 -1.09709543 -1.10863812 -0.75098398
##  [61] -1.22056718 -1.12792306 -1.17576093 -0.47747891 -0.88581487 -0.08457390
##  [67] -0.61970075 -0.64951901 -1.50621445 -1.33441624 -1.31659331 -0.71988126
##  [73] -1.55010314 -0.97013642 -0.35923070 -1.37925234 -0.05995138 -1.10067770
##  [79] -0.53844136 -0.58708762 -0.42394747 -1.24081529 -1.08459770 -0.50122085
##  [85] -0.40913800 -1.46104098 -1.24132103 -0.90581317 -0.47180760 -1.32866228
##  [91] -1.47261852 -1.31783593 -0.11205057 -1.06068739 -0.42745386 -0.37907367
##  [97] -1.24382149 -1.38531906 -0.53109443 -1.48372359 -1.36379624 -1.18423453
## [103] -1.56826661 -1.44845662 -0.66178848 -0.14991238 -0.55483173 -0.50287371
## [109] -0.51385670 -1.49740064 -0.01531612 -0.62026871 -0.22708126 -1.09548621
## [115] -1.30433782 -1.45191487 -0.11714206
```

```
angle[obs[2,]<0 & obs[1,]<0]
```

```
##   [1] -1.957100 -2.413596 -1.917752 -2.551480 -1.832486 -1.787226 -2.993323
##   [8] -2.972094 -2.493173 -1.739676 -2.812108 -1.871156 -2.283243 -2.962433
##  [15] -1.753416 -3.078015 -2.855428 -2.497460 -1.853042 -2.684302 -2.667071
##  [22] -1.667751 -2.617357 -1.642864 -1.976090 -2.933916 -2.144999 -1.989597
##  [29] -1.798698 -2.217029 -3.001664 -2.573448 -2.117371 -2.834828 -2.823992
##  [36] -3.135918 -1.683406 -1.660765 -2.955281 -2.460457 -2.459258 -1.989030
##  [43] -1.978764 -2.867183 -1.945207 -2.579316 -3.100563 -2.502992 -2.959212
##  [50] -2.831194 -1.855269 -2.248415 -1.790236 -3.114727 -1.693263 -1.590280
##  [57] -1.711840 -3.084474 -1.837213 -2.471124 -2.247565 -2.239126 -1.859110
##  [64] -1.721408 -2.419900 -1.965374 -2.534852 -2.897642 -2.953741 -2.069639
##  [71] -3.085258 -2.927803 -2.642951 -2.484220 -2.343525 -1.881290 -2.491276
##  [78] -1.926553 -2.610123 -3.123327 -2.296389 -2.207844 -2.910444 -2.190146
##  [85] -2.077922 -3.056492 -2.216194 -2.310093 -2.643397 -1.820553 -2.257588
##  [92] -2.054444 -2.613903 -2.232518 -2.378113 -2.551658 -1.653906 -2.794888
##  [99] -2.673613 -2.212206 -2.018254 -2.029056 -2.968024 -1.690091 -3.138991
## [106] -2.300508 -2.162043 -2.263487 -1.697627 -2.036550 -3.138046 -2.913219
```

```
## [113] -1.765660 -2.949027 -2.893210 -1.798134 -2.146435 -1.825460 -2.358560
## [120] -1.855035 -1.954420 -3.074139 -2.101131 -2.198720 -1.676296 -2.467140
```

```
angle[obs[2,]<0 & obs[1,]>0] = angle[obs[2,]<0 & obs[1,]>0] + 2*pi
angle[obs[2,]<0 & obs[1,]<0] = angle[obs[2,]<0 & obs[1,]<0] + 2*pi

angle[obs[2,]>0 & obs[1,]>0]
```

```
##   [1] 0.419301336 0.510373963 1.328959879 1.195368358 1.305880537 0.713432249
##   [7] 1.491229912 0.194254557 0.768934336 1.061860177 0.144598176 0.257388468
##  [13] 0.399372329 1.088376277 1.009760618 0.415498058 0.698513160 1.391314674
##  [19] 0.563743816 0.865281311 0.111000988 1.201172040 1.036853667 1.087184029
##  [25] 1.079875553 0.075331019 1.520614695 0.964667647 0.848469312 1.018460850
##  [31] 0.623724739 0.391300524 1.262756224 0.009345486 1.245682372 1.039257371
##  [37] 1.000630695 0.801593883 1.229434049 0.837234550 1.477237162 0.296749767
##  [43] 1.004316643 0.318624709 1.009466149 1.557231987 0.604164492 0.468977519
##  [49] 0.323625537 0.569411950 1.532217535 0.485546739 0.625110897 0.010055512
##  [55] 1.236037291 1.266991213 0.055490118 1.217175328 0.088820307 1.022975591
##  [61] 0.680238668 1.462281411 1.473612824 0.516279242 1.275729480 1.522874399
##  [67] 0.700203855 0.169538055 0.814172243 1.269799979 0.807730018 1.275885309
##  [73] 0.725080380 0.199759490 0.576050508 0.705643545 1.242338293 0.778786760
##  [79] 0.401893292 1.371160118 1.239250409 0.171315889 0.140424910 1.249715042
##  [85] 1.567609446 1.152049382 0.436197281 1.195667485 1.473880578 0.934254137
##  [91] 0.799141686 0.669543144 0.134962761 0.223228367 1.535042777 0.501963946
##  [97] 0.283596881 0.450026311 0.570922973 0.625854869 0.360668130 0.574208359
## [103] 1.322139046 1.212605227 0.013641965 1.221629489 0.835063529 0.049607321
## [109] 1.518752745 0.483750081 1.312752933 0.506678508 0.098801804 0.777224290
## [115] 0.435040928 1.552960927 0.209403458 1.166807343 0.404434739 0.216919682
## [121] 1.269785875 1.054340907 1.019721716 1.428411494 0.733946688 0.594788190
## [127] 0.029895612 0.590175609 0.142268256 0.395037708
```

```
angle[obs[2,]>0 & obs[1,]<0]
```

```
##   [1] 1.719860 2.323273 1.930711 1.745753 1.929560 2.110178 2.022937 1.985532
##   [9] 1.724645 2.998721 1.925301 2.224388 2.562929 2.578621 1.678620 3.109149
##  [17] 1.860754 2.412713 1.850680 2.807035 3.110825 1.786768 1.703245 2.395779
##  [25] 2.730176 1.752798 2.136441 3.117579 3.032598 2.378965 1.681066 1.680784
##  [33] 1.731134 2.699649 1.750325 2.478438 2.175330 2.619054 3.007507 2.413005
##  [41] 2.918241 2.339193 1.925522 2.501327 1.614996 2.494573 2.553052 2.456461
##  [49] 2.276706 3.025615 2.072354 2.220723 2.862102 2.147927 1.912679 2.370075
##  [57] 2.426488 1.935719 1.994893 1.841582 2.886283 1.763799 2.843028 2.702978
##  [65] 2.610799 3.009390 2.377458 2.408532 2.872823 2.783542 1.853542 2.837227
##  [73] 1.589667 2.872627 2.617517 2.560725 2.698224 2.690569 2.151159 1.698008
##  [81] 2.068943 2.513553 1.815287 2.079972 1.585140 2.384125 2.124359 2.291358
##  [89] 1.810735 3.024578 1.962518 2.252376 1.929547 3.101631 2.511534 1.947589
##  [97] 2.136539 2.598776 2.088534 2.678621 1.642935 2.057245 1.830270 1.634577
## [105] 2.750623 2.661333 1.812111 2.824846 2.971548 2.302606 2.198438 2.538612
## [113] 1.838640 1.647992 2.964783 2.396050 2.344155 1.666365 2.862168 1.882226
## [121] 2.132205 2.685806 2.991761 3.101575 3.101693 1.727362 1.838852
```

```
angle[obs[2,]<0 & obs[1,]>0]
```

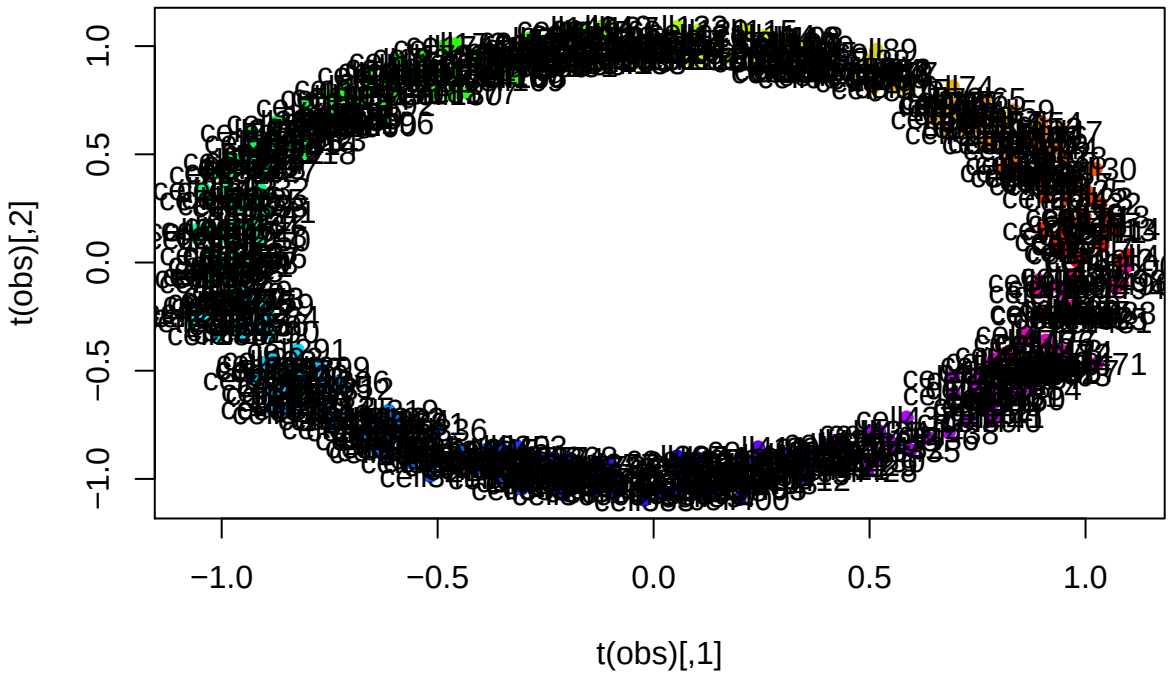
```
##   [1] 6.205012 5.804355 5.866380 5.301501 5.885322 5.584321 5.495023 6.191245
##   [9] 4.871150 6.190191 5.100517 5.612014 5.899959 5.737976 5.636068 4.935051
##  [17] 6.176042 4.825332 5.762015 5.802268 5.779132 6.026187 5.082276 4.772429
##  [25] 5.645051 4.935298 5.180244 5.154491 4.802962 5.711604 6.032099 6.031260
```

```
##  [33] 5.137323 6.054896 5.428526 4.851713 5.280324 6.034040 4.766427 6.024073
##  [41] 6.063412 5.555141 5.773039 6.073242 6.137822 6.032189 5.291029 5.045012
##  [49] 6.022229 5.297908 4.810674 4.892041 5.573628 5.790741 5.608782 5.546836
##  [57] 4.988348 5.186090 5.174547 5.532201 5.062618 5.155262 5.107424 5.805706
##  [65] 5.397370 6.198611 5.663485 5.633666 4.776971 4.948769 4.966592 5.563304
##  [73] 4.733082 5.313049 5.923955 4.903933 6.223234 5.182508 5.744744 5.696098
##  [81] 5.859238 5.042370 5.198588 5.781964 5.874047 4.822144 5.041864 5.377372
##  [89] 5.811378 4.954523 4.810567 4.965349 6.171135 5.222498 5.855731 5.904112
##  [97] 5.039364 4.897866 5.752091 4.799462 4.919389 5.098951 4.714919 4.834729
## [105] 5.621397 6.133273 5.728354 5.780312 5.769329 4.785785 6.267869 5.662917
## [113] 6.056104 5.187699 4.978847 4.831270 6.166043
```

```
angle[obs[2,]<0 & obs[1,]<0]
```

```
##   [1] 4.326085 3.869589 4.365434 3.731706 4.450699 4.495959 3.289862 3.311091
##   [9] 3.790012 4.543509 3.471077 4.412030 3.999942 3.320752 4.529769 3.205170
##  [17] 3.427757 3.785725 4.430143 3.598883 3.616114 4.615434 3.665829 4.640321
##  [25] 4.307095 3.349269 4.138186 4.293589 4.484488 4.066156 3.281521 3.709737
##  [33] 4.165814 3.448357 3.459193 3.147267 4.599779 4.622420 3.327904 3.822728
##  [41] 3.823927 4.294156 4.304421 3.416002 4.337978 3.703869 3.182622 3.780193
##  [49] 3.323974 3.451991 4.427916 4.034770 4.492949 3.168458 4.589922 4.692905
##  [57] 4.571345 3.198711 4.445972 3.812061 4.035621 4.044060 4.424075 4.561778
##  [65] 3.863285 4.317811 3.748334 3.385544 3.329444 4.213546 3.197927 3.355383
##  [73] 3.640234 3.798965 3.939660 4.401895 3.791909 4.356632 3.673062 3.159858
##  [81] 3.986796 4.075342 3.372741 4.093039 4.205263 3.226693 4.066991 3.973092
##  [89] 3.639788 4.462632 4.025597 4.228742 3.669282 4.050667 3.905072 3.731528
##  [97] 4.629279 3.488297 3.609573 4.070980 4.264931 4.254129 3.315161 4.593094
## [105] 3.144194 3.982677 4.121142 4.019698 4.585559 4.246636 3.145139 3.369966
## [113] 4.517525 3.334159 3.389975 4.485052 4.136750 4.457725 3.924626 4.428150
## [121] 4.328765 3.209046 4.182054 4.084465 4.606889 3.816046
```

```
obs <- obs[, order(angle)]
#obs
## rainbow
col = colorRampPalette(c(rainbow(10)))(ncol(obs))
labels <- paste0('cell', 1:ncol(obs))
## plot
plot(t(obs),col=col, pch=16)
text(t(obs), labels)
```




```
colnames(obs) <- labels
```

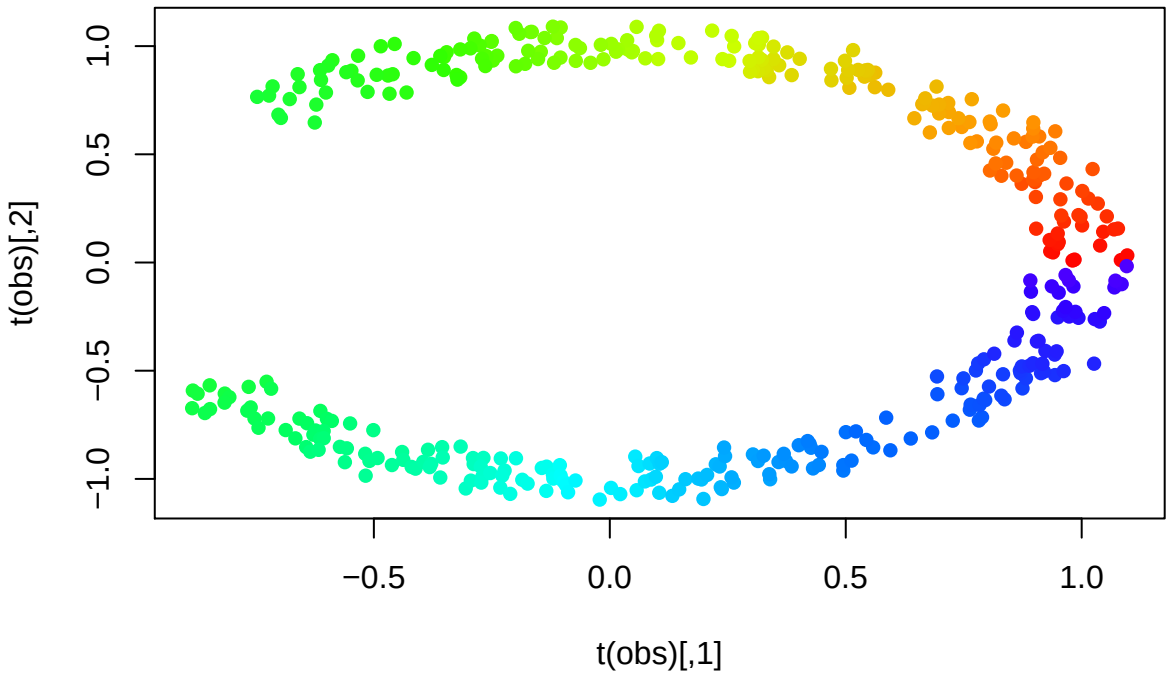
Remove some transient cells

```
cells.keep <- setdiff(labels, paste0('cell', 200:300))
cells.keep
```

```
##   [1] "cell1"   "cell2"   "cell3"   "cell4"   "cell5"   "cell6"   "cell7"
##   [8] "cell8"   "cell9"   "cell10"  "cell11"  "cell12"  "cell13"  "cell14"
##  [15] "cell15"  "cell16"  "cell17"  "cell18"  "cell19"  "cell20"  "cell21"
##  [22] "cell22"  "cell23"  "cell24"  "cell25"  "cell26"  "cell27"  "cell28"
##  [29] "cell29"  "cell30"  "cell31"  "cell32"  "cell33"  "cell34"  "cell35"
##  [36] "cell36"  "cell37"  "cell38"  "cell39"  "cell40"  "cell41"  "cell42"
##  [43] "cell43"  "cell44"  "cell45"  "cell46"  "cell47"  "cell48"  "cell49"
##  [50] "cell50"  "cell51"  "cell52"  "cell53"  "cell54"  "cell55"  "cell56"
##  [57] "cell57"  "cell58"  "cell59"  "cell60"  "cell61"  "cell62"  "cell63"
##  [64] "cell64"  "cell65"  "cell66"  "cell67"  "cell68"  "cell69"  "cell70"
##  [71] "cell71"  "cell72"  "cell73"  "cell74"  "cell75"  "cell76"  "cell77"
##  [78] "cell78"  "cell79"  "cell80"  "cell81"  "cell82"  "cell83"  "cell84"
##  [85] "cell85"  "cell86"  "cell87"  "cell88"  "cell89"  "cell90"  "cell91"
##  [92] "cell92"  "cell93"  "cell94"  "cell95"  "cell96"  "cell97"  "cell98"
##  [99] "cell99"  "cell100" "cell101" "cell102" "cell103" "cell104" "cell105"
## [106] "cell106" "cell107" "cell108" "cell109" "cell110" "cell111" "cell112"
## [113] "cell113" "cell114" "cell115" "cell116" "cell117" "cell118" "cell119"
## [120] "cell120" "cell121" "cell122" "cell123" "cell124" "cell125" "cell126"
## [127] "cell127" "cell128" "cell129" "cell130" "cell131" "cell132" "cell133"
## [134] "cell134" "cell135" "cell136" "cell137" "cell138" "cell139" "cell140"
## [141] "cell141" "cell142" "cell143" "cell144" "cell145" "cell146" "cell147"
## [148] "cell148" "cell149" "cell150" "cell151" "cell152" "cell153" "cell154"
## [155] "cell155" "cell156" "cell157" "cell158" "cell159" "cell160" "cell161"
## [162] "cell162" "cell163" "cell164" "cell165" "cell166" "cell167" "cell168"
## [169] "cell169" "cell170" "cell171" "cell172" "cell173" "cell174" "cell175"
## [176] "cell176" "cell177" "cell178" "cell179" "cell180" "cell181" "cell182"
```

```
## [183] "cell183" "cell184" "cell185" "cell186" "cell187" "cell188" "cell189"
## [190] "cell190" "cell191" "cell192" "cell193" "cell194" "cell195" "cell196"
## [197] "cell197" "cell198" "cell199" "cell301" "cell302" "cell303" "cell304"
## [204] "cell305" "cell306" "cell307" "cell308" "cell309" "cell310" "cell311"
## [211] "cell312" "cell313" "cell314" "cell315" "cell316" "cell317" "cell318"
## [218] "cell319" "cell320" "cell321" "cell322" "cell323" "cell324" "cell325"
## [225] "cell326" "cell327" "cell328" "cell329" "cell330" "cell331" "cell332"
## [232] "cell333" "cell334" "cell335" "cell336" "cell337" "cell338" "cell339"
## [239] "cell340" "cell341" "cell342" "cell343" "cell344" "cell345" "cell346"
## [246] "cell347" "cell348" "cell349" "cell350" "cell351" "cell352" "cell353"
## [253] "cell354" "cell355" "cell356" "cell357" "cell358" "cell359" "cell360"
## [260] "cell361" "cell362" "cell363" "cell364" "cell365" "cell366" "cell367"
## [267] "cell368" "cell369" "cell370" "cell371" "cell372" "cell373" "cell374"
## [274] "cell375" "cell376" "cell377" "cell378" "cell379" "cell380" "cell381"
## [281] "cell382" "cell383" "cell384" "cell385" "cell386" "cell387" "cell388"
## [288] "cell389" "cell390" "cell391" "cell392" "cell393" "cell394" "cell395"
## [295] "cell396" "cell397" "cell398" "cell399" "cell400" "cell401" "cell402"
## [302] "cell403" "cell404" "cell405" "cell406" "cell407" "cell408" "cell409"
## [309] "cell410" "cell411" "cell412" "cell413" "cell414" "cell415" "cell416"
## [316] "cell417" "cell418" "cell419" "cell420" "cell421" "cell422" "cell423"
## [323] "cell424" "cell425" "cell426" "cell427" "cell428" "cell429" "cell430"
## [330] "cell431" "cell432" "cell433" "cell434" "cell435" "cell436" "cell437"
## [337] "cell438" "cell439" "cell440" "cell441" "cell442" "cell443" "cell444"
## [344] "cell445" "cell446" "cell447" "cell448" "cell449" "cell450" "cell451"
## [351] "cell452" "cell453" "cell454" "cell455" "cell456" "cell457" "cell458"
## [358] "cell459" "cell460" "cell461" "cell462" "cell463" "cell464" "cell465"
## [365] "cell466" "cell467" "cell468" "cell469" "cell470" "cell471" "cell472"
## [372] "cell473" "cell474" "cell475" "cell476" "cell477" "cell478" "cell479"
## [379] "cell480" "cell481" "cell482" "cell483" "cell484" "cell485" "cell486"
## [386] "cell487" "cell488" "cell489" "cell490" "cell491" "cell492" "cell493"
## [393] "cell494" "cell495" "cell496" "cell497" "cell498" "cell499" "cell500"
```

```
labels <- labels[cells.keep]
obs <- obs[,cells.keep]
plot(t(obs),col=col, pch=16)
```

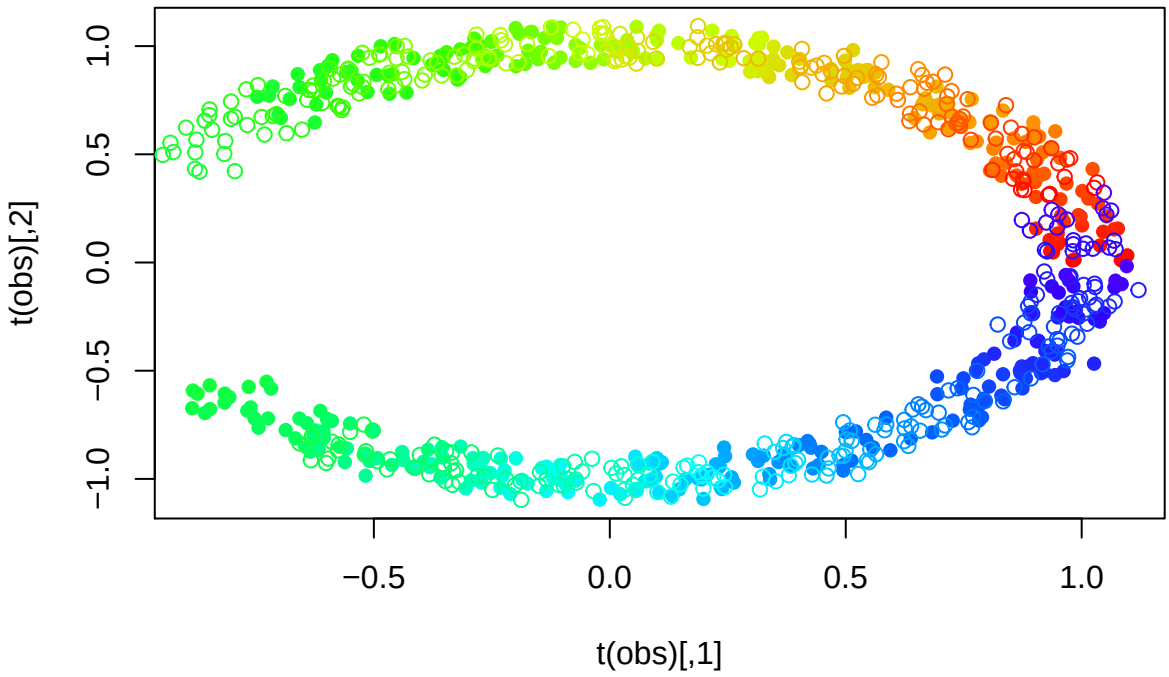



```
#text(t(obs), labels)
```

Simulate lower dimensional representation of future transcriptional state

```
## rotate circle slightly
f = pi*0.1 # adjust as needed
exp = t(obs)
exp[,1] = obs[1,]*cos(f) - obs[2,]*sin(f)
exp[,2] = obs[2,]*cos(f) + obs[1,]*sin(f)
exp = t(exp)

plot(t(obs),col=col, pch=16)
points(t(exp),col=col)
```




```
colnames(exp) <- labels
```

Try different embeddings

```
k = 10

## Lyla's FDG
library(igraph)
```

```
##
## Attaching package: 'igraph'
```

```
## The following objects are masked from 'package:stats':
##
##     decompose, spectrum
```

```
## The following object is masked from 'package:base':
##
##     union
```

```
library(matie)
```

```
## Registered S3 method overwritten by 'seriation':
##   method         from
##   reorder.hclust gclus
```

```
## Registered S3 methods overwritten by 'proxy':
##   method               from
##   print.registry_field registry
##   print.registry_entry registry
```

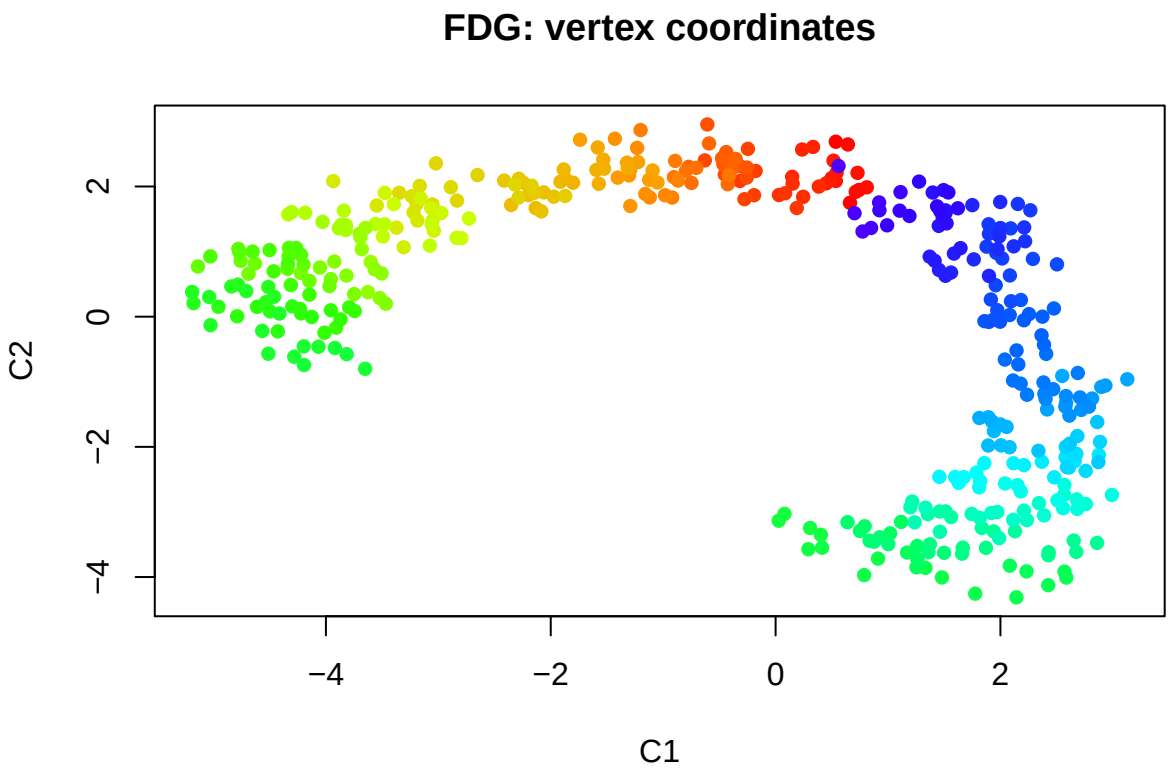
```
library(RANN)
source('../graphViz/projectedNeighbors.R')
gsim = graphViz(obs, exp, k, cell.colors=col, weighted=TRUE, plot = FALSE, return_graph = TRUE)
```

```
## [1] "Done finding neighbors"
```

```
## Warning in vattrs[[name]][index] <- value: number of items to replace is not a
## multiple of replacement length
```

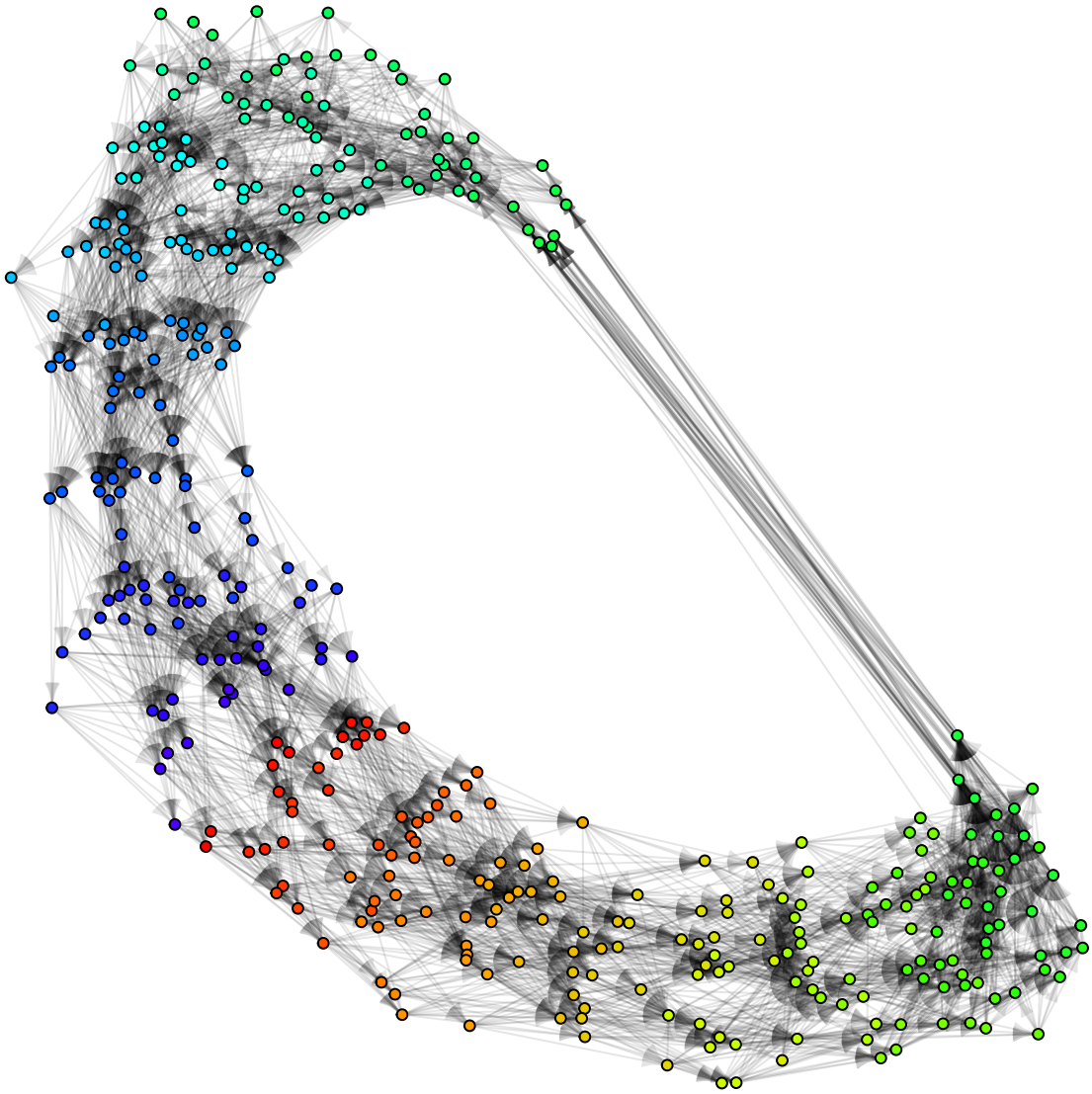
```
## [1] "Done making graph"
```

```
plot(gsim$fdg_coords, main = "FDG: vertex coordinates", col=col, pch=16)
```

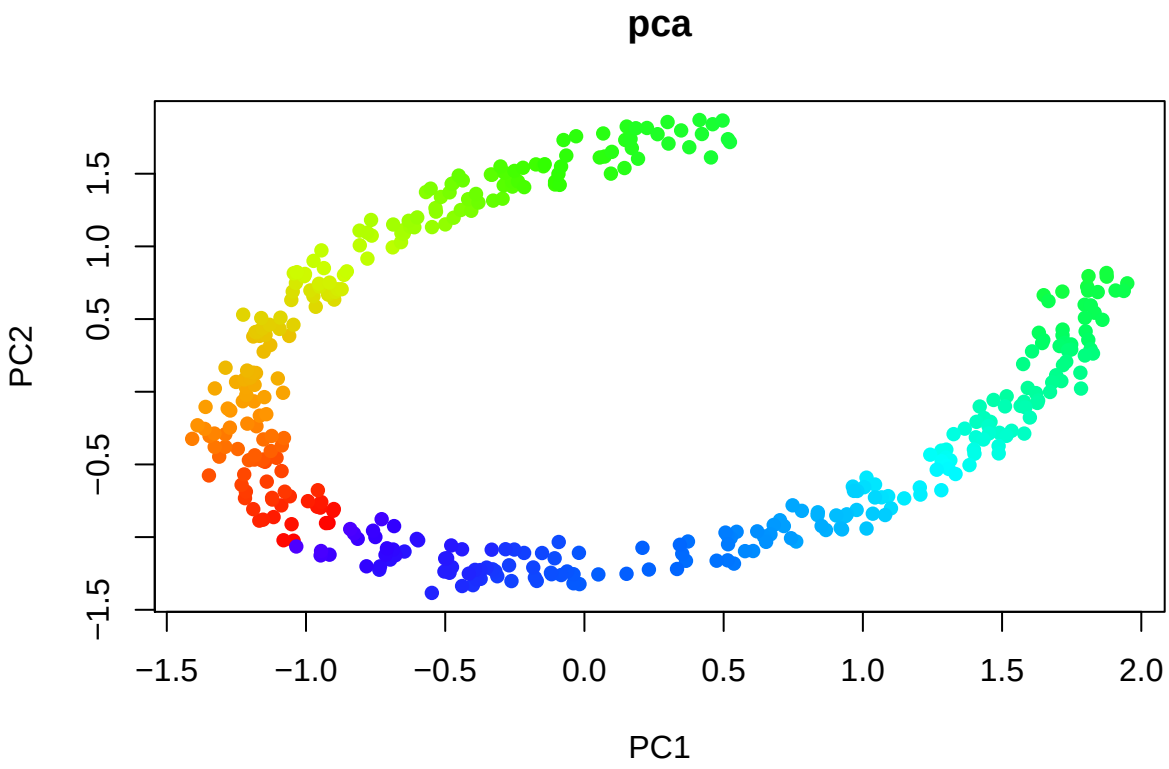



```
#text(gsim$fdg_coords+0.1, labels = labels)
```

```
g <- gsim$graph
V(g)$label = NA
V(g)$size = 2
E(g)$arrow.size = 0.5
E(g)$color = rgb(0,0,0,0.1)
plot(g)
```

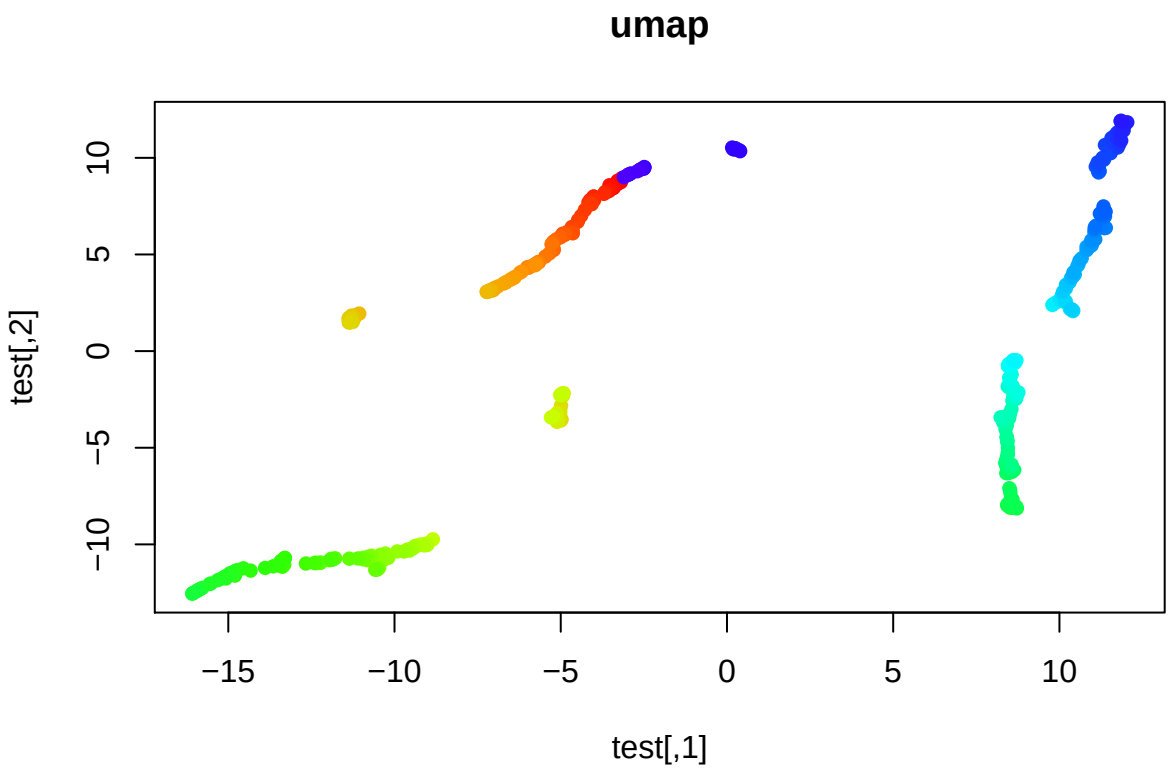


```
## PCA
test <- prcomp(t(obs), scale=TRUE, center=TRUE)
test <- test$x
plot(test, main = "pca", col=col, pch=16)
```



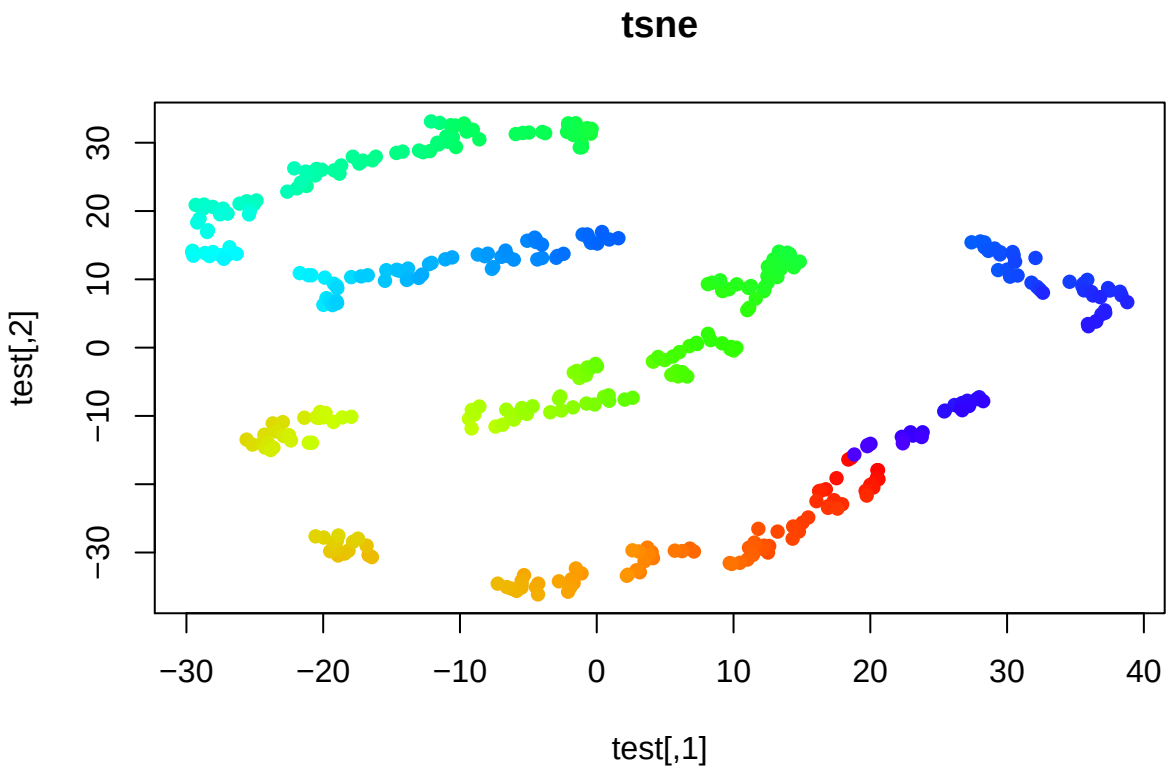

```
#text(test+0.1, labels=labels)
```

```
## Umap
test <- uwot::umap(t(obs), n_neighbors = k, min=0.1)
plot(test, main = "umap", col=col, pch=16)
```



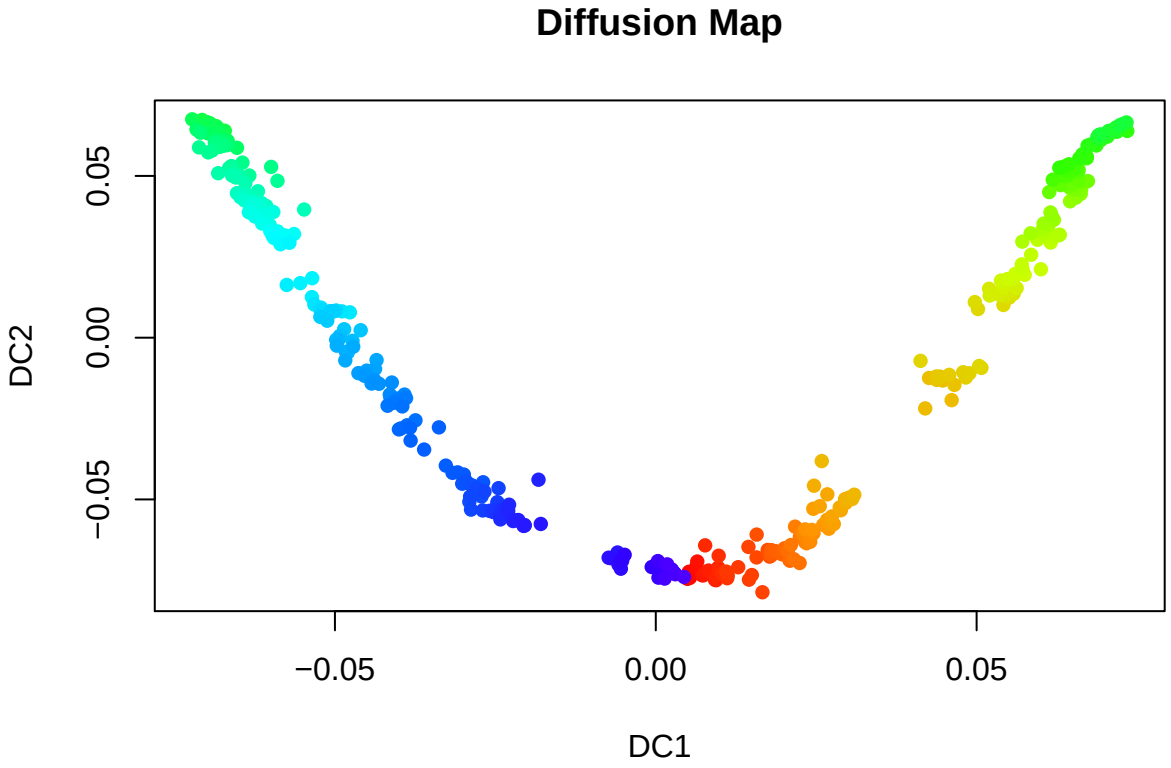
```
#text(test+0.1, labels=labels)
```

```
## tSNE
test <- Rtsne::Rtsne(t(obs), perplexity=k)$Y
plot(test, main = "tsne", col=col, pch=16)
```



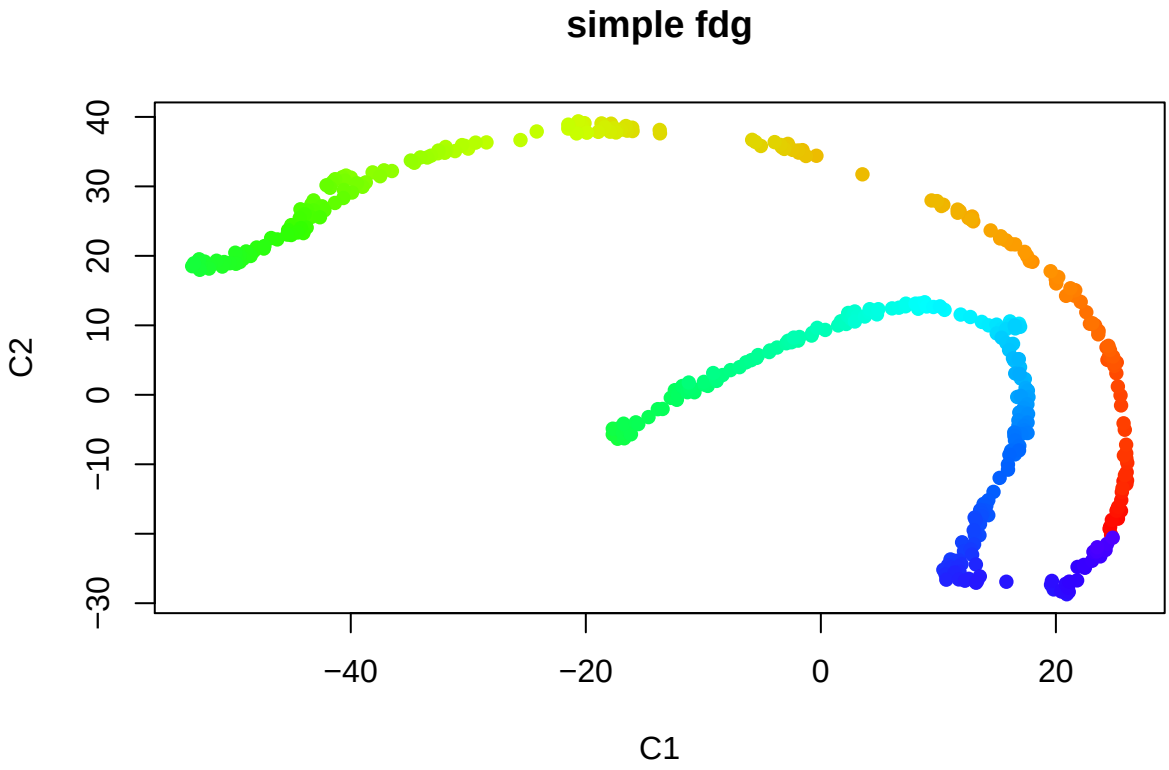

```
#text(test+0.1, labels=labels)
```

```
## diffusion map
test <- destiny::DiffusionMap(t(obs))
test <- test@eigenvectors[,1:2]
plot(test, main = "Diffusion Map", col=col, pch=16)
```




```
#text(test+0.1, labels=labels)
```

```
## Regular FDG on observed only
nn = RANN::nn2(t(obs), k = k) ## KNN
names(nn) <- c('idx', 'dists')
weight <- 1/(1+ as.vector(nn$dists))
nn.df = data.frame(from = rep(1:nrow(nn$idx), k),
                   to = as.vector(nn$idx),
                   weight = weight
)
g <- igraph::graph_from_data_frame(nn.df, directed = FALSE)
g <- igraph::simplify(g)
fdg = layout_with_fr(g,dim=2)
colnames(fdg) = c("C1","C2")
rownames(fdg) <- labels
plot(fdg, main = "simple fdg", col=col, pch=16)
```




```
#text(fdg+0.1, labels = labels)
```