# Output Angle Means Fixed Effects

Monday, December 14, 2020      8:27 PM

## Fixed Effects with age, gender, hand, region
## No update in iterations and burn iterations

```
bpnr(pred.I = y ~ age + gender + hand + region, data = mean_per_cluster)
MCMC:
iterations = 1000
burn-in = 1
lag = 1
Model Fit:
        Statistic Parameters
lppd    -3405.098   18.00000
DIC      6846.495   18.60995
DIC.alt  7100.175  145.44972
WAIC     6845.575   17.69007
WAIC2    6845.782   17.79365
Linear Coefficients
Component I:
```

| | mean | mode | sd | LB HPD | UB HPD |
|---|---|---|---|---|---|
| (Intercept) | -1.610446753 | -1.62649287 | 0.08195132 | -1.76749786 | -1.45073796 |
| age25-40 | 0.002633647 | 0.01371292 | 0.06963150 | -0.12282580 | 0.14626622 |
| age41-60 | 0.498572462 | 0.50462245 | 0.06321817 | 0.36482820 | 0.61652567 |
| age61+ | 0.610747874 | 0.60004473 | 0.08794453 | 0.43505621 | 0.78288099 |
| gendermale | 0.169100815 | 0.16286612 | 0.05063561 | 0.07206331 | 0.27574475 |
| handright | -0.093128017 | -0.09145050 | 0.07331266 | -0.24280127 | 0.03887876 |
| regionnortheast | 0.171844991 | 0.24566695 | 0.22038403 | -0.25412602 | 0.57812584 |
| regionsouth | -0.010936711 | -0.01936598 | 0.08190571 | -0.17430860 | 0.14219894 |
| regionwest | -0.328290942 | -0.31550200 | 0.14142867 | -0.58222569 | -0.01838395 |

```
Component II:
```

| | mean | mode | sd | LB HPD | UB HPD |
|---|---|---|---|---|---|
| (Intercept) | -0.39802179 | -0.40193124 | 0.06439136 | -0.5259000 | -0.27752112 |
| age25-40 | -0.07035059 | -0.06321375 | 0.05652580 | -0.1653668 | 0.04690193 |
| age41-60 | 0.63990934 | 0.62877638 | 0.05275579 | 0.5449481 | 0.75342622 |
| age61+ | 1.20048134 | 1.20898014 | 0.09019862 | 1.0107780 | 1.36693043 |
| gendermale | 0.36195101 | 0.36471221 | 0.04213839 | 0.2795005 | 0.44044412 |
| handright | 0.37758341 | 0.37163234 | 0.06129887 | 0.2526039 | 0.48586027 |
| regionnortheast | -0.85615369 | -0.92082110 | 0.19098227 | -1.2169625 | -0.48938881 |
| regionsouth | 0.32626368 | 0.35302741 | 0.06752711 | 0.1865866 | 0.45491467 |
| regionwest | -0.14236085 | -0.11137371 | 0.11501625 | -0.3417097 | 0.09765457 |

```
Circular Coefficients
Continuous variables:
[1] "There are no numeric predictors in the model"
Categorical variables:
Means:
```

| | mean | mode | sd | LB | UB |
|---|---|---|---|---|---|
| (Intercept) | -2.899236 | -2.897141 | 0.03849500 | -2.970834 | -2.821491 |
| age25-40 | -2.858009 | -2.859332 | 0.04297384 | -2.945452 | -2.781073 |
| age41-60 | 2.927233 | 2.941879 | 0.05848306 | 2.804117 | 3.035658 |
| age61+ | 2.464900 | 2.448915 | 0.07884095 | 2.313663 | 2.619006 |
| gendermale | -3.116603 | -3.126784 | 0.04654240 | 3.085504 | 3.261765 |
| handright | -3.129584 | -3.129304 | 0.02519093 | 3.106609 | 3.203710 |
| regionnortheast | -2.423115 | -2.443937 | 0.10678622 | -2.622055 | -2.203211 |

|  |  |  |  |  |  |
|---|---|---|---|---|---|
| regionsouth | -3.096916 | -3.104852 | 0.05591253 | 3.075033 | 3.288680 |
| regionwest | -2.868769 | -2.891754 | 0.07114733 | -3.019640 | -2.750580 |
| age25-40age41-60 | 2.988305 | 2.967924 | 0.07839569 | 2.820125 | 3.131574 |
| age25-40age61+ | 2.507654 | 2.499670 | 0.09586600 | 2.326136 | 2.704192 |
| age25-40gendermale | -3.067768 | -3.085263 | 0.05182574 | 3.120528 | 3.319266 |
| age25-40handright | -3.088206 | -3.095458 | 0.02992885 | -3.141290 | -3.026217 |
| age25-40regionnortheast | -2.394759 | -2.397586 | 0.11023901 | -2.614664 | -2.184222 |
| age25-40regionsouth | -3.053625 | -3.057076 | 0.05291834 | 3.127654 | 3.333635 |
| age25-40regionwest | -2.835104 | -2.843430 | 0.06711145 | -2.959707 | -2.704479 |
| age41-60age61+ | 1.904760 | 1.909585 | 0.07941009 | 1.736406 | 2.047492 |
| age41-60gendermale | 2.571549 | 2.597191 | 0.06804378 | 2.428796 | 2.696338 |
| age41-60handright | 2.666723 | 2.666150 | 0.02813821 | 2.610389 | 2.719766 |
| age41-60regionnortheast | -2.559147 | -2.631077 | 0.19352801 | -2.940952 | -2.189696 |
| age41-60regionsouth | 2.672550 | 2.640918 | 0.07410715 | 2.507984 | 2.799461 |
| age41-60regionwest | 3.073155 | 3.081113 | 0.09613093 | 2.880678 | 3.251621 |
| age61+gendermale | 2.190313 | 2.188058 | 0.07258588 | 2.044471 | 2.327455 |
| age61+handright | 2.318059 | 2.313463 | 0.04737816 | 2.233222 | 2.417749 |
| age61+regionnortheast | -3.078047 | -2.984467 | 0.28232527 | 2.684675 | 3.753597 |
| age61+regionsouth | 2.300011 | 2.257013 | 0.08112824 | 2.142087 | 2.460604 |
| age61+regionwest | 2.680090 | 2.683044 | 0.09775608 | 2.503660 | 2.879533 |
| gendermalehandright | 2.922650 | 2.923620 | 0.02759975 | 2.869183 | 2.976657 |
| gendermaleregionnortheast | -2.527531 | -2.547305 | 0.12595057 | -2.741372 | -2.246278 |
| gendermaleregionsouth | 2.944568 | 2.913596 | 0.06272144 | 2.809290 | 3.051361 |
| gendermaleregionwest | -3.040269 | -3.059713 | 0.07822762 | 3.086945 | 3.389065 |
| handrightregionnortheast | -2.620997 | -2.642595 | 0.10680704 | -2.833130 | -2.413769 |
| handrightregionsouth | 2.965243 | 2.971807 | 0.04175432 | 2.882597 | 3.047137 |
| handrightregionwest | -3.061299 | -3.052016 | 0.06036638 | 3.103017 | 3.328819 |
| regionnortheastregionsouth | -2.570409 | -2.561555 | 0.12748903 | -2.814963 | -2.309164 |
| regionnortheastregionwest | -2.471770 | -2.446271 | 0.10961988 | -2.684767 | -2.251978 |
| regionsouthregionwest | -3.031081 | -3.023663 | 0.08157365 | 3.099712 | 3.406676 |

Differences:

|  | mean | mode | sd | LB | UB |
|---|---|---|---|---|---|
| age25-40 | -0.04122605 | -0.03498237 | 0.03472424 | -0.1085568766 | 0.02461593 |
| age41-60 | 0.45671546 | 0.45029303 | 0.04704597 | 0.3633649655 | 0.54474747 |
| age61+ | 0.91903639 | 0.94541771 | 0.07734513 | 0.7488484321 | 1.05314542 |
| gendermale | 0.21736697 | 0.21598533 | 0.02999221 | 0.1614801580 | 0.27699585 |
| handright | 0.23034780 | 0.23058787 | 0.03726175 | 0.1521558708 | 0.29765045 |
| regionnortheast | -0.47609622 | -0.46088450 | 0.10417292 | -0.6939326655 | -0.28316207 |
| regionsouth | 0.19767745 | 0.20528739 | 0.04296601 | 0.1149389708 | 0.28485443 |
| regionwest | -0.03046385 | -0.02172903 | 0.05927953 | -0.1475230329 | 0.08444247 |
| age25-40age41-60 | 0.39564946 | 0.41616542 | 0.07719539 | 0.2354713281 | 0.54485066 |
| age25-40age61+ | 0.87629014 | 0.87367106 | 0.09756918 | 0.6861655653 | 1.06244792 |
| age25-40gendermale | 0.16853384 | 0.17230880 | 0.04822136 | 0.0864501321 | 0.26452262 |
| age25-40handright | 0.18897015 | 0.23350042 | 0.04930314 | 0.0925630704 | 0.28048500 |
| age25-40regionnortheast | -0.50445231 | -0.48463092 | 0.11091220 | -0.7106879941 | -0.27601423 |
| age25-40regionsouth | 0.15438514 | 0.15671647 | 0.04823525 | 0.0581995451 | 0.24572367 |
| age25-40regionwest | -0.06412831 | -0.04206337 | 0.06032738 | -0.1892842175 | 0.03744008 |
| age41-60age61+ | 1.47917334 | 1.44783672 | 0.08770578 | 1.3098149155 | 1.64337537 |
| age41-60gendermale | 0.81239386 | 0.80222288 | 0.06740922 | 0.6720886723 | 0.93614176 |
| age41-60handright | 0.71722411 | 0.74257703 | 0.04834944 | 0.6224385615 | 0.81213935 |
| age41-60regionnortheast | -0.33998583 | -0.31184513 | 0.19094026 | -0.7074848266 | 0.04758807 |
| age41-60regionsouth | 0.71138973 | 0.69724969 | 0.07292401 | 0.5590127662 | 0.84619277 |
| age41-60regionwest | 0.31079578 | 0.26578399 | 0.08852737 | 0.1529744663 | 0.49789831 |
| age61+gendermale | 1.19362389 | 1.18124902 | 0.07774701 | 1.0434303443 | 1.34342254 |
| age61+handright | 1.06588689 | 1.06186910 | 0.06049313 | 0.9543417745 | 1.18040581 |
| age61+regionnortheast | 0.17892066 | 0.08896487 | 0.27717879 | -0.3600826060 | 0.69191673 |
| age61+regionsouth | 1.08392194 | 1.08223056 | 0.08540973 | 0.9302890452 | 1.25282348 |
| age61+regionwest | 0.70384832 | 0.66799722 | 0.09390854 | 0.5223558967 | 0.87868397 |
| gendermalehandright | 0.46129956 | 0.43973031 | 0.04454636 | 0.3800100289 | 0.55884156 |

| | | | | | |
|---|---|---|---|---|---|
| gendermaleregionnortheast | -0.37167244 | -0.35488172 | 0.12314423 | -0.6251005962 | -0.15278083 |
| gendermaleregionsouth | 0.43937737 | 0.41943406 | 0.05677134 | 0.3341320467 | 0.54777043 |
| gendermaleregionwest | 0.14103343 | 0.12073764 | 0.06888021 | 0.0178169159 | 0.28390061 |
| handrightregionnortheast | -0.27822211 | -0.26996181 | 0.11136657 | -0.5120896751 | -0.07111939 |
| handrightregionsouth | 0.41870820 | 0.42073297 | 0.05279113 | 0.3197082036 | 0.52281765 |
| handrightregionwest | 0.16206360 | 0.16270695 | 0.06331705 | 0.0355404289 | 0.27954784 |
| regionnortheastregionsouth | -0.32879978 | -0.33946917 | 0.12371431 | -0.5932533508 | -0.10284923 |
| regionnortheastregionwest | -0.42744529 | -0.40004340 | 0.10538152 | -0.6453831442 | -0.22188791 |
| regionsouthregionwest | 0.13184509 | 0.11078914 | 0.07251508 | 0.0004372266 | 0.27497990 |

# Fixed Effects with age, gender, hand, region
# with update in iterations and burn iterations

```
bpnr(pred.I = y ~ age + gender + hand + region, data = mean_per_cluster,
    its = 5000, burn = 500)
MCMC:
iterations = 5000
burn-in = 500
lag = 1
Model Fit:
        Statistic Parameters
lppd     -3405.020   18.00000
DIC       6845.235   17.98988
DIC.alt   6845.038   17.89143
WAIC      6844.451   17.20594
WAIC2     6844.735   17.34777
Linear Coefficients
Component I:
```

**Component I:**

| | mean | mode | sd | LB HPD | UB HPD |
|---|---|---|---|---|---|
| (Intercept) | -1.611977016 | -1.5985269143 | 0.08139920 | -1.76104948 | -1.44635895 |
| age25-40 | 0.001615054 | 0.0009925236 | 0.07109072 | -0.14423405 | 0.13646373 |
| age41-60 | 0.497874548 | 0.4905237839 | 0.06158438 | 0.37423092 | 0.61504182 |
| age61+ | 0.617138388 | 0.5949919472 | 0.09116355 | 0.44577527 | 0.80557665 |
| gendermale | 0.166959921 | 0.1554518077 | 0.05102558 | 0.06695081 | 0.26390006 |
| handright | -0.092627843 | -0.1008643895 | 0.07349121 | -0.23055741 | 0.05436793 |
| regionnortheast | 0.180715901 | 0.1920184208 | 0.21746230 | -0.25603849 | 0.59539731 |
| regionsouth | -0.007742906 | -0.0098376955 | 0.08032755 | -0.16375684 | 0.14661392 |
| regionwest | -0.329806544 | -0.3536540388 | 0.13714601 | -0.60831262 | -0.07297978 |

**Component II:**

| | mean | mode | sd | LB HPD | UB HPD |
|---|---|---|---|---|---|
| (Intercept) | -0.3978327 | -0.39557450 | 0.06781197 | -0.5367944 | -0.27180266 |
| age25-40 | -0.0700593 | -0.06403184 | 0.05817790 | -0.1805465 | 0.04816251 |
| age41-60 | 0.6383001 | 0.65016492 | 0.05271850 | 0.5387609 | 0.74321335 |
| age61+ | 1.1935196 | 1.20611738 | 0.08996394 | 1.0249517 | 1.37677729 |

```
gendermale          0.3617239  0.37163292 0.04395676  0.2744263   0.44525811
handright           0.3786947  0.37066765 0.06387991  0.2551227   0.50172521
regionnortheast    -0.8672594 -0.88853245 0.18771582 -1.2176261  -0.48133483
regionsouth         0.3252405  0.33602011 0.06672940  0.1948951   0.45023499
regionwest         -0.1397652 -0.16913337 0.11799957 -0.3700890   0.09194676
```

Circular Coefficients

Continuous variables:

[1] "There are no numeric predictors in the model"

Categorical variables:

Means:

|  | mean | mode | sd | LB | UB |
|---|---|---|---|---|---|
| (Intercept) | -2.899630 | -2.895752 | 0.04030615 | -2.974960 | -2.816587 |
| age25-40 | -2.858610 | -2.873006 | 0.04335588 | -2.939497 | -2.772777 |
| age41-60 | 2.928815 | 2.929694 | 0.06080417 | 2.813187 | 3.047137 |
| age61+ | 2.467033 | 2.456668 | 0.07845508 | 2.322913 | 2.628760 |
| gendermale | -3.116649 | -3.121926 | 0.04821186 | 3.075394 | 3.265139 |
| handright | -3.130346 | -3.132075 | 0.02629901 | 3.101964 | 3.204243 |
| regionnortheast | -2.415958 | -2.441307 | 0.10527410 | -2.616725 | -2.210979 |
| regionsouth | -3.096676 | -3.113595 | 0.05741687 | 3.076405 | 3.300911 |
| regionwest | -2.870902 | -2.876687 | 0.07170135 | -3.011160 | -2.732558 |
| age25-40age41-60 | 2.989794 | 3.017452 | 0.07945086 | 2.827964 | 3.139413 |
| age25-40age61+ | 2.510527 | 2.496804 | 0.09409750 | 2.324444 | 2.688902 |
| age25-40gendermale | -3.067966 | -3.080868 | 0.05122396 | 3.115418 | 3.317218 |
| age25-40handright | -3.089212 | -3.087838 | 0.03010333 | 3.134633 | 3.251069 |
| age25-40regionnortheast | -2.388483 | -2.398009 | 0.10881409 | -2.601135 | -2.176531 |
| age25-40regionsouth | -3.053253 | -3.066926 | 0.05244815 | 3.130774 | 3.335117 |
| age25-40regionwest | -2.837469 | -2.846859 | 0.06567594 | -2.968035 | -2.710960 |
| age41-60age61+ | 1.903642 | 1.895159 | 0.07880368 | 1.750012 | 2.060473 |
| age41-60gendermale | 2.574907 | 2.565173 | 0.06810326 | 2.441819 | 2.708539 |
| age41-60handright | 2.667519 | 2.671977 | 0.02793386 | 2.615829 | 2.724070 |
| age41-60regionnortheast | -2.546762 | -2.555595 | 0.18763277 | -2.914250 | -2.187902 |
| age41-60regionsouth | 2.674043 | 2.675212 | 0.07554097 | 2.519801 | 2.815052 |
| age41-60regionwest | 3.072344 | 3.088741 | 0.09767235 | 2.876270 | 3.261229 |
| age61+gendermale | 2.191533 | 2.186656 | 0.07163468 | 2.050634 | 2.333096 |
| age61+handright | 2.317838 | 2.311861 | 0.04501936 | 2.225733 | 2.401978 |
| age61+regionnortheast | -3.055723 | 3.174344 | 0.28895148 | 2.666397 | 3.801053 |
| age61+regionsouth | 2.299791 | 2.290356 | 0.08137678 | 2.148341 | 2.462422 |
| age61+regionwest | 2.681945 | 2.707718 | 0.10083436 | 2.480513 | 2.876112 |
| gendermalehandright | 2.922400 | 2.916156 | 0.02880708 | 2.866168 | 2.979394 |
| gendermaleregionnortheast | -2.519193 | -2.532934 | 0.12555450 | -2.758731 | -2.269249 |
| gendermaleregionsouth | 2.945182 | 2.934672 | 0.06449682 | 2.820154 | 3.073201 |
| gendermaleregionwest | -3.042315 | -3.020302 | 0.07863969 | 3.084057 | 3.391094 |
| handrightregionnortheast | -2.613938 | -2.608521 | 0.10467820 | -2.822518 | -2.415009 |
| handrightregionsouth | 2.964748 | 2.971048 | 0.04246011 | 2.881414 | 3.046881 |
| handrightregionwest | -3.063271 | -3.056283 | 0.06270054 | 3.102734 | 3.348216 |
| regionnortheastregionsouth | -2.560919 | -2.546725 | 0.12290030 | -2.783558 | -2.315933 |
| regionnortheastregionwest | -2.466548 | -2.461403 | 0.10787554 | -2.673548 | -2.249286 |
| regionsouthregionwest | -3.032381 | -3.020463 | 0.08323730 | 3.089533 | 3.412385 |

Differences:

|  | mean | mode | sd | LB | UB |
|---|---|---|---|---|---|
| age25-40 | -0.04101976 | -0.02922956 | 0.03609261 | -0.11216168 | 0.02823492 |
| age41-60 | 0.45473813 | 0.45143993 | 0.04778830 | 0.35695018 | 0.54426492 |
| age61+ | 0.91651304 | 0.90223702 | 0.07498954 | 0.76997769 | 1.06409519 |
| gendermale | 0.21701891 | 0.21395092 | 0.03100126 | 0.16009269 | 0.28047337 |
| handright | 0.23071563 | 0.22573426 | 0.03852671 | 0.15737057 | 0.30567044 |
| regionnortheast | -0.48366694 | -0.48365012 | 0.10243834 | -0.68548413 | -0.28661864 |
| regionsouth | 0.19704250 | 0.19239753 | 0.04247036 | 0.11088100 | 0.27593522 |
| regionwest | -0.02873006 | -0.02580164 | 0.06039363 | -0.14375864 | 0.09261462 |
| age25-40age41-60 | 0.39376007 | 0.40220804 | 0.07858445 | 0.24175994 | 0.54600788 |

| | | | | | |
|---|---|---|---|---|---|
| age25-40age61+ | 0.87302405 | 0.85643163 | 0.09494328 | 0.68772958 | 1.06134586 |
| age25-40gendermale | 0.16833531 | 0.16515705 | 0.04889264 | 0.07612377 | 0.26609012 |
| age25-40handright | 0.18958216 | 0.20221853 | 0.05168111 | 0.09141684 | 0.28921567 |
| age25-40regionnortheast | -0.51114039 | -0.50782146 | 0.10996887 | -0.73370187 | -0.30530420 |
| age25-40regionsouth | 0.15362108 | 0.15104810 | 0.04767230 | 0.06372768 | 0.24939415 |
| age25-40regionwest | -0.06216334 | -0.04584758 | 0.06066530 | -0.18156552 | 0.05352750 |
| age41-60age61+ | 1.47991013 | 1.49341688 | 0.08729066 | 1.31084474 | 1.64911908 |
| age41-60gendermale | 0.80864500 | 0.82372589 | 0.06662082 | 0.68088508 | 0.93786670 |
| age41-60handright | 0.71603649 | 0.71593629 | 0.04955968 | 0.62010986 | 0.81193967 |
| age41-60regionnortheast | -0.35284913 | -0.32277027 | 0.18473137 | -0.70083104 | 0.02164885 |
| age41-60regionsouth | 0.70950769 | 0.71567623 | 0.07124266 | 0.56796814 | 0.84927630 |
| age41-60regionwest | 0.31119865 | 0.29984240 | 0.08984854 | 0.12947111 | 0.48484496 |
| age61+gendermale | 1.19201781 | 1.19556332 | 0.07599269 | 1.03890455 | 1.33902743 |
| age61+handright | 1.06571741 | 1.05718276 | 0.05903407 | 0.95272961 | 1.18147726 |
| age61+regionnortheast | 0.15599740 | 0.22871070 | 0.28354881 | -0.41246128 | 0.71264864 |
| age61+regionsouth | 1.08375792 | 1.08304167 | 0.08269962 | 0.91921025 | 1.24351860 |
| age61+regionwest | 0.70158771 | 0.68284783 | 0.09517955 | 0.51614272 | 0.89215376 |
| gendermalehandright | 0.46115487 | 0.46594143 | 0.04653411 | 0.37578449 | 0.55571507 |
| gendermaleregionnortheast | -0.38042437 | -0.37203116 | 0.12297637 | -0.62508994 | -0.14520954 |
| gendermaleregionsouth | 0.43837057 | 0.44099103 | 0.05653414 | 0.33343319 | 0.55092507 |
| gendermaleregionwest | 0.14268143 | 0.12915939 | 0.06978436 | 0.00684615 | 0.27843109 |
| handrightregionnortheast | -0.28568721 | -0.23550589 | 0.11008172 | -0.48905887 | -0.06516412 |
| handrightregionsouth | 0.41880462 | 0.39794819 | 0.05266196 | 0.31741497 | 0.52398444 |
| handrightregionwest | 0.16364048 | 0.16053816 | 0.06656920 | 0.03241163 | 0.29073232 |
| regionnortheastregionsouth | -0.33870838 | -0.35614905 | 0.11950889 | -0.58435296 | -0.11822099 |
| regionnortheastregionwest | -0.43307732 | -0.40553808 | 0.10468682 | -0.63127161 | -0.22459361 |
| regionsouthregionwest | 0.13274422 | 0.15235565 | 0.07424300 | -0.01043300 | 0.27966498 |