

# Output Angle Means Mixed Effects

Tuesday, December 15, 2020 1:57 PM

## Mixed Effects with age, gender, hand, region

### No update in iterations and burn iterations

```
bpmme(pred.I = y ~ age + gender + hand + region + (1 | writer),  
      data = mean_per_cluster)
```

MCMC:

iterations = 1000

burn-in = 1

lag = 1

Model Fit:

	Statistic	Parameters
lppd	-2435.326	18.00000
DIC	5085.797	78.10454
DIC.alt	7075.796	1073.10395
WAIC	5144.733	137.04072
WAIC2	5154.624	141.98612

Fixed Effects

Linear Coefficients

Component I:

	mean	mode	sd	LB HPD	UB HPD
(Intercept)	-2.02753050	-1.97605770	0.2296563	-2.47421327	-1.5900438
age25-40	0.04234137	0.08110802	0.2029766	-0.35209633	0.4333978
age41-60	0.54371296	0.53632693	0.1753747	0.20121825	0.8552081
age61+	0.66071607	0.48510609	0.2862307	0.09674088	1.1959558
gendermale	0.16270954	0.20108198	0.1492590	-0.12820818	0.4528629
handright	0.03568729	0.09326908	0.2107907	-0.35715848	0.4639383
regionnortheast	0.48309023	0.59130731	0.6253787	-0.68479638	1.7146115
regionsouth	0.04905440	-0.03220135	0.2245638	-0.37093836	0.4847509
regionwest	-0.30735609	-0.30039365	0.4047554	-1.08125571	0.4534604

Component II:

	mean	mode	sd	LB HPD	UB HPD
(Intercept)	-0.4105116	-0.29279907	0.3453212	-1.05943683	0.3064681
age25-40	-0.1127782	-0.09861160	0.3117899	-0.74616013	0.4507588
age41-60	0.8393801	0.83768817	0.2724681	0.31525315	1.3576349
age61+	1.3120049	1.25541692	0.4224636	0.46513281	2.0829986
gendermale	0.4800517	0.60340359	0.2295778	0.02426394	0.9163866
handright	0.4072627	0.32025396	0.3298586	-0.17348646	1.0836861
regionnortheast	-1.0236070	-0.75556513	0.9623727	-3.02618545	0.7231791
regionsouth	0.3585414	0.35878145	0.3544822	-0.29407171	1.0917276
regionwest	-0.1529597	-0.09800837	0.5952559	-1.32415473	0.9716232

Circular Coefficients

Continuous variables:

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

Categorical variables:

Means:

	mean	mode	sd	LB	UB
(Intercept)	-2.945340	-2.955260	0.1635628	3.019873	3.654786
age25-40	-2.888664	-2.916058	0.1798157	3.041112	3.727903
age41-60	2.867042	2.861178	0.2173720	2.450240	3.285917
age61+	2.579788	2.479764	0.2842863	2.060627	3.124262
gendermale	3.105273	3.104299	0.1849369	2.778324	3.508375
handright	-3.139653	3.100059	0.1158023	2.906594	3.354998
regionnortheast	-2.440455	-2.421358	0.4462103	2.859832	4.652889
regionsouth	-3.115908	3.144691	0.2350924	2.756511	3.635270

regionwest	-2.912923	-2.814633	0.2849790	2.815112	3.906075
age25-40age41-60	2.933715	2.828292	0.3008239	2.357368	3.535803
age25-40age61+	2.633281	2.380430	0.3647360	1.959019	3.331928
age25-40gendermale	-3.118411	3.070114	0.2087001	2.770176	3.547167
age25-40handright	-3.082684	-2.997648	0.1397544	2.938666	3.468104
age25-40regionnortheast	-2.392553	-2.398221	0.4630129	2.922054	4.796016
age25-40regionsouth	-3.058466	-3.106270	0.2220963	2.760832	3.630440
age25-40regionwest	-2.864018	-2.932611	0.2686058	2.893352	3.899666
age41-60age61+	2.032528	2.079587	0.2448020	1.598277	2.541112
age41-60gendermale	2.553154	2.516577	0.2106804	2.122378	2.943080
age41-60handright	2.621452	2.617291	0.1098245	2.408747	2.844198
age41-60regionnortheast	-2.674675	-2.616420	0.8434086	1.663080	4.936193
age41-60regionsouth	2.660256	2.648864	0.2781703	2.105050	3.181737
age41-60regionwest	3.000868	2.907165	0.3750501	2.273511	3.687715
age61+gendermale	2.307671	2.298901	0.2444259	1.900255	2.804407
age61+handright	2.375699	2.325440	0.1742476	2.050542	2.719608
age61+regionnortheast	-3.041864	2.882999	1.0388983	1.124060	5.152238
age61+regionsouth	2.405257	2.400073	0.2958211	1.892627	3.034057
age61+regionwest	2.741355	2.649532	0.3709389	2.078722	3.505053
gendermalehandright	2.889104	2.865200	0.1235343	2.653154	3.131760
gendermaleregionnortheast	-2.589218	-2.444498	0.5568335	2.393109	4.580595
gendermaleregionsouth	2.919177	2.884783	0.2476537	2.417479	3.401075
gendermaleregionwest	-3.102778	3.134233	0.3082854	2.589756	3.794106
handrightregionnortheast	-2.588649	-2.426702	0.4868480	2.701047	4.590072
handrightregionsouth	2.964244	3.025731	0.1953313	2.604882	3.336596
handrightregionwest	-3.074631	3.163114	0.2698105	2.675777	3.692950
regionnortheastregionsouth	-2.568194	-2.455449	0.5424273	2.535841	4.612647
regionnortheastregionwest	-2.477695	-2.507680	0.4540501	2.825618	4.665705
regionsouthregionwest	-3.053173	-2.985155	0.3421631	2.597284	3.952717

Differences:

	mean	mode	sd	LB	UB
age25-40	-0.05637110	-0.03770935	0.1482044	-0.343010572	0.2431078
age41-60	0.47045792	0.43107897	0.1643989	0.159478413	0.8059536
age61+	0.75637002	0.80436735	0.2492816	0.270690324	1.2331718
gendermale	0.23252536	0.22737696	0.1196110	0.011237711	0.4754012
handright	0.19442934	0.23132874	0.1587636	-0.098741786	0.4972651
regionnortheast	-0.50132398	-0.51589863	0.4256855	-1.267926674	0.4111771
regionsouth	0.17056488	0.16740377	0.1774985	-0.156621057	0.5451544
regionwest	-0.03205199	-0.06137832	0.2393457	-0.506796255	0.4004772
age25-40age41-60	0.40424303	0.39872977	0.3017383	-0.180080528	0.9777862
age25-40age61+	0.70288842	0.79757340	0.3606515	0.003292525	1.3665167
age25-40gendermale	0.17321998	0.22279513	0.2042649	-0.211573435	0.5851276
age25-40handright	0.13759085	0.13380797	0.2197482	-0.302698533	0.5362272
age25-40regionnortheast	-0.54947197	-0.72282405	0.4587576	-1.453121919	0.4304098
age25-40regionsouth	0.11335429	0.04887749	0.2040244	-0.290301423	0.5086050
age25-40regionwest	-0.08107323	-0.11359307	0.2482380	-0.557043193	0.3677904
age41-60age61+	1.30414749	1.36145057	0.2716216	0.762379412	1.7986557
age41-60gendermale	0.78434105	0.74871211	0.2130947	0.349503818	1.1854303
age41-60handright	0.71651527	0.72655730	0.2005826	0.296414764	1.0801105
age41-60regionnortheast	-0.26647020	-0.32773606	0.8261914	-1.568776496	1.6859211
age41-60regionsouth	0.67661365	0.66464914	0.2622985	0.151301204	1.1461472
age41-60regionwest	0.33614591	0.45146658	0.3436344	-0.310935066	1.0014248
age61+gendermale	1.02877197	1.14909555	0.2508189	0.515003102	1.4925490
age61+handright	0.96209392	0.96266241	0.2294378	0.492163082	1.3786922
age61+regionnortheast	0.09207226	-0.21658668	1.0118744	-1.937179700	1.9713207
age61+regionsouth	0.93088346	0.95419763	0.2866091	0.386650637	1.4633665
age61+regionwest	0.59470482	0.58608971	0.3348975	-0.110755024	1.1799189
gendermalehandright	0.44879727	0.49171442	0.1973907	0.024617682	0.7930094
gendermaleregionnortheast	-0.35297885	-0.42204548	0.5384159	-1.326558132	0.8376135
gendermaleregionsouth	0.41858872	0.49368524	0.2207372	-0.003657829	0.8355499
gendermaleregionwest	0.15727035	0.20337066	0.2752671	-0.363413367	0.7058301

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handrightregionnortheast -0.35717554 -0.35284413 0.5008090 -1.187354861 0.7205618
handrightregionsouth 0.37367683 0.47589364 0.2340767 -0.062119827 0.8323529
handrightregionwest 0.12948573 0.10290563 0.2831289 -0.447633023 0.6473633
regionnortheastregionsouth -0.37356831 -0.48296620 0.5241287 -1.247880618 0.8703754
regionnortheastregionwest -0.46516608 -0.38603112 0.4357295 -1.322888173 0.4587569
regionsouthregionwest 0.10820865 0.19705268 0.3081480 -0.474905721 0.7406456
Random Effects
Linear Coefficients
Component I:
      mean      mode      sd    LB HPD    UB HPD
RI 0.3323103 0.2912908 0.07115355 0.2039095 0.4735829
Component II:
      mean      mode      sd    LB HPD    UB HPD
RI 0.8450904 0.7503812 0.1583251 0.5902477 1.188568
Circular Coefficients
mean      mode      sd      LB      UB
RI 0.9063572 0.9157881 0.02148011 0.8649772 0.9468372

```

From <<https://csafe-01.cssm.iastate.edu/>>

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

```

bpmme(pred.I = y ~ age + gender + hand + region + (1 | writer),
      data = mean_per_cluster, its = 5000, burn = 500)

```

MCMC:

iterations = 5000

burn-in = 500

lag = 1

Model Fit:

	Statistic	Parameters
lppd	-2434.857	18.0000
DIC	5118.491	112.3313
DIC.alt	5204.470	155.3203
WAIC	5142.607	136.4470
WAIC2	5153.029	141.6581

Fixed Effects

Linear Coefficients

Component I:

	mean	mode	sd	LB HPD	UB HPD
(Intercept)	-2.02444796	-2.017857544	0.2317000	-2.5034390	-1.6015332

age25-40	0.03520492	0.069646355	0.2066519	-0.3896656	0.4306705
age41-60	0.54098894	0.528130417	0.1783607	0.1993037	0.8976392
age61+	0.65919326	0.672058053	0.2755022	0.1330200	1.2085621
gendermale	0.16755780	0.151395670	0.1472670	-0.1258710	0.4472347
handright	0.03040022	0.055971641	0.2179580	-0.4166836	0.4328049
regionnortheast	0.48028526	0.301148350	0.6370827	-0.7759761	1.7260622
regionsouth	0.05006652	-0.002947432	0.2280889	-0.4033889	0.4904385
regionwest	-0.28192528	-0.327778664	0.3852397	-0.9961978	0.5071241

Component II:

	mean	mode	sd	LB HPD	UB HPD
(Intercept)	-0.4290503	-0.3707329	0.3517631	-1.12389294	0.2403955
age25-40	-0.1059548	-0.2003162	0.3094954	-0.71332107	0.5074588
age41-60	0.8594830	0.8335494	0.2721446	0.31665628	1.3876417
age61+	1.3175742	1.3768486	0.4155725	0.47211338	2.0888091
gendermale	0.4903272	0.4986879	0.2278799	0.05336976	0.9492778
handright	0.4212643	0.3783953	0.3266730	-0.22473825	1.0434427
regionnortheast	-1.0036017	-0.9932475	0.9792542	-2.84796137	1.0620243
regionsouth	0.3654953	0.3178548	0.3529249	-0.32852072	1.0559610
regionwest	-0.1495212	-0.1170133	0.5883603	-1.24594310	1.0384914

Circular Coefficients

Continuous variables:

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

Categorical variables:

Means:

	mean	mode	sd	LB	UB
(Intercept)	-2.935988	-2.906483	0.1663963	3.029149	3.675373
age25-40	-2.882729	-2.887858	0.1771557	3.042648	3.730228
age41-60	2.865942	2.845262	0.2212973	2.441376	3.288031
age61+	2.585119	2.553670	0.2783744	2.076470	3.175940
gendermale	3.109018	3.128197	0.1901639	2.759724	3.504296
handright	-3.137563	3.154658	0.1169130	2.920885	3.377234
regionnortheast	-2.442792	-2.284160	0.4583616	2.896629	4.674113
regionsouth	-3.111107	3.123257	0.2390156	2.718881	3.648900
regionwest	-2.906526	-2.948561	0.2884856	2.802746	3.906343
age25-40age41-60	2.930731	2.938803	0.3050158	2.326770	3.508904
age25-40age61+	2.638997	2.432484	0.3535749	1.977768	3.357474
age25-40gendermale	-3.116673	3.133780	0.2098511	2.742034	3.575454
age25-40handright	-3.084321	-3.082698	0.1383421	2.910492	3.451238
age25-40regionnortheast	-2.399618	-2.212185	0.4687453	2.881102	4.692251
age25-40regionsouth	-3.056408	-3.038183	0.2264755	2.781963	3.655566
age25-40regionwest	-2.859991	-2.788479	0.2683831	2.868640	3.894316
age41-60age61+	2.028847	1.952085	0.2345636	1.600528	2.522539
age41-60gendermale	2.544869	2.513823	0.2194268	2.108419	2.965190
age41-60handright	2.615026	2.600830	0.1111562	2.395666	2.831524
age41-60regionnortheast	-2.690560	-2.284226	0.8363308	1.720670	4.977543
age41-60regionsouth	2.652913	2.544250	0.2820722	2.125519	3.226639
age41-60regionwest	2.992621	2.959912	0.3823314	2.277037	3.745053
age61+gendermale	2.305966	2.273399	0.2395895	1.869488	2.794905
age61+handright	2.377154	2.407248	0.1750773	2.043200	2.725507
age61+regionnortheast	-3.034066	-2.776307	1.0279509	1.258332	5.118249
age61+regionsouth	2.407677	2.297867	0.3064832	1.893767	3.078196
age61+regionwest	2.746452	2.594828	0.3811536	2.044560	3.512588
gendermalehandright	2.885561	2.894730	0.1214090	2.649125	3.120998
gendermaleregionnortheast	-2.599671	-2.341254	0.5745030	2.435602	4.665043
gendermaleregionsouth	2.915867	2.788954	0.2579455	2.463331	3.451086
gendermaleregionwest	-3.103540	3.166305	0.3149237	2.557858	3.771722
handrightregionnortheast	-2.600753	-2.421432	0.5033586	2.629136	4.572971
handrightregionsouth	2.963156	3.001006	0.1913235	2.585552	3.338326
handrightregionwest	-3.075672	-3.061200	0.2710198	2.676047	3.723706
regionnortheastregionsouth	-2.575306	-2.351403	0.5623520	2.500701	4.666945
regionnortheastregionwest	-2.474738	-2.350661	0.4735938	2.814073	4.656184

regionsouthregionwest	-3.054611	-2.894964	0.3487484	2.535235	3.880314
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Differences:

	mean	mode	sd	LB	UB
age25-40	-0.05319315	-0.05775259	0.1473233	-0.335789900	0.2394569
age41-60	0.48073440	0.49522355	0.1683348	0.133188434	0.7999552
age61+	0.76058447	0.77746819	0.2497869	0.262744373	1.2502858
gendermale	0.23796975	0.19343851	0.1203526	0.010837749	0.4805280
handright	0.20149907	0.19920303	0.1570725	-0.110776763	0.4998646
regionnortheast	-0.48926135	-0.59330728	0.4461742	-1.277184710	0.4959735
regionsouth	0.17499359	0.14774659	0.1764935	-0.183504597	0.5117533
regionwest	-0.02886511	-0.06039838	0.2392352	-0.469646407	0.4635787
age25-40age41-60	0.41586516	0.45433564	0.3064778	-0.225062973	0.9943620
age25-40age61+	0.70654983	0.74377013	0.3551977	0.003678720	1.3876965
age25-40gendermale	0.18057973	0.18137435	0.2041961	-0.205959409	0.5900148
age25-40handright	0.14828757	0.11907673	0.2203265	-0.282590907	0.5778590
age25-40regionnortheast	-0.53377609	-0.71189409	0.4730595	-1.346145402	0.5187970
age25-40regionsouth	0.12032611	0.11856938	0.2076633	-0.291226103	0.5276297
age25-40regionwest	-0.07556368	-0.09711171	0.2473839	-0.589543527	0.3814135
age41-60age61+	1.31724675	1.26366061	0.2701364	0.781253524	1.8326682
age41-60gendermale	0.80154877	0.81615453	0.2184214	0.347733173	1.2139689
age41-60handright	0.73215348	0.74485563	0.2013667	0.339109210	1.1205570
age41-60regionnortheast	-0.23935094	-0.44205869	0.8233126	-1.672018953	1.6026229
age41-60regionsouth	0.69300434	0.63499633	0.2635948	0.184342176	1.2292235
age41-60regionwest	0.35396509	0.40941585	0.3521512	-0.319519662	1.0422125
age61+gendermale	1.04008096	1.01990875	0.2515616	0.544516536	1.5241244
age61+handright	0.96996468	0.93792097	0.2373271	0.502233689	1.4235257
age61+regionnortheast	0.09716331	-0.09785295	1.0076624	-1.736397593	2.1529846
age61+regionsouth	0.93750497	1.01111899	0.3009137	0.304495176	1.4872527
age61+regionwest	0.59878281	0.60094015	0.3523876	-0.091012068	1.2824746
gendermalehandright	0.46160249	0.42409660	0.1921921	0.098366605	0.8510246
gendermaleregionnortheast	-0.33179386	-0.60449075	0.5635505	-1.276346558	0.9516613
gendermaleregionsouth	0.43066663	0.43368973	0.2257371	0.008928831	0.8825782
gendermaleregionwest	0.16760915	0.11620407	0.2781795	-0.368438525	0.7028794
handrightregionnortheast	-0.33429124	-0.53913971	0.5214918	-1.264617664	0.8000649
handrightregionsouth	0.38389714	0.42303169	0.2267259	-0.089726104	0.8102803
handrightregionwest	0.13970414	0.15669094	0.2829780	-0.398243094	0.7009635
regionnortheastregionsouth	-0.35586353	-0.50214446	0.5488218	-1.323390728	0.8301398
regionnortheastregionwest	-0.45691819	-0.57197476	0.4602994	-1.274091590	0.5692122
regionsouthregionwest	0.11898950	0.12422684	0.3110526	-0.438954417	0.7747406

Random Effects

Linear Coefficients

Component I:

	mean	mode	sd	LB	HPD	UB	HPD
RI	0.3335339	0.3152189	0.06705012	0.2143532	0.4714254		

Component II:

	mean	mode	sd	LB	HPD	UB	HPD
RI	0.8509307	0.7740402	0.1597269	0.5742308	1.173427		

Circular Coefficients

	mean	mode	sd	LB	UB
RI	0.9057536	0.914394	0.02185319	0.86436	0.9469555

From <<https://csafe-01.cssm.iastate.edu/>>

