Statcast Study

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New Statcast system records the exit velocity (mph) of each batted ball

Collect the exit velocities of batted balls for all “regular” players during 2017 season

Interested in how they hit ahead in the (pitch) count and behind the count
Let \( y_{ij} \) denote the \( j \)th exit velocity for the \( i \)th player

Let \( x_{ij} = 1 \) if we have a batter’s count and \( x_{ij} = 0 \) otherwise

Consider varying-intercepts, varying-slopes model

\[
y_{ij} \sim N(\mu_{ij}, \sigma)
\]

where

\[
\mu_{ij} = \alpha_{j[i]} + \beta_{j[i]} x_{ij}
\]

where

\[
\alpha_j \sim N(\mu_\alpha, \sigma_\alpha), \beta_j \sim N(\mu_\beta, \sigma_\beta)
\]
modelString = "
model {
  for(i in 1:N){
    mu.y[i] <- alpha[j[i]] + beta[j[i]] * x[i]
    y[i] ~ dnorm(mu.y[i], tau[1])
  }
  for (p in 1:J){
    alpha[p] ~ dnorm(mu.alpha, tau[2])
    beta[p] ~ dnorm(mu.beta, tau[3])
  }
  mu.alpha ~ dnorm(0, .0001)
  mu.beta ~ dnorm(0, .0001)
  for(p in 1:3){
    tau[p] <- pow(sigma[p], -2)
    sigma[p] ~ dunif(0, 100)
  }
}
"
Traceplots of random effects sd's
Posterior estimates at random effects sds

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Naive SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>sigma[1]</td>
<td>14.0646960</td>
<td>0.07147698</td>
<td>0.0007147698</td>
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<tr>
<td>sigma[2]</td>
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<td>0.21042994</td>
<td>0.0021042994</td>
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<tr>
<td>sigma[3]</td>
<td>0.4381792</td>
<td>0.27899597</td>
<td>0.0027899597</td>
</tr>
</tbody>
</table>

Time-series SE

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<tbody>
<tr>
<td>sigma[1]</td>
<td>0.000845912</td>
</tr>
<tr>
<td>sigma[2]</td>
<td>0.003106246</td>
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<tr>
<td>sigma[3]</td>
<td>0.036697126</td>
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Scatterplot of regression estimates