

IQ, Sex, Charisma, Social Status, and Friendships: Comparing Equation-based p-models with Intelligent Agent Models

Model 3 (Charisma is added)

Eric Vance

Sunday, June 5, 2005

1 Models and Rules

The basic p-friendship model:

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_s s_i + \beta_r r_j + \delta X_{ij} - |z_i - z_j|$$

★ p-Model 3:

$$\text{logit}(p_{ij}) = \beta_0 + \delta_1 \left(\mathbf{I}(Sex_i = Sex_j) - \overline{\mathbf{I}(Sex_i = Sex_j)} \right) + \beta_s (s_i + s_j) - |z_i - z_j|$$

- β_s is the sensitivity of friendships to **Charisma**.
- **Charisma** $s_i \sim N(0, 1)$, and is further standardized to guarantee mean 0 and std dev of 1. Both the sender and the receiver have **Charisma** and both are equally weighted when making friendships.

★ Rules for Agent Model 3:

- Rule 0. Agents start randomly at time=1 on grid in 2-dimensional Social Space.
- Rule 1. Agents are split evenly between the genders.
- Rule 2. The **Charisma** (sociality s_i) of each agent is added to the model. $s_i \sim N(0, 1)$.
- Rule 3. At every time step each agent i proffers a friendship to all agents $j \neq i$, and these proffers are accepted with probability p_{ij} .
- Rule 4. After new friendships are created, agents move a “**move.fraction**” towards the average of their friends’ locations in Social Space. The size of Social Space is $n \times n$, (20×20).

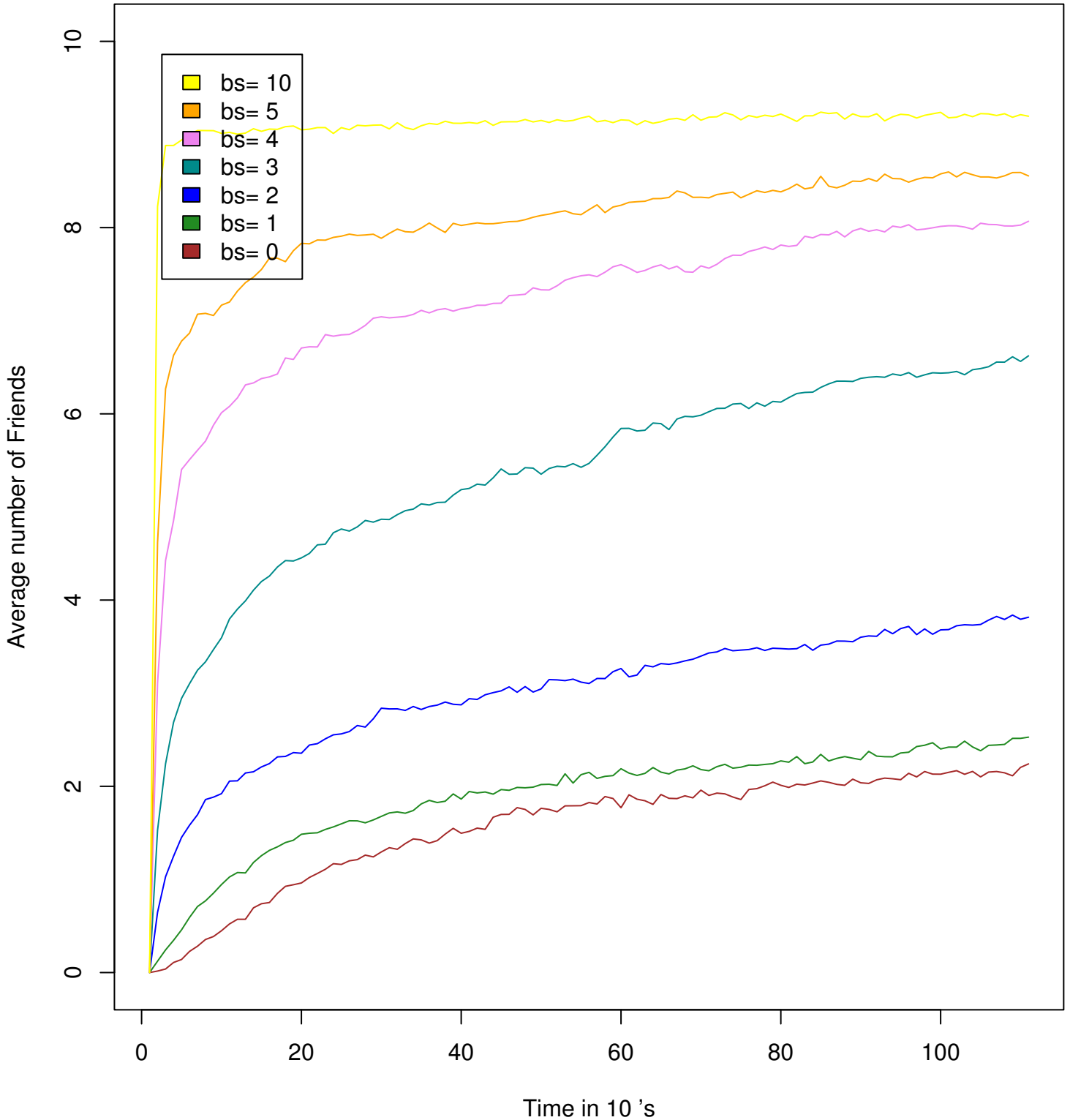
Implications of Rules for Model 3

- **Charisma** of the sender s_i and the receiver $r_j = s_j$ are equally important in making friendships since the coefficients are equal ($\beta_s = \beta_r$).
- Agents with high **Charisma** will make lots of friends and will live in large clusters. They might even bring everybody together into a perfect cluster.
- The distribution of **Charisma** might make a difference in the behavior of the model.
- A new summary statistic **Average net distance moved in Social Space** has been added to tracking of the model. This measures the average difference between an agent’s initial location and its location at the end of the run, time=1098.

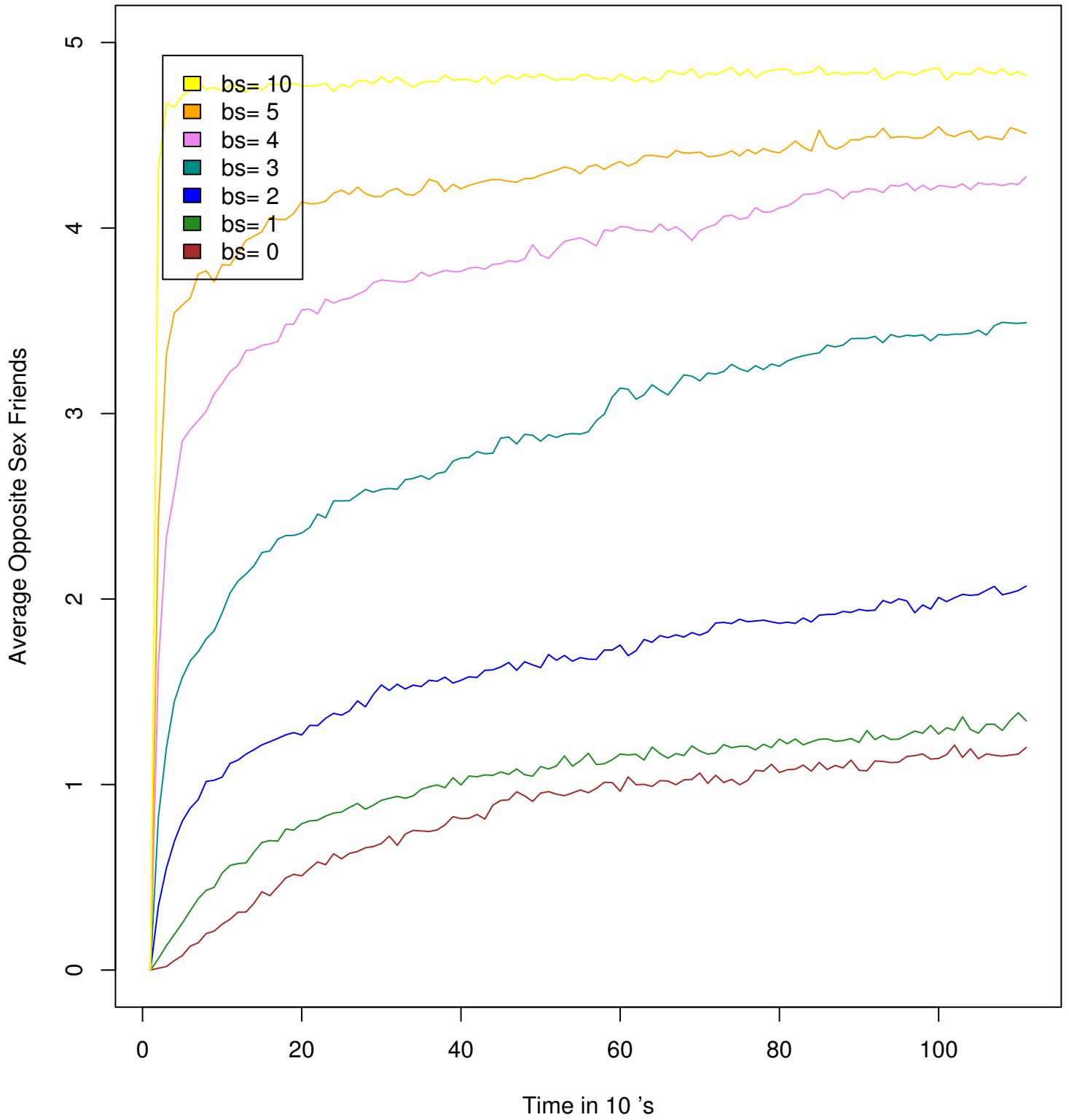
2 Results

For seven values of the sensitivity to **Charisma** parameter β_s , I ran the intelligent agent model 50 times. I kept the summary statistics for every tenth time step then averaged them. These summary statistics are shown below. For these plots $\beta_0 = 0$ and $\delta_1 = 0$.

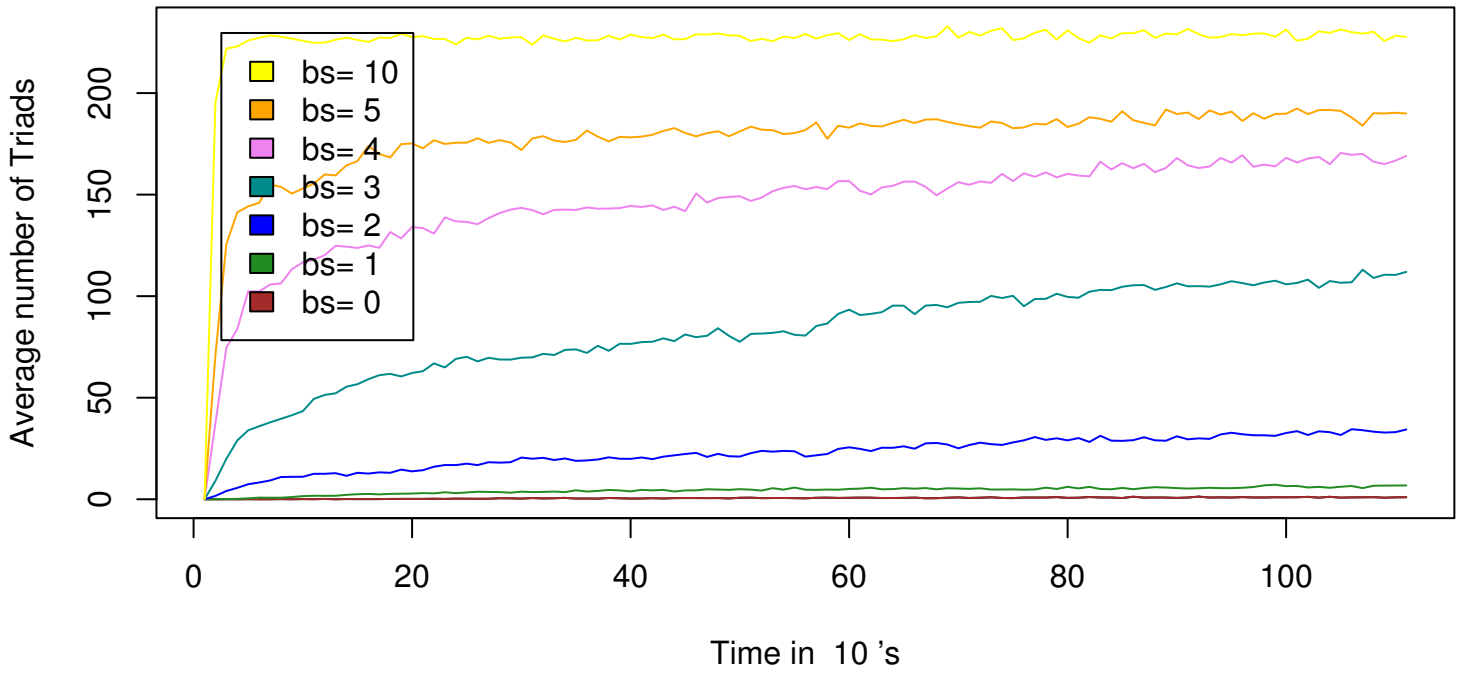
Average number of Friends Model 3



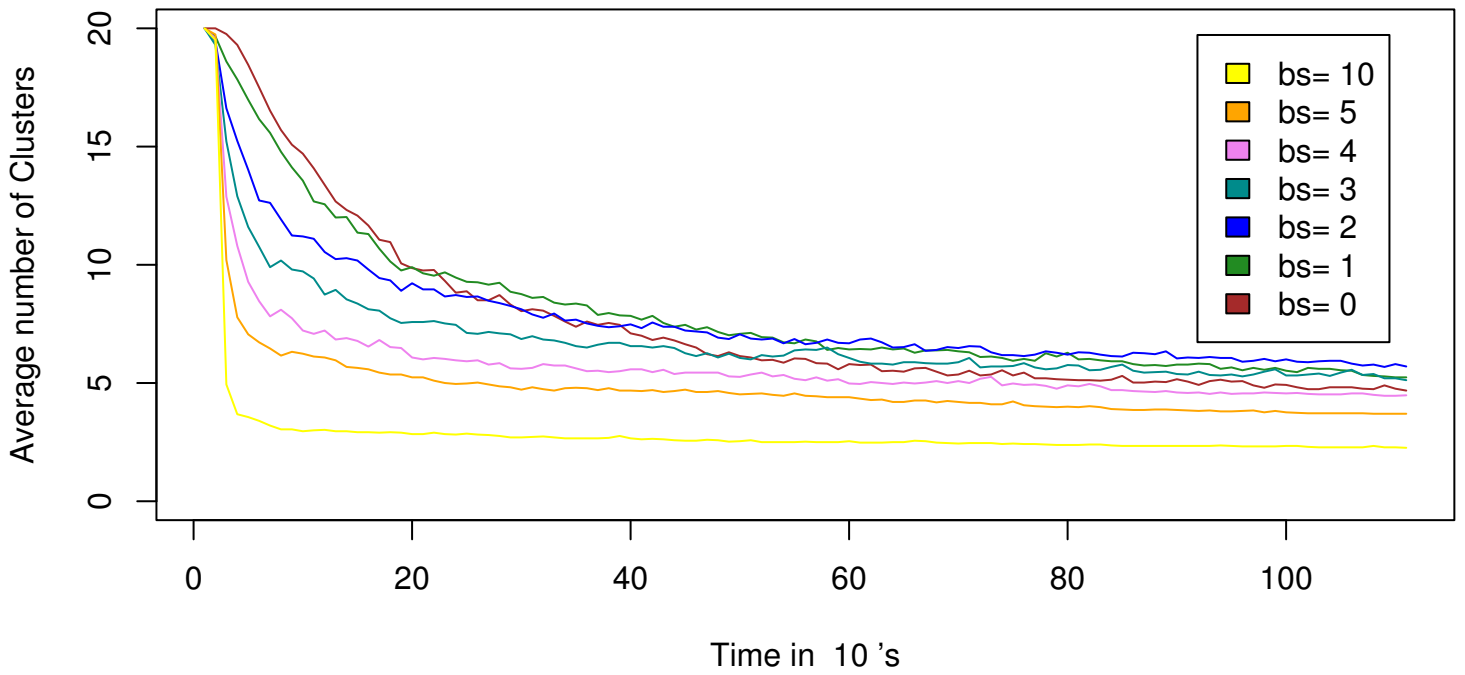
Average number of Opposite Sex Friends Model 3



Average number of Triads Model 3



Average number of Clusters Model 3



3 Results, Implications, Observations, and Notes for Model 3

- Could the number of clusters be a function of the size of Social Space only? As time goes on, the average number of clusters hardly decreases. I think the **size** of Social Space determines how many loners there are initially. After everyone else has made friends, the loners remain friendless.
- I am running simulations with varying δ_1 (sensitivity to **Sex**) parameters along with varying β_s parameters.
- A big question is how to make sense of so much qualitative data. Each simulation tells a different story. Which statistics are sufficient to tell the story?
- Much of the behavior (if not all) of the intelligent agent models can be predicted using pencil and paper calculations.

4 Notes on Future Work

- Movement in Social Space based on $\text{logit}(p_{ij})$, the *degree* of friendship, not on the presence/absence of a friendship tie.
- Use R to draw a graph of the agents based on their friendship ties. Not sure how to do this.

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Model 3b (Charisma is compared with Sex)

Eric Vance

Saturday, June 11, 2005

5 Models and Rules

The basic p-friendship model:

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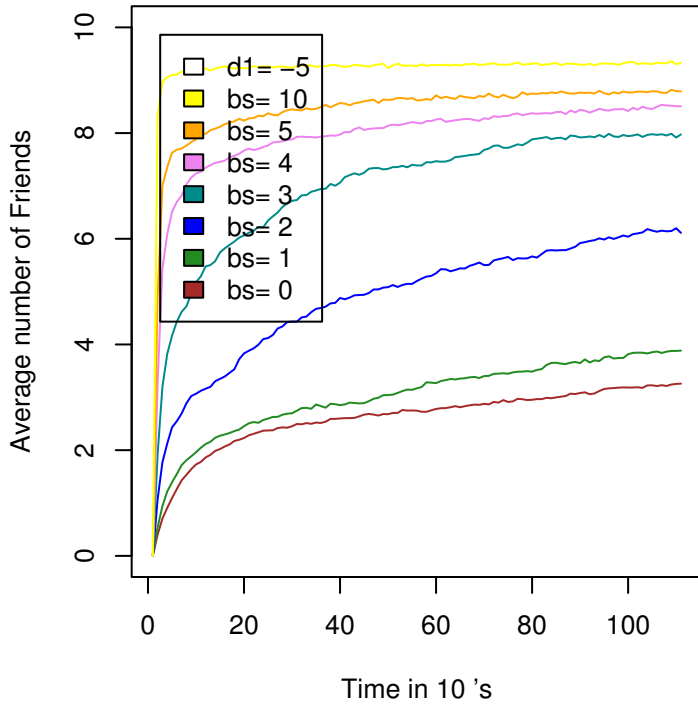
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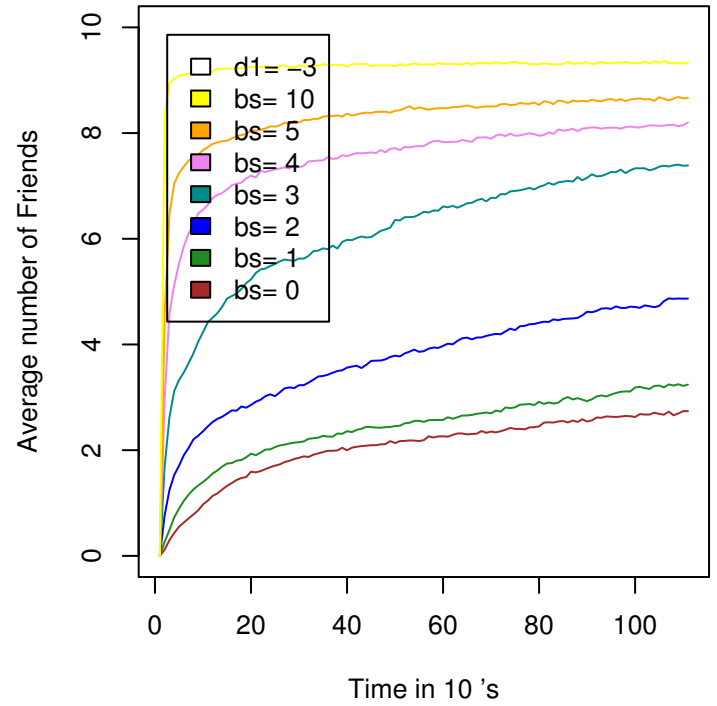
6 Results

- For seven values of the sensitivity to **Charisma** parameter $\beta_s = (0, 1, 2, 3, 4, 5, 10)$, I ran the intelligent agent model 100 times for each of seven values of the sensitivity to **Sex** parameter $\delta_1 = (-5, -3, -1, 0, 2, 5, 10)$.
- The baseline degree of friendship remains fixed at $\beta_0 = 0$.
- For the statistic **Average Number of Friends**, varying δ_1 only made a noticeable difference in the extreme case of $\delta_1 = 10$. All other curves show a similar increase in **Average Number of Friends** with an increase in β_s . **Average Opposite Sex Friends** behave similarly.
- The statistic **Net Distance Moved** averages the distances the agents have moved from their initial location to their location at time = t for each set of parameters β_s and δ_1 .

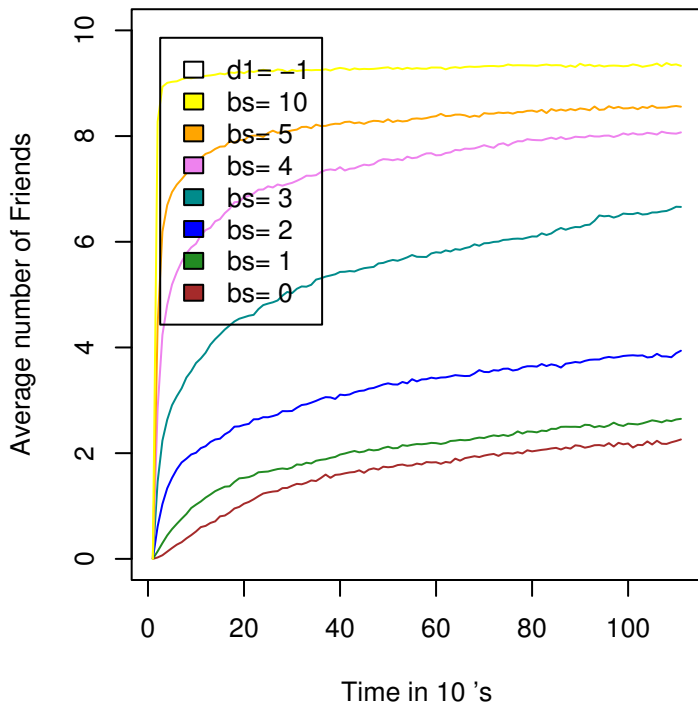
Average # of Friends Model 3b, $d1 = -5$



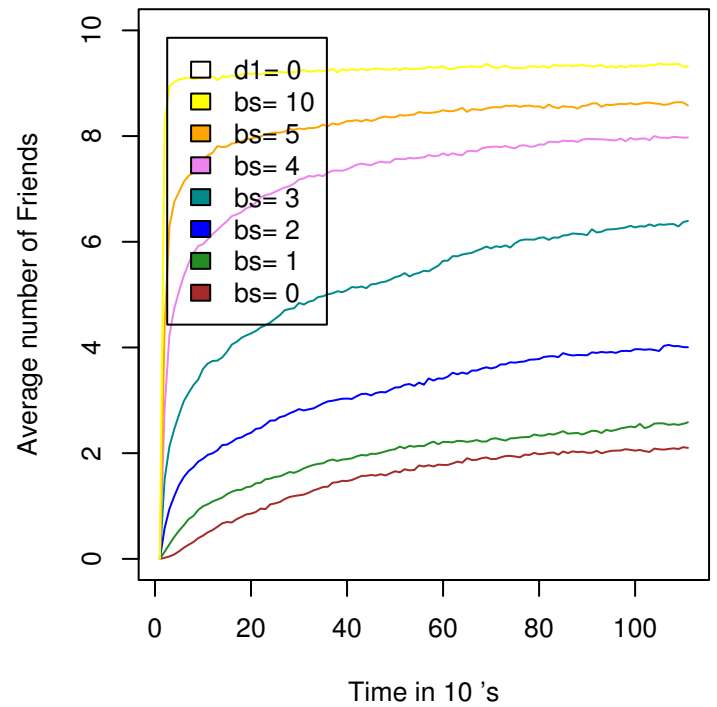
Average # of Friends Model 3b, $d1 = -3$



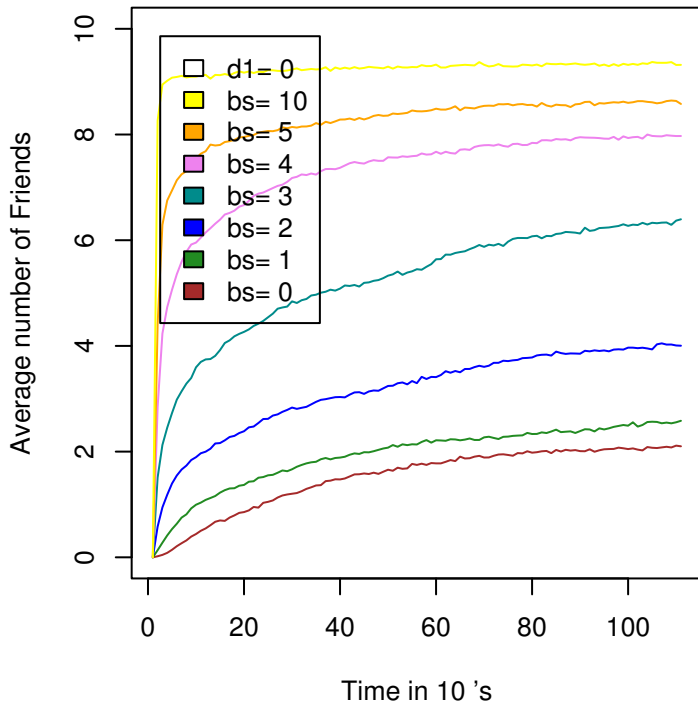
Average # of Friends Model 3b, $d1 = -1$



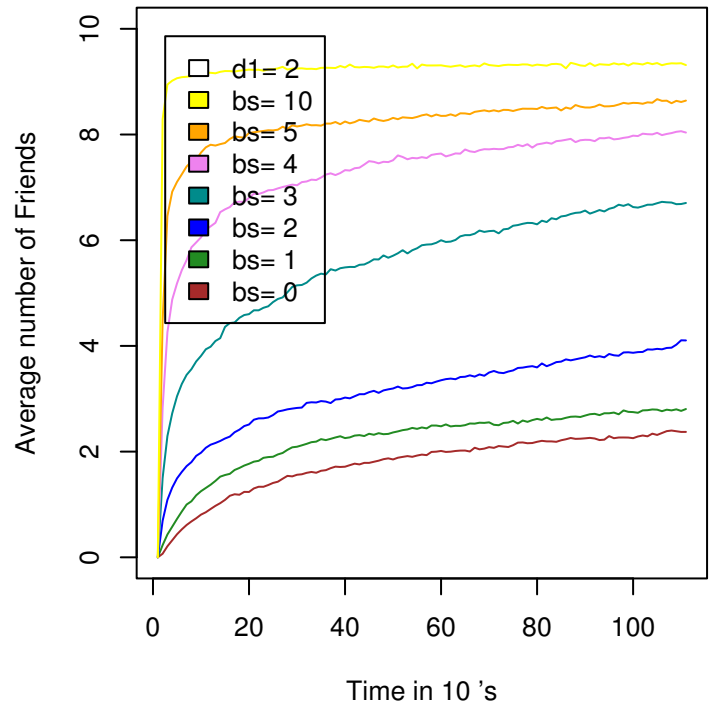
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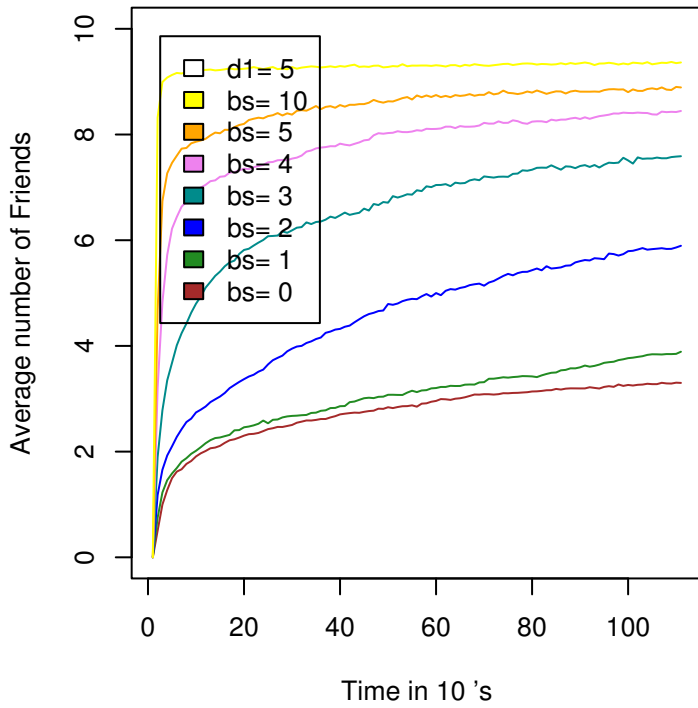
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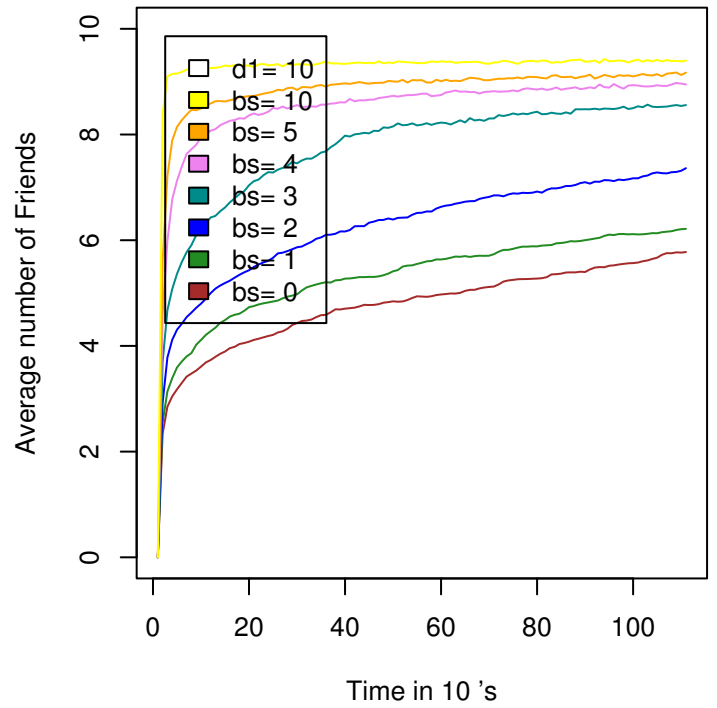
Average # of Friends Model 3b, d1= 2



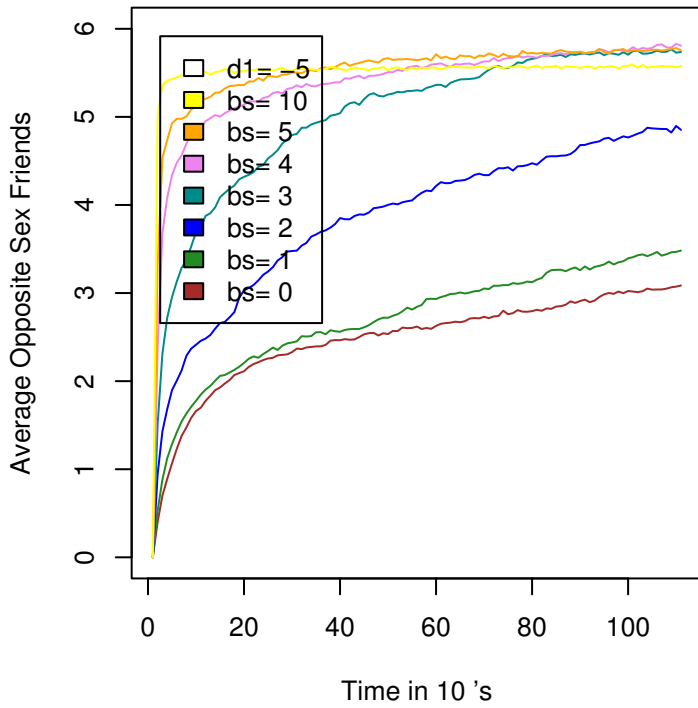
Average # of Friends Model 3b, d1= 5



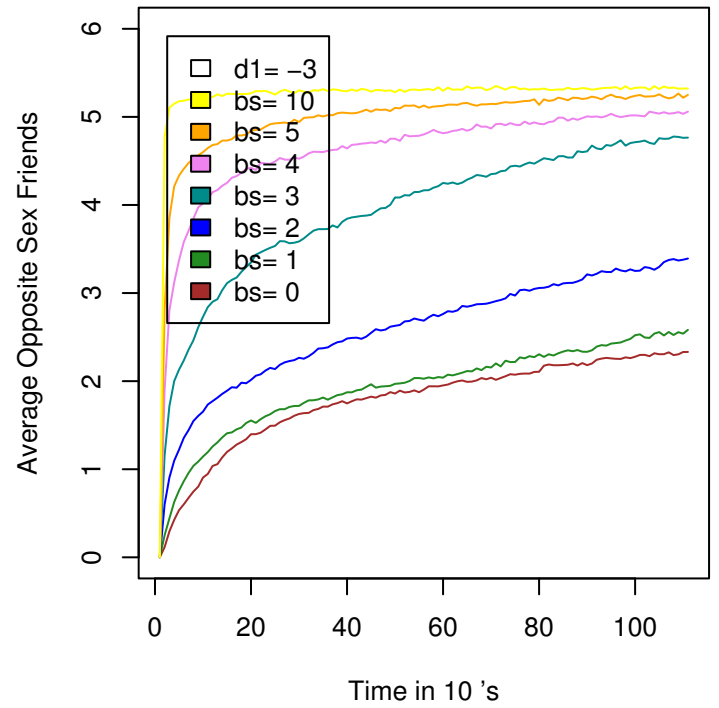
Average # of Friends Model 3b, d1= 10



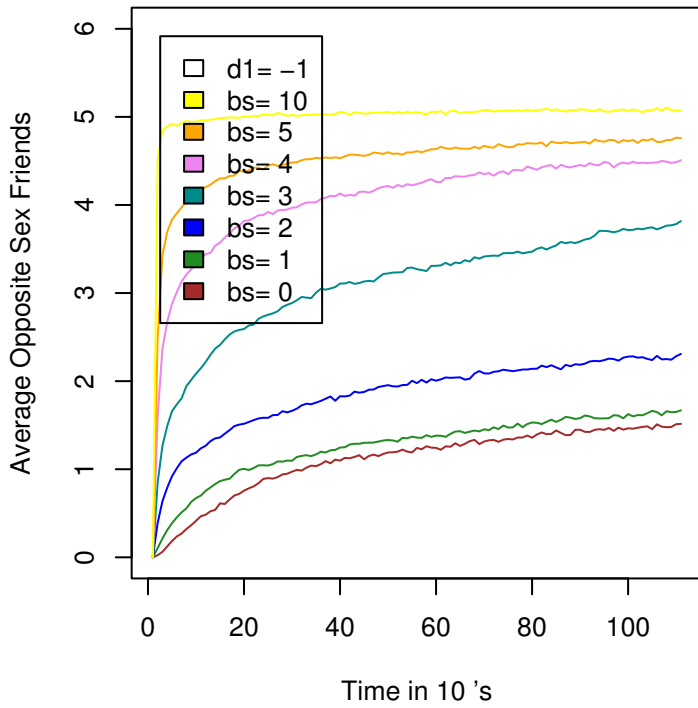
Average #Opp Sex Friends Model 3b, d1= -5



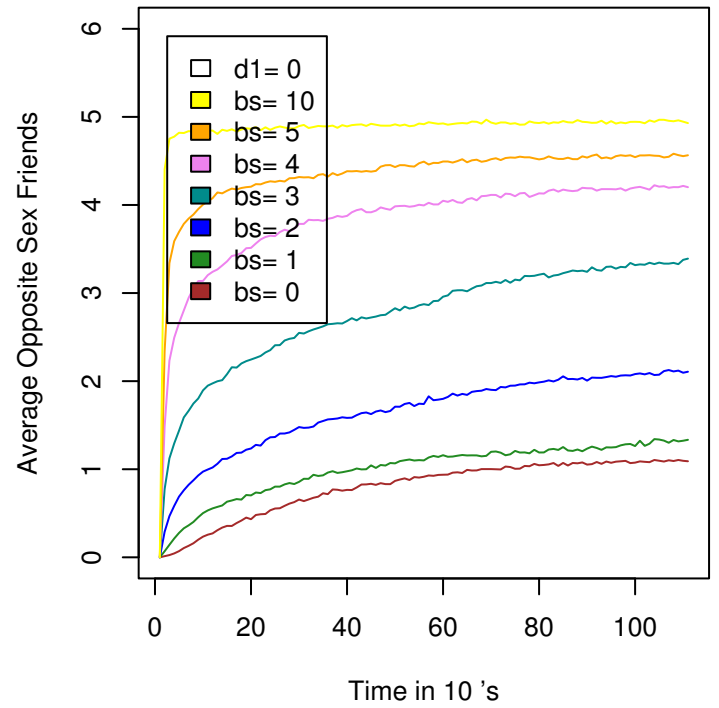
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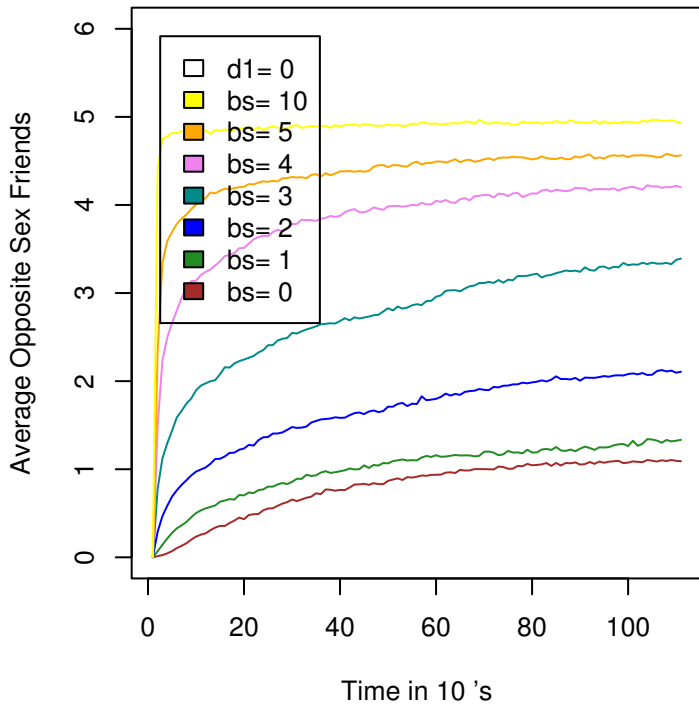
Average #Opp Sex Friends Model 3b, d1= -1



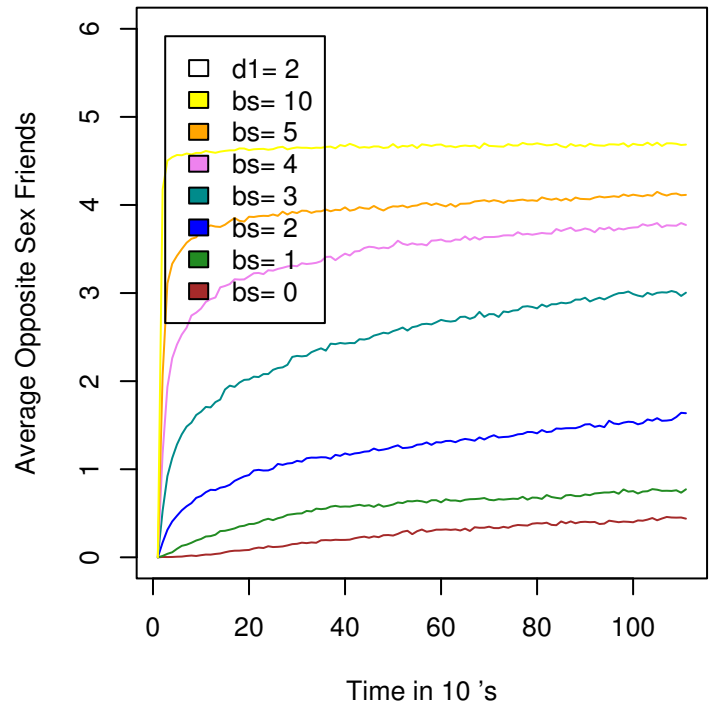
Average #Opp Sex Friends Model 3b, d1= 0



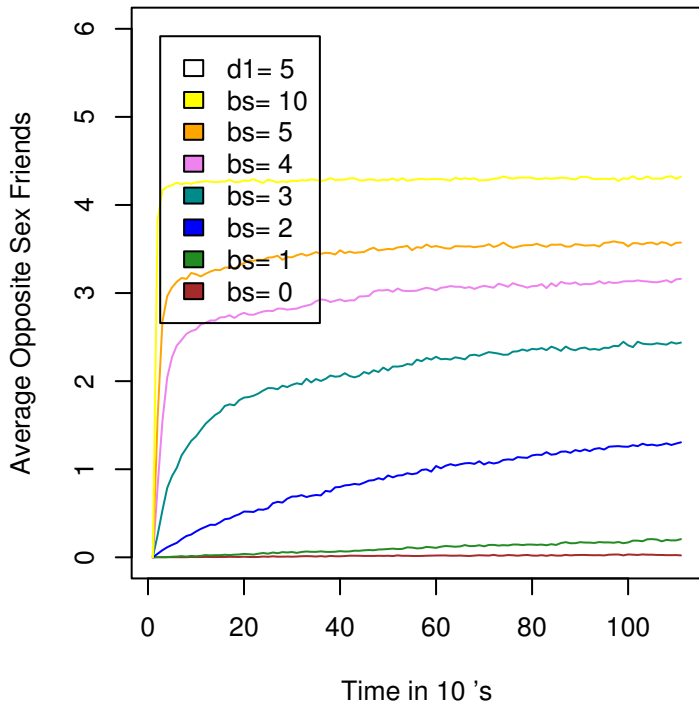
Average #Opp Sex Friends Model 3b, d1= 0



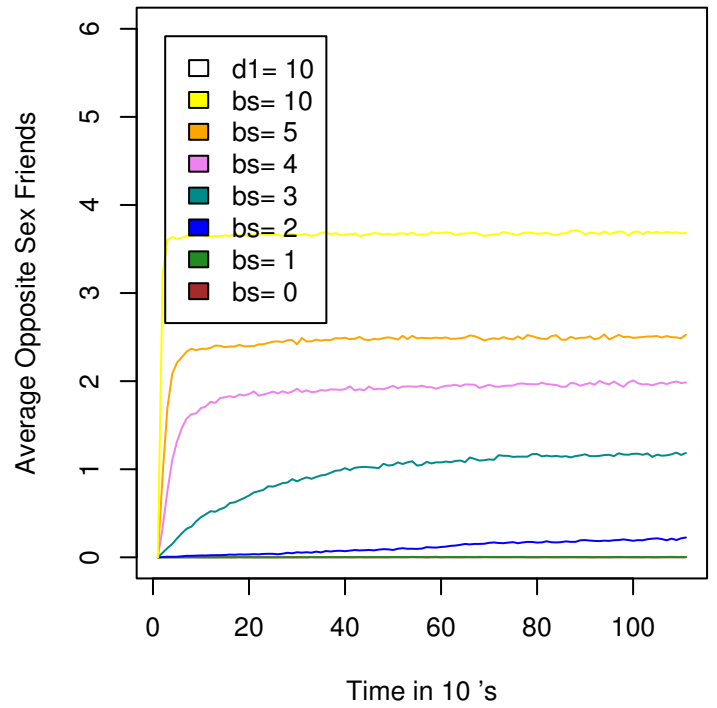
Average #Opp Sex Friends Model 3b, d1= 2



Average #Opp Sex Friends Model 3b, d1= 5

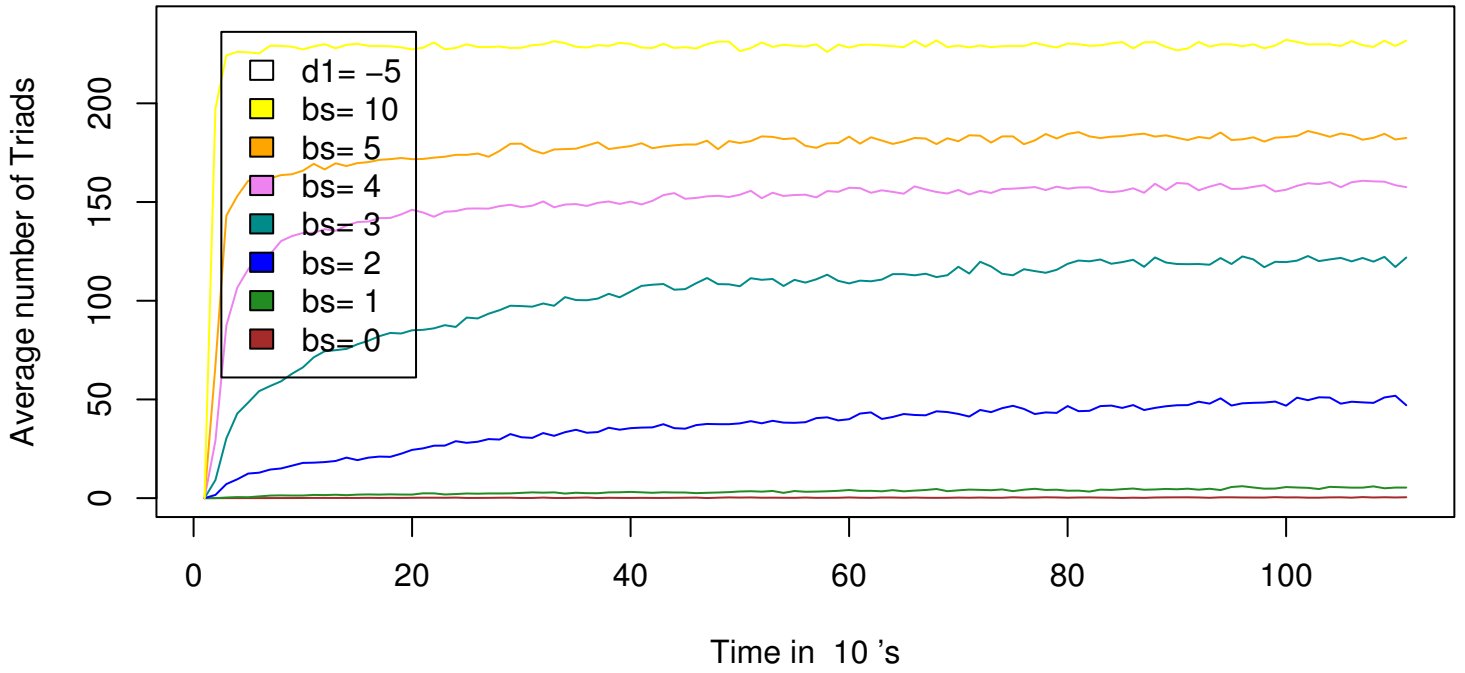


Average #Opp Sex Friends Model 3b, d1= 10

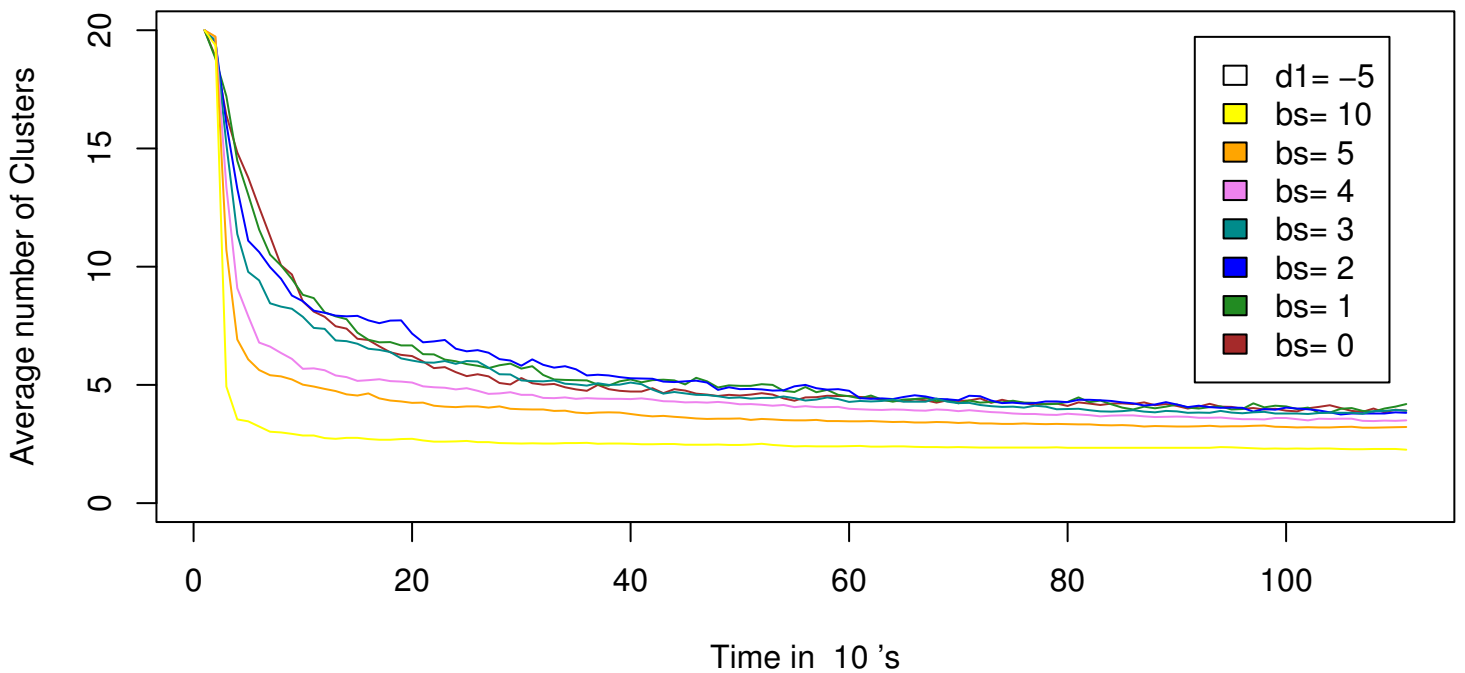


- As in the case of the Average Number of Friends, **Number of Triads** only change noticeably in the extreme case of $\delta_1 = 10$.
- The **Number of Clusters** behave similarly.

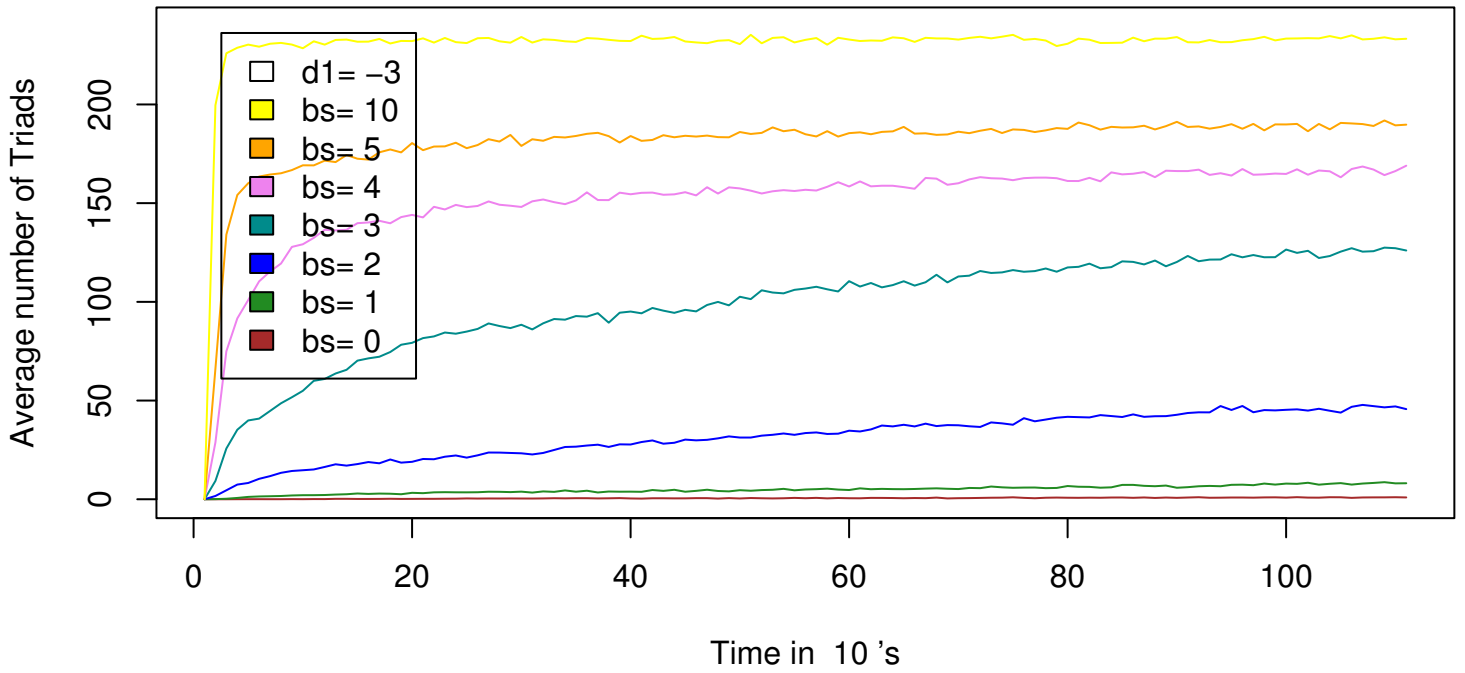
Average number of Triads Model 3b, $d_1 = -5$



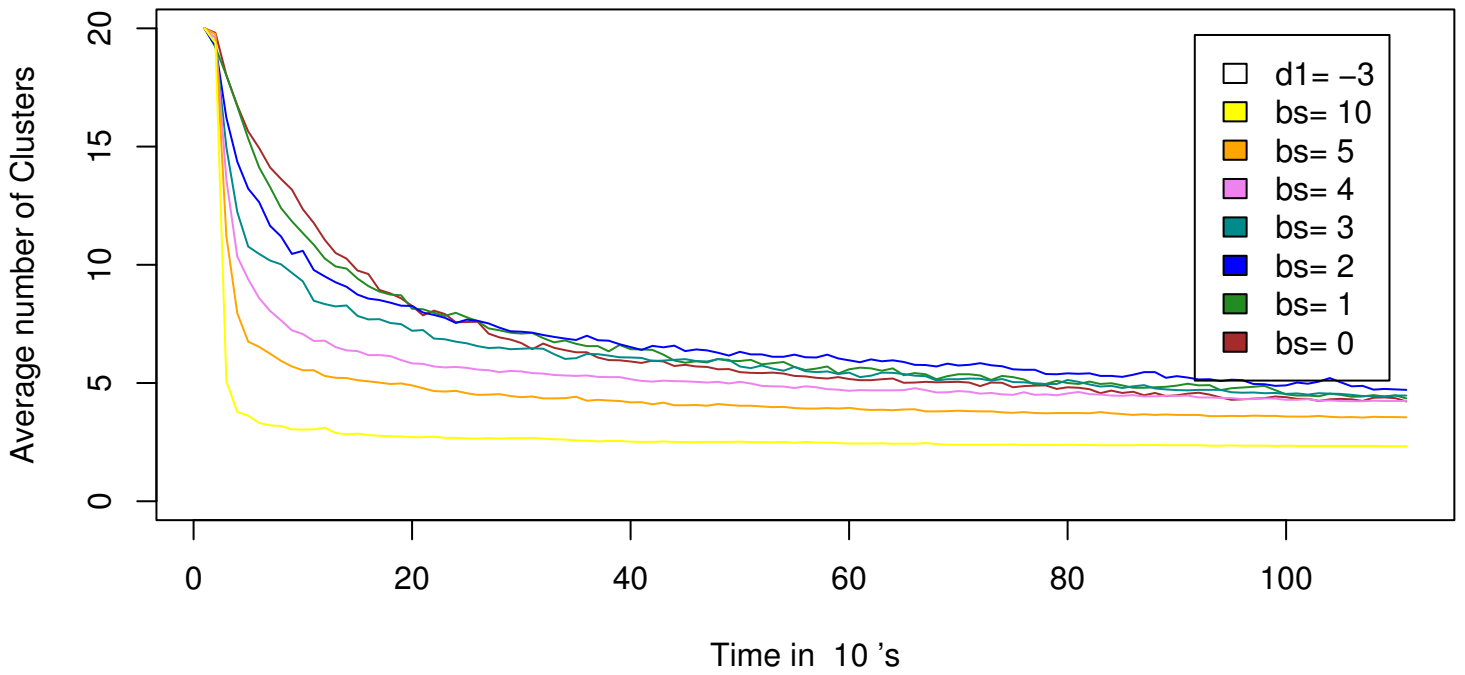
Average number of Clusters Model 3b, $d_1 = -5$



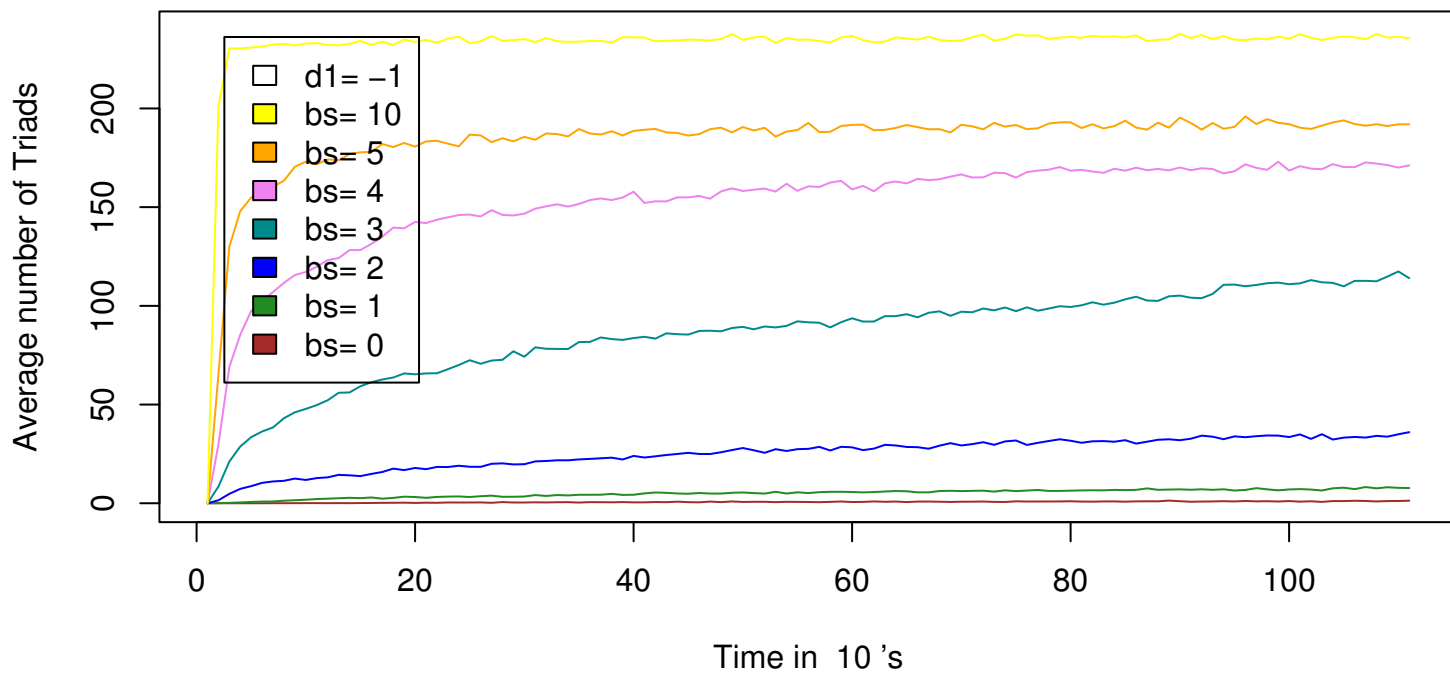
Average number of Triads Model 3b, $d_1 = -3$



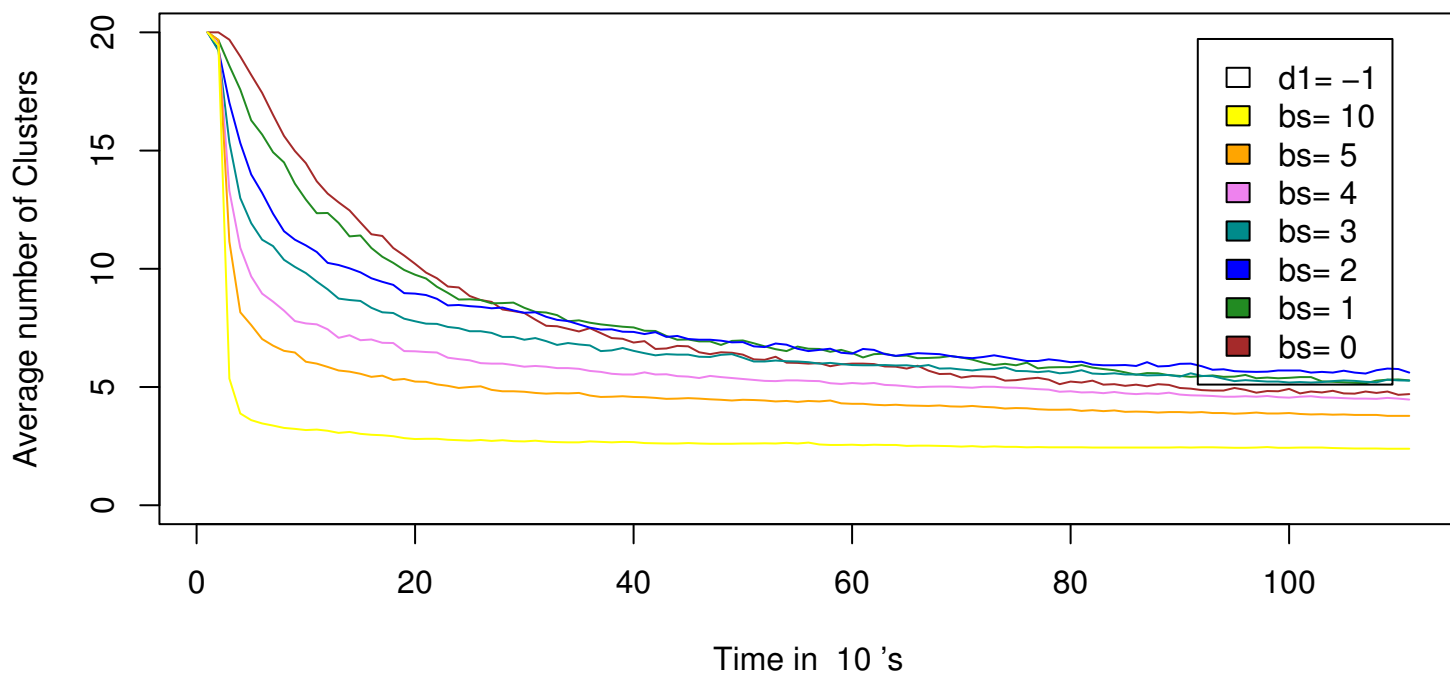
Average number of Clusters Model 3b, $d_1 = -3$



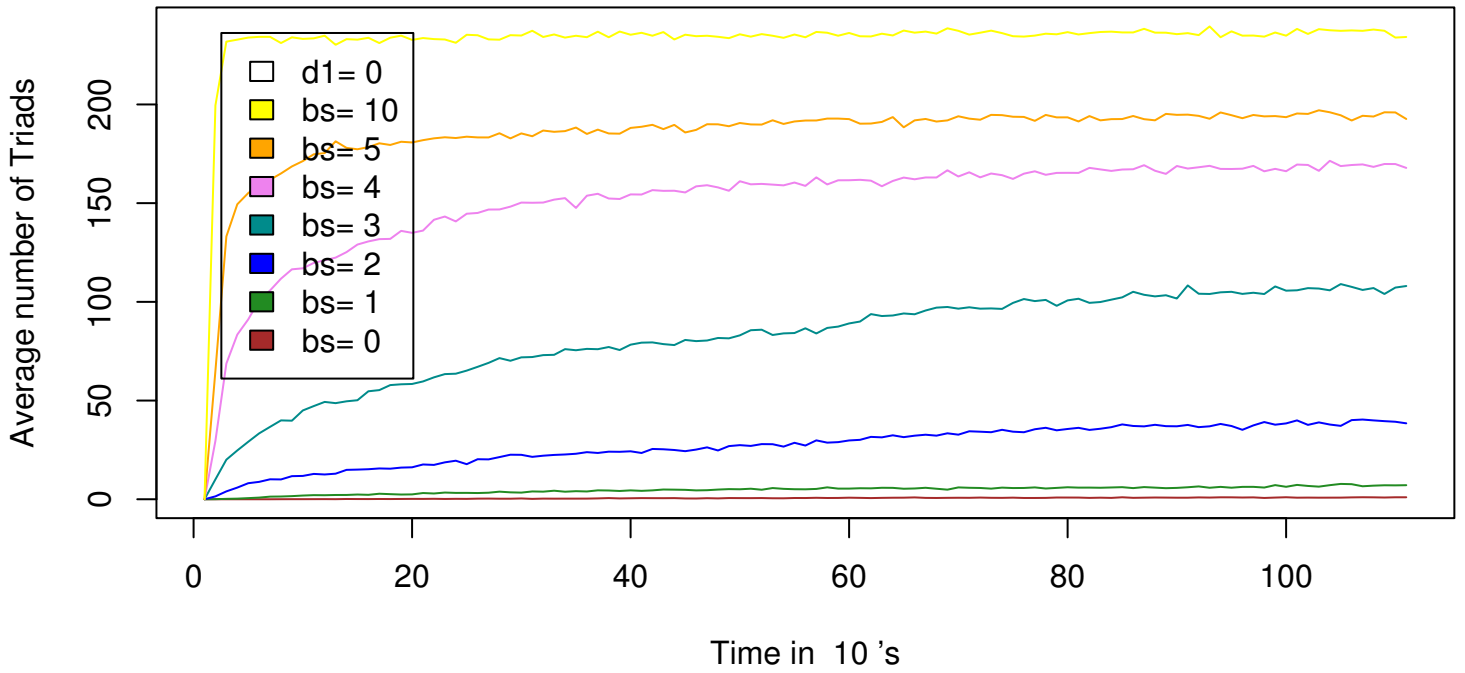
Average number of Triads Model 3b, $d1 = -1$



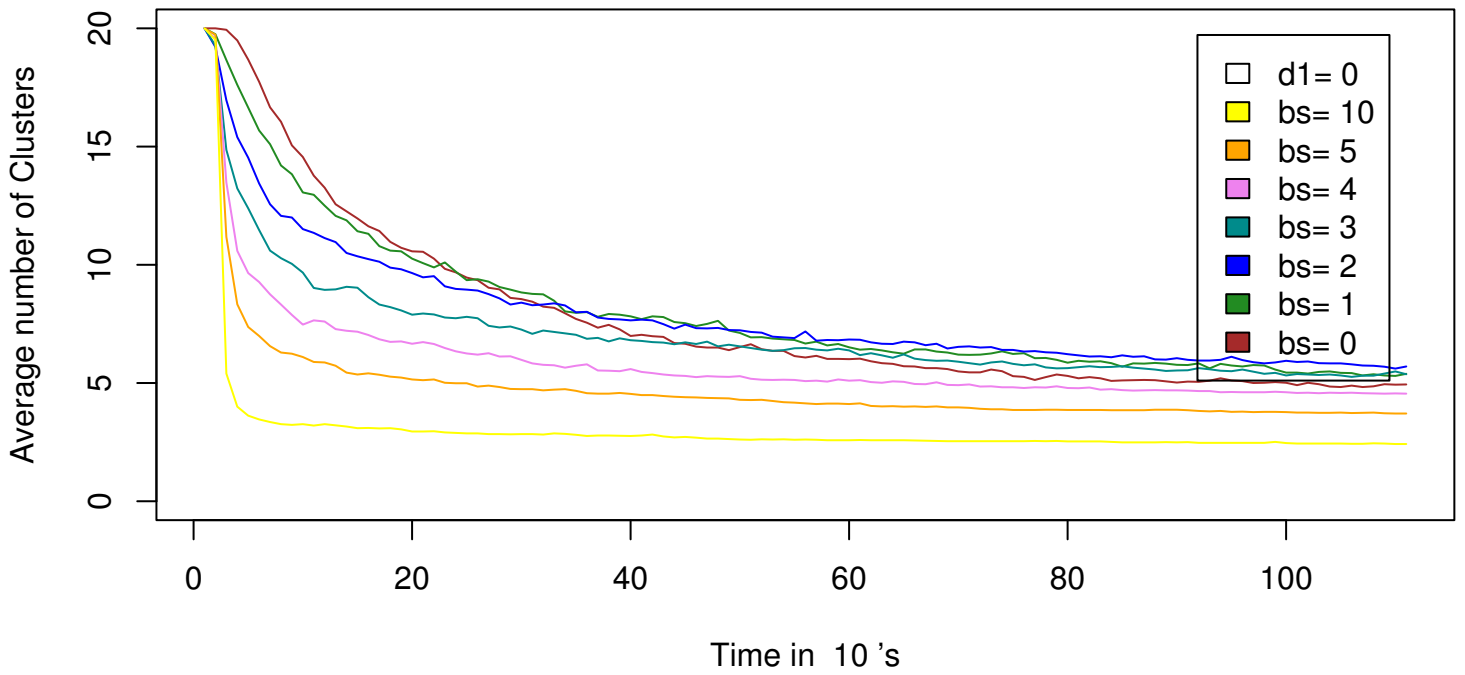
Average number of Clusters Model 3b, $d1 = -1$



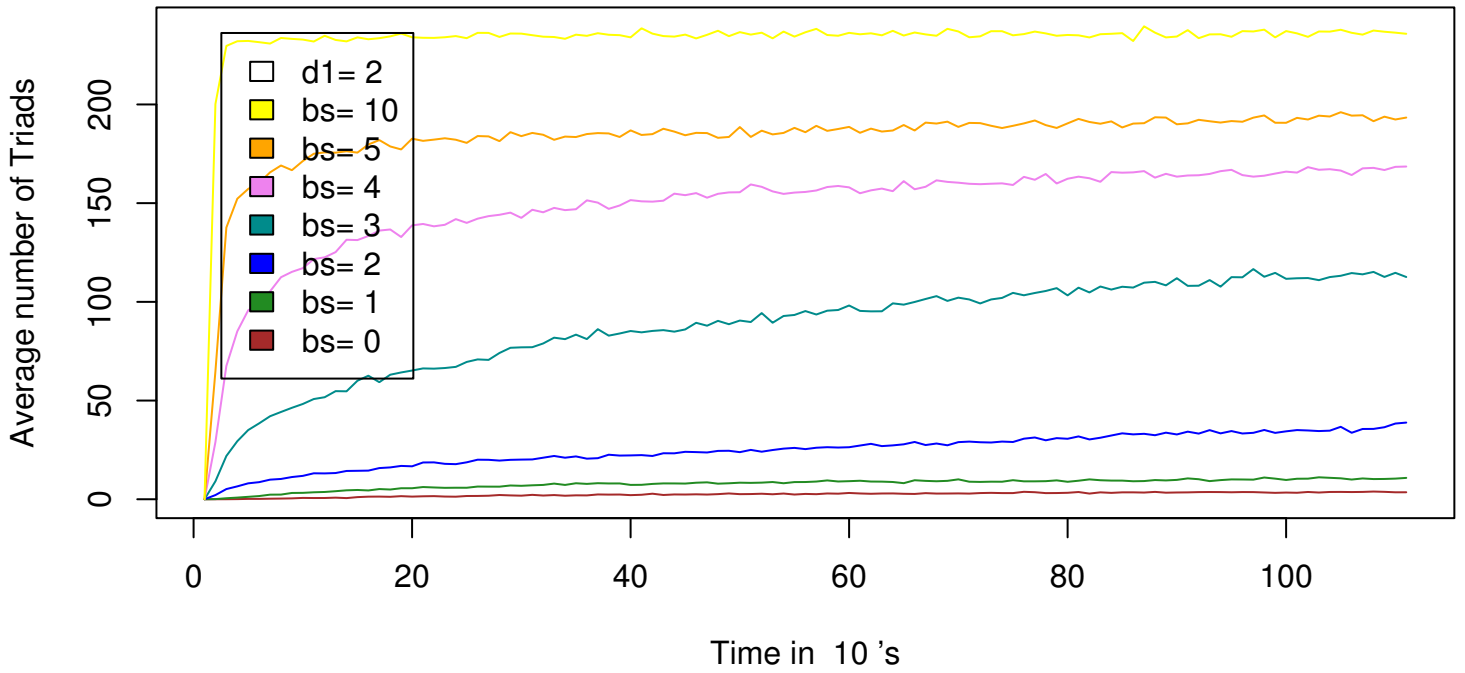
Average number of Triads Model 3b, d1= 0



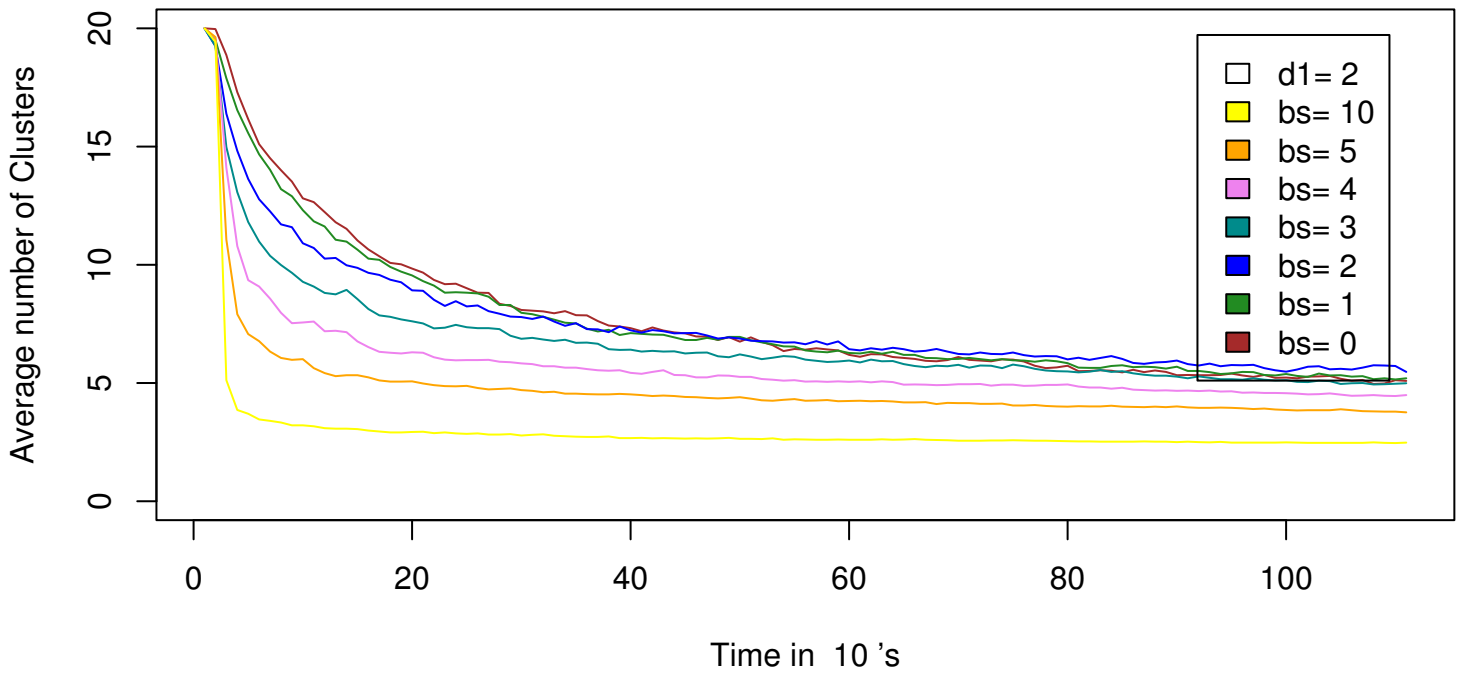
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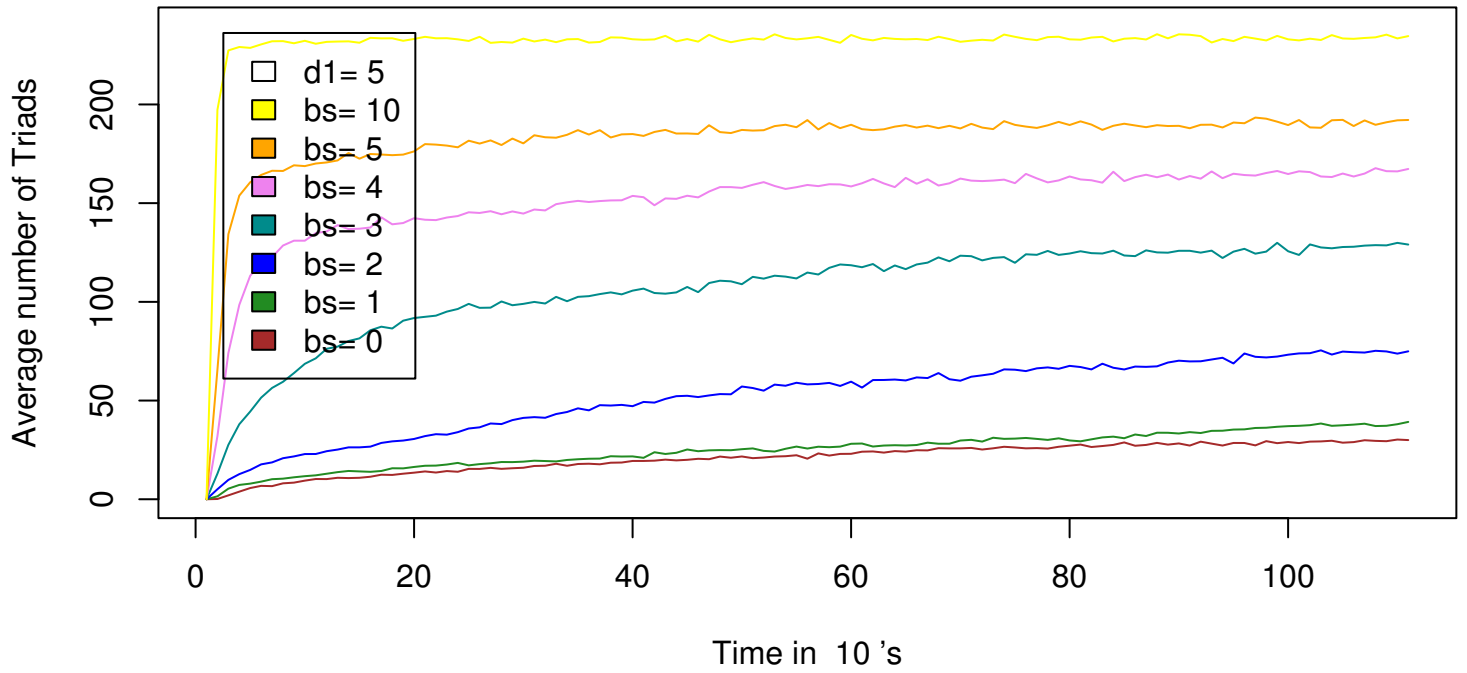
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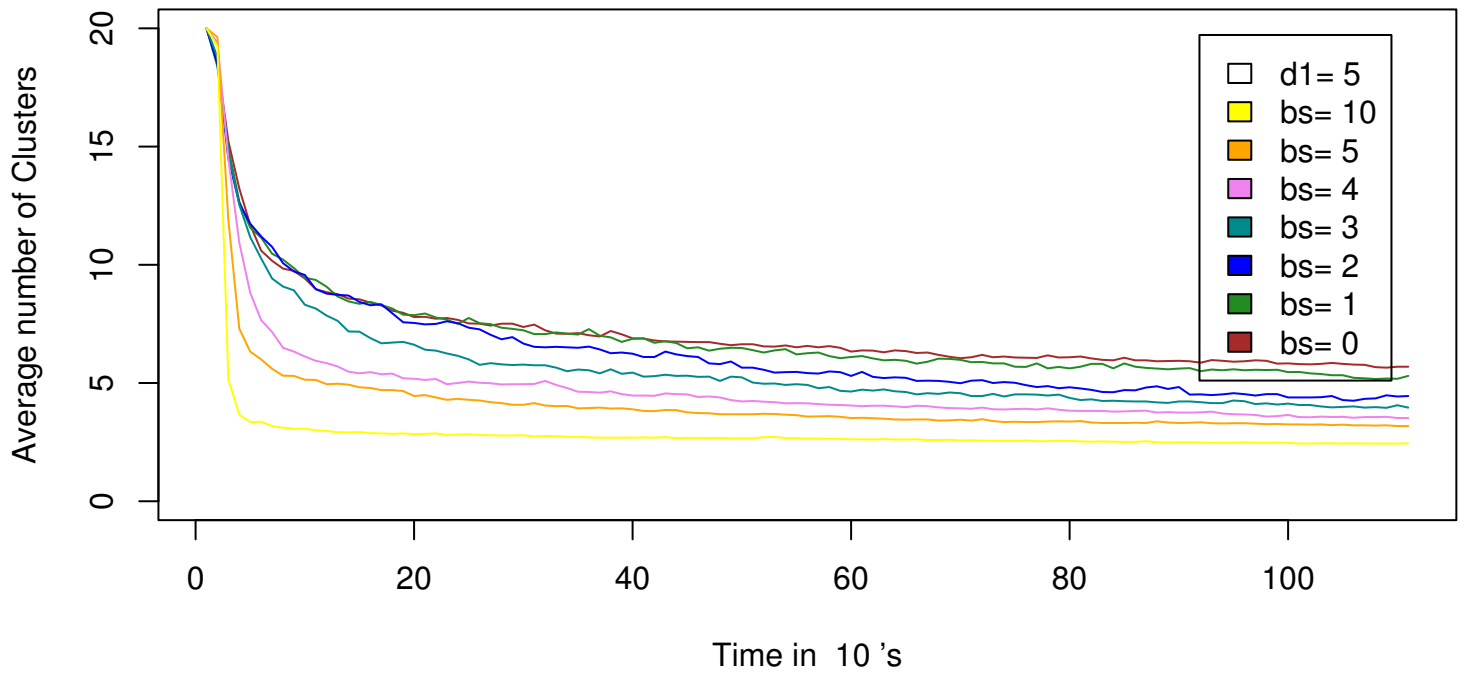
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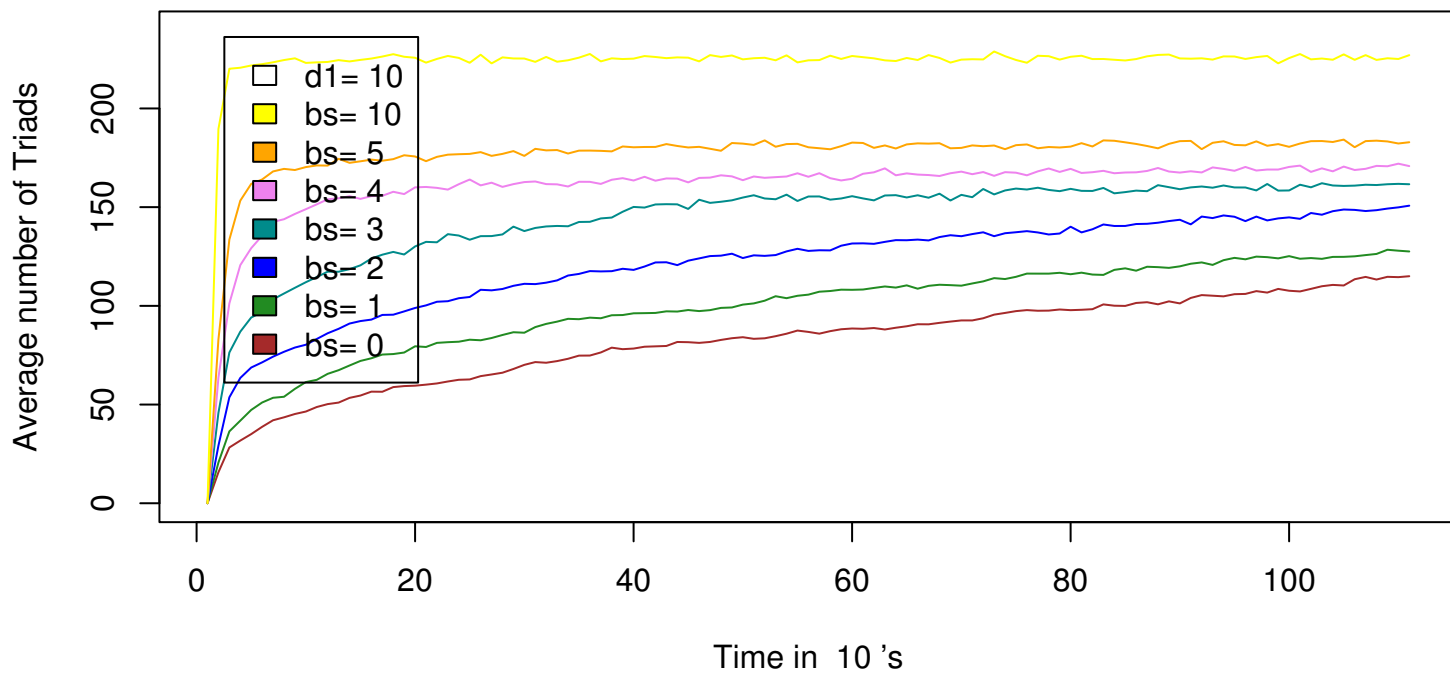
Average number of Triads Model 3b, $d1=5$



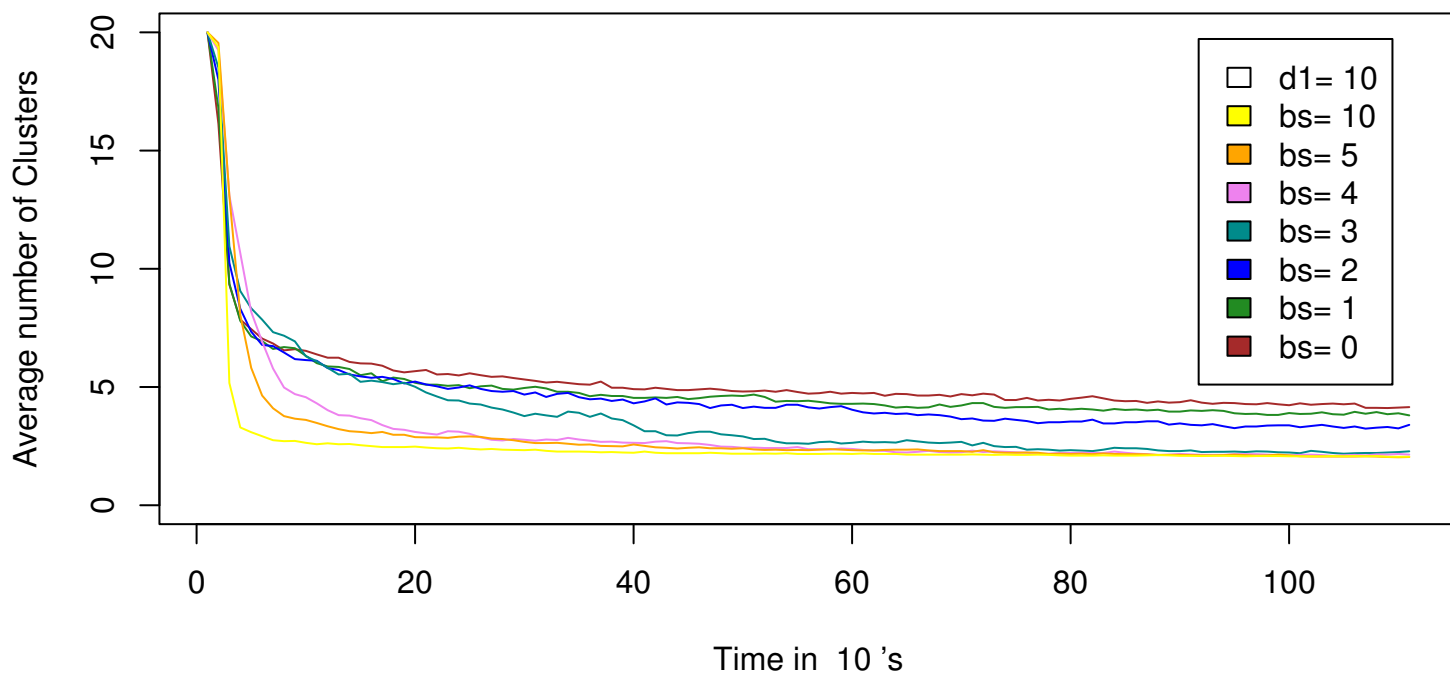
Average number of Clusters Model 3b, $d1=5$



Average number of Triads Model 3b, d1= 10

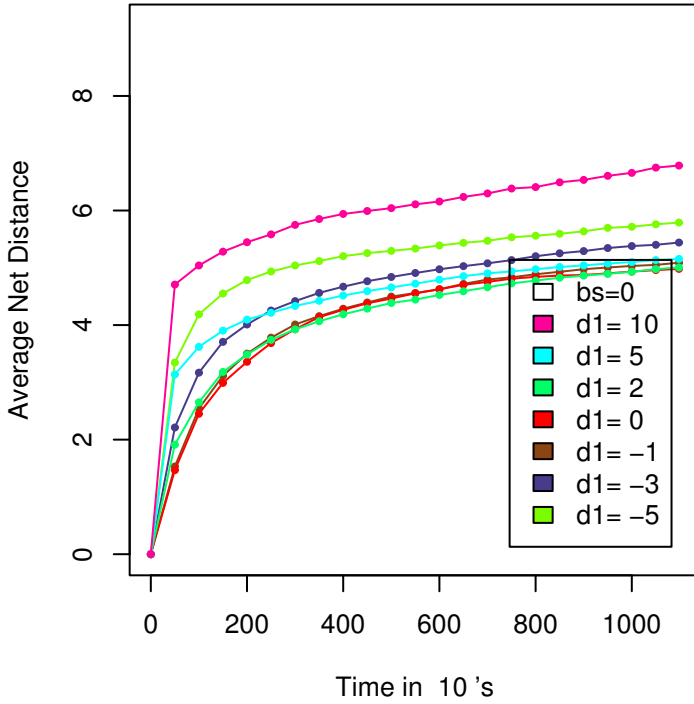


Average number of Clusters Model 3b, d1= 10

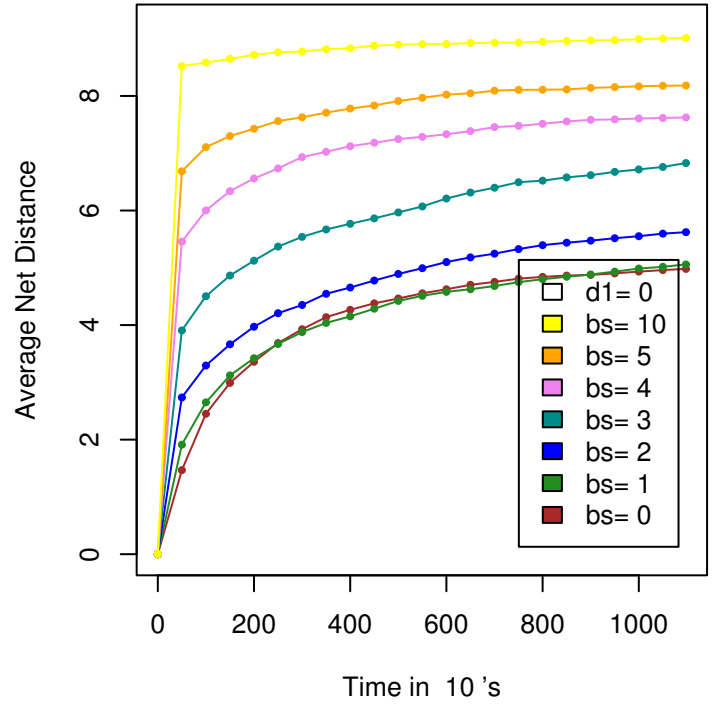


- The effect of δ_1 on **Net Distance Moved** is interesting. Generally, higher absolute values of δ_1 indicate farther distances moved, but not always as shown for $\beta_s = 0$ when $\delta_1 = 5$.
- As β_s increases, the **Net Distance Moved** increases across all values of δ_1 .

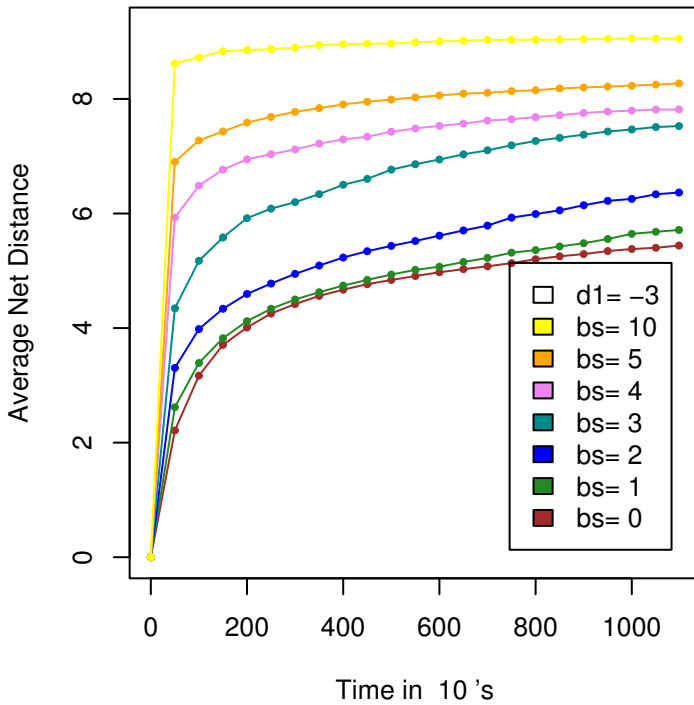
Avg Net Dist Moved Model 3b, bs=0



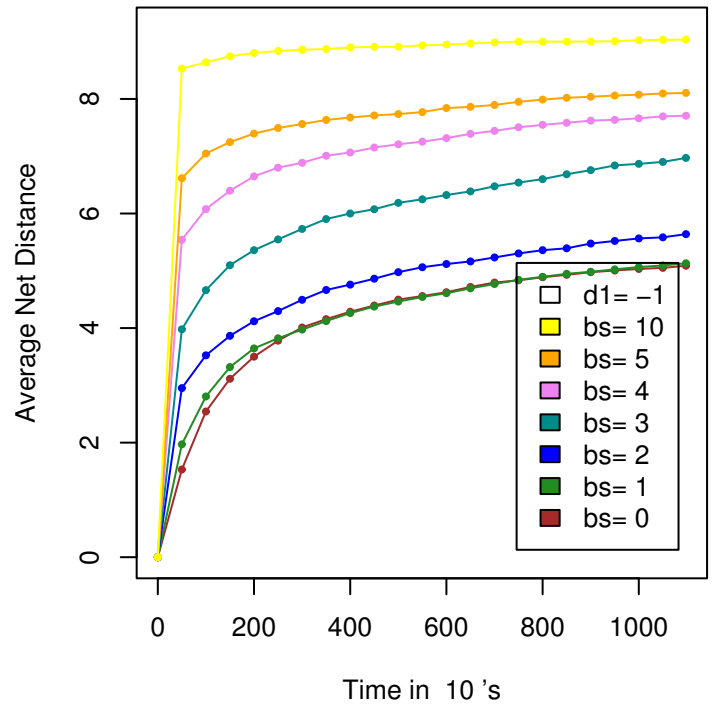
Avg Net Dist Moved Model 3b, d1=0



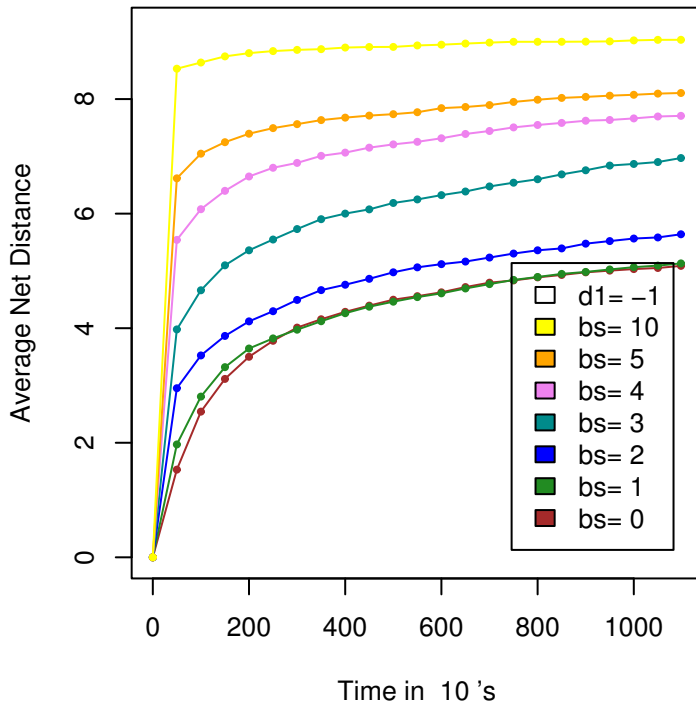
Avg Net Dist Moved Model 3b, d1= -3



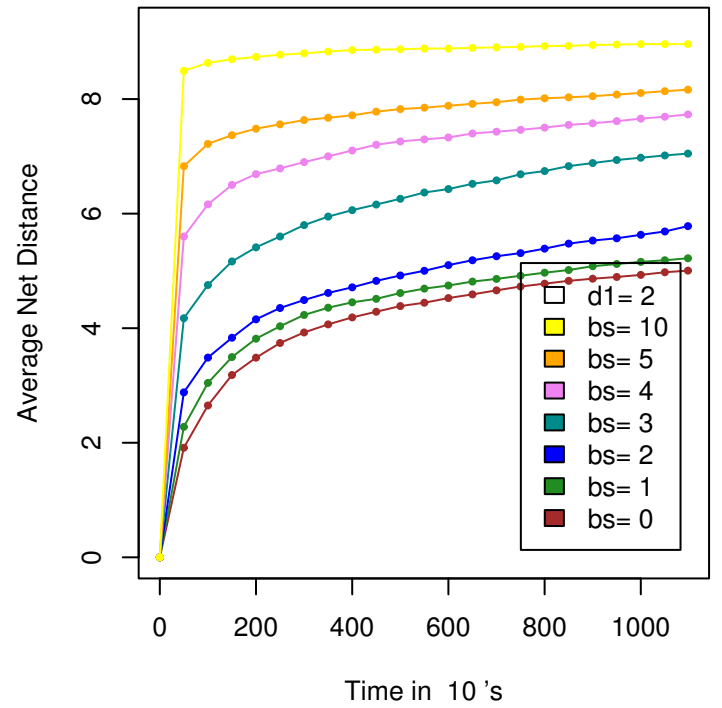
Avg Net Dist Moved Model 3b, d1= -1



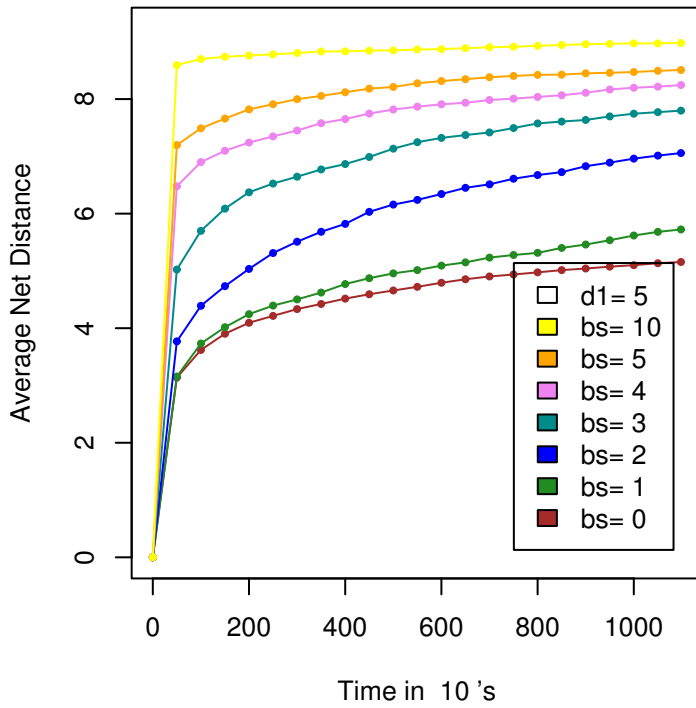
Avg Net Dist Moved Model 3b, d1= -1



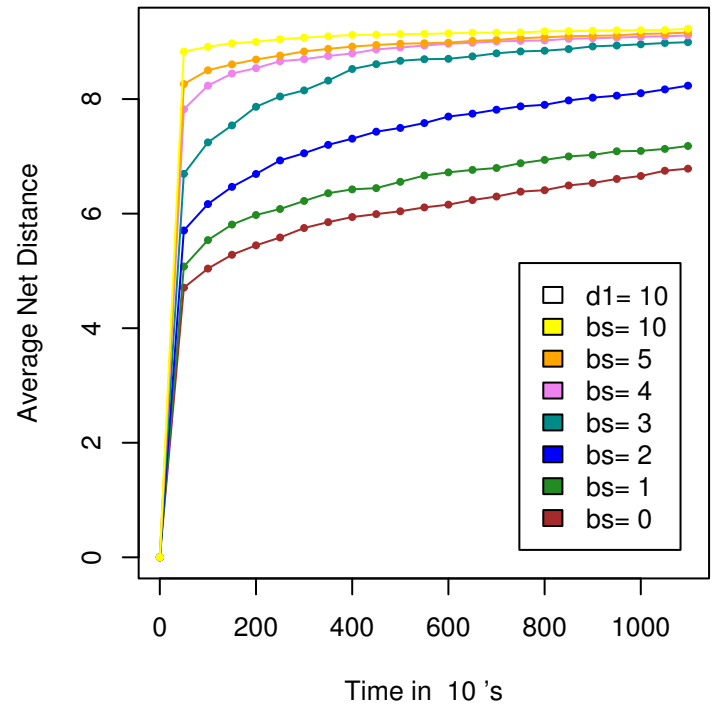
Avg Net Dist Moved Model 3b, d1= 2



Avg Net Dist Moved Model 3b, d1= 5



Avg Net Dist Moved Model 3b, d1= 10



7 Results, Notes, Implications, and Questions for Model 3 (comparing Sex and Charisma)

- 1. Only when $\delta_1 = 10$ is there a noticeable difference in **Average Number of Friends** for different values of β_s .
- 2. For all values of δ_1 (sensitivity to **Sex**), Avg friends increases with an increase in β_s .
- 3. Average number of **Opposite Sex Friends** seems very high for all values of δ_1 when $\beta_s = 10$. For most values of δ_1 , opp-sex friends increases with an increase in β_s .
- 4. The average final location is not a perfect cluster for any values of the parameters. Social Space seems to be big enough to get stable sub-clusters (the agents start off far enough apart to have a high probability of remaining apart).
- 5. The **Number of Triads** is the same for all values of δ_1 (except slightly when $\delta_1 = 10$). There is a perfect relationship between number of triads and β_s (for a given δ_1).
- 6. The **Number of Clusters** is also largely unaffected by δ_1 and the relationship between clusters and β_s is fairly strong.
- 7. How do clusters merge when $\beta_s = 10$? Does the charismatic leader pull everyone together eventually? The code says that agents move to where their friends were last time step (not to where they moved this current time step).