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Individual Simulation Statistical Analysis

Hypothesis:

H_{01} = The mean number of gray patches in the simulation will not be affected by the activity level selected in the simulation

H_{02} = The mean number of gray patches in the simulation will not be affected by whether or not osteoporosis is set to yes or no

H_{03} = The effect of the activity level on the average gray patches is the same for this simulation both with osteoporosis and without

Procedure:
The simulation was run 5 times for 2000 ticks for each of the following 6 different conditions:

LOW activity level, NO osteoporosis
LOW activity level, YES osteoporosis
AVERAGE activity level, NO osteoporosis
AVERAGE activity level, YES osteoporosis
INTENSE activity level, NO osteoporosis
INTENSE activity level, YES osteoporosis

The output analyzed was the mean amount of gray patches over 2000 ticks

Results:

[run number]	activity-level	osteoporosis?	[reporter]	[mean]	[STD]
1	low	no	count patches with [pcolor = gray]	18.2094	2.424795
2	low	no	count patches with [pcolor = gray]	15.70665	3.299152
3	low	no	count patches with [pcolor = gray]	10.75762	3.894704
4	low	no	count patches with [pcolor = gray]	10.83358	3.590793
5	low	no	count patches with [pcolor = gray]	17.66567	5.621091
6	low	yes	count patches with [pcolor = gray]	35.94203	13.65081
7	low	yes	count patches with [pcolor = gray]	21.83608	2.7704
8	low	yes	count patches with [pcolor = gray]	33.41079	6.576486
9	low	yes	count patches with [pcolor = gray]	25.02799	8.609658
10	low	yes	count patches with [pcolor = gray]	21.70065	4.510083
11	average	no	count patches with [pcolor = gray]	34.2019	5.759099
12	average	no	count patches with [pcolor = gray]	22.7901	6.040523
13	average	no	count patches with [pcolor = gray]	33.07946	8.672669
14	average	no	count patches with [pcolor = gray]	28.30385	7.048165
15	average	no	count patches with [pcolor = gray]	32.73613	7.795662
16	average	yes	count patches with [pcolor = gray]	36.44628	8.026035
17	average	yes	count patches with [pcolor = gray]	59.13093	22.89858
18	average	yes	count patches with [pcolor = gray]	54.52474	20.55868
19	average	yes	count patches with [pcolor = gray]	65.15492	24.34223
20	average	yes	count patches with [pcolor = gray]	52.93503	16.3508
21	intense	no	count patches with [pcolor = gray]	50.62669	14.56111
22	intense	no	count patches with [pcolor = gray]	44.92354	10.57566
23	intense	no	count patches with [pcolor = gray]	55.25287	15.84418
24	intense	no	count patches with [pcolor = gray]	56.82909	14.21818
25	intense	no	count patches with [pcolor = gray]	57.70365	9.027438
26	intense	yes	count patches with [pcolor = gray]	109.4088	45.52702
27	intense	yes	count patches with [pcolor = gray]	86.05997	31.19961
28	intense	yes	count patches with [pcolor = gray]	99.44978	39.98515
29	intense	yes	count patches with [pcolor = gray]	83.09545	27.45828
30	intense	yes	count patches with [pcolor = gray]	97.87006	43.47185

Table 1: Raw Data of Tests Run

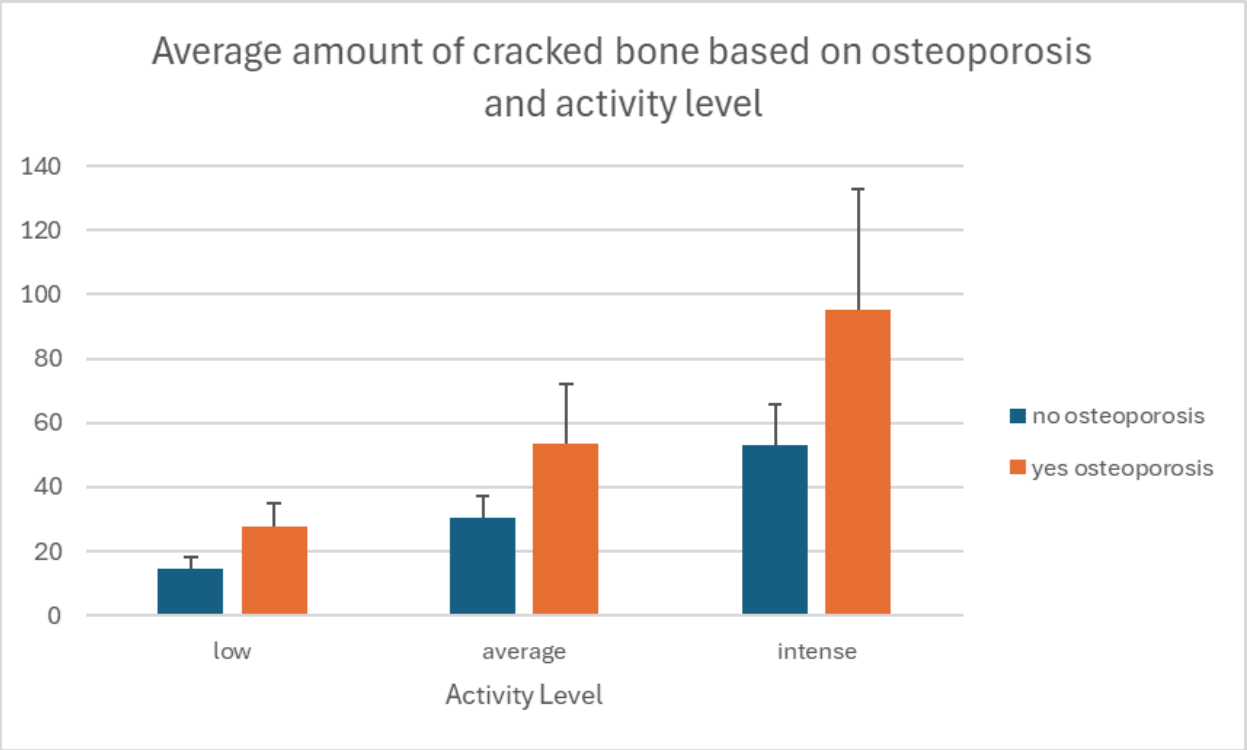

Figure 1: Error bars show standard deviation

ANOVA Analysis:

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	14267.33623	2	7133.66812	126.885431	1.7308E-13	3.40282611
Columns	5131.893901	1	5131.8939	91.2801885	1.189E-09	4.25967721
Interaction	1091.131729	2	545.565865	9.7038941	0.00081606	3.40282611
Within	1349.311999	24	56.2213333			
Total	21839.67386	29				

Table 2: Two Factor ANOVA Analysis Table

Here my “sample” factor is the three different activity levels, and the “column” factor is osteoporosis. My alpha value was set to 0.05 for these tests. When looking at the interaction between the two factors, the p-value is significant or < 0.05. This means that we are able to deny the third null hypothesis which was that the effect of the activity level on the average gray

patches is the same both with and without osteoporosis. From this test we cannot conclude anything statistically significant about the individual factors.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	419.1866814	1	419.186681	14.5432092	0.00513658	5.31765506
Within Groups	230.5882701	8	28.8235338			
Total	649.7749515	9				

Table 3: One factor ANOVA of osteoporosis yes/no during low activity

After performing a one factor ANOVA on osteoporosis, which simplifies to a t-test, the p-value is well below the alpha value of 0.05. This means that we can statistically deny that there is no correlation between different osteoporosis inputs and the number of gray patches during low activity

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3736.547507	2	1868.27375	88.079952	6.7286E-08	3.88529383
Within Groups	254.5333477	12	21.2111123			
Total	3991.080855	14				

Table 4: One factor ANOVA of different activity levels with no osteoporosis

The final ANOVA test performed was a one factor anova of the different activity levels with no osteoporosis. The p-value here was also below the alpha value of 0.05. This means we can statistically say that at least one level of the different activity levels are different from the others.

Interpretation of Results and Analysis:

Out of the three hypotheses at the beginning of the paper, we can only statistically deny the third hypothesis that the effect of the activity level on the average gray patches is the same both with and without osteoporosis. We can also deny that there is no difference in the average amount of gray patches between different activity levels with no osteoporosis. Finally we can deny that there is no difference between having osteoporosis and not with low activity. However we can make other conclusions from looking at the bar graph shown in Figure 1. We can visually see the massive difference in the average gray patches for different activity levels. It is visible for both cases of osteoporosis as well. This is true even when accounting for the standard deviation. We can also see that there are many more gray patches when simulating osteoporosis versus when there is no osteoporosis in every activity level. One thing that is interesting to note about the data is that there is an increasing standard deviation when increasing activity level. This could be because the simulation starts to vary a lot when gray patches are created faster. The reason for this variation could be due to more frequent agent-patch interactions happening when there are more gray patches on the screen.