

## 1. Introduction: Numerical evidence for the “Broken Window Effect”.

JQ Wilson and GL Kelling claimed in their paper [1] that if a window in a building is broken and is left unrepaired, then the public disorder could occur locally, by that broken window. I guess the term “broken windows” in their context can be interpreted as any other spatial disorders such as abandoned buildings or vehicles. On this article, I try to give an empirical evidence for their insights with abandoned buildings as “broken windows”.

## 2. Data

I prepared spatial entities with/without reported abandoned buildings and cumulated number of crimes that are categorized as “Criminal Damage”(Since “Criminal Damage” is the crime type which is most likely to be influenced by the “Broken Windows” intuitively). Because there is no possible way to sample all the urban areas in United States randomly, I used public dataset of Chicago, Illinois (Year 2012) instead. The online data center of Chicago provides crime information [2] and records of abandoned buildings [3]. Both dataset contains the coordinates attributes of each event (Longitude and Latitude). I divided the city into 2,543 spatial pieces with  $0.005(\text{Longitude}) \times 0.005(\text{Latitude})$  squares and aggregate the number of each type of events in each square piece of Chicago. I used the result as samples of two types of urban regions: with and without abandoned buildings (or Broken Windows).

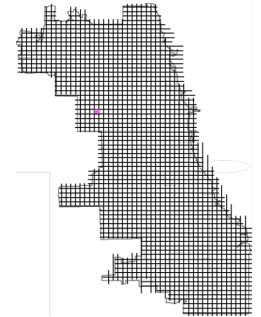
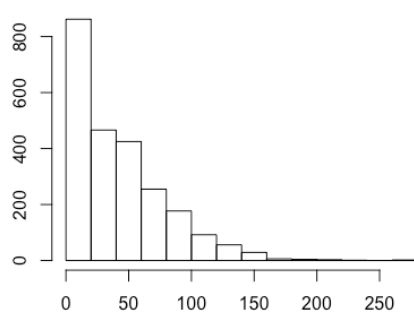
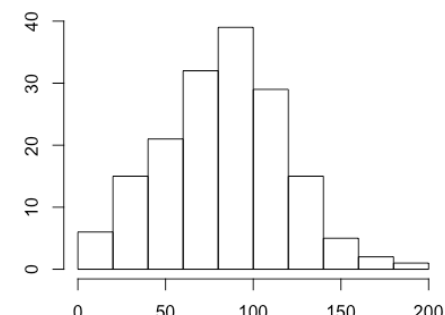


Figure 1. Conceptual Image of Division

## 3. Summary Statistics

	Areas without Abandoned Buildings(X)	Areas with Abandoned Buildings(Y)
Number of Areas	n = 2378	m = 165
Sample Mean	$\bar{X} = 41.9765$	$\bar{Y} = 83.8182$
Sample Variance	$S_X^2 = 1423.085$	$S_Y^2 = 1197.735$
Histogram		

## 4. Hypothesis Testing (One sided t-test, two sample means)

$H_0: \mu_X - \mu_Y = 0$ $H_a: \mu_X - \mu_Y < 0$	$S_p = \frac{(n-1)S_X^2 + (m-1)S_Y^2}{n+m-2} = 1408.541$ $T = \frac{(\bar{X} - \bar{Y}) - (\mu_X - \mu_Y)}{S_p \sqrt{\frac{1}{n} + \frac{1}{m}}} = \frac{(\bar{X} - \bar{Y})}{S_p \sqrt{\frac{1}{n} + \frac{1}{m}}} \quad (H_0 \text{ is True}) = -13.8484$ Decision Rule: ( $\alpha = 1\%$ , $df = 192$ ) If ( $T < -2.364$ ) then reject $H_0$ .
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## 5. Interpretation

As the result of the test showed,  $H_0$  can be rejected at 1% significance level and the T-statistic is way smaller than the critical value. Thus we can say that we have strong evidence that “criminal damage” happens more frequently with spatial environments including abandoned buildings. Although the pseudo sampling method I used is not quite reasonable, I got an intuition that someday we can get numerical evidence for “Broken Window Effect” with enough spatial data.

## 6. References

- [1] Wilson, James Q., and George L. Kelling. "Broken windows." *Critical issues in policing: Contemporary readings* (1982)
- [2] <https://data.cityofchicago.org/view/5cd6-ry5g>
- [3] <https://data.cityofchicago.org/Buildings/Vacant-and-Abandoned-Buildings-Violations/kc9i-wa85>