

Descriptive Analysis

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Settings

```
rm(list = ls())
bomb_data <- read.csv("../data/geocoded_bomb_data.csv")

bomb_data$Time <- as.POSIXct(bomb_data$Time)

bomb_data$district <- as.factor(bomb_data$district)
bomb_data$Type.of.bomb <- as.factor(bomb_data$Type.of.bomb)

head(bomb_data)
```

```
##      X              Time                      Location
## 1 1 1940-09-07 00:08:00          43 Southwark Park Road, SE16, London, UK
## 2 2 1940-09-07 00:10:00 49 Southwark Park road, Bermondsey, SE16, London, UK
## 3 3 1940-09-07 00:15:00          84 Southwark Park Road, SE16, London, UK
## 4 4 1940-09-07 00:18:00        141 Braidwood Road, Catford SE6, London, UK
## 5 5 1940-09-07 00:20:00        129 Killearn Road, Catford SE6, London, UK
## 6 6 1940-09-07 00:20:00          27 Crutchley Road, Downham, London, UK
##      Type.of.bomb
## 1                IB
## 2                IB
## 3                IB
## 4                IB
## 5                IB
## 6                IB
##
##                                Damage.or.other
## 1                                Grocers: 3x2 roof damaged
## 2                                Bakers: 3x2 roof damaged
## 3 front room on 1st floor and contents slightly damaged. 3x2 rood damage
## 4                                10x6 roof damage
## 5                                Front room on 1st floor severely damaged
## 6                                IB on enclosed ground at rear of premises
##      lat      lon  district
## 1 51.49225 -0.0621761 Southwark
## 2 51.49269 -0.0653908 Southwark
## 3 51.49225 -0.0621761 Southwark
## 4 51.44085 -0.0053336 Lewisham
## 5 51.44151 -0.0054617 Lewisham
```

```
## 6 51.43674 0.0052611 Lewisham
```

Descriptive analysis

Explosive event type

We got the following types of bombs - Explosive Bombs (EB) - Incendiary Bombs (IB) - Magnesium Flare - Crude Oil Bomb (COB) - Shrapnel - Unknown enemy action - Crashed aircraft

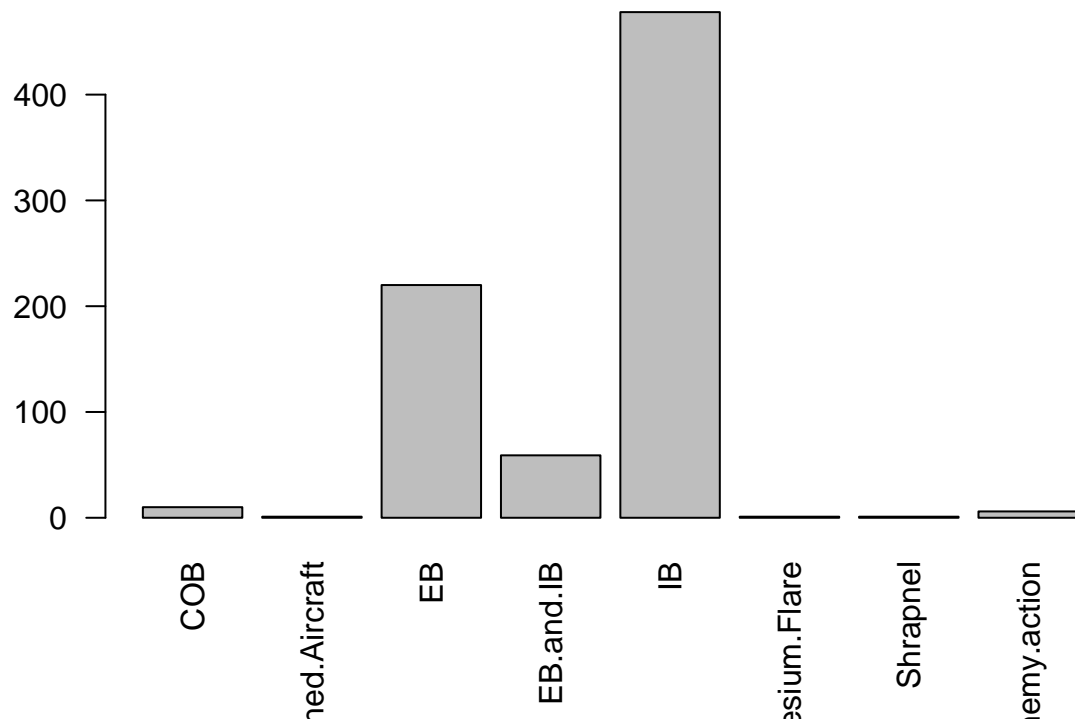
Moreover we got 67 NAs

```
summary(bomb_data$Type.of.bomb)
```

```
##          COB      Crashed.Aircraft          EB          EB.and.IB
##          10              1          220              59
##          IB      Magnesium.Flare      Shrapnel  Unknown.enemy.action
##          478              1              1              6
##          NA's
##          67
```

```
#Type of bomb
```

```
barplot(table(bomb_data$Type.of.bomb), las=2)
```

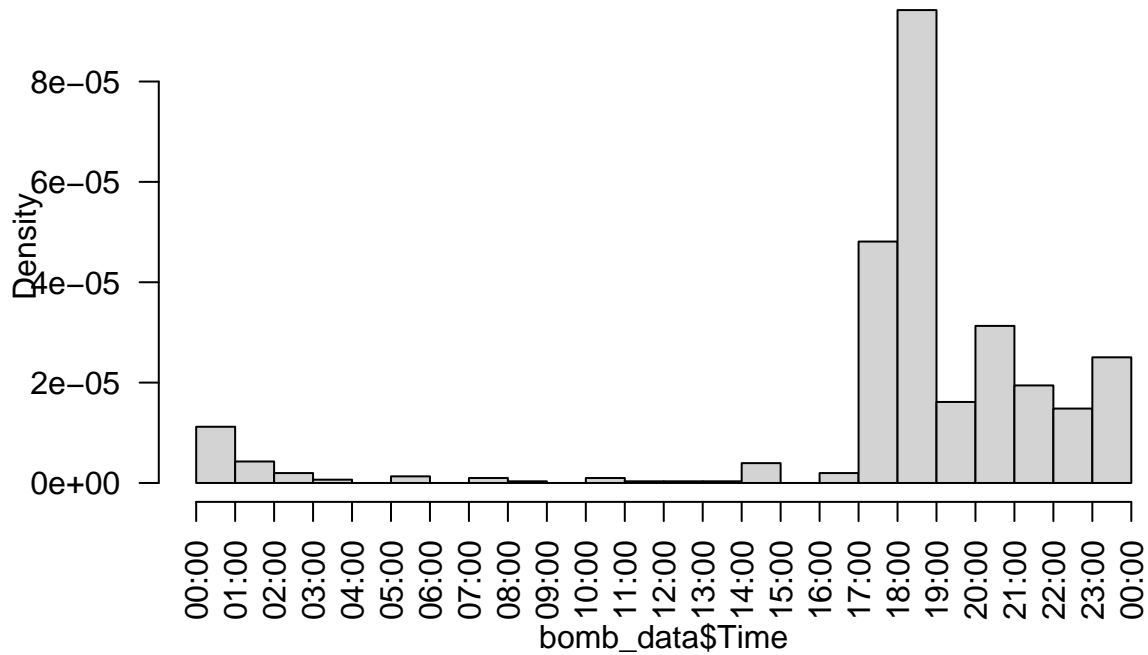


Evolution in time

All types of bombs

```
hist(bomb_data$Time, breaks = "hours", las=2)
```

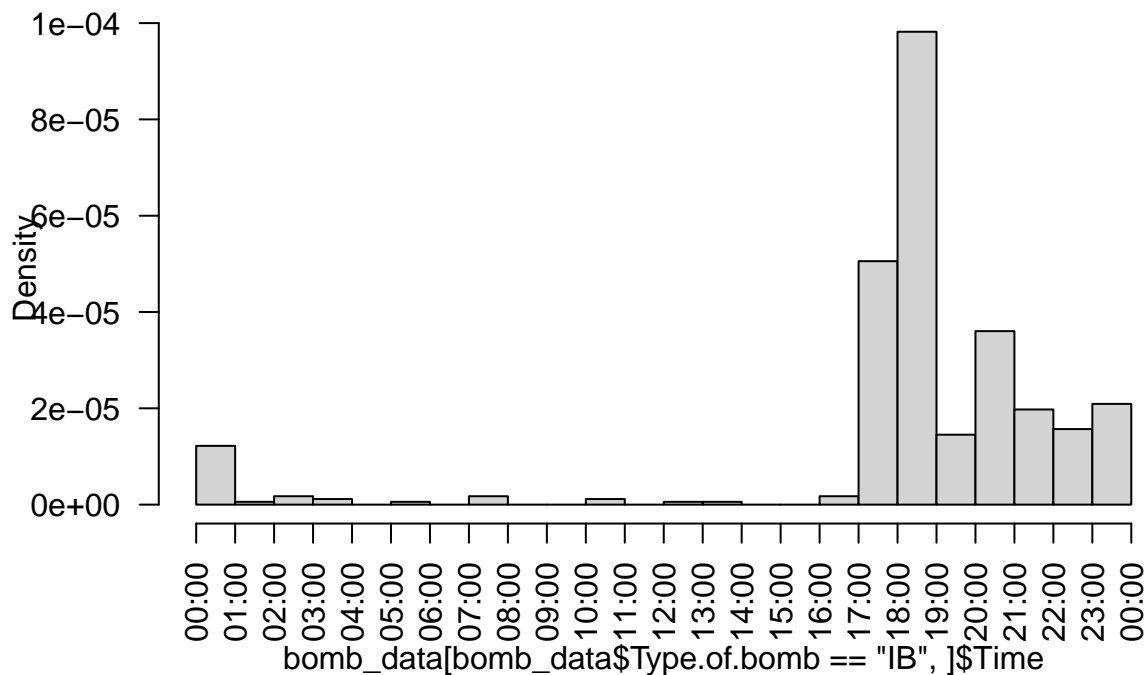
Histogram of bomb_data\$Time



By bomb type

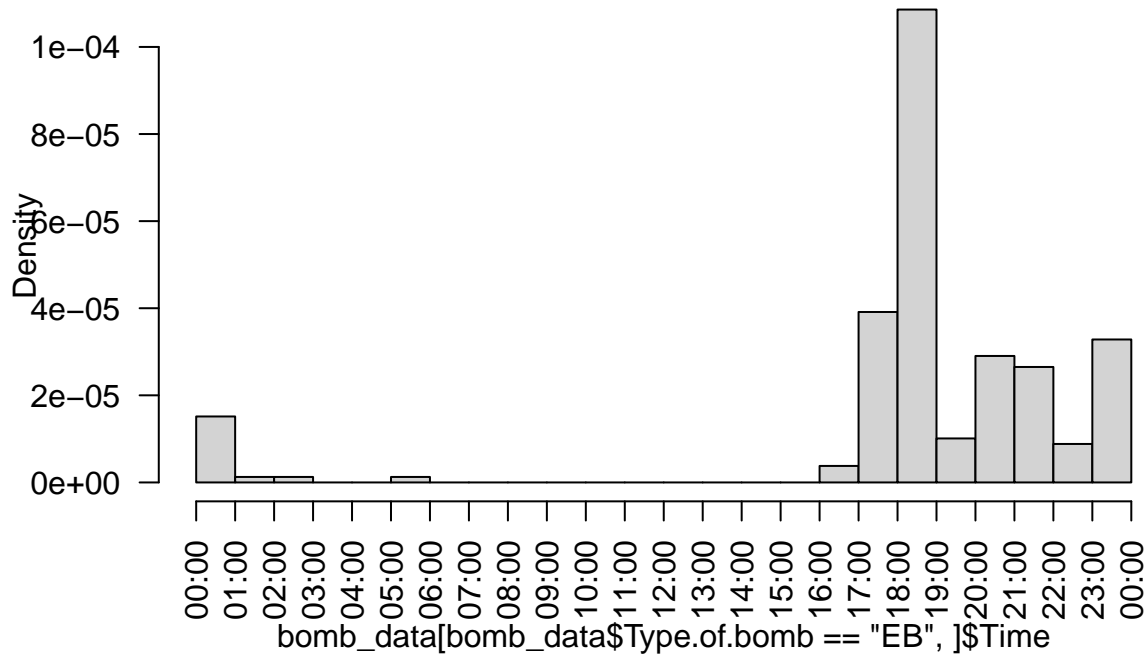
```
hist(bomb_data[bomb_data$Type.of.bomb == "IB",]$Time, breaks = "hours", las=2)
```

Histogram of bomb_data[bomb_data\$Type.of.bomb == "IB",]\$Time



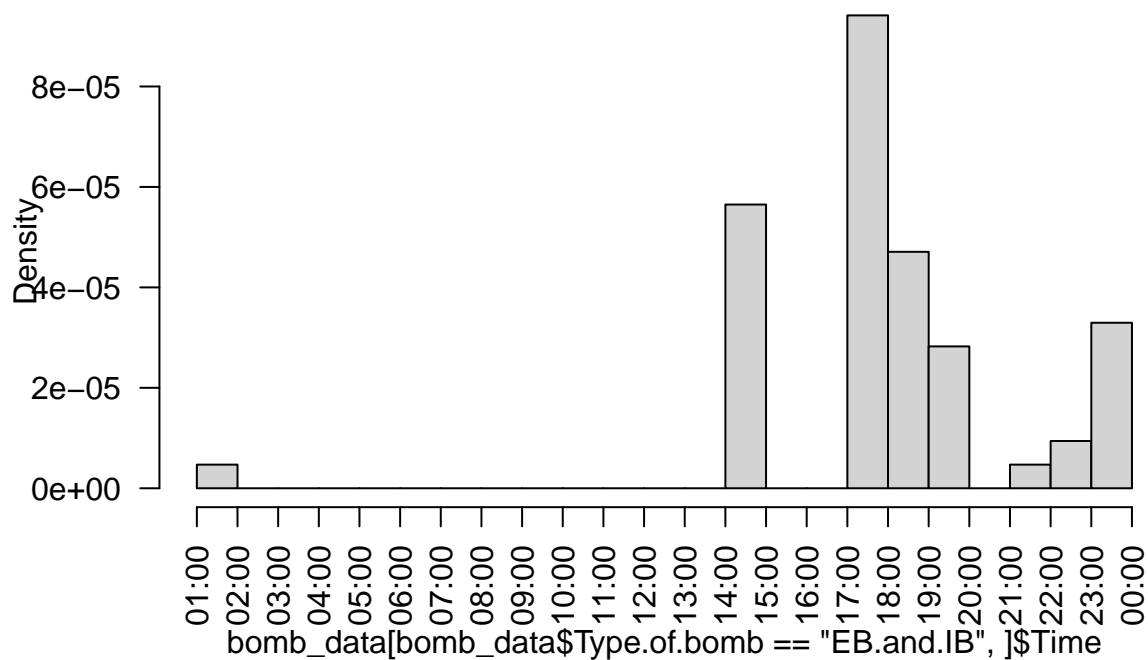
```
hist(bomb_data[bomb_data$Type.of.bomb == "EB",]$Time, breaks = "hours", las=2)
```

Histogram of bomb_data[bomb_data\$Type.of.bomb == "EB",]\$Time



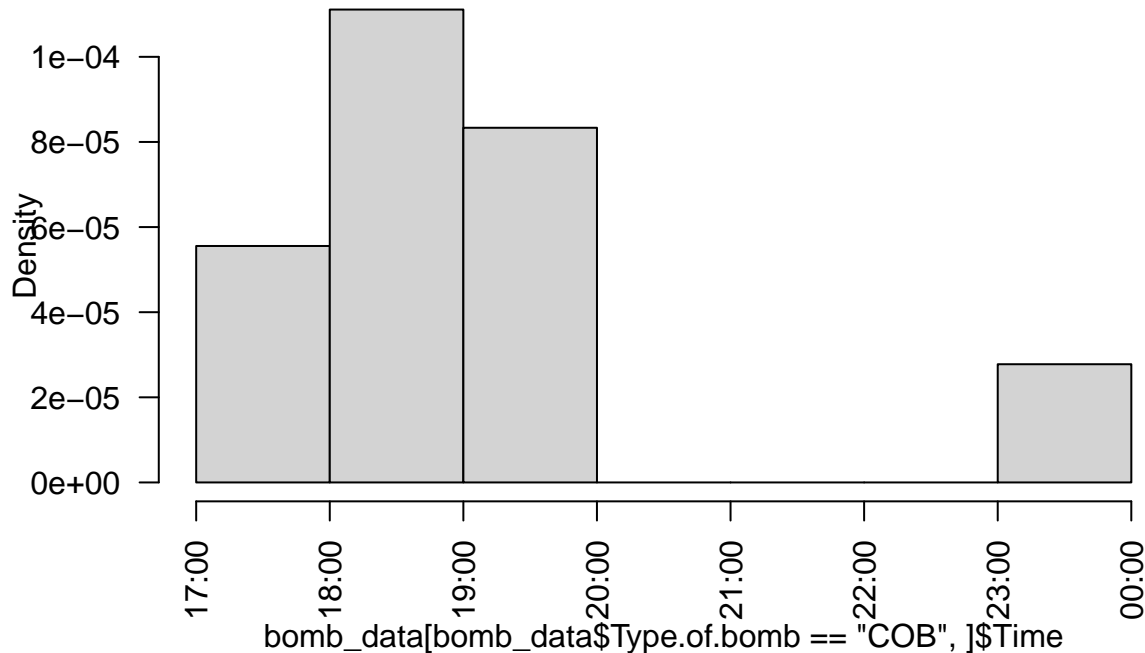
```
hist(bomb_data[bomb_data$Type.of.bomb == "EB.and.IB",]$Time, breaks = "hours", las=2)
```

Histogram of bomb_data[bomb_data\$Type.of.bomb == "EB.and.IB",]\$Time



```
hist(bomb_data[bomb_data$Type.of.bomb == "COB",]$Time, breaks = "hours", las=2)
```

Histogram of bomb_data[bomb_data\$Type.of.bomb == "COB",]\$Time



Maps

References - https://www.paulamoraga.com/tutorial-terra/#2_Vector_data - <https://data.london.gov.uk/dataset/statistical-gis-boundary-files-london> - <https://conservancy.umn.edu/bitstream/handle/11299/220339/time-maps-tutorial-v2.html?sequence=3&isAllowed=y> - <https://rspatial.org/spatial/6-crs.html>

```
library(terra)
```

```
## terra 1.7.55
```

```
library(ggplot2)
```

```
library(tidyterra)
```

```
## Warning: package 'tidyterra' was built under R version 4.2.3
```

```
##
```

```
## Attaching package: 'tidyterra'
```

```
## The following object is masked from 'package:stats':
```

```
##
```

```
## filter
```

```
london_spat_vect <- vect("../data/London-data/London_Borough_Excluding_MHW.shp")
```

```
london_spat_vect
```

```
## class : SpatVector
```

```
## geometry : polygons
```

```
## dimensions : 33, 7 (geometries, attributes)
```

```
## extent : 503568.2, 561957.5, 155850.8, 200933.9 (xmin, xmax, ymin, ymax)
```

```
## source : London_Borough_Excluding_MHW.shp
```

```
## coord. ref. : OSGB36 / British National Grid
## names      :      NAME  GSS_CODE  HECTARES  NONLD_AREA  ONS_INNER
## type       :      <chr>   <chr>      <num>      <num>      <chr>
## values     : Kingston upon ~ E09000021      3726          0          F
##            : Croydon E09000008      8649          0          F
##            : Bromley E09000006 1.501e+04          0          F
## SUB_2009 SUB_2006
##   <chr>   <chr>
##     NA     NA
##     NA     NA
##     NA     NA
```

```
newcrs <- "+proj=longlat +datum=WGS84"
london_spat_vect <- terra::project(london_spat_vect, newcrs)
```

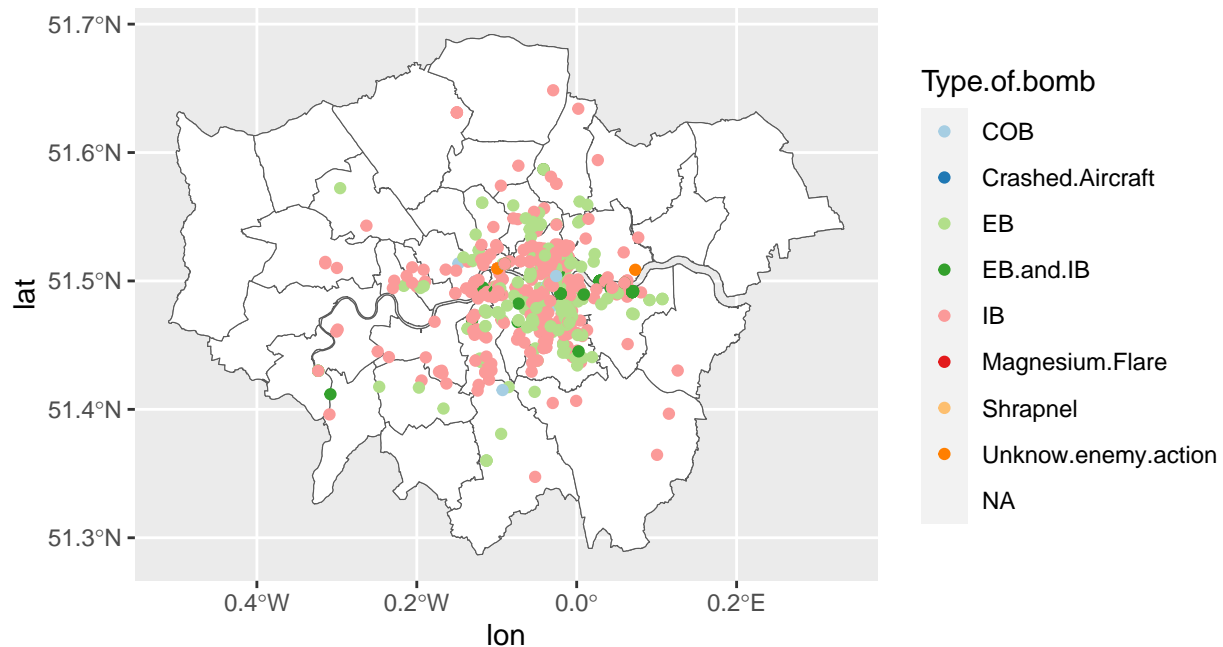
```
london_map <- ggplot(data = london_spat_vect) +
  geom_spatvector() +
  geom_sf(fill = "white")

# adding data points
explosion_sites <- london_map +
  geom_point(data = bomb_data[-c(367,459,745,395,750,749)],,
    aes(x = lon, y = lat, label = X, group = Time, col = Type.of.bomb)) +
  scale_colour_brewer(palette = "Paired")
```

```
## Warning in geom_point(data = bomb_data[-c(367, 459, 745, 395, 750, 749)], :
## Ignoring unknown aesthetics: label
```

```
explosion_sites
```

```
## Warning: Removed 74 rows containing missing values (`geom_point()`).
```



```
greenwich <- london_map +
  geom_sf(fill = ifelse(london_map$data$NAME == "Greenwich", 'red', "white"))
```

```
greenwich + geom_point(data = bomb_data[-c(367,459,745,395, 750,749)],,
  aes(x = lon, y = lat, label = X, group = Time, col = district == "Greenwich" ))
```

```
## Warning in geom_point(data = bomb_data[-c(367, 459, 745, 395, 750, 749)], :  
## Ignoring unknown aesthetics: label
```

```
## Warning: Removed 8 rows containing missing values (`geom_point()`).
```

