

Sunrise and sunset times

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20 April 2024

```
make_local <- function(time, tz) {  
  as.character(with_tz(time, tz)) |>  
  as.POSIXct() |>  
  strftime(x = _, format = "%H:%M:%S")  
}
```

```
the_date <- "2019-04-05"
```

```
big_cities <-  
  world.cities |>  
  filter(pop > 2e5) |>  
  mutate(date = as.Date(the_date)) |>  
  rename(lon = long) |>  
  mutate(tz = tz_lookup_coords(lat, lon, warn = FALSE)) |>  
  as_tibble()
```

```
sunrise_times <-  
  big_cities |>  
  getSunlightTimes(data = _, keep = "sunrise") |>  
  as_tibble()
```

```
sunrise <-  
  big_cities |>  
  inner_join(sunrise_times, by = join_by(lat, lon, date)) |>  
  select(name, country.etc, sunrise, date, tz, pop) |>  
  rowwise() %>%  
  mutate(local_time = make_local(sunrise, tz)) |>  
  mutate(local_time = as.POSIXct(paste(date, local_time)))
```

```
sunrise |>
  ggplot(aes(x = local_time)) +
  geom_histogram(binwidth = 5 * 60) +
  geom_text_repel(data =
    subset(sunrise,
      name == "Boston" | (pop > 1e6 &
        (local_time > as.POSIXct(paste(date, "07:50.00")) |
          country.etc %in% c("Australia")))),
    mapping = aes(y = 10, label = name, color = country.etc),
    angle = 90, vjust = 1, hjust = 1) +
  theme(legend.position = "bottom")
```

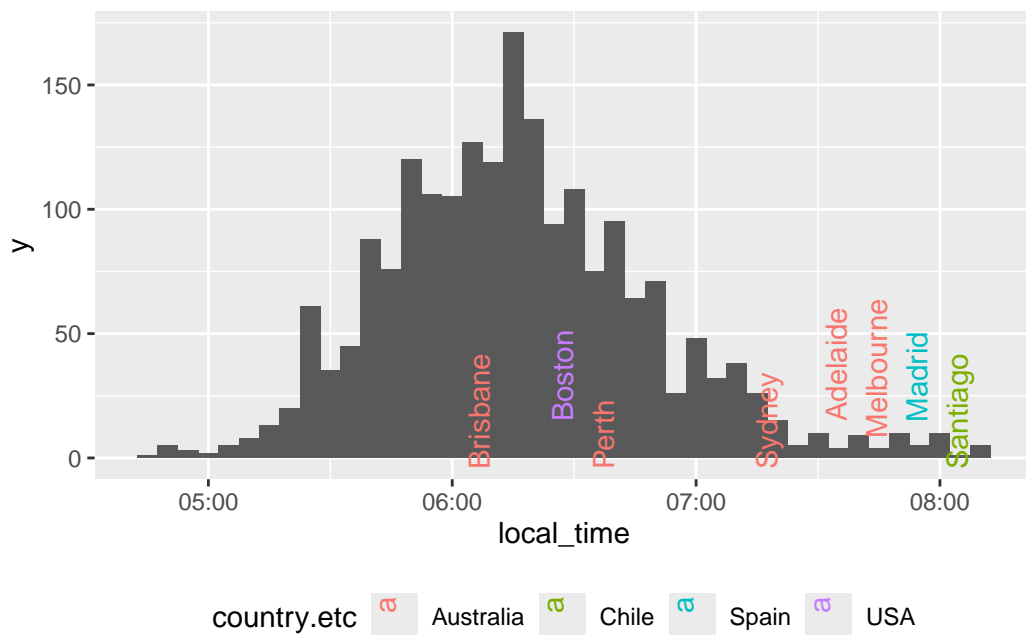


Figure 1: Sunrise on 2019-04-05 (UTC)

```
the_year <- year(the_date)

sample_cities <-
  crossing(
    world.cities %>%
      filter(name %in% "Tokyo" |
        (name %in% c("Boston", "Sydney")
          & country.etc %in% c("USA", "Australia"))) |
```

```

      (name == "Melbourne" & country.etc == "Australia")) %>%
    rename(lon = long) %>%
    mutate(tz = tz_lookup_coords(lat, lon, warn = FALSE)) %>%
    as_tibble(),
    date = seq(as.Date(str_glue("{the_year}-01-01")),
               to = as.Date(str_glue("{the_year}-12-31")),
               by = 1))

make_time <- function(a_time, tz) {
  res <- strptime(a_time, format="%H:%M:%S", tz = tz)
  res <- as.POSIXct(paste("2019-01-01", res))
  res
}

sample_cities_times <-
  sample_cities |>
  getSunlightTimes(data = _, keep = c("sunset", "sunrise")) |>
  as_tibble() |>
  inner_join(sample_cities, by = join_by(date, lat, lon)) |>
  rowwise() |>
  mutate(sunrise = make_time(sunrise, tz),
         sunset = make_time(sunset, tz))

```

```

sample_cities_times |>
  gather(key = "event", value = "time", sunrise, sunset) |>
  ggplot(aes(x = date, y = time, group = event, color = event)) +
  geom_line() +
  facet_wrap(~ name) +
  scale_x_date(date_labels = "%b") +
  scale_y_datetime(labels = function(x) strptime(x, format="%H:%M"),
                  date_breaks = "1 hour") +
  theme(legend.position = "bottom")

```

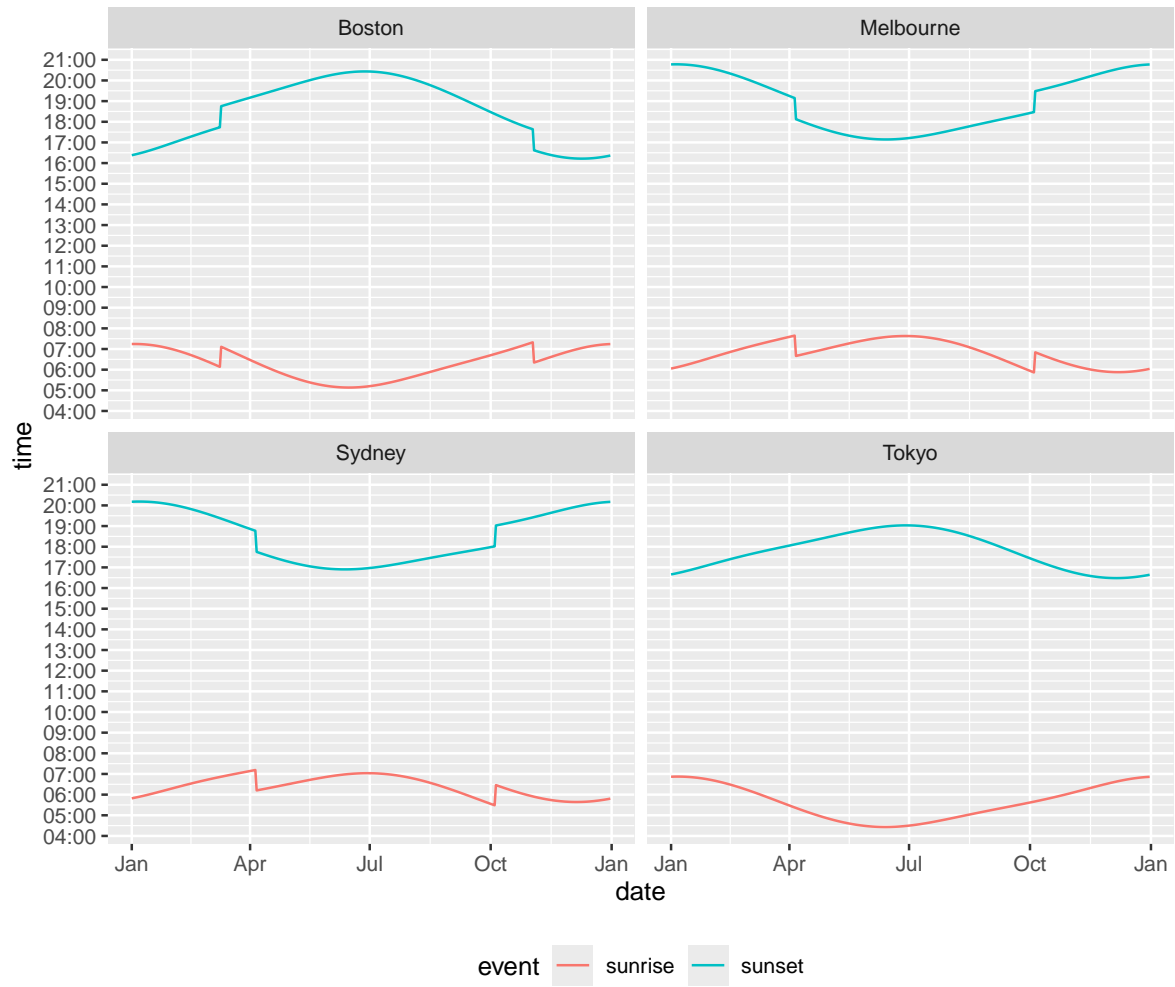


Figure 2: Sunrise and sunset times over 2019