…In the process, a static perspective on the changing demographics of America.

```
library(tidyverse)
gen <- c('Post-Z', 'Gen Z', 'Millennial',
         'Gen X', 'Boomers', 'Silent',
         'Greatest')

range <- c('> 2012', '1997-2012', '1981-1996',
           '1965-1980', '1946-1964', '1928-1945',
           '< 1927')

gen_desc <- data.frame(rank = 7:1,
                       gen = gen,
                       range = range,
                       stringsAsFactors = FALSE)%>%
  arrange(rank)

knitr::kable(gen_desc)
```

rank	gen	range
1	Greatest	< 1927
2	Silent	1928-1945
3	Boomers	1946-1964
4	Gen X	1965-1980
5	Millennial	1981-1996
6	Gen Z	1997-2012
7	Post-Z	> 2012

Four of America's seven living generations are more or less "complete," and only getting smaller (albeit at different rates): `Greatest`, `Silent`, `Boomers`, and `Gen X`. The generation comprised of `Millenials` is complete as well, in that it has been delineated chronologically; however, the group likely continues to grow via immigration.

While `Gen Z` has been tentatively stamped chronologically by the folks at Pew Research, only the very eldest in the group have just entered the work force. So lot's can happen still. And although we include them here, the `Post-Z` generation is mostly but a thought; half of the group has yet to be born.

Monthly US population estimates

Monthly Postcensal Resident Population plus Armed Forces Overseas, December 2018. Made available by the US Census here. The census has transitioned to a new online interface, and (seemingly) many data sets have been discontinued. Hence, the data set utilized here is slightly dated.

```
pops <- read.csv (
  url('https://www2.census.gov/programs-surveys/popest/datasets/2010-2018/national/asrh/nc-est2018-alldata-p-File18.csv')) %>%
  filter(MONTH == '12' & YEAR == '2018') %>%
  gather(key = 'race', value = 'pop', -UNIVERSE:-AGE)
```

A more detailed description of the population estimates can be found here. Note: Race categories reflect non-Hispanic populations.

```
race <- c('NHWA', 'NHBA', 'NHIA',
          'NHAA', 'NHNA', 'NHTOM', 'H')

race1 <- c('White Alone',
```

```
            'Black Alone',
            'American Indian Alone',
            'Asian Alone',
            'Native Hawaiian Alone',
            'Two or More Races',
            'Hispanic')

labels <- data.frame(race = race,
                     race1=race1,
                     stringsAsFactors = FALSE)

search <- paste(paste0('^',race, '_'), collapse =  '|')
```

The following table details **a random sample of the data set** – with Pew Research defined generations & estimated year-of-birth.

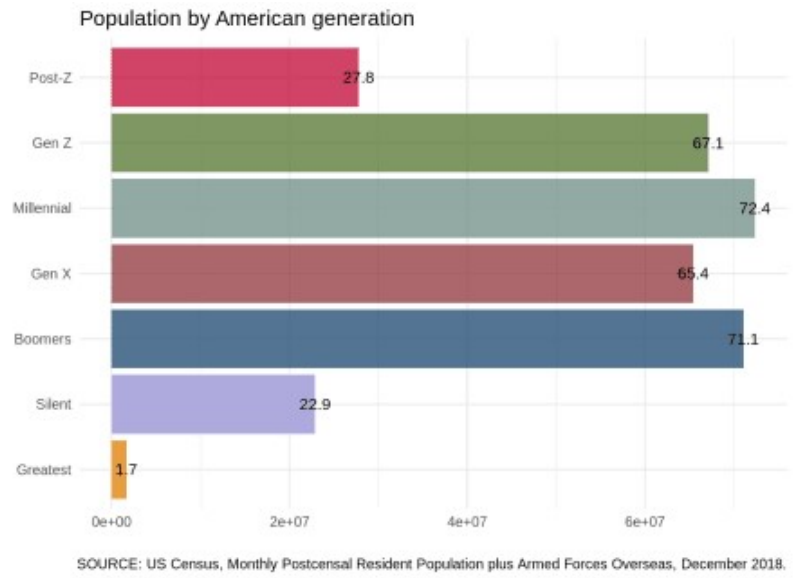
```
gen_pops <- pops %>%
  filter(grepl(search, race)) %>%
  mutate(race = gsub('_.*$', '', race)) %>%
  group_by(AGE, race) %>%
  summarise(pop = sum(pop))%>%
  left_join(labels) %>%
  filter(AGE != '999') %>%
  mutate(yob = 2019 - AGE)  %>% ##
  mutate (gen = case_when (
    yob < 2013 & yob > 1996 ~ 'Gen Z',
    yob < 1997 & yob > 1980 ~ 'Millennial',
    yob < 1981 & yob > 1964 ~ 'Gen X',
    yob < 1965 & yob > 1945 ~ 'Boomers',
    yob < 1946 & yob > 1927 ~ 'Silent',
    yob < 1928 ~ 'Greatest',
    yob > 2012 ~ 'Post-Z')) %>%
  left_join(gen_desc) %>%
  ungroup() %>%
  select(gen, rank, range, race,
         race1, yob, AGE, pop)

set.seed(999)
gen_pops %>% sample_n(7)  %>%
  select(gen, range, race1:pop) %>%
  knitr::kable()
```

gen	range	race1	yob	AGE	pop
Gen X	1965-1980	Asian Alone	1973	46	290212
Gen Z	1997-2012	Native Hawaiian Alone	2011	8	7964
Silent	1928-1945	Asian Alone	1936	83	50750
Gen X	1965-1980	American Indian Alone	1968	51	28192
Greatest	< 1927	Black Alone	1926	93	24189
Millennial	1981-1996	American Indian Alone	1993	26	41055
Post-Z	> 2012	Black Alone	2018	1	531987

American population by generation

The figure below summarizes the populations of America's seven living generations. These numbers will vary some depending on the data source. **Millenials constitute the plurality of Americans**, more recently overtaking a Boomer generation on the wane.

```
gen_pops %>%
  group_by(gen, rank) %>%
  summarize(pop = sum(pop)) %>%
  mutate(lab = round(pop/1000000, 1)) %>%
  ggplot(aes(x = reorder(gen, rank),
             y = pop,
             fill = gen)) +
  geom_col(show.legend = FALSE,
           alpha = 0.75)  +
  geom_text(aes(label = lab),
            size = 3.5)+
  theme(axis.text.x=element_blank(),
        axis.ticks.x=element_blank())+
  xlab('') + ylab('') +
  coord_flip()+
  ggthemes::scale_fill_stata() +
  theme_minimal() +
  labs(title = 'Population by American generation',
       caption = 'SOURCE: US Census, Monthly Postcensal Resident Population plus
Armed Forces Overseas, December 2018.')
```



American generations by age & race

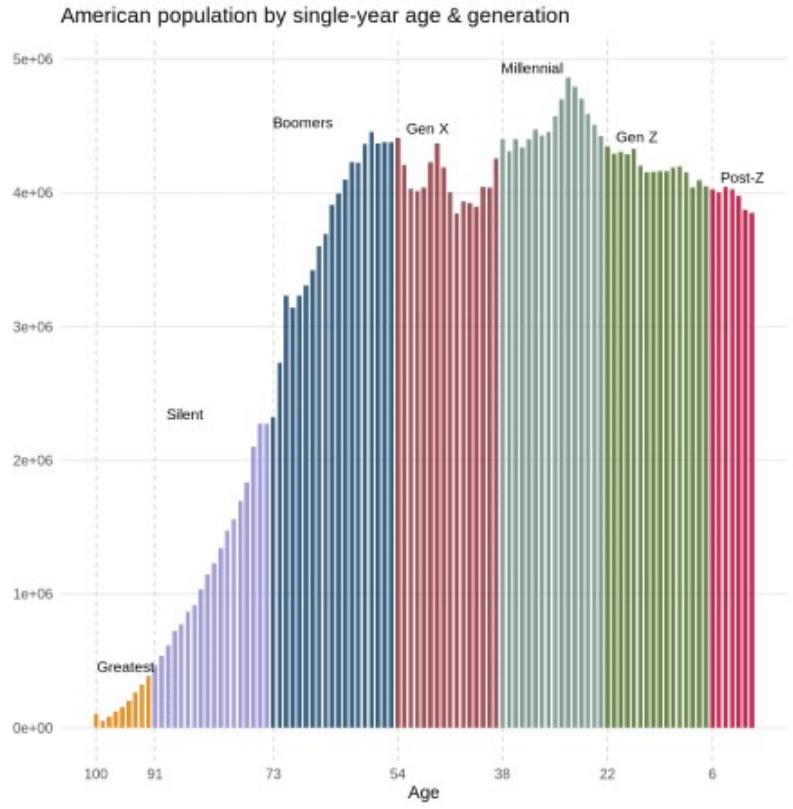
```
gg <- gen_pops %>%
  group_by(yob, AGE, gen) %>%
  summarize(tot = sum(pop)) %>%
  group_by(gen) %>%
  mutate(tot = max(tot)) %>% #For labels below.
  filter(yob %in% c('1919', '1928', '1946', '1965',
                    '1981', '1997', '2013'))
```

Age

The figure below illustrates the US population by single year of age, ranging from the population aged less than a year to the population over 100 (as of December 2018). Generation membership per single year of age is specified by color.

```
gen_pops %>%
  ggplot(aes(x = AGE,
             y = pop,
             fill = gen)) +
```

```
  geom_vline(xintercept = gg$AGE,
             linetype =2,
             color = 'gray',
             size = .25)+

  geom_col(show.legend = FALSE,
           alpha = 0.85,
           width = .7)   +
  annotate(geom="text",
           x = gg$AGE - 4.5,
           y = gg$tot + 70000,
           label = gg$gen,
           size = 3.25) +
  xlab('Age')+
  ylab('') +
  theme_minimal() +
  theme(legend.position="bottom",
        legend.title = element_blank(),
        panel.grid.major.x=element_blank(),
        panel.grid.minor.x=element_blank(),
        panel.grid.minor.y=element_blank()) +
  ggthemes::scale_fill_stata()+
  scale_x_reverse(breaks = rev(gg$AGE)) +
  labs(title = 'American population by single-year age & generation')
```



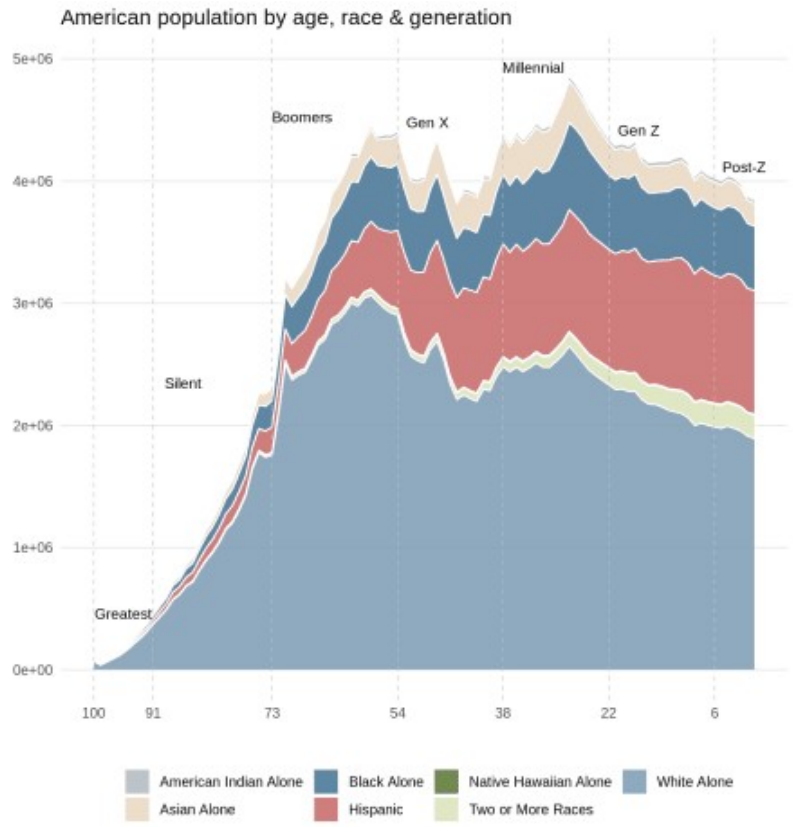
Age & race

```
gen_pal <- c('#b0bcc1','#ead8c3', '#437193',
             '#c66767', '#55752f', '#dae2ba',
             '#7b9bb3')
```

Next, we crosscut the single year of age counts presented above by race & ethnicity.

```
gen_pops %>%
```

```
  ggplot(aes(x = AGE,
             y = pop,
             fill = race1)) +
  geom_area(stat = "identity",
            color = 'white',
            alpha = 0.85) +
  scale_fill_manual(values = gen_pal) +
  geom_vline(xintercept = gg$AGE,
             linetype =2, color = 'gray', size = .25)+
  annotate(geom="text",
           x = gg$AGE - 4.5,
           y = gg$tot + 70000,
           label = gg$gen,
           size = 3.25) +
  xlab('')+ ylab('') +
  theme_minimal() +
  theme(legend.position="bottom",
        legend.title = element_blank(),
        panel.grid.major.x=element_blank(),
        panel.grid.minor.x=element_blank(),
        panel.grid.minor.y=element_blank()) +

  scale_x_reverse(breaks = rev(gg$AGE) )+
  labs(title ='American population by age, race & generation')
```



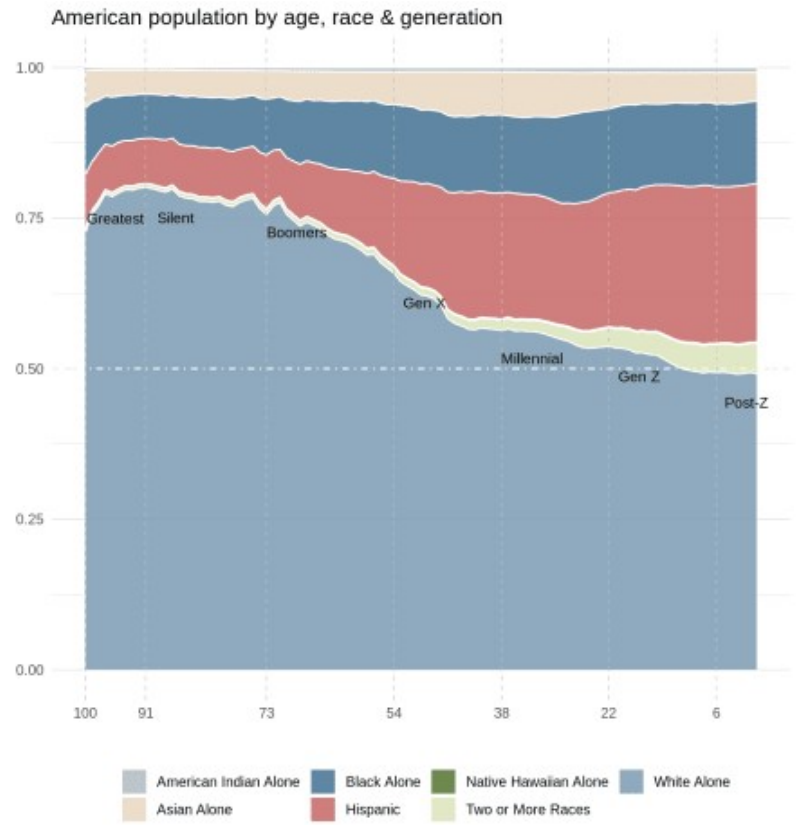
White America on the wane

```
white_label <- gen_pops %>%
  group_by(gen, AGE) %>%
  mutate(per = pop/sum(pop))%>%
  filter(race1 == 'White Alone') %>%
  group_by(gen) %>%
  mutate(per = max(per)) %>% #For labels below.
```

```
  arrange(yob) %>%
  filter(yob %in% c('1919', '1928', '1946', '1965',
                    '1981', '1997', '2013'))
```

The last figure illustrates a **proportional perspective of race & ethnicity in America** by single year of age. Per figure, generational differences (at a single point in time) can shed light on (the direction of) potential changes in the overall composition of a given populace. As well as a view of what that populace may have looked like in the past.

```
gen_pops %>%
  group_by(gen, AGE) %>%
  mutate(per = pop/sum(pop)) %>%
  ggplot(aes(x = (AGE),
             y = per,
             fill = race1)) +
  geom_area(stat = "identity",
            color = 'white',
            alpha = 0.85) +
  geom_hline(yintercept = .5,
             linetype = 4,
             color = 'white') +
  scale_fill_manual(values = gen_pal) +
  geom_vline(xintercept = gg$AGE,
             linetype = 2,
             color = 'gray',
             size = .25)+
  annotate(geom="text",
           x = gg$AGE-4.5,
           y = white_label$per - .05,
           label = gg$gen,
           size = 3.25) +
  xlab('')+ ylab('') +
  theme_minimal() +
  theme(legend.position="bottom",
        legend.title = element_blank(),
        panel.grid.major.x=element_blank(),
        panel.grid.minor.x=element_blank()) +

  scale_x_reverse(breaks = rev(gg$AGE)) +
  labs(title = 'American population by age, race & generation')
```



American generations in (apparent) time & space

Aggregate race-ethnicity profiles for America's seven living generations are presented in the table below. Per American Community Survey (ACS) 2018 5-year estimates, the `Gen X` race-ethnicity profile (or distribution) is most representative of American demographics overall.

```
sums <- gen_pops %>%
  group_by(rank, gen, race1) %>%
  summarize(pop = sum(pop))%>%
  group_by(gen) %>%
  mutate(per = round(pop / sum(pop), 3))
```

rank gen	Asian Alone	Black Alone	Hispanic	Two or More Races	White Alone
1 Greatest	4.4	8.0	7.7	0.6	78.9
2 Silent	4.4	8.4	8.0	0.7	77.9
3 Boomers	4.9	10.9	10.6	1.0	71.9
4 Gen X	6.7	12.6	18.5	1.3	60.0
5 Millennial	7.1	13.8	20.9	2.2	55.1
6 Gen Z	5.3	13.8	24.5	3.8	51.6
7 Post-Z	5.1	13.7	26.1	4.8	49.3

Race-ethnicity profiles for US counties

Here, we compare race-ethnicity profiles for US counties to those of American generations. Using the `tidycensus` R package, we first obtain county-level race-ethnicity estimates (ACS 2018 5-year);

```
#x <- tidycensus::load_variables(year = 2018, dataset = 'acs5/profile')
variable <- c('DP05_0071P', 'DP05_0077P', 'DP05_0078P',
              'DP05_0079P', 'DP05_0080P',
              'DP05_0081P', 'DP05_0082P',
              'DP05_0083P')
```

```
variable_name <- c('Hispanic', 'White Alone', 'Black Alone',
                   'American Indian Alone', 'Asian Alone',
                   'Native Hawaiian Alone', 'Some Other Race Alone',
                   'Two or More Races')

gen <-  tidycensus::get_acs(geography = 'county',
                            variables = variable,
                            year = 2018,
                            survey = 'acs5') %>%
  left_join(data.frame(variable, variable_name, stringsAsFactors = FALSE))%>%
  select(-variable, -moe) %>%
  rename(variable = variable_name) %>%
  select(GEOID:NAME, variable, estimate)
```

then, via the `tigris` library, we obtain shapefiles for (1) all US counties and (2) US states.

```
nonx <- c('78', '69', '66', '72', '60', '15', '02')

library(tigris)
options(tigris_use_cache = TRUE,
        tigris_class = "sf")

us_counties <- tigris::counties(cb = TRUE) %>%
  filter(!STATEFP %in% nonx)
us_states <- tigris::states(cb = TRUE) %>%
  filter(!STATEFP %in% nonx)

laea <- sf::st_crs("+proj=laea +lat_0=30 +lon_0=-95")
us_counties <- sf::st_transform(us_counties, laea)
us_states <- sf::st_transform(us_states, laea)
```

Comparing distributions

The table below highlights the race-ethnicity distribution for my hometown, **Dutchess County, NY**. GEOID = 36027.

Asian Alone	Black Alone	Hispanic	Two or More Races	White Alone
3.6	9.7	11.9	2.4	71.9

```
which1 <- gen %>%
  mutate(estimate = ifelse(estimate == 0, .0000001, estimate)) %>%
  inner_join(sums, by = c('variable' = 'race1')) %>%

  mutate(div = estimate/100 * log((estimate/100)/per)) %>%
  group_by(GEOID, NAME, gen) %>%
  summarize (relative_entropy = round(sum(div), 4)) %>%
  ungroup()
```

Via `Kullback-Leibler divergence` (ie, relative entropy), we compare the demographic profile of Dutchess County to the demographic profiles of each American generation. Per the table below, the Dutchess County profile is most similar to that of the `Boomer` generation. *Per the lowest relative entropy value*. This is not to say that there are more Boomers in Dutchess County; instead, **the racial demographics of Dutchess County are most akin to an America when Boomers were in their prime**.

```
which1 %>%
  filter(GEOID == 36027) %>%
  left_join(gen_desc) %>%
  select(rank, NAME, gen, relative_entropy) %>%
  arrange(rank) %>%
```

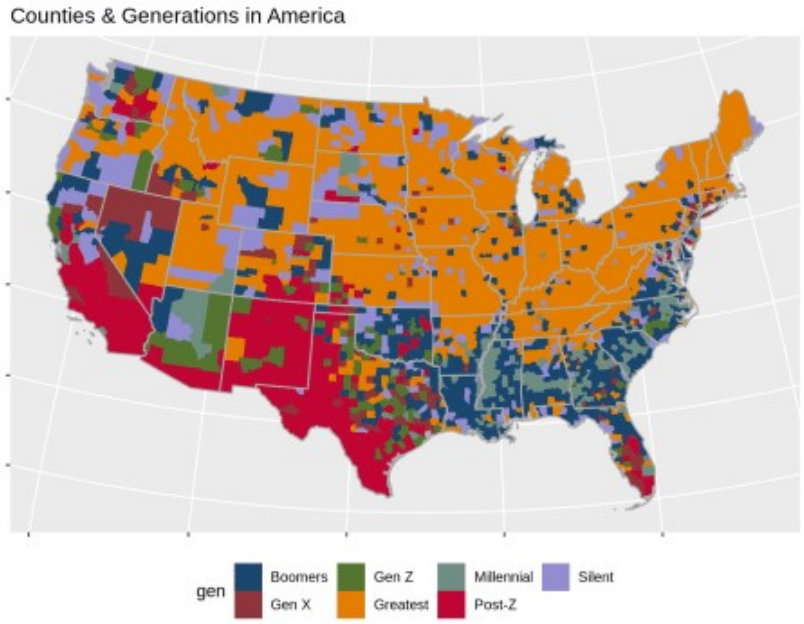
```
  knitr::kable(booktabs = T, format = "html") %>%
  kableExtra::kable_styling() %>%
  kableExtra::row_spec(3,
                       background = "#dae2ba")
```

rank	NAME	gen	relative_entropy
1	Dutchess County, New York	Greatest	0.0284
2	Dutchess County, New York	Silent	0.0243
3	Dutchess County, New York	Boomers	0.0104
4	Dutchess County, New York	Gen X	0.0426
5	Dutchess County, New York	Millennial	0.0657
6	Dutchess County, New York	Gen Z	0.0914
7	Dutchess County, New York	Post-Z	0.1131

```
which2 <- which1 %>%
  group_by(GEOID, NAME) %>%
  filter(relative_entropy == min(relative_entropy)) %>%
  ungroup()
```

So, while `Gen X` is most representative of America in the aggregate, **per the map below**, the demographics of America's youngest & eldest generations are most prevalent at the county-level. `Post-Z` in the West, and the `Greatest` in the East & Midwest. (With `Boomer` & `Millenial` demographics most prevalent in the South.) New & Old Americas, perhaps.

```
us_counties %>%
  left_join(which2, by = 'GEOID') %>%
  ggplot() +
  geom_sf(aes(fill = gen),  lwd = 0) +
  ggthemes::scale_fill_stata() +
  geom_sf(data=us_states,
          fill = NA,
          show.legend = F,
          color="darkgray",
          lwd=.5) +
  theme(axis.title.x=element_blank(),
        axis.text.x=element_blank(),
        axis.title.y=element_blank(),
        axis.text.y=element_blank(),
        legend.position = 'bottom') +
  labs(title = "Counties & Generations in America")
```



Summary

Some different perspectives on the composition of America & American generations, as well as a novel (static) take on the changing demographics of America.