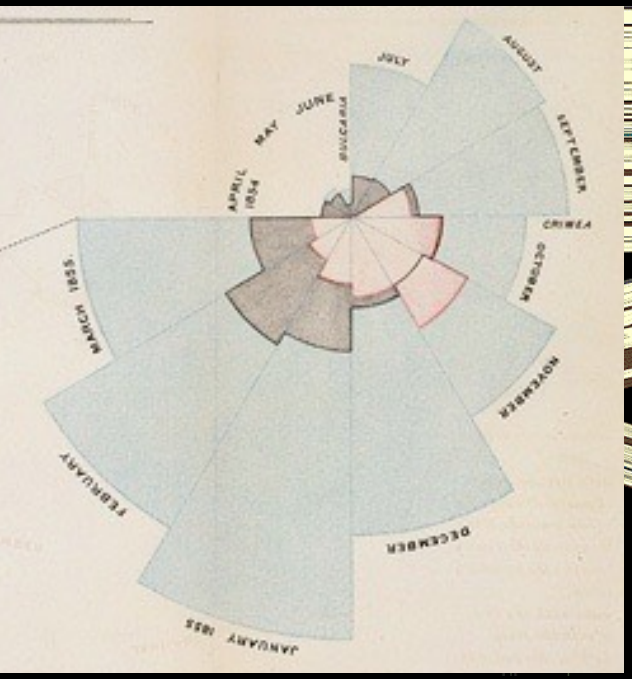
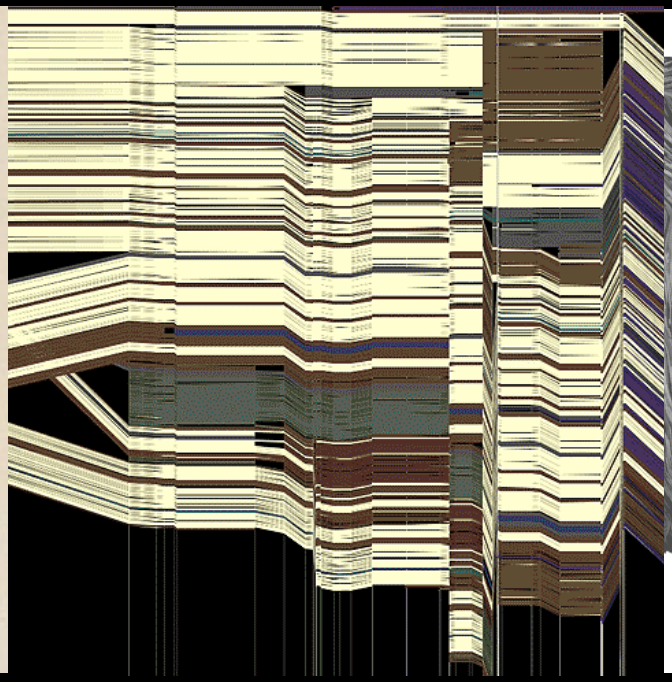
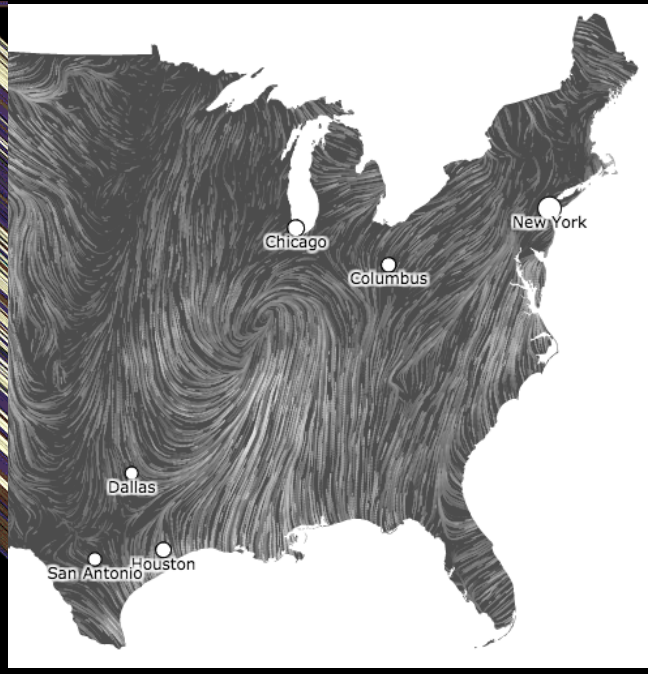
CSE 442 - Data Visualization

A1 Review



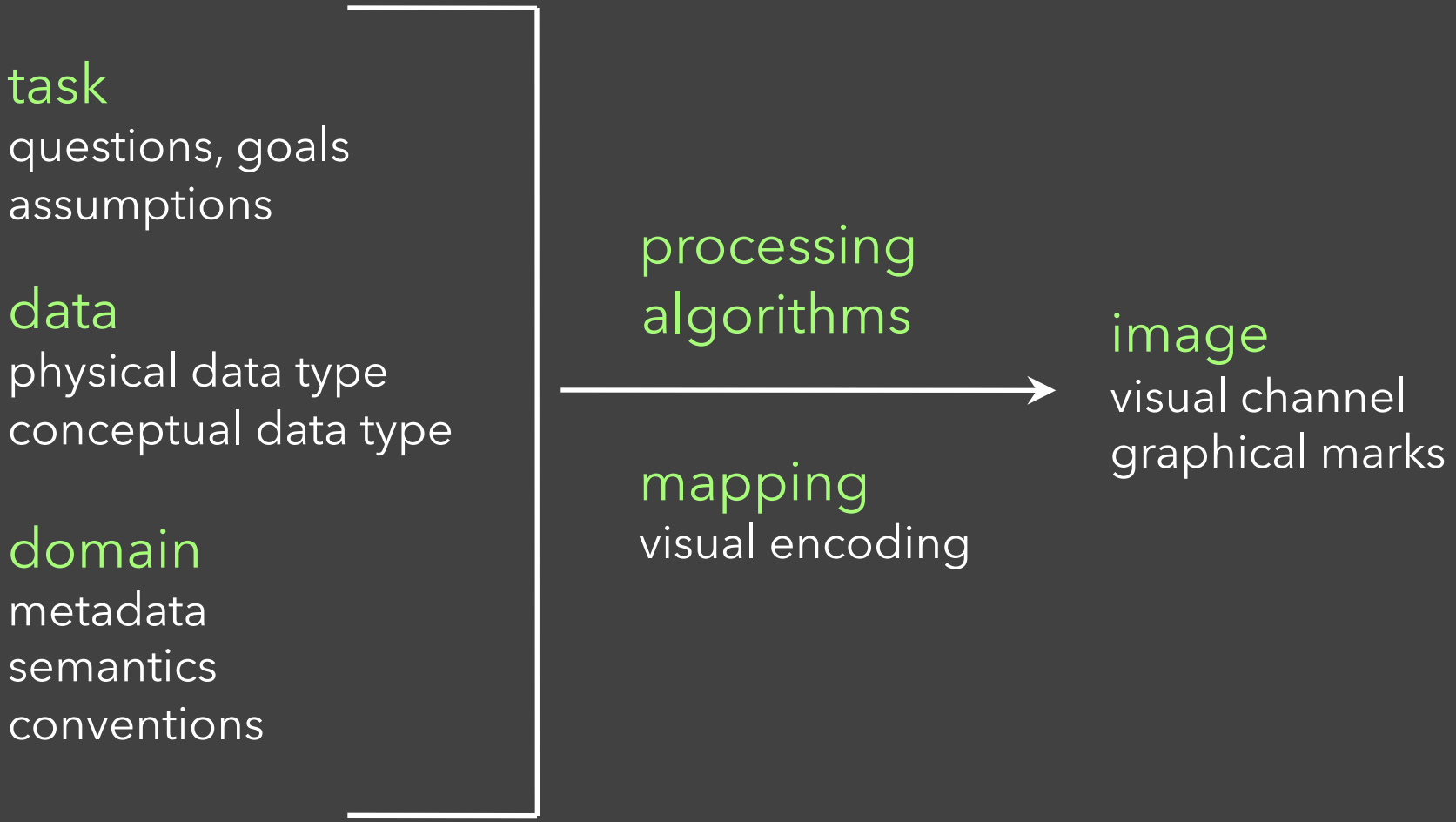




Jeffrey Heer University of Washington

Last Time:
Data & Image Models

The Big Picture



Nominal, Ordinal & Quantitative

N - Nominal (labels or categories)

- Operations: =, ≠

O - Ordered

- Operations: =, ≠, <, >

Q - Interval (location of zero arbitrary)

- Operations: =, ≠, <, >, -
- Can measure distances or spans

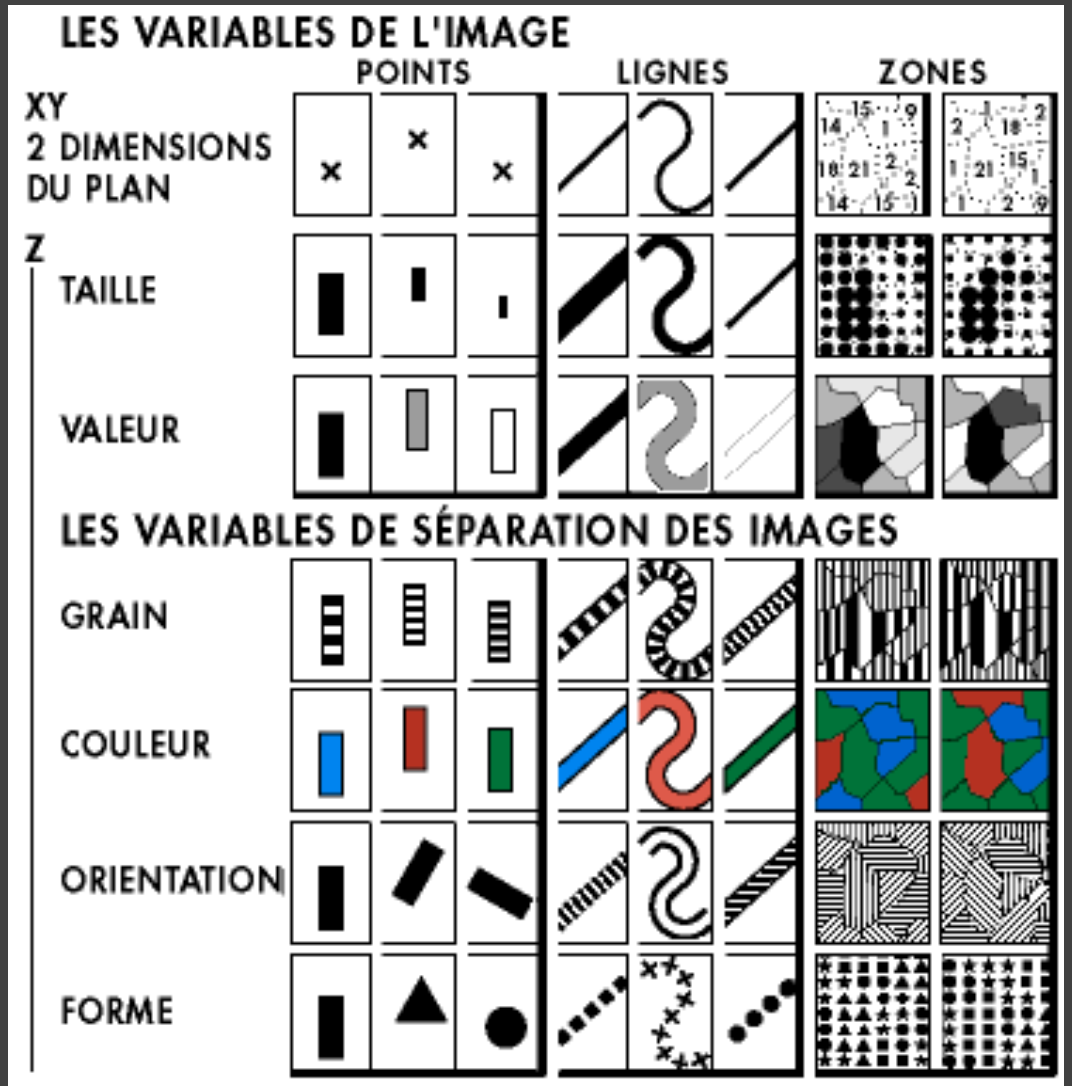
Q - Ratio (zero fixed)

- Operations: =, ≠, <, >, -, %
- Can measure ratios or proportions

Visual Encoding Variables

Position (x 2)
Size
Value
Texture
Color
Orientation
Shape

Others?



Bertin's "Levels of Organization"

Position	N	O	Q
Size	N	O	Q
Value	N	O	q
Texture	N	o	
Color	N		
Orientation	N		
Shape	N		

Nominal

Ordinal

Quantitative

Note: **Q** ⊂ **O** ⊂ **N**

Choosing Visual Encodings

Assume *k* visual encodings and *n* data attributes. We would like to pick the "best" encoding among a combinatorial set of possibilities of size $(n+1)^k$

Principle of Consistency
The properties of the image (visual variables) should match the properties of the data.

Principle of Importance Ordering
Encode the most important information in the most effective way.

Design Criteria [Mackinlay 86]

Expressiveness
A set of facts is *expressible* in a visual language if the sentences (i.e. the visualizations) in the language express all the facts in the set of data, and only the facts in the data.

Effectiveness
A visualization is more *effective* than another visualization if the information conveyed by one visualization is more readily perceived than the information in the other visualization.

Design Criteria *Translated*

Tell the truth and nothing but the truth
(don't lie, and don't lie by omission)

Use encodings that people decode better
(where better = faster and/or more accurate)

Effectiveness Rankings [Mackinlay 86]

QUANTITATIVE	ORDINAL	NOMINAL
Position	Position	Position
Length	Density (Value)	Color Hue
Angle	Color Sat	Texture
Slope	Color Hue	Connection
Area (Size)	Texture	Containment
Volume	Connection	Density (Value)
Density (Value)	Containment	Color Sat
Color Sat	Length	Shape
Color Hue	Angle	Length
Texture	Slope	Angle
Connection	Area (Size)	Slope
Containment	Volume	Area
Shape	Shape	Volume

Effectiveness Rankings [Mackinlay 86]

QUANTITATIVE	ORDINAL	NOMINAL
Position	**Position**	**Position**
Length	Density (Value)	Color Hue
Angle	Color Sat	Texture
Slope	Color Hue	Connection
Area (Size)	Texture	Containment
Volume	Connection	Density (Value)
Density (Value)	Containment	Color Sat
Color Sat	Length	Shape
Color Hue	Angle	Length
Texture	Slope	Angle
Connection	Area (Size)	Slope
Containment	Volume	Area
Shape	Shape	Volume

Effectiveness Rankings [Mackinlay 86]

QUANTITATIVE	ORDINAL	NOMINAL
Position	Position	Position
Length	Density (Value)	**Color Hue**
Angle	Color Sat	Texture
Slope	**Color Hue**	Connection
Area (Size)	Texture	Containment
Volume	Connection	Density (Value)
Density (Value)	Containment	Color Sat
Color Sat	Length	Shape
Color Hue	Angle	Length
Texture	Slope	Angle
Connection	Area (Size)	Slope
Containment	Volume	Area
Shape	Shape	Volume

A1 Review

A1 Submission Designs

Measures: Population count, Gender ratio, Growth rate, Age, Difference between years or genders

Transforms: Percentages, Counts, Proportions

Marks: Bar, Line/Area, Dot/Scatter, Pie, Other

Bars: Stacked, Grouped, Opposed Axes

Extra Context: Labor Force, Other Countries

Design Considerations

Title, labels, legend, captions, source!

Expressiveness and Effectiveness

Avoid unexpressive marks (lines? gradients?)

Use perceptually effective encodings

Don’t distract: faint gridlines, pastel highlights/fills

The “elimination diet” approach – start minimal

Support comparison and pattern perception

Between elements, to a reference line, or to totals

Use human-friendly units (10M or 10,000,000?)

Design Considerations

Transform data (e.g., invert, log, normalize)

Group / sort data by meaningful dimensions

Reduce cognitive overhead
Minimize visual search, minimize ambiguity
Appropriate size, aspect ratio, legible text
Avoid legend lookups if direct labeling works
Avoid color mappings with indiscernible colors

Be consistent! Visual inferences should consistently support data inferences.

Bar Charts

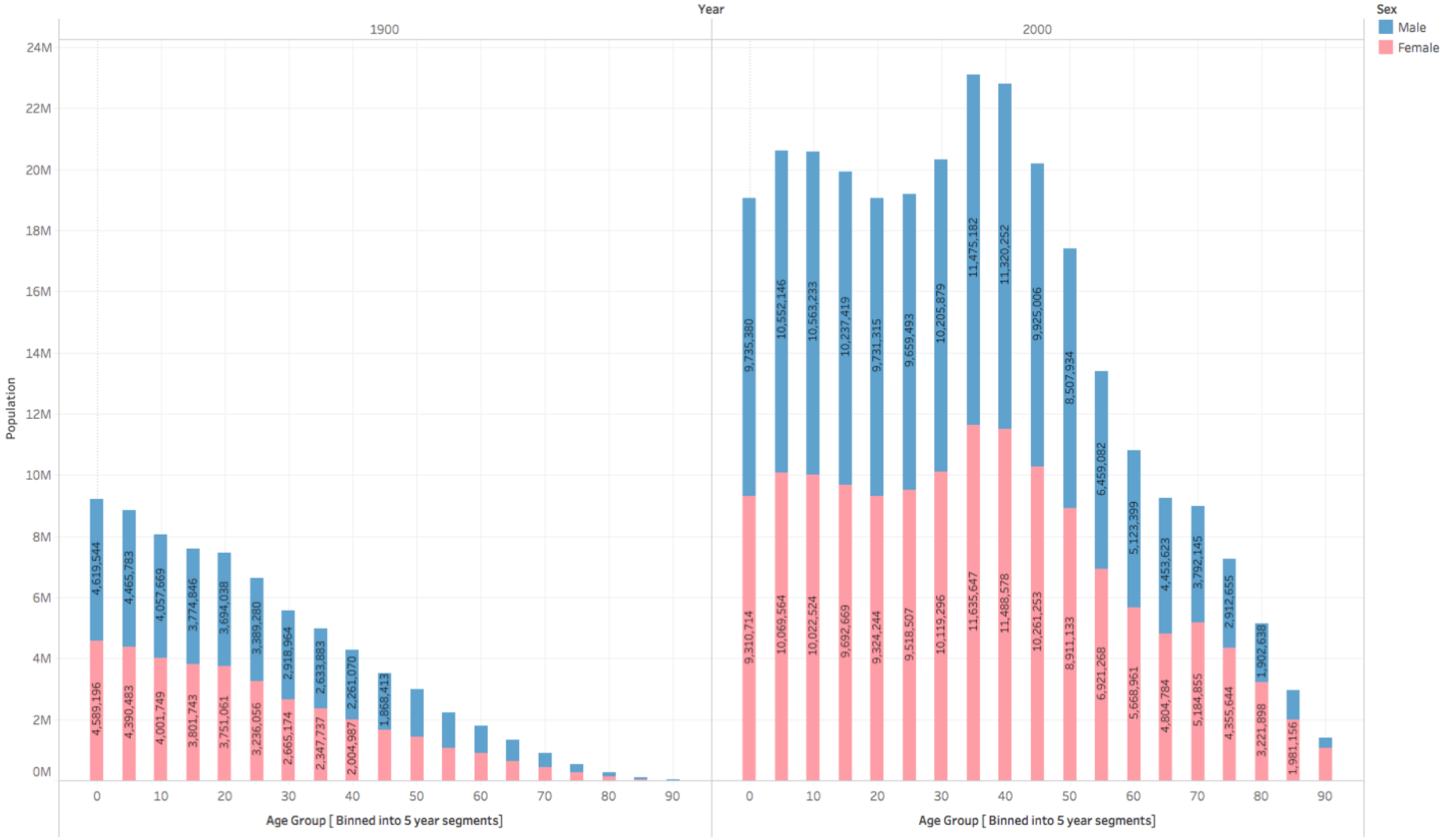
Age, Sex, Year

Population Count

Population of different age groups in 1900 and 2000

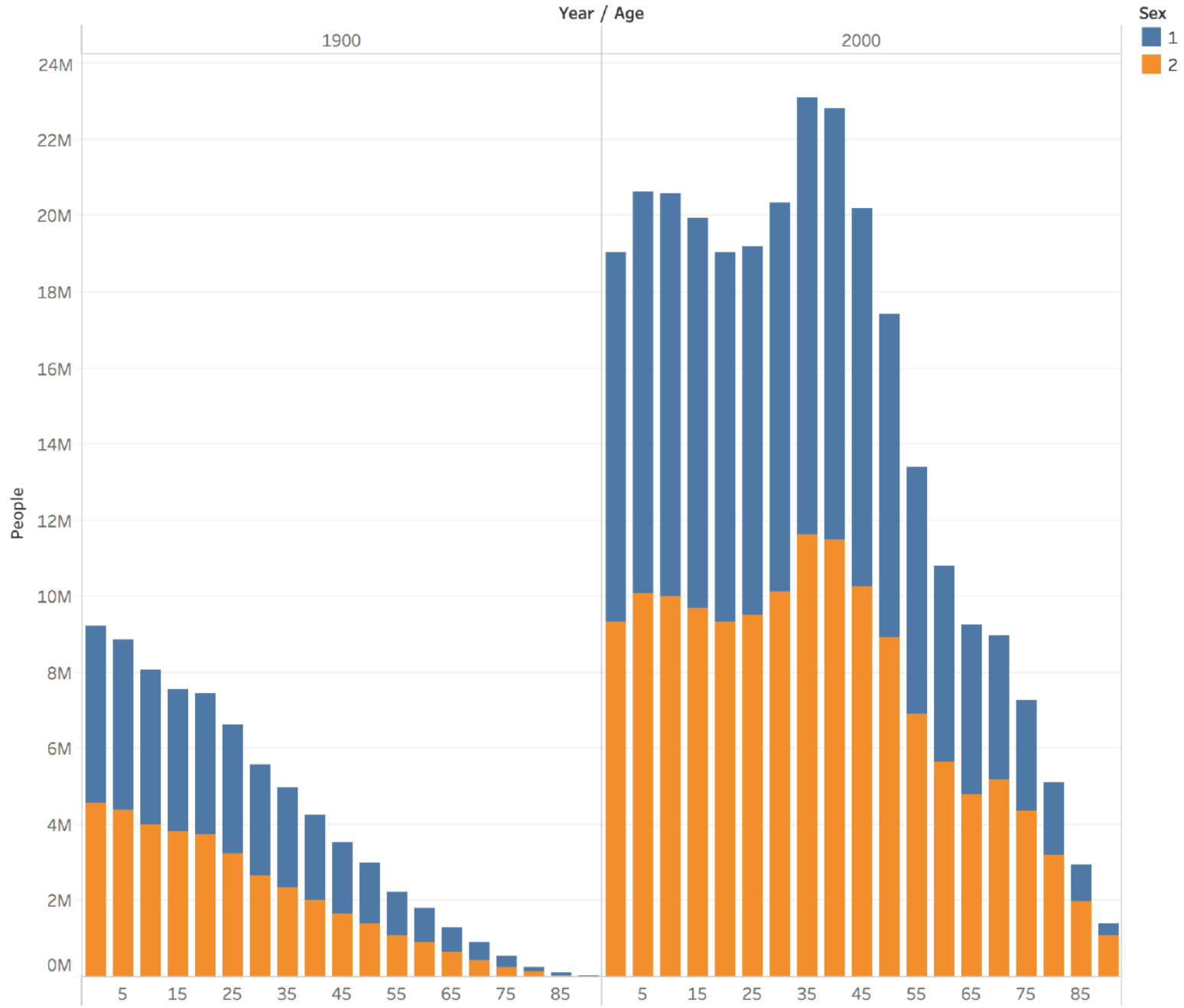
Sum of People for each Age broken down by Year and Sex. Color shows details about Sex.

How different is the US Population of 1900 compared to the population in 2000 by age group and sex?



The plot of Population(Sum of People) for Age broken down by Age Group(Year). Color shows details about Sex with Labels denoting Population for that Sex within the Age Group. The data is filtered on Year, which ranges from 1900 to 2000 discretely.

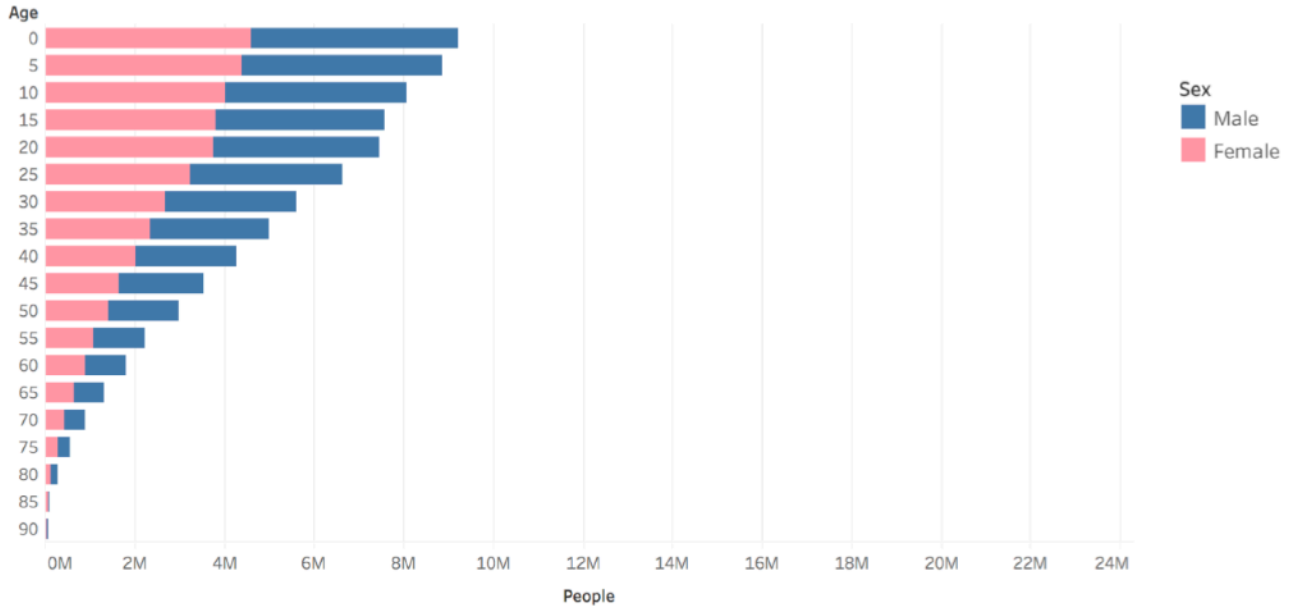
Population of different ages and sexs: 1900 v.s. 2000



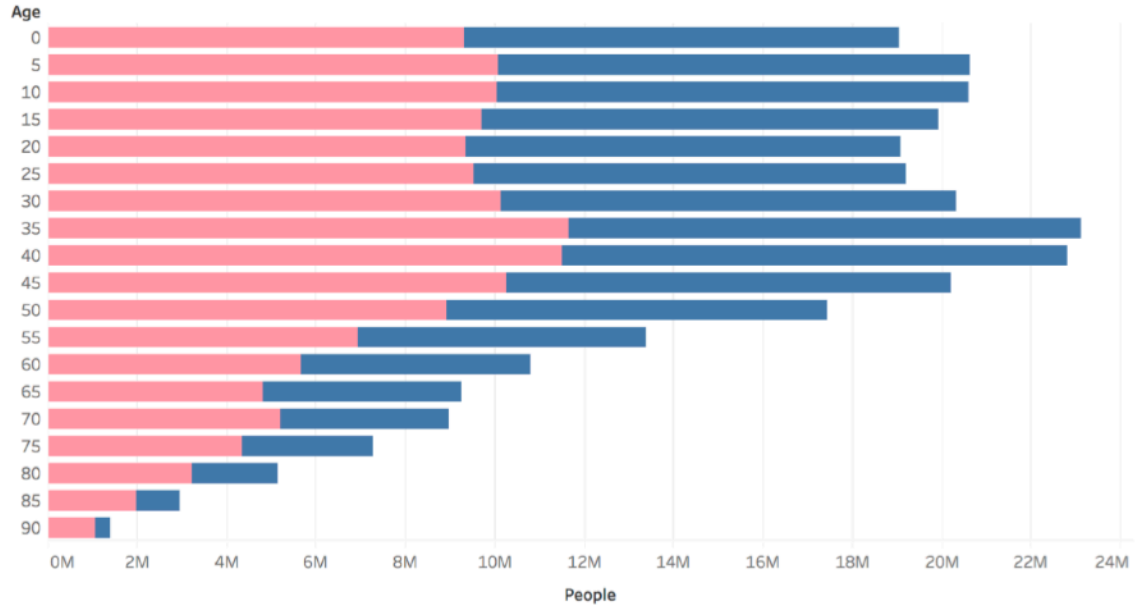
Sum of People for each Age broken down by Year. Color shows details about Sex.

How does the age distribution of the US population vary between 1900 and 2000?

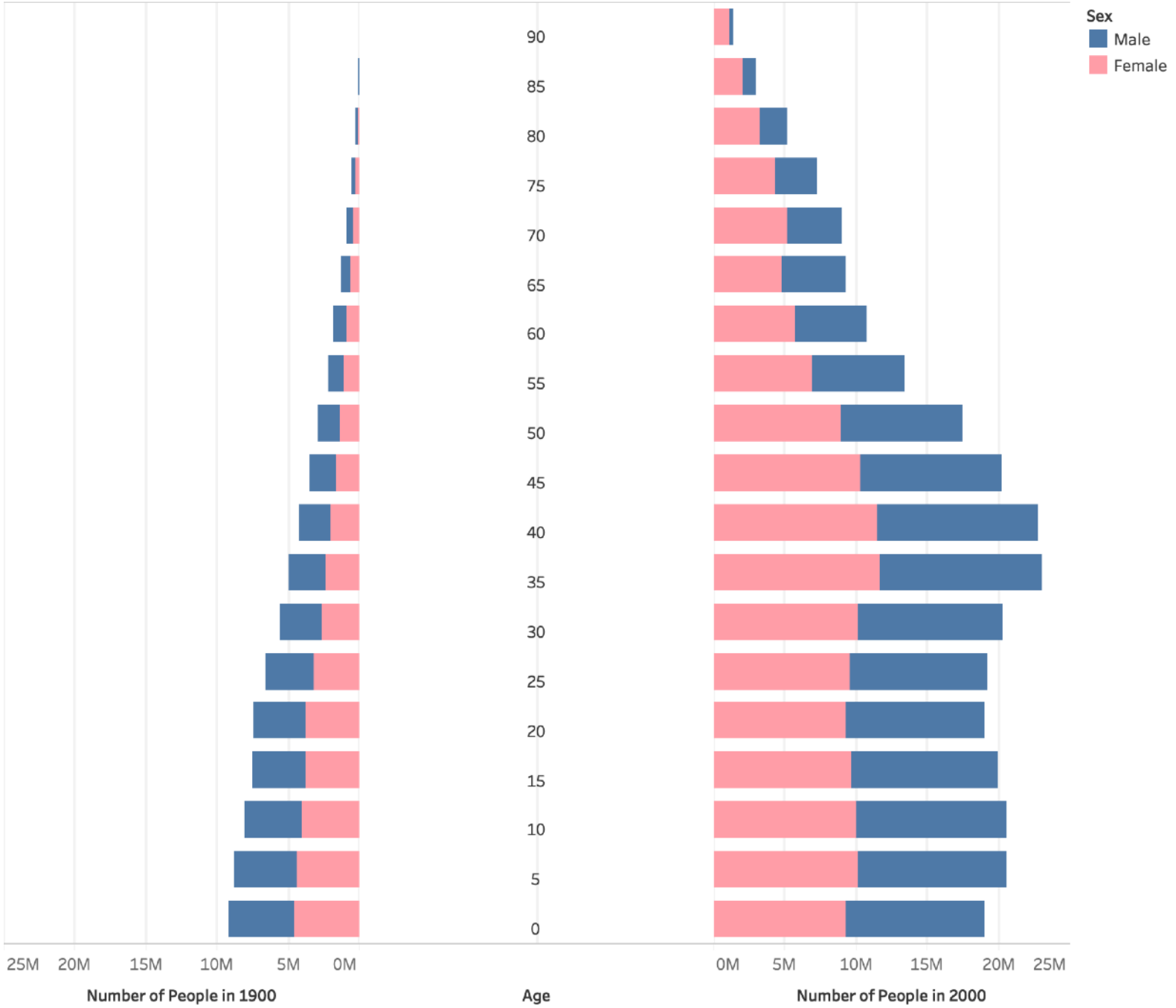
1900

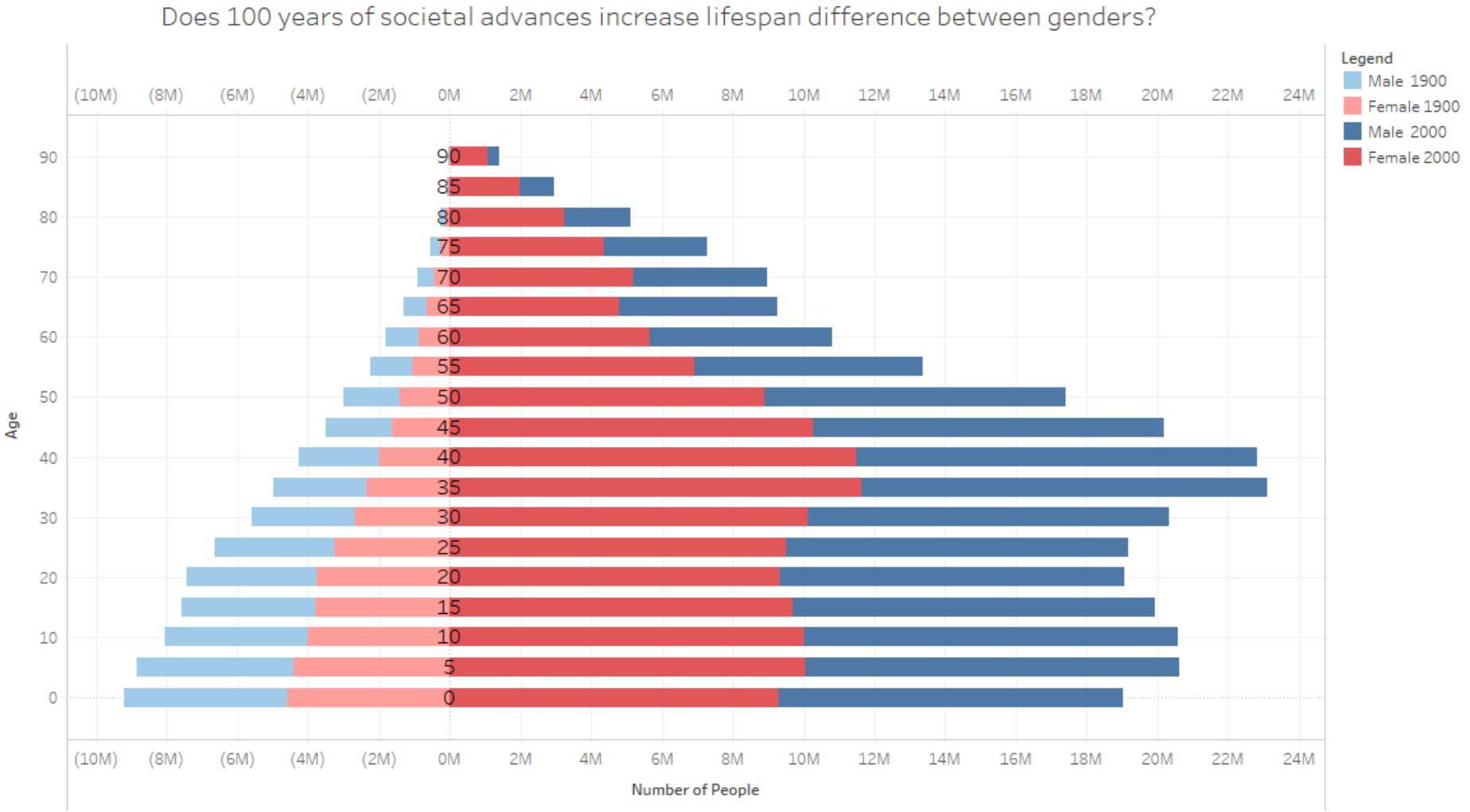


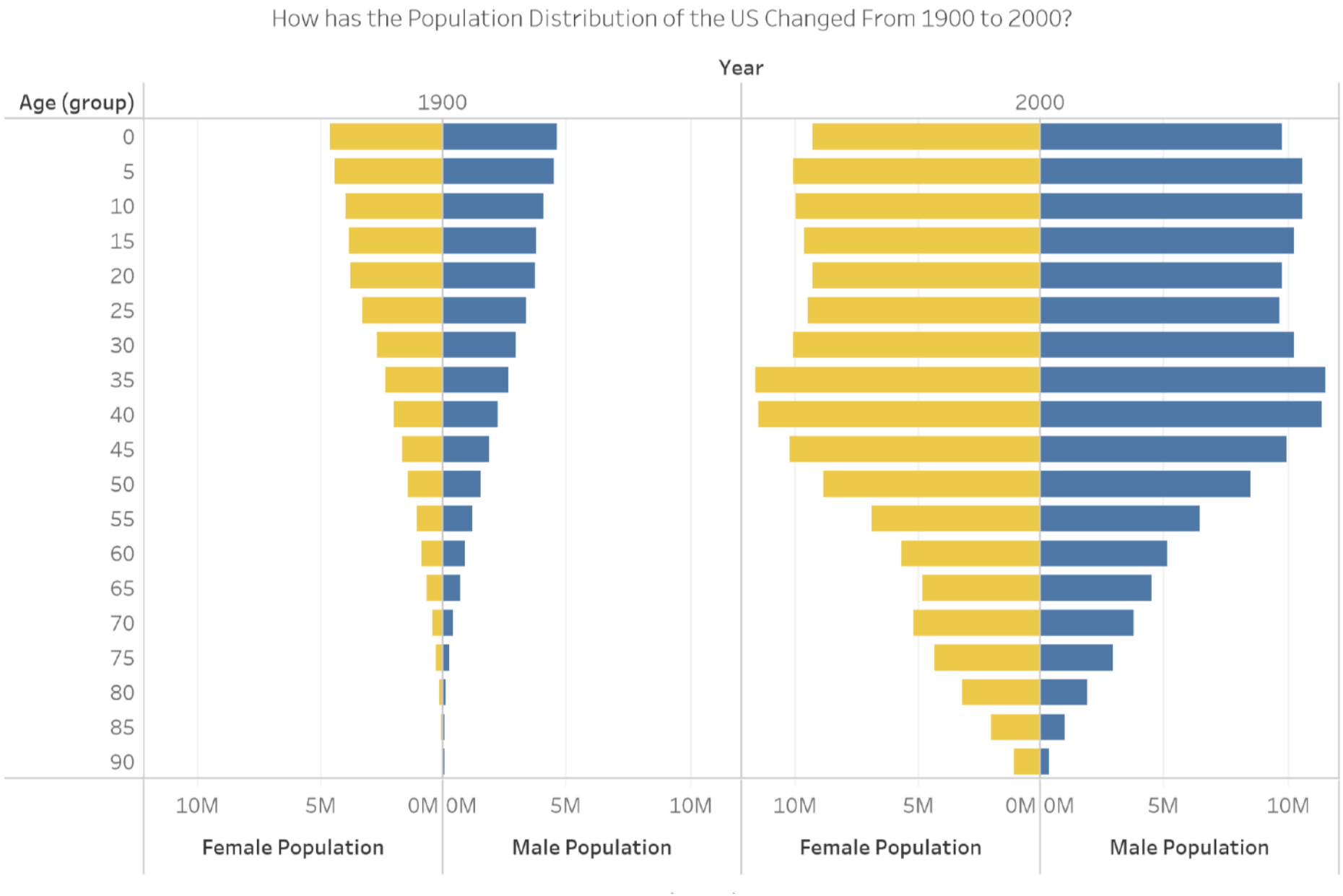
2000



What has U.S population changed in Age and Sex composition from 1900 to 2000?

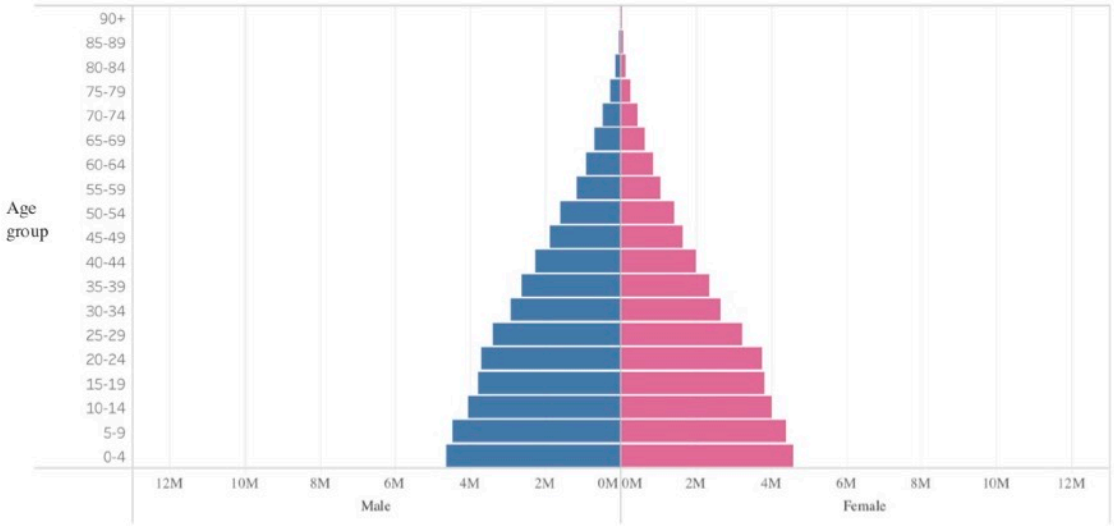



Does 100 years of societal advances increase lifespan difference between genders?
Legend
Male 1900
Female 1900
Male 2000
Female 2000
(10M) (8M) (6M) (4M) (2M) 0M 2M 4M 6M 8M 10M 12M 14M 16M 18M 20M 22M 24M
Age
90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
Number of People

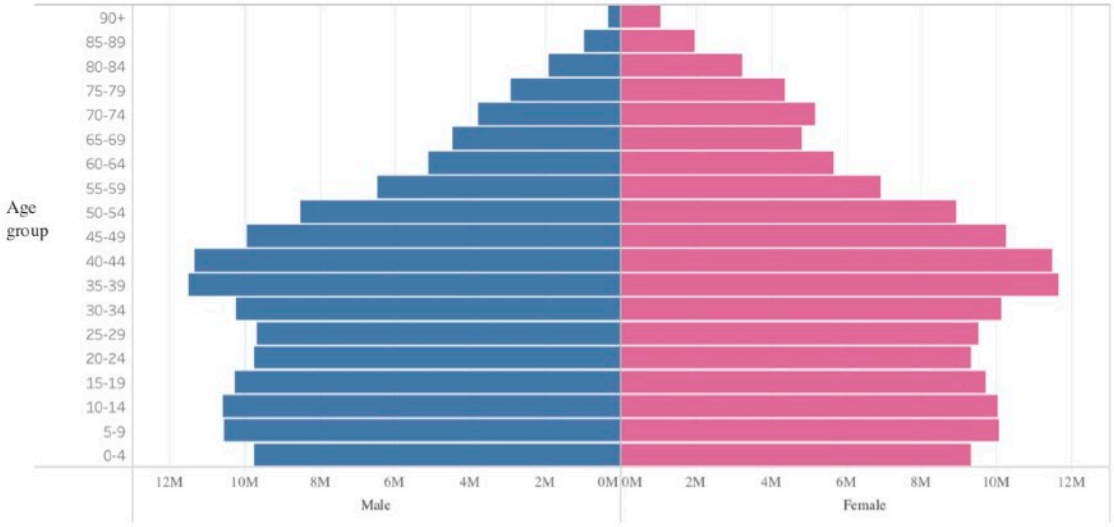

How has the Population Distribution of the US Changed From 1900 to 2000?
Year
Age (group)
1900
2000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
10M
5M
0M
0M
5M
10M
Female Population
Male Population
10M
5M
0M
0M
5M
10M
Female Population
Male Population

How does the U.S population's general trend change in 1900-2000?

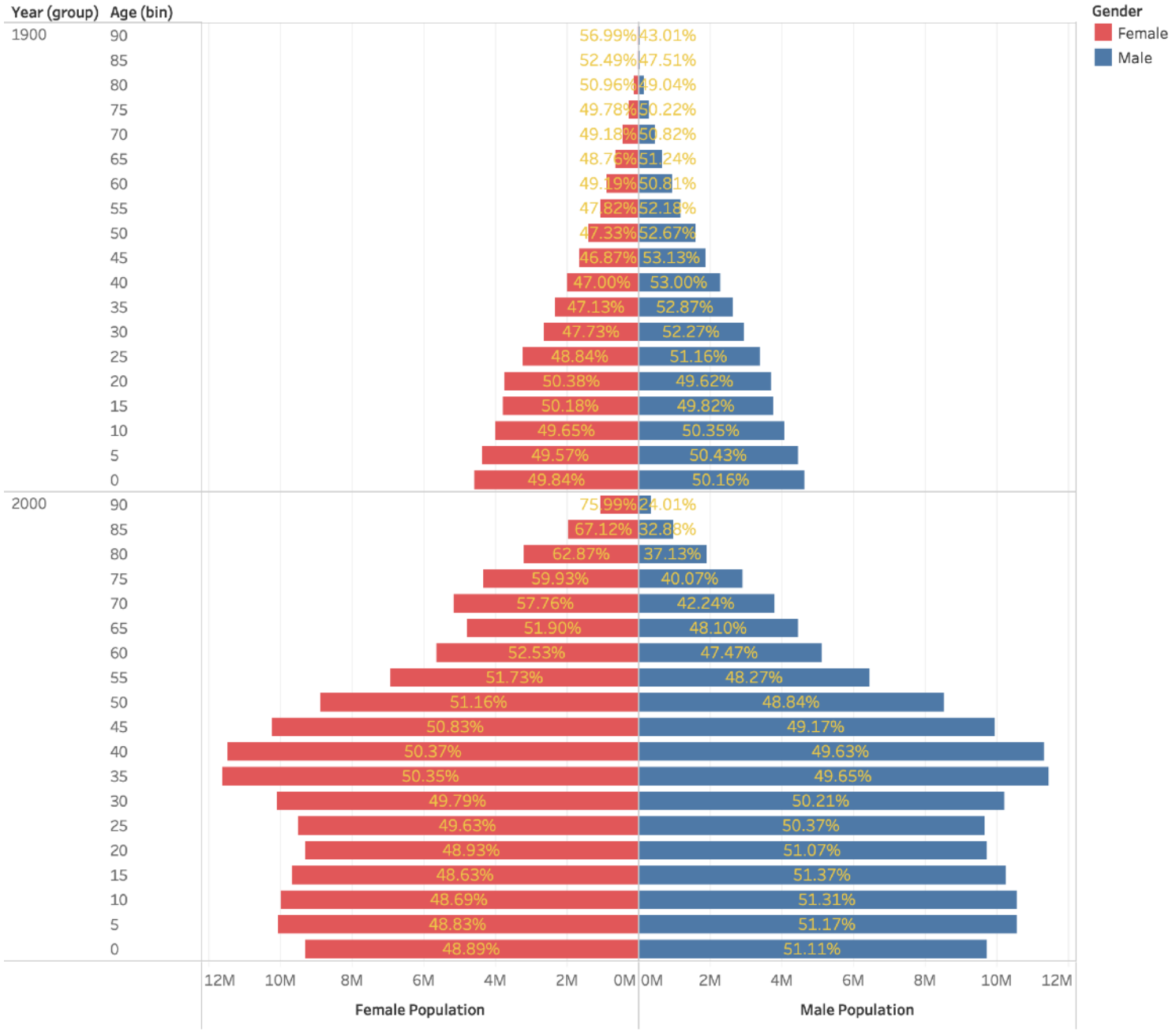
population pyramid - 1900



population pyramid - 2000

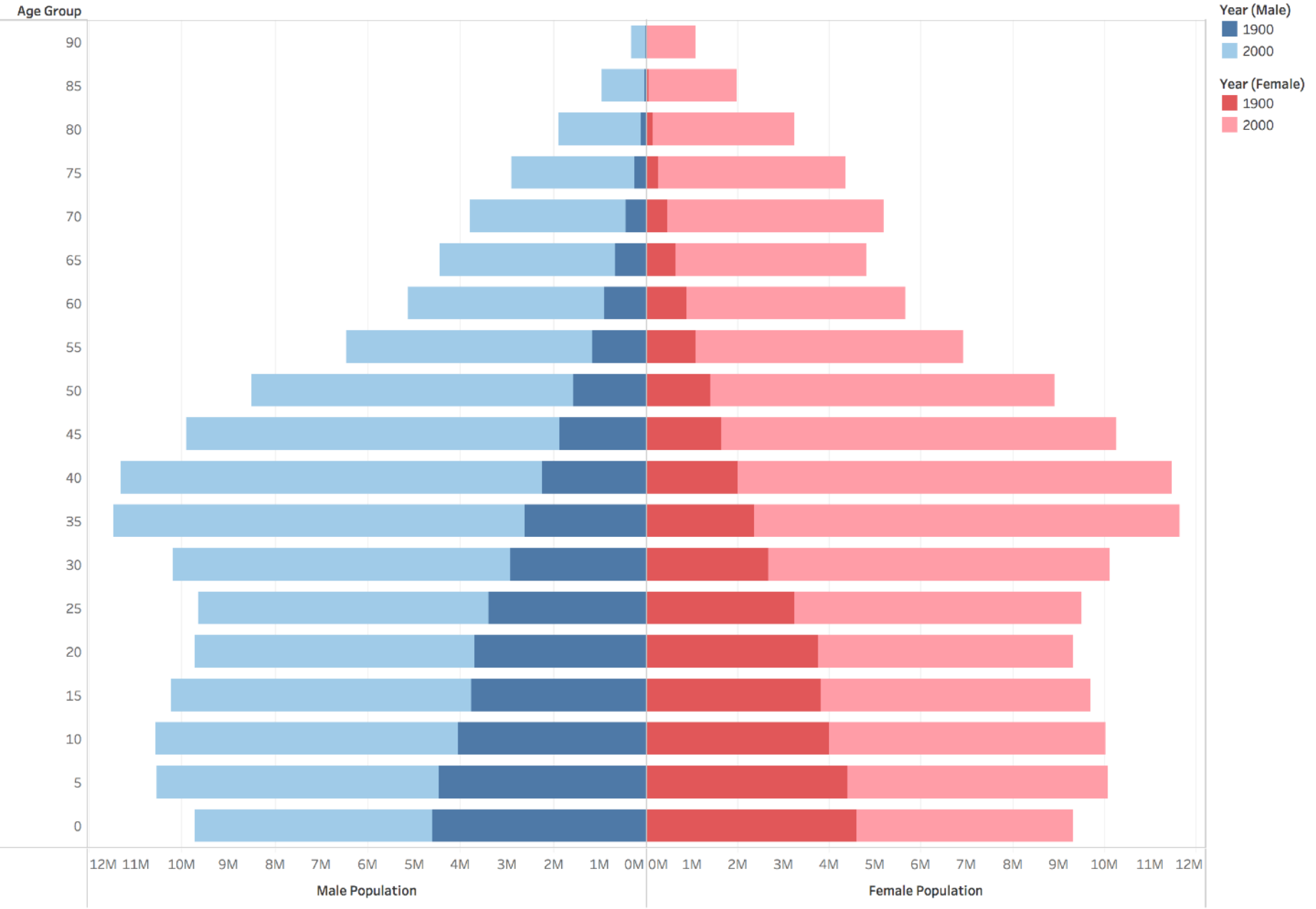


What is the gender and population structure across different age groups in 100 years?



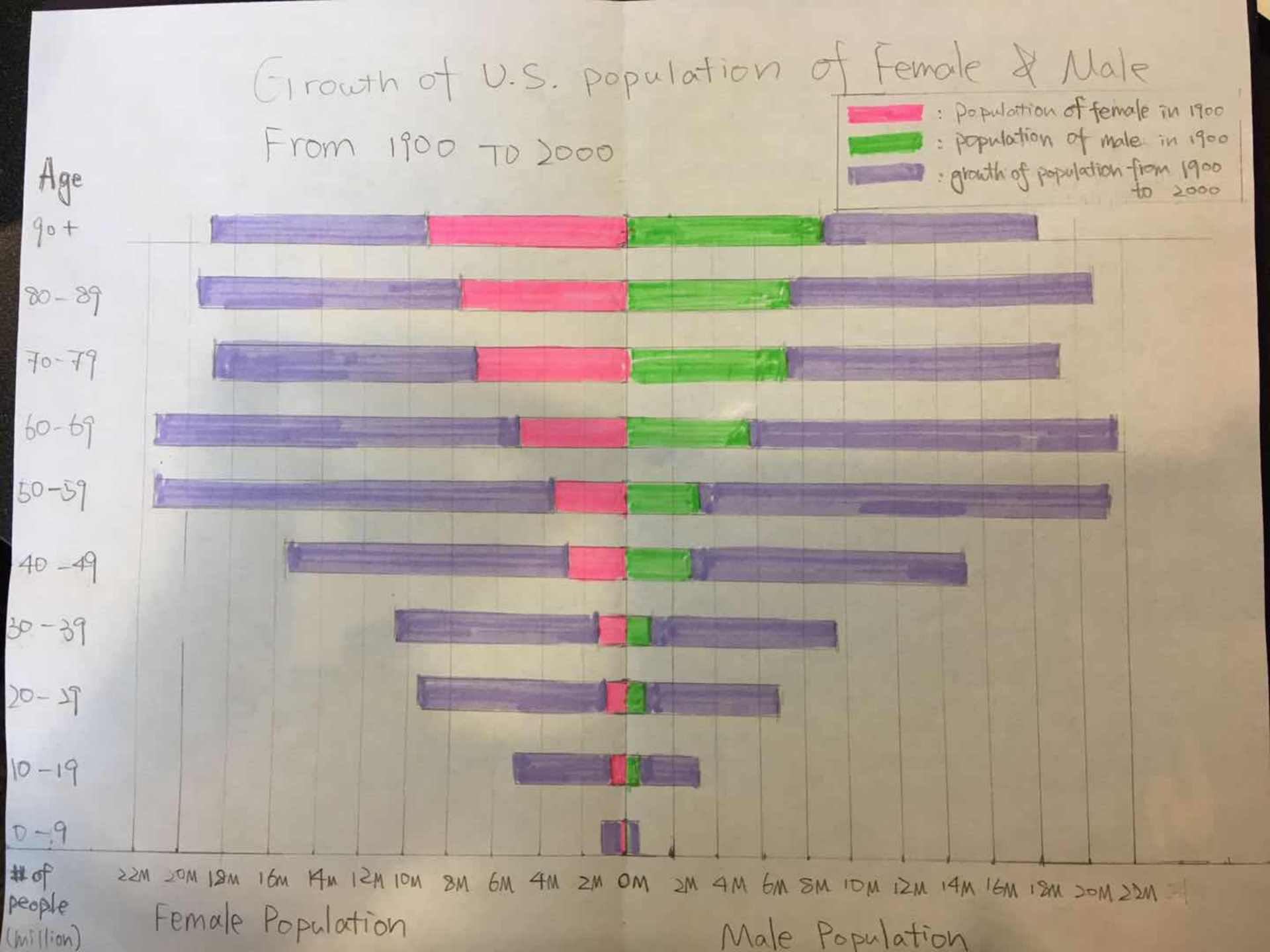
Sum of Female Population and sum of Male Population for each Age (bin) broken down by Year (group). Color shows details about Gender. The marks are labeled by % of Total 1900 Population and % of Total 2000 Population. The view is filtered on Year (group), which keeps 1900 and 2000.

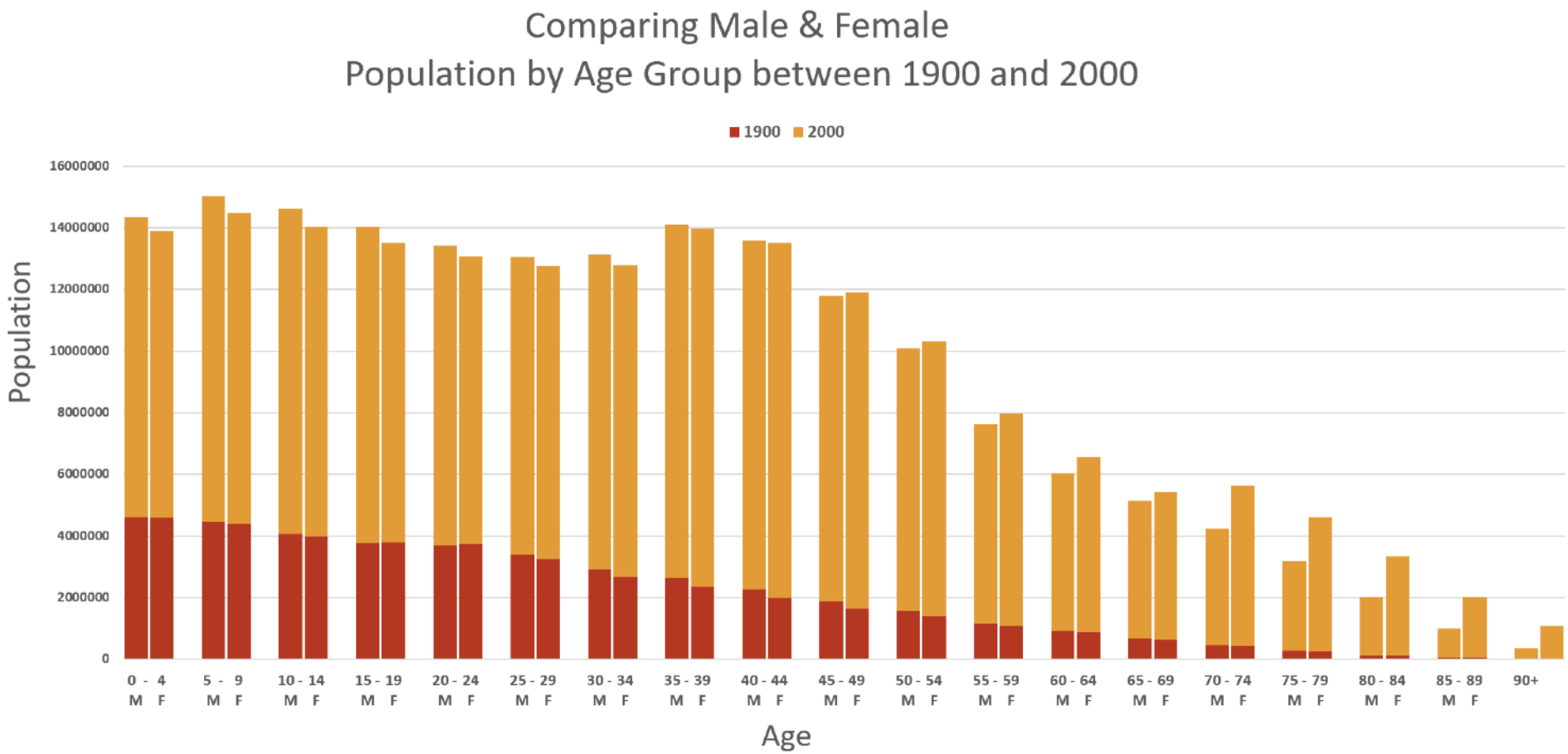
Population Structure Difference between 1900 and 2000



Sum of Male Population and sum of Female Population for each Age Group. For pane Sum of Male Population: Color shows details about Year (Male). For pane Sum of Female Population: Color shows details about Year (Female).

Growth of U.S. population of Female & Male From 1900 TO 2000




Comparing Male & Female
Population by Age Group between 1900 and 2000
1900
2000
Population
16000000
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
0 - 4 M F
5 - 9 M F
10 - 14 M F
15 - 19 M F
20 - 24 M F
25 - 29 M F
30 - 34 M F
35 - 39 M F
40 - 44 M F
45 - 49 M F
50 - 54 M F
55 - 59 M F
60 - 64 M F
65 - 69 M F
70 - 74 M F
75 - 79 M F
80 - 84 M F
85 - 89 M F
90+
Age

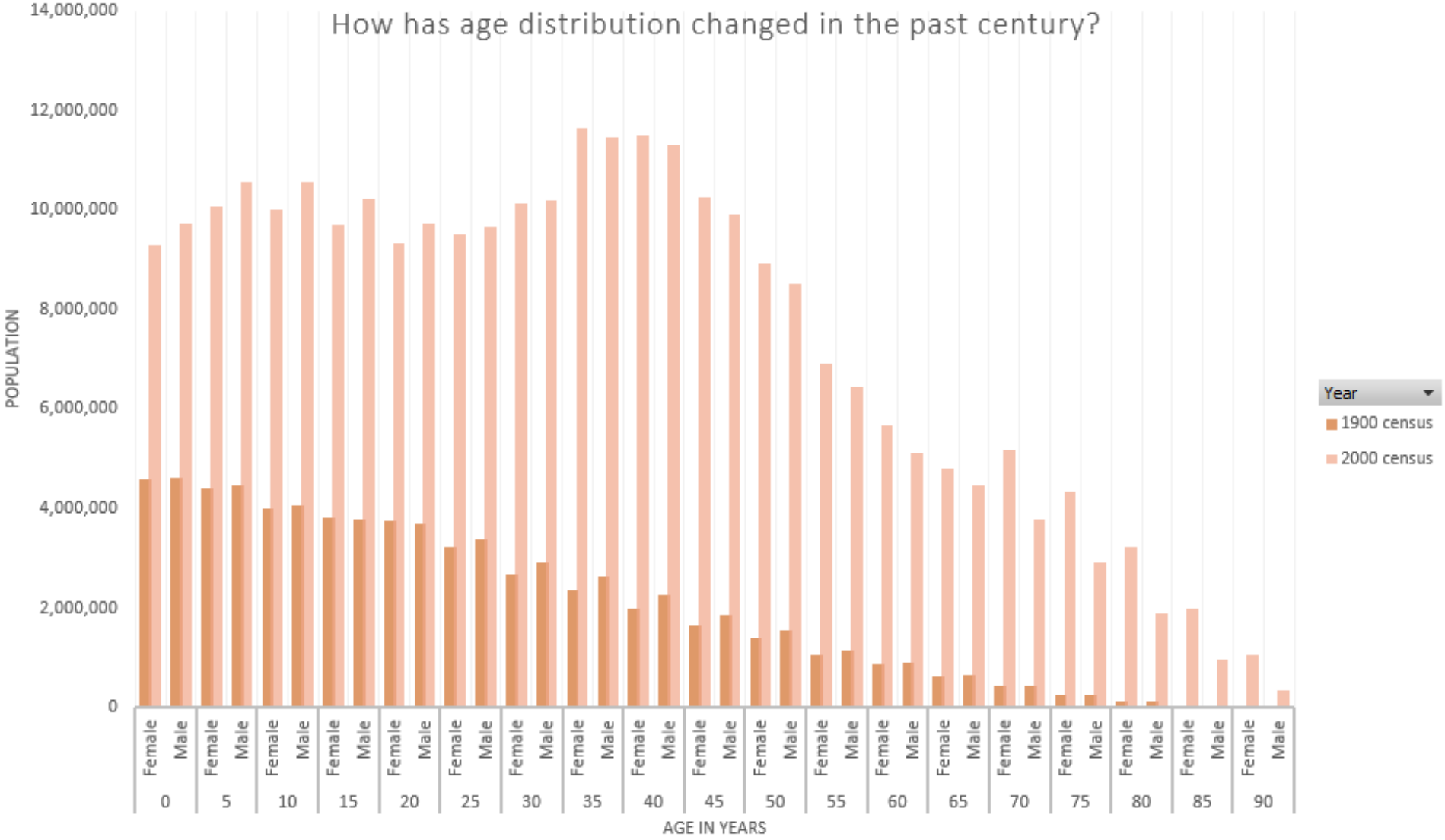
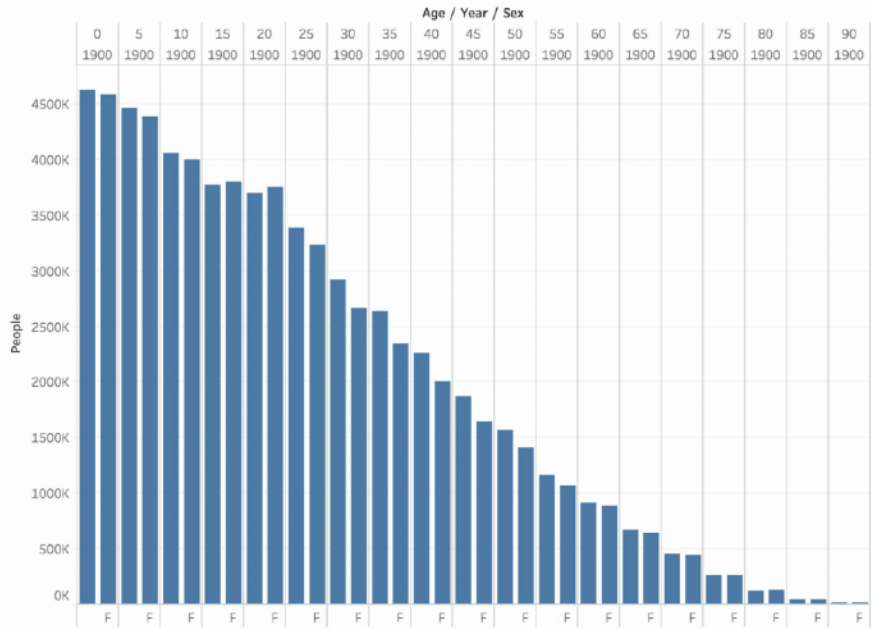
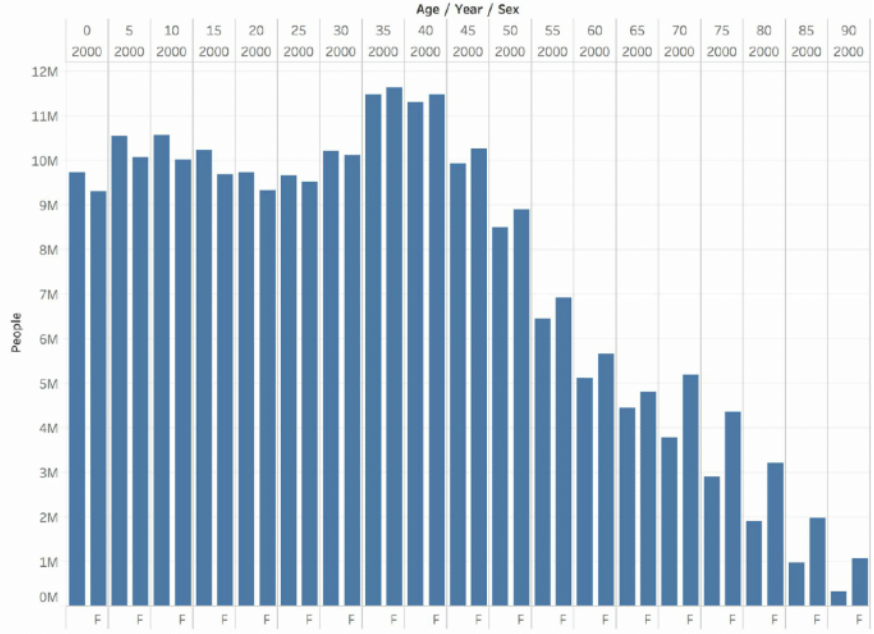

How has age distribution changed in the past century?
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
POPULATION
Female
Male
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
AGE IN YEARS
Year
1900 census
2000 census

Figure 1



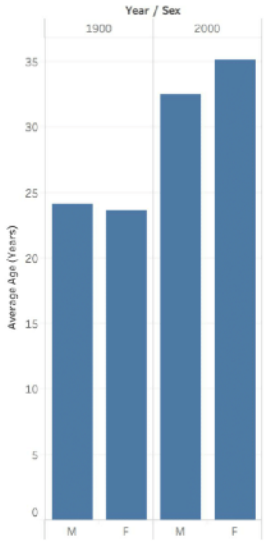
Sum of People for each Sex broken down by Age and Year. The view is filtered on Year, which keeps 1900.

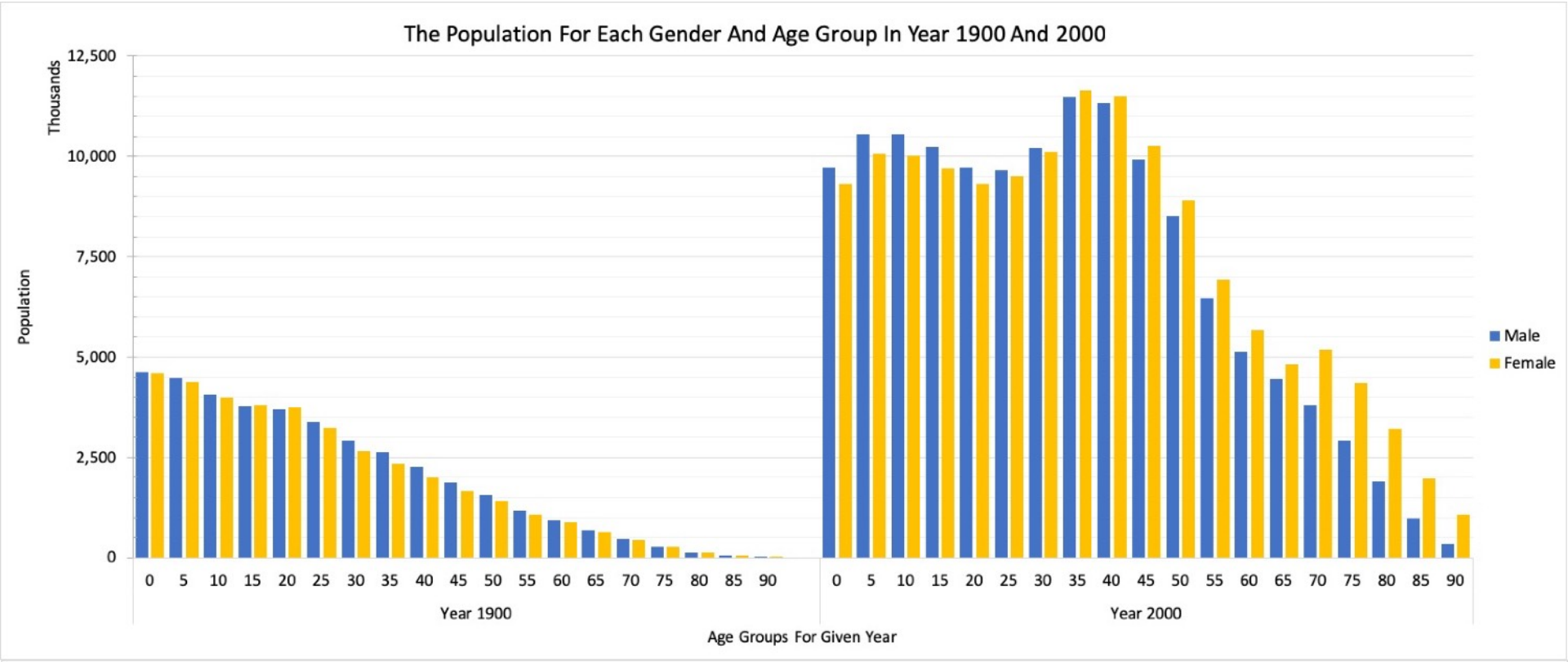
Figure 2

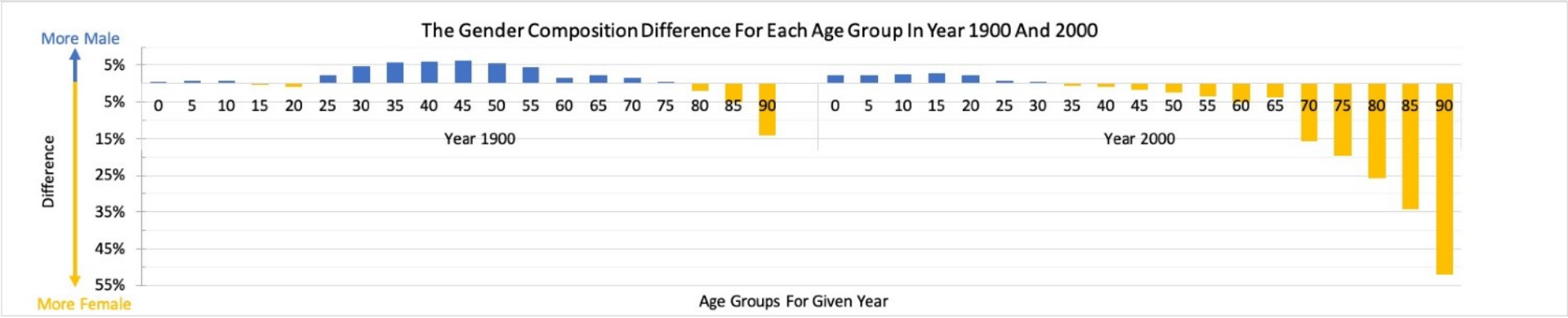


Sum of People for each Sex broken down by Age and Year. The view is filtered on Year, which keeps 2000.

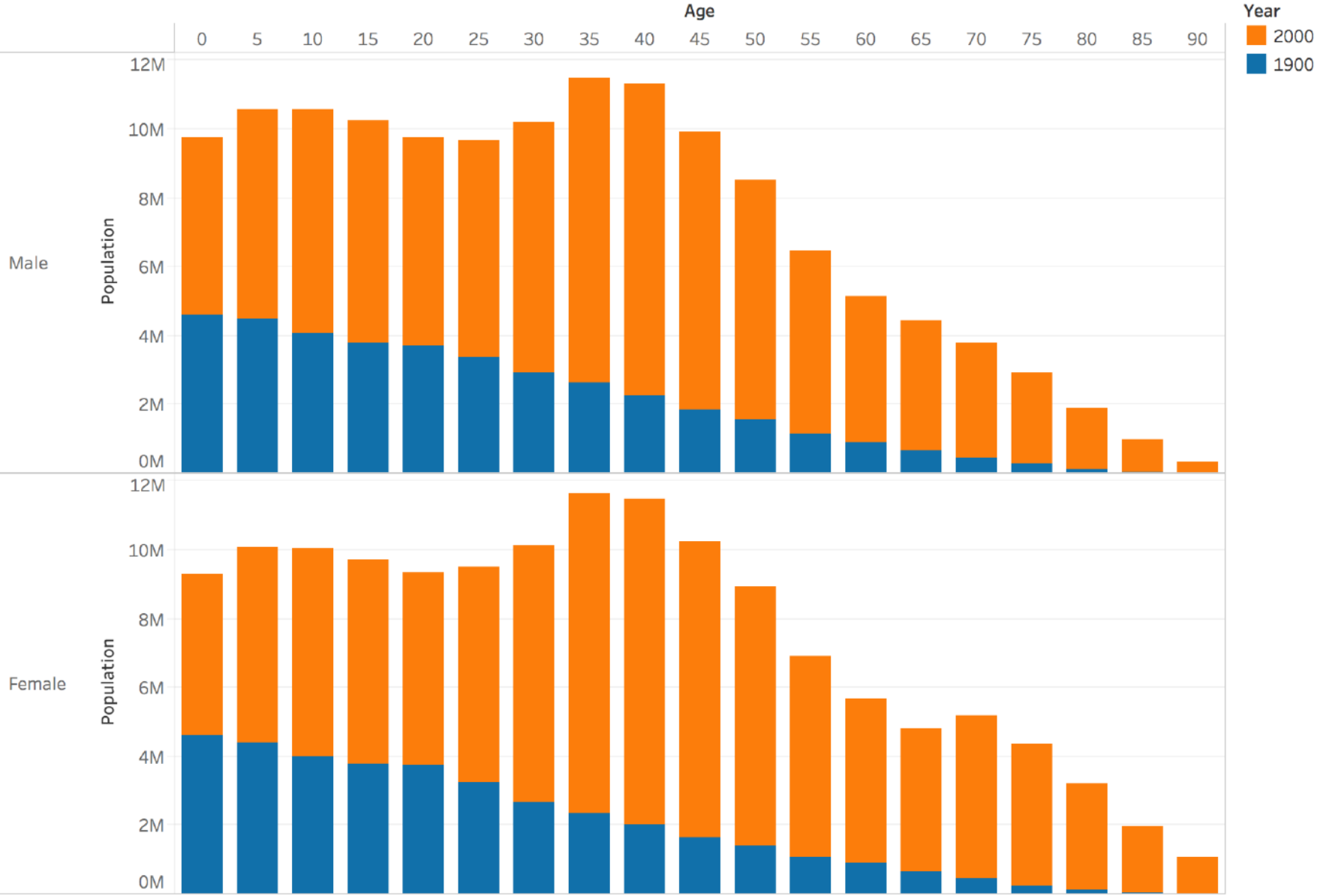
Figure 3




The Population For Each Gender And Age Group In Year 1900 And 2000
Thousands
12,500
10,000
7,500
5,000
2,500
0
Population
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Year 1900
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Year 2000
Age Groups For Given Year
Male
Female

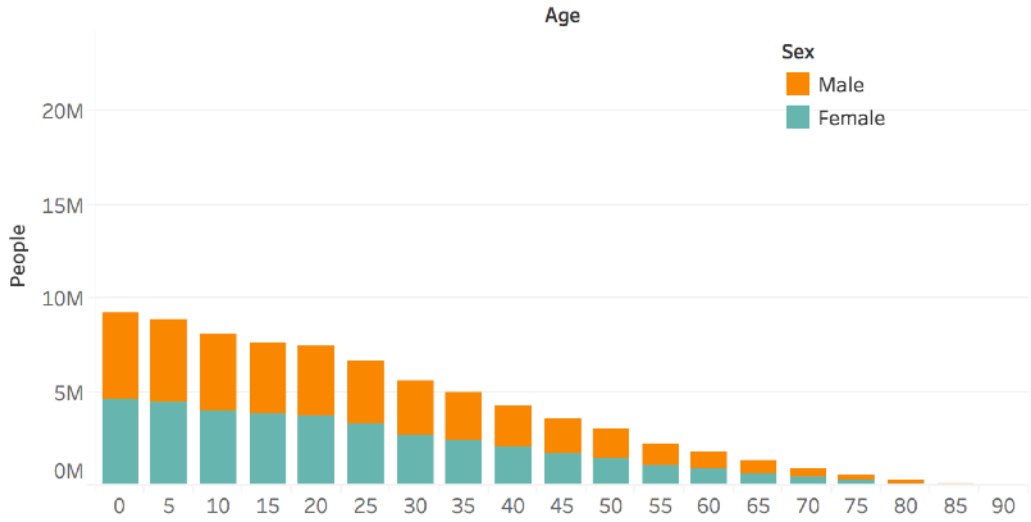

The Gender Composition Difference For Each Age Group In Year 1900 And 2000
More Male
5%
5%
15%
25%
35%
45%
55%
More Female
Difference
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Year 1900
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Year 2000
Age Groups For Given Year

Male and Female Population Growth From 1900 to 2000

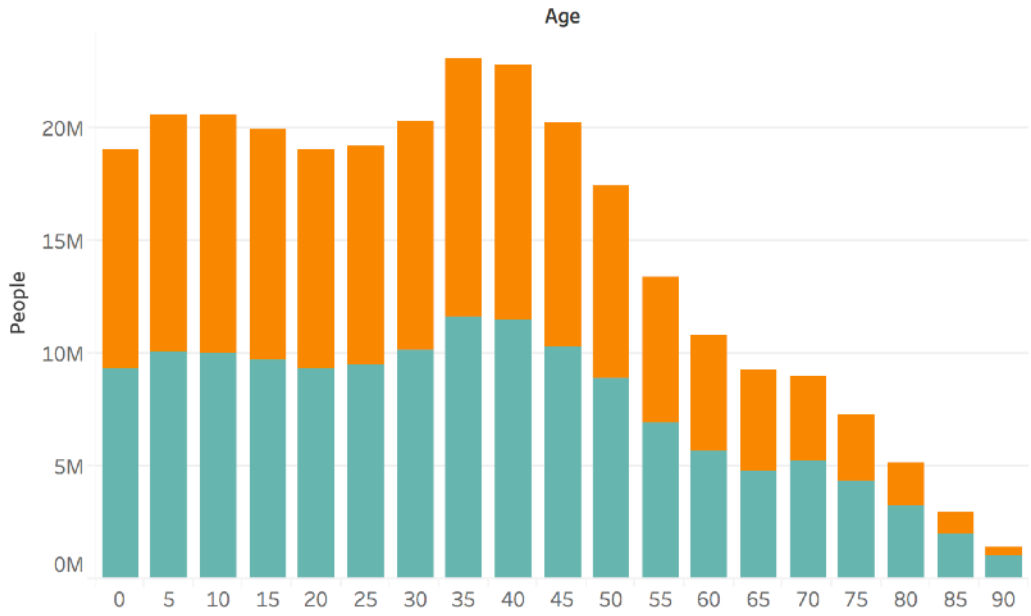


How have US population demographics changed over time?

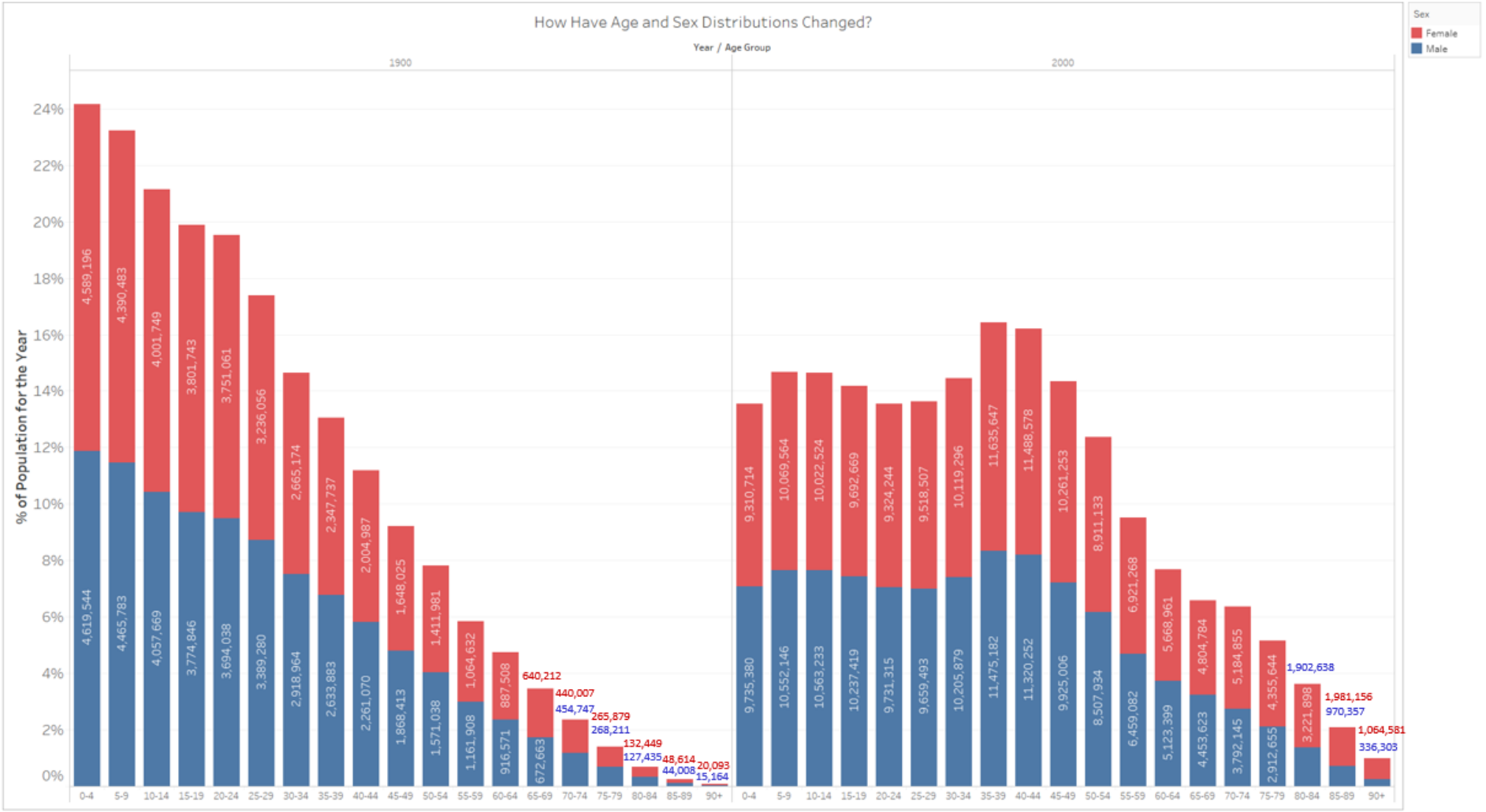
1900



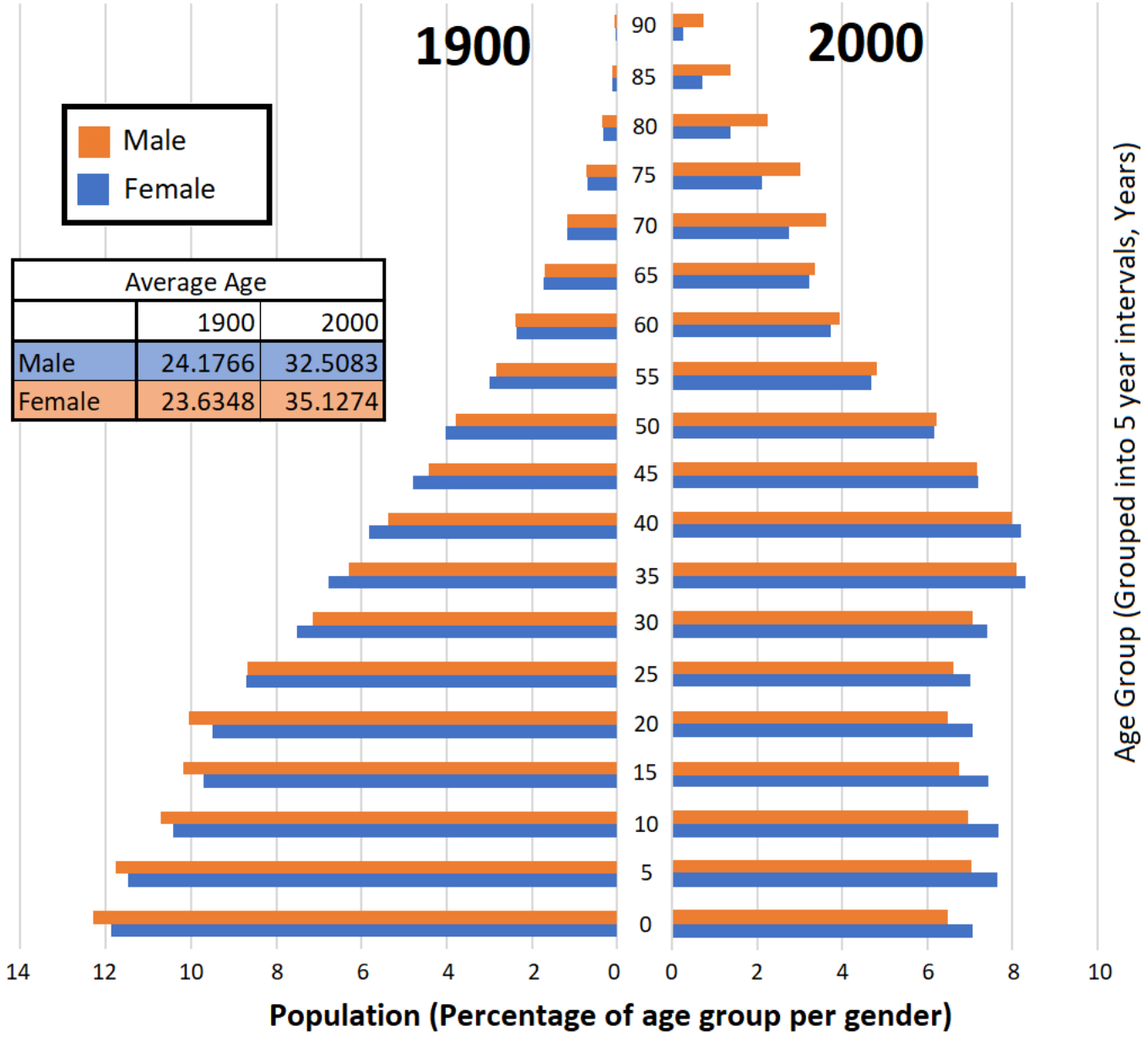
2000



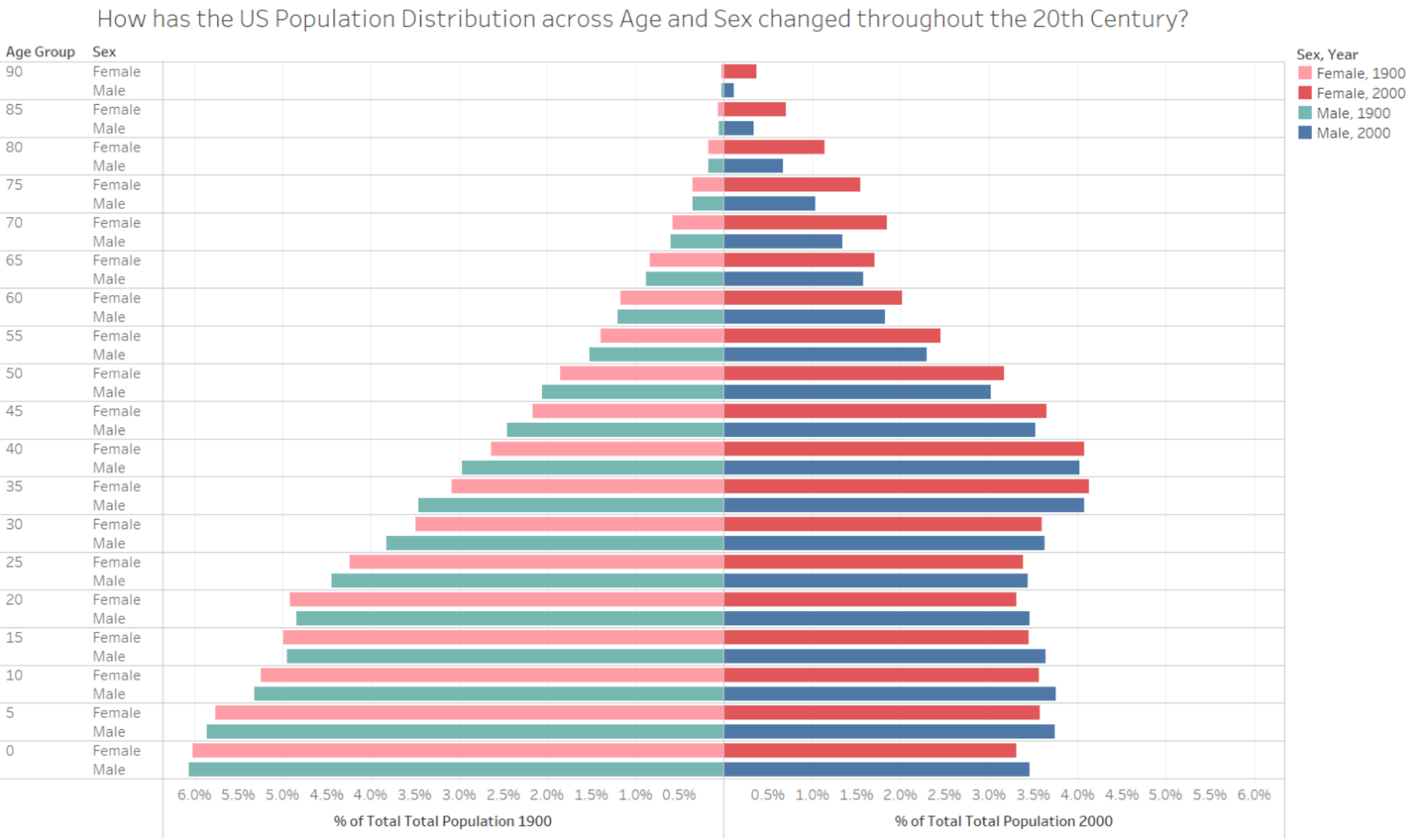
Population Percentage


How Have Age and Sex Distributions Changed?
Year / Age Group
1900
2000
Sex
Female
Male
% of Population for the Year
24%
22%
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
4,589,196
4,619,544
4,390,483
4,465,783
4,001,749
4,057,669
3,801,743
3,774,846
3,751,061
3,694,038
3,236,056
3,389,280
2,665,174
2,918,964
2,347,737
2,633,883
2,004,987
2,261,070
1,648,025
1,868,413
1,411,981
1,571,038
1,064,632
1,161,908
887,508
916,571
640,212
672,663
440,007
454,747
265,879
268,211
132,449
127,435
48,614
44,008
20,093
15,164
9,310,714
9,735,380
10,069,564
10,552,146
10,022,524
10,563,233
9,692,669
10,237,419
9,324,244
9,731,315
9,518,507
9,659,493
10,119,296
10,205,879
11,635,647
11,475,182
11,488,578
11,320,252
10,261,253
9,925,006
8,911,133
8,507,934
6,921,268
6,459,082
5,668,961
5,123,399
4,804,784
4,453,623
5,184,855
3,792,145
4,355,644
2,912,655
1,902,638
3,221,898
1,981,156
970,357
1,064,581
336,303
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+

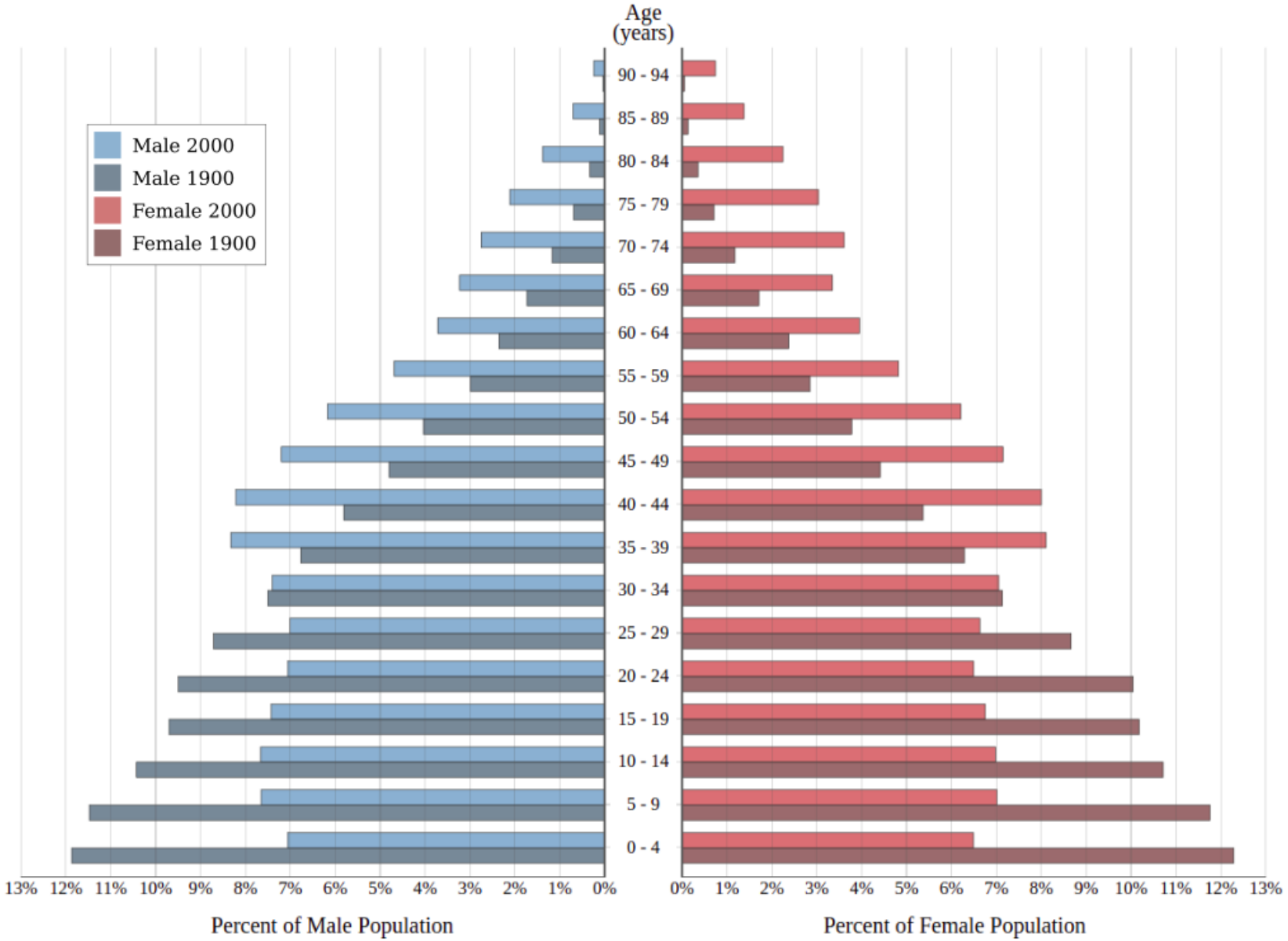
How Has the Distribusion of Age shifted between 1900 and 2000?



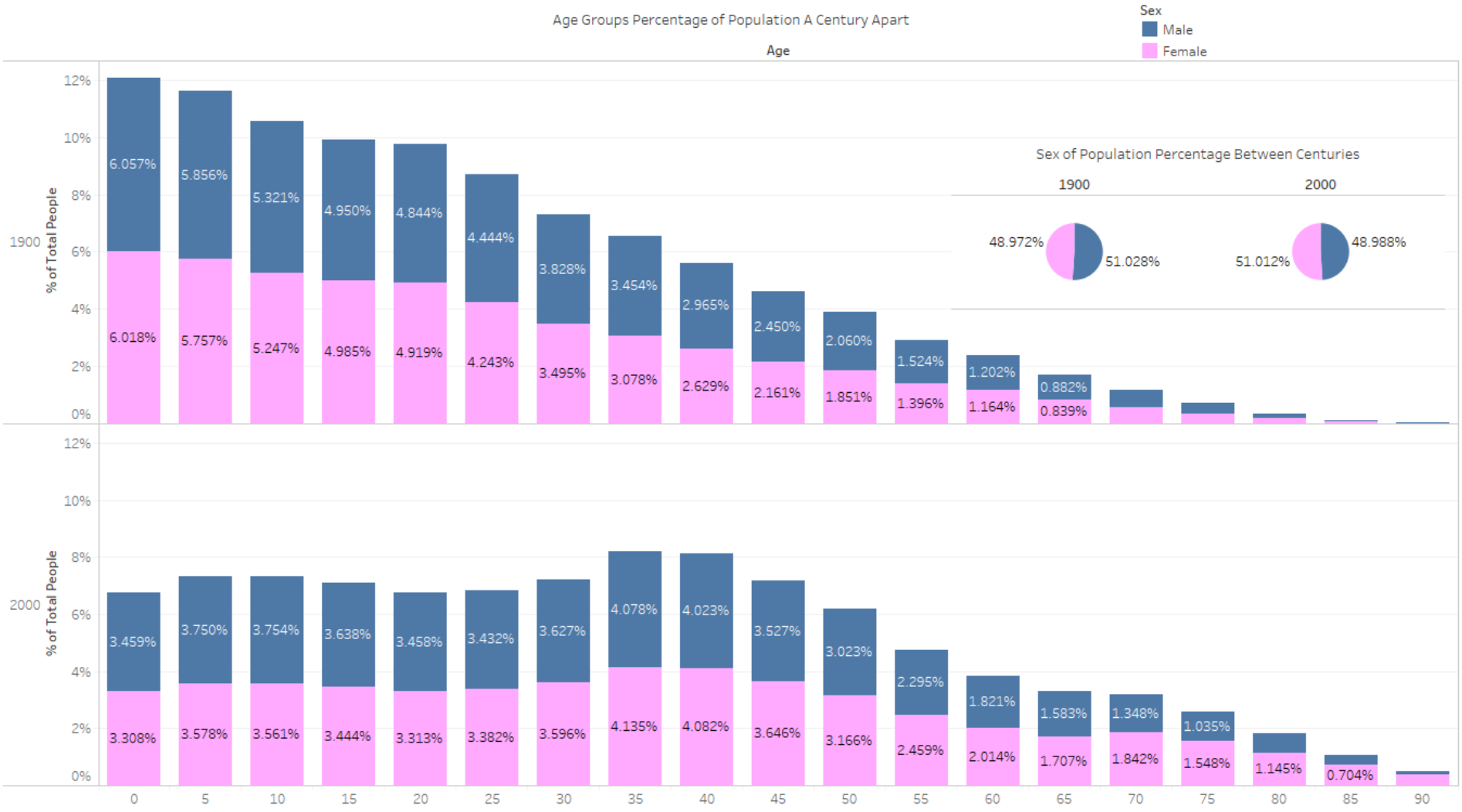
Average Age		
	1900	2000
Male	24.1766	32.5083
Female	23.6348	35.1274


How has the US Population Distribution across Age and Sex changed throughout the 20th Century?
Age Group
Sex
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Female
Male
Sex, Year
Female, 1900
Female, 2000
Male, 1900
Male, 2000
6.0% 5.5% 5.0% 4.5% 4.0% 3.5% 3.0% 2.5% 2.0% 1.5% 1.0% 0.5%
% of Total Total Population 1900
0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0% 4.5% 5.0% 5.5% 6.0%
% of Total Total Population 2000

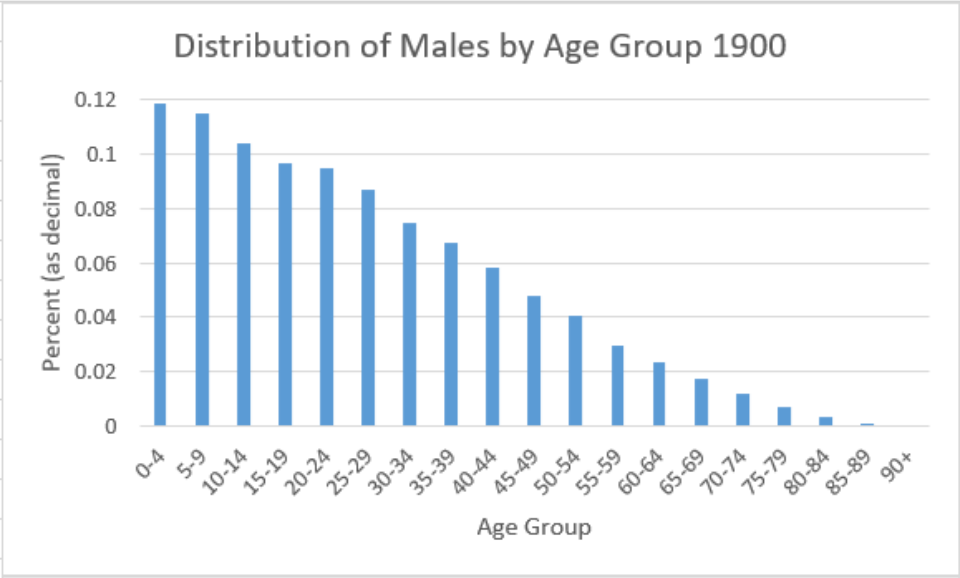
Change of Age Distribution of Male and Female Sexes from 1900 to 2000 in the US

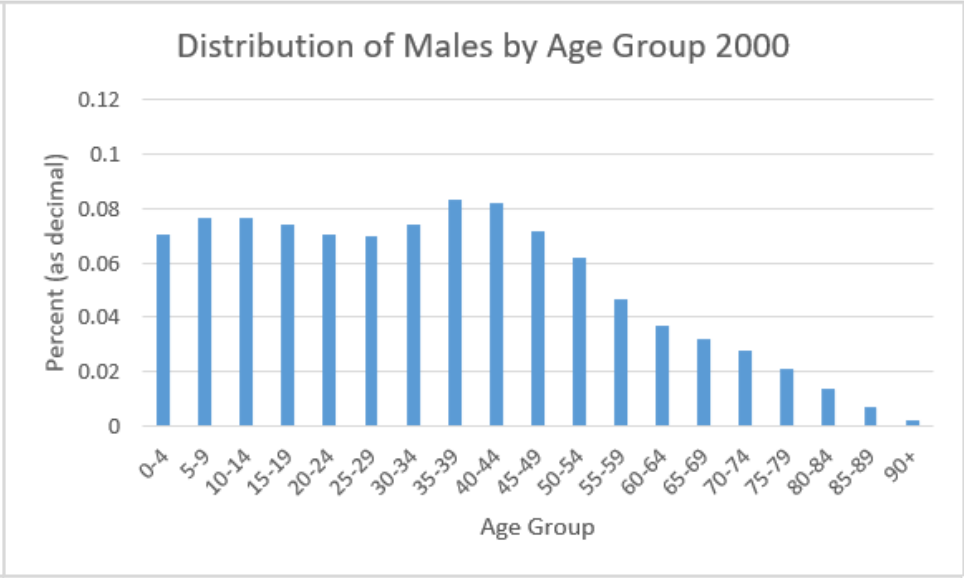


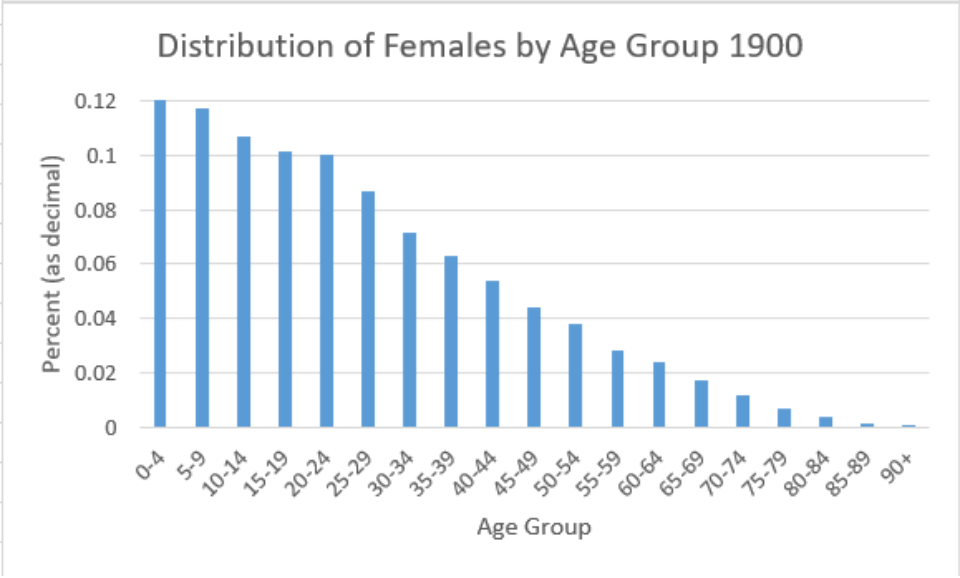
This graphic shows the distributions of age for each sex in each indicated year. Each data series (ex: "Male 2000", etc.) is self-contained, thus each bar in the graphic indicates its respective age group's population as a percentage of the total population of the series.

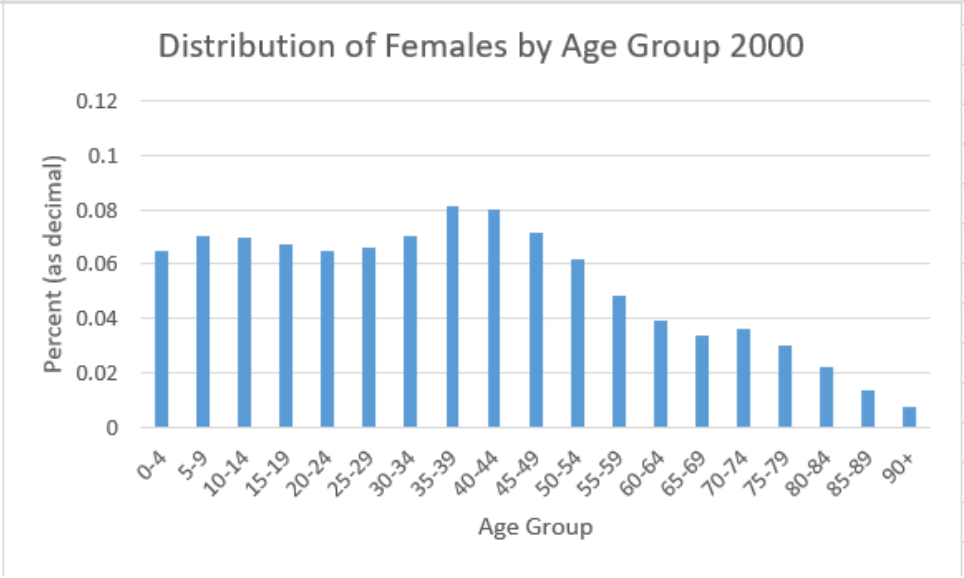

Age Groups Percentage of Population A Century Apart
Age
Sex
Male
Female
1900
2000
% of Total People
12%
10%
8%
6%
4%
2%
0%
6.057%
5.856%
5.321%
4.950%
4.844%
4.444%
3.828%
3.454%
2.965%
2.450%
2.060%
1.524%
1.202%
0.882%
6.018%
5.757%
5.247%
4.985%
4.919%
4.243%
3.495%
3.078%
2.629%
2.161%
1.851%
1.396%
1.164%
0.839%
Sex of Population Percentage Between Centuries
1900
2000
48.972%
51.028%
51.012%
48.988%
3.459%
3.750%
3.754%
3.638%
3.458%
3.432%
3.627%
4.078%
4.023%
3.527%
3.023%
2.295%
1.821%
1.583%
1.348%
1.035%
3.308%
3.578%
3.561%
3.444%
3.313%
3.382%
3.596%
4.135%
4.082%
3.646%
3.166%
2.459%
2.014%
1.707%
1.842%
1.548%
1.145%
0.704%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90

Distribution of US Population by Age Group Over Time

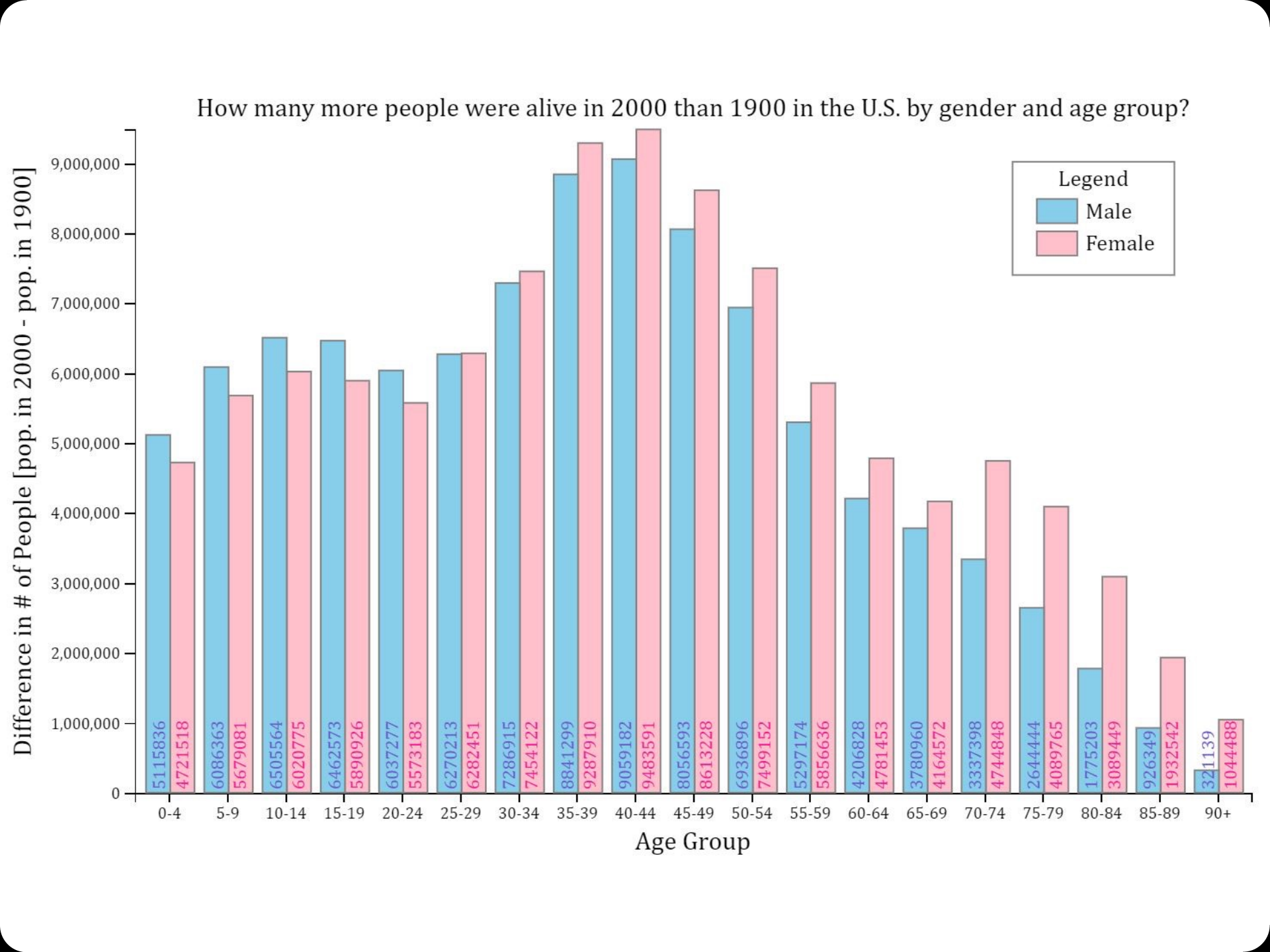


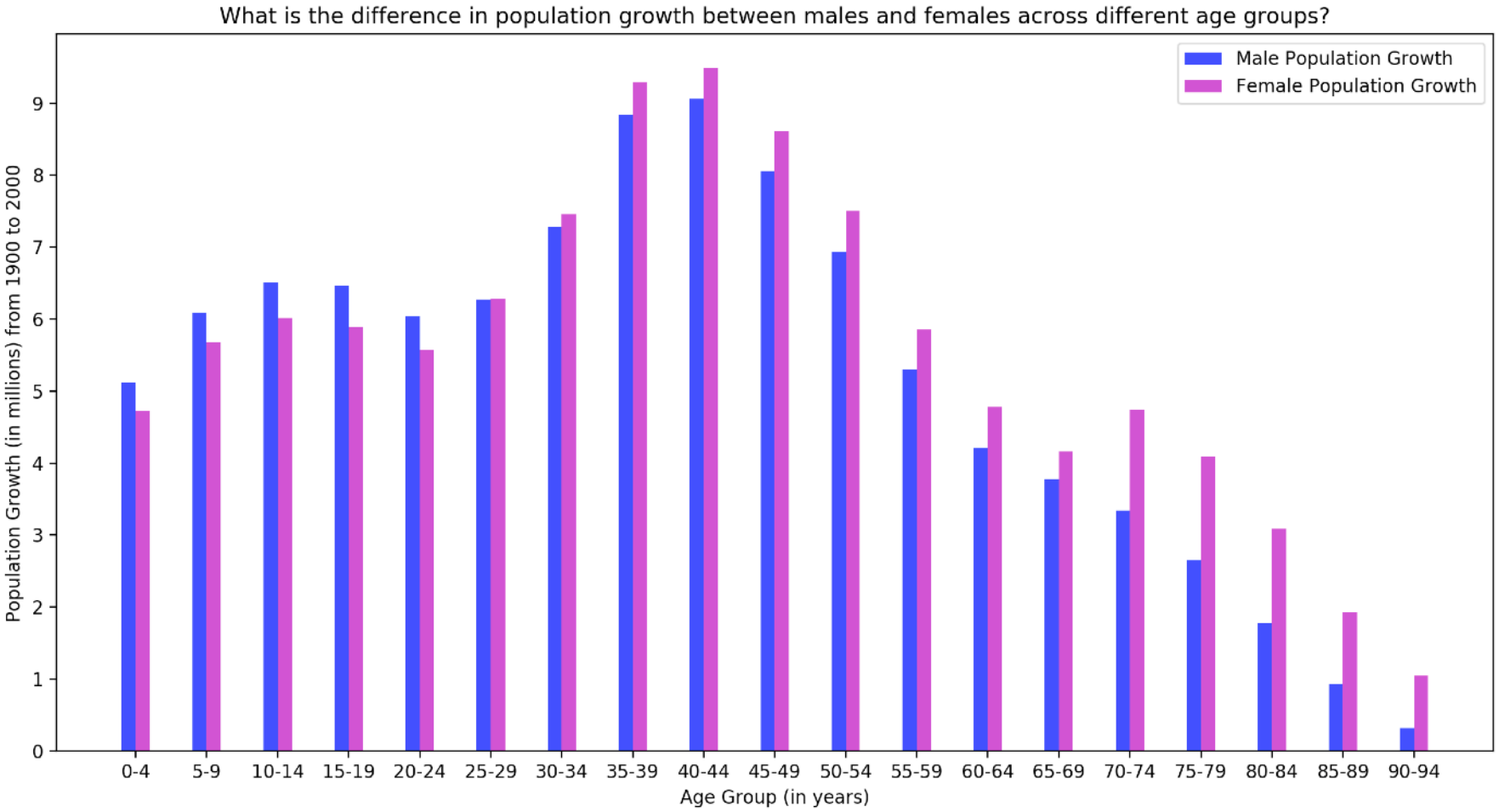


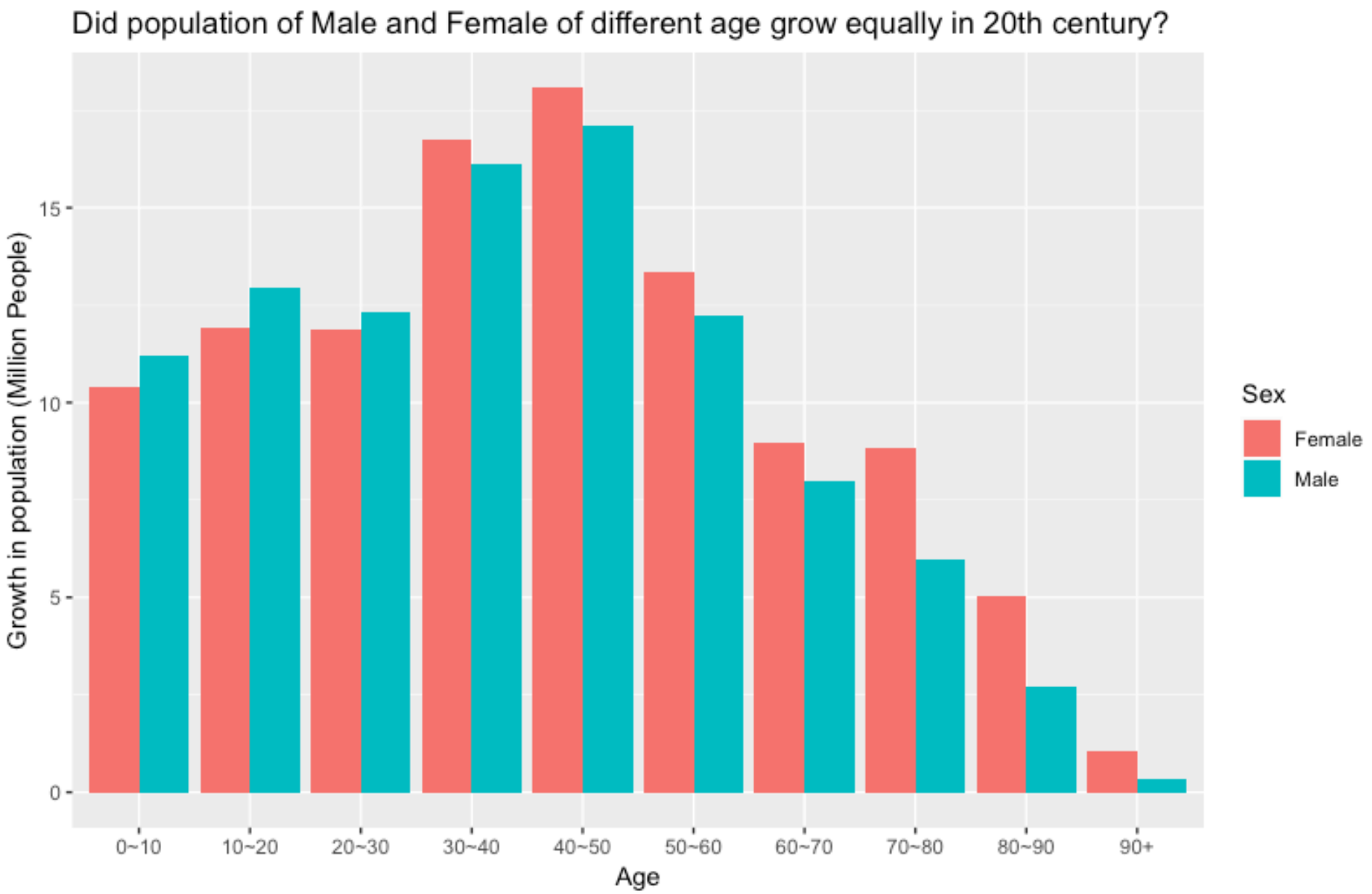




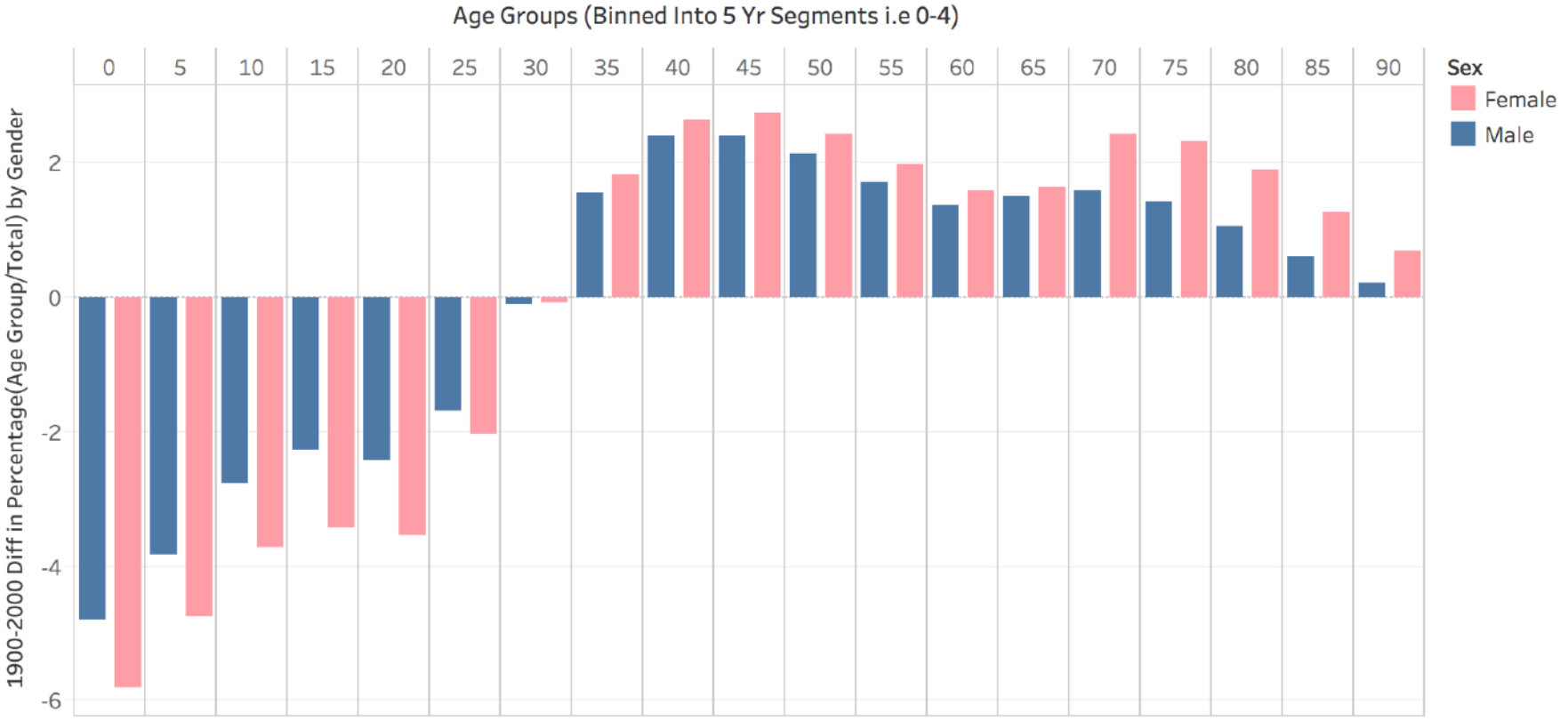
Growth Rates

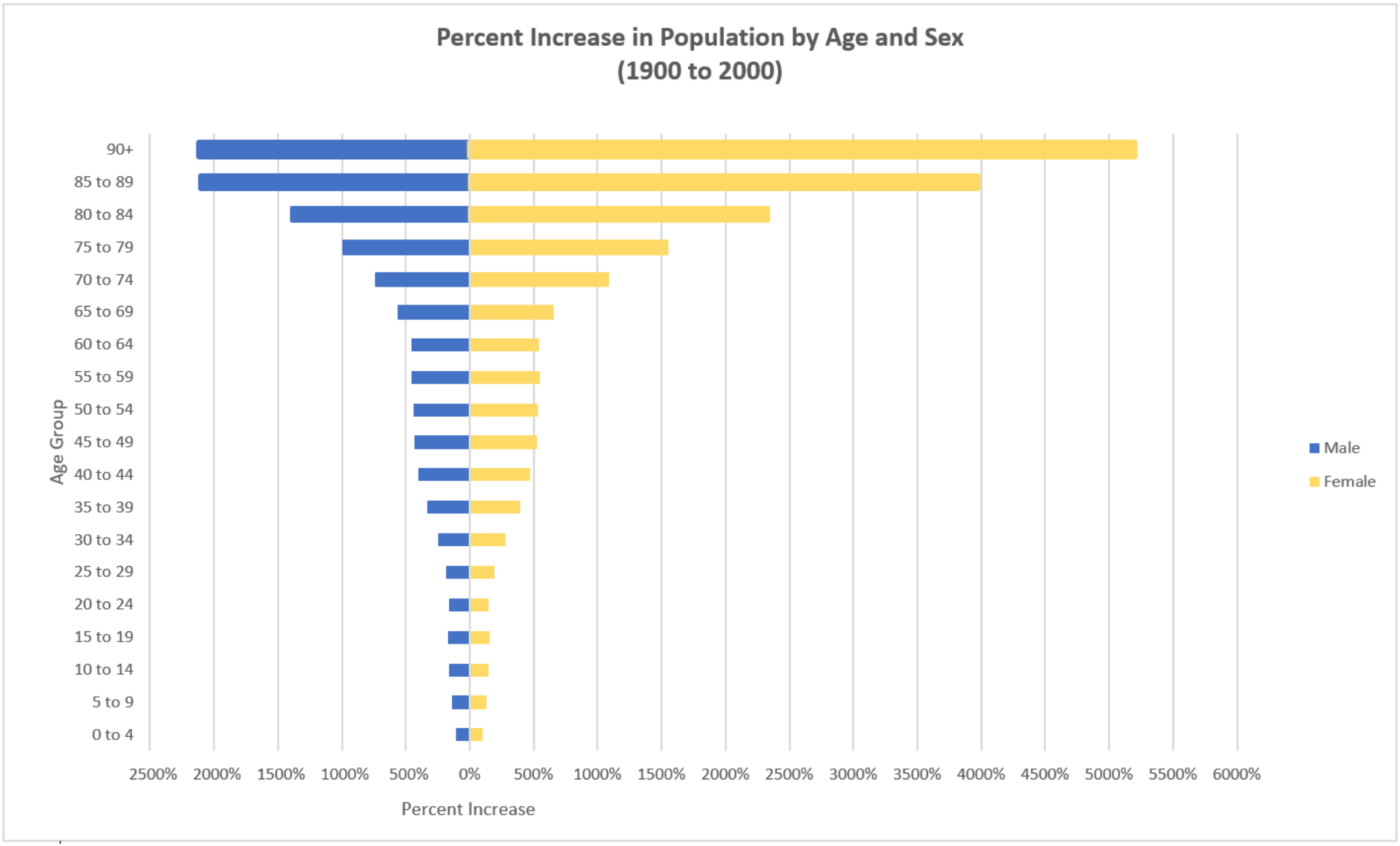

How many more people were alive in 2000 than 1900 in the U.S. by gender and age group?
Difference in # of People [pop. in 2000 - pop. in 1900]
Age Group
Legend
Male
Female
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
7,000,000
8,000,000
9,000,000
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+
5115836
4721518
6086363
5679081
6505564
6020775
6462573
5890926
6037277
5573183
6270213
6282451
7286915
7454122
8841299
9287910
9059182
9483591
8056593
8613228
6936896
7499152
5297174
5856636
4206828
4781453
3780960
4164572
3337398
4744848
2644444
4089765
1775203
3089449
926349
1932542
321139
1044488


What is the difference in population growth between males and females across different age groups?
Male Population Growth
Female Population Growth
Population Growth (in millions) from 1900 to 2000
0
1
2
3
4
5
6
7
8
9
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
Age Group (in years)

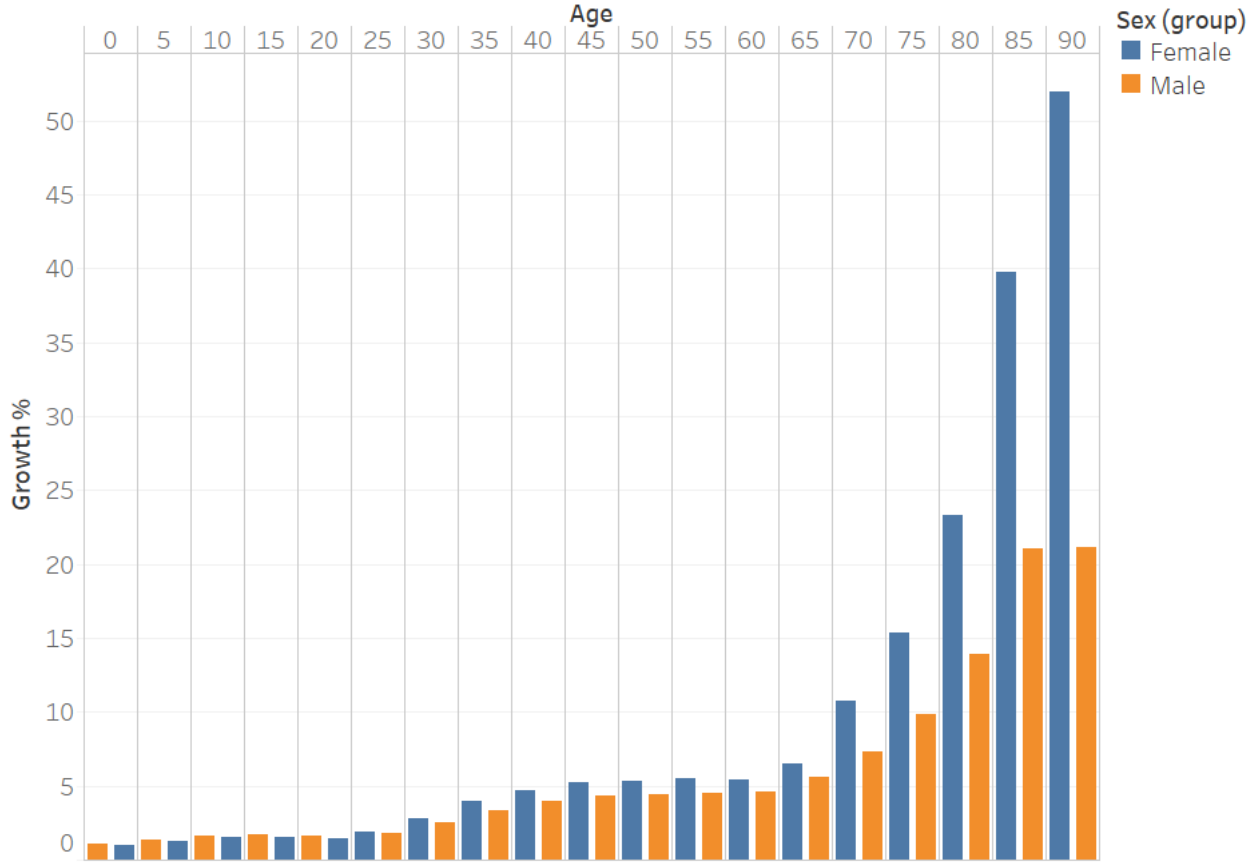

Did population of Male and Female of different age grow equally in 20th century?
Growth in population (Million People)
15
10
5
0
0~10
10~20
20~30
30~40
40~50
50~60
60~70
70~80
80~90
90+
Age
Sex
Female
Male

How has the age distribution in the U.S from 1900 to 2000 changed differently for males and females?

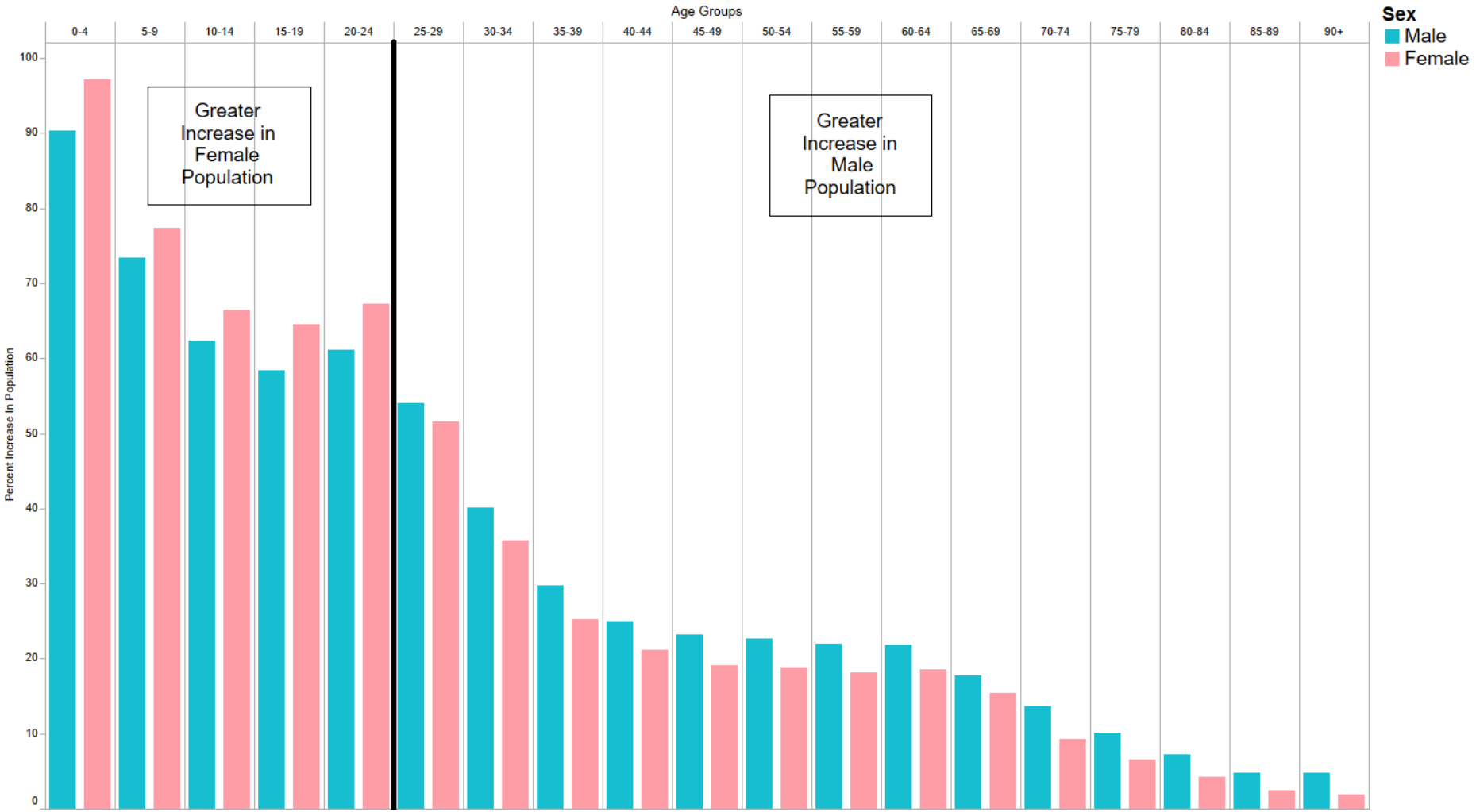


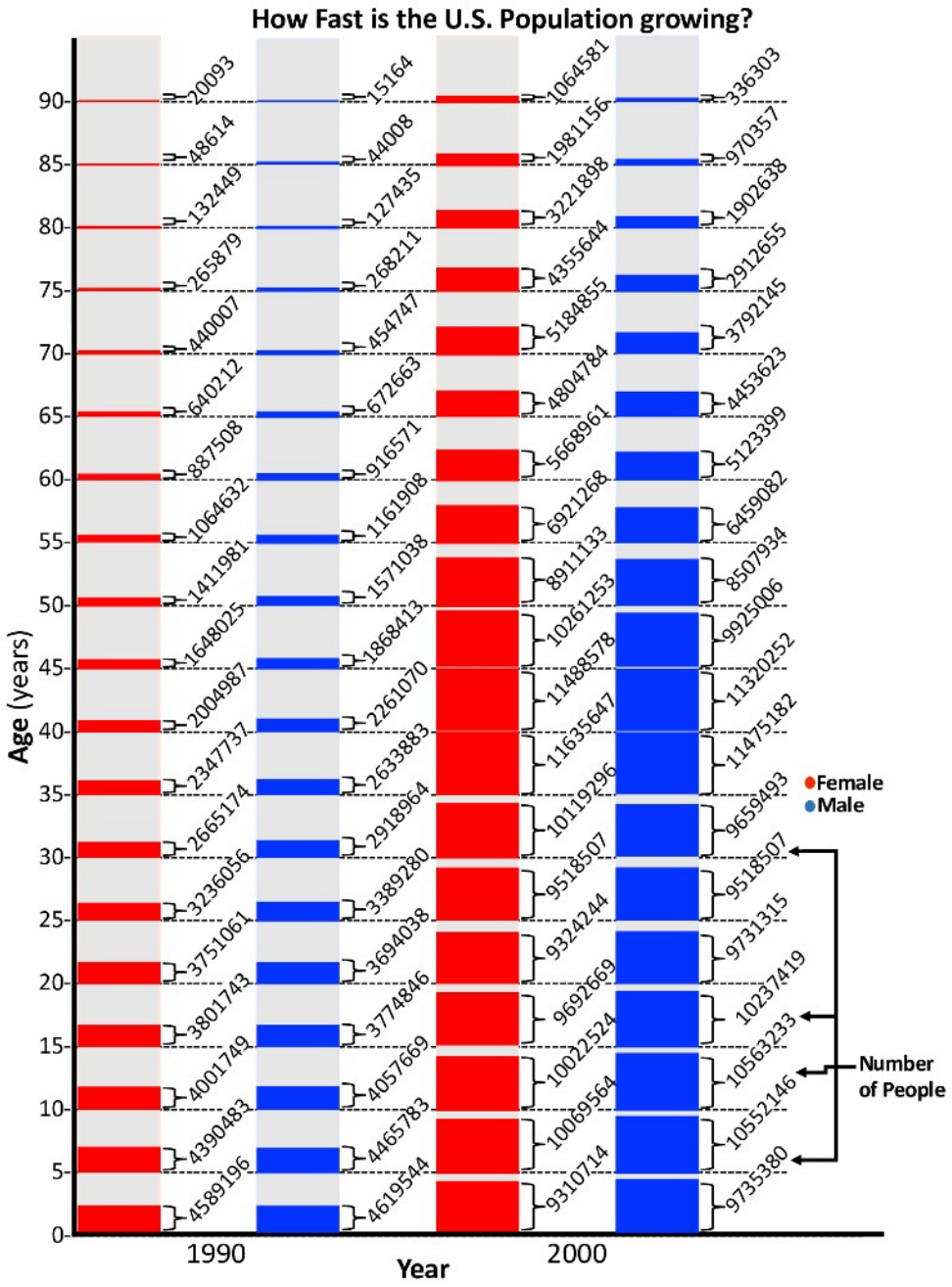

Percent Increase in Population by Age and Sex
(1900 to 2000)
90+
85 to 89
80 to 84
75 to 79
70 to 74
65 to 69
60 to 64
55 to 59
50 to 54
45 to 49
40 to 44
35 to 39
30 to 34
25 to 29
20 to 24
15 to 19
10 to 14
5 to 9
0 to 4
Age Group
2500% 2000% 1500% 1000% 500% 0% 500% 1000% 1500% 2000% 2500% 3000% 3500% 4000% 4500% 5000% 5500% 6000%
Percent Increase
Male
Female

How Have Age and Sex Demographics Changed In the 20th Century?



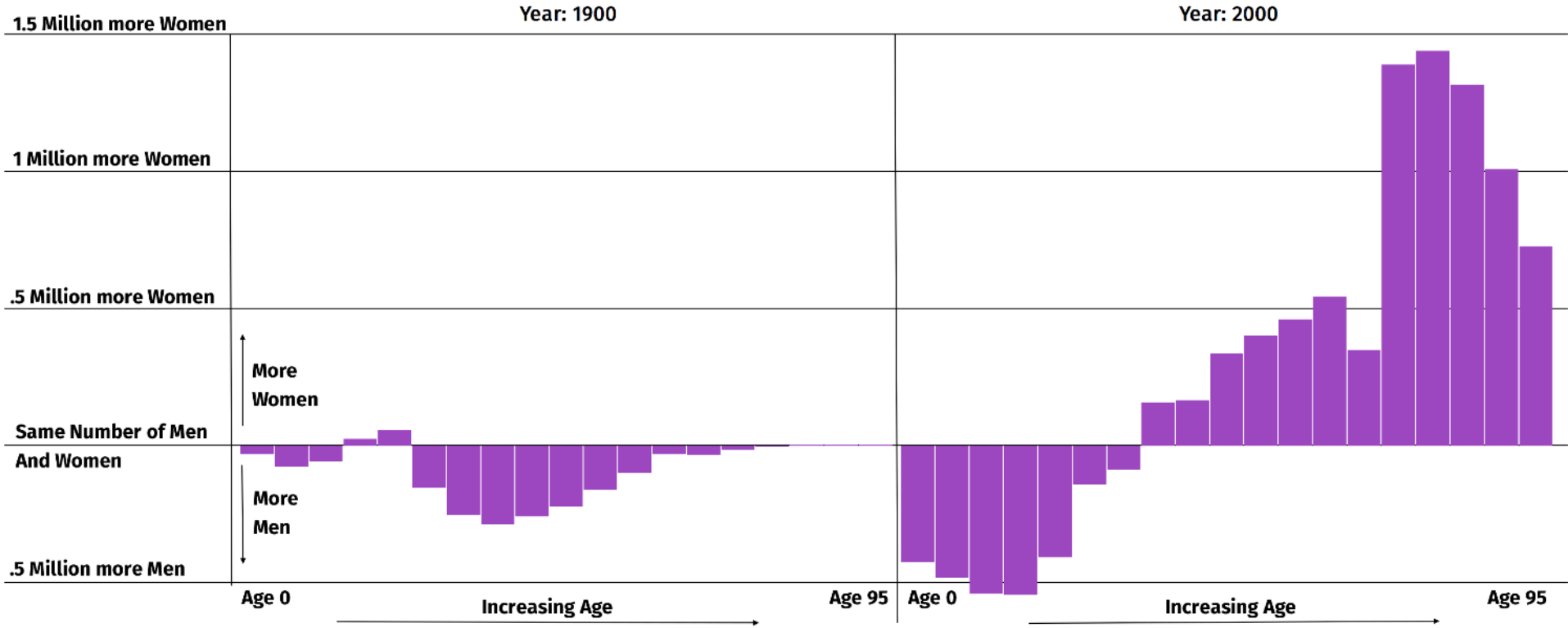
Growth % for each Sex (group) broken down by Age. Color shows details about Sex (group).


Percent Change in Population of USA from 1900 to 2000 by Age and Gender
Age Groups
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+
Sex
Male
Female
Percent Increase In Population
100
90
80
70
60
50
40
30
20
10
0
Greater Increase in Female Population
Greater Increase in Male Population

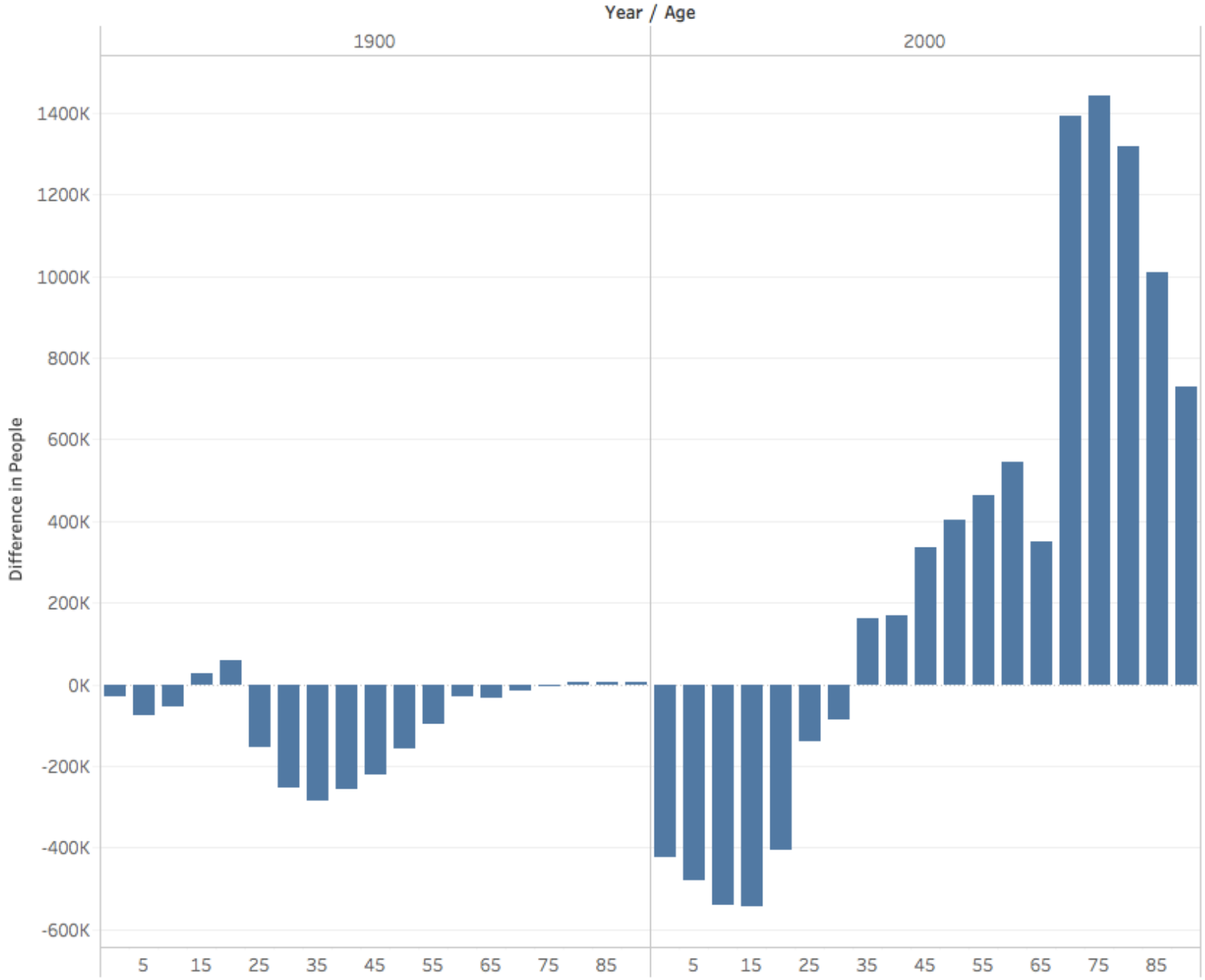

How Fast is the U.S. Population growing?
Age (years)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
20093
48614
132449
265879
440007
640212
887508
1064632
1411981
1648025
2004987
2347737
2665174
3236056
3751061
3801743
4001749
4390483
4588196
15164
44008
127435
268211
454747
672663
916571
1161908
1571038
1868413
2261070
2633883
2918964
3389280
3694038
3774846
4057669
4465783
4619544
1064581
1981156
3221898
4355644
5184855
4804784
5668961
6921268
8911133
10261253
11488578
11635647
10119296
9518507
9324244
9692669
10022524
10069564
9310714
336303
970357
1902638
2912655
3792145
4453623
5123399
6459082
8507934
9925006
11320252
11475182
9659493
9518507
9731315
10237419
10563233
10552146
9735380
Female
Male
Number of People
1990
2000
Year

Sex Ratios

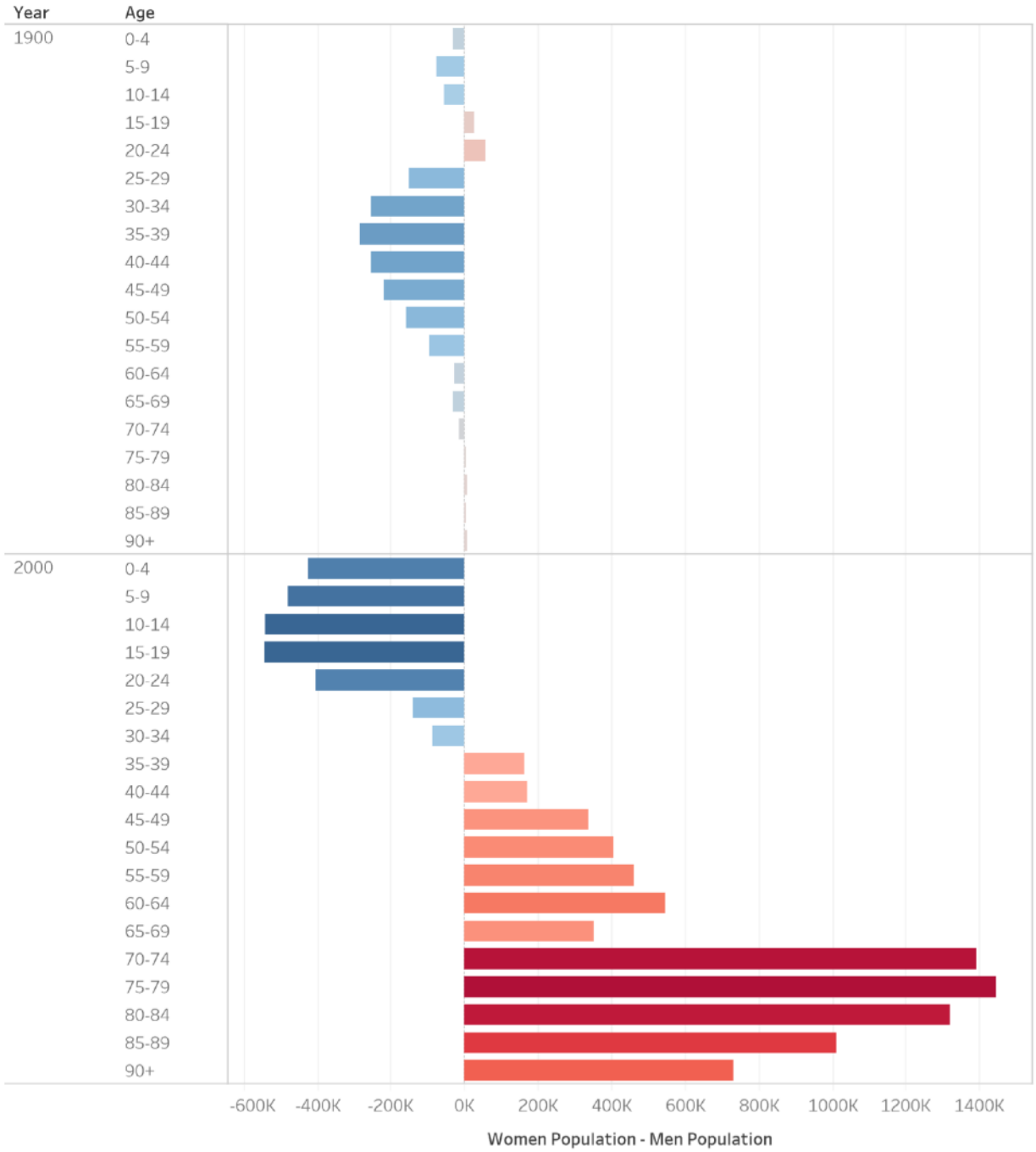
Was there a change in the population balance between men and women from 1900 to 2000?

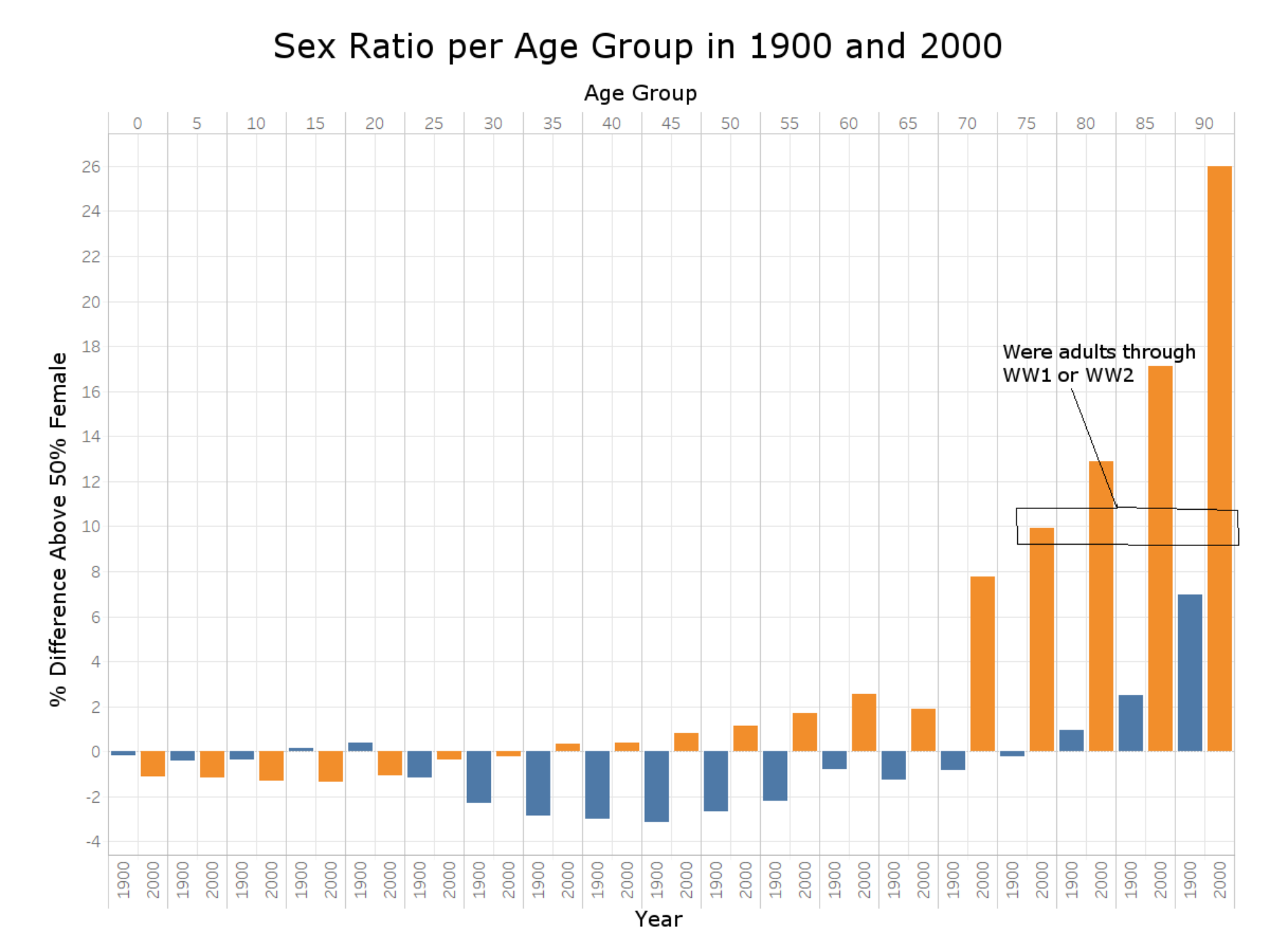


Female surplus in different age groups in year 1900 and 2000

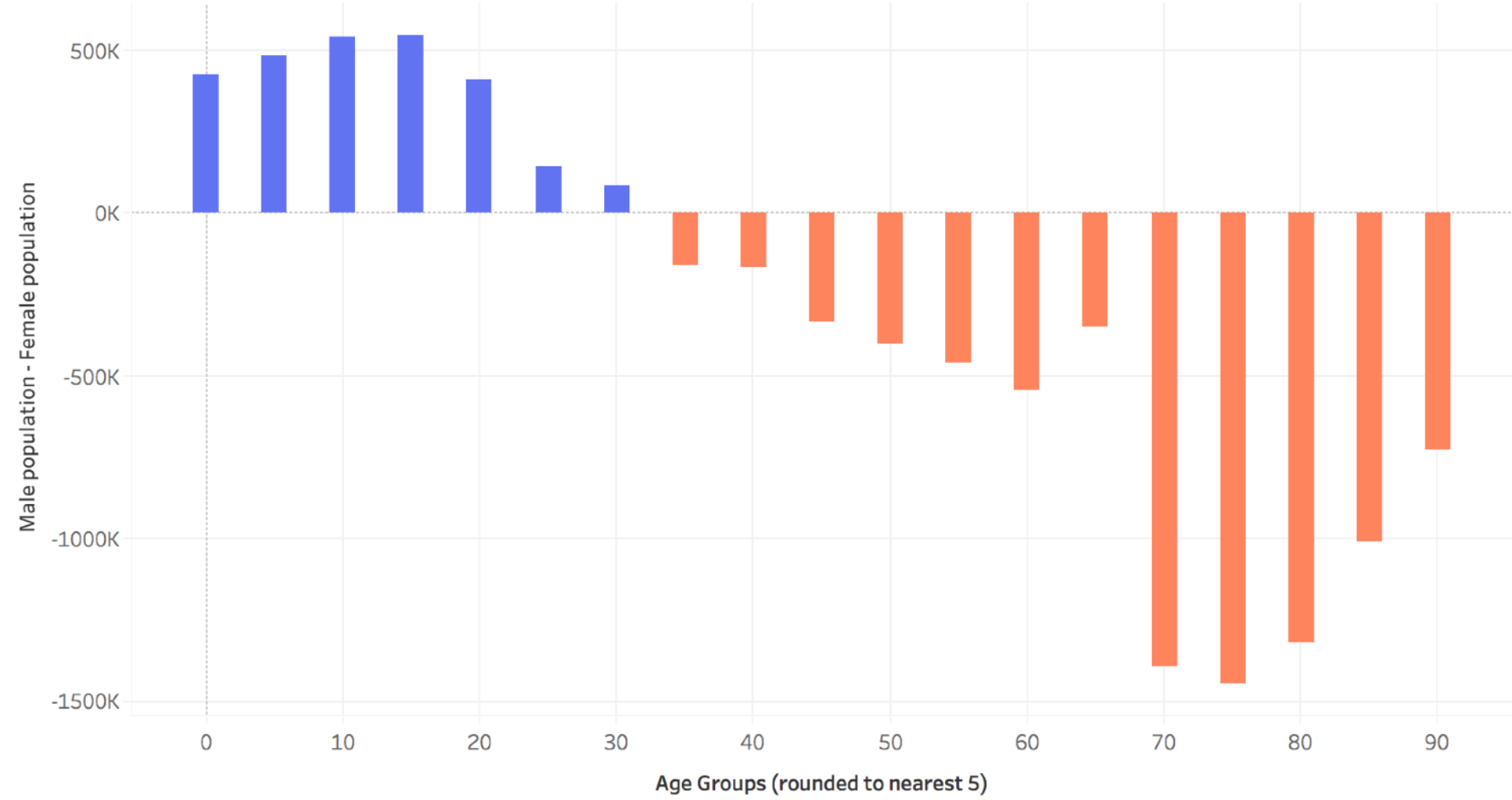


How do the differences in population of women and men change over time?

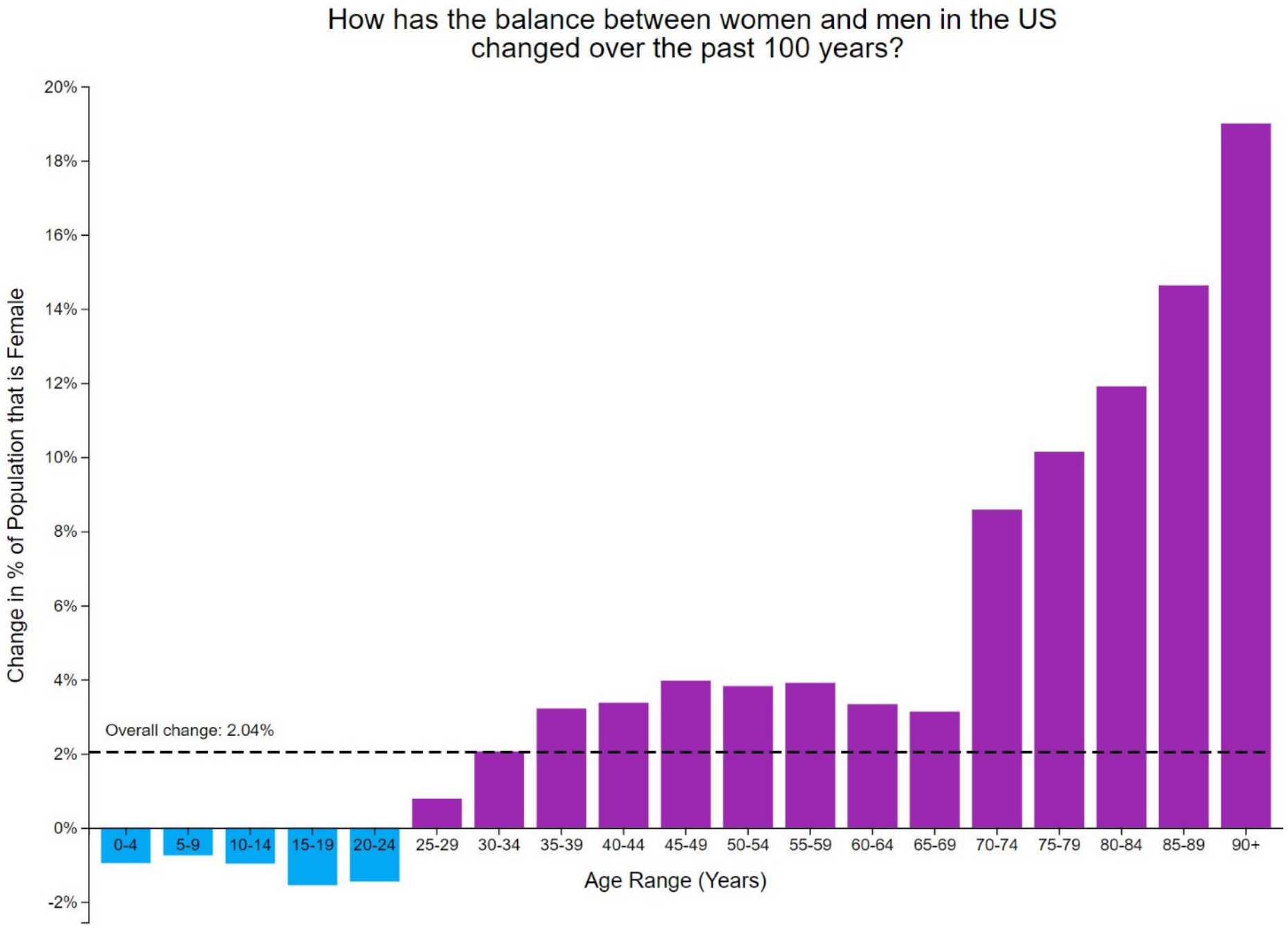



Sex Ratio per Age Group in 1900 and 2000
Age Group
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
% Difference Above 50% Female
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
Were adults through
WW1 or WW2
1900
2000
Year

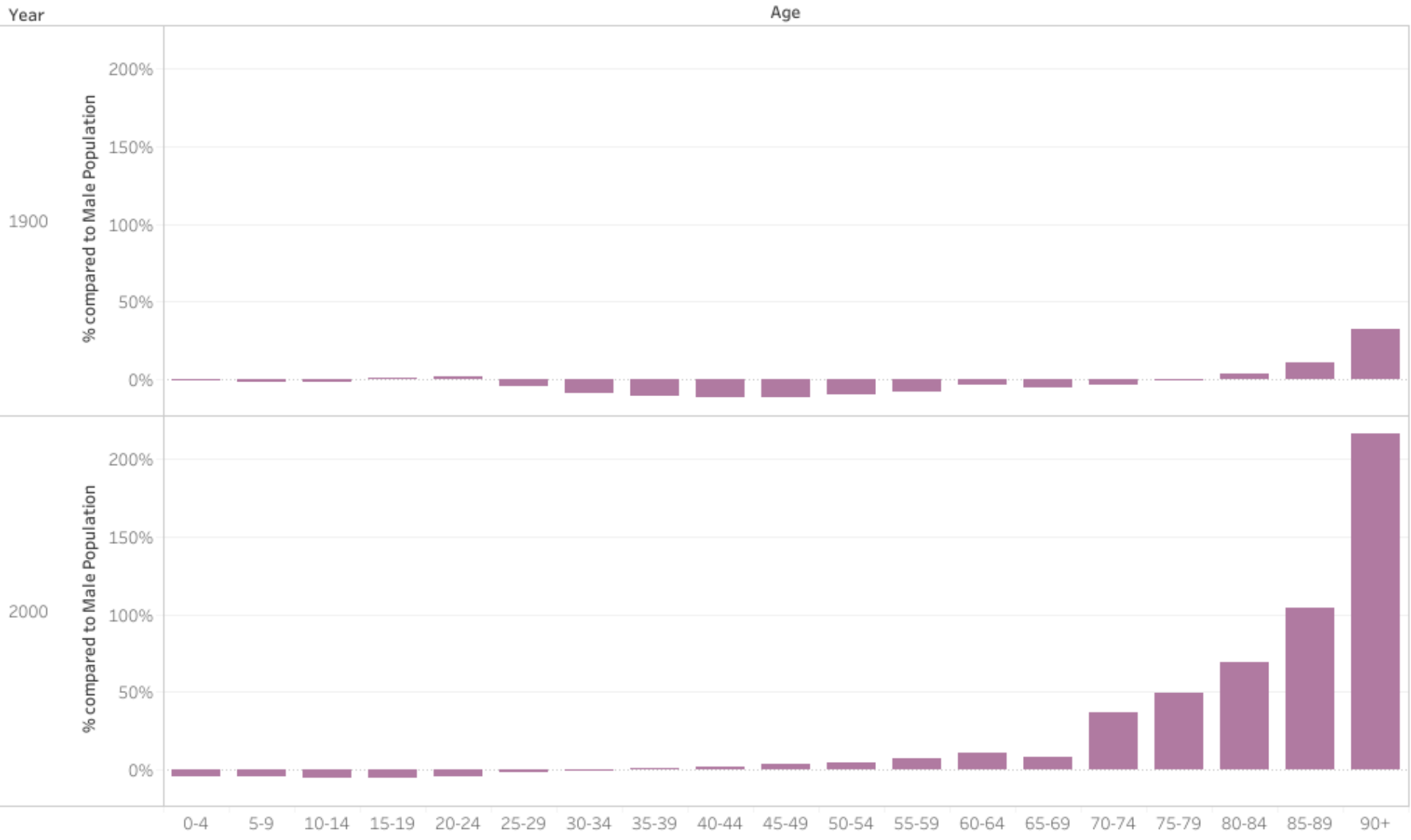
What is the population difference between genders trend across age groups in 2000?

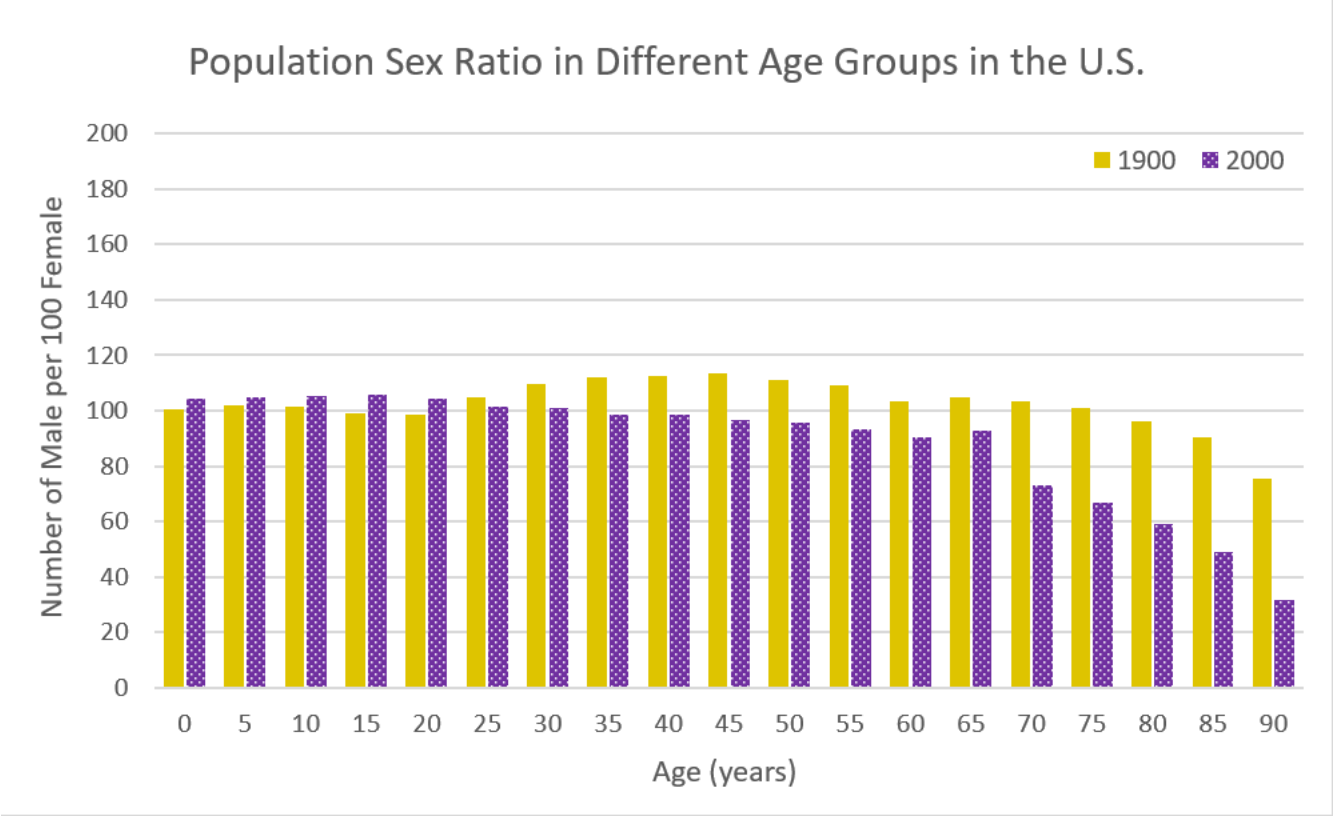


The plot of sum of Difference for Age. Color shows details about Difference.

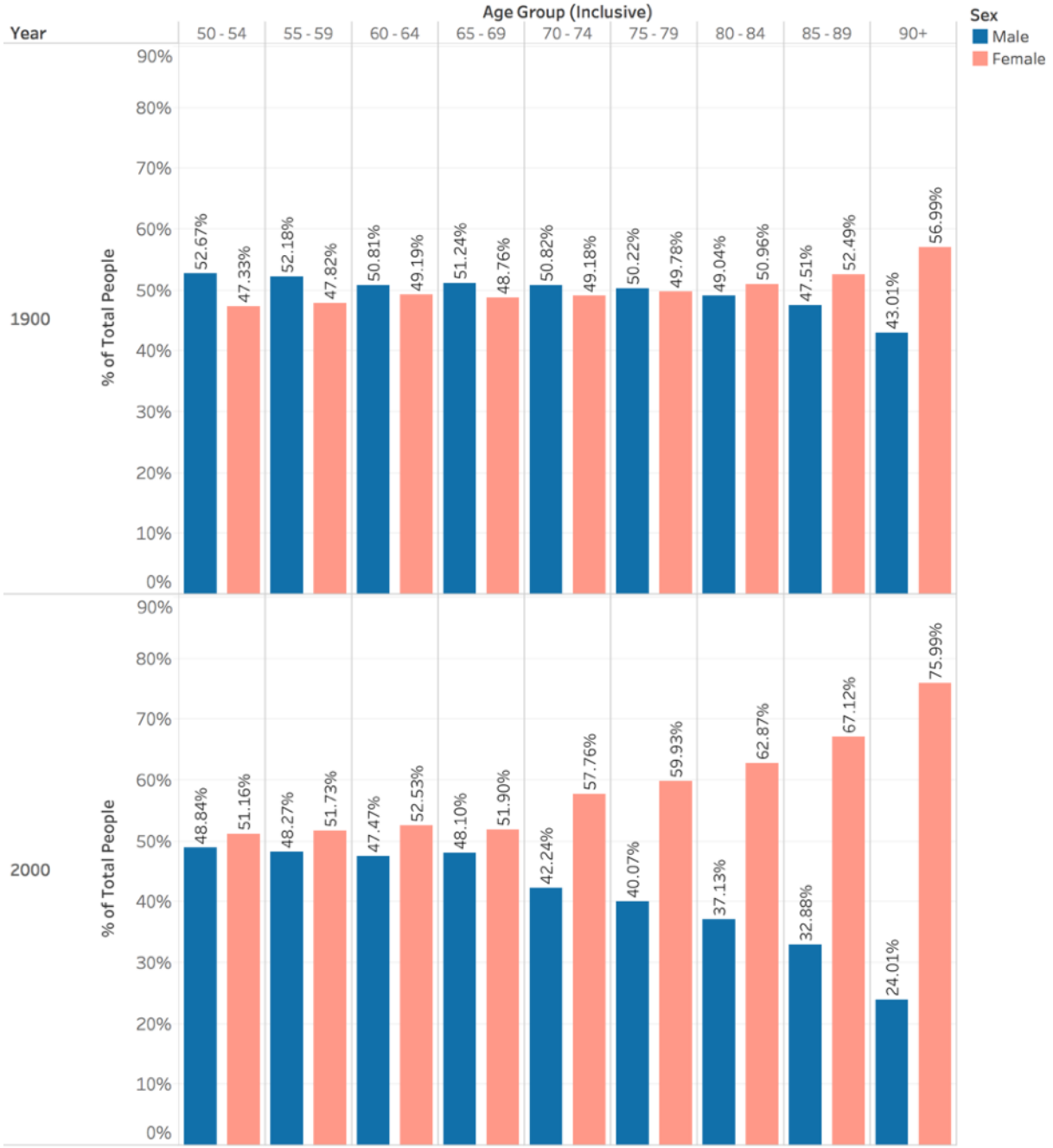

How has the balance between women and men in the US changed over the past 100 years?
Change in % of Population that is Female
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
-2%
Overall change: 2.04%
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+
Age Range (Years)

Is there a relationship between age groups and the percentage of female population compared to male population?




Population Sex Ratio in Different Age Groups in the U.S.
1900
2000
Number of Male per 100 Female
200
180
160
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Age (years)

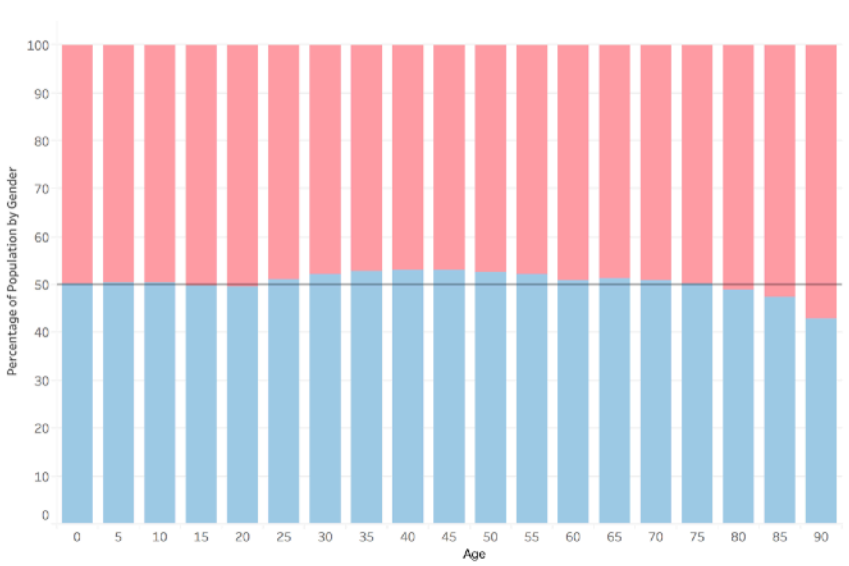
How did male-to-female ratios change between years 1900 and 2000 for USA persons over 50 years of age?



% of Total People represents a percentage of the total population. Each age group defines an inclusive range.

How has the life expectancy of men and women changed between 1900 and 2000?

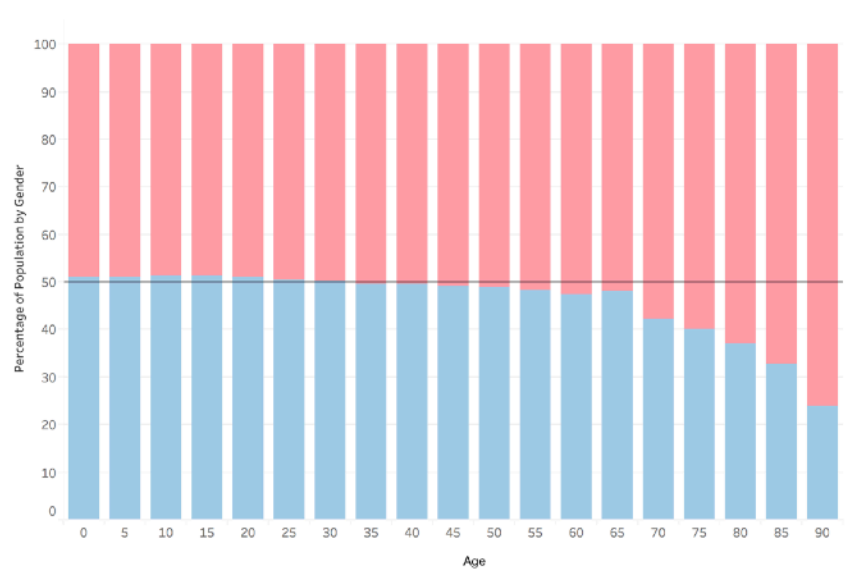
Population Ratio by Age (Year 1900)



Average Life Expectancy
(Year 1900)

Male: 24.18
Female: 23.63

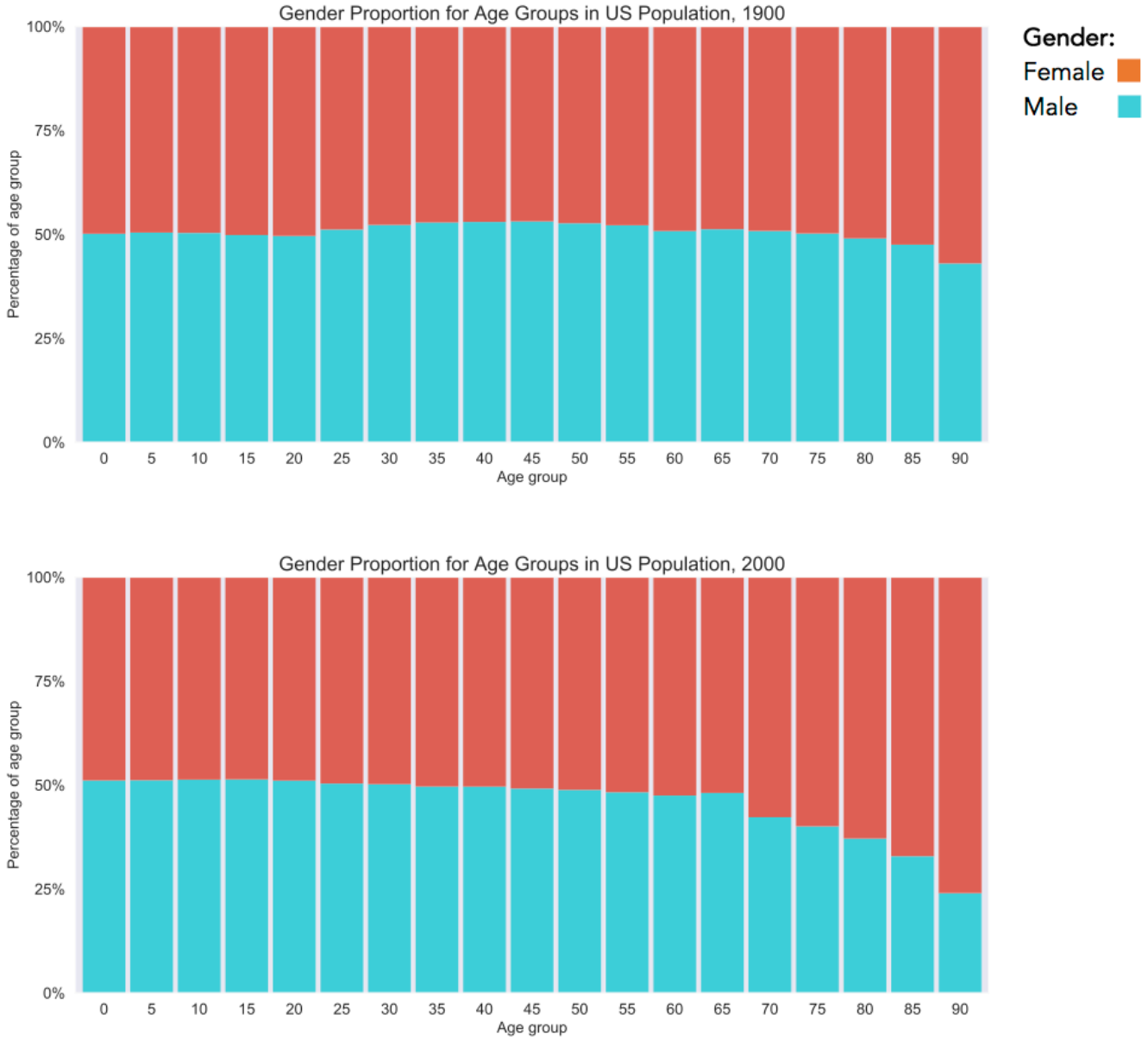
Population Ratio by Age (Year 2000)



Average Life Expectancy
(Year 2000)

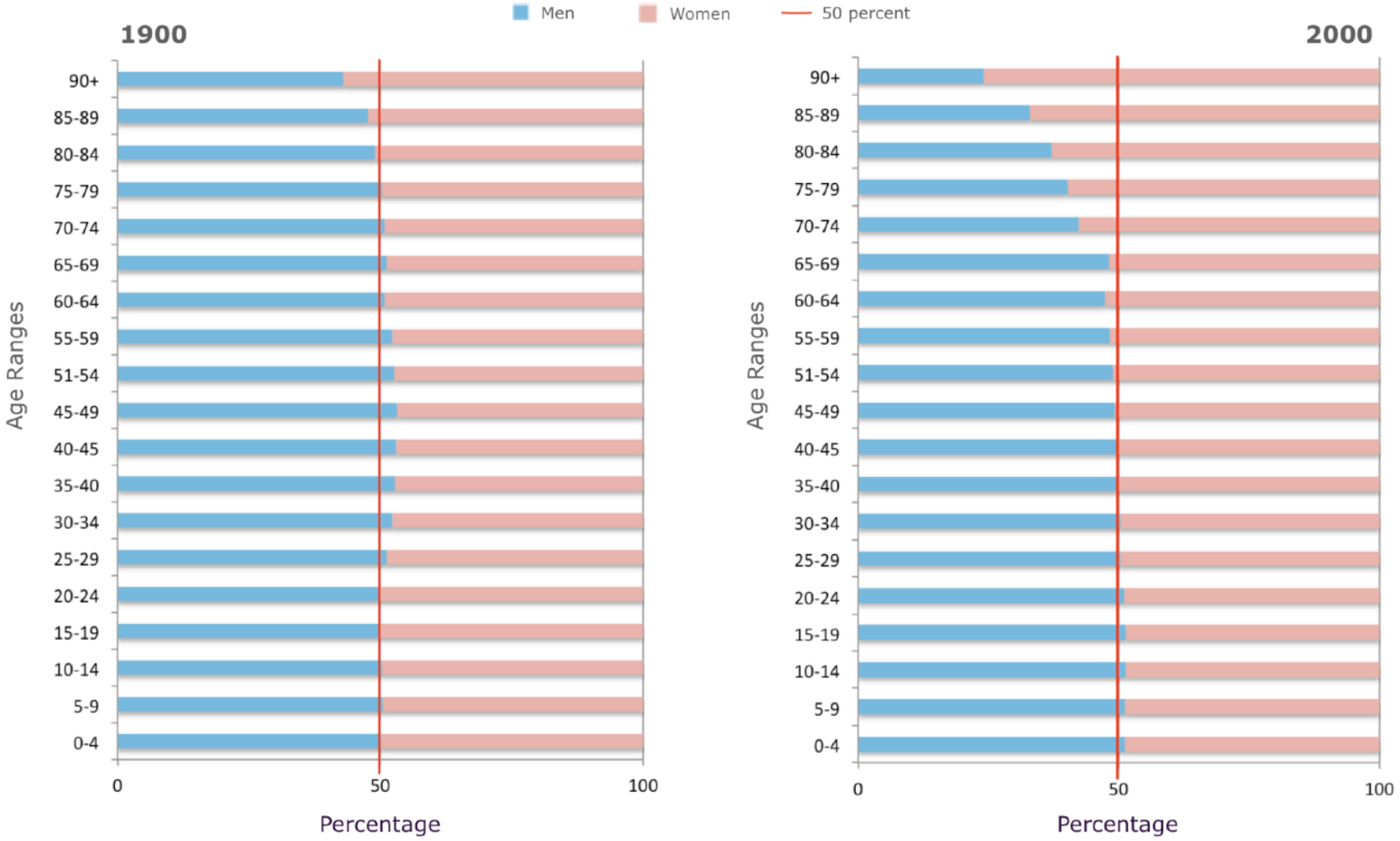
Male: 32.51
Female: 35.13

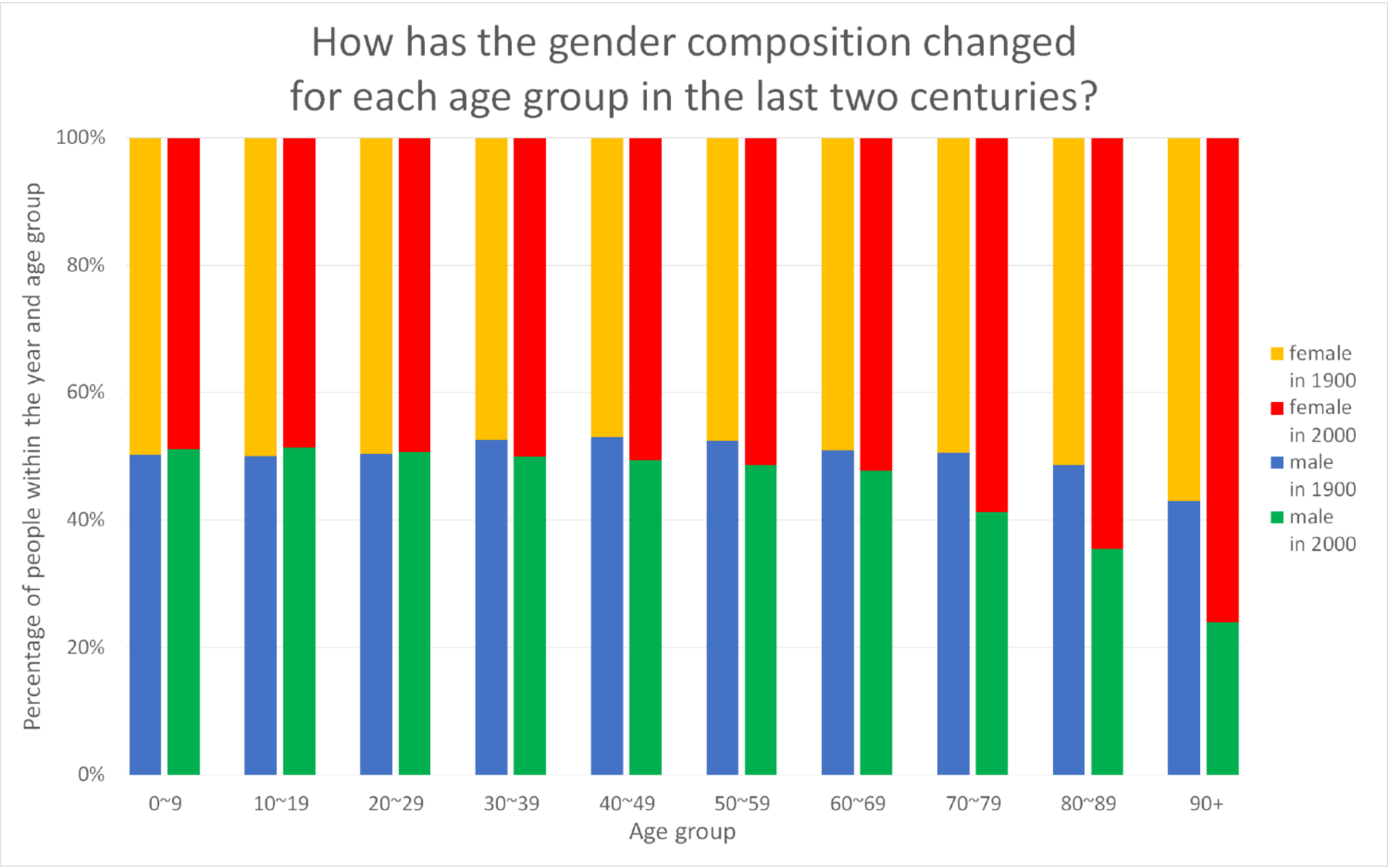
How Has The US Population Gender Breakdown Changed Between Two Centuries?



Is it really 50/50?

A look at the ratio of men to women in 1900 and 2000.

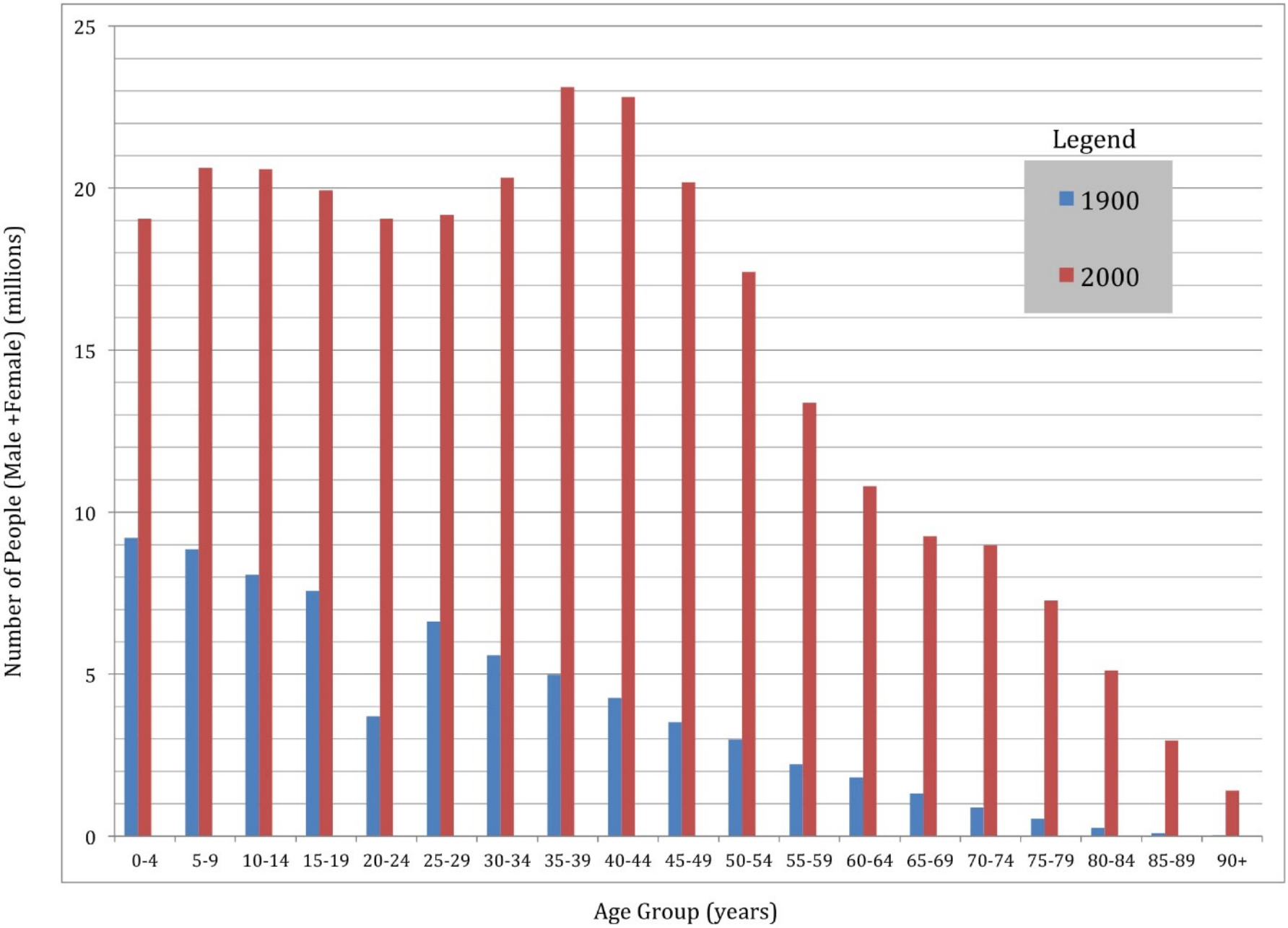


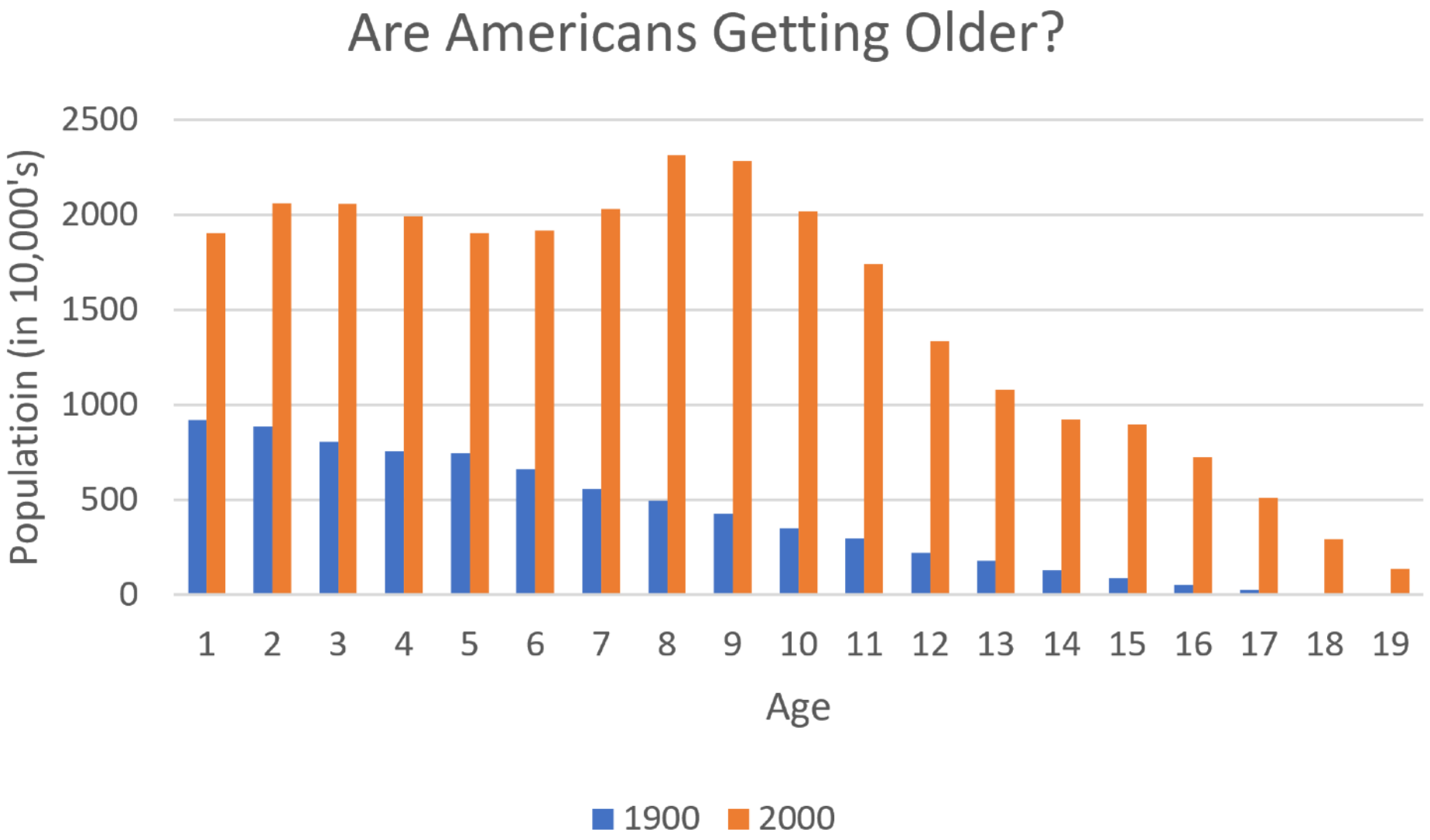

How has the gender composition changed for each age group in the last two centuries?
Percentage of people within the year and age group
100%
80%
60%
40%
20%
0%
0~9
10~19
20~29
30~39
40~49
50~59
60~69
70~79
80~89
90+
Age group
female in 1900
female in 2000
male in 1900
male in 2000

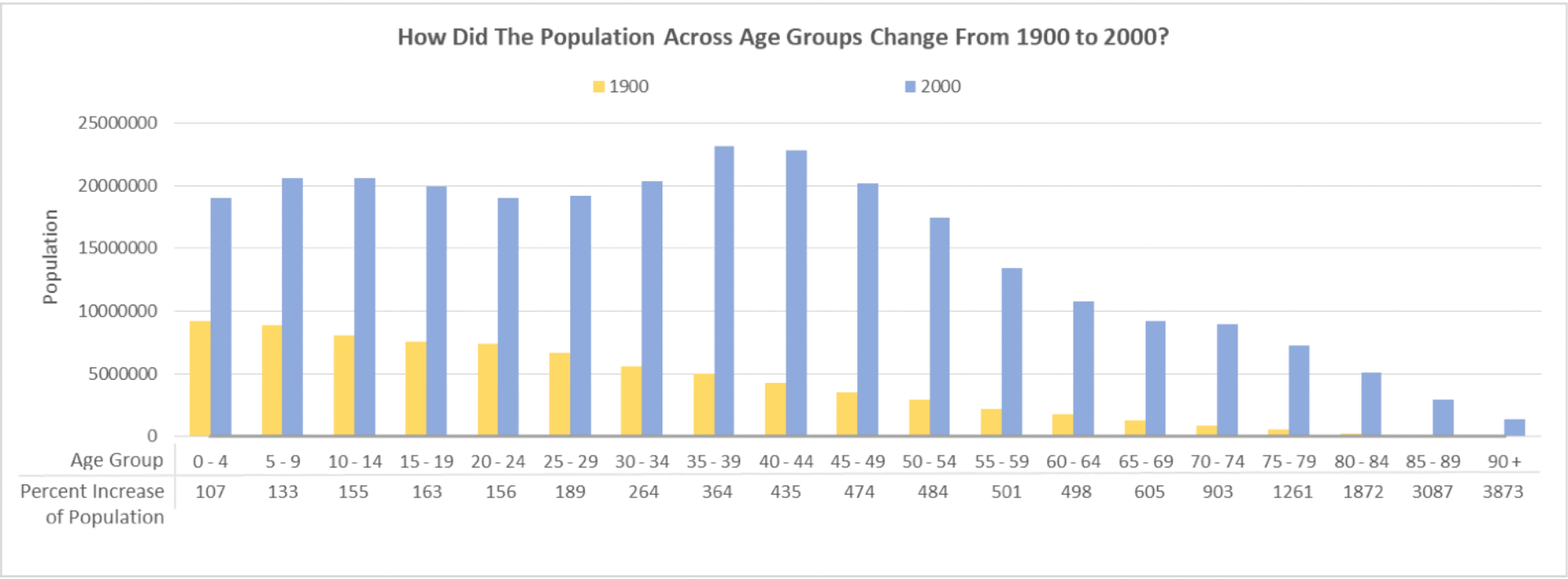
Age, Year

Population Count

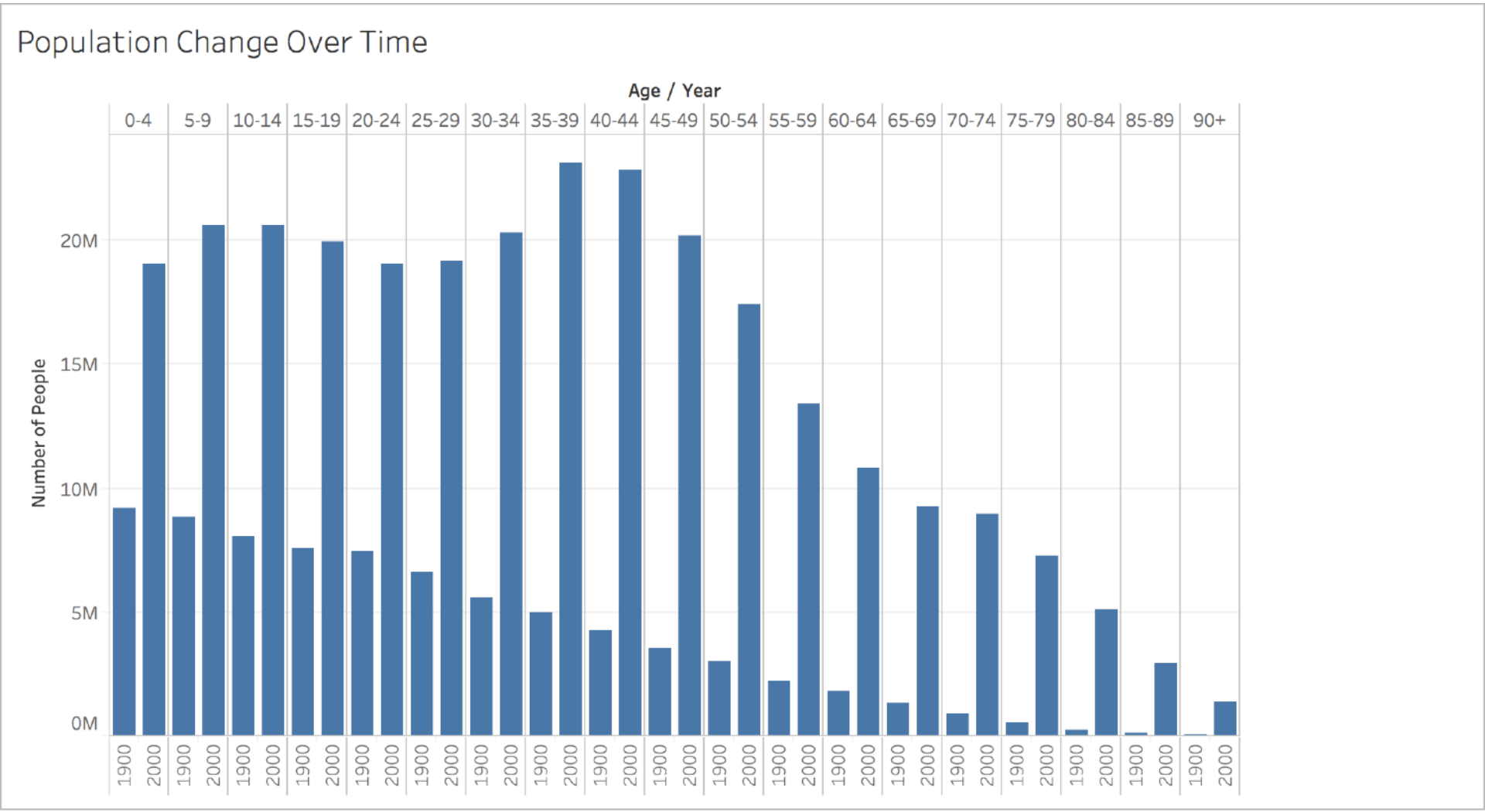
How does the number of people in each age group (binned into 5-year segments) differ from 1900 to 2000?

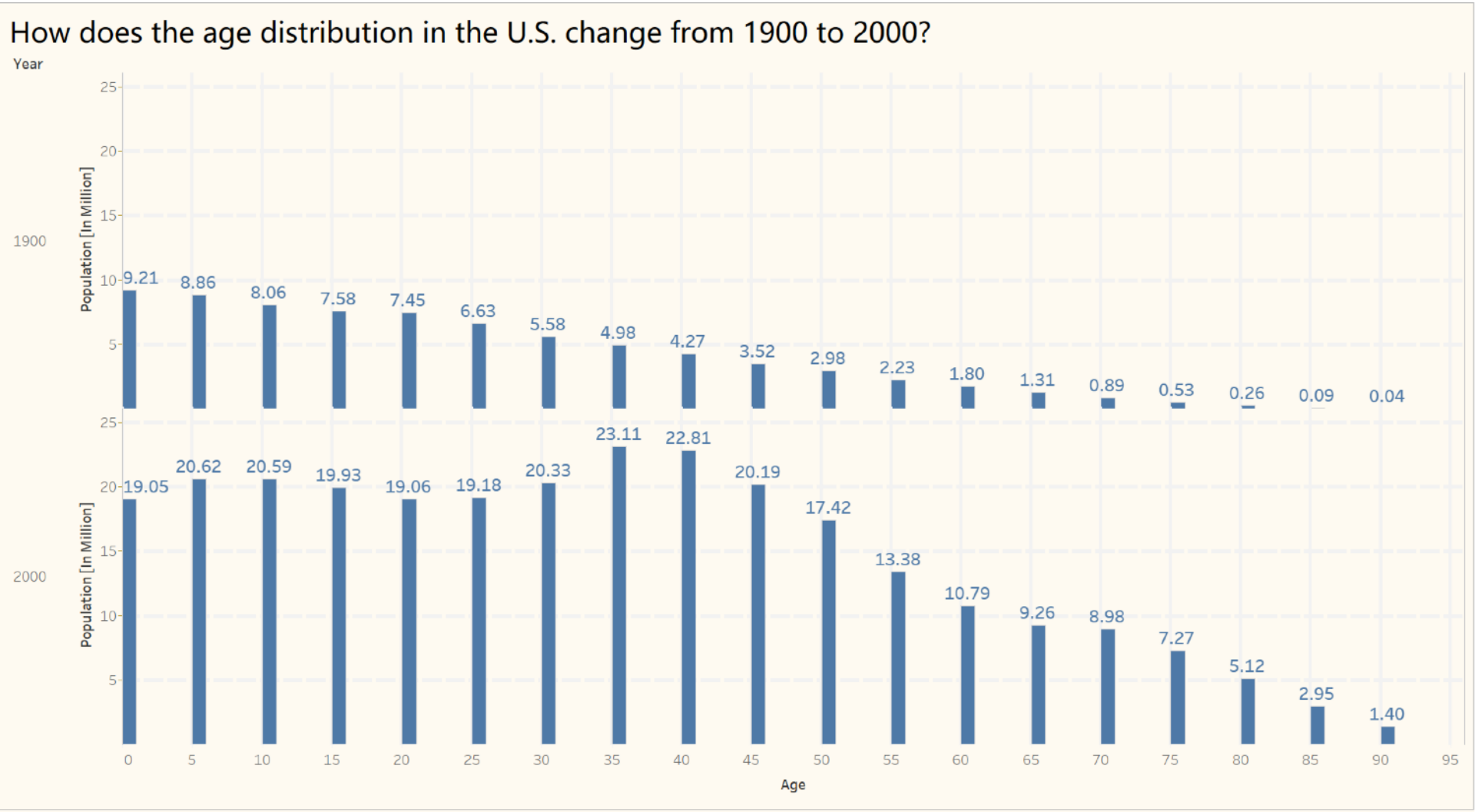


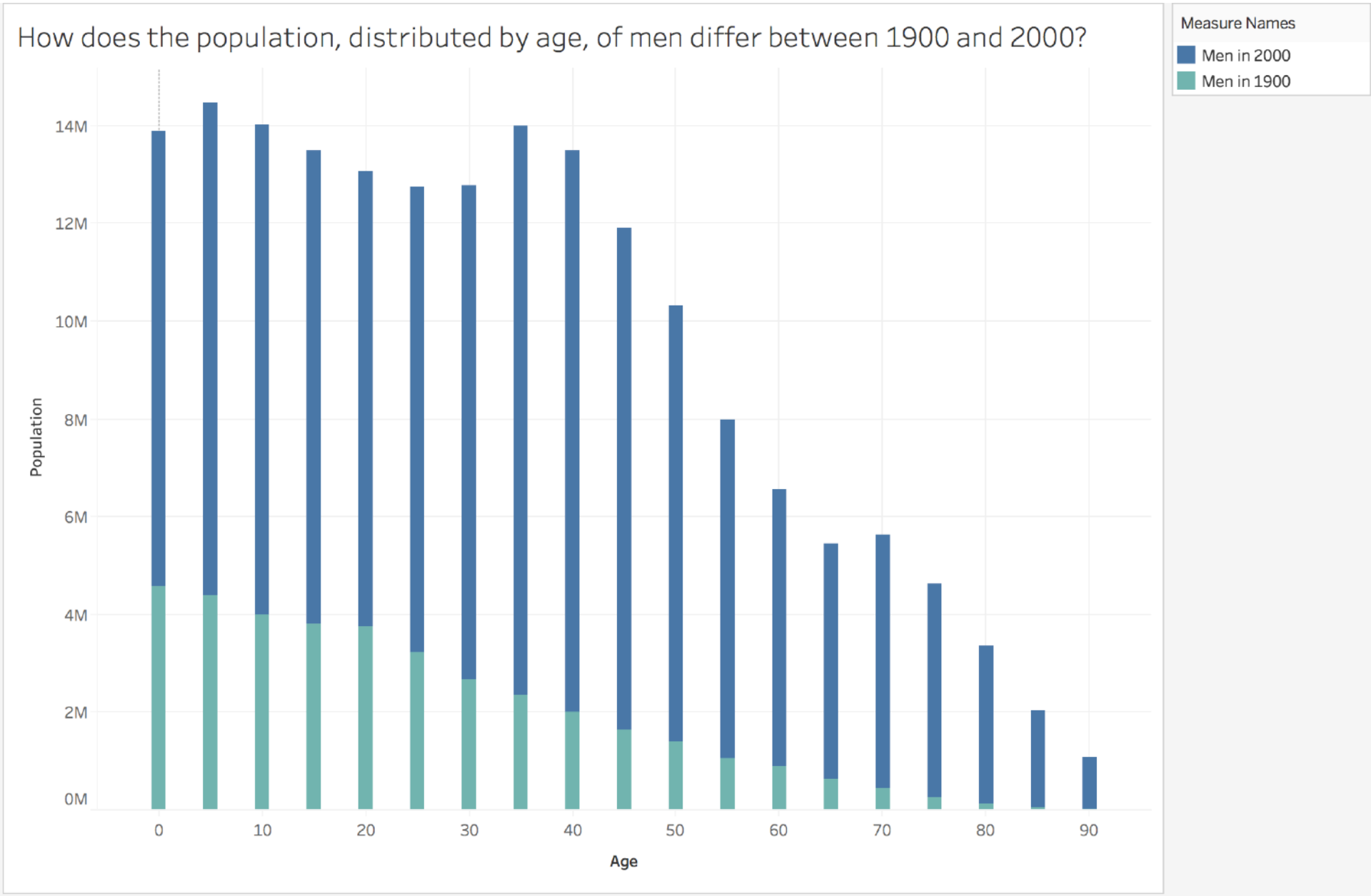

Are Americans Getting Older?
Populatioin (in 10,000's)
2500
2000
1500
1000
500
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Age
1900
2000



Age Group	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	65 - 69	70 - 74	75 - 79	80 - 84	85 - 89	90 +
Percent Increase of Population	107	133	155	163	156	189	264	364	435	474	484	501	498	605	903	1261	1872	3087	3873

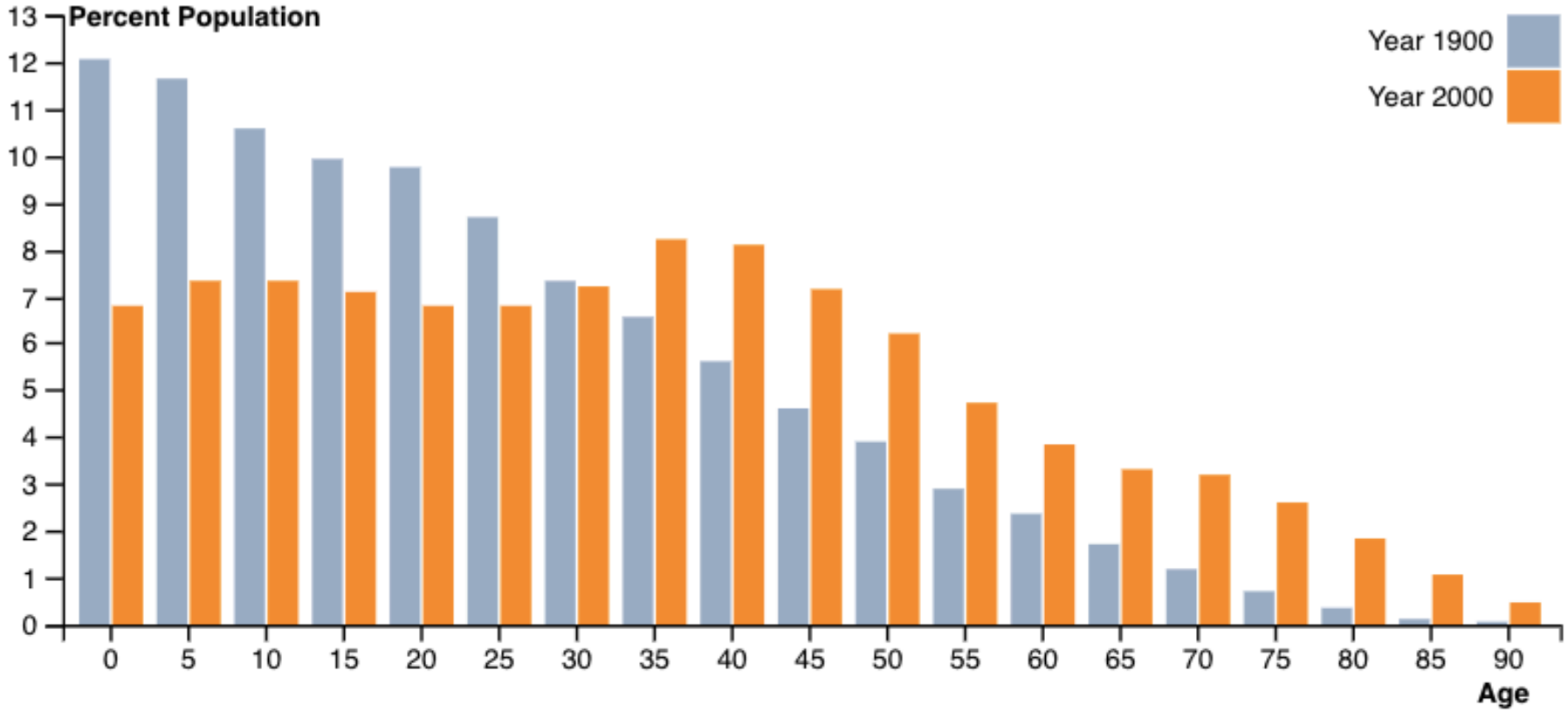

Population Change Over Time
Age / Year
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+
Number of People
20M
15M
10M
5M
0M
1900
2000

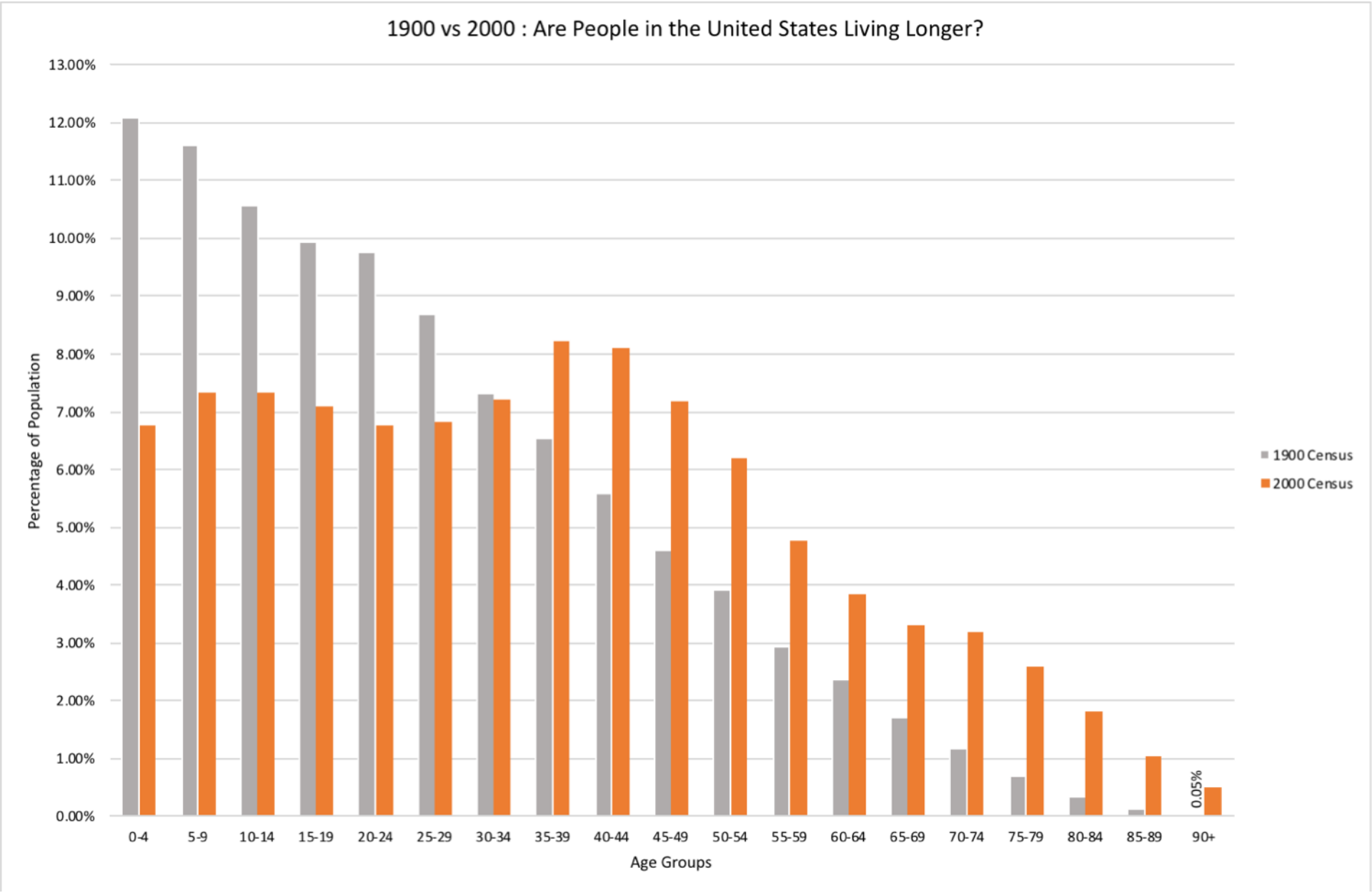

How does the age distribution in the U.S. change from 1900 to 2000?
Year
1900
2000
Population [In Million]
Population [In Million]
9.21
8.86
8.06
7.58
7.45
6.63
5.58
4.98
4.27
3.52
2.98
2.23
1.80
1.31
0.89
0.53
0.26
0.09
0.04
19.05
20.62
20.59
19.93
19.06
19.18
20.33
23.11
22.81
20.19
17.42
13.38
10.79
9.26
8.98
7.27
5.12
2.95
1.40
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Age

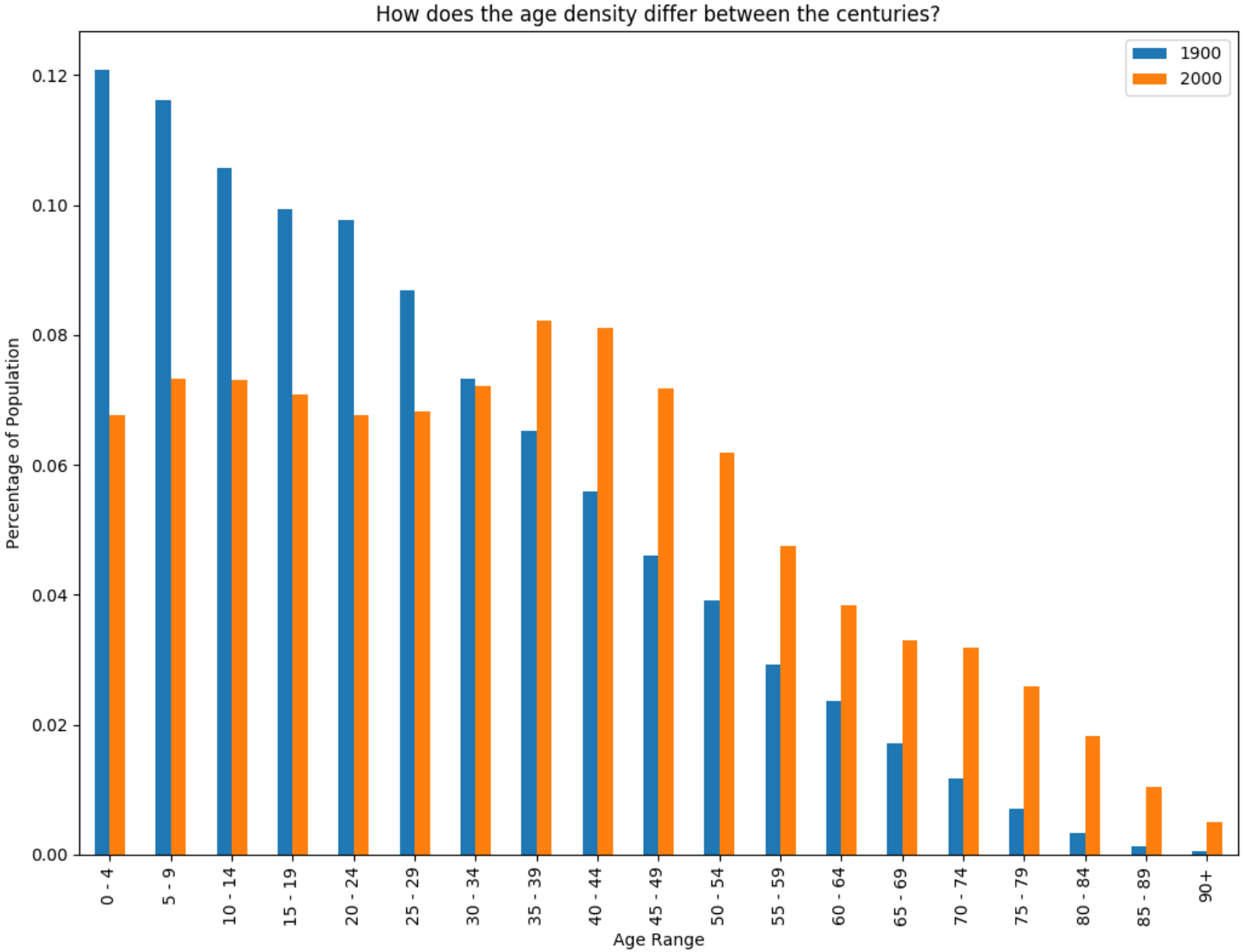

How does the population, distributed by age, of men differ between 1900 and 2000?
Measure Names
Men in 2000
Men in 1900
Population
14M
12M
10M
8M
6M
4M
2M
0M
0
10
20
30
40
50
60
70
80
90
Age

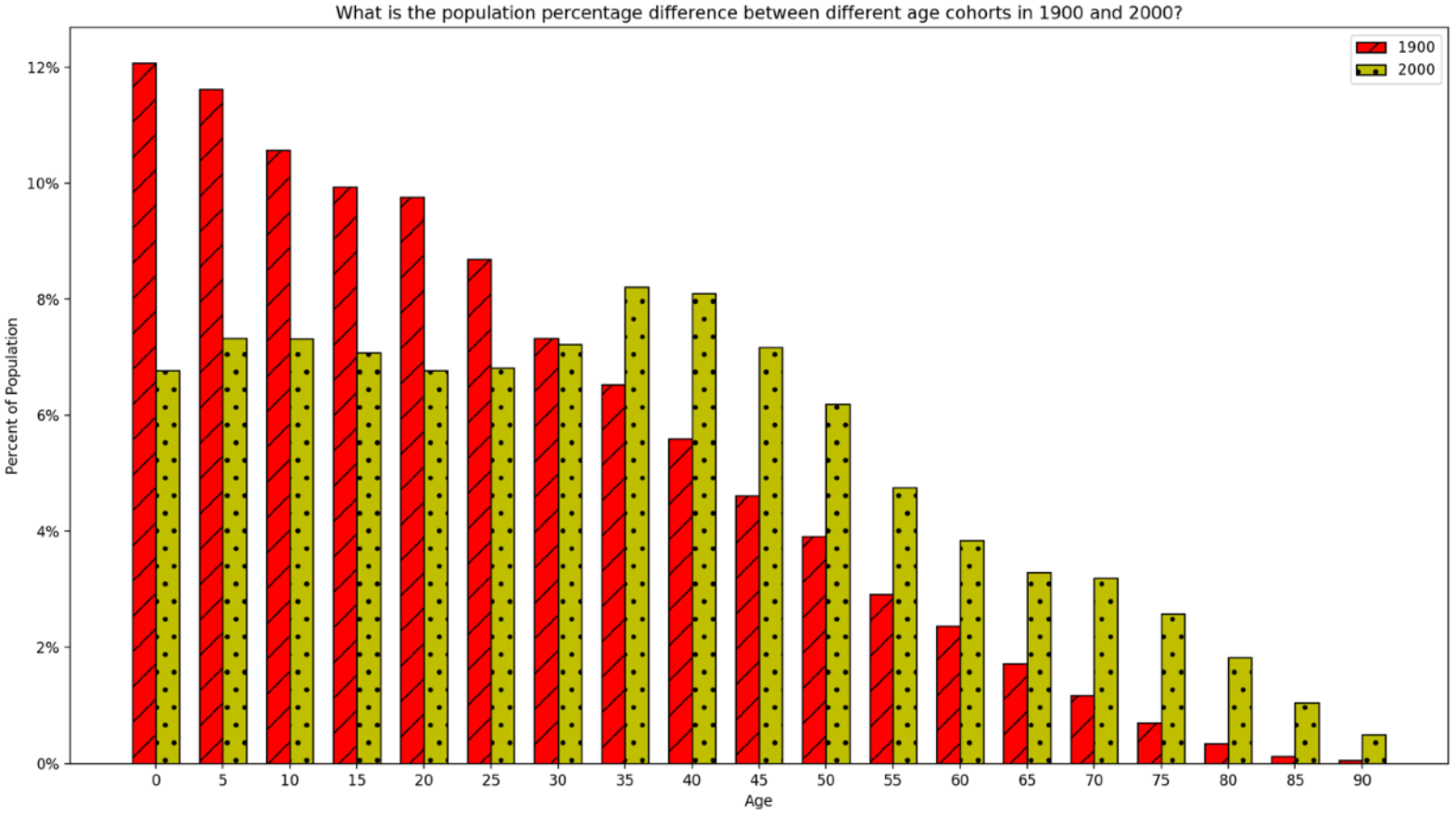
Population Percentage

Age distribution comparison between 1900 and 2000.

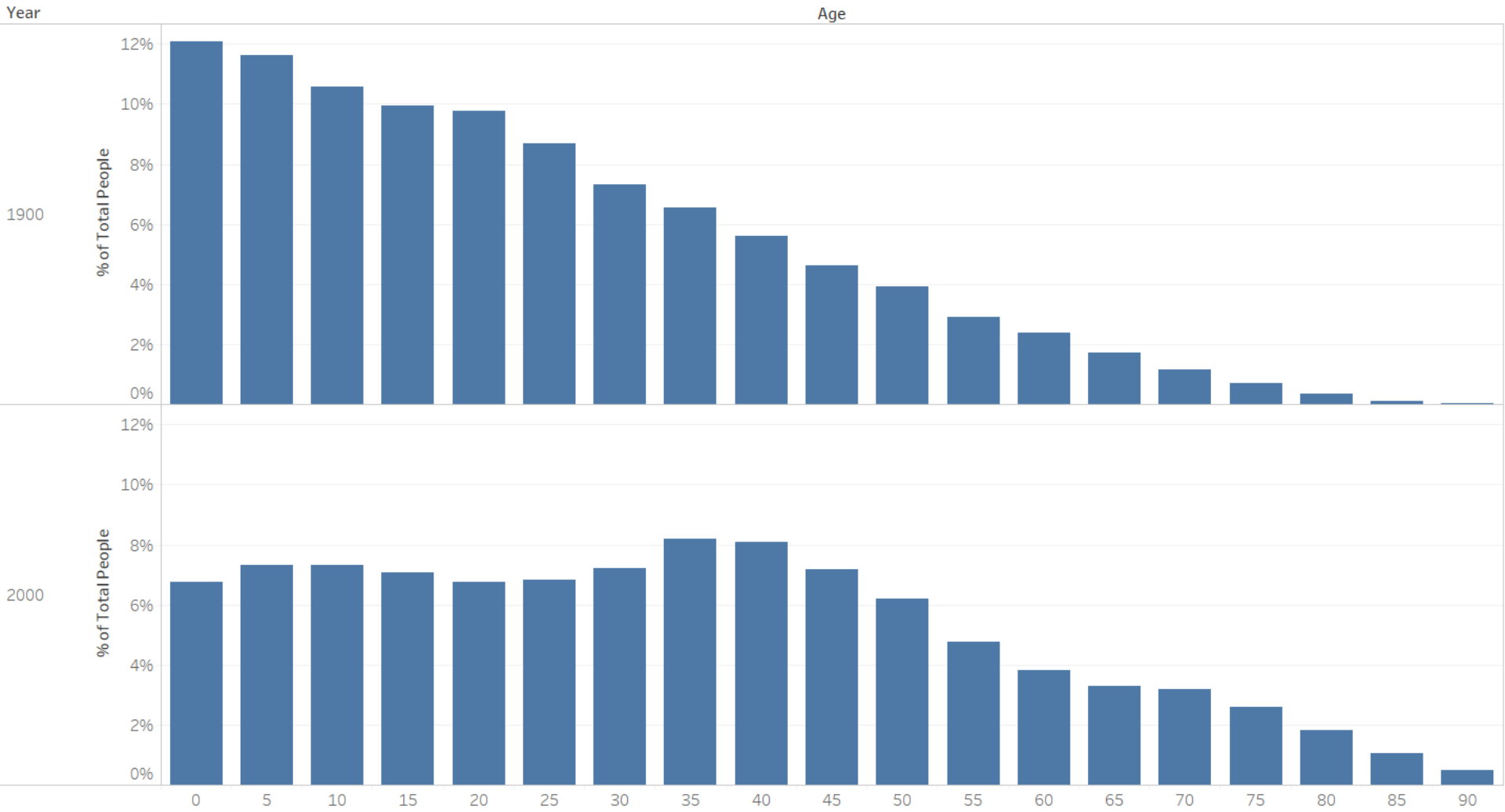


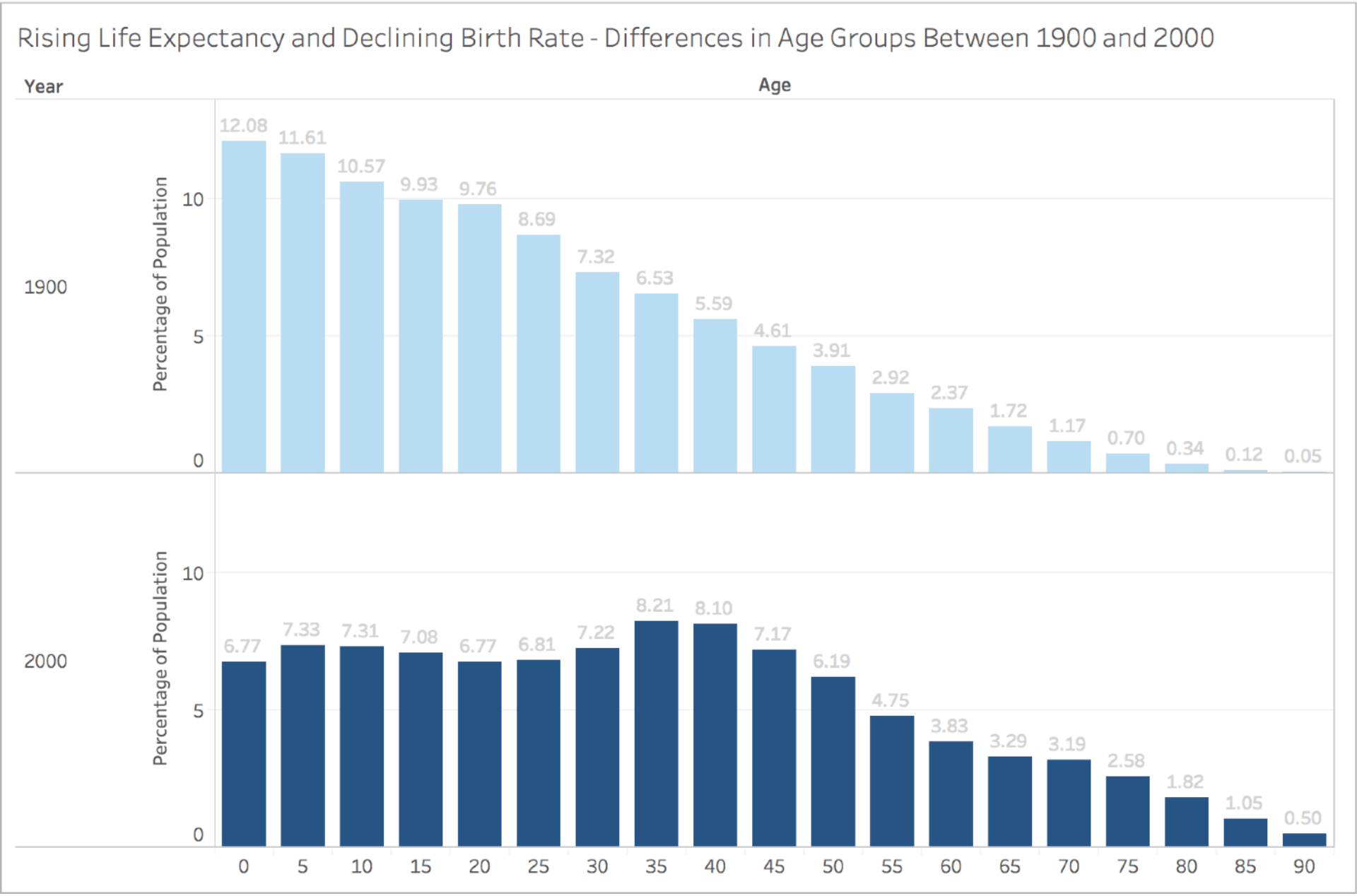

1900 vs 2000 : Are People in the United States Living Longer?
13.00%
12.00%
11.00%
10.00%
9.00%
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Percentage of Population
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+
0.05%
Age Groups
1900 Census
2000 Census

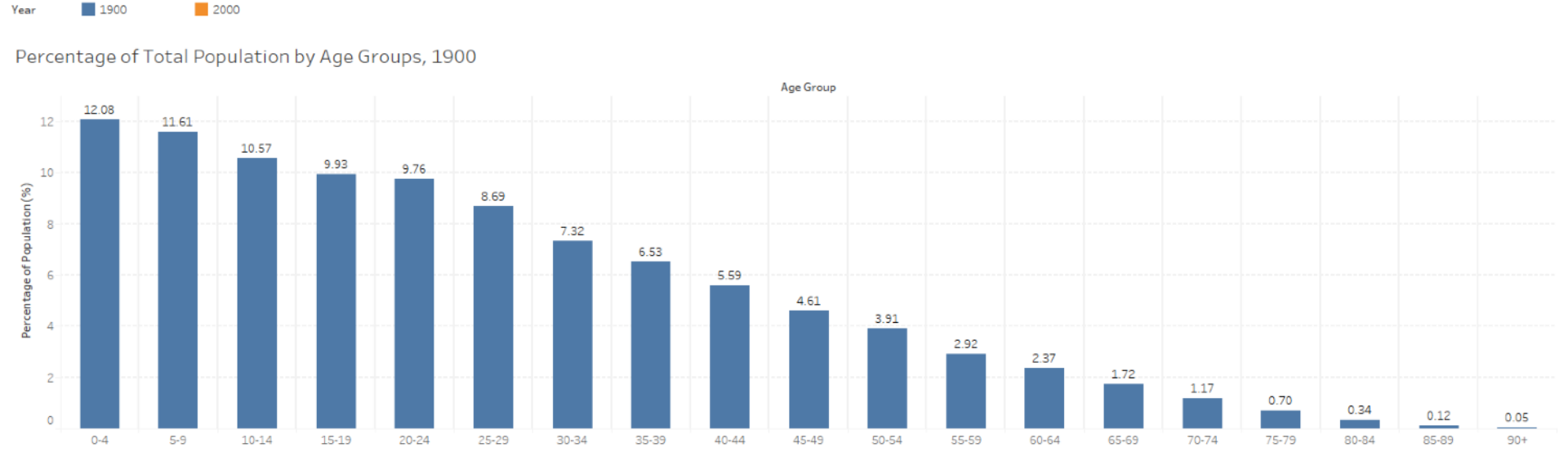

How does the age density differ between the centuries?
1900
2000
Percentage of Population
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0 - 4
5 - 9
10 - 14
15 - 19
20 - 24
25 - 29
30 - 34
35 - 39
40 - 44
45 - 49
50 - 54
55 - 59
60 - 64
65 - 69
70 - 74
75 - 79
80 - 84
85 - 89
90+
Age Range

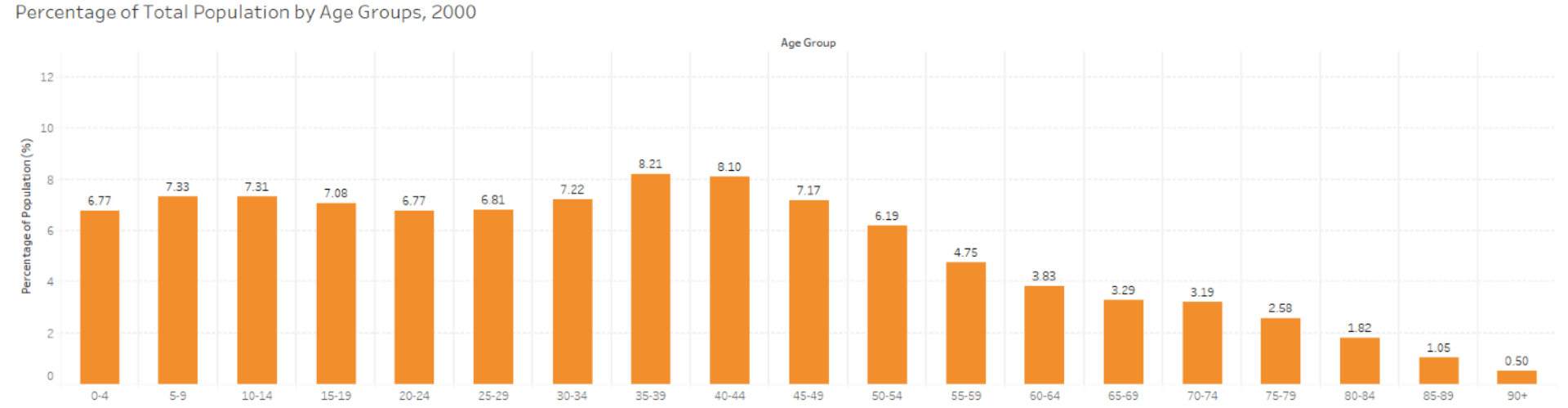

What is the population percentage difference between different age cohorts in 1900 and 2000?
1900
2000
12%
10%
8%
6%
4%
2%
0%
Percent of Population
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Age

How Did Developments in the 20th Century Affect American Age Demographics?

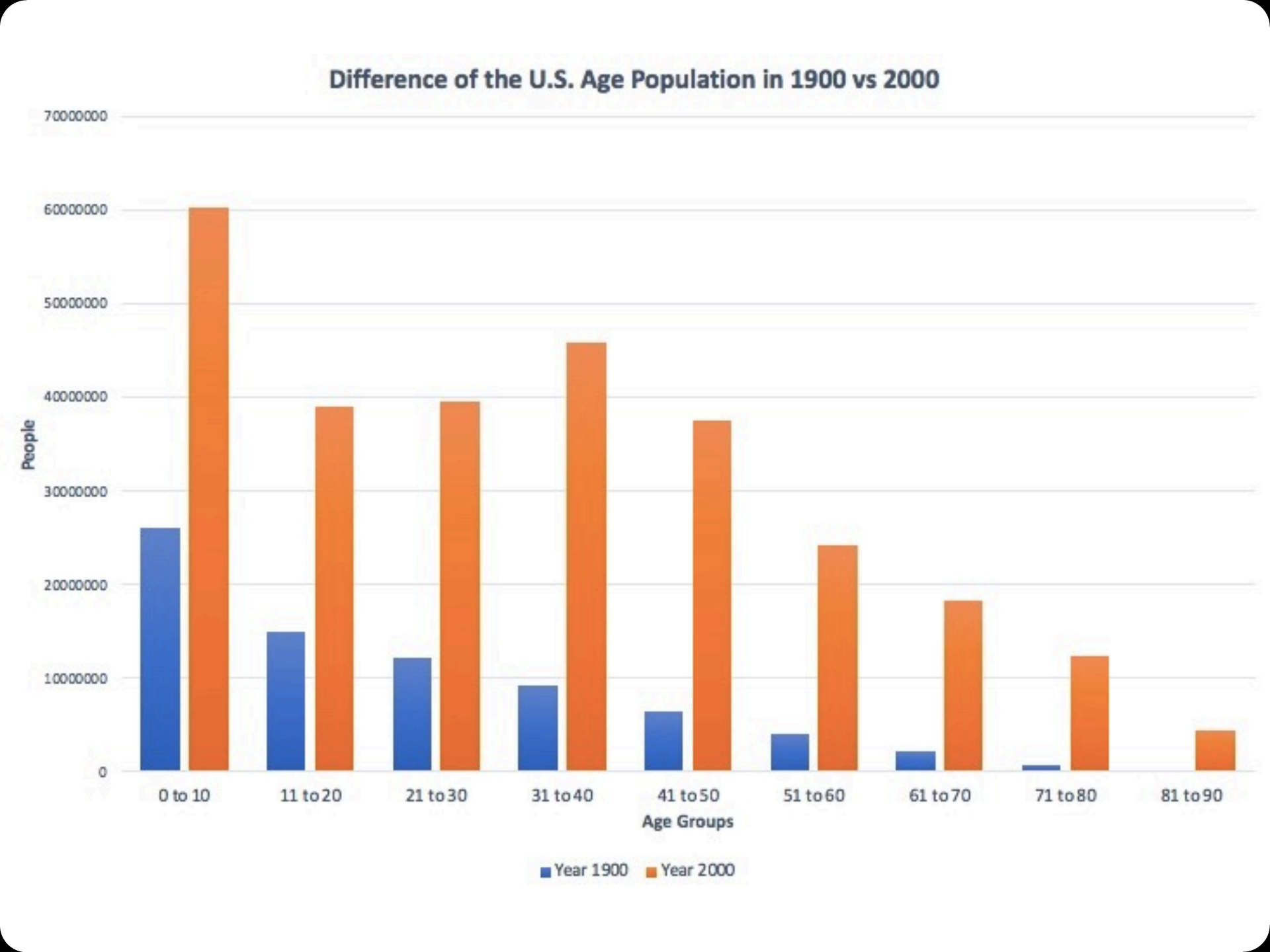


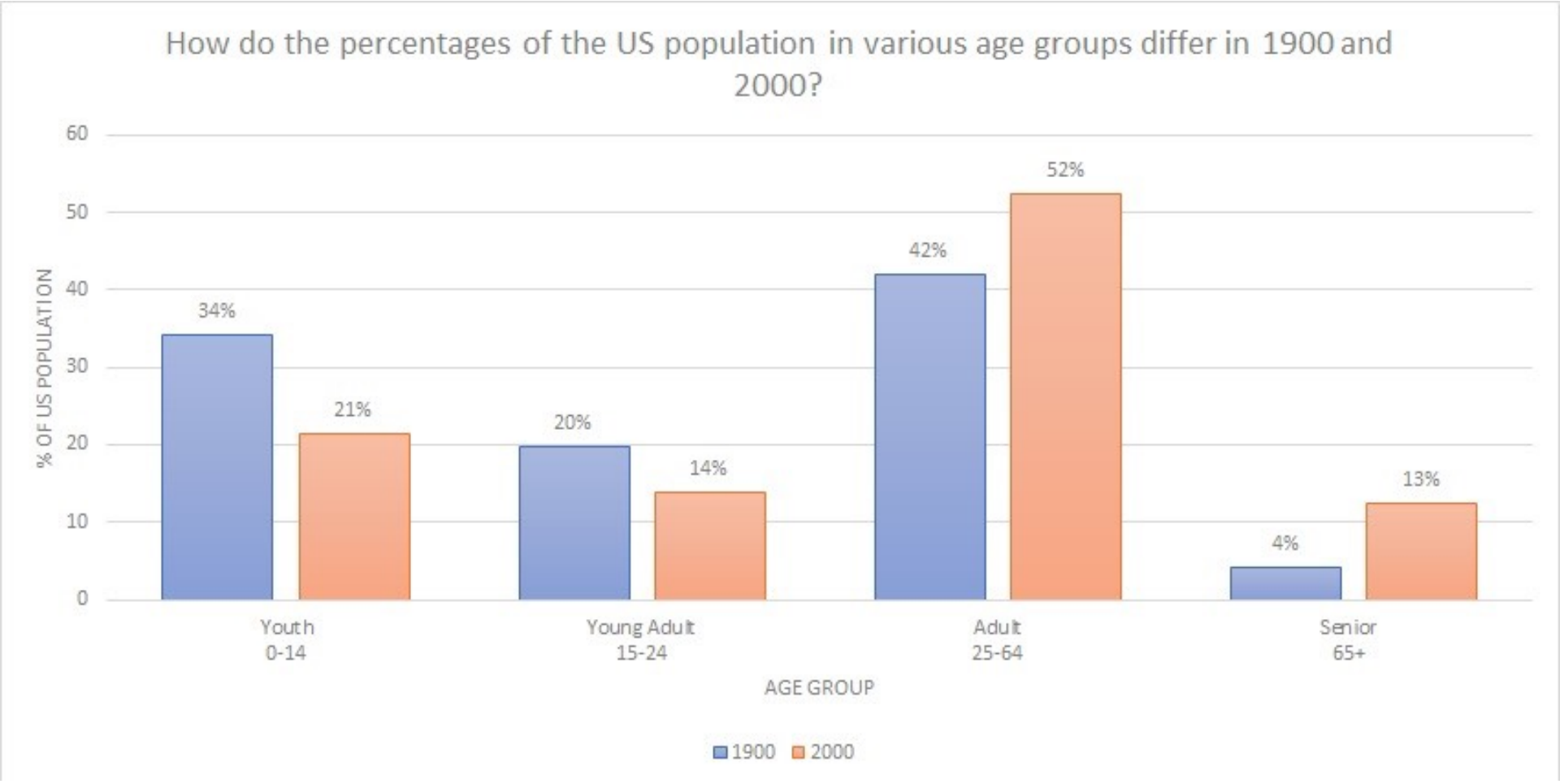

Rising Life Expectancy and Declining Birth Rate - Differences in Age Groups Between 1900 and 2000
Year
Age
1900
Percentage of Population
0
5
10
12.08
11.61
10.57
9.93
9.76
8.69
7.32
6.53
5.59
4.61
3.91
2.92
2.37
1.72
1.17
0.70
0.34
0.12
0.05
2000
Percentage of Population
0
5
10
6.77
7.33
7.31
7.08
6.77
6.81
7.22
8.21
8.10
7.17
6.19
4.75
3.83
3.29
3.19
2.58
1.82
1.05
0.50
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90


Year
1900
2000
Percentage of Total Population by Age Groups, 1900
Age Group
Percentage of Population (%)
0
2
4
6
8
10
12
12.08
11.61
10.57
9.93
9.76
8.69
7.32
6.53
5.59
4.61
3.91
2.92
2.37
1.72
1.17
0.70
0.34
0.12
0.05
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+

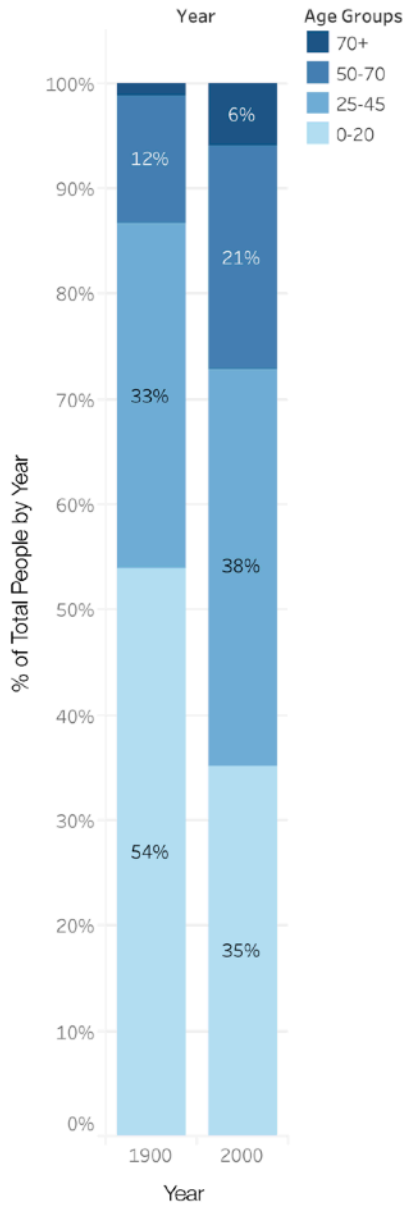

Percentage of Total Population by Age Groups, 2000
Age Group
Percentage of Population (%)
0
2
4
6
8
10
12
6.77
7.33
7.31
7.08
6.77
6.81
7.22
8.21
8.10
7.17
6.19
4.75
3.83
3.29
3.19
2.58
1.82
1.05
0.50
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+

Age Binning

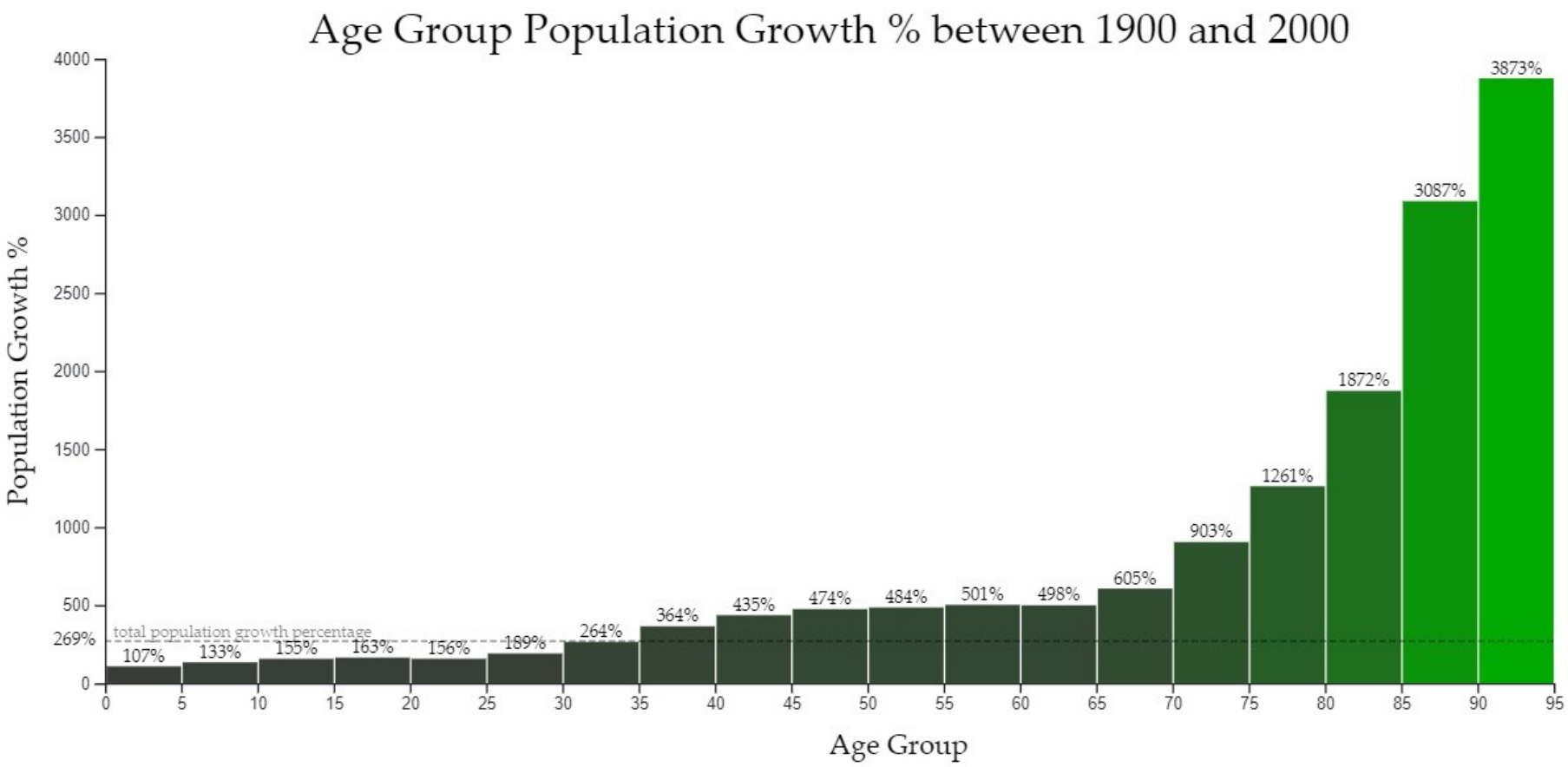

Difference of the U.S. Age Population in 1900 vs 2000
70000000
60000000
50000000
40000000
30000000
20000000
10000000
0
People
0 to 10
11 to 20
21 to 30
31 to 40
41 to 50
51 to 60
61 to 70
71 to 80
81 to 90
Age Groups
Year 1900
Year 2000


How do the percentages of the US population in various age groups differ in 1900 and 2000?
60
50
40
30
20
10
0
% OF US POPULATION
34%
21%
20%
14%
42%
52%
4%
13%
Youth
0-14
Young Adult
15-24
Adult
25-64
Senior
65+
AGE GROUP
1900
2000

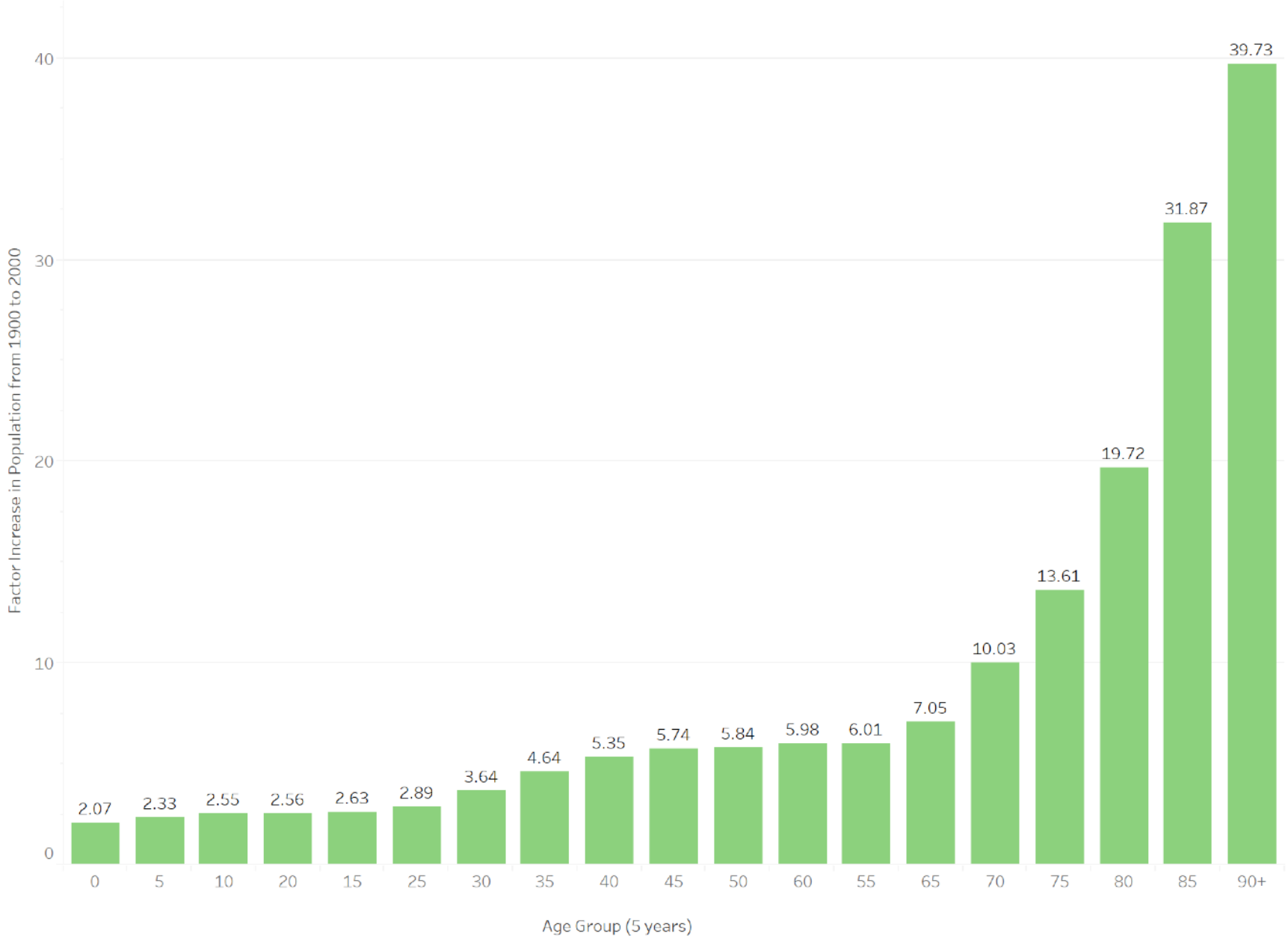
How has the age distribution in the U.S. changed from 1900 to 2000?



Growth Rates

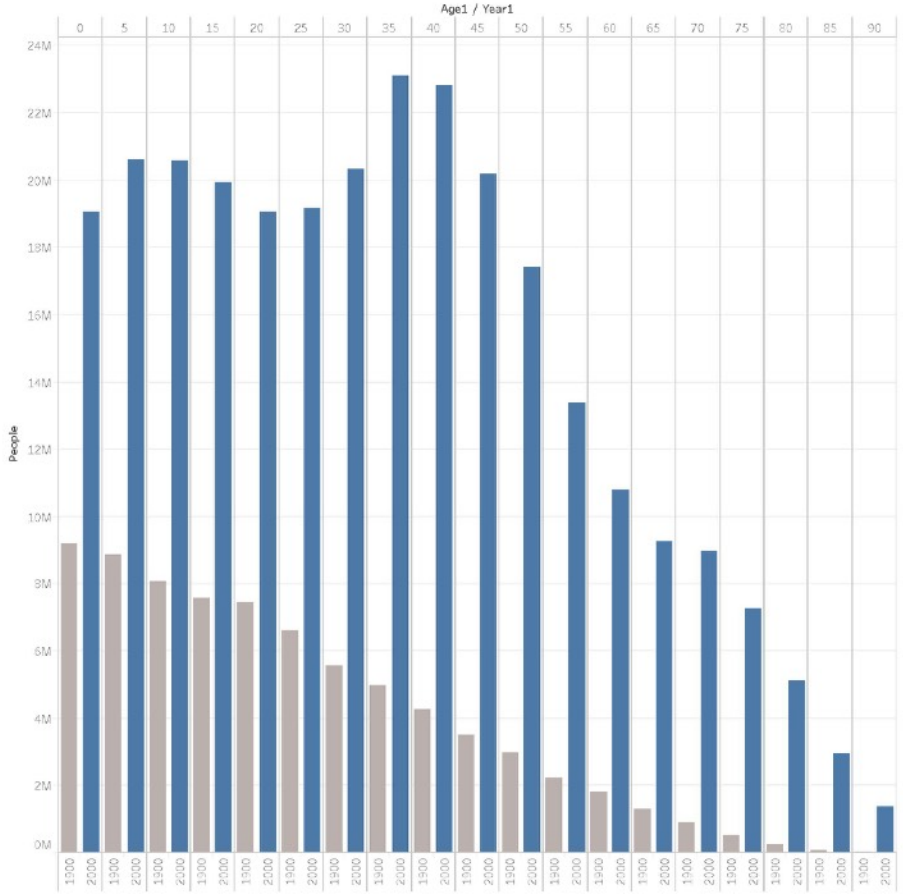

Age Group Population Growth % between 1900 and 2000
Population Growth %
Age Group
total population growth percentage
269%
107%
133%
155%
163%
156%
189%
264%
364%
435%
474%
484%
501%
498%
605%
903%
1261%
1872%
3087%
3873%
0
500
1000
1500
2000
2500
3000
3500
4000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Which US Age Group is Growing the Fastest?

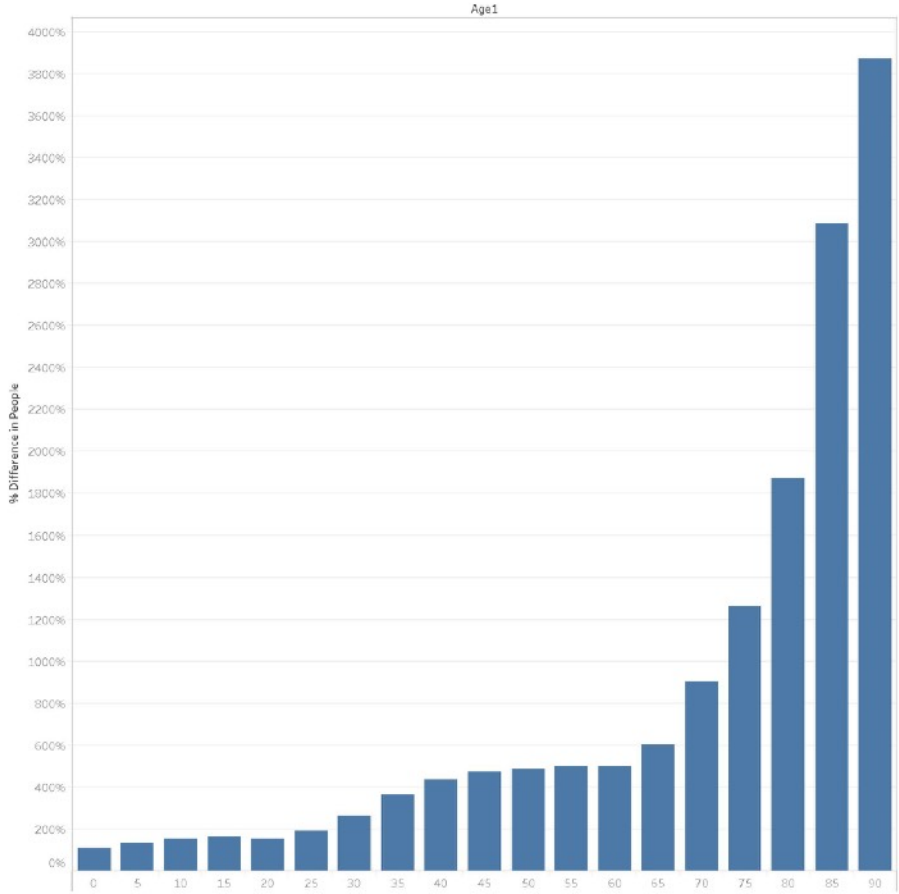


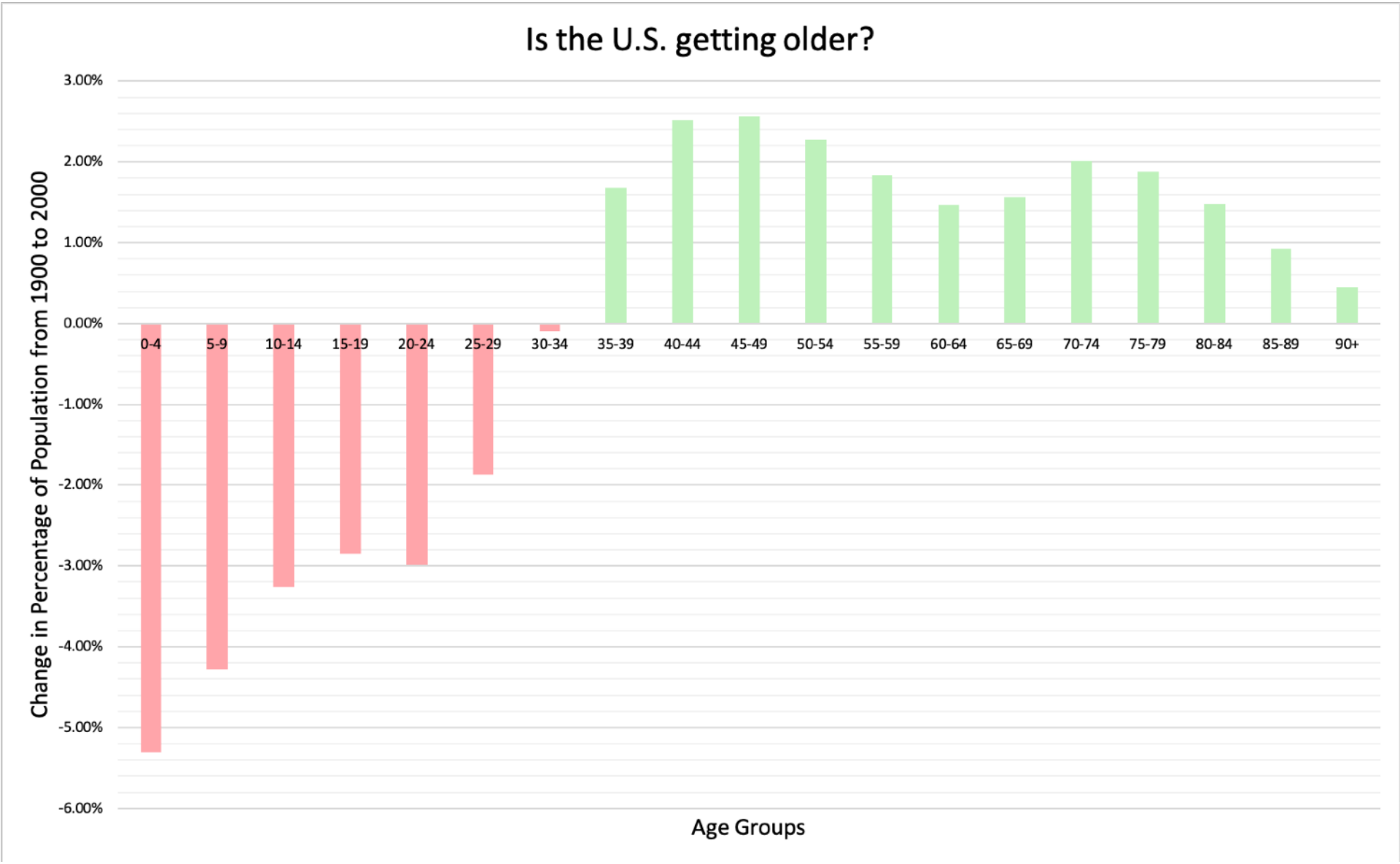
What Age Groups Saw the Largest Increase in Population from 1900 to 2000?

Count of People by Age and Year

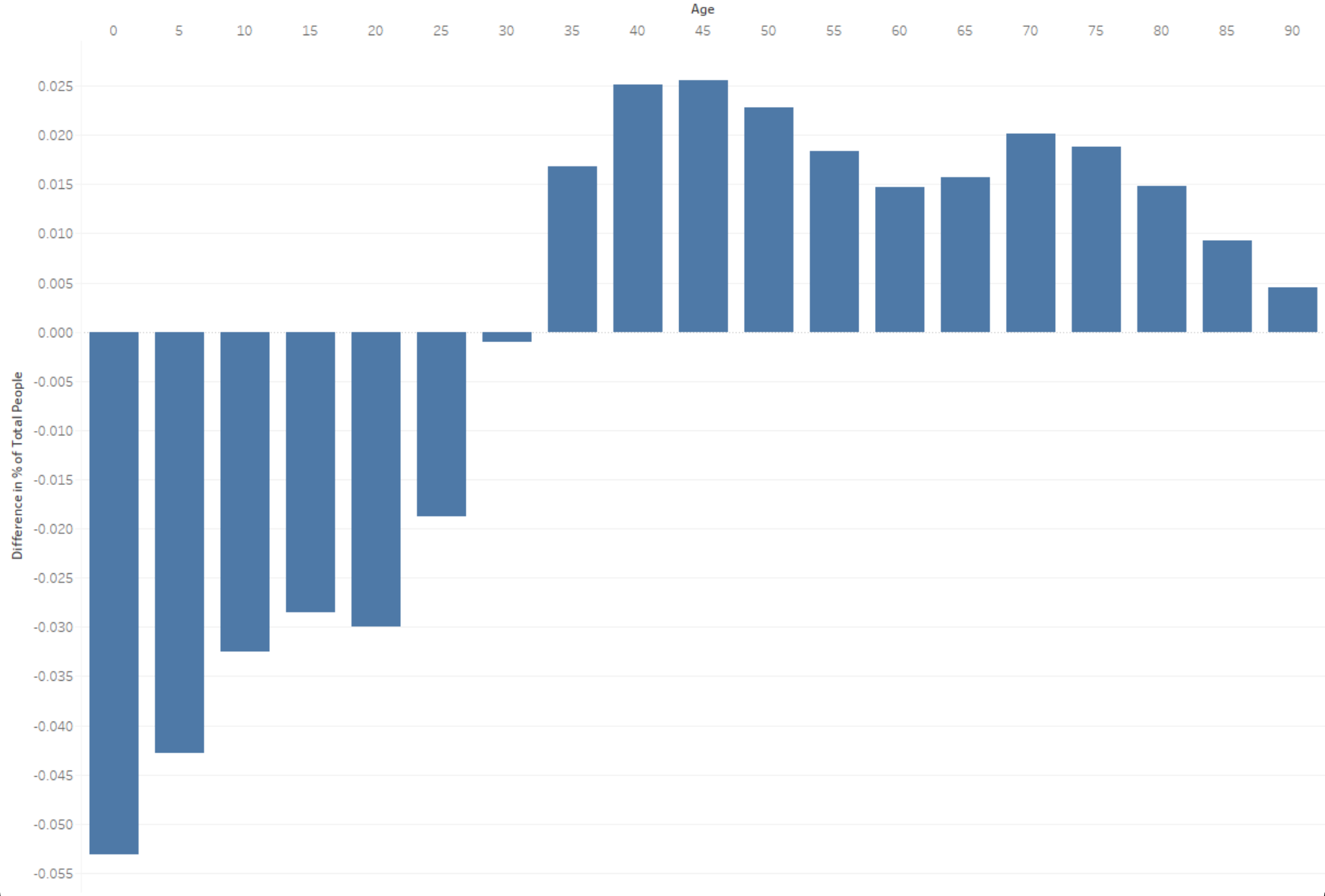


Percent Difference in People Count From 1900 to 2000 Organized by Age



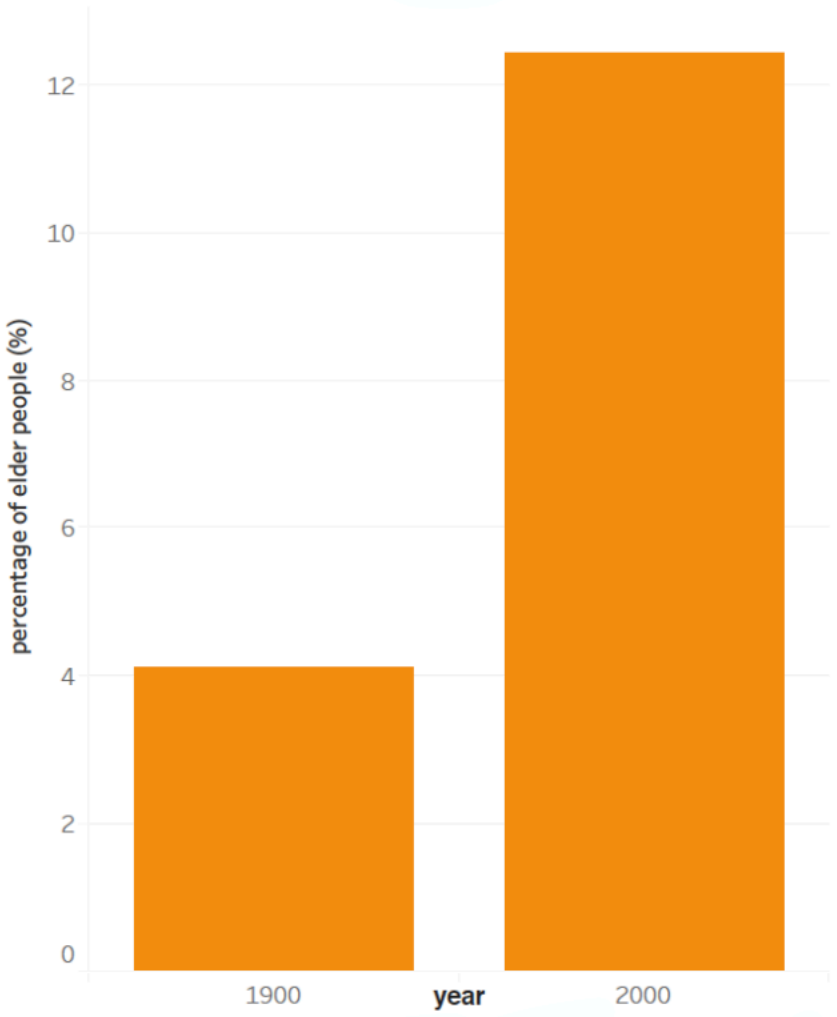

Is the U.S. getting older?
Change in Percentage of Population from 1900 to 2000
3.00%
2.00%
1.00%
0.00%
-1.00%
-2.00%
-3.00%
-4.00%
-5.00%
-6.00%
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90+
Age Groups

How does the population distribution by age in America differ in year 2000 compared to 1900?



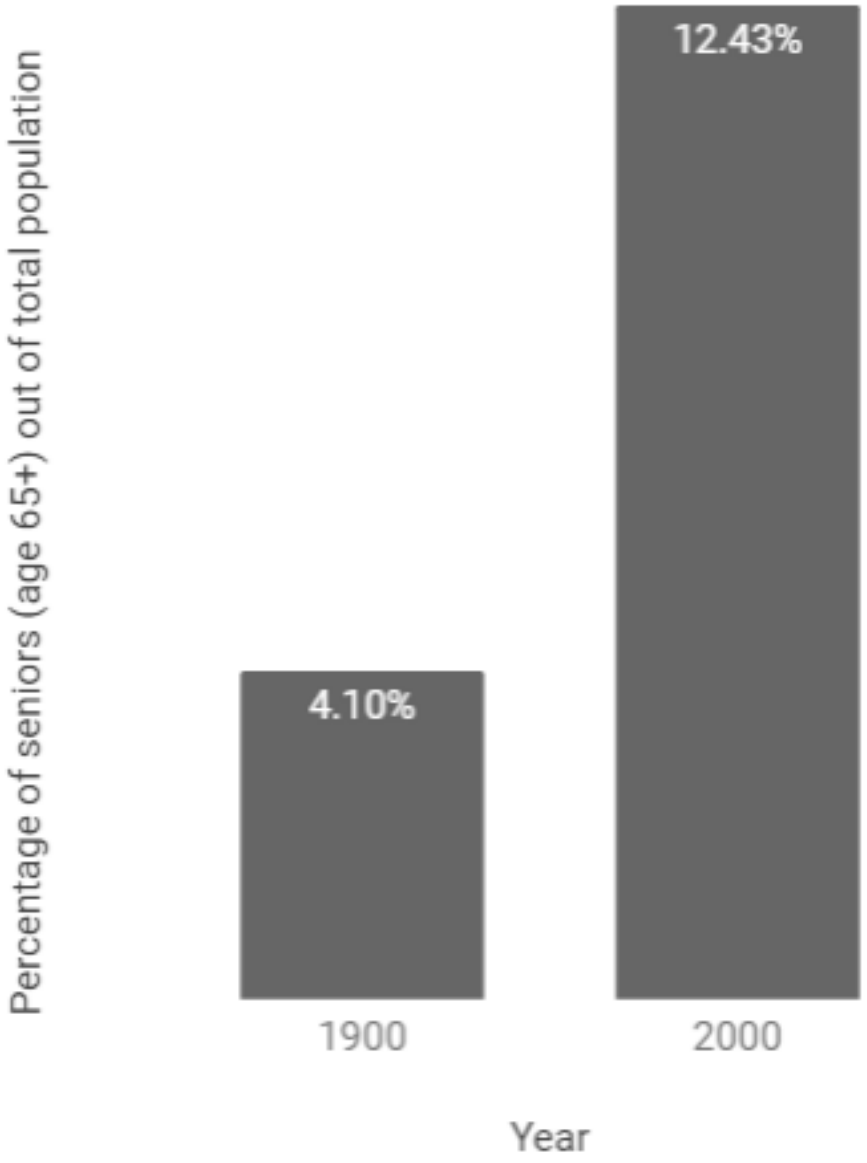
Simplification

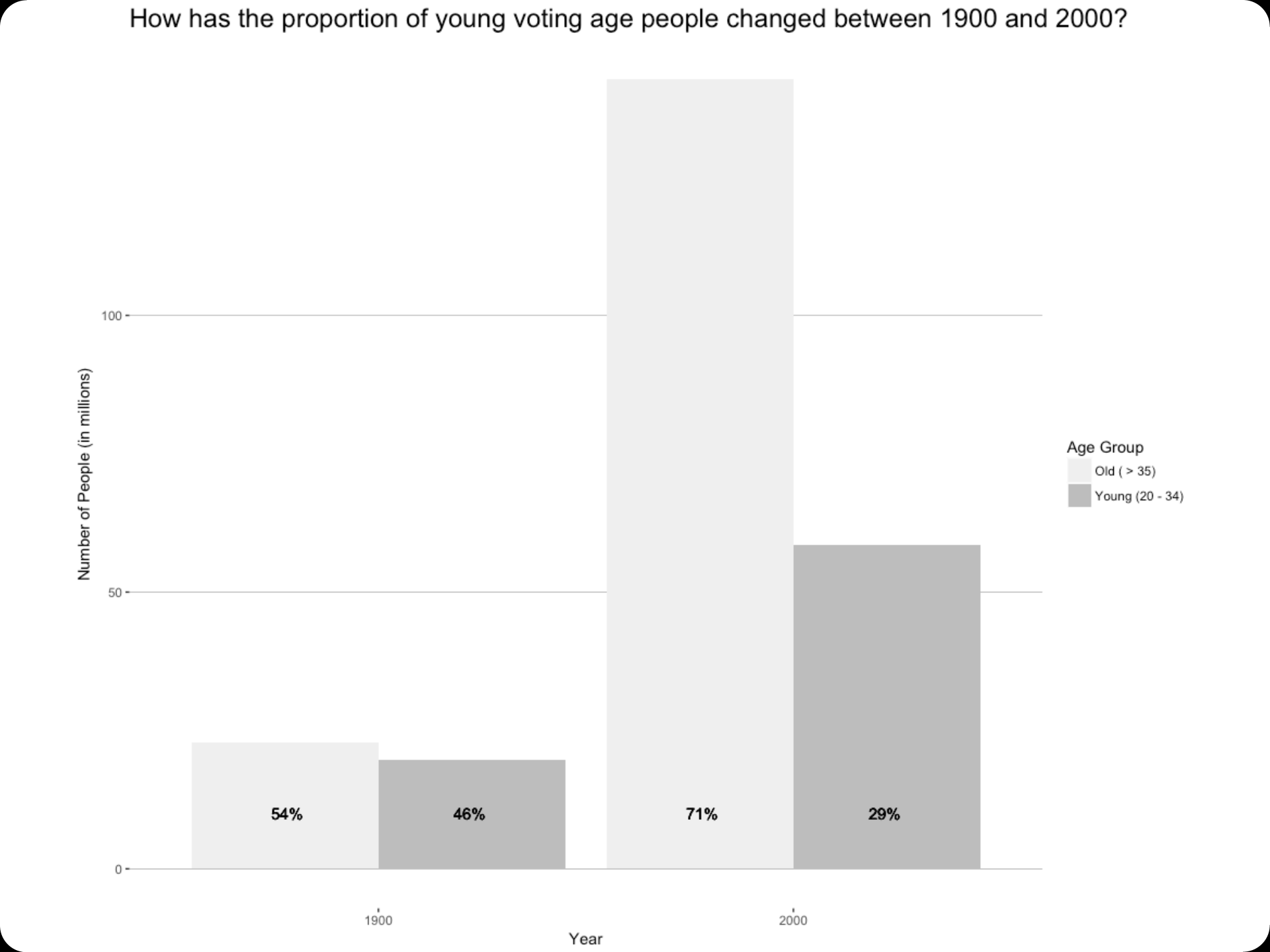
How does the percentage of elder people in 1900 compare to that in 2000?



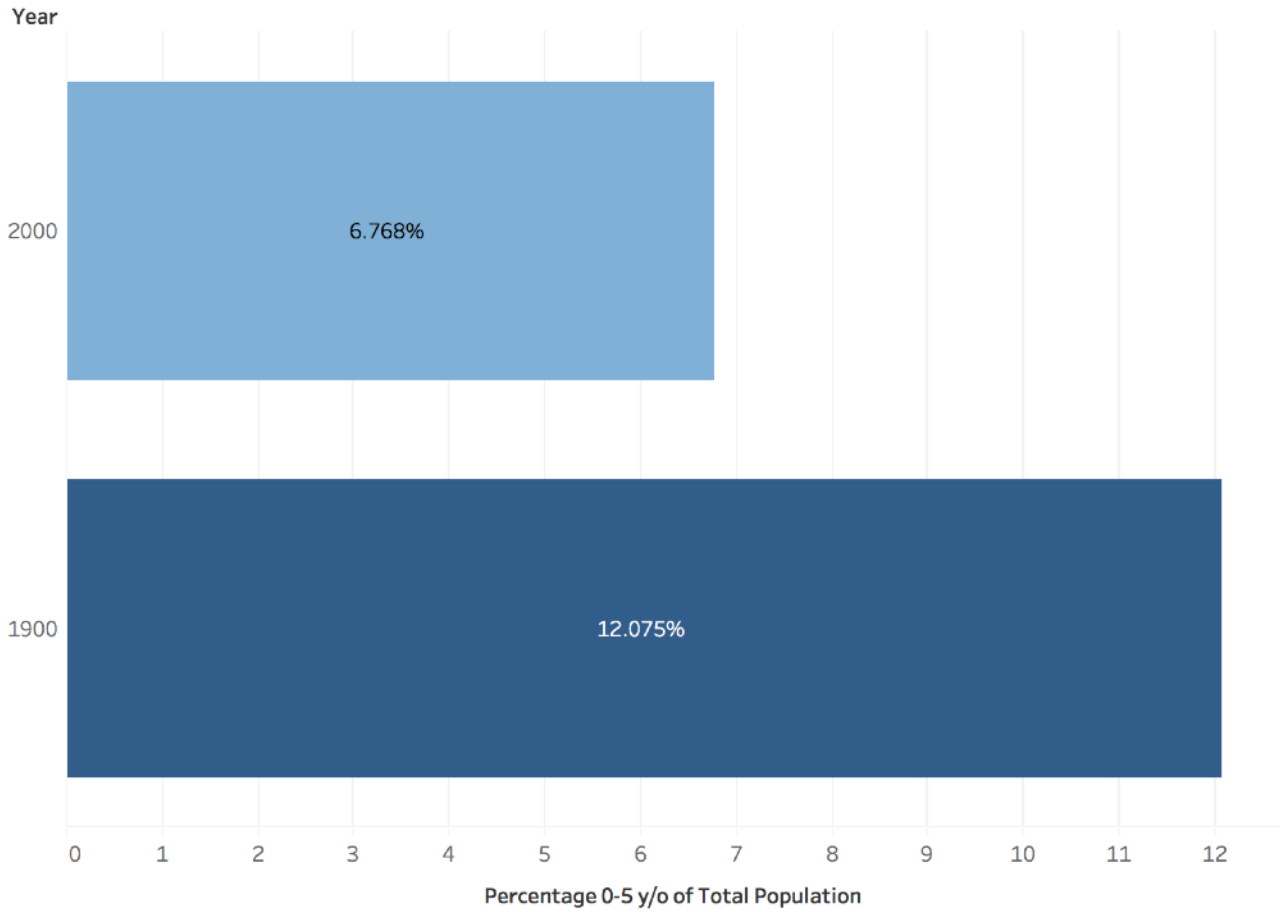
Note that according to WHO's definition, "elder people" here refer to those people who are over (and including) age 65.
(http://www.who.int/healthinfo/survey/ageingdefnolder/en/)

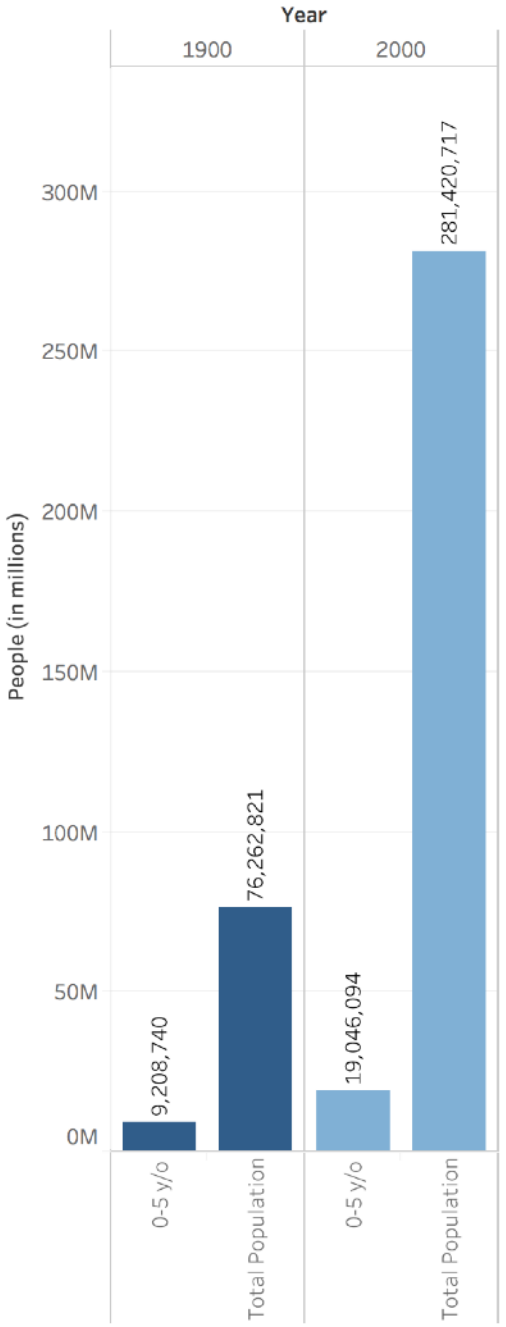
How has our senior population changed over a century?

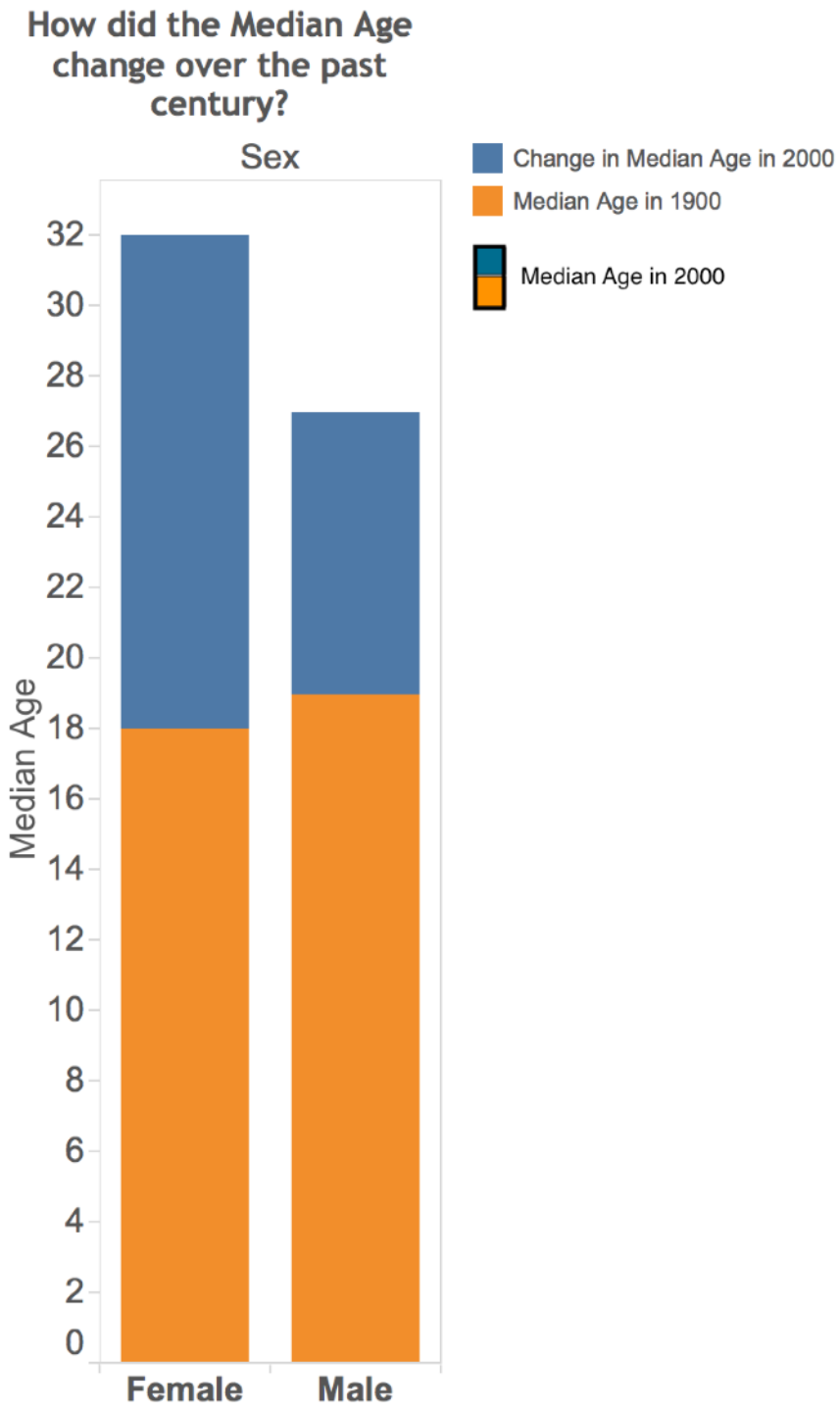



How has the proportion of young voting age people changed between 1900 and 2000?
Number of People (in millions)
100
50
0
54%
46%
71%
29%
1900
2000
Year
Age Group
Old (> 35)
Young (20 - 34)

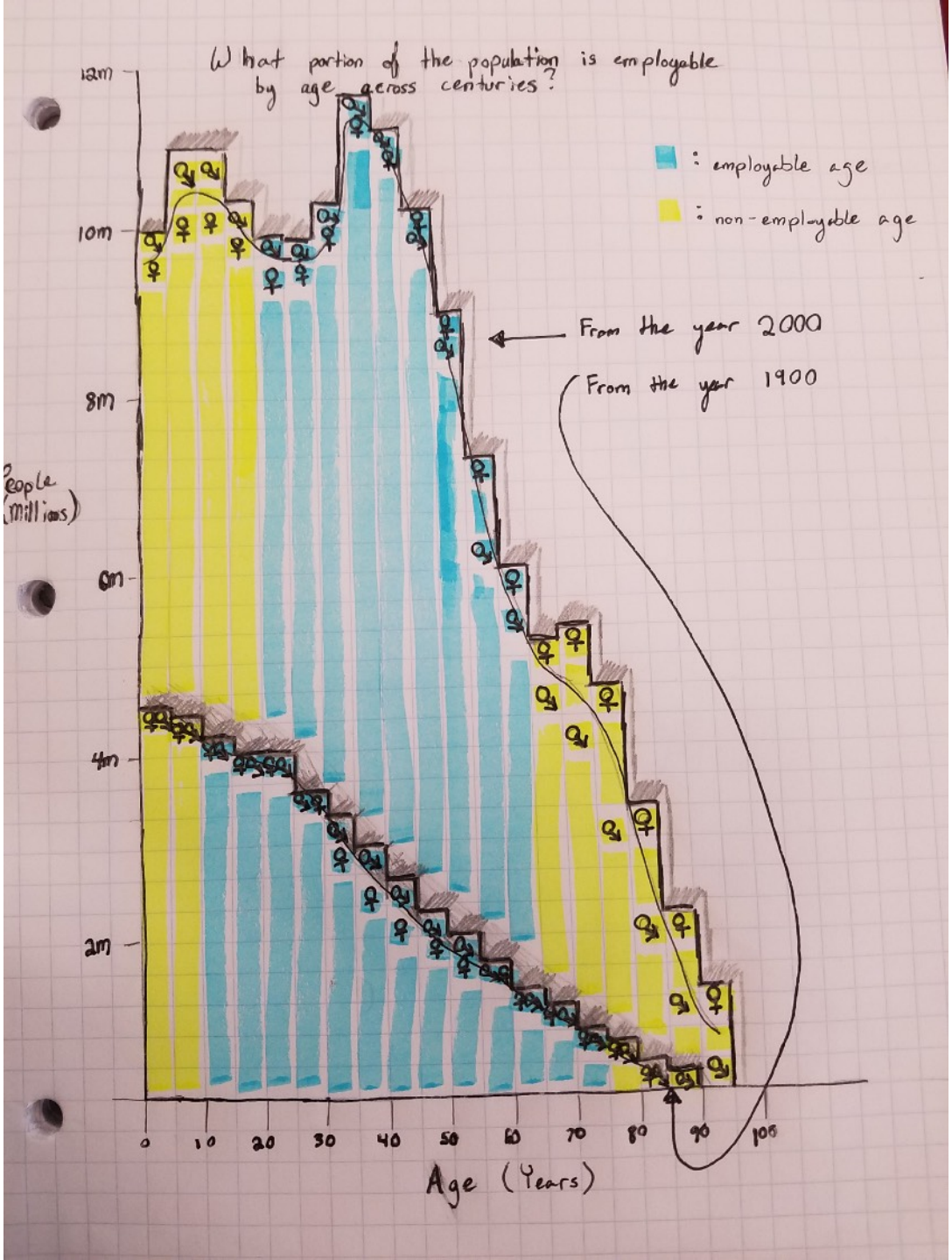
What percentage of the population is 0-5 years old in 1900 vs. 2000?



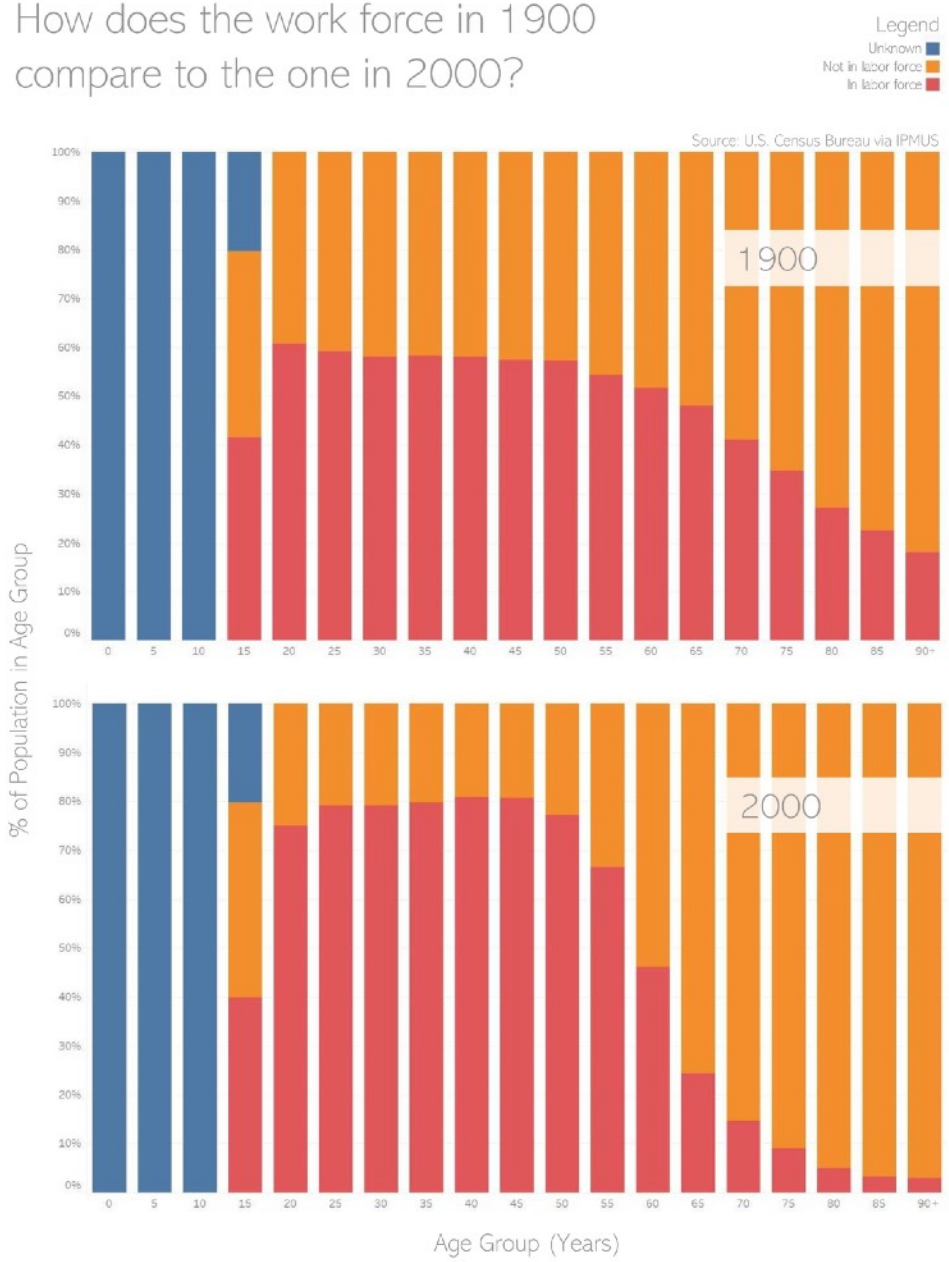



How did the Median Age change over the past century?
Sex
Change in Median Age in 2000
Median Age in 1900
Median Age in 2000
Median Age
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Female
Male

Employment


What portion of the population is employable by age across centuries?
: employable age
: non-employable age
From the year 2000
From the year 1900
12m
10m
8m
6m
4m
2m
People (millions)
0
10
20
30
40
50
60
70
80
90
100
Age (Years)

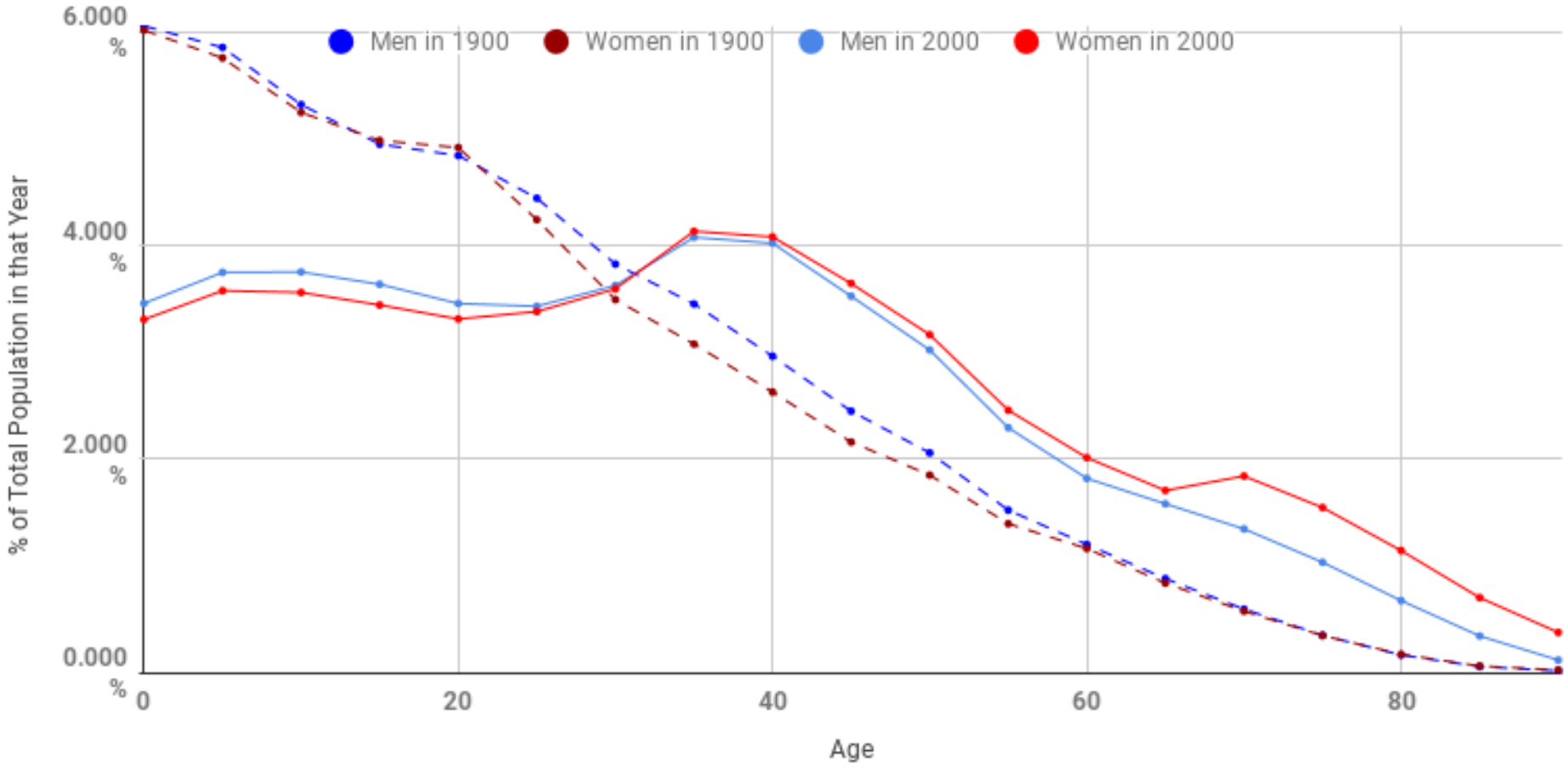
How does the work force in 1900 compare to the one in 2000?



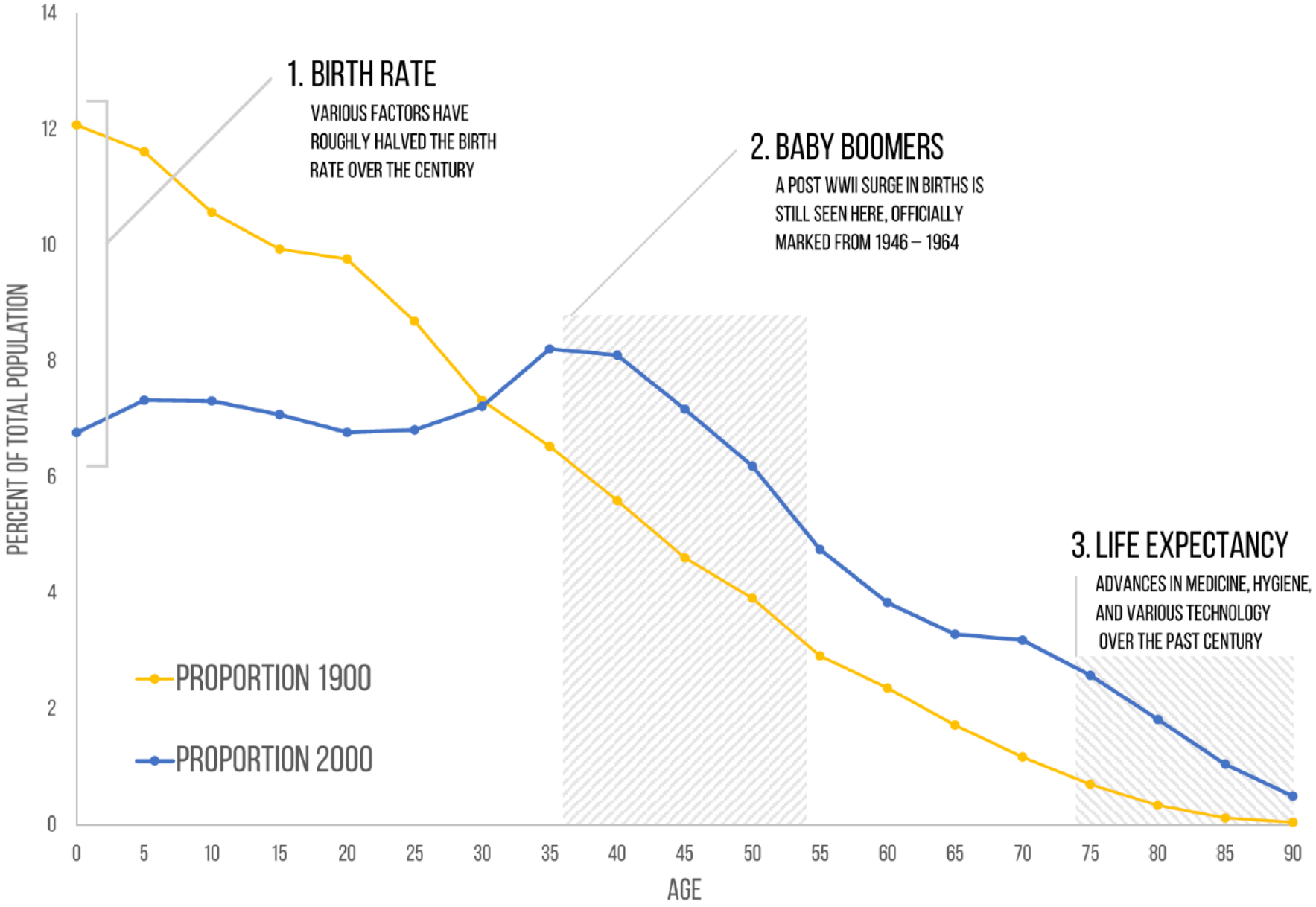
Lines / Area

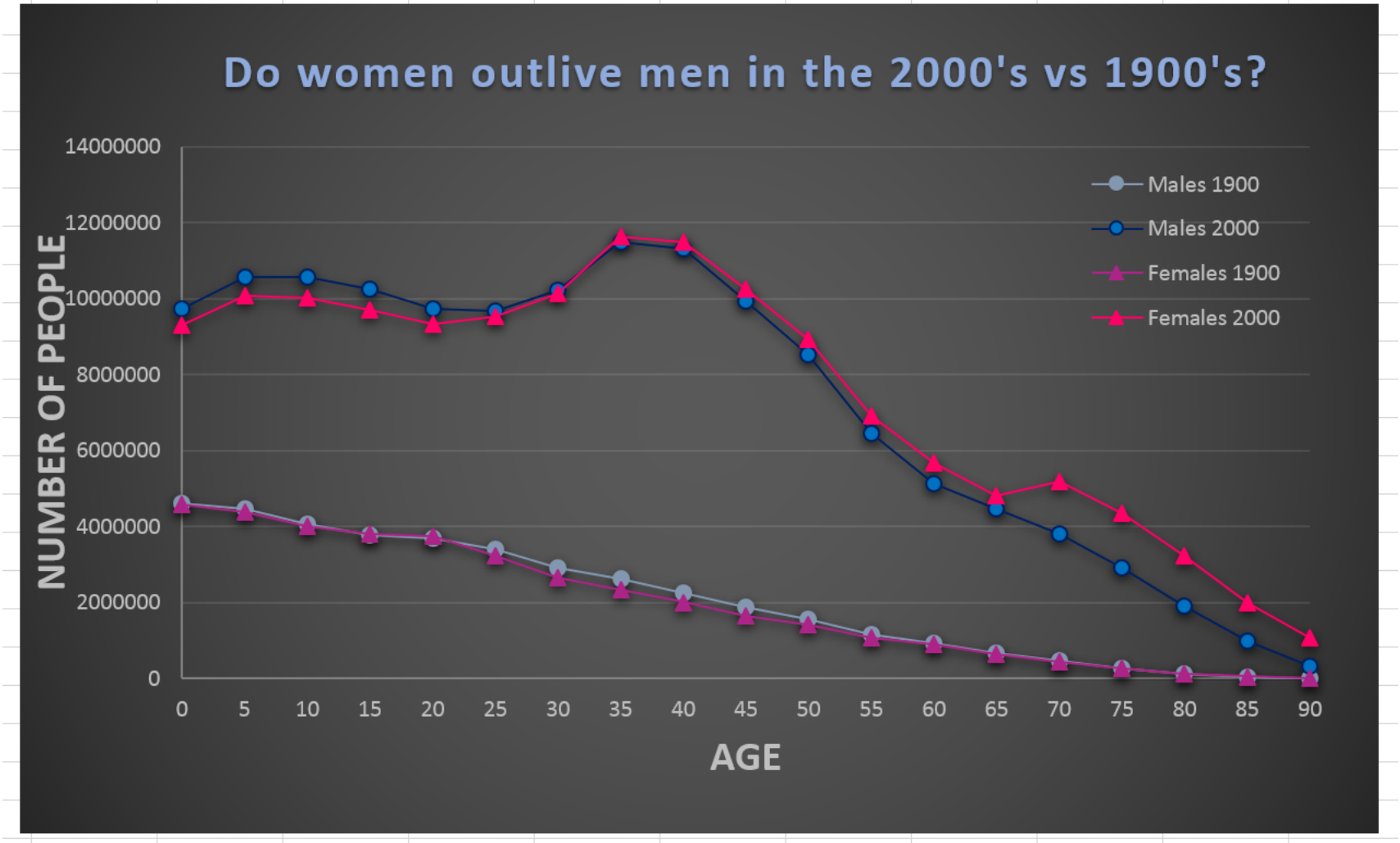
Distribution of the U.S. Population

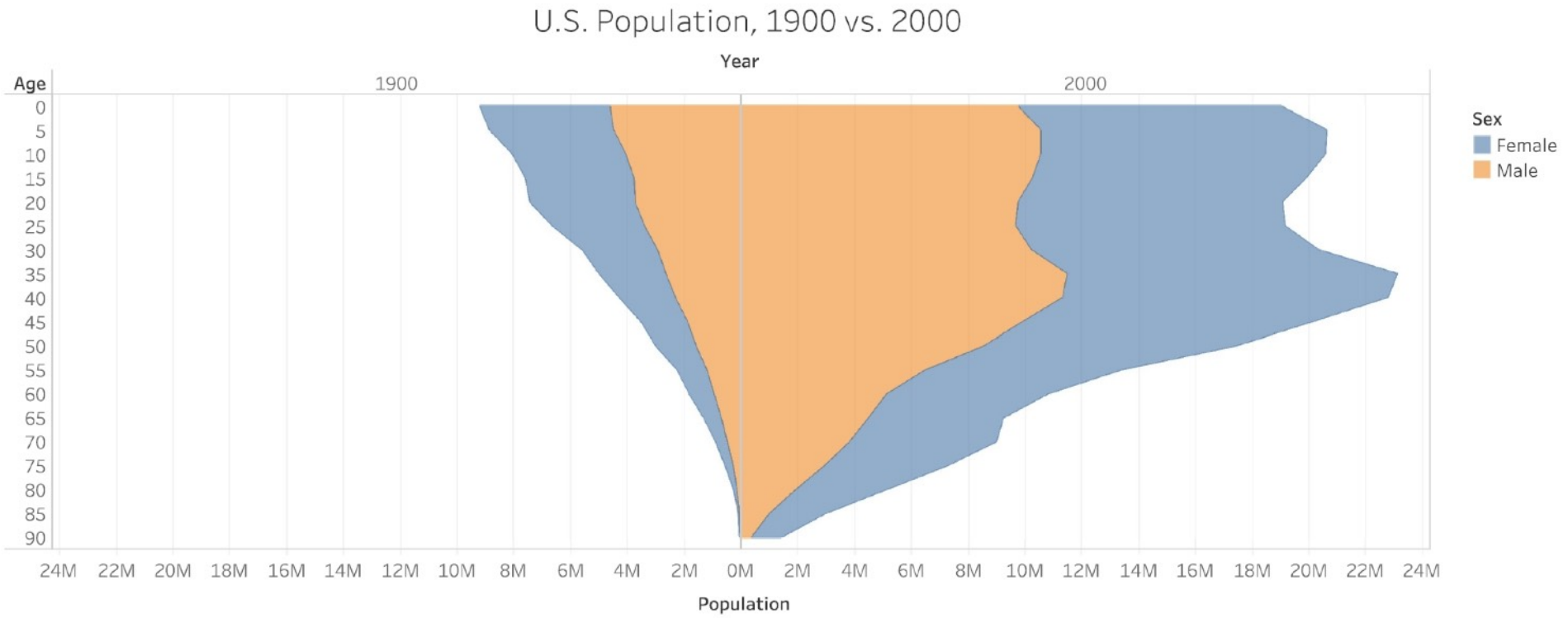
1900 vs 2000



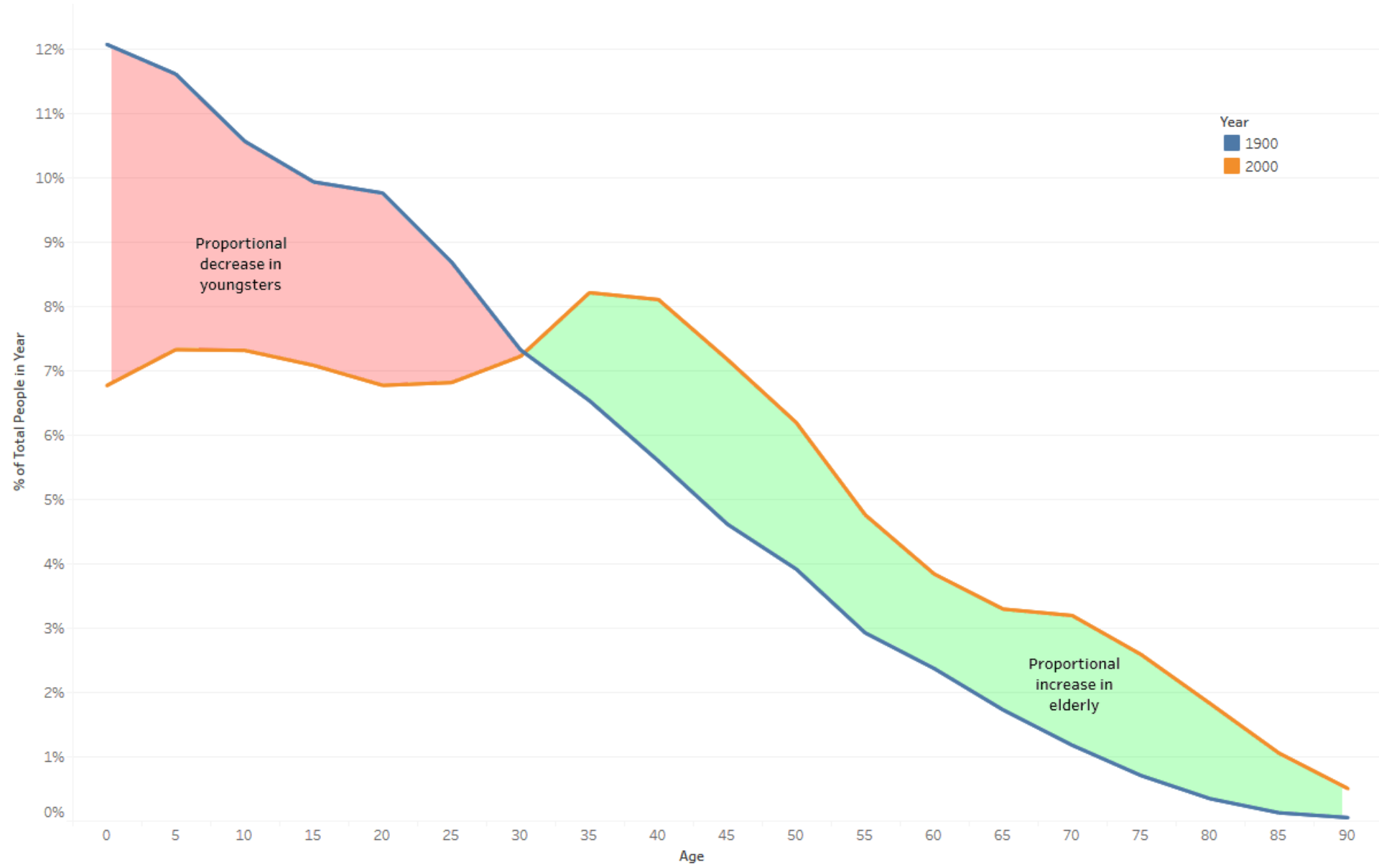
HOW HAS THE POPULATION DISTRIBUTION CHANGED OVER 100 YEARS?



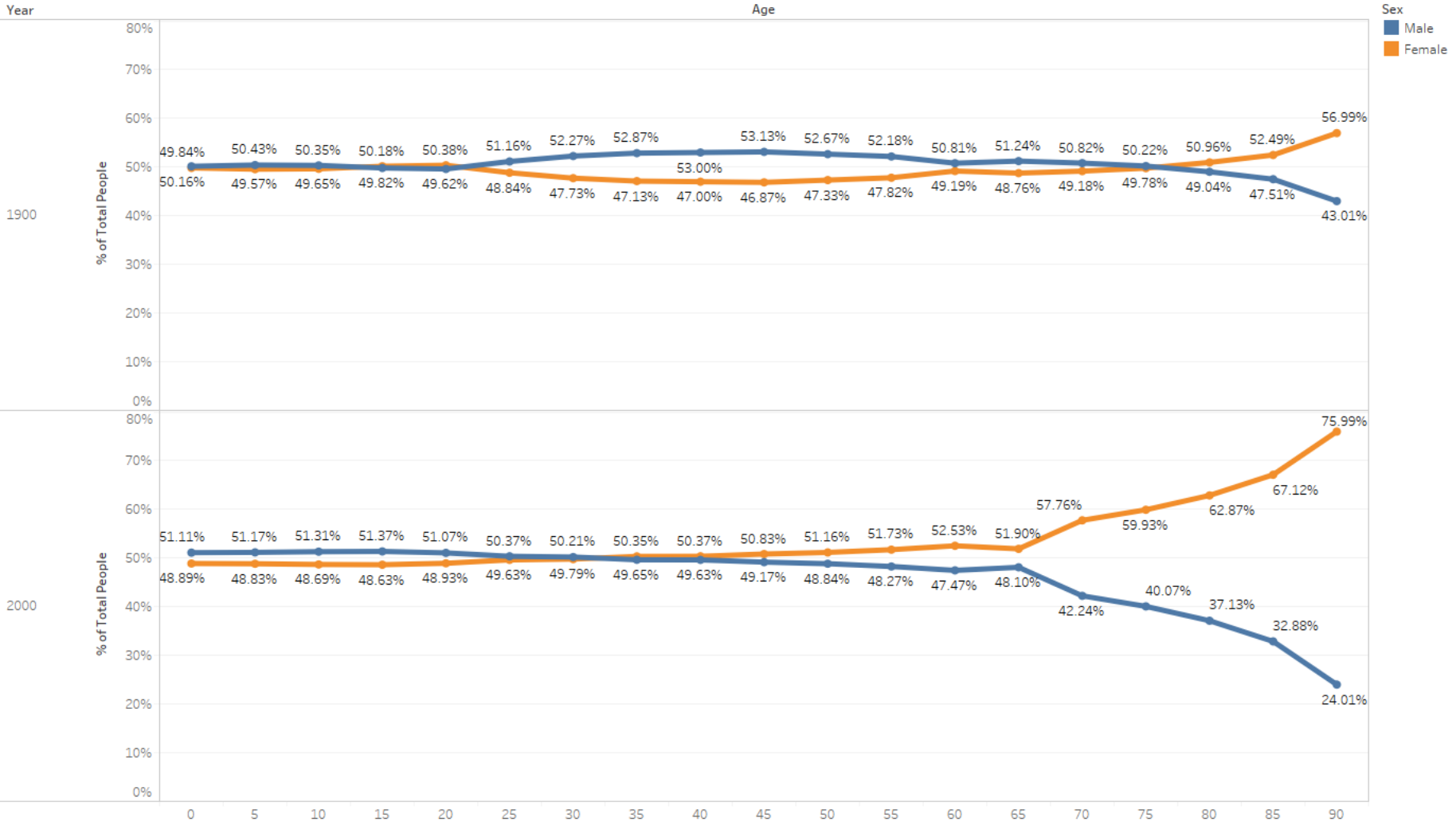

Do women outlive men in the 2000's vs 1900's?
NUMBER OF PEOPLE
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
AGE
Males 1900
Males 2000
Females 1900
Females 2000


U.S. Population, 1900 vs. 2000
Year
1900
2000
Age
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
24M
22M
20M
18M
16M
14M
12M
10M
8M
6M
4M
2M
0M
2M
4M
6M
8M
10M
12M
14M
16M
18M
20M
22M
24M
Population
Sex
Female
Male

How has the proportion of youngsters (0-20) and elderly (60+) in the United States population changed from 1900 to 2000?



How did WWII affect US male population?

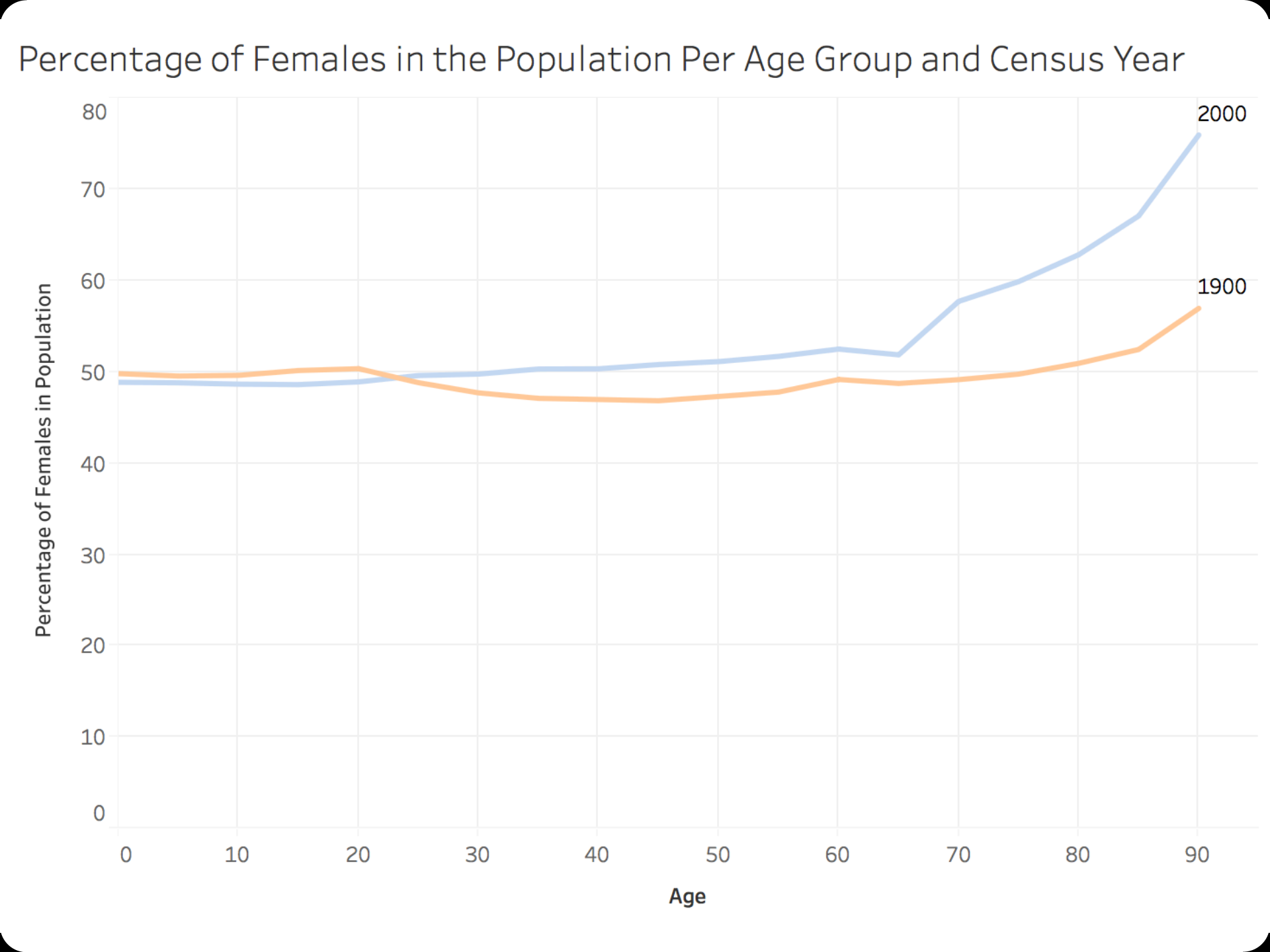


The trend of % of Total People for Age broken down by Year. Color shows details about Sex.

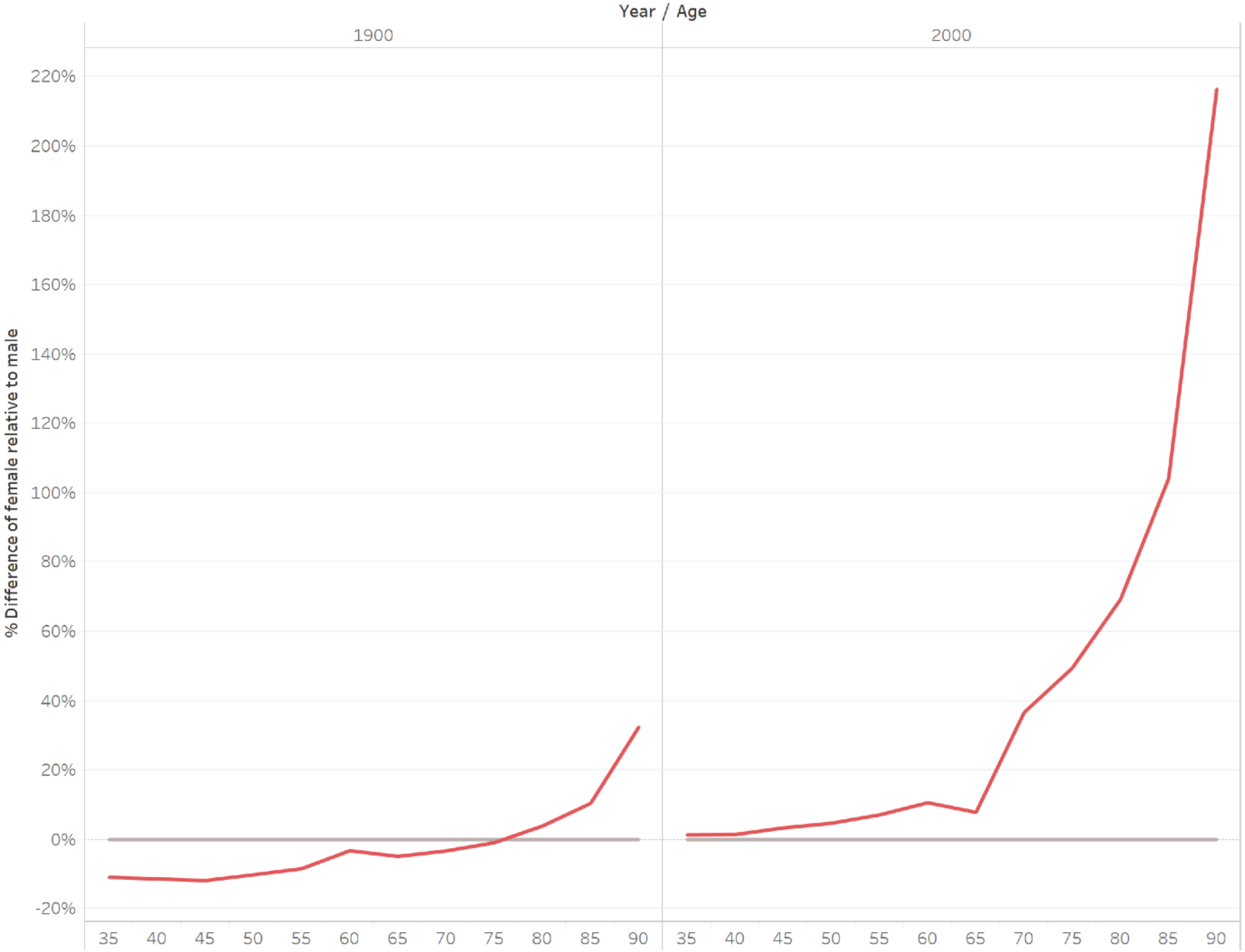
How did gender population differences by age group change over time?

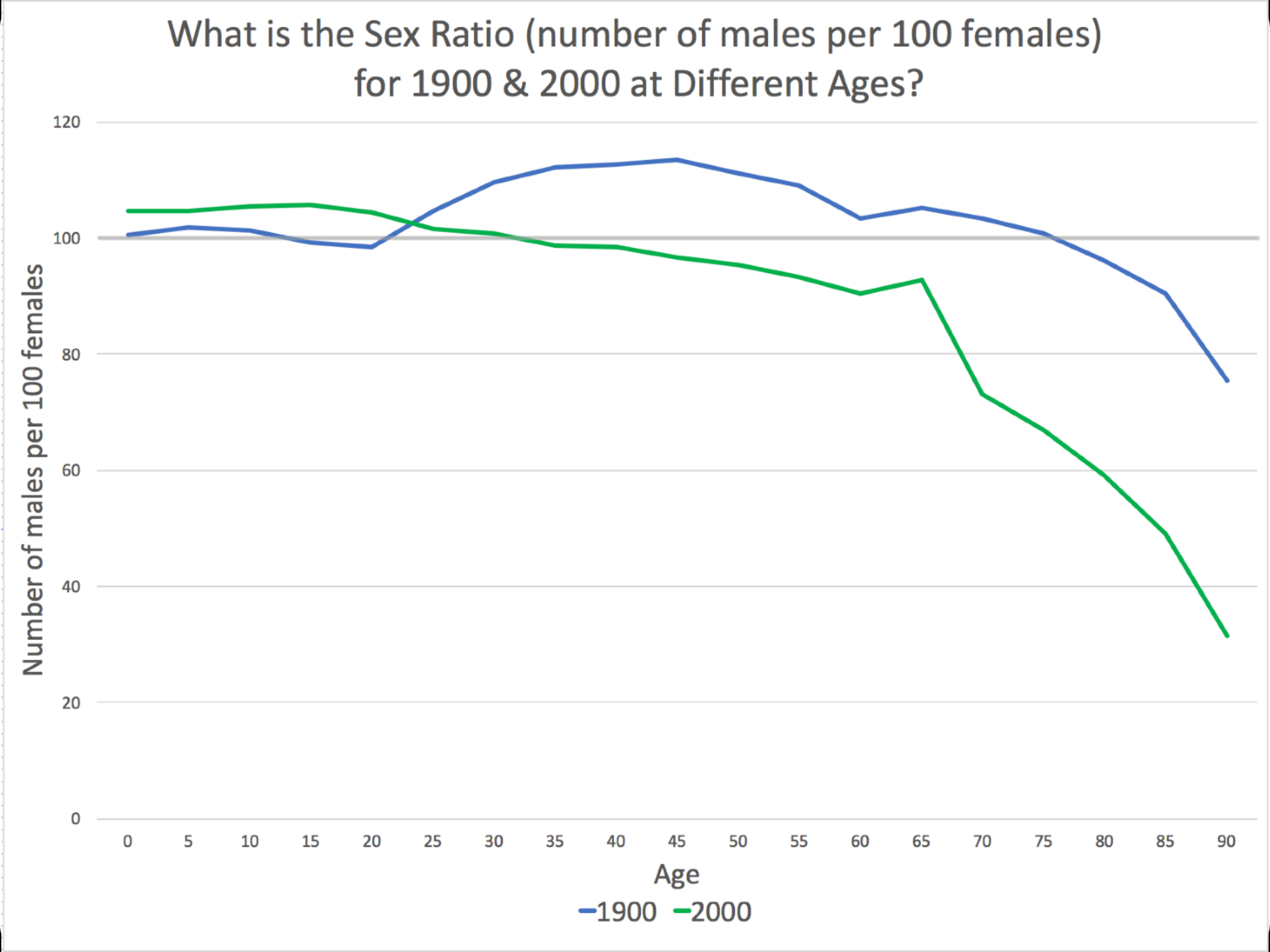
Sex Difference

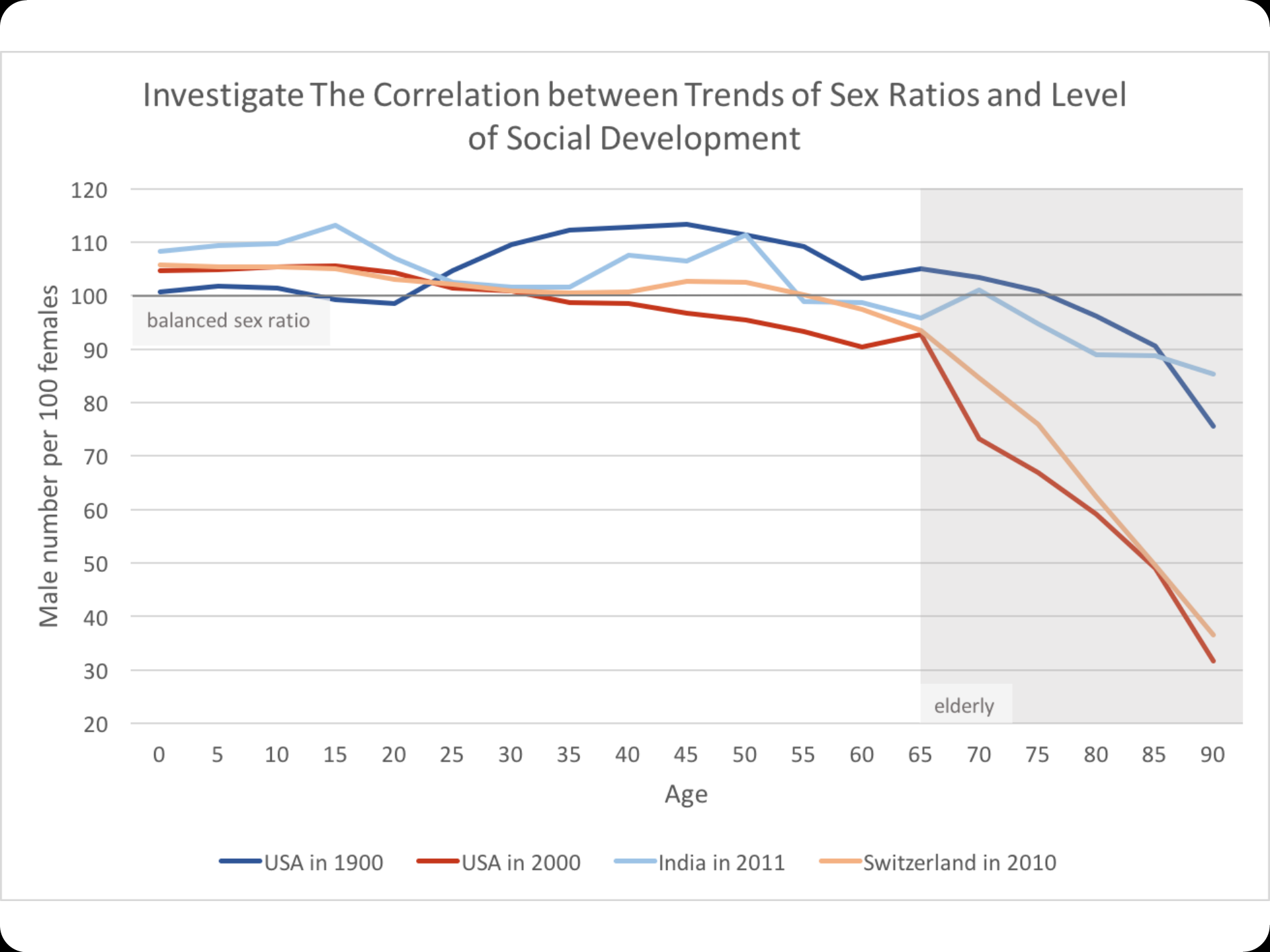
More Women — More Men


Percentage of Females in the Population Per Age Group and Census Year
Percentage of Females in Population
80
70
60
50
40
30
20
10
0
2000
1900
0
10
20
30
40
50
60
70
80
90
Age

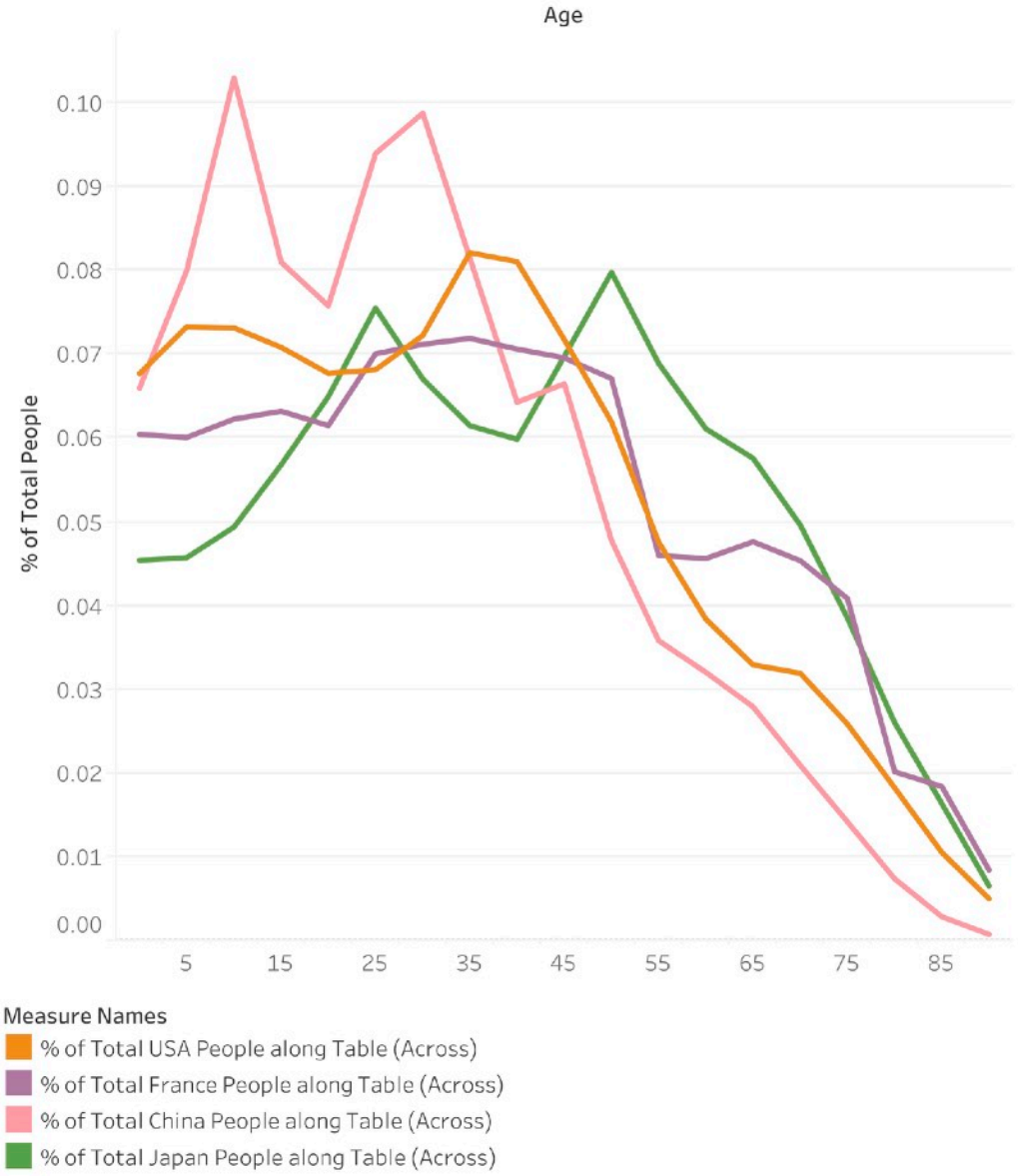
Does female out-live male even more now than 100 years ago



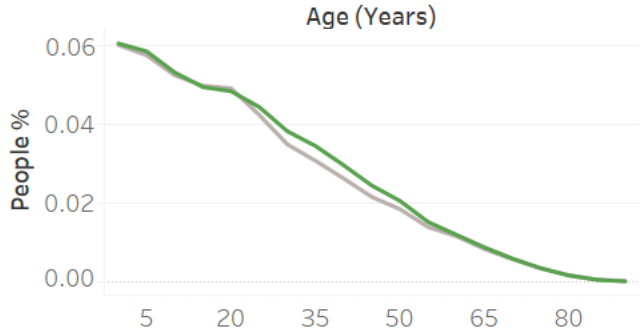

What is the Sex Ratio (number of males per 100 females) for 1900 & 2000 at Different Ages?
Number of males per 100 females
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Age
1900
2000


Investigate The Correlation between Trends of Sex Ratios and Level of Social Development
Male number per 100 females
120
110
100
90
80
70
60
50
40
30
20
balanced sex ratio
elderly
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Age
USA in 1900
USA in 2000
India in 2011
Switzerland in 2010

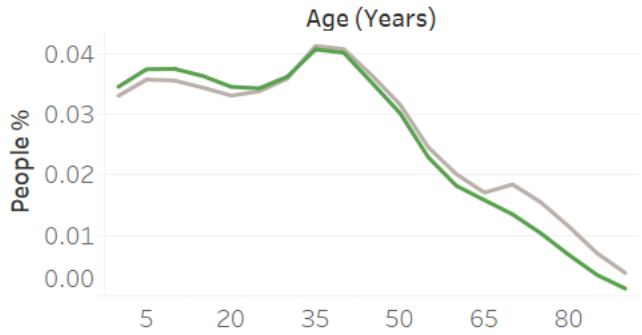
Did other countries experience the same "baby boom" that the US did?



People % vs. age comparing male & female: Year 1900

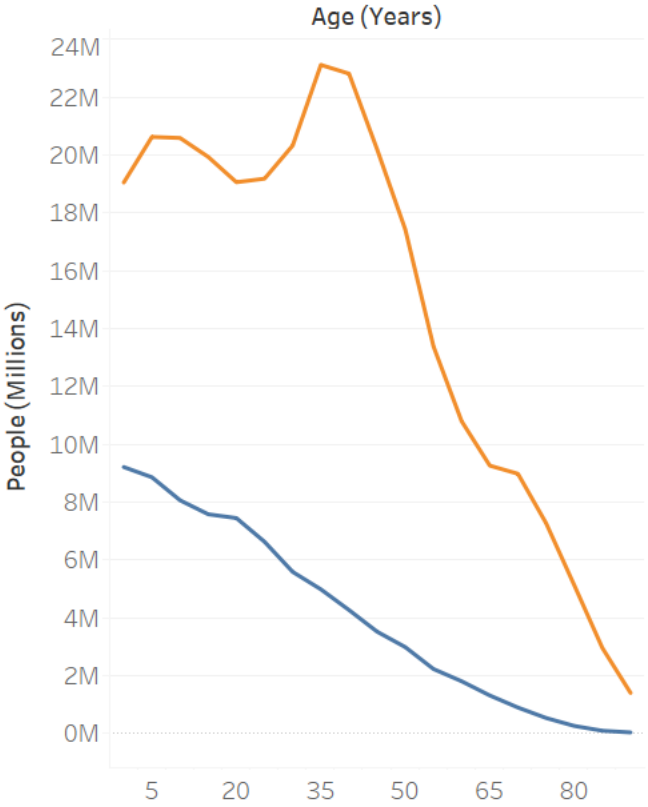


People % vs. age comparing male & female: Year 2000



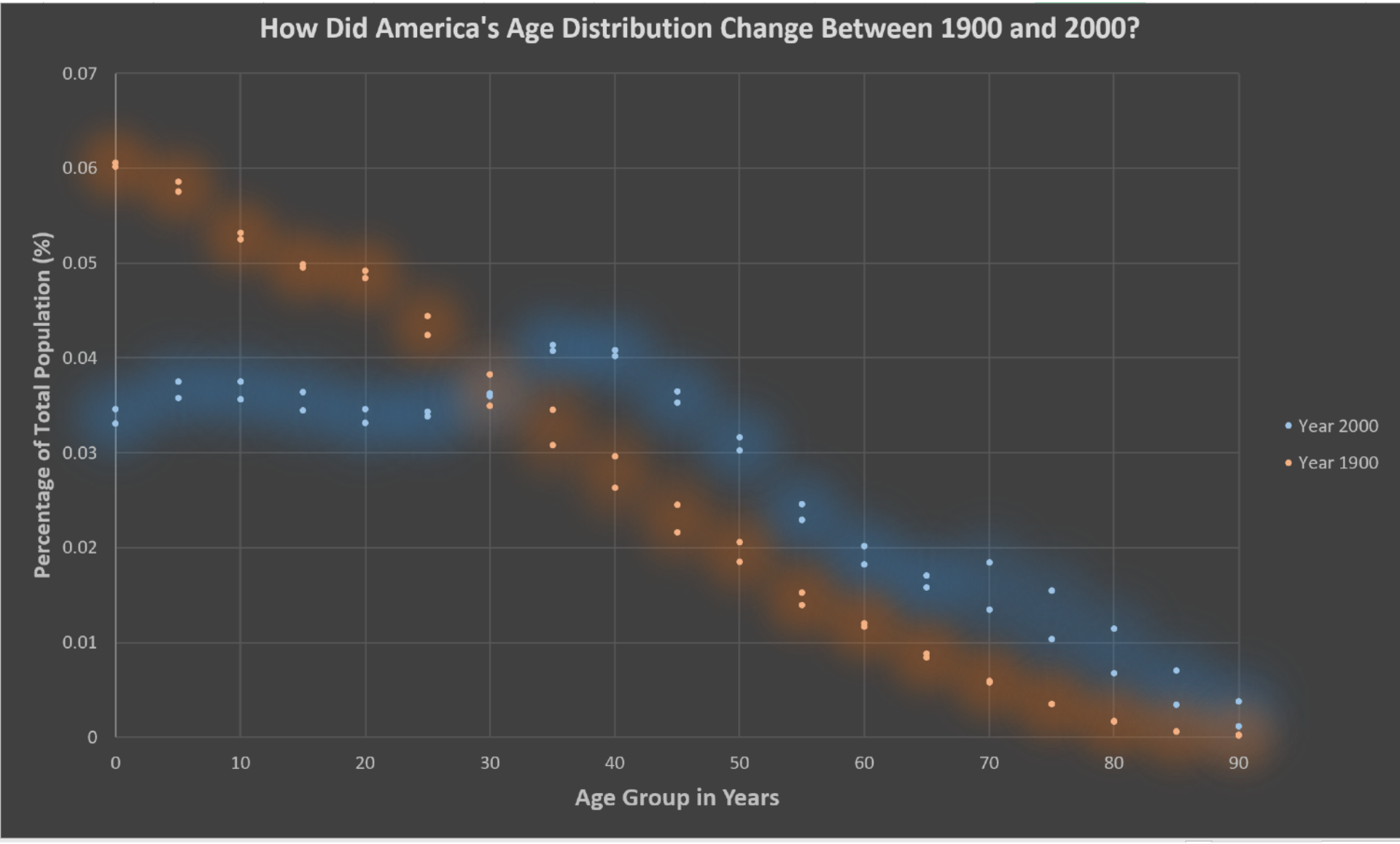
Sex
Male Female

People vs age compared from 1900 and 2000

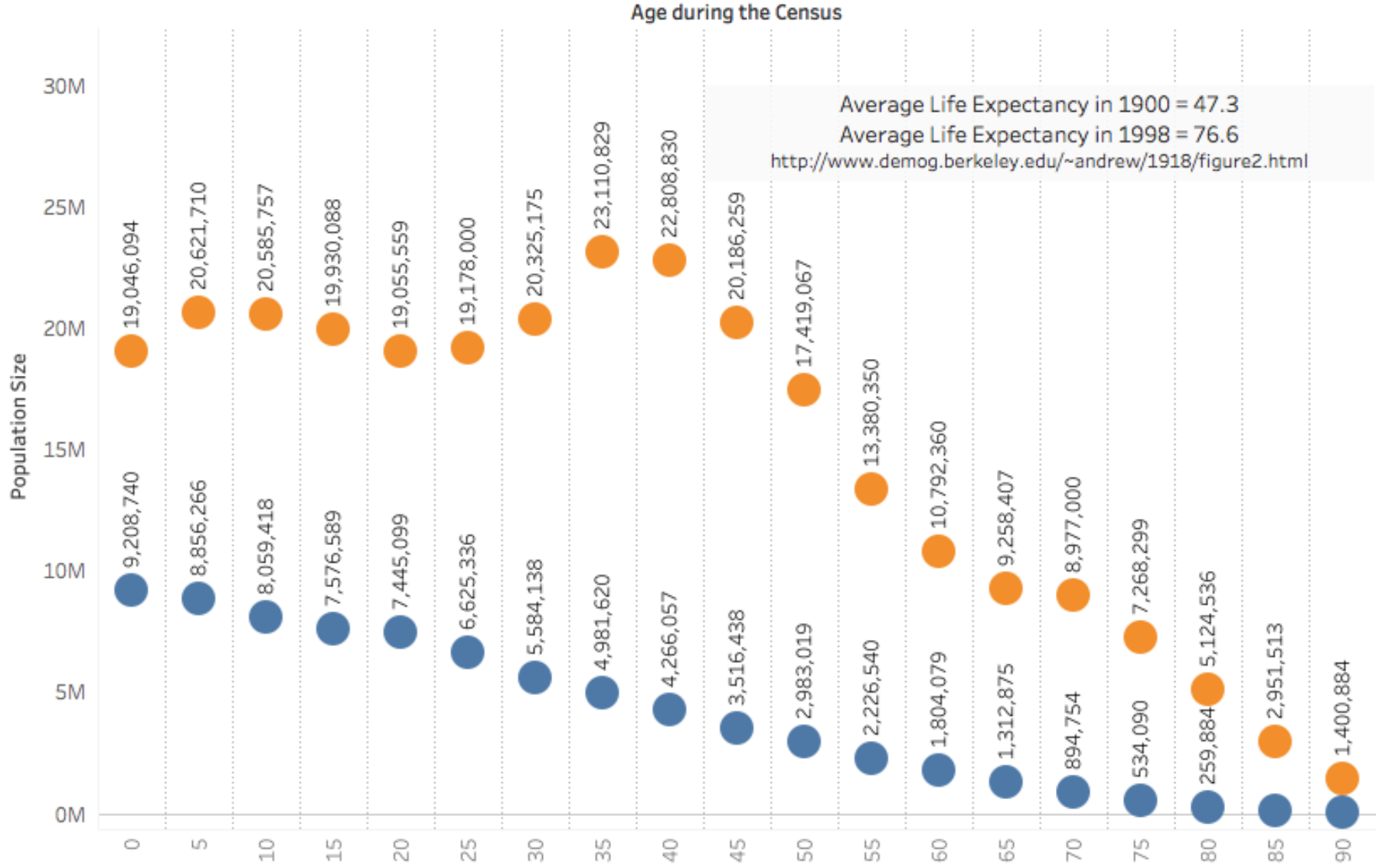


Year
1900 2000

Dot / Scatter Plots

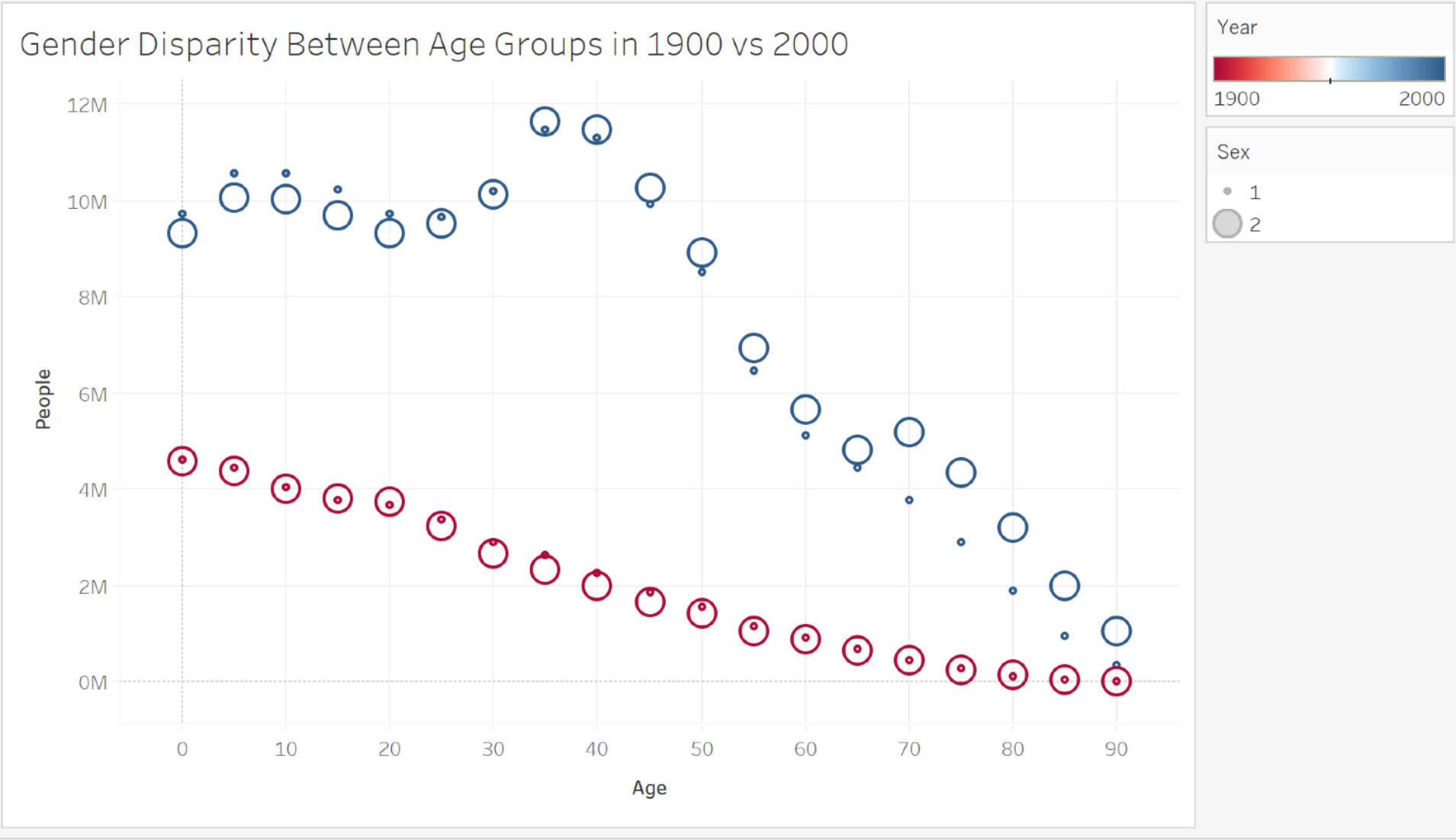

How Did America's Age Distribution Change Between 1900 and 2000?
Percentage of Total Population (%)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
10
20
30
40
50
60
70
80
90
Age Group in Years
Year 2000
Year 1900

What's the age of America's population?



Sum of Population Size for each Age during the Census. Color shows details about Year. The marks are labeled by sum of Population Size.

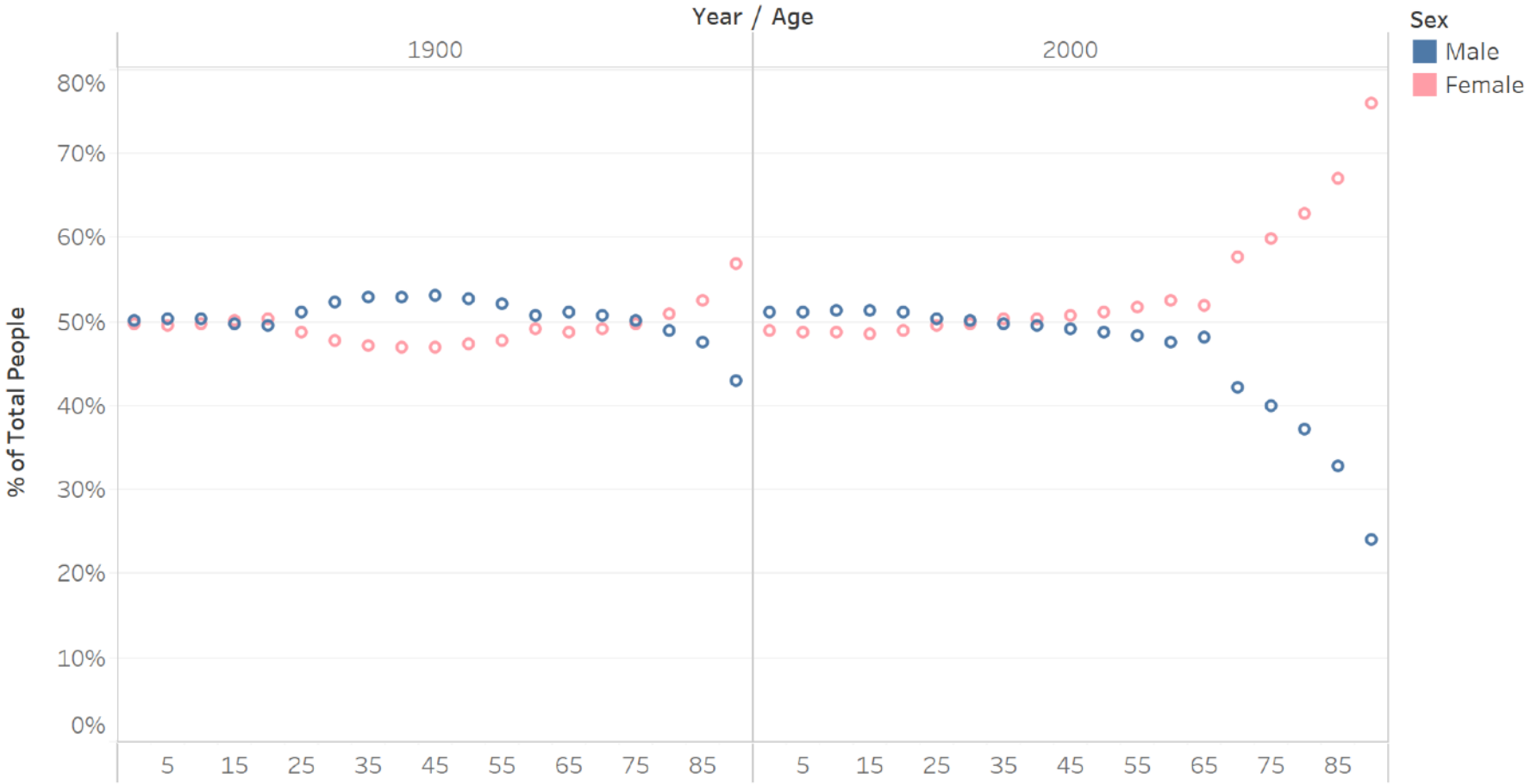
Year
- 1900
- 2000


Gender Disparity Between Age Groups in 1900 vs 2000
12M
10M
8M
6M
4M
2M
0M
People
0
10
20
30
40
50
60
70
80
90
Age
Year
1900
2000
Sex
1
2

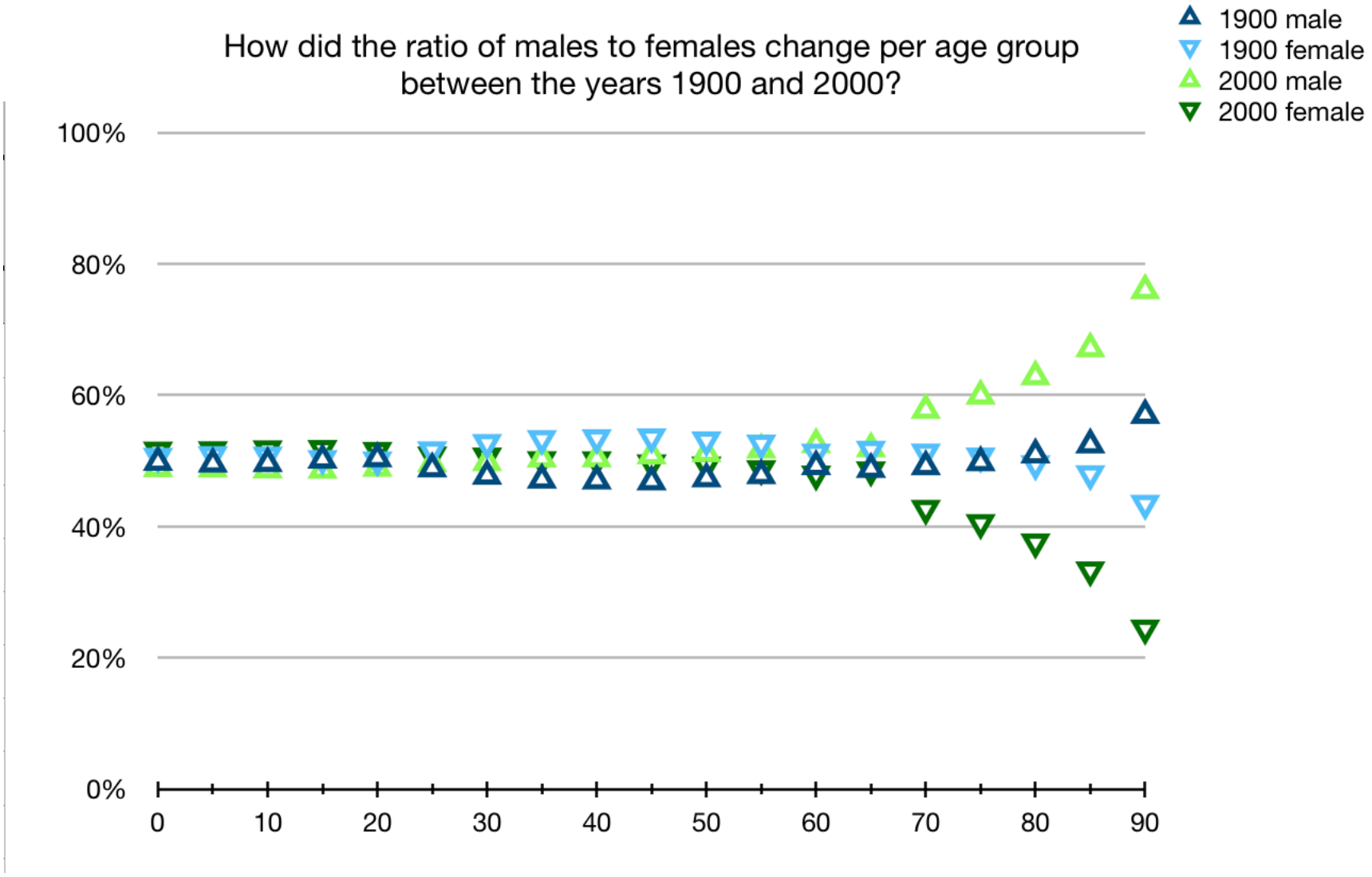
Is it possible that the support for same-sex marriage resulted from a gap between men and women?

Sum of People for each Age broken down by Year. Color shows details about Sex. Size shows sum of ABS-Diff (sex difference).

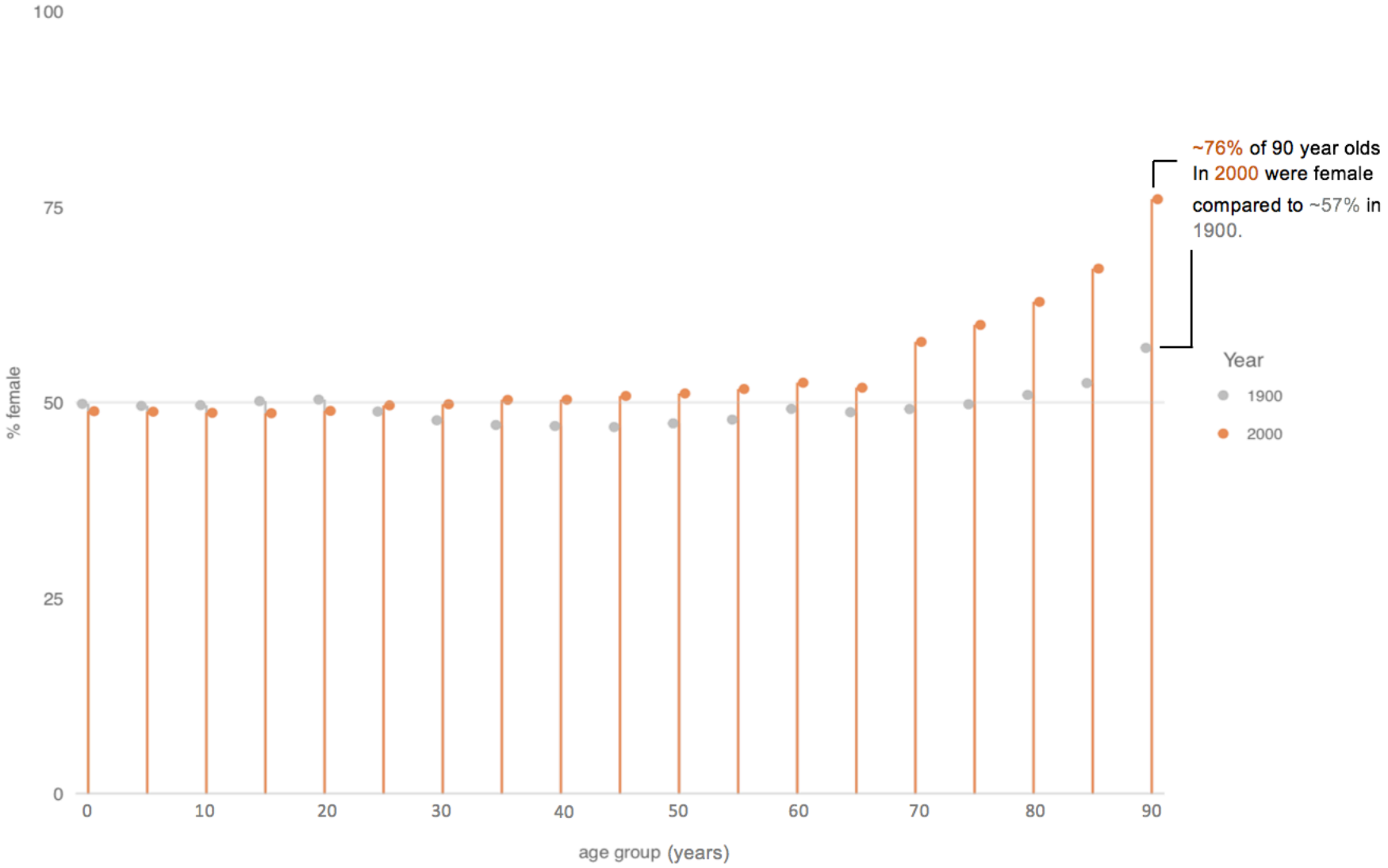
How has the male and female ratio changed over the century for each age group?



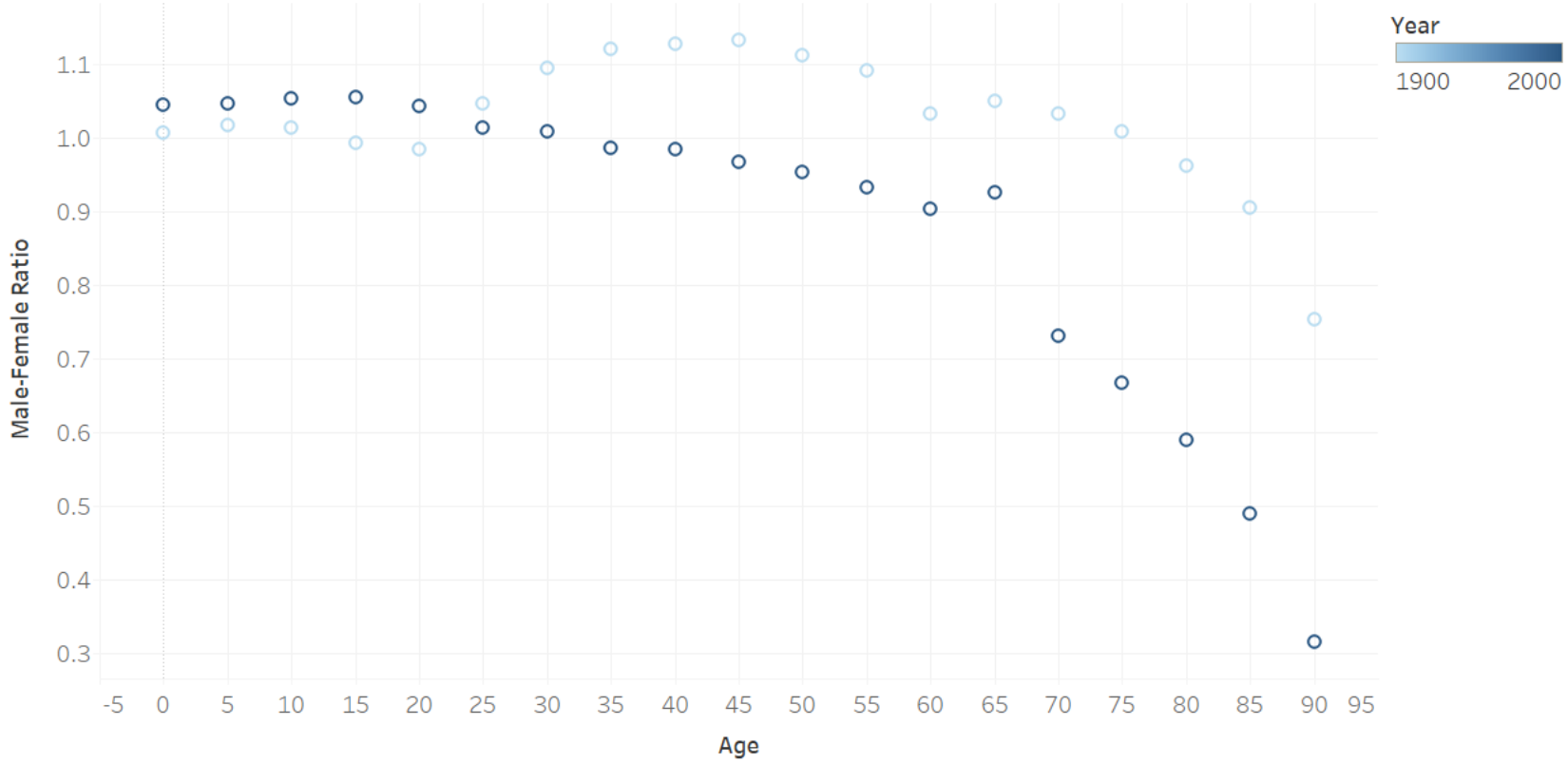
% of Total People calculated using respective male and female population and dividing by the combined population of both genders


How did the ratio of males to females change per age group between the years 1900 and 2000?
1900 male
1900 female
2000 male
2000 female
100%
80%
60%
40%
20%
0%
0
10
20
30
40
50
60
70
80
90

How Does the Total US Population Represented by Females for Each Age Group in 2000 compare to 1900?



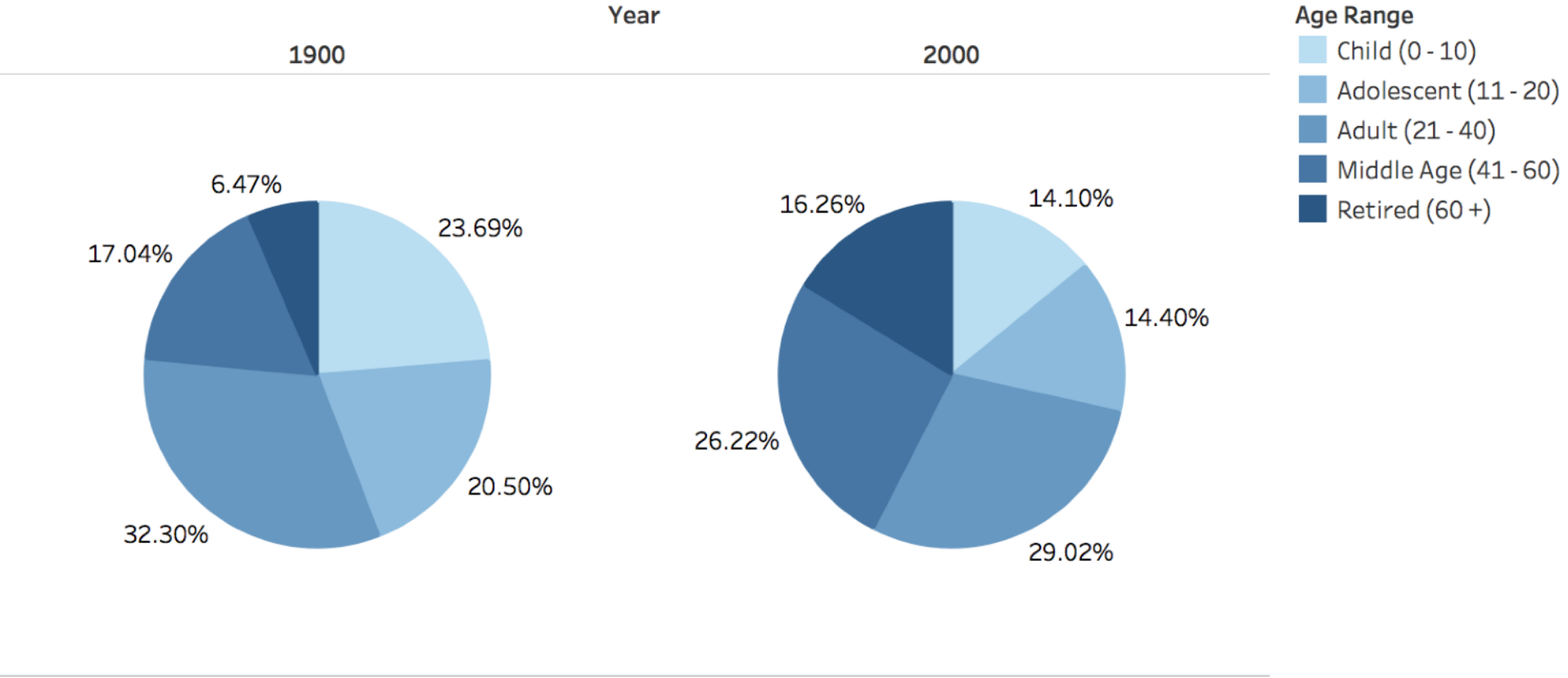
The Decreasing Male-Female Aging Ratio (based on 1900 and 2000 US Census Data)



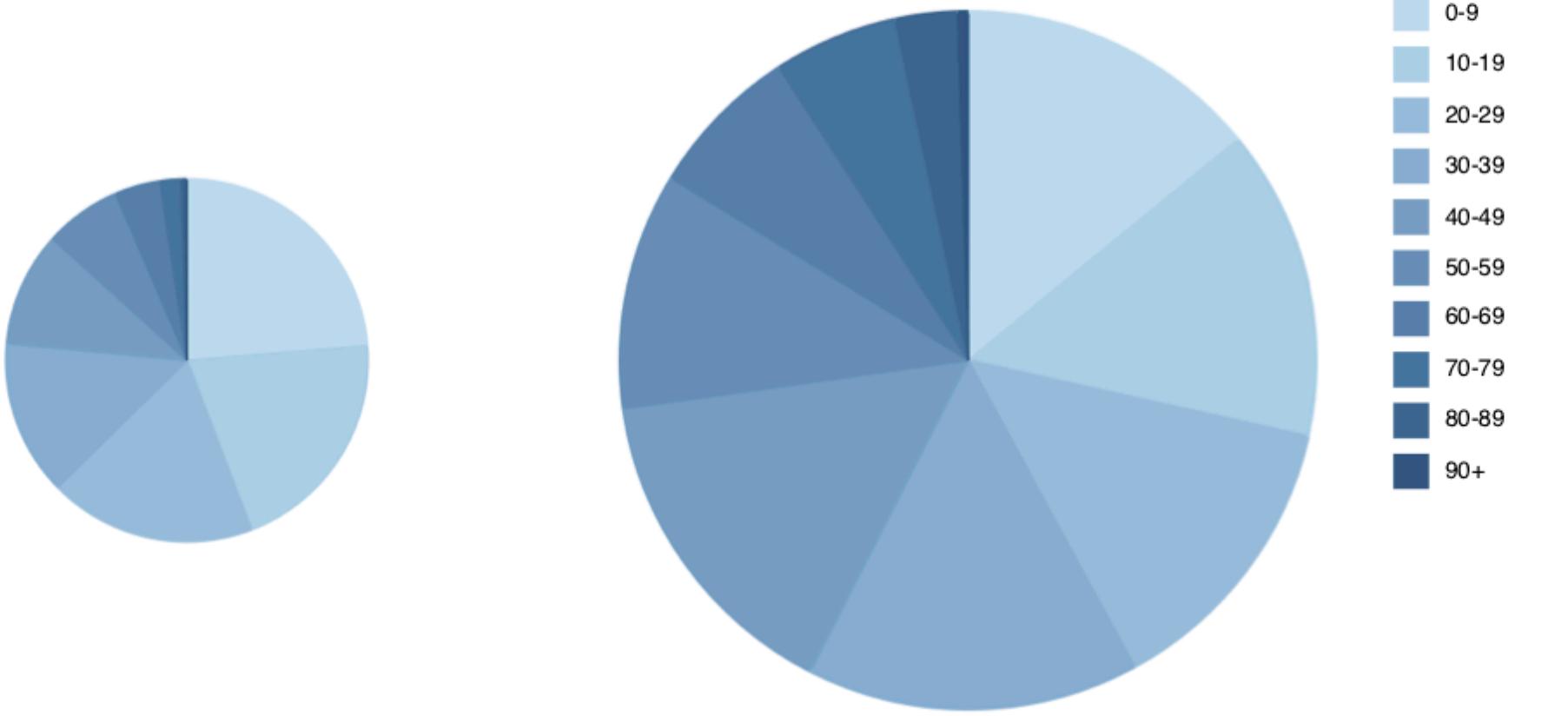
The plot of sum of Age for Male-Female Ratio. Color shows details about Year.

Circular Charts

Change in the Proportions of Different Age Groups in the Population from 1900 to 2000



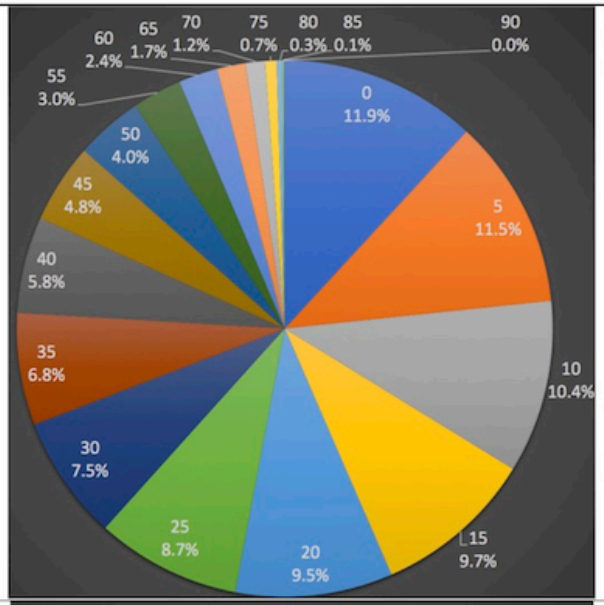
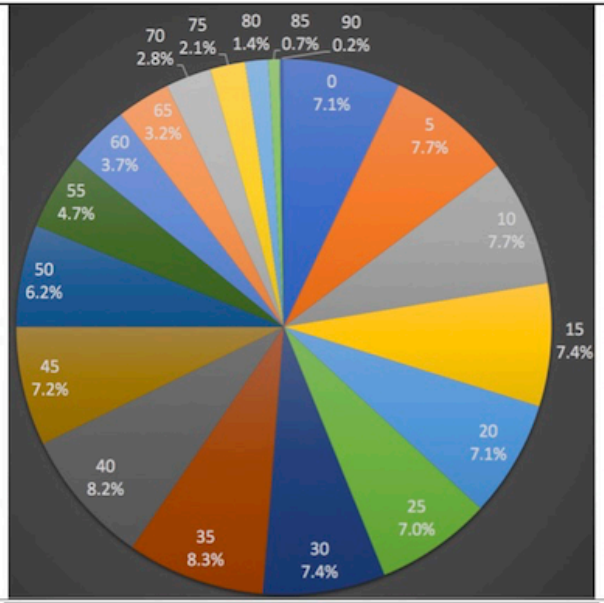
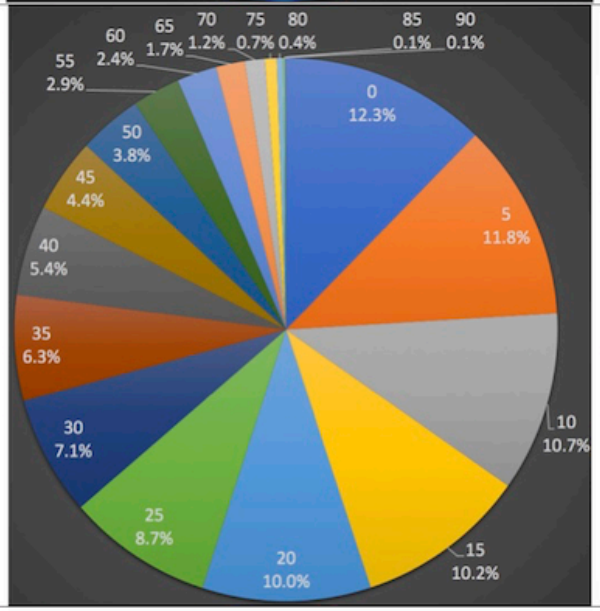
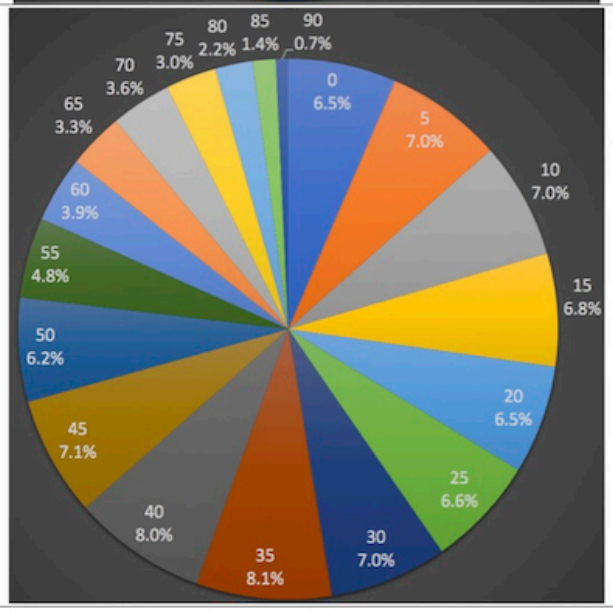
How did the age composition of the U.S. population change over the twentieth century?



Year: 1900
Total population: 76,262,821

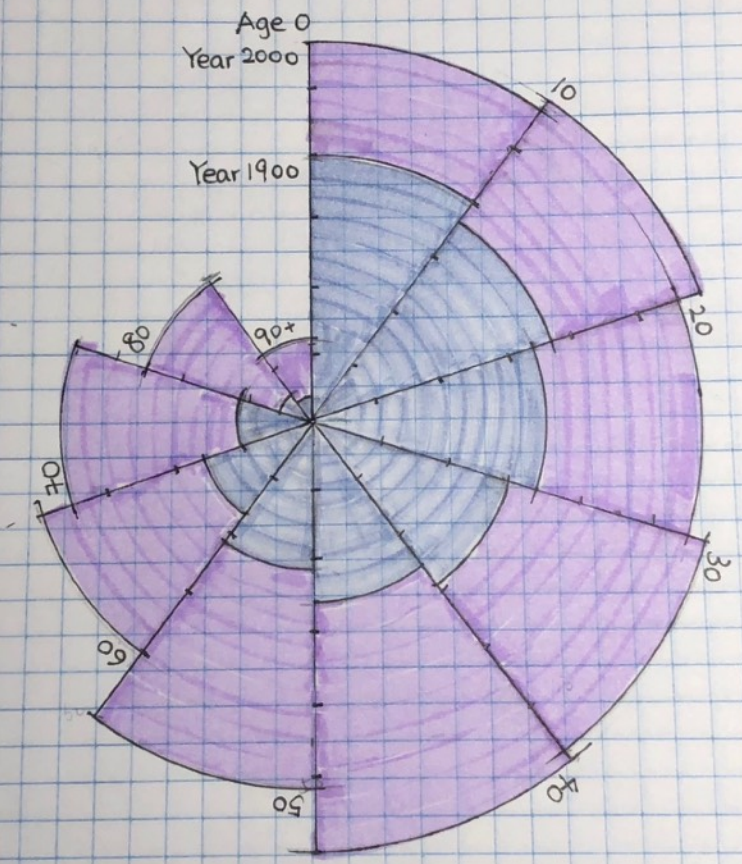
Year: 2000
Total population: 281,420,717

How Did Gendered Population Distribution Based on Age change from 1900 to 2000

	1900	2000	Age Key
Men			
Women			Top line of each label is the lowest age in the bucket (0: 0 to 4, 5: 5 to 9, etc.). Bottom line is the percentage of population for that gender in the given year

A Century Apart

U.S. Population Age Composition and Growth



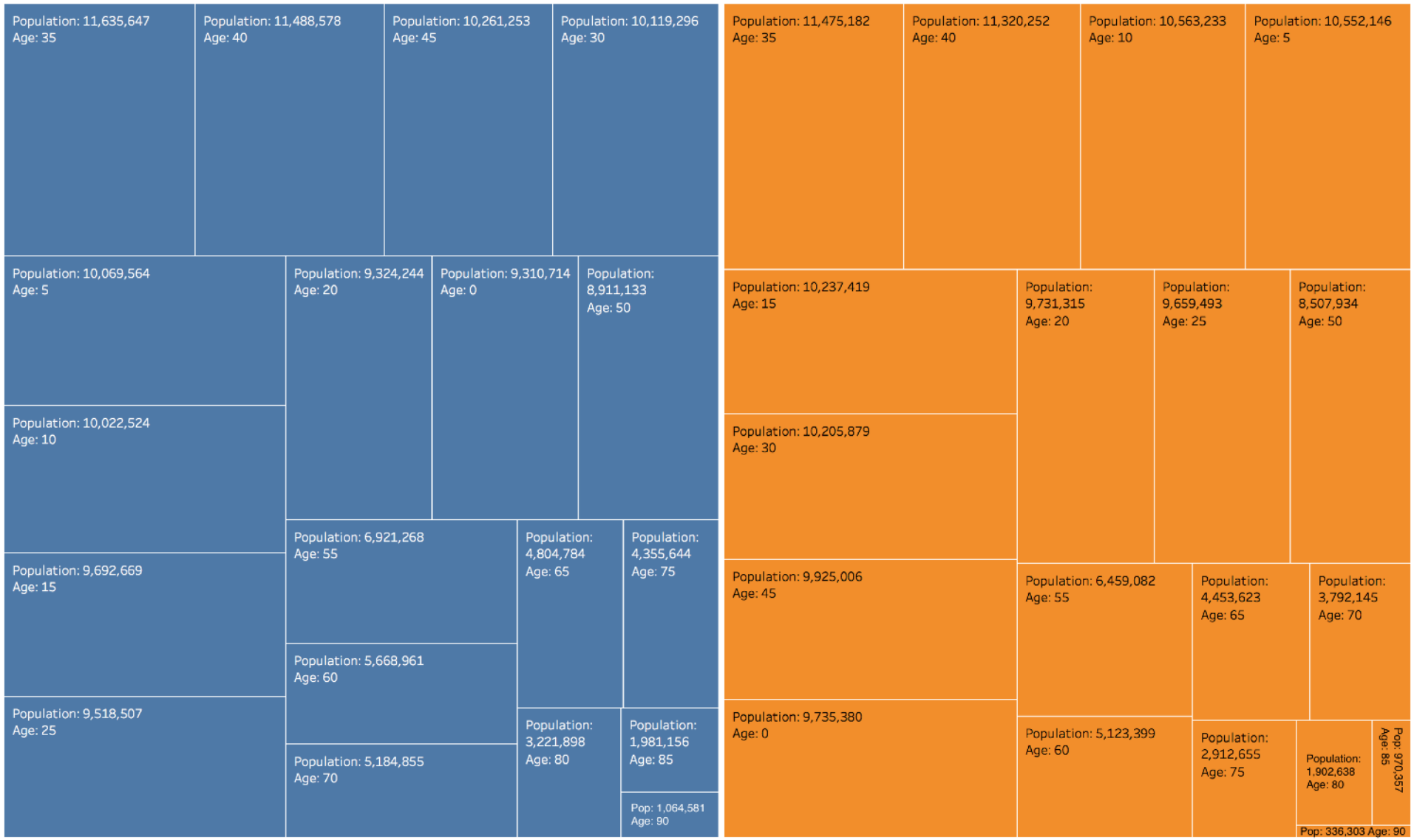
≈ 0.95 Million PPL

Year 2000 Total : 281,420,717 ppl

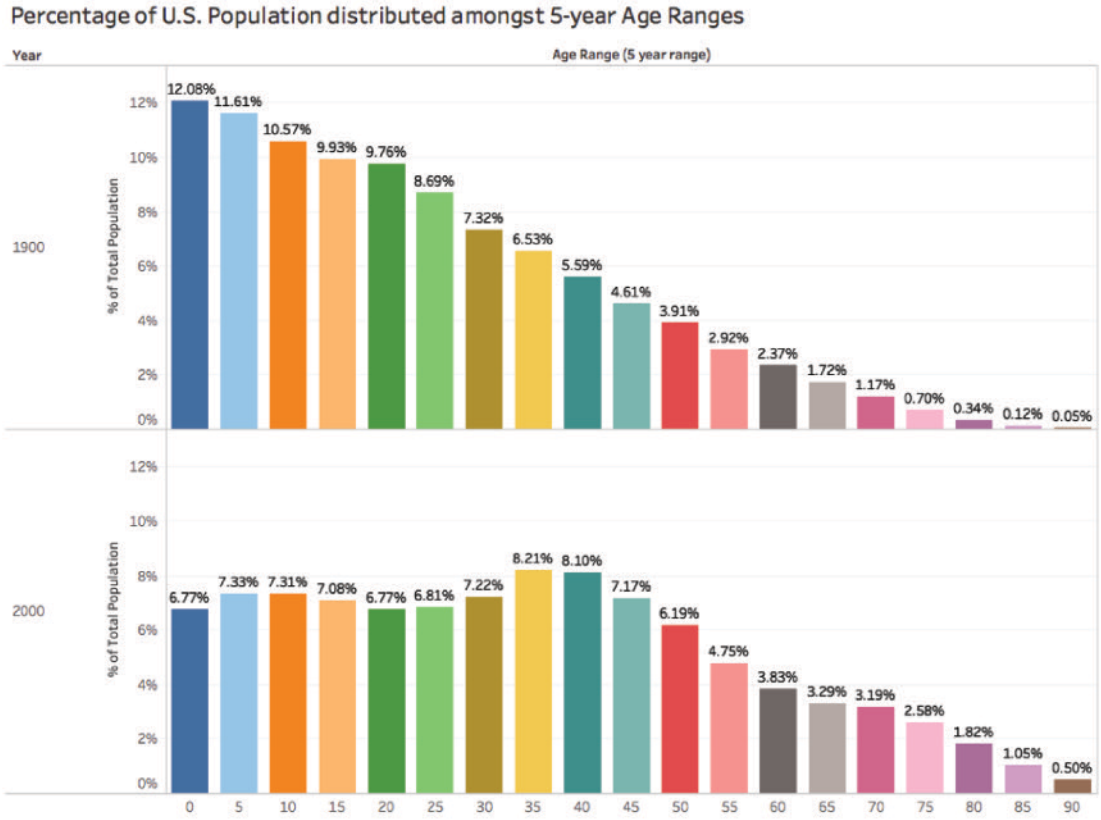
Year 1900 Total : 76, 262, 821 ppl

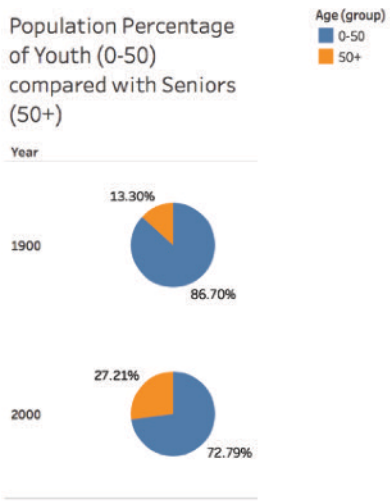
Other!

How does the 2000 U.S. population brake down in terms of age and sex?

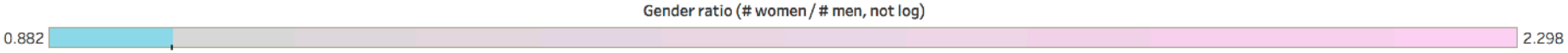


Was the United States younger in 1900, or in 2000?

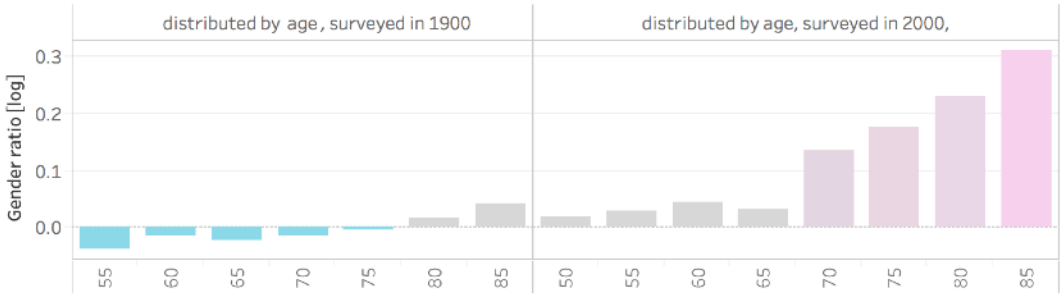




Did wars affect the ratio of women to men in the USA?



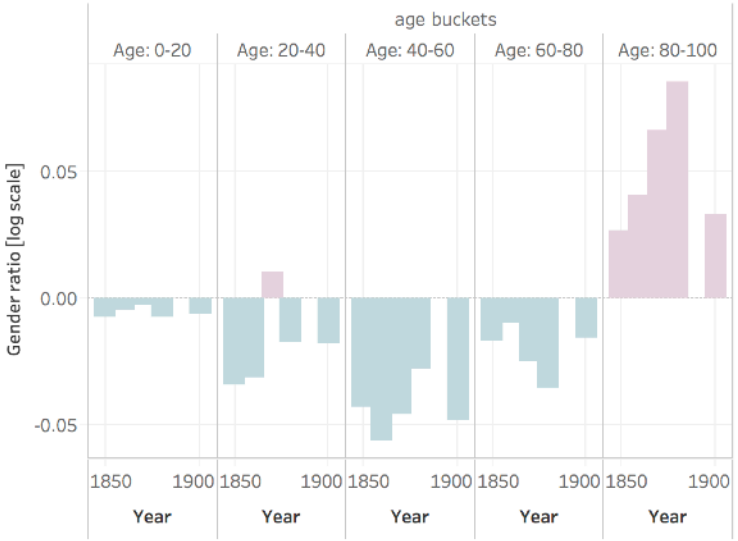
Female-male ratios across ages, as surveyed in 1900 and 2000



The Civil War took place in 1861-1865. Veterans of that war must've been at least 60 during the 1900 census. **We see a higher female-male ratio for ages 60 +** than for 55.

World War I took place in 1942-1945, the Korean war 1950-1953, and the Vietnam 1955-1975. Veterans of those wars must've been at least 70 by the 2000 census. **We see a higher female-male ratio for ages 70+.**

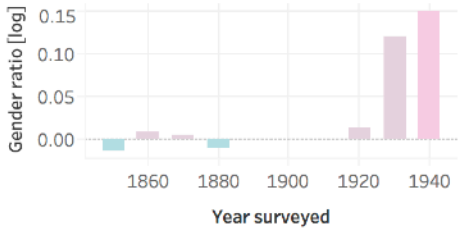
Gender ratio across the 19th century, bucketed by age groups



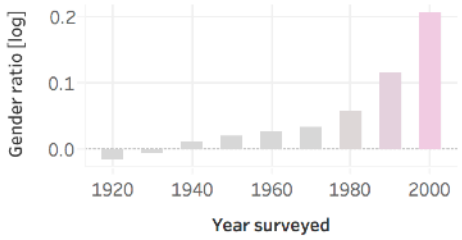
At high ages (80-100) do females become the majority. **This implies biological lifespan accounts for a high female-male gender ratio.**

The 1870 / Age: 20-40 is the only other point with more women then men. **It is likely due to the civil war** (estimated death toll: 600,000, armies: majority male)

People born in 1835-1844



People born in 1915-1924



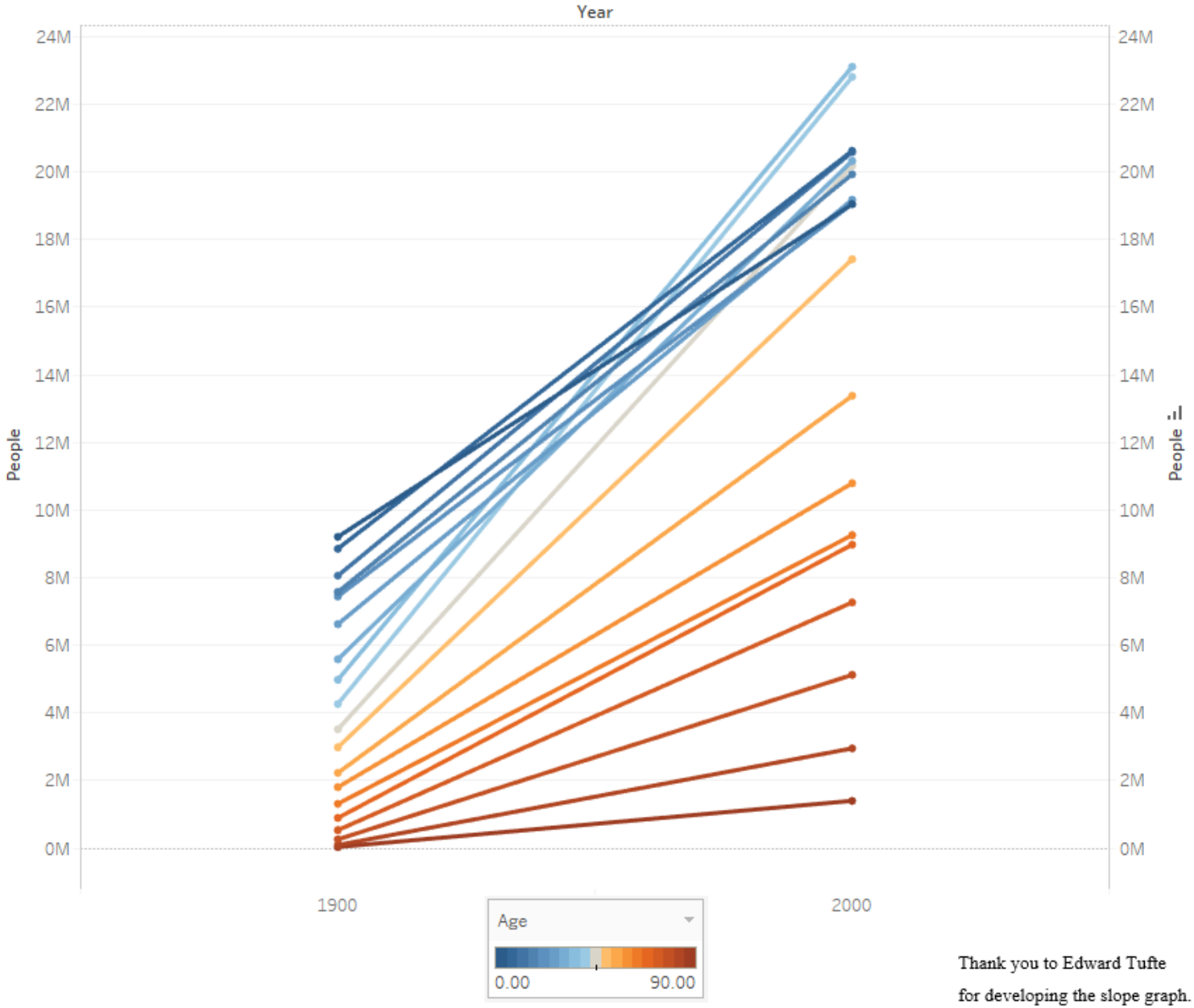
The average soldiers of the civil war and WWII were ~26 years old. So *people born in 1835-1844* capture the 'generation' of civil war soldiers, and *people born in 1915-1924* capture the 'generation' of WWII soldiers.

We see **jumps in female-male ratios corresponding to the civil war and WWII timeframes,** but the **highest female-male gender ratios appear when the soldier generations become old.**

In conclusion: The five wars with the highest American casualty counts took place in the 19th and 20th centuries. **Wars seem to have an effect on gender ratios, although not as dramatically as biological lifespan.**

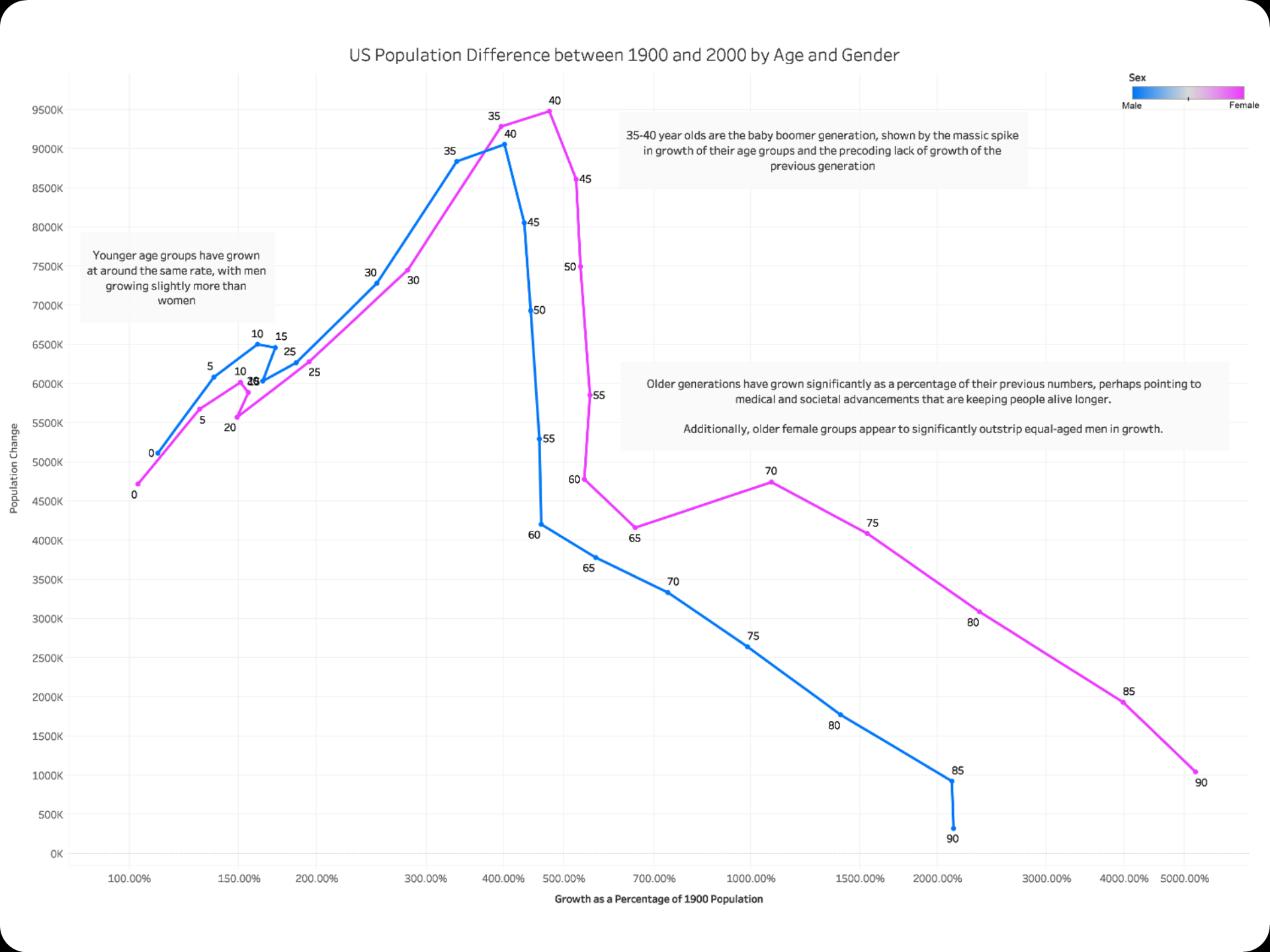
How different is the age make-up of the U.S. comparing 1900 to 2000?

1900 vs. 2000: U.S. Population by Age from Two Snapshots

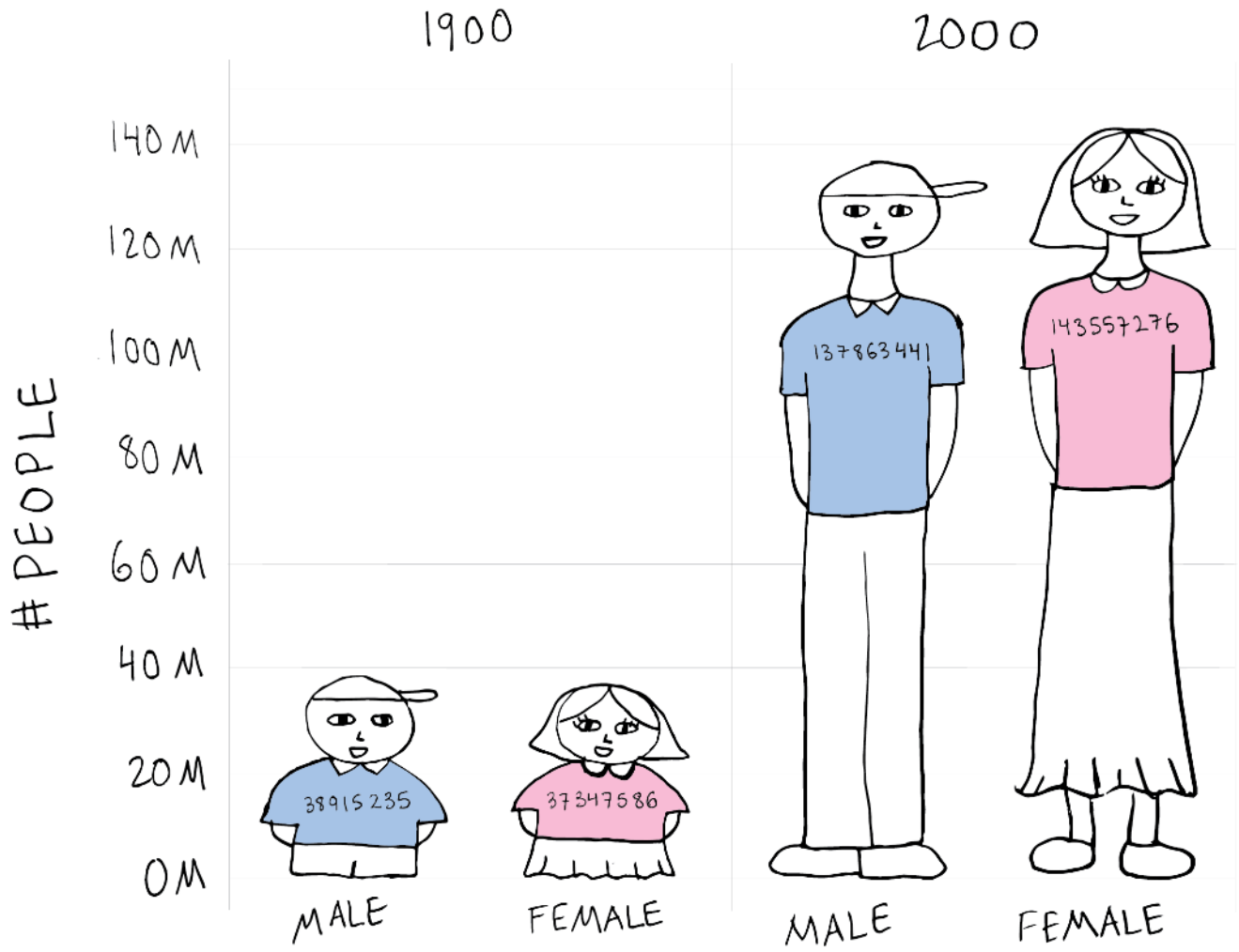


Thank you to Edward Tufte for developing the slope graph.

Each color represents a 5-year segment of ages from 0-4 to 90+ years old.


US Population Difference between 1900 and 2000 by Age and Gender
Sex
Male
Female
35-40 year olds are the baby boomer generation, shown by the massic spike in growth of their age groups and the precoding lack of growth of the previous generation
Younger age groups have grown at around the same rate, with men growing slightly more than women
Older generations have grown significantly as a percentage of their previous numbers, perhaps pointing to medical and societal advancements that are keeping people alive longer.
Additionally, older female groups appear to significantly outstrip equal-aged men in growth.
Population Change
9500K
9000K
8500K
8000K
7500K
7000K
6500K
6000K
5500K
5000K
4500K
4000K
3500K
3000K
2500K
2000K
1500K
1000K
500K
0K
100.00%
150.00%
200.00%
300.00%
400.00%
500.00%
700.00%
1000.00%
1500.00%
2000.00%
3000.00%
4000.00%
5000.00%
Growth as a Percentage of 1900 Population

HOW HAS THE POPULATION CHANGED BY SEX IN 100 YEARS?



What Is The Combined Weight Of All US Citizens

Re-Design Exercise

Re-Design Exercise

Task: Analyze and Re-design visualization

Identify data variables (N/O/Q) and encodings
Critique the design: what works, what doesn't
Sketch a re-design to improve communication
Be ready to share your thoughts with the class

Break into groups with those sitting near you
(~4 people per group)

Effectiveness Rankings [Mackinlay 86]

QUANTITATIVE	ORDINAL	NOMINAL
Position	Position	Position
Length	Density (Value)	Color Hue
Angle	Color Sat	Texture
Slope	Color Hue	Connection
Area (Size)	Texture	Containment
Volume	Connection	Density (Value)
Density (Value)	Containment	Color Sat
Color Sat	Length	Shape
Color Hue	Angle	Length
Texture	Slope	Angle
Connection	Area (Size)	Slope
Containment	Volume	Area
Shape	Shape	Volume

Teacher Salaries: Is It Really That Bad?

National and State averages for K-12 Public-School Teachers

UNITED STATES

AVG. SALARY: $47,674

Avg. vacation days: 63

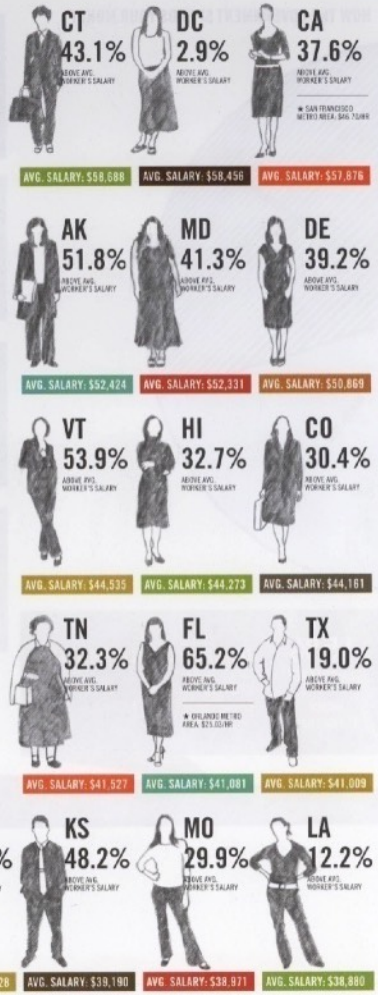
HOURLY
Hours per week on-site: 36.5
Public-School Teacher: $34.06
Private-School Teacher: $21.08
Average Worker: $25.08
Police: $22.64
Fire: $17.91

CANADA

AVG. SALARY: $43,000

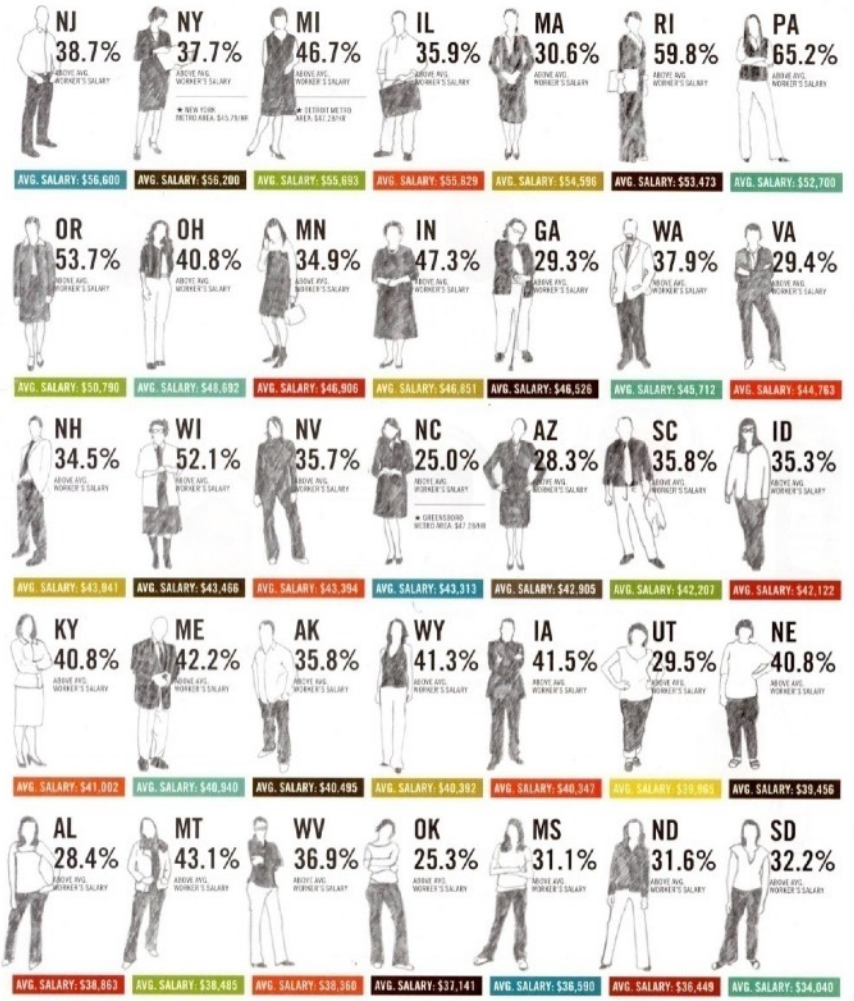
Avg. vacation days: 50

HOURLY: $30.18
Hours per week on-site: 55.6

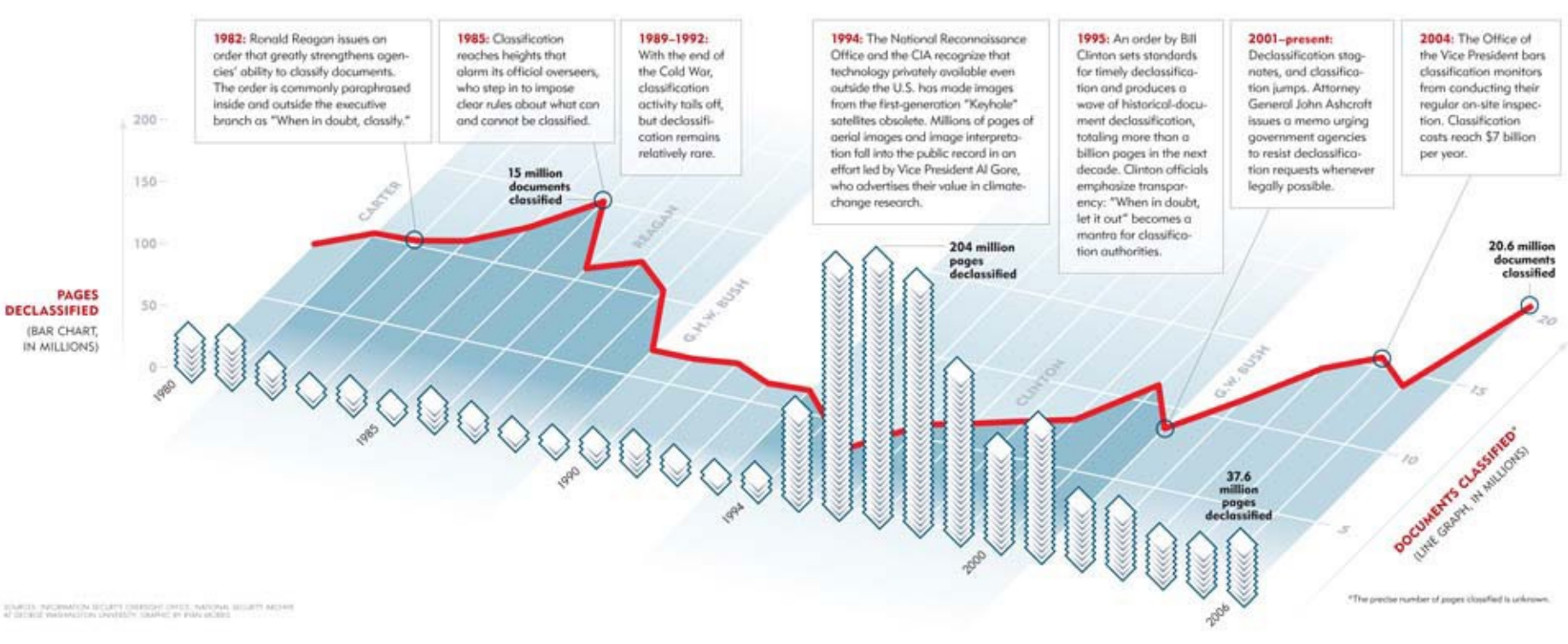


SOURCES Manhattan Institute; National Center For Education Statistics; National Education Association; U.S. Bureau of Labor Statistics

AVERAGE Workers' salaries used for comparison are those of white-collar, nonsales employees.

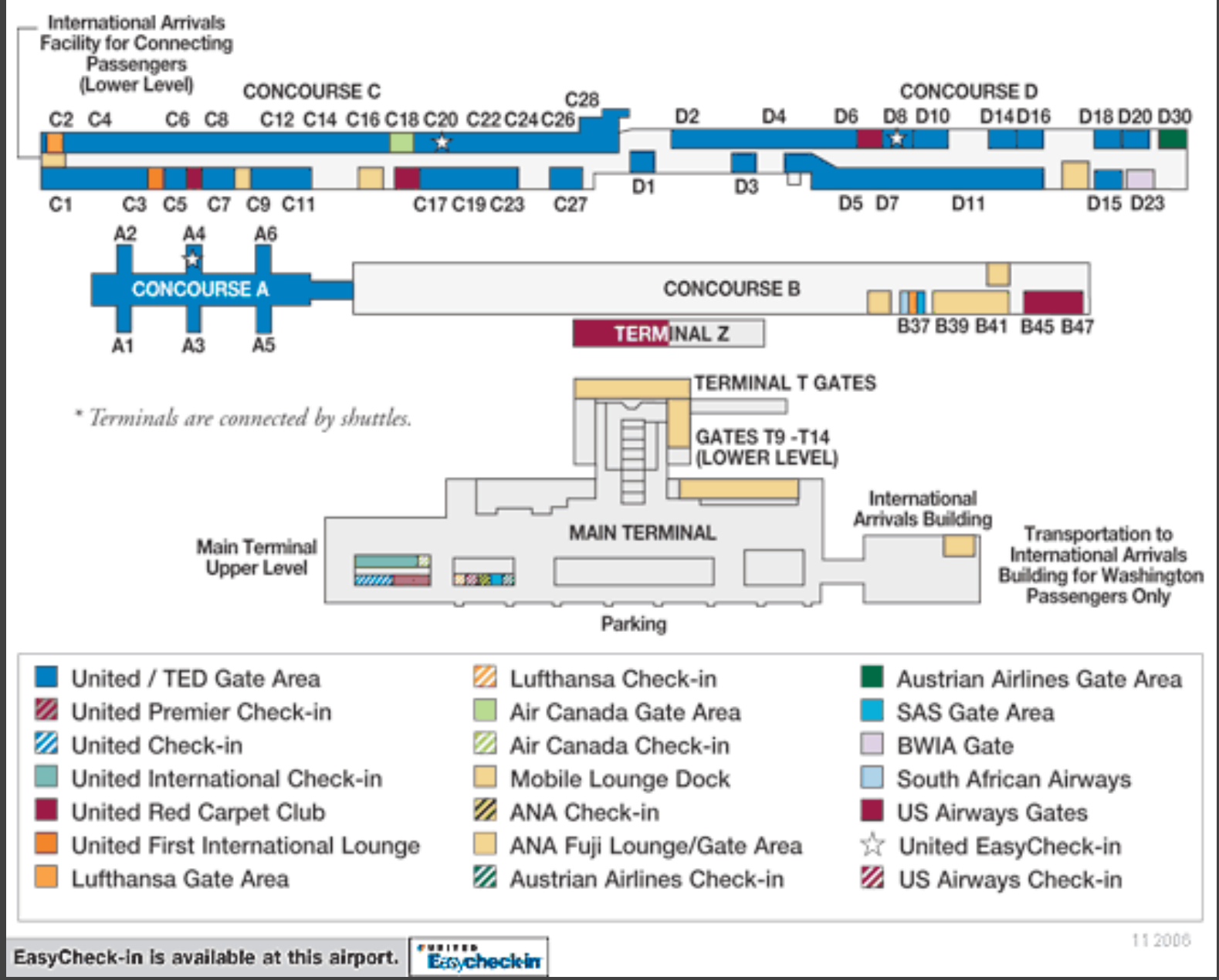


Source: *Good* Magazine



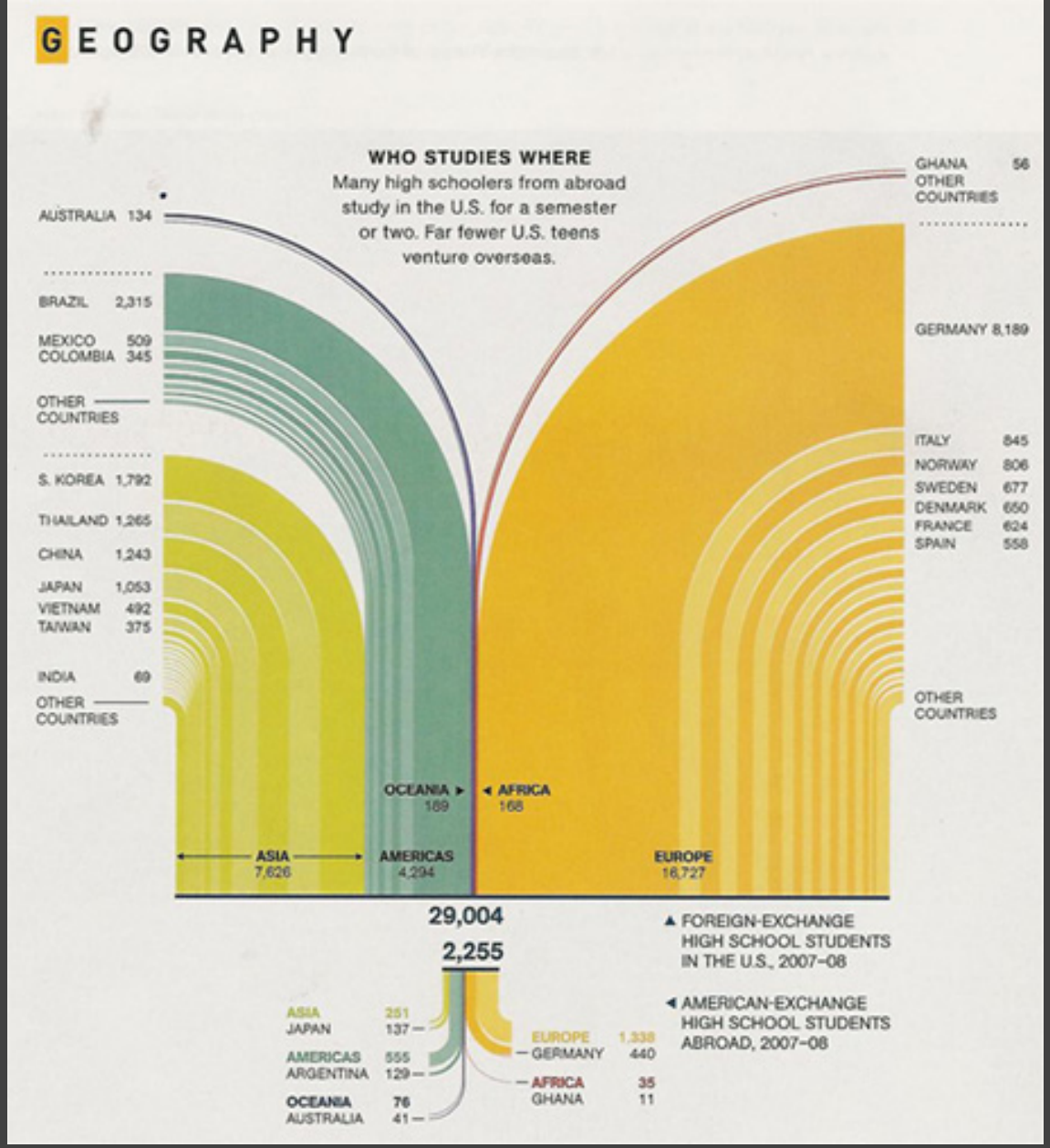
Source: *The Atlantic* 300 no. 2 (September 2007)

Number of Classified U.S. Documents



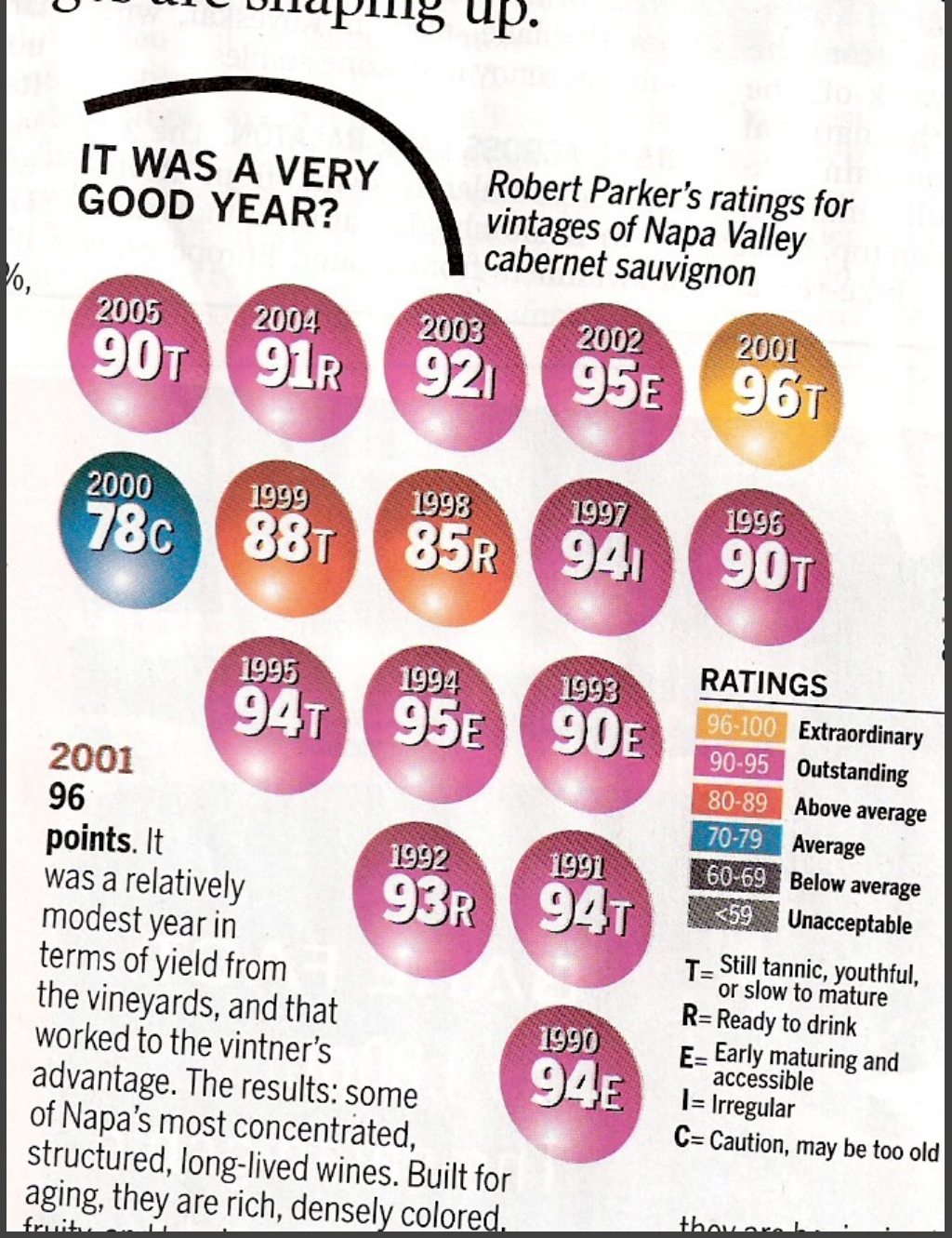
Washington Dulles Airport Map

Source: United Airlines *Hemispheres*



Source: *National Geographic*, September, 2008, p. 22.

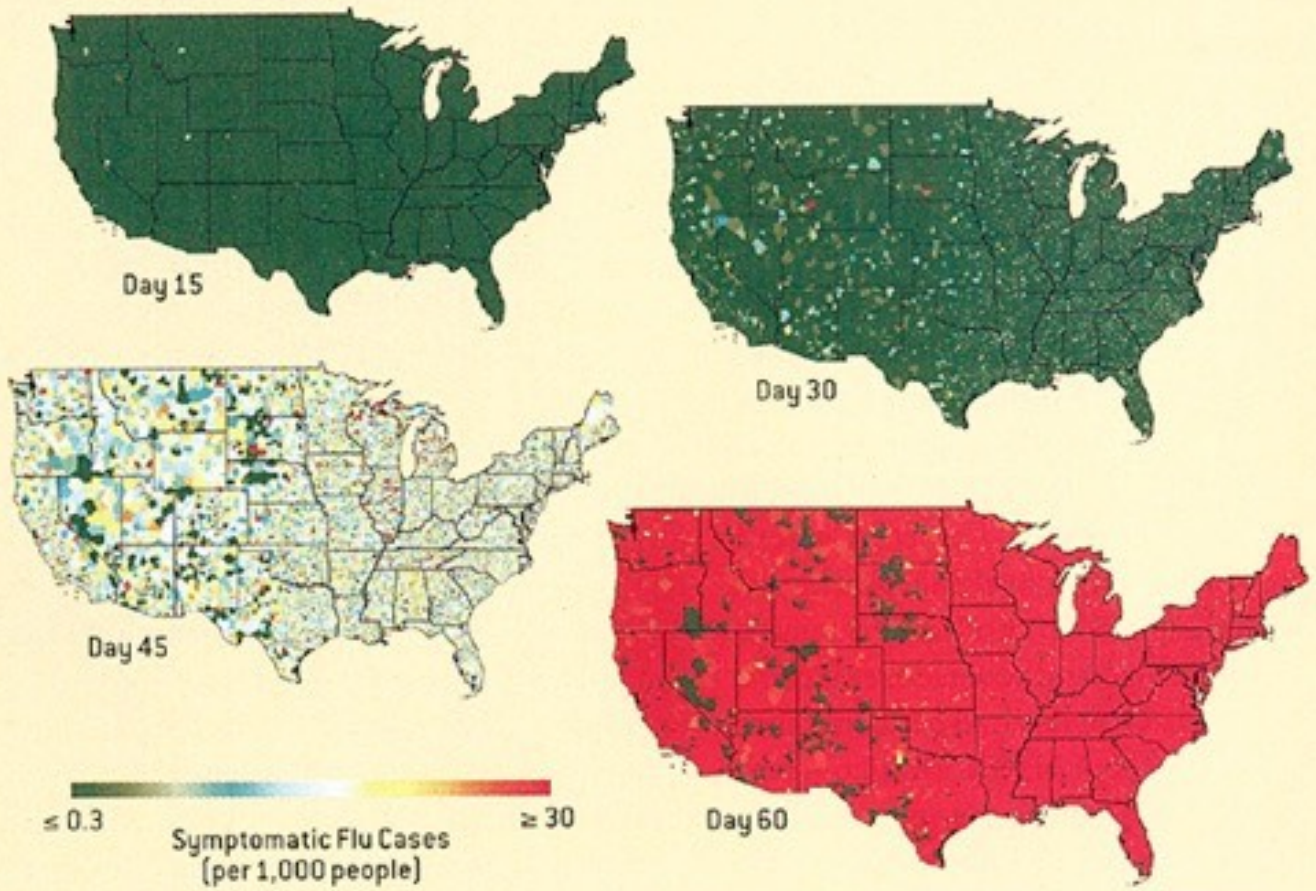
Silver, Mark. "High School Give-and-Take."



Source: *Business* Week, June 18, 2007

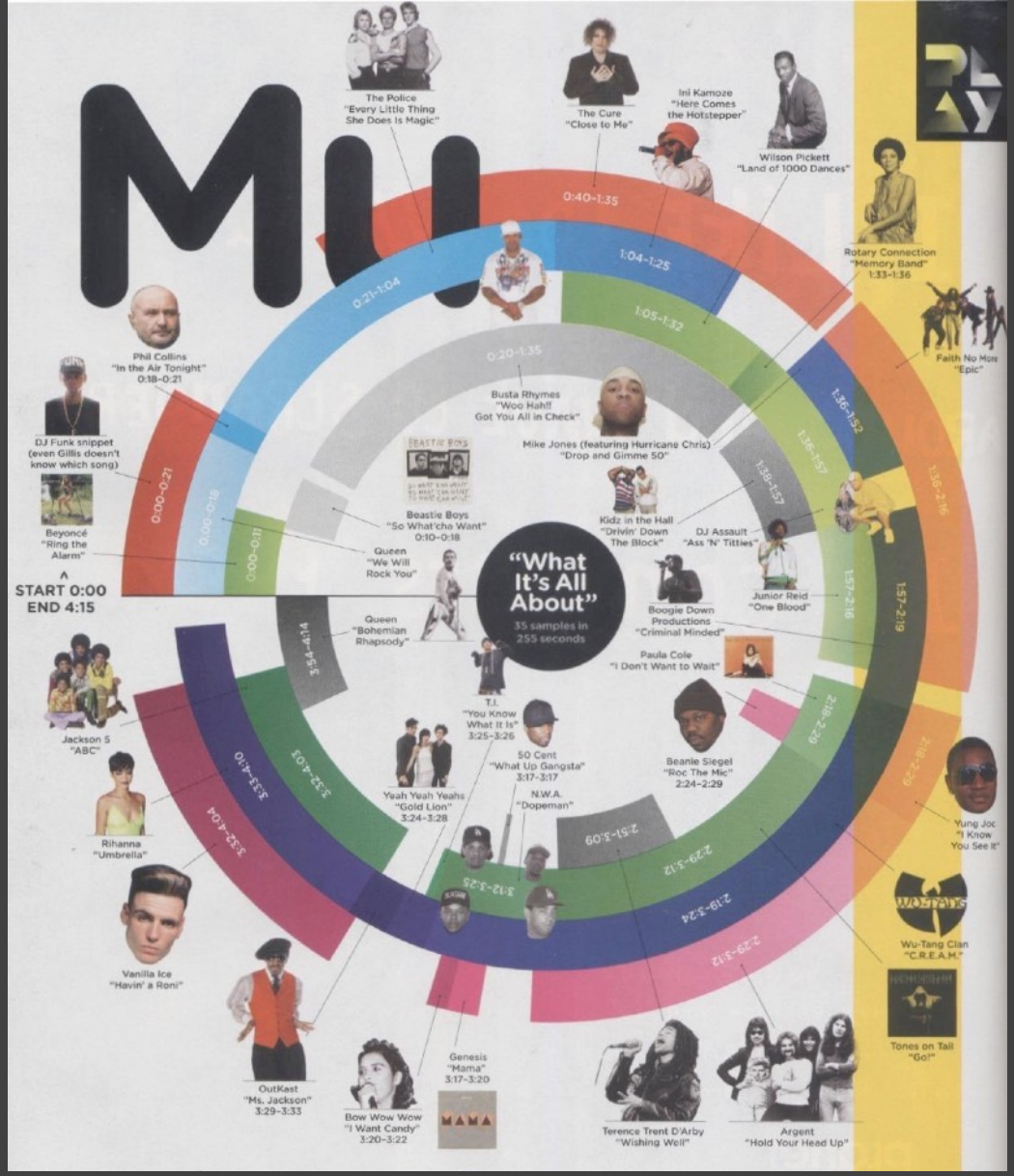
Pandemic Flu Hits the U.S.

A simulation created by researchers from Los Alamos National Laboratory and Emory University shows the first wave of a pandemic spreading rapidly with no vaccine or antiviral drugs employed to slow it down. Colors represent the number of symptomatic flu cases per 1,000 people (*see scale*). Starting with 40 infected people on the first day, nationwide cases peak around day 60, and the wave subsides after four months with 33 percent of the population having become sick. The scientists are also modeling potential interventions with drugs and vaccines to learn if travel restrictions, quarantines and other disruptive disease-control strategies could be avoided.



Preparing for a Pandemic

Source: *Scientific American*, 293(5). November, 2005, p. 50



Source: *Wired Magazine*, September 2008 Edition

Music: Super Cuts (page 92)