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Analyzing Multi-Generational Gathering and Dispersion to and from Ten 19th-Century American Cities

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Abstract: Genealogy, with its tying of people to places, allows for the study of migration over multiple generations. In this paper we use family history data from FamilySearch.org to analyze the migration of the ancestors of those born between 1865 and 1875 in ten United States cities followed by the migration of descendants of people born in the same city during that same decade. Other work has followed the ancestors for multiple generations, and we have added in an examination of the migration of descendants from city origins. We calculate a number of statistics and indices and use maps to illustrate the main spatial themes of these migrations and how they vary among the cities. We find that cities have their own unique mixes of migrants that lead to differences in how often the generations were stable in a community; that descendants of those born in our study cities tended to stay close to the city for some time; that the ancestors of migration funneling into a city were more spread out than the descendants of those born in the city; that migration generally proceeded from east to west from the great-great-grandparents to the children, but that the center of migration was more random for the descendants; and that the distance of migration between ancestral generations was highly affected by the share of European ancestors and the regional location of the city. The value of this approach is that genealogical migration research can examine a large number of historical migration questions within one unified framework, which has not been carried out in other studies.

Keywords: multi-generational migration; North America; community stability; diaspora; gathering

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Citation: Otterstrom, Samuel M., Jane Selander, and Rafael Deo. 2024. Analyzing Multi-Generational Gathering and Dispersion to and from Ten 19th-Century American Cities. *Genealogy* 8: 148. https://doi.org/10.3390/genealogy8040148

Received: 9 October 2024
Revised: 23 November 2024
Accepted: 13 December 2024
Published: 17 December 2024

Correction Statement: This article has been republished with a minor change. The change does not affect the scientific content of the article and further details are available within the backmatter of the website version of this article.

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1. Introduction

Genealogical research is full of opportunities for connecting generations through time and space. Because geography is a central variable that can help explain the movement of people over time, thorough genealogical research often includes referring to place and distance when attempting to tie names to families.

In this paper, we explore the genealogical connections and migrations of people born in the decade of 1865 to 1875 in ten United States cities, using FamilySearch Family Tree data and statistical analysis. The cities range from north to south, from the coast to inland locations, and from large to middle size, and include (with their 1870 population where available) Cleveland (OH (92,829), Atlanta (GA) (21,789), Boston (MA) (250,526), Charleston (SC) (48,956), Charleston (WV), Charlotte, (NC) (4473), Jackson (MS), Chicago (IL) (298,977), New Orleans (LA) (191,418), and Washington (D.C.) (131,700). This research highlights how migration in and out of American cities had distinctly different characteristics that can be shown within a genealogical migration system.

In the past, many other studies have used different datasets, and censuses in particular, to analyze migration in historical places and regions in the United States. Published biographies found in many U.S. county histories, although constrained by time, place, and population, are useful and valuable resources due to their detailed life course migration accounts (Hudson 1988; Palmer 1880). Additionally, some published genealogies, obituaries (Knowles 1995), school records (Gant 2008), and certain censuses yield migration data, but

their coverage in time, space, and population are seldom comprehensive. These limitations thus hamper the ability of these data sources to reveal additional far-reaching migratory trends in the past (Appendix B discusses some of the studies that have used linked census records to study past populations). Other papers have used linked census records to trace migration patterns across the country (Thernstrom and Knights 1970; Hudson 1988; Steckel 1988), but our use of genealogical data makes this study distinctly different. Indeed, the strength of our approach is that we do not rely on census records and linked census because censuses do not have the ability to report specifically where people were born or where individuals' parents were born (usually only given as states or countries, and only in later censuses). U.S. censuses do have advantages, though, such as including economic, race, language, and education variables, depending on the census year.

When using genealogical data, geographers and other scholars generally have a broader goal in mind than the professional genealogist who compiles family histories. The academic desires to reveal larger social and environmental processes, while a genealogist is most interested in certain related groups of people with connections to their ancestors and descendants. This contrast suggests that genealogical and family history data are not generally in the format required by scholars, or in sufficiently sizable collections to be useful. Fortunately, the digital explosion of genealogical data and advances in map use and GIS have made it possible to overcome the traditional limitations of family history data so that genealogies can become powerful resources for those interested in evaluating complicated past geographies (Kashuba 2008; Ruvane and Dobbs 2008; Shular 2009; Chen et al. 2011).

This is in line with our method of using genealogical data to track migration. It has been some time since scholars have recognized how genealogical data can be used for migration and other social science purposes (e.g., Mineau et al. 1989). In the past, small sizes of genealogical databases have limited this approach, and made studies less representative of the general population, but the method has become increasingly used in this type of research as datasets have grown and technology has improved (e.g., Koylu et al. 2014; Kaplanis et al. 2018; Koylu and Kasakoff 2022). Additionally, at the macro scale scholars have shown the value of using large databases of demographic data to show the complicated bilateral migration flows around the world (Abel 2013; Abel and Sander 2014; Abel and Cohen 2019, 2022).

Recently, genealogical databases have aided the more accurate linking of censuses, so that genealogy datasets and linked records can be used hand in hand to study historical U.S. populations (Koylu et al. 2020; Price et al. 2021; Buckles et al. 2023). These improved linked datasets can now be used to model interesting historical trends, including what happened to people who left shrinking cities 100 years ago (Otterstrom et al. 2022). We should here emphasize two great advantages of genealogical datasets compared with record linking studies. First, genealogies can extend back before regular censuses were held, and second, genealogies easily follow people and families across national boundaries, which is not as straightforward for linked records that are reliant on censuses in individual countries.

This research paper builds upon publications and research using FamilySearch.org website genealogy data that have been queried and analyzed for multi-generational patterns of migration using many thousands of records. Specifically, previous research has considered backward flowing ancestral migration flows that recreate patterns that begin at a root location and follow the birth locations of ancestors by individual generation. This has allowed a variety of research inquiry approaches, including analyzing origins of migrants to the United States from different parts of the British Isles, the movement of people associated with the Gold Rush in California, and the relative European makeup of the populations of different cities in the U.S. in about 1900 (Otterstrom and Bunker 2013; Otterstrom et al. 2021; Otterstrom and Bunker 2018).

In this paper, we expand on previous studies by showing the value of ancestor and descendant genealogical migration study, and by analyzing the patterns of both gathering to cities using ancestor data and the dispersion or diaspora from cities of people born

there using their descendants as the measure of the extent of spreading. This has not been carried out before. We compare this with the gathering portion of the generational hourglass (Figure 1), where the ancestors of those born in those same cities came from are illustrated and quantified, and we evaluate a number of geographical statistics related to these migration geographies. We focus on the results of our research, and not on an exhaustive review of the related literature, although Otterstrom et al. (2021) and Otterstrom and Bunker (2013) set the stage well for this expanded work.

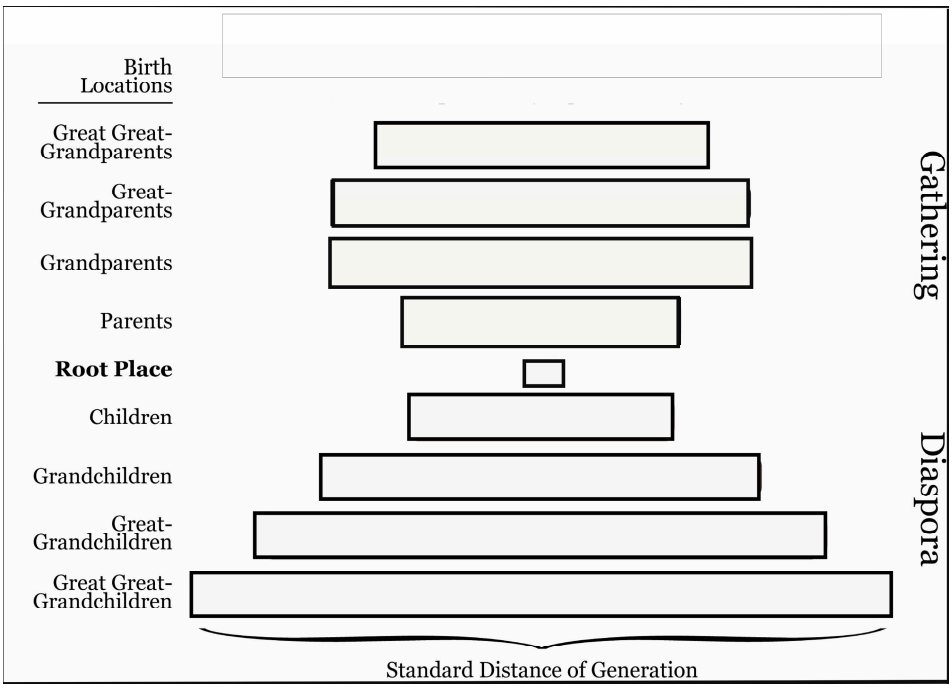


Figure 1. Generational hourglass (after Otterstrom and Bunker 2013, p. 547).

The approach of genealogical geography, or the spatial patterns related to the locations of related people over time, can illuminate historical migration trajectories across a wide array of places on the planet. The generational migration hourglass, developed by Otterstrom and Bunker (2013), illustrates underlying geographies of diaspora and gathering (Figure 1). The migration hourglass shows the standard distance width of the source or destination locations related to the sample of people born in a certain city with each other in one generation, and it is the spatial equivalent to the standard deviation. The distinct width of each hourglass generation is affected by the time period and geographic place of each city, with the larger standard distance meaning that the people in that generation are more spread out compared with other generations.[1]

In the case studies of previous papers, the patterns of migration are revealed at the more aggregated scale, where large numbers of individuals are tracked, and their distance of migration measured and added together to represent the macro level (Otterstrom and Bunker 2013, 2018). Those historical migration studies measure the process of individual to child or parent migration across one or more generations. In other words, the generational migration approach emphasizes a distinct migration process that focuses on child to parent geographic measures, in contrast with life-course migration research that follows individuals from their place of birth through their place of death (see, for example, Adams et al. 2002). Thus, generational migration examines multiple generations that are tied together through family bonds. Because of this genetically tied migration characteristic, one can illustrate cultural traits that diffuse along with the intertwined migrating individuals, generation by generation (see Woodard 2012).

We can now ask more about both where settlers in a region came from, and where they leave to. For instance, using the concept of diaspora, one can study the Irish Potato

Famine of the 1840s in more detail using genealogy tools. The potato blight translated into starvation, death, and significant emigration. Some 1.5 million Irish died, and a million others left Ireland (Kilbride and Farley 2005). A large number of the emigrants made their way to the United States. In the 1850 U.S. Census, Ireland was the birthplace for the largest number of foreign-born residents. These immigrants consistently found their way to the largest cities, such as New York, Boston, Chicago, and New Orleans (Myers 1977). In this study, we are looking at the next generation after the large Irish diaspora, so we will be able to track Irish heritage back in time from the big cities.

We are approaching the following questions related to these migrations using our ancestor and descendant approach:

1. How does the percentage of ancestors and/or descendants born near a city from generation to generation differ, and what does that say about the population compositions of those cities at that time?
2. Are there noticeable differences among the base cities in terms of whether future generations migrated far distances or short distances from one generation to the next?
3. How does the character of forward migration (descendancy) differ from the backward migration patterns (ancestor)?
4. What does the center of ancestors' or descendants' birthplaces for each generation from the base cities say about the migration trends between generations related to those base cities?
5. How far, on average, does each generation migrate from a parent's to a child's birthplace or from a child's to a parent's birthplace, and what does this say about the underlying geo-demographic makeup of the cities?
6. Each city has a different makeup of descendant and ancestral homelands (states and nations); how and why does this vary by city?

Thus, in this paper the additional ability to follow the migration patterns of descendants (diaspora) in addition to ancestors (gathering) will be a valuable asset in explaining the more complete migration story around cities through analysis of maps and statistics that represent the long-term patterns of migration that show a mix of diasporas and gatherings (Otterstrom and Bunker 2018).

2. Materials and Methods

In this paper, we are exploring the concepts of both gathering and diaspora. In terms of diaspora, or where people and their descendants spread out to, we can look at different source cities or regions and then track their migration patterns for several generations. Conversely, how people "gather" to a city or region ("root" location) can be followed by finding the birth places of the ancestors (such as parents, grandparents, and great-grandparents) of those born in that root location, and then reversing the perspective by starting at the most distant relationship (e.g., great-grandparents) and following their gathering migration to the root city or region. In our case, we are choosing cities in the United States as the central passage in the hourglass to show migration diasporas from these places from the initial search period, like Knowles (1995) showed with the Welsh diaspora. This is carried out by using the birthplaces of the root generation in a city between 1865 and 1875 and then retrieving the names and birthplaces of their descendants (such as children, grandchildren, and great-grandchildren). The death places of those in the search could also help give a more detailed description of the migration trajectories of the people in each generation. For the gathering portion, the top of the hourglass represents the ancestors, and the standard distance width of their migration ("shed" like a water "shed") from which the main thrust of the migration originated. Through the generations, the descendants focus in on, or gather to, the respective U.S. cities, in our case, and the children born there in the study decade.

As mentioned earlier, in other papers using the FamilySearch API, the analysis focused on the locations of the births of the ancestors of people born in one city, or the "root" location. In this paper we add analyses of descendancy relationships (such as children,

grandchildren, and great-grandchildren). The migration hourglass (Figure 1) shows the hypothetical spreading of ancestors across space both back in time (ancestors) and forward in time (descendants). Of note is the fact that each descendant generation can potentially vary more in size than the ancestor generations because one can have zero to multiple children, whereas a child only has two parents (unless stepparents are included for some). So, we now build both sides of the migration hourglass and assess how the migration flows differ in statistical and spatial makeup to and from place to place around the United States.

Here, we consider the inward gathering of people to a sampling of cities followed by the outward diasporas of people (descendants). As such, we can analyze the question of the ethnic origins of people in a city at a certain time and also the tendency of residents to stay in that place over time. We map the birth cities of both the ancestors and descendants of the people born in root cities, and we also calculate a number of statistics that are explained in Otterstrom and Bunker (2013) for the generations before and after those born in the root city. These statistics include the Community Stability Index, Ravenstein Close Migration Index, Concentration Index, Dispersal Index, Standard Distance of Generation, Genealogical Mixing Ratios, and Mean Migration Distance between Generations.

- Community Stability Index—Ratio of parents born within 25 miles of the birth city of their children to parents born farther away for ancestor searches, or conversely the ratio of children born within 25 miles of the birth city of their parents to children born farther away for descendant searches.
- Ravenstein Close Migration Index—Ratio of parents born within 50 miles of the succeeding generation to all parents in that generation for ancestor searches, or the ratio of children born within 50 miles of the previous generation to all children in that generation.
- Mean Migration Distance—Average distance between the birthplaces of parents and their children who were born in a specific city or county at a certain time.
- Standard Distance of Generation—Relative dispersion statistic of all birth places from the weighted mean center in one generation. In other words, this is the standardized distance of all the birth places of one generation to the spatial center of that generation.
    - Spatial Center—The weighted geographic mean center in place of all the birthplaces in one generation.
    - Dispersal Index (Ancestor or Descendant)—Mean migration distances compared and computed between generations.
    - Concentration Index (Ancestor or Descendant)—Standard distances of each generation compared between generations, computed by dividing one generation's standard distance by that of the other generation. In other words, a comparison between two generations will show if one generation was more concentrated in its distribution than the second generation.
    - Genealogical Mixing Ratios—Proportion of ancestors from various source regions/countries. (see Otterstrom and Bunker 2013, p. 551)

We performed our searches within FamilySearch, which has some 1.66 billion individuals in its database (as of 30 October 2024 (FamilySearch 2024)). This is about twice as many people as in 2011 (Otterstrom and Bunker 2013). The FamilySearch Family Tree database is full of individual records that are linked to others through family relationships. The records have information such as name, date of birth, place of birth, marriage date and place, death date and place, and family members (children and/or parents). Only records of individuals who are dead are available for searches (there are some people in the database who are alive, but they are designated as private). When a search is performed, a base city, timeframe, number of generations, and ancestor or descendant type are designated by the user, and then the program searches for people born at that time and place up to the size of the search query, if possible. If there are more people born in that place than the search size, the search still ends when the maximum sample size is attained. From that sample, the program uses the family links in each record to obtain the children or parents of those

individuals, and that continues for the number of generations originally specified. It should be acknowledged here that we discovered the presence of a small number of duplicate records and incorrectly linked individuals in the searches (specifically in the cities that we analyzed for errors), but these errors were found to be small in number in comparison with the full dataset for each city. Also, the FamilySearch Family Tree is constantly being updated and expanded by contributors so that searches carried out six months ago will not yield the same sample if the same search was carried out now, but they should become more accurate over time (we have noticed consistency in the migration statistics in different samples from the same city taken at different times).[2]

In this study, the ten study cities are known as "root cities," and they are the center points of our study of gathering and diaspora processes. We chose these cities on the basis of them being spread out across the eastern half of the United States and having different physical (coast versus interior), ethnic, and size characteristics. The largest city, New York, is notably absent. New York could be a subject of a paper on its own with its size and importance as an immigrant gateway. There are other cities that would be valuable to analyze as well. The migration to and from our sample cities illustrates the ancestral focus or descendant spread of migration by families with children who happened to be born in a sample city from 1865 to 1875. Additionally, those cities are spread across the eastern half of the country, and they mostly had fairly large populations at the time we queried in the FamilySearch Data.[3]

For each root generation search, we queried for an initial sample of about 200 individuals born in the specific decade (1865 to 1875) and analyzed through both descendant and ancestor generations. In some of the smaller cities (e.g., Charleston, SC) there were not enough children in the database born within the decade, so we obtained all the root people we were able to. In terms of representativeness of the total population at the time, the samples of 200 should statistically give a representative view of the people born in those cities at the queried time, that are in the FamilySearch Family Tree database. That said, the results from Charleston, SC and Jackson, MS are potentially less representative because of their small sample sizes. Furthermore, there is a high probability that there are fewer minorities, such as African Americans or Native Americans, in the results because of fewer being in the database from sparser genealogical and census records available concerning these groups. Beyond that, we realize that the FamilySearch Family Tree database does not hold the complete population, even with 1.66 billion records in it, but over time there will be an improvement in the representations of all groups of people as more records are added to the system. Relatedly, the database does not identify race as one of the variables for a person, so it is unfortunately not possible to separate different groups of people in order to study their migration patterns, such as finding out what happened to African Americans in Atlanta, Georgia after the U.S. Civil War.[4]

After retrieving the sample individuals in the root generation, the birthplaces of children, grandchildren, great-grandchildren, and great-great-grandchildren were located for the descendant analysis. The locations of the births of the people in our searches are identified through the FamilySearch Place database, which had 6,370,891 place entries as of 3 November 2024 (FamilySearch 2024). The places in the database are tagged with a latitude and longitude so that locations can be mapped and great circle distances can be calculated (straight line distances are used even when physical barriers such as mountain and seas are along the point-to-point route). When only a state or country is listed as a birthplace, the center point of that state or country is the latitude and longitude in the database.[5]

With separate searches, the birthplaces of parents, grandparents, great-grandparents, and great-great-grandparents of people born in the root city were also obtained through our searches. Table 1 shows the numbers found in each ancestor generation, and Table 2 shows those found in the descendant generations (see Appendix C for the birthdate ranges for several of the cities by generation).

Table 1. Number of Ancestors Retrieved with Birth Locations.

	Atlanta	**Boston**	**Charleston, SC**	**Charleston, WV**	**Charlotte**
Gen 0 (Root)	202	201	51	195	199
Generation 1	225	201	59	239	249
Generation 2	278	256	63	337	352
Generation 3	335	256	62	506	428
Generation 4	532	380	81	783	648
	Chicago	Cleveland	Jackson, MS	New Orleans	Wash. DC
Gen 0 (Root)	193	192	60	197	200
Generation 1	278	359	76	289	222
Generation 2	274	328	104	293	216
Generation 3	290	316	125	337	224
Generation 4	394	440	208	487	317

Table 2. Number of Descendants Retrieved with Birth Locations.

	Atlanta	**Boston**	**Charleston, SC**	**Charleston, WV**	**Charlotte**
Gen 0 (Root)	201	338	51	198	203
Generation 1	197	251	59	359	368
Generation 2	189	124	35	432	556
Generation 3	63	51	9	137	151
Generation 4	9	14	0	9	7
	Chicago	Cleveland	Jackson, MS	New Orleans	Wash. DC
Gen 0 (Root)	195	190	59	203	199
Generation 1	344	260	133	376	163
Generation 2	326	238	172	397	146
Generation 3	71	50	41	91	44
Generation 4	11	2	3	2	6

Again, the questions that we asked about the ancestors to and descendants from the root cities are below, but now with the different statistical approaches used:

1. How does the percentage of ancestors and/or descendants born near the root city from generation to generation differ, and what does that say about the population compositions of those cities at that time? (Community Stability Indices. Section 3.1).
2. Are there noticeable differences among the root cities in terms of whether future generations migrated far distances or short distances from one generation to the next? (Ravenstein Close Migration Indices. Section 3.2)
3. How does the character of forward migration (descendancy) differ from the backward migration patterns (ancestor)? (Standard Distance and Genealogy Hourglasses. Section 3.3)
4. What does the center of ancestors' or descendants' birthplaces for each generation from the base cities say about the migration trends between generations related to those base cities? (Spatial Centers. Section 3.4)
5. How far, on average, does each generation migrate from a parent's to a child's birthplace or from a child's to a parent's birthplace, and what does this say about the underlying geo-demographic makeup of the cities? (Mean Migration Distances and Dispersal Indices. Section 3.5)
6. Each city has a different makeup of descendant and ancestral homelands (states and nations); how and why does this vary by city? (Genealogical Mixing Ratios. Section 3.6)

3. Results

Using our FamilySearch migration research query program, we performed searches, ascendancy and descendancy, for each of our root cities in the 1865 to 1875 timeframe. The streams of migration for each city are interesting and distinctly tied to the population makeup of the city and its location in the country.

3.1. Comparison of Percentages of Those Who Stayed in the Root City (Community Stability Indices)

Community stability, or the relative share of the descendants or ancestors who were born very near the root city where the root generation (or succeeding generation) was born (within 25 miles, about a one-day journey by wagon, indicating closeness to the community of origin), can help describe and measure demographic continuity. In our sample, there are a range of values for this statistic beginning with our 1865 to 1875 root generation. The statistics compare different generations in terms of those of one generation born close to compared with those born far from the root location. Then, the first generation is compared to the second, second to the third, and third to the fourth. We focus on the root generation to first generation stability values because they always pertain to the specific city being analyzed. The other generation comparisons only tell us if a person in one generation was born within 25 miles of their parent (or child), but the statistics could relate to any number of places around the world where the people of the two generations were born.

That said, Table 3 compares the ancestor community stability values of each of our study cities. The first line for each city in the Ancestor table shows the 0 (root) to 1 (parent) stability ratio. For example, in Atlanta, 79 parents were born within 25 miles of Atlanta, while 231 parents were born farther away, making a 0.342 stability ratio. New Orleans' and Boston's stability values were remarkably similar (0.348 and 0.308, respectively), while there is a wide range for the other cities. Chicago shows very low first-generation stability (only 0.063), while Charleston, SC, is an example of a pretty stable place for that time period at 0.721. These numbers point to Chicago having a large number of newer immigrants in the population at that time, while in Charleston, SC, it means that an exceptionally large proportion of the parents were born close to that city. In other words, the people there did not move in or out very much during that generation.

Table 3. Ancestor Community Stability Index.

City	Generation	CSI	Ratio
Atlanta, GA	Generation 0-1	79/231	0.34
	Generation 1-2	110/183	0.60
	Generation 2-3	87/253	0.34
	Generation 3-4	134/410	0.33
Boston, MA	Generation 0-1	52/169	0.31
	Generation 1-2	149/107	1.39
	Generation 2-3	153/106	1.44
	Generation 3-4	252/124	2.03
Charleston, SC	Generation 0-1	31/43	0.72
	Generation 1-2	29/38	0.76
	Generation 2-3	22/43	0.51
	Generation 3-4	36/46	0.78

Table 3. *Cont.*

City	Generation	CSI	Ratio
Charleston, WV	Generation 0-1	91/191	0.48
	Generation 1-2	117/241	0.49
	Generation 2-3	141/380	0.37
	Generation 3-4	250/560	0.45
Charlotte, NC	Generation 0-1	107/172	0.62
	Generation 1-2	171/188	0.91
	Generation 2-3	196/262	0.75
	Generation 3-4	186/485	0.38
Chicago, IL	Generation 0-1	18/286	0.06
	Generation 1-2	142/142	1.00
	Generation 2-3	172/122	1.41
	Generation 3-4	247/139	1.78
Cleveland, OH	Generation 0-1	46/316	0.15
	Generation 1-2	133/206	0.65
	Generation 2-3	142/180	0.79
	Generation 3-4	275/164	1.68
Jackson, MS	Generation 0-1	13/67	0.19
	Generation 1-2	31/77	0.40
	Generation 2-3	28/99	0.28
	Generation 3-4	62/140	0.44
New Orleans, LA	Generation 0-1	81/233	0.35
	Generation 1-2	134/170	0.79
	Generation 2-3	174/165	1.05
	Generation 3-4	239/254	0.94
Washington, DC	Generation 0-1	87/182	0.48
	Generation 1-2	102/113	0.90
	Generation 2-3	113/111	1.02
	Generation 3-4	186/140	1.33

In terms of the descendant community stability (Table 4), the different mix of cities showed variable levels of stability, which deserves exploring. Boston, MA, is by far the most stable place where 184 children of those born during the time period (1865–1875) were born close to Boston, and only 68 of the sample were born farther away, for a ratio of 2.71. Washington, D.C. (2.10), and New Orleans (1.74) also had high levels of stability around their cities for the children's births. Even Chicago, which showed the effect of immigration in the ancestor stability numbers, had a descendant community stability index over 1 (1.18). All of these cities showed the tendency for the people born between 1865 and 1875 to still be around their places of birth when they had children. Out-migration was less common at the time. The big exception is Jackson, MS, which has only a 0.20 index value, which points to the fact that a large number of people born in the city had moved somewhere else by the time they had children. We are not sure why this is the case, but it could relate to the small size of the city at the time (1870 census population of 4234, which meant a small sample size in our search), which led to people moving elsewhere for jobs or other opportunities once they became adults.

Table 4. Descendant Community Stability Index.

City	Generation	CSI	Ratio
Atlanta, GA	Generation 1-0	36/161	0.22
	Generation 2-1	60/127	0.47
	Generation 3-2	22/41	0.54
	Generation 4-3	7∣2	3.50
Boston, MA	Generation 1-0	184/68	2.71
	Generation 2-1	62/62	1.00
	Generation 3-2	14/37	0.38
	Generation 4-3	0/13	0.00
Charleston, SC	Generation 1-0	24/35	0.69
	Generation 2-1	14/21	0.67
	Generation 3-2	4∣5	0.80
	Generation 4-3	0∣0	N/A
Charleston, WV	Generation 1-0	171/193	0.89
	Generation 2-1	149/283	0.53
	Generation 3-2	70/67	1.04
	Generation 4-3	5∣4	1.25
Charlotte, NC	Generation 1-0	108/266	0.41
	Generation 2-1	257/295	0.87
	Generation 3-2	65/81	0.80
	Generation 4-3	3∣4	0.75
Chicago, IL	Generation 1-0	186/158	1.18
	Generation 2-1	175/152	1.15
	Generation 3-2	41/30	1.37
	Generation 4-3	4∣6	0.67
Cleveland, OH	Generation 1-0	148/112	1.32
	Generation 2-1	106/130	0.82
	Generation 3-2	20/29	0.69
	Generation 4-3	0/2	0.00
Jackson, MS	Generation 1-0	22/111	0.20
	Generation 2-1	60/116	0.52
	Generation 3-2	13/28	0.46
	Generation 4-3	1∣2	0.50
New Orleans, LA	Generation 1-0	239/137	1.74
	Generation 2-1	163/229	0.71
	Generation 3-2	29/57	0.51
	Generation 4-3	2∣1	2.00
Washington, DC	Generation 1-0	111/53	2.09
	Generation 2-1	90/57	1.58
	Generation 3-2	29/15	1.93
	Generation 4-3	3∣3	1.00

3.2. Close Migration Comparisons (Ravenstein Close Migration Index)

The purpose of the Ravenstein Close Migration Index is to get a sense of how far one generation moves compared with the next generation. The distance cutoff to be considered "close" between the generations is 50 miles. Following Ravenstein's ([1885] 1976) thoughts that most migration is short distance, this cutoff can help show whether people migrated a far distance during their lifetime. This statistic is similar to the Community Stability Index, except that the cut-off distance between generations is twice as large for the "close" measure. Also, each generational comparison is useful because the aim is to see if people migrated a long or short distance as they funneled into one city or dispersed from that same place.

Table 5 depicts the Ancestor Ravenstein Close Migration Index for the different cities and note here that the ratio can also be expressed as a percentage. A minority of children's parents (Generation 0–1) in all of the cities moved from closer than 50 miles from their places of birth to have children in our study cities between 1865 and 1875. This means that most parents in all of our study cities were born a good distance from where they had their children. Charlotte, NC, Charleston, SC, and Jackson, MS, were the places that showed relatively more parents born in the distance band of 50 miles from the root city, at 47%, 46%, and 40%, respectively, of parents being close to the cities of their children's births. These three southern cities must have had less immigration during this time period. On the other hand, Chicago children's parents were mostly born a good distance from the city—94% of them (6% born closely)—and Cleveland had longer distance first-generation movements, too, with 85% of the parents being born greater than 50 miles away from the city (15% born close to the city). These two northern cities were hot spots for urban growth fed by migration from other areas of the country and immigration during that time, which helps explain the long-distance migration pattern. Thus, our data for this initial ancestor generation shows the importance of Chicago and Cleveland as entry ports, especially in comparison with the interior, southern cities. It is true that the parents could have migrated through another city before arriving in a place like Chicago (and then having a child there), but with the sheer numbers of international parents in the first generation, we are confident that a large number of these parents came to Chicago fairly early on in their American experience.

Looking at the earlier ancestral generations (i.e., Generations 1–2, 2–3, and 3–4) we find higher index values for root cities that tended to have large New England and European immigrant populations in 1865–1875, such as Chicago and Boston. This means that a larger share of the parents between generations moved less than 50 miles from their own birthplaces to the birthplaces of their children. The reason for this is that in those earlier generations, people in Europe and New England moved shorter distances for many generations until they made the long-distance moves to these destination cities. On the other hand, some of the southern cities such as Atlanta, Charlotte, and Jackson had relatively low ratios of people staying put over the several generations, showing that the bulk of the ancestors of these cities were making their way across the south and over the ocean at various earlier times.

Several contrasts are apparent for the descendancy Ravenstein indices (Table 6). Most of the children of those born in our sample cities were born near there, except in Charlotte, Atlanta, and Jackson, where less than 50% stayed close-by for the birth of their children. Atlanta was the extreme case, where only 19% of the children of the root generation were born within the 50-mile ring. Atlanta is noteworthy and probably indicates high mobility. Looking at the map (Figure 2—because some of the maps had to be made with new search data, they may not always exactly match the data in the tables), many children were born to the west in Texas and other states such as Louisiana and Arkansas. However, this statistic might also be partly an undercount because 45 of the children were listed as being born in "Georgia," which put the point on the map in the center of Georgia (near Macon), even though they very well could have been born in Atlanta, as one of their parents was from there.

Table 5. Ravenstein Close Migration Index (Ancestor).

City	Generation	RCMI	Ratio
Atlanta, GA	Generation 0-1	91/310	0.29
	Generation 1-2	133/293	0.45
	Generation 2-3	109/340	0.32
	Generation 3-4	178/544	0.33
Boston, MA	Generation 0-1	60/221	0.27
	Generation 1-2	173/256	0.68
	Generation 2-3	179/259	0.69
	Generation 3-4	275/376	0.73
Charleston, SC	Generation 0-1	34/74	0.46
	Generation 1-2	34/67	0.51
	Generation 2-3	29/65	0.45
	Generation 3-4	47/82	0.57
Charleston, WV	Generation 0-1	110/282	0.39
	Generation 1-2	141/358	0.39
	Generation 2-3	190/521	0.36
	Generation 3-4	339/810	0.42
Charlotte, NC	Generation 0-1	131/279	0.47
	Generation 1-2	212/359	0.59
	Generation 2-3	245/458	0.53
	Generation 3-4	236/671	0.35
Chicago, IL	Generation 0-1	18/304	0.06
	Generation 1-2	163/284	0.57
	Generation 2-3	199/294	0.68
	Generation 3-4	278/386	0.72
Cleveland, OH	Generation 0-1	53/362	0.15
	Generation 1-2	151/339	0.45
	Generation 2-3	179/322	0.56
	Generation 3-4	305/439	0.69
Jackson, MS	Generation 0-1	32/80	0.40
	Generation 1-2	38/108	0.35
	Generation 2-3	36/127	0.28
	Generation 3-4	81/202	0.40
New Orleans, LA	Generation 0-1	89/314	0.28
	Generation 1-2	149/304	0.49
	Generation 2-3	195/339	0.58
	Generation 3-4	272/493	0.55
Washington, DC	Generation 0-1	104/269	0.39
	Generation 1-2	115/215	0.53
	Generation 2-3	137/224	0.61
	Generation 3-4	233/326	0.71

Table 6. Ravenstein Close Migration Index (Descendant).

City	Generation	RCMI	Ratio
Atlanta, GA	Generation 1-0	38/197	0.19
	Generation 2-1	75/187	0.40
	Generation 3-2	25/63	0.40
	Generation 4-3	7|9	0.78
Boston, MA	Generation 1-0	189/252	0.75
	Generation 2-1	77/124	0.62
	Generation 3-2	20/51	0.39
	Generation 4-3	0/13	0.00
Charleston, SC	Generation 1-0	24/59	0.41
	Generation 2-1	14/35	0.40
	Generation 3-2	5|9	0.56
	Generation 4-3	N/A	N/A
Charleston, WV	Generation 1-0	185/364	0.51
	Generation 2-1	165/432	0.38
	Generation 3-2	73/137	0.53
	Generation 4-3	5|9	0.56
Charlotte, NC	Generation 1-0	117/374	0.31
	Generation 2-1	277/552	0.50
	Generation 3-2	71/146	0.49
	Generation 4-3	3|7	0.43
Chicago, IL	Generation 1-0	194/344	0.56
	Generation 2-1	180/327	0.55
	Generation 3-2	41/71	0.58
	Generation 4-3	4|10	0.40
Cleveland, OH	Generation 1-0	154/260	0.59
	Generation 2-1	116/236	0.49
	Generation 3-2	24/49	0.49
	Generation 4-3	1|2	0.50
Jackson, MS	Generation 1-0	57/133	0.43
	Generation 2-1	79/176	0.45
	Generation 3-2	15/41	0.37
	Generation 4-3	2|3	0.67
New Orleans, LA	Generation 1-0	239/376	0.64
	Generation 2-1	170/392	0.43
	Generation 3-2	29/86	0.34
	Generation 4-3	2|2	1.00
Washington, DC	Generation 1-0	111/164	0.68
	Generation 2-1	97/147	0.66
	Generation 3-2	30/44	0.68
	Generation 4-3	3|6	0.50

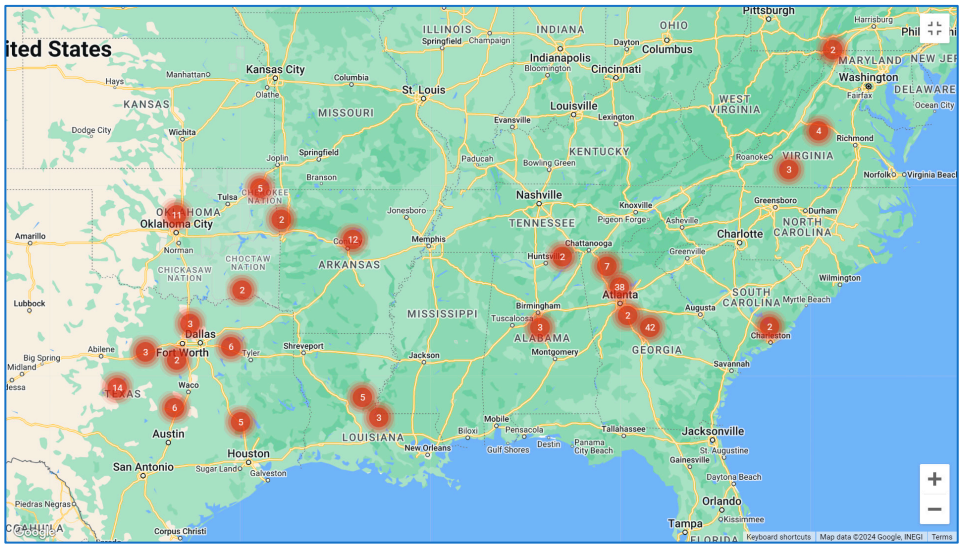


Figure 2. Birthplaces of children of those born in Atlanta, GA (1865–1875). Each dot includes the number of children born in that vicinity. For example, the circle northwest of Washington, D.C. represents where two of the children were born (specifically, Gerrardstown, West Virginia). If desired, one can zoom in on the map to see the numbers more clearly, if they are viewing the map online.

Most of the other cities were in the 40–60% range in terms of children in each succeeding generation that were born within the 50-mile Ravenstein range. This means that around half of parents stayed close-by in their first 20 to 40 years, so that their children were born there, too. Washington, D.C. had the ability to retain about two-thirds of its people from the root generation to their children, and then their descendants kept close to their parents at about a 67% rate.

3.3. Comparison of Migration Hourglasses (Standard Distances)

As a reminder, the standard distance within each generation is the "square root of the average squared distance to the mean center" (Rogerson 2015, p. 43), and it is the spatial equivalent to the standard deviation. Standard distances statistics illustrate the width of the main thrust of the migration stream in each generation. The larger the number, the more spread out the ancestors or descendants are around a mean center, while a smaller number indicates the opposite. Figures 3–11 show the migration hourglasses for each of the cities (except Charleston, SC, which had a small sample size), which illustrate standard distances by generation, with the ancestors on the top half of the hourglass and the descendants on the bottom half (the scale varies by city).

The approximately 200-person sample of people born in the root city between 1865 and 1875 and searches performed for their descendants were not necessarily the same as the 200-person sample for the ancestor search. Nevertheless, the results across the various cities are fairly consistent with the descendancy standard distances being generally less than the ancestral standard distances. This means that the descendants were apt to be closer together than the ancestors of those born in the respective city between 1865 and 1875. Part of this can be explained by the fact that many of the ancestors were born overseas, which greatly increases the standard distance. However, looking across the list of cities shows that these distant international birthplaces were more prevalent in some cities compared with others. Also, the fourth generation of descendants (great-great-grandchildren) is small in the number of individuals, necessarily because many or most of that generation are still alive, so they are not searchable in the FamilySearch database.

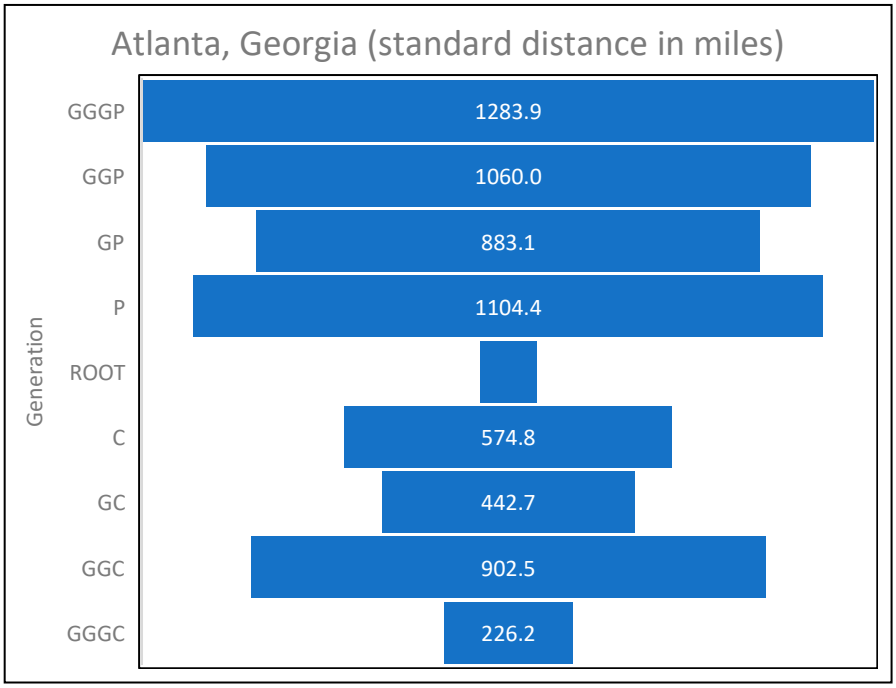


Figure 3. Generational hourglass for Atlanta, GA. The horizontal bar is the standard distance in each generation. (Root births 1865–1875) (Root is base city, P = parents, GP = grandparents, GGP = great-grandparents, GGGP = great-great-grandparents, C = children, GC= grandchildren, GGC = great-grandchildren, GGGC = great-great-grandchildren).

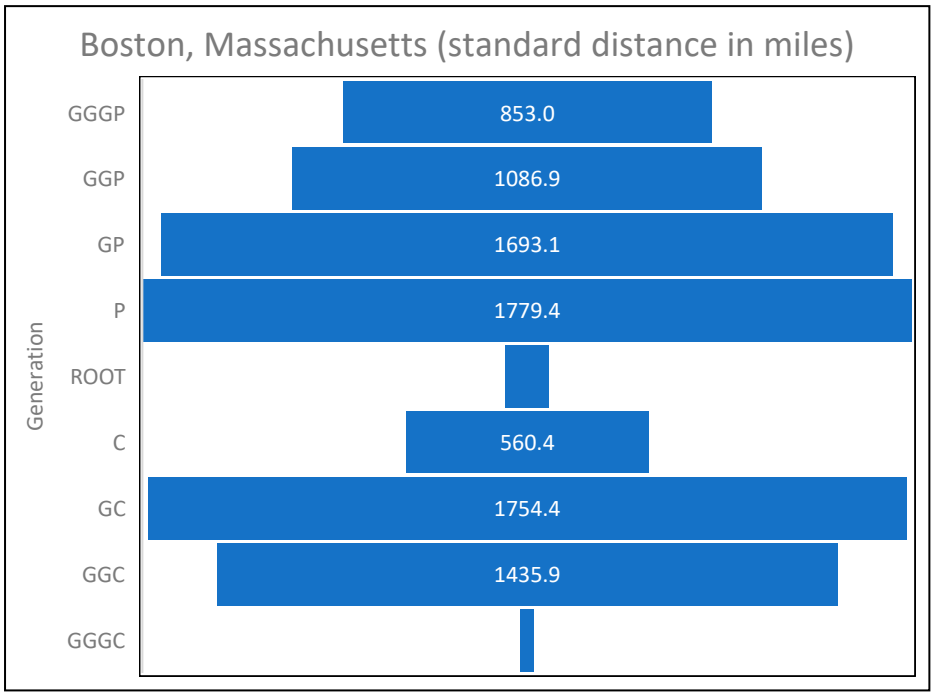


Figure 4. Generational hourglass for Boston, MA (Root births 1865–1875).

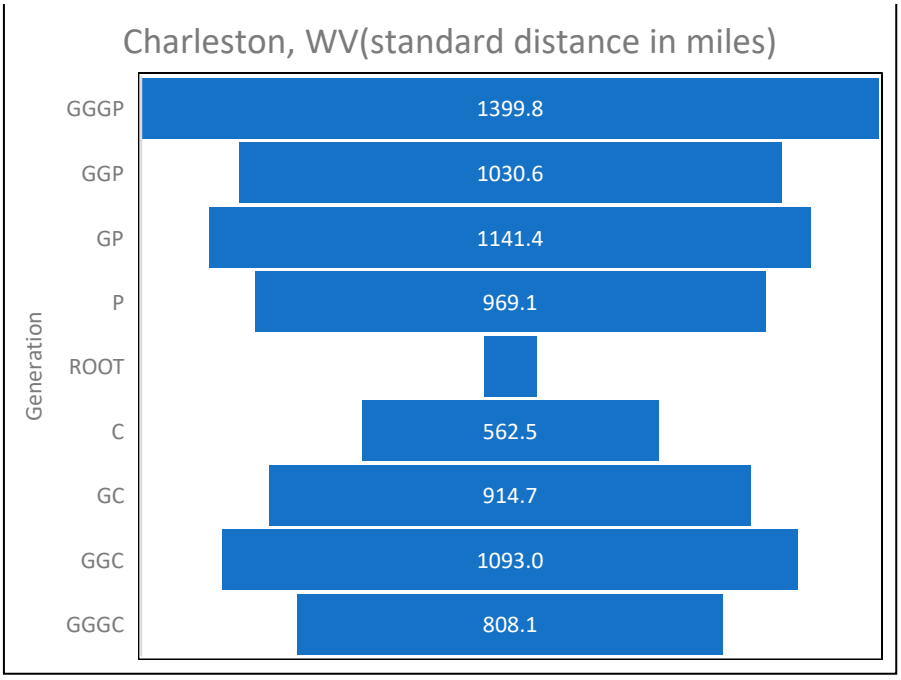


Figure 5. Generational hourglass for Charleston, West Virginia (root births 1865–1875).

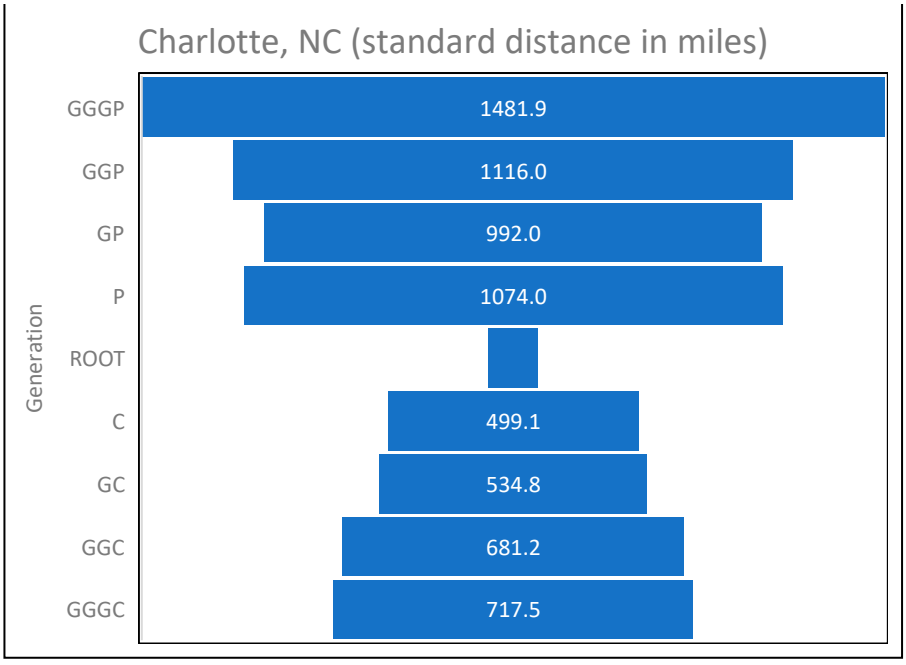


Figure 6. Generational hourglass for Charlotte, North Carolina (root births 1865–1875).

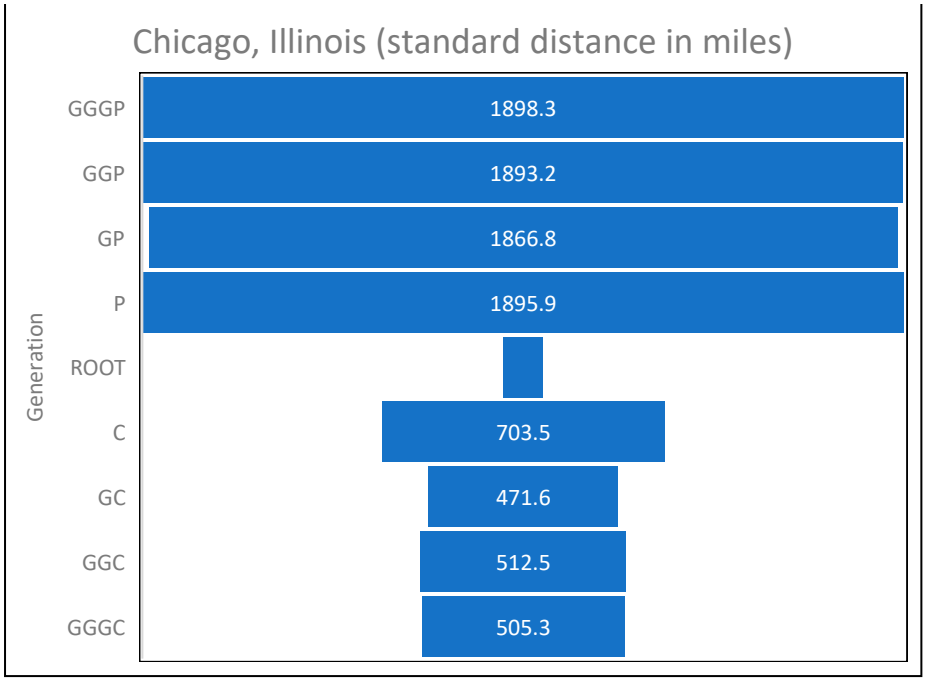


Figure 7. Generational hourglass for Chicago, IL (root births 1865–1875).

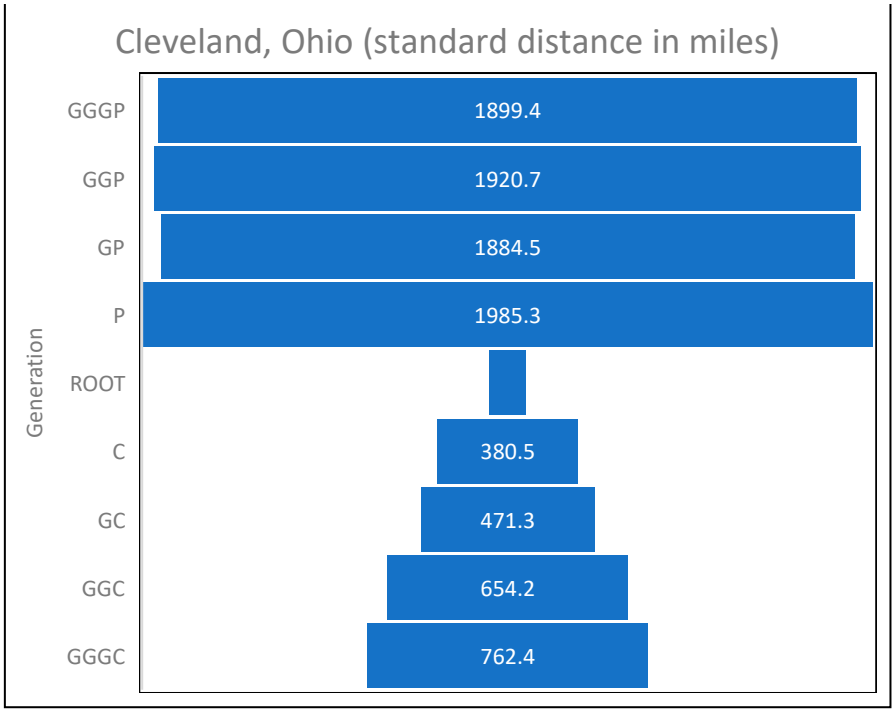


Figure 8. Generational hourglass for Cleveland, OH (root births 1865–1875).

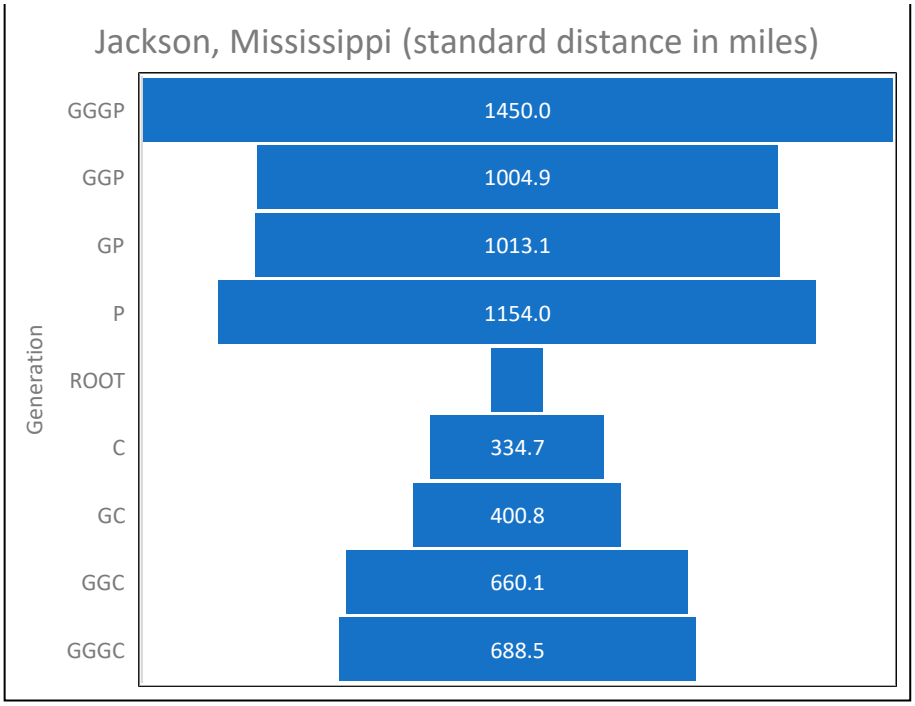


Figure 9. Generational hourglass for Jackson, MS (root births 1865–1875).

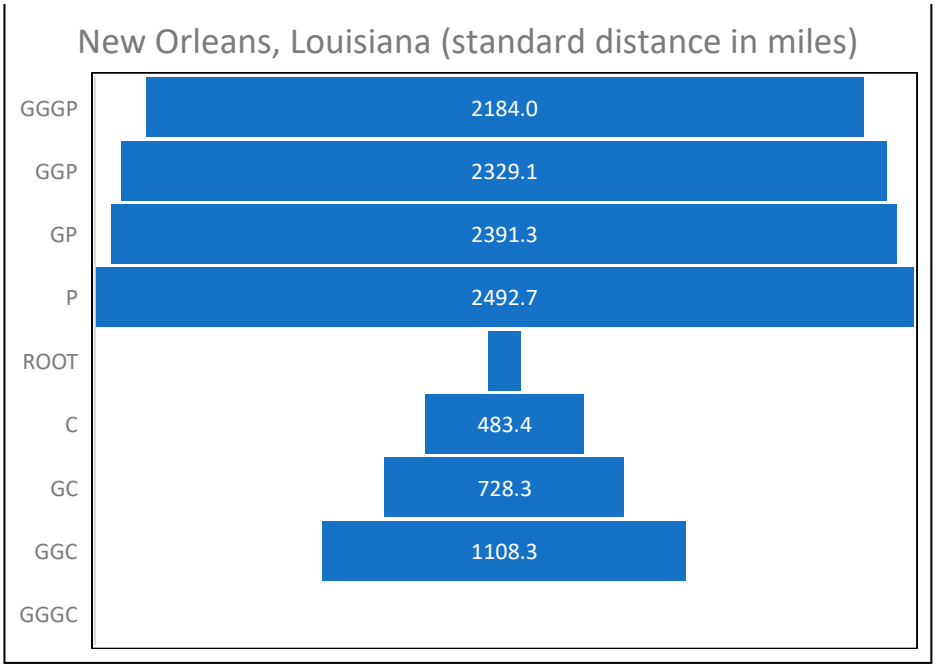


Figure 10. Generational hourglass for New Orleans, LA (root births 1865–1875).

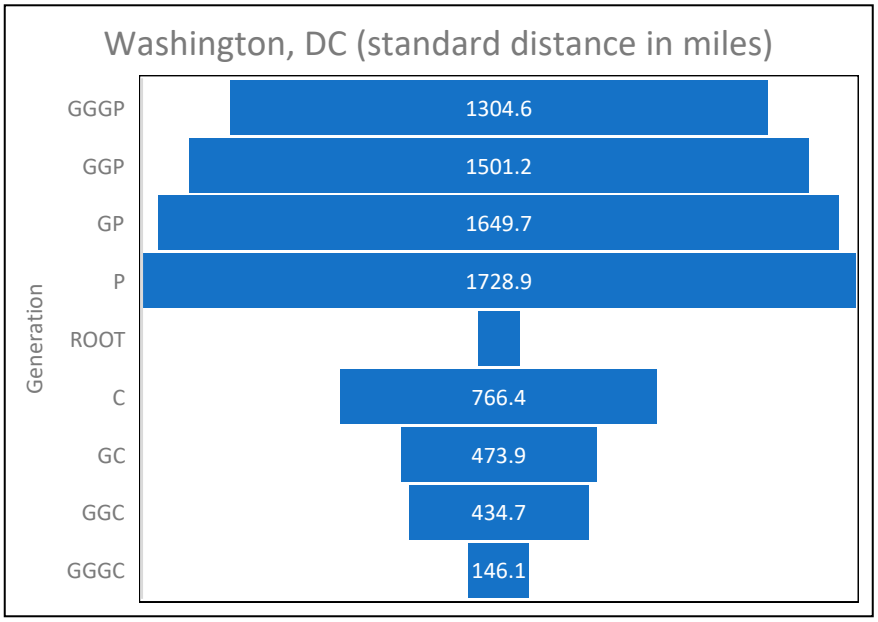


Figure 11. Generational hourglass for Washington, D.C. (root births 1865–1875).

Patterns of the migration hourglass vary for each city, and analyzing individual patterns and comparing the generational migration statistics with others helps explain each city's migration geographies. For example, Chicago's standard distances (Figure 7) for ancestors were hundreds of miles more for each generation compared with Atlanta, Georgia, in the south (Figure 3). That would indicate that during that period, Atlanta was a relatively more provincial city in terms of the source origins of the ancestors of people born from 1865 to 1875. New Orleans (Figure 10), a port city, had the largest standard distances for ancestors of any city in our sample, which emphasizes the fact that its source origins for migrants to the city came from far distances, many from across the sea, and relatively fewer came from nearby parishes or states.

Washington, D.C., is an interesting case (Figure 11). Instead of ancestors being more spread out as generations are projected back in time, the standard distances are less for each ensuing generation. This is similar to New Orleans, except New Orleans has much higher standard distances. One explanation for this pattern for the parents' generation is that Washington, D.C., at that time was a place where people migrated to work somewhere in the government sector, so it could attract people from a long distance for work. As the additional generations unfold, decreasing standard distances seem to reflect relatively more ancestors living in the United States, rather than in Europe and elsewhere, because of a spatial bias toward longstanding American settlement regions (especially places like New York and Massachusetts), that eventually were an important source of migrants to Washington, D.C.

Another way to compare the relative areal size of the flow of people within one generation with another generation is the Concentration Index (see Appendix A with Tables A1 and A2). For each city, one can choose two generations (horizontally and vertically) and then see the Concentration Index value. If it is over 1, then the first generation was more widespread than the second comparative generation. If the value is under 1, then it was less spread out. The table allows for the comparison of the standard distances of non-sequential (e.g., parents to great-grandparents) and sequential (e.g., parents to grandparents) generations.

3.4. Spatial Centers of Each Generation Comparisons

Within each generation, the mean center of the birthplaces indicates the general movement of people from generation to generation. What is common is an east to west

movement for ancestors of those born during 1865 to 1875 in the root cities. Ancestor mean centers usually follow an east to west pattern, as many ancestors came from Europe and/or the eastern seaboard, but the spatial weight of ancestors born in North America versus Europe can cause the central point to go back and forth as shown with Chicago (Figure 12). These maps do not show migration flow size, but just the spatial center points in each generation as the bulk of the city's ancestors or descendants move to and from the city. New Orleans' spatial centers shifted farther toward Europe in each of the four generations (Figure 13). On the other hand, descendant mean centers do not always shift to the west, as after 1875 settlement extended to most areas of the country, making the mean centers especially sensitive to local geographies of migration. For example, Atlanta descendants' mean centers have moved almost due west over the four generations (Figure 14), while we found in another search that the mean center for Philadelphia descendants rotates closely around both sides of Philadelphia. Chicago and Boston (Figure 15) are other cities where the descendants, on average, did not move far away from them. These patterns tie back to our Ravenstein Close Migration indices, but they are able to show the central point of the migration during each specific generation, which gives one a sense of the overall composite movement in the generation, which is harder to see with the straight indices. The spatial centers' maps do not actually show flow, but the spatial center of all the people born in that generation, so putting in line sizes for flow size does not work. The small arrows simply point toward the root city. There are five larger arrowhead symbols, one for each of the four generations and one for the root city (the midpoint of all the people born in that generation).

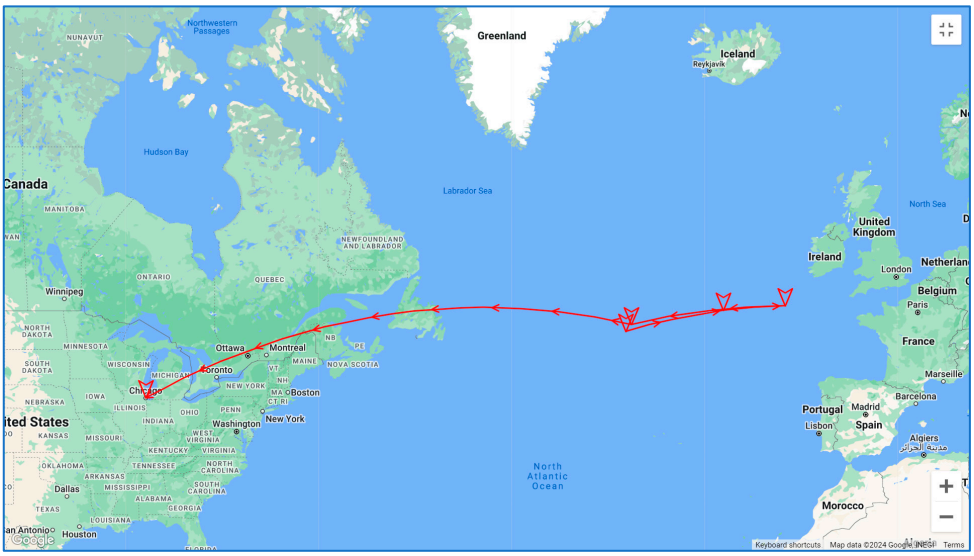


Figure 12. Spatial centers of four ancestor generations from Chicago, IL. The large arrowhead symbols are the spatial centers for each generation, with one also at Chicago. The line and small arrows connect the generations back to Chicago. This shows the large European composition of all the ancestral generations, with the center for each generation being in the Atlantic closer to Europe than North America.

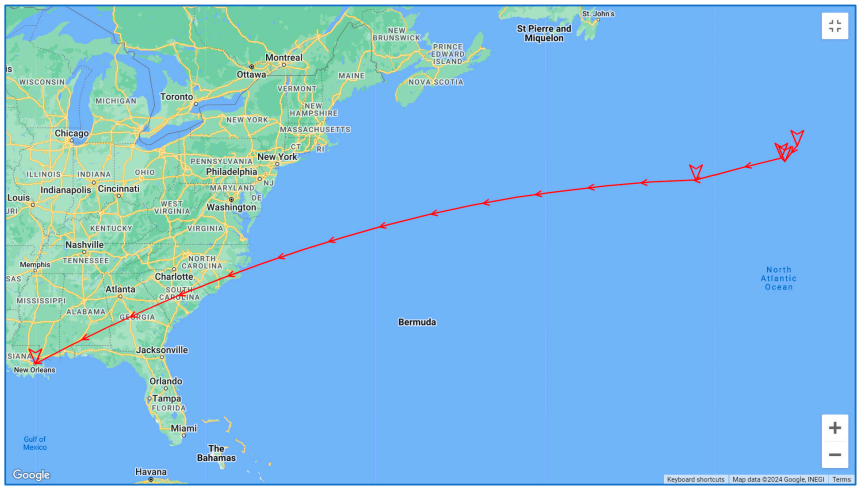


Figure 13. Spatial centers of four ancestor generations from New Orleans, LA. The large arrowhead symbols are the spatial centers for each generation, with one also at New Orleans. The line and small arrows connect the generations back to New Orleans.

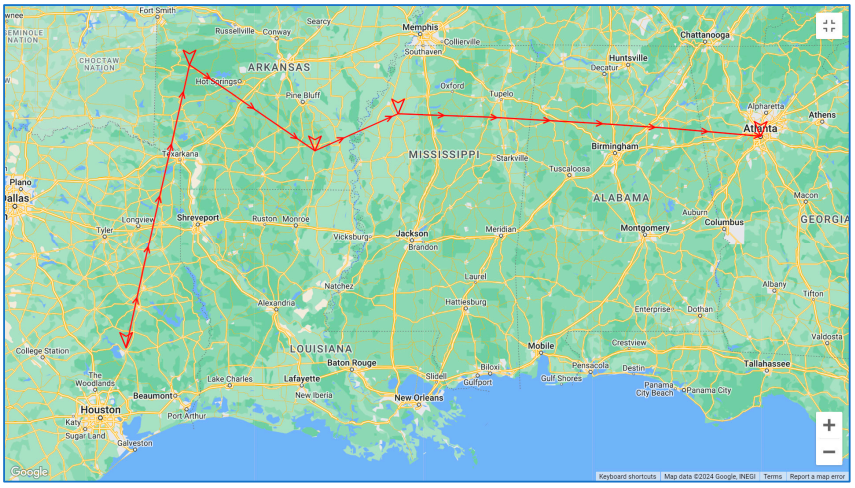


Figure 14. Spatial centers of four descendant generations from Atlanta, GA. The large arrowhead symbols are the spatial centers for each generation, with one also at Atlanta. The line and small arrows connect the generations back to Atlanta.

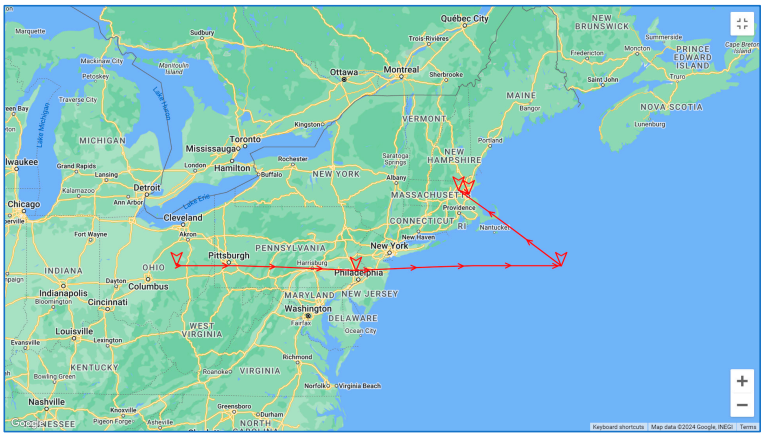


Figure 15. Spatial centers of four descendant generations from Boston, MA. The large arrowhead symbols are the spatial centers for each generation, with one also at Boston. The line and small arrows connect the generations back to Boston.

3.5. Differences in Forward Versus Backward Analyses (Mean Migration Distances and Dispersal Indices)

In the two types of migration streams, descendancy versus ancestral, there is a distinct difference in the spatial distribution of each generation. Part of the reason for this may be that long-distance migration was more common before the 1870s in many parts of the country than after that time. A big component of this pattern was that many migrants in the mid-1850s had moved to America from overseas, which naturally pushes up the mean distances. Thus, the mean migration distances tended to be higher for the first generation (parents), and then drop for the grandparents and great-grandparents, who were less transient in those generations, especially when they were in Europe. In terms of descendants' mean migrations, they tended to move very short distances during the first few generations.

It is good to remember that the Mean Migration Distance is the average distance between each person's birthplace in one generation to that of their parent's or children's birth locations in another generation. It is a similar statistic to the Standard Distance shown in Figures 3–11, but the Standard Distance gives a sense of how narrow or wide the stream of migration was (via the surrogate of birthplaces of one generation), while the Mean Migration Distance statistics discussed here focus on the distance between the births of two generations, without reference to how dispersed or concentrated those lines of migration were.

Some cities had exceptionally large mean migration distances for the ancestor generations, and others were much more parochial in terms of how far they moved (see Tables 7 and 8). For instance, cities in the north such as Cleveland, Boston, and Chicago showed long-distance moves especially in the first generation of the ancestors (parents), while southern and interior cities such as Atlanta, Charleston, WV, and Jackson, MS, had much lower mean migrations for that first ancestor generation in comparison, which means that more of the parents were natural-born United States residents. An exception to this pattern is New Orleans, which being an important port city, was higher in this regard as discussed before.[6]

Table 7. Ancestor Mean Migration Distances.

City	Generation	Distance (mi)
Atlanta, GA	Generation 0-1	456.8
	Generation 1-2	157.8
	Generation 2-3	336.8
	Generation 3-4	493.0
Boston, MA	Generation 0-1	1609.0
	Generation 1-2	348.7
	Generation 2-3	138.3
	Generation 3-4	161.9
Charleston, SC	Generation 0-1	1602.2
	Generation 1-2	499.4
	Generation 2-3	394.3
	Generation 3-4	592.6
Charleston, WV	Generation 0-1	390.1
	Generation 1-2	218.2
	Generation 2-3	251.7
	Generation 3-4	487.5

Table 7. *Cont.*

City	Generation	Distance (mi)
Charlotte, NC	Generation 0-1	339.0
	Generation 1-2	158.2
	Generation 2-3	311.9
	Generation 3-4	631.6
Chicago, IL	Generation 0-1	2974.2
	Generation 1-2	470.1
	Generation 2-3	71.7
	Generation 3-4	118.9
Cleveland, OH	Generation 0-1	2575.3
	Generation 1-2	695.4
	Generation 2-3	164.4
	Generation 3-4	168.9
Jackson, MS	Generation 0-1	747.1
	Generation 1-2	368.9
	Generation 2-3	413.1
	Generation 3-4	502.3
New Orleans, LA	Generation 0-1	2195.7
	Generation 1-2	883.7
	Generation 2-3	627.8
	Generation 3-4	729.1
Washington, DC	Generation 0-1	1031.5
	Generation 1-2	432.6
	Generation 2-3	296.0
	Generation 3-4	214.1

Table 8. Descendant Mean Migration Distances.

City	Generation	Distance (mi)
Atlanta, GA	Generation 1-0	463.4
	Generation 2-1	135.7
	Generation 3-2	358.0
	Generation 4-3	67.1
Boston, MA	Generation 1-0	178.8
	Generation 2-1	497.3
	Generation 3-2	484.3
	Generation 4-3	87.1
Charleston, SC	Generation 1-0	185.1
	Generation 2-1	453.1
	Generation 3-2	1244.7
	Generation 4-3	0.0

Table 8. *Cont.*

City	Generation	Distance (mi)
Charleston, WV	Generation 1-0	174.7
	Generation 2-1	286.8
	Generation 3-2	271.4
	Generation 4-3	326.3
Charlotte, NC	Generation 1-0	275.6
	Generation 2-1	169.8
	Generation 3-2	197.1
	Generation 4-3	490.1
Chicago, IL	Generation 1-0	212.1
	Generation 2-1	173.4
	Generation 3-2	173.5
	Generation 4-3	213.9
Cleveland, OH	Generation 1-0	125.2
	Generation 2-1	145.6
	Generation 3-2	297.6
	Generation 4-3	857.5
Jackson, MS	Generation 1-0	227.5
	Generation 2-1	220.2
	Generation 3-2	384.5
	Generation 4-3	565.8
New Orleans, LA	Generation 1-0	212.3
	Generation 2-1	200.0
	Generation 3-2	389.3
	Generation 4-3	0.0
Washington, DC	Generation 1-0	218.2
	Generation 2-1	309.8
	Generation 3-2	142.2
	Generation 4-3	147.9

Another indicator of the overall spread of parent–child relations between generations is the Dispersal Index, which has the ability to compare relative spreads from one generation to another. As a reminder, the Dispersal Index is the ratio of the mean migration distance of one generation compared with another generation. For example, the mean migration distance of the root generation in Atlanta to their children's birthplaces was 463.4 miles, and the mean migration distance for the next generation (children to grandchildren) was 135.7 miles. Divide the first number by the second and you get 3.41 (see Tables 9 and 10), which indicates that the initial dispersal (from the root city) was much larger than the spread from the birthplaces of the children to the grandchildren (overall more than three times farther). So, when the index is above 1, the dispersal is greater in the first generation to the second, and vice versa.

Looking at that initial comparison between the first-generation descendants to the second-generation, five of the cities had index values over one and five below it. Atlanta was an extreme example at the high end, and the rest of the cities with higher Dispersal Index values were between 1 and 2 in that indicator (so less than twice as far in terms of

mean migration between the generations). The extreme low for the Dispersal Index was Boston, at 0.360, meaning that the second generation (children to grandchildren) were born nearly three times farther away than the first generation (root to children). This means that those from Boston at that time tended to stay quite close to Boston for that first generation (born in the late 1800s and early 1900s), but that the next generation began to move more.

Table 9. Dispersal Index–Ancestor.

Atlanta, GA				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	2.894	1.356	0.927
Generation 1-2	0.346	-	0.469	0.320
Generation 2-3	0.737	2.134	-	0.683
Generation 3-4	1.079	3.124	1.464	-
Boston, MA				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	4.614	11.634	9.939
Generation 1-2	0.217	-	2.521	2.154
Generation 2-3	0.086	0.397	-	0.854
Generation 3-4	0.101	0.464	1.171	-
Charleston, SC				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	3.208	4.063	2.704
Generation 1-2	0.312	-	1.267	0.843
Generation 2-3	0.246	0.790	-	0.665
Generation 3-4	0.370	1.187	1.503	-
Charleston, WV				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	1.788	1.550	0.800
Generation 1-2	0.559	-	0.867	0.448
Generation 2-3	0.645	1.154	-	0.516
Generation 3-4	1.250	2.235	1.937	-
Charlotte, NC				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	2.143	1.087	0.537
Generation 1-2	0.467	-	0.507	0.251
Generation 2-3	0.920	1.971	-	0.494
Generation 3-4	1.863	3.992	2.025	-

Table 9. *Cont.*

Chicago, IL				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	6.327	41.468	25.018
Generation 1-2	0.158	-	6.555	3.955
Generation 2-3	0.024	0.153	-	0.603
Generation 3-4	0.040	0.253	1.658	-
Cleveland, OH				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	3.704	15.661	15.251
Generation 1-2	0.270	-	4.229	4.118
Generation 2-3	0.064	0.237	-	0.974
Generation 3-4	0.066	0.243	1.027	-
Jackson, MS				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	2.025	1.809	1.487
Generation 1-2	0.494	-	0.893	0.734
Generation 2-3	0.553	1.120	-	0.822
Generation 3-4	0.672	1.362	1.216	-
New Orleans, LA				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	2.485	3.498	3.012
Generation 1-2	0.403	-	1.408	1.212
Generation 2-3	0.286	0.710	-	0.861
Generation 3-4	0.332	0.825	1.161	-
Washington, DC				
	Ancestor			
	Generation 0-1	Generation 1-2	Generation 2-3	Generation 3-4
Generation 0-1	-	2.384	3.485	4.818
Generation 1-2	0.419	-	1.462	2.021
Generation 2-3	0.287	0.684	-	1.383
Generation 3-4	0.208	0.495	0.723	-

Table 10. Dispersal Index–Descendants.

Atlanta, GA				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	3.415	1.294	6.911
Generation 2-1	0.293	-	0.379	2.024
Generation 3-2	0.773	2.638	-	5.339
Generation 4-3	0.145	0.494	0.187	-

Table 10. *Cont.*

Boston, MA				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	0.360	0.369	2.053
Generation 2-1	2.782	-	1.027	5.712
Generation 3-2	2.709	0.974	-	5.562
Generation 4-3	0.487	0.175	0.180	-
Charleston, SC				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	0.409	0.149	N/A
Generation 2-1	2.448	-	0.364	N/A
Generation 3-2	6.726	2.747	-	N/A
Generation 4-3	0.000	0.000	0.000	-
Charleston, WV				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	0.609	0.644	0.536
Generation 2-1	1.641	-	1.056	0.879
Generation 3-2	1.554	0.947	-	0.832
Generation 4-3	1.867	1.138	1.202	-
Charlotte, NC				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	1.623	1.398	0.562
Generation 2-1	0.616	-	0.861	0.346
Generation 3-2	0.715	1.161	-	0.402
Generation 4-3	1.779	2.887	2.486	-
Chicago, IL				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	1.224	1.223	0.992
Generation 2-1	0.817	-	0.999	0.810
Generation 3-2	0.818	1.001	-	0.811
Generation 4-3	1.009	1.234	1.233	-
Cleveland, OH				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	0.860	0.421	0.146
Generation 2-1	1.162	-	0.489	0.170
Generation 3-2	2.377	2.045	-	0.347
Generation 4-3	6.847	5.891	2.881	-
Jackson, MS				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	1.033	0.592	0.402
Generation 2-1	0.968	-	0.573	0.389
Generation 3-2	1.690	1.746	-	0.680
Generation 4-3	2.487	2.569	1.472	-

Table 10. *Cont.*

New Orleans, LA				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	1.062	0.545	N/A
Generation 2-1	0.942	-	0.514	N/A
Generation 3-2	1.834	1.947	-	N/A
Generation 4-3	0.000	0.000	0.000	-
Washington, D.C.				
	Descendant			
	Generation 1-0	Generation 2-1	Generation 3-2	Generation 4-3
Generation 1-0	-	0.704	1.534	1.476
Generation 2-1	1.420	-	2.178	2.095
Generation 3-2	0.652	0.459	-	0.962
Generation 4-3	0.678	0.477	1.040	-

3.6. Origins/Destinations Comparisons (Country/State Origins)

There are a few ways to illustrate the geographic gathering or dispersion of people to or from a city. The first is to map the places where the people in each generation were born (or died) in comparison with the root generation. The second is to create tables that show the different regions, states, and countries of the origins or destinations of each generation. Figures 16–25 show the distribution of births through maps of select cities and Tables 11–20 show percentages of some cities through tabular means.

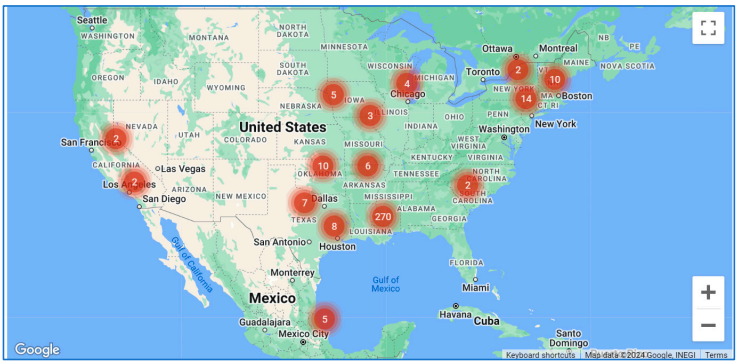


Figure 16. New Orleans descendant birth locations (first generation). Each dot includes the number of children born in that vicinity.

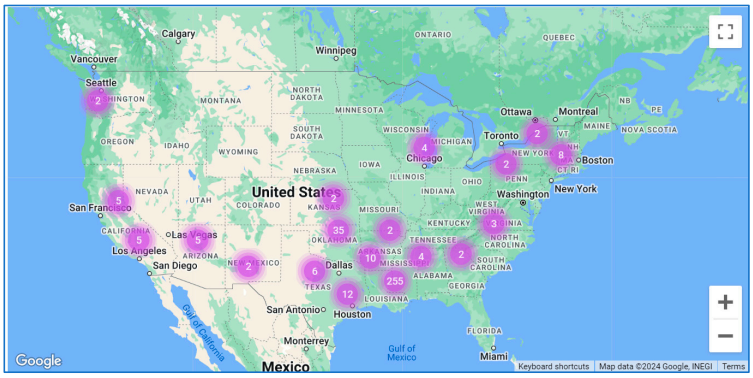


Figure 17. New Orleans descendant birth locations (second generation). Each dot includes the number of grandchildren born in that vicinity.

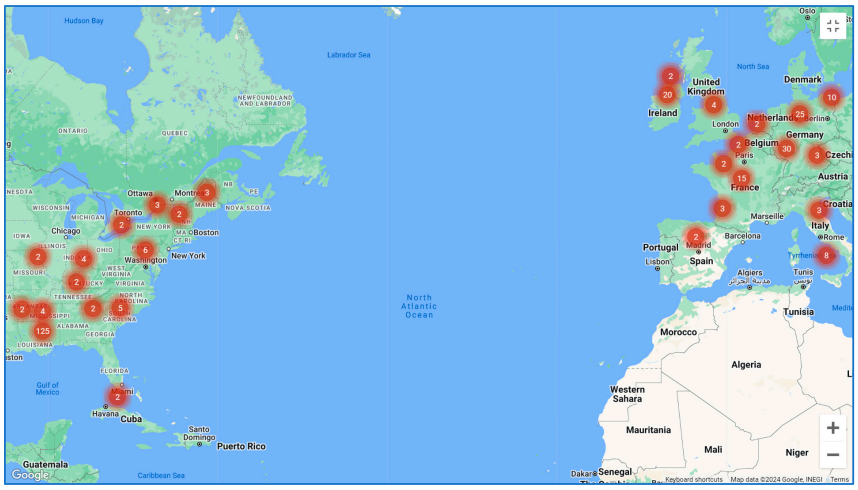


Figure 18. New Orleans ancestor birth locations (first generation). Each dot includes the number of parents born in that vicinity.

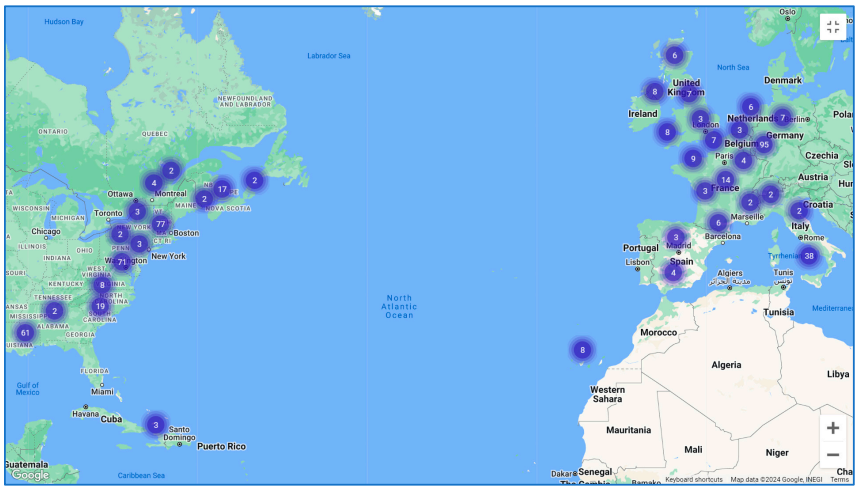


Figure 19. New Orleans ancestor birth locations (fourth generation). Each dot includes the number of fourth-generation ancestors born in that vicinity.

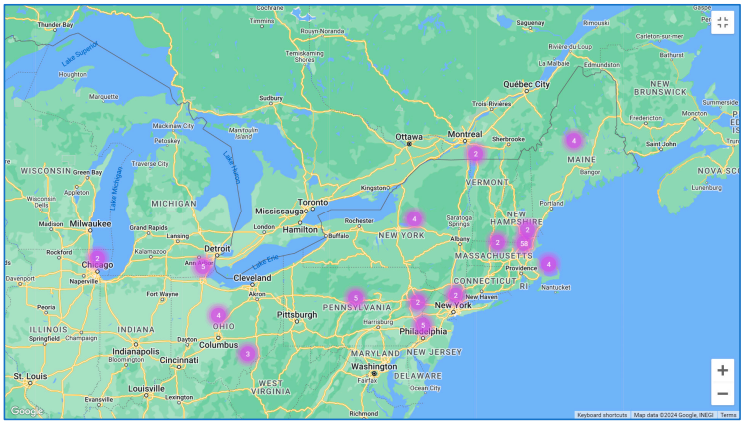


Figure 20. Boston descendant birth locations (second generation). Each dot includes the number of grandchildren born in that vicinity.

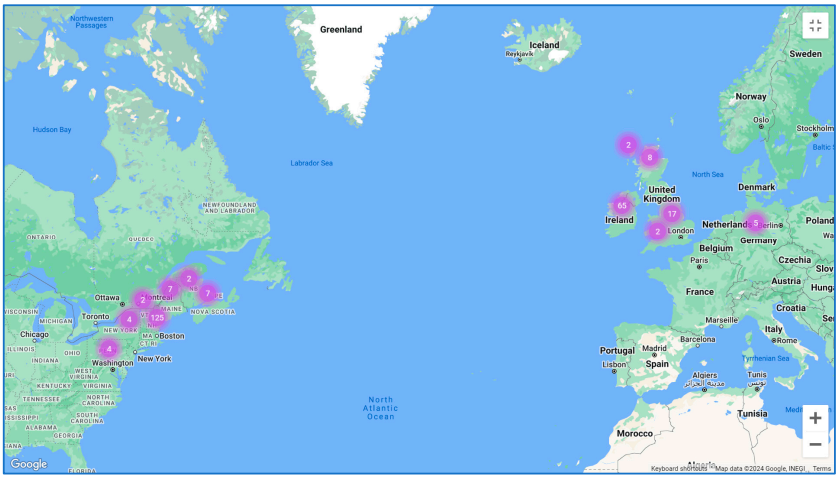


Figure 21. Boston ancestor birth locations (second generation). Each dot includes the number of grandparents born in that vicinity.

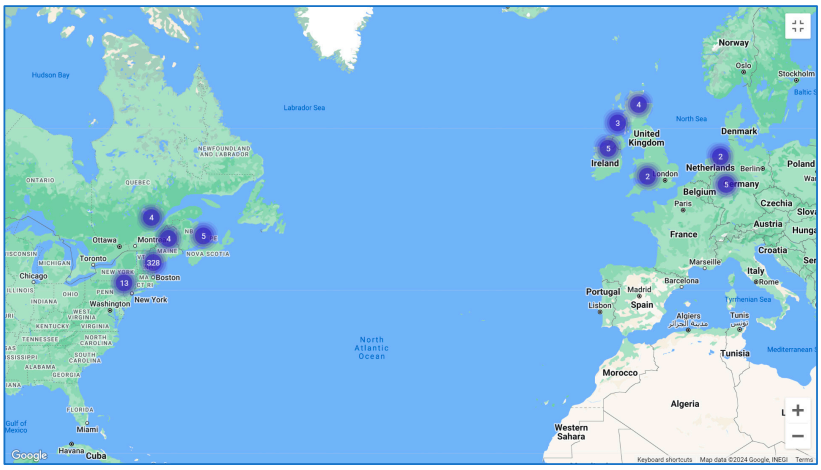


Figure 22. Boston ancestor birth locations (fourth generation). Each dot includes the number of fourth-generation ancestors born in that vicinity.

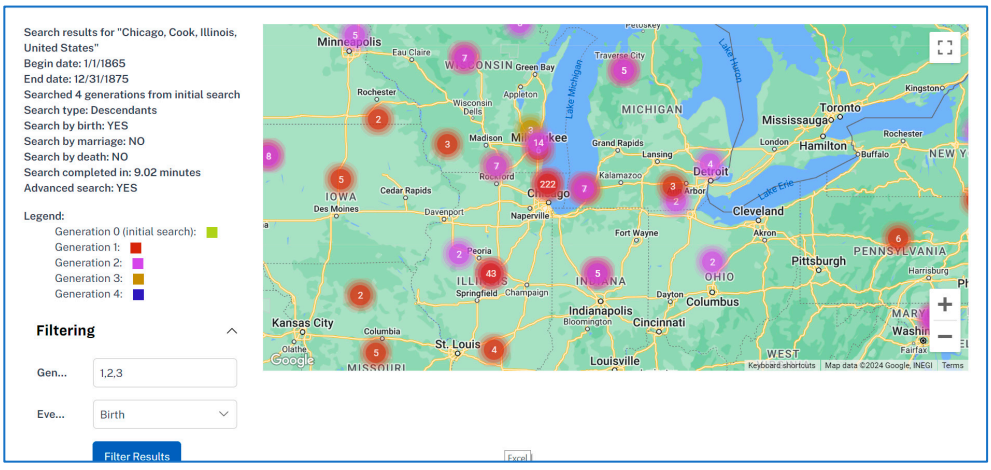


Figure 23. Four generations of Chicago descendants.

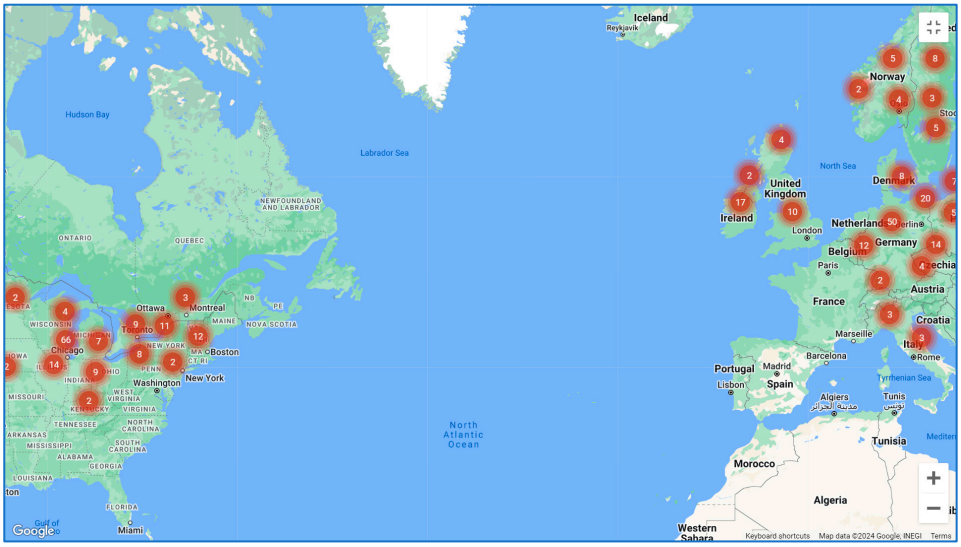


Figure 24. Chicago ancestor birth locations (first generation).

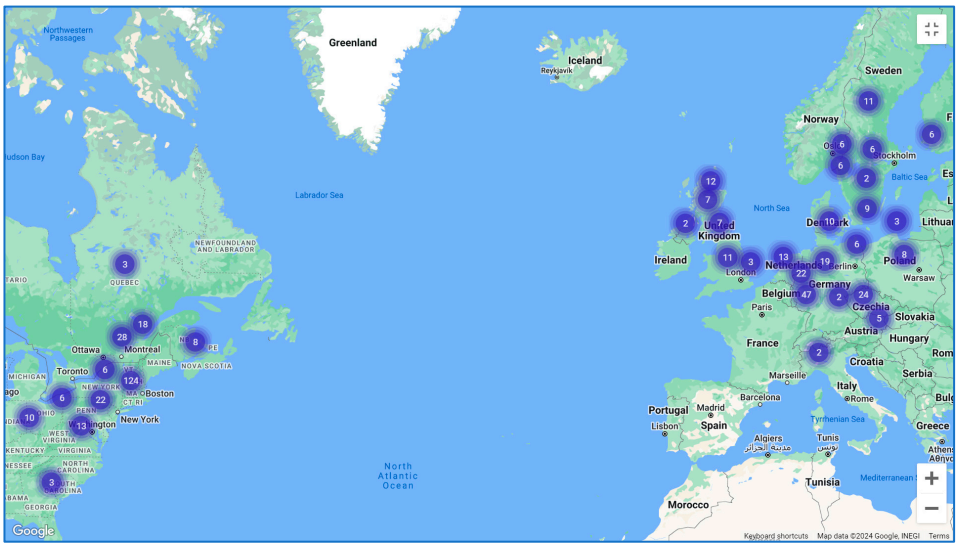


Figure 25. Chicago ancestor birth locations (fourth generation).

The ancestor tables and figures give a good sense of the distinctive patterns of migration origins in each city. The mix of origins of the first generation of ancestors (the parents) from both nearby states and foreign locations gives a good indication of the local cultural makeup of the cities during the study period. For example, in Boston (Table 11) some 33% of the parents were born in Massachusetts (including Boston), and 28% were born in Ireland, 9% in Canada, 8% Maine, and 7% Great Britain. So, one can see the New England plus Irish mix of these people. Of note, the Irish figure is roughly similar to the 1870 U.S. Census results, where 22.8% of the total population were born in Ireland (Byrne et al. 2008, p. 552, 106–107). Cleveland (Table 12) had a different pattern with 31.9% born in Germany, Ohio at 20.2%, and Ireland at 12.7%, showing the newer age of that city. Going farther west to Chicago (Table 13), the even more recent settlement of the area translated into more other-state or foreign-born parents with 24.7% Germany, 12.8% Ireland, 9.4% New York, 6% Sweden, and just 5.8% Illinois. One thing to note is that nations and countries in the listed tables were designated by the people who submitted the genealogical data, and the place in the table may not be the right political unit for the exact time, but the area listed is still where the people were from. Often, the place entered by the contributor will be of a village

or city, but other times it might just be of a nation, state, or territory. When a contributor enters the place into the database, they are often given full places with their embedded geographies to choose from (e.g., Cornwood, Devon, England, United Kingdom). The dates of the specific geography (county, state, or nation) are given as well, so the user is supposed to choose the one that matches the time period of the vital event (such as the birth or death). The program then puts together all the people from specific countries (e.g., anyone born in Cornwood would be added to the United Kingdom numbers).

Table 11. Boston Ancestors.

Generation 1:
Massachusetts, United States: 33.44%
Ireland: 27.86%
Canada: 9.29%
Maine, United States: 8.05%
United Kingdom: 7.12%
Germany: 3.72%
New Hampshire, United States: 1.86%
New York, United States: 1.24%
Rhode Island, United States: 0.93%
Vermont, United States: 0.93%
England: 0.93%
District of Columbia, United States: 0.62%
Portugal: 0.62%
Pennsylvania, United States: 0.62%
Maryland, United States: 0.62%
Australia: 0.62%
Hanover: 0.31%
Belgium: 0.31%

Table 12. Cleveland Ancestors.

Generation 1:	
Germany: 31.90%	
Ohio, United States: 20.17%	
Ireland: 12.73%	
	New York, United States: 6.94%
United Kingdom: 6.78%	
Czechoslovakia: 1.98%	
Baden: 1.82%	
Austria: 1.65%	
Switzerland: 1.65%	
Canada: 1.65%	
Netherlands: 1.32%	
Prussia: 1.32%	
United States: 1.16%	
Maine, United States: 0.99%	
	Pennsylvania, United States: 0.99%
Illinois, United States: 0.83%	
England: 0.66%	
Vermont, United States: 0.66%	
Grand Duchy of Hesse: 0.66%	
Scotland: 0.50%	
	Massachusetts, United States: 0.50%
France: 0.50%	
Hanover: 0.33%	
Czechia: 0.33%	
	New Hampshire, United States: 0.33%
Isle of Man: 0.33%	
	New Jersey, United States: 0.33%
Michigan, United States: 0.33%	
	West Virginia, United States: 0.33%
	Connecticut, United States: 0.17%

Table 13. Chicago Ancestors.

Generation 1:	
Germany: 24.73%	Vermont, United States: 0.85%
Ireland: 12.79%	Czechoslovakia: 0.64%
New York, United States: 9.38%	Michigan, United States: 0.64%
Sweden: 5.97%	Hanover: 0.43%
Illinois, United States: 5.76%	Georgia, United States: 0.43%
United Kingdom: 5.12%	Bavaria: 0.43%
Switzerland: 3.41%	Virginia, United States: 0.43%
Ohio, United States: 3.20%	Austria: 0.43%
Canada: 2.99%	Maryland, United States: 0.43%
Poland: 2.13%	Indiana, United States: 0.43%
France: 2.13%	Missouri, United States: 0.43%
Czechia: 1.92%	Kentucky, United States: 0.43%
Norway: 1.92%	Pennsylvania, United States: 0.43%
Baden: 1.71%	Belgium: 0.43%
Netherlands: 1.71%	Denmark: 0.43%
Prussia: 1.71%	Holstein: 0.43%
British Colonial America: 1.71%	Wisconsin, United States: 0.21%
Maine, United States: 1.07%	Alabama, United States: 0.21%
Connecticut, United States: 0.85%	Tennessee, United States: 0.21%
Massachusetts, United States: 0.85%	

Table 14. Charleston, WV Ancestors Gen 1.

Generation 1:
Virginia, United States: 46.27%
West Virginia, United States: 28.11%
Pennsylvania, United States: 4.73%
Ohio, United States: 4.23%
Germany: 2.99%
United Kingdom: 1.74%
Maryland, United States: 1.74%
New Jersey, United States: 1.24%
North Carolina, United States: 1.24%
Indiana, United States: 1.00%
New Hampshire, United States: 1.00%
Kentucky, United States: 1.00%
Baden: 0.50%
Rhode Island, United States: 0.50%
United States: 0.50%
Switzerland: 0.50%
Missouri, United States: 0.50%
Canada: 0.50%
Ireland: 0.50%
Massachusetts, United States: 0.50%
Maine, United States: 0.50%
England: 0.25%

Table 15. Charleston, WV Ancestors Gen 2.

Generation 2:
Virginia, United States: 59.66%
West Virginia, United States: 11.93%
Pennsylvania, United States: 4.20%
Germany: 2.86%
Maryland, United States: 2.52%
United Kingdom: 2.35%
New York, United States: 2.18%
North Carolina, United States: 2.02%
Ohio, United States: 1.68%
New Hampshire, United States: 1.51%
Massachusetts, United States: 1.51%
New Jersey, United States: 1.18%
Ireland: 1.18%
Kentucky, United States: 1.01%
British Colonial America: 0.67%
Maine, United States: 0.67%
Baden: 0.34%
England: 0.34%
Switzerland: 0.34%
Alabama, United States: 0.34%
Connecticut, United States: 0.34%
Sweden: 0.17%

Table 16. Charleston, WV Ancestors Gen 3.

Generation 3:
Virginia, United States: 41.90%
British Colonial America: 20.90%
Pennsylvania, United States: 8.53%
West Virginia, United States: 4.70%
Maryland, United States: 4.38%
United Kingdom: 2.95%
North Carolina, United States: 2.95%
Massachusetts, United States: 1.86%
Connecticut, United States: 1.75%
New Jersey, United States: 1.75%
Germany: 1.64%
New York, United States: 0.88%
Kentucky, United States: 0.88%
England: 0.77%
Ireland: 0.77%
New Hampshire, United States: 0.66%
United States: 0.33%
Scotland: 0.33%
Ohio, United States: 0.33%
Maine, United States: 0.22%
Prussia: 0.22%
Denmark: 0.22%
South Carolina, United States: 0.22%
Tennessee, United States: 0.22%
Baden: 0.11%
Georgia, United States: 0.11%
Vermont, United States: 0.11%

Table 17. Charleston, WV Ancestors Gen 4.

Generation 4:
British Colonial America: 37.36%
Virginia, United States: 23.43%
Pennsylvania, United States: 6.63%
Maryland, United States: 4.64%
Germany: 4.37%
United Kingdom: 4.10%
New Jersey, United States: 3.07%
Ireland: 2.73%
Massachusetts, United States: 2.66%
West Virginia, United States: 1.57%
England: 1.30%
Connecticut, United States: 1.02%
North Carolina, United States: 1.02%
Scotland: 0.89%
New York, United States: 0.75%
New Hampshire, United States: 0.61%
France: 0.61%
Switzerland: 0.41%
Baden: 0.27%
Prussia: 0.27%
Kentucky, United States: 0.27%
United States: 0.14%
Delaware, United States: 0.14%
Russia: 0.14%
Alabama, United States: 0.14%
South Carolina, United States: 0.14%
At Sea: 0.14%

Table 18. Washington, D.C. Descendants.

Generation 1:
District of Columbia, United States: 62.39%
New York, United States: 8.12%
Illinois, United States: 6.84%
Massachusetts, United States: 5.56%
Maryland, United States: 3.42%
Pennsylvania, United States: 2.99%
North Dakota, United States: 2.14%
Ohio, United States: 1.71%
South Dakota, United States: 1.71%
Philippines: 0.85%
New Jersey, United States: 0.85%
Indiana, United States: 0.85%
Washington, United States: 0.85%
South Carolina, United States: 0.85%
New Hampshire, United States: 0.43%

Charleston, West Virginia, is a particularly American city in terms of its ancestry from 1865 to 1875. A majority in all four generations (parents to great-great-grandparents) were born somewhere in North America. Indeed, more than 50% of the first two generations were born in Virginia (or West Virginia if entered that way). In the parent generation (Table 14), 4.7% were born in Pennsylvania and 4.2% in Ohio, being the next places of origin after Virgina. In the grandparent generation (Table 15), Germany (2.9%), United Kingdom (2.4%), and Ireland (1.2%) were the only foreign countries that notched over 1% of birth locations. By the third generation of great-grandparents, the less specific "British Colonial America" accounted for 21.9% of birth locations, second to Virginia (Table 16), and in the great-great-grandparents' generation, British Colonial America was the top origin

(Table 17). The very long American multi-generational history of this inland city is thus, quite impressive.

Table 19. Boston, MA Descendants.

Generation 1:
Massachusetts, United States: 72.34%
Maine, United States: 5.33%
Ohio, United States: 4.82%
New York, United States: 4.06%
Illinois, United States: 2.28%
United Kingdom: 1.78%
Rhode Island, United States: 1.02%
Vermont, United States: 1.02%
New Jersey, United States: 1.02%
New Hampshire, United States: 1.02%
British Colonial America: 1.02%
Pennsylvania, United States: 0.76%
Iowa, United States: 0.51%
Michigan, United States: 0.51%
Kentucky, United States: 0.51%
Sweden: 0.51%
California, United States: 0.51%
Missouri, United States: 0.25%

Table 20. Chicago, IL Descendants.

Generation 1:
Illinois, United States: 73.58%
Michigan, United States: 3.95%
Wisconsin, United States: 3.43%
Iowa, United States: 3.26%
Indiana, United States: 2.23%
Missouri, United States: 2.23%
Pennsylvania, United States: 1.72%
California, United States: 1.72%
South Dakota, United States: 1.37%
Kansas, United States: 1.20%
Colorado, United States: 1.20%
Maryland, United States: 0.86%
New York, United States: 0.69%
Minnesota, United States: 0.69%
Montana, United States: 0.51%
United Kingdom: 0.34%
Australia: 0.34%
United States: 0.17%
Tennessee, United States: 0.17%

The descendancy tables show how the generations distributed themselves over time. Parents born in one city tended to stay nearby for the birth of their children, such as in Washington, D.C., where 62% of the children of those born in the District between 1865 and 1875 were also born in D.C. (Table 18). The state of New York was a distant second with an 8% location share of the first generation, and Illinois was third with about 7%. Over 70% of the people born in Boston had children born in Massachusetts (Table 19), and Chicago individuals (Table 20) had over 73% of their children born in Illinois. By and large, this pattern repeats itself in the other cities, and the in-state connection remains high (although dropping in most cities) in the second and third generations.

The maps of the birth locations of the descendants and ancestors of people born in the root cities are also valuable. In terms of the descendants, New Orleans shows the bulk of

the first generation born in Louisiana, with a dispersion north up toward Chicago, to the northeast (Boston and New York), and out to California (Figure 16). The second generation builds on the patterns of the first, with a continuing presence in Louisiana and the southern half of the country, especially in the middle region (Figure 17). Looking at the parents' birth locations of those born in New Orleans, there is a decided emphasis on Louisiana followed by both Western Europe (especially Germany, Ireland, and France) and the eastern states of the United States (Figure 18). By the fourth generation (great-great-grandparents) the Boston area, southern Italy, and Germany have particularly large representations of those ancestors of New Orleans children in 1865–1875 (Figure 19).

Boston's location patterns for both descendants and ancestors are quite different from New Orleans. The grandchildren of Bostonians were almost exclusively born around Boston and west across the northeast through the Midwest to Chicago (Figure 20). The ancestors of Boston children were decidedly of New England stock, with some connection to the Ireland and the British Isles, even at the great-great-grandparent generation (Figures 21 and 22). That makes sense as per the time period of the searches, and it would probably show a different pattern if the base years were in the first decade of the 20th century, when there were more migrants from southern and eastern Europe in Boston. The difference in the maps, with more Irish-born grandparents compared with very few Irish-born great-great-grandparents, is a reminder of the difficulty of conducting family history research in Ireland in the 1700s.

Moving west to Chicago, we found a city that attracted many migrants from Europe closer to our time period. This was because it was a younger city than Boston, for example, and it kept a large portion of its descendants in the vicinity. Figure 23 shows the distribution of descendants of people born in Chicago from 1865 to 1875, and it includes the children, grandchildren, and great-grandchildren generations. We focused the map on the north-central part of the country, as most of the descendants of those generations were born in that region. Because of the overlap, one cannot see all the places that had multiple generations born there, and many of the cities on the map also share that situation. For example, the Chicago area itself had 233 children, 192 grandchildren, and 43 great-grandchildren born there, but the map only shows the 233 from the first generation. In terms of the ancestors of Chicago births, in the first generation (parents) (Figure 24) 66 were born in the Chicago area, while many others were born across the northeastern part of the United States and all across Northern and Central Europe. By the fourth generation (great-great-grandparents) (Figure 25) the patterns of the birthplaces of the parents were reinforced, but without a focus on Chicago, as it had not been settled yet.

4. Conclusions

Our United States city examples of migration flows both through ancestor and descendant streams have revealed unique geographical patterns of migration that are tied to individual cities at specific time periods. Each city has its own multi-generational migration imprint related to the source of its immigrants, its relative location to other parts of the country, and the tendency of people to move around in that particular era. The gathering of families to American cities to have children in the 1865 to 1875 time period from various parts of the world was followed by a more focused and less distant diaspora for the children and grandchildren of those born in those cities.

We summarize some of what we found with each of the six questions posed at the end of the Methods section and explored in the Results section:

1. Community stability of ancestors and descendants. Community Stability Indices highlighted that Chicago had a large number of newer immigrants in the population at that time (low ancestor stability), while Charleston, SC, had an exceptionally large proportion of parents born close to that city (high stability). With descendants, Boston had very high stability and Jackson, MS, low stability, but overall, in most cities the children of people born in the study cities tended to also be born in or near those

study cities, showing higher descendant community stability than ancestor stability. (Section 3.1)

2. Close or far migration (Ravenstein). A minority of parents of children (Generation 0–1) in all of the cities moved from closer than 50 miles from their places of birth to have children in our study cities between 1865 and 1875. This means that most parents in all of our study cities were born a good distance from where they had their children. With descendants, several contrasts are apparent with the Ravenstein indices. Most of the children of those born in our sample cities were born near there, except in Charlotte, Atlanta, and Jackson, where less than 50% stayed close-by for the birth of their children. Atlanta was an extreme case, where only 19% of the children of the root generation were born within the 50-mile ring. (Section 3.2)
3. Comparisons of ancestral and descendant birth locations by generation (Generational Hourglasses). Each city has a distinct hourglass, but there are similarities in both the ancestral and descendant generations of standard distances, as ancestors were nearly always more spread out in their births than the descendants who stayed fairly close to each other through the generations. The international, spread-out character of the ancestors is shown by the large-distance ancestral generations. (Section 3.3)
4. Center of ancestor or descendants' birthplaces and migration flow direction (Spatial Centers). What is general is that the spatial centers of the ancestors of people born during 1865 to 1875 in the root cities usually move progressively east with each generation back. On the other hand, descendant mean centers do not always shift to the west, as after 1875 settlement extended to most areas of the country, making the mean centers especially sensitive to local geographies of migration. (Section 3.4)
5. Migration distances and city comparisons (Mean migration distances and dispersal indices). There is a distinct difference in the size of the Mean Migration Distances for the first ancestor generation among the cities, with the immigrant cities in the north such as Cleveland, Boston, and Chicago showing long-distance moves especially in the first generation of the ancestors (parents), while southern and interior cities such as Atlanta, Charleston, WV, and Jackson, MS, had much lower mean migrations for that first ancestor generation in comparison, which means that more of the parents were natural-born United States residents. (Section 3.5)
6. Makeup of ancestral homelands and descendant destinations (Genealogical Mixing Ratios). Using a combination of maps and tabular data, we showed how each city had a mix of generational percentages that were unique. Chicago in 1870 was quite international. Boston had a large share of Irish residents. Charleston, West Virginia, was almost exclusively "American," even four generations back. Descendants were normally found in large numbers in the same state as the root city, especially in the first generation. (Section 3.6)

So, some takeaways from our research are that in the past, each city in the United States has attracted people from a distinct mix of origins and has in turn distributed their populations over generations in a unique geographic pattern as well. In concert with that finding, we have shown how descendants of those born in our study cities tended to stay close to the city for some time; that the ancestors of migration funneling into a city were more spread out than the descendants of those born in the city; that migration generally proceeded from east to west from the great-great-grandparents to the children, but that the center of migration was more random for the descendants; and that distance of migration between ancestral generations was highly affected by the share of European ancestors and the regional location of the city. Thus, this paper has emphasized how geography and history come together to influence the patterns of migration in and out of cities. Future studies can analyze other areas of the world and other time periods using this same family migration tool tied to FamilySearch, including separating out the migration streams by gender to highlight the distinct gendered migration patterns, to expand our understanding of gathering and diasporic migration streams of which we, in our own family histories, have all been a part.

Author Contributions: Conceptualization, S.M.O. and J.S.; methodology, S.M.O. and J.S.; validation, S.M.O., J.S. and R.D.; formal analysis, S.M.O., J.S. and R.D.; investigation, S.M.O. and J.S.; resources, S.M.O.; data curation, S.M.O., J.S. and R.D.; writing—original draft preparation, S.M.O. and J.S.; writing—review and editing, S.M.O.; visualization, S.M.O., J.S. and R.D.; supervision, S.M.O.; project administration, S.M.O.; funding acquisition, S.M.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the College of Family, Home, and Social Sciences at Brigham Young University.

Data Availability Statement: Family history data were obtained from FamilySearch.org through a FamilySearch API program developed at Brigham Young University. The lead author of the study will be exploring if parts of the program can be made available to the public for them to conduct their own research. Map figures were made using Google Maps.

Acknowledgments: The authors would like to thank the anonymous reviewers for their insightful and valuable critiques and recommendations. We would also like to thank the Brigham Young University College of Family, Home, and Social Sciences for its financial support and the FHSS College Computing Services Web Team for their programming services, and particularly Kenneth Millard for his administrative support and programmers Alek Spackman and Harrison Cole for their excellent system improvements. We also would like to thank secretarial staff from the Department of Geography, and Brigham Young University for their assistance--particularly Amy Richins, Eva Laraway, and Olivia Howe.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Ancestor Concentration Index.

Atlanta, GA				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.251	1.042	0.860
Generation 2	0.800	-	0.833	0.688
Generation 3	0.960	1.200	-	0.826
Generation 4	1.163	1.454	1.211	-
Boston, MA				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.051	1.637	2.086
Generation 2	0.952	-	1.558	1.985
Generation 3	0.611	0.642	-	1.274
Generation 4	0.479	0.504	0.785	-
Charleston, SC				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.067	1.103	1.070
Generation 2	0.937	-	1.034	1.003
Generation 3	0.906	0.967	-	0.970
Generation 4	0.935	0.997	1.031	-

Table A1. *Cont.*

Charleston, WV				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.849	0.940	0.692
Generation 2	1.178	-	1.108	0.815
Generation 3	1.064	0.903	-	0.736
Generation 4	1.445	1.226	1.358	-
Charlotte, NC				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.083	0.962	0.725
Generation 2	0.924	-	0.889	0.669
Generation 3	1.039	1.125	-	0.753
Generation 4	1.380	1.494	1.328	-
Chicago, IL				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.016	1.002	0.999
Generation 2	0.985	-	0.986	0.983
Generation 3	0.999	1.014	-	0.997
Generation 4	1.001	1.017	1.003	-
Cleveland, OH				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.054	1.034	1.045
Generation 2	0.949	-	0.981	0.992
Generation 3	0.968	1.019	-	1.011
Generation 4	0.957	1.008	0.989	-
Jackson, MS				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.243	1.385	1.095
Generation 2	0.805	-	1.114	0.881
Generation 3	0.722	0.897	-	0.791
Generation 4	0.913	1.135	1.265	-
New Orleans, LA				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.042	1.070	1.141
Generation 2	0.959	-	1.027	1.095
Generation 3	0.934	0.974	-	1.066
Generation 4	0.876	0.913	0.938	-

Table A1. *Cont.*

Washington, DC				
	Ancestor			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.048	1.152	1.325
Generation 2	0.954	-	1.099	1.265
Generation 3	0.868	0.910	-	1.151
Generation 4	0.755	0.791	0.869	-

Table A2. Descendant Concentration Index.

Atlanta, GA				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.298	0.637	2.541
Generation 2	0.770	-	0.491	1.957
Generation 3	1.570	2.038	-	3.989
Generation 4	0.394	0.511	0.251	-
Boston, Massachusetts				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.319	0.390	17.857
Generation 2	3.130	-	1.222	55.900
Generation 3	2.562	0.819	-	45.753
Generation 4	0.056	0.018	0.022	-
Charleston, South Carolina				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.154	0.939	N/A
Generation 2	6.514	-	6.119	N/A
Generation 3	1.065	0.163	-	N/A
Generation 4	N/A	N/A	N/A	-
Charleston, West Virginia				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.615	0.515	0.696
Generation 2	1.626	-	0.837	1.132
Generation 3	1.943	1.195	-	1.353
Generation 4	1.437	0.883	0.739	-

Table A2. *Cont.*

Charlotte, North Carolina				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.933	0.733	0.696
Generation 2	1.072	-	0.785	0.745
Generation 3	1.365	1.274	-	0.949
Generation 4	1.438	1.342	1.053	-
Chicago, Illinois				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.492	1.373	1.392
Generation 2	0.671	-	0.920	0.933
Generation 3	0.729	1.087	-	1.014
Generation 4	0.718	1.071	0.986	-
Cleveland, Ohio				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.807	0.582	0.499
Generation 2	1.239	-	0.720	0.618
Generation 3	1.719	1.388	-	0.858
Generation 4	2.004	1.618	1.165	-
Jackson, Mississippi				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.621	0.455	0.382
Generation 2	1.612	-	0.733	0.615
Generation 3	2.198	1.364	-	0.839
Generation 4	2.619	1.625	1.192	-
New Orleans, Louisiana				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	0.664	0.436	N/A
Generation 2	1.507	-	0.657	N/A
Generation 3	2.293	1.522	-	N/A
Generation 4	0.000	0.000	0.000	-
Washington, D.C.				
	Descendant			
	Generation 1	Generation 2	Generation 3	Generation 4
Generation 1	-	1.617	1.763	5.246
Generation 2	0.618	-	1.090	3.243
Generation 3	0.567	0.917	-	2.975
Generation 4	0.191	0.308	0.336	-

Appendix B

Despite some pitfalls, using censuses to study U.S. populations over decades has been the main method in many migration and other historical social sciences studies for

decades. Scholars have written extensively about the potentials of this approach, but also its limitations because of underreporting of certain populations and mistakes in the records caused by the census takers and the population being enumerated (Knights 1969; Knights 1991a; Anderson 1988; Anderson and Fienberg 1997; Anderson 2019; Winchester 1970; Hershberg et al. 1976; Markoff and Shapiro 1973; Ruggles et al. 2018; Pouyez et al. 1983). Nevertheless, scholars have used these approaches to study a variety of topics including migration, economic and social mobility (Thernstrom 1964; Thernstrom 1973), ethnic neighborhoods (Chudacoff 1973; Conzen 1979), ethnic and cultural migration (Waters et al. 2007; Arreola and Hartwell 2014; Ueda 2017), demographic structure in communities (Chudacoff 2014), urban history (Knights 1971; Knights 1991b; Conzen 1981), among others (see also Conzen 1983).

Appendix C

The following tables show examples of the birthdate ranges of the different generations for several cities. We removed incorrect outliers in the dataset from the ranges (but those outliers remain in the statistics).

Table A3. Birthdate ranges for people tied to the Root city generation (incorrect outliers removed).

Generation	First Birth	Last Birth	City
0	1865	1875	Atlanta, GA
1	1790	1855	
2	1767	1835	
3	1725	1815	
4	1695	1784	
0	1865	1875	Boston, MA
1	1810	1853	
2	1779	1830	
3	1740	1802	
4	1651	1779	
0	1865	1875	Charleston, SC
1	1818	1852	
2	1773	1828	
3	1738	1801	
4	1688	1772	

Table A4. Descendant birthdate ranges for people tied to the root city generation (incorrect outliers removed).

Generation	First Birth	Last Birth	
0	1865	1875	Atlanta, GA
1	1882	1926	
2	1898	1950	
3	1926	1973	
4	1961	1977	
0	1865	1875	Boston, MA
1	1885	1919	
2	1907	1945	
3	1938	1965	
4	2002	2004	
0	1865	1875	Charleston, SC
1	1887	1925	
2	1910	1947	
3	1932	1962	
0	1865	1875	Charleston, WV
1	1880	1929	
2	1900	1948	
3	1922	1964	
4	1948	1982	

Notes

[1] The hourglass does not show the number of people in each generation, but the standard distances for each generation of the birth distances to the spatial center in that one generation. The root city is the spatial center of the root generation and has no standard distance because everyone was born in that city, but the other generations are being measured by the distances of the birthplaces in that generation to the mean spatial center of those birthplaces, standardized. Thus, the ancestral hourglass widths can be wider or lower than the descendant widths for each generation even though each succeeding generation from the root location, either ancestor or descendant, potentially has more people in it than the generation before it.

[2] Below are several points related to data quality that we explain and consider related to issues of the FamilySearch Family Tree data such as missing records, duplicates, uncertainties in places, and family connections. Our web interface does not include ancestors or descendants in its search results if they are only names without a birth location. In terms of missing data, as searches go back in time to ancestors or forward in time, the numbers of people in each generation are less than they could be because of research that has not been carried out yet. So, if Person A's parents are known in the first generation, but only Person A's grandmother is known in the second generation, then the third generation will be necessarily smaller. With these family connections, because the searches are so large, we take the data as they are in terms of relationships and assume that they are as correct as they can be for the time being. Additionally, as there are sometimes duplicates in the FamilySearch Tree, we have looked at a sample of these cities' searches and have found the following total numbers of duplicates in all generations together: Atlanta (ancestors—4, descendants—0), Boston (ancestors—18 [including 11 in the root], descendants—19 [including 17 in the root]), Charleston, SC, (ancestors—1, descendants—0), Charleston, WV, (ancestors—3 [including one in the root], descendants not analyzed), and New Orleans (ancestors—4 [including one in the root], descendants—2 [including one in the root]). Since the family tree database is user contributed, people can merge records when those types of mistakes are made, which helps cut down on the risk of duplicates over time. Also, when we carried out the sampling of the year ranges of the births of people in each generation, we found a small number of data issues related to incorrect data entry or incorrect retrieval of a person by the computer system who was not born in the initial 1865–1875 decade (see Appendix C). Even with these limitations, we see the value of our approach to building ancestral and descendancy migration profiles for our sample cities because of the large size of the FamilySearch database.

[3] The program searches for people in the database who were born in the relevant sample city according to their personal records. The city of birth for each person was designated by the user(s) who entered the information about their ancestor in the database, using the FamilySearch Place database as a guide, which database also includes dates of city existence to aid the user in choosing the right place. Sometimes it was only a county that is known about as a place of birth for an individual, and so that was put into the system. Consequentially, that person wouldn't show up in a search for the city even if they happened to be born in the main city (e.g., someone listed as being born in Cook County, IL may have been born in Chicago, but there is no way of knowing that, so they are omitted in a search).

[4] We actually set the search size to around 200–210 for each city (except for Boston descendants because of the larger number in the root generation needed to achieve a good sampling of descendants). In the larger cities there were assuredly more than 210 people born over the decade and in the database, but our sample usually stopped once it retrieved the maximum size. Usually, the final root generation number was less than the initial sample size because of people initially retrieved by the system who were later omitted because of data issues with their record. For the smaller cities of Jackson, Mississippi, and Charleston, South Carolina, the numbers of people retrieved for the root generation were far less than 200, even though we put the sample size at 200 plus. This indicates that there were fewer people in the FamilySearch Family Tree database born during that decade in those places. An additional issue with Jackson, Mississippi, was that we had to omit a large number of people who were retrieved in the sample, but who were actually born in Jackson County, Mississippi.

[5] When a contributor adds a person to the FamilySearch Family Tree, they enter in personal data including name, birthdate, and place of birth, death, christening, marriage (they put in the data that are available). When entering birthplaces the user is supposed to choose a standardized place name from the FamilySearch Place Database, for each event such as birth and death. Those standardized place names are attached to a specific latitude and longitude in the database.

[6] The different order of the generational comparisons helps show whether we are looking at ancestor or descendant generations, and it shows a flow outward from the root city both ways (back in time and forward in time). So, for ancestors, we are measuring the distance from Generation 0 (the root generation at the sample city) to the birth locations of parents, and the 1–2 generation is a measurement of the birth locations of parents to the grandparents. On the other side, the 1–0 is measuring the birth locations of the children of people born in the sample city to the sample city location. So, in these tables for each line it is the mean distance of all the distances of those born in one generation to the next generation.

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