

Coordinated Migration

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Large-scale migrations are an important part of human history. Whether they result from economics, wars, natural disaster, cultural imperatives or state policies, the worldwide flows of human beings are highly complex and notoriously difficult to measure. Here we turn our attention to a specific, fascinating kind of human migration, which we call “**coordinated migration**”.

Coordinated migration:

In a coordinated migration, a significant proportion of the population of a city has migrated, as a group, to a different city. More specifically, a flow of population from city A (*hometown*) to another city B (*current city*) is considered a coordinated migration if, among the cities in which people from hometown A currently live, city B is the city with the largest number of individuals with current city B, and hometown A.

To study between-city coordinated migration, we examined aggregate, anonymized data on all users who list both their hometown and their current city on their Facebook profile.

For a given hometown h , let $c(h)$ denote the most likely current city of the users from hometown h , that is, the city $c(h)$ is the most often listed as current city among the users from hometown h . Let $p(h)$ denote the percentage of users from hometown h who currently live in the city $c(h)$. Note that $p(h)$ essentially represents the (empirical) conditional probability that a user lists $c(h)$ as current city given that he or she lists h as hometown.

For instance, let's say 1,000,000 people list Boston as their hometown on Facebook. Out of these individuals, 300,000 list Boston as their current city, and no other city has more individuals listing Boston as their hometown. From the definitions above, it follows that Boston is the most likely current city for people who grew up in Boston. People who grew up in Boston still live there with a 30% probability. This is quite a common occurrence – for many cities, people are most likely to stay where they grew up. The study of coordinated migration focuses on cities for which the most likely current city is *different* from the hometown. For example, 67% of the individuals with Badagry, Nigeria as hometown have Lagos, Nigeria as their current city. Lagos is the most likely current city for people from Badagry.

We formally define a coordinated migration as the movement of population from a hometown h to its most likely current city $c(h)$ such that:

- At least 100 users have listed city h as their hometown.
- At least 20% of the users with hometown h have current city $c(h)$ in their profile

$(p(h) > 0.2)$.

- The hometown h and its most likely current city $c(h)$ are different cities.

To reiterate, what we look into here are those cases where at least 20% of the users from city h moved out AND currently live in city $c(h)$. For this reason, we gave the name of "coordinated" migration from hometown/origin h to current city/destination $c(h)$.

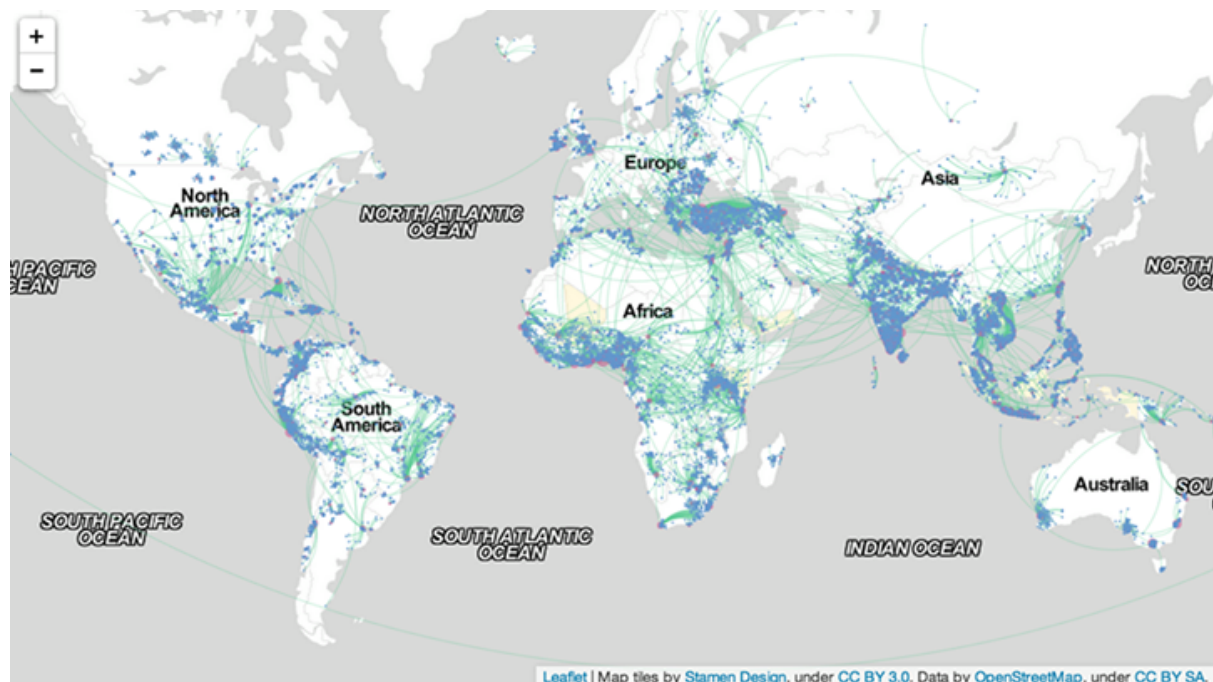
Note the following properties:

- Because there is a unique most likely current city for a given hometown, each city can only be the origin of a single coordinated migration.
- A city c can be the destination of several coordinated migrations. For such a city c , we count the number of coordinated migration flows which have c as destination and denote it $n(c)$. For example, if there are three cities such that their corresponding most likely current city is c (with probability 20% of higher), then $n(c) = 3$.

We display the coordinated migrations as follows:

- The origin cities of coordinated migrations are represented by blue dots.
- The destination cities of coordinated migrations are represented by red dots. For each destination city c , the size of the red dot depends on $n(c)$, the number of coordinated migrations which end in the city, as defined above.
- The coordinated migrations are represented by an arc between the origin and the destination cities.

The following map represents coordinated migrations over the world. Besides the coordinated migration, the map highlights (yellow shade) the countries with the largest urbanization growth between 2000 and 2012, according to the [data](#) from the World Bank.



Coordinated migration over the world

Key findings:

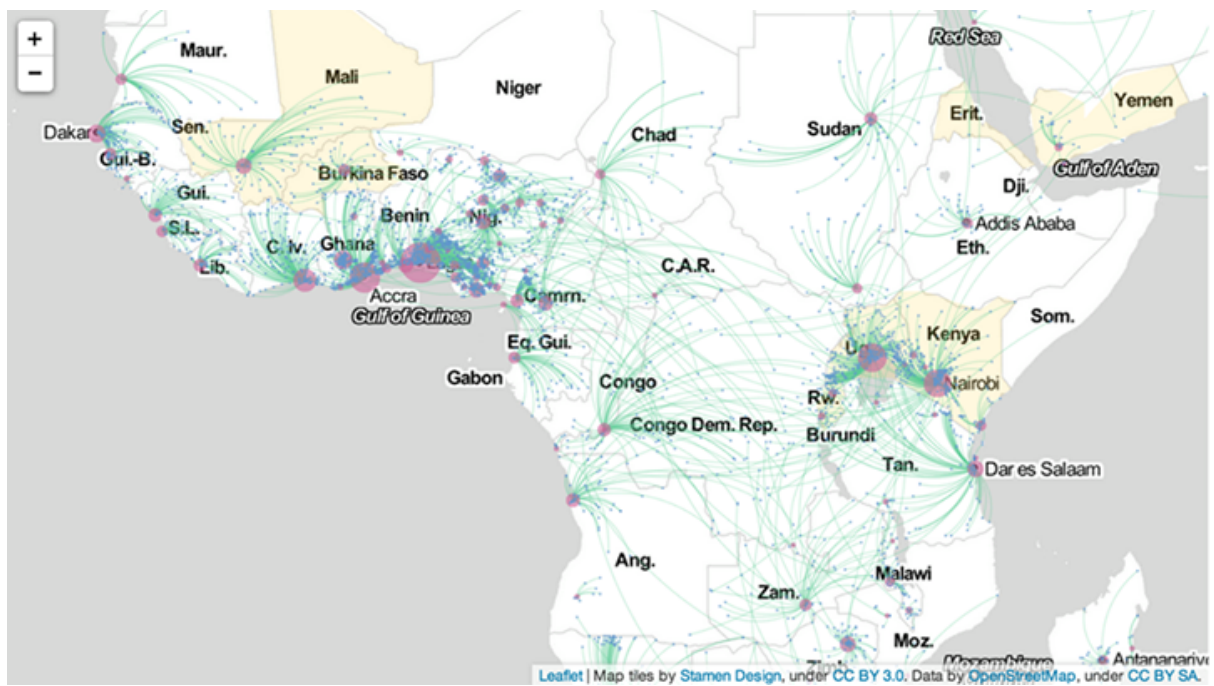
1. Major destinations of coordinated migration are in rapidly urbanizing countries

Destination city	Country	Number of coordinated migration: n(h)	Urbanization growth between 2000 and 2012 (%)	Hometown countries of the coordinated migrations
Lagos	Nigeria	566	18.6	Nigeria (96%)
Istanbul	Turkey	387	11.7	Turkey (84%), Macedonia (4%), Bulgaria (3%)
Bogota	Colombia	370	4.8	Columbia (98%)
Bangkok	Thailand	322	10.7	Thailand (90%)
Accra	Ghana	315	19.5	Ghana (97%)
Hyderabad	India	307	14.4	India (98%)
Kampala	Uganda	280	32.4	Uganda (93%), Democratic Republic of the Congo (3%)
Lima	Peru	279	6.2	Peru (97%)
Chennai	India	278	14.4	India (98%)
London	Great Britain	270	1.4	Great Britain (94%)

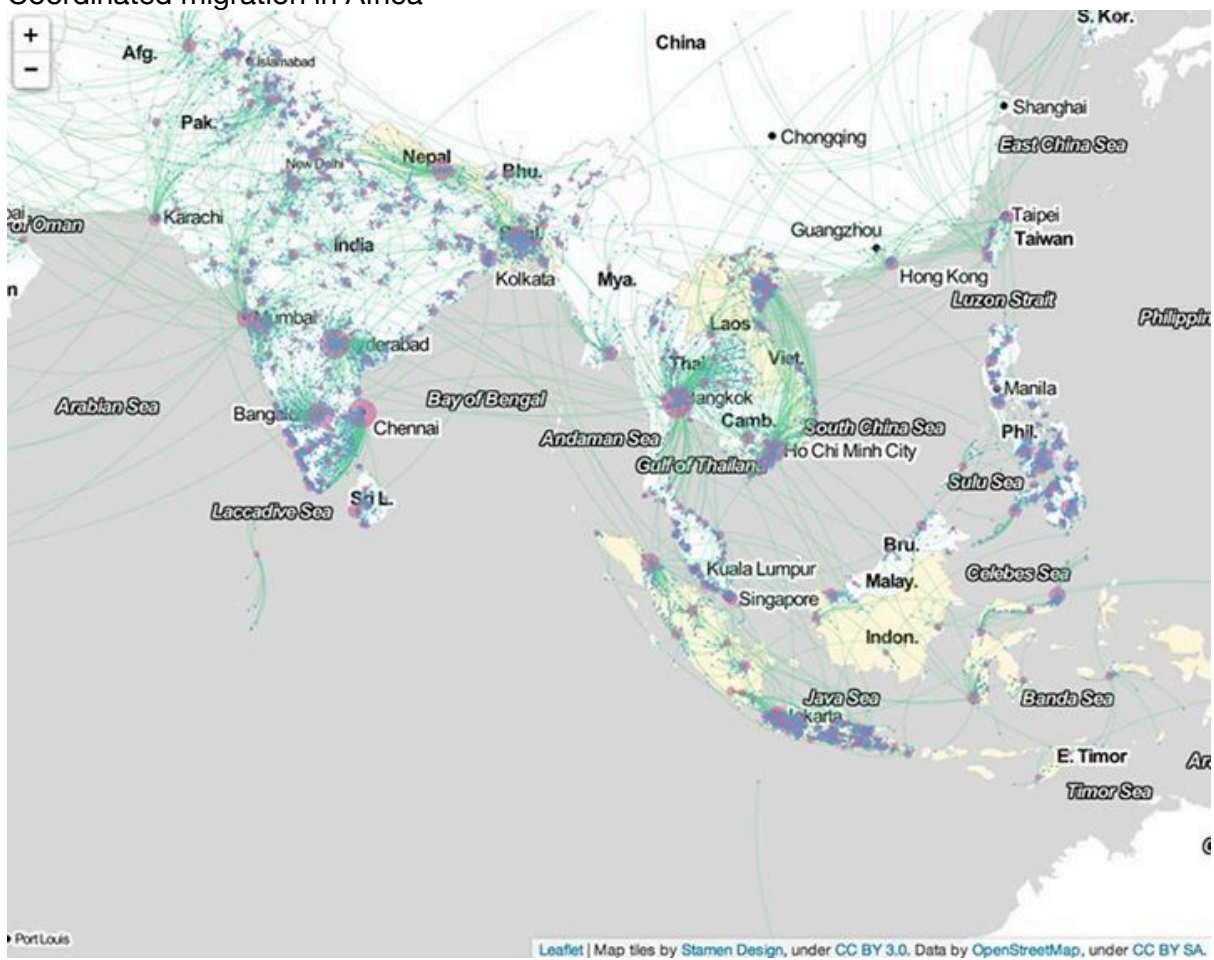
Urbanization growth between 2000 and 2012 for the top coordinated migration destinations

The importance of a destination for coordinated migration is measured by the number of coordinated flows arriving to the city, rather than the total flows of migrations to the city.

Rapidly urbanizing cities attract population from the neighboring cities, most often within the same country. Depending on how centralized a country is, there might be a single hub attracting people from the entire country (as seen in West Africa) or different hubs as seen in South-East Asia and even more strongly in India.



Coordinated migration in Africa



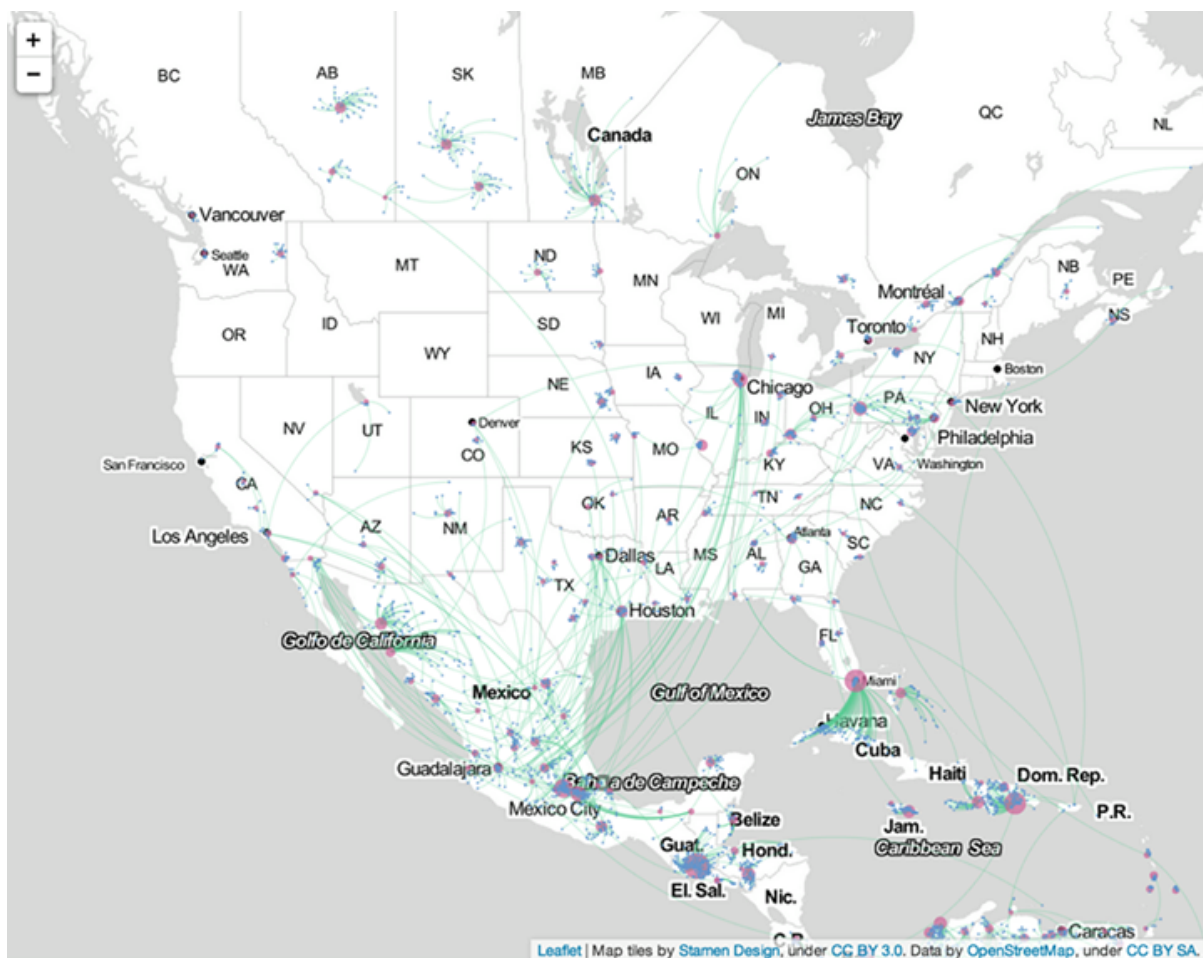
Coordinated migration in Asia

Large urban centers in occidental countries (e.g. San Francisco, New York City, Paris, and so on) are not the destination of a large number of coordinated migrations. These urban centers attract population from all over the world, but rarely in a coordinated way. For example, people moving to New York City could have moved to another large urban area and no coordinated population movement arises.

2. Examples of international coordinated migrations

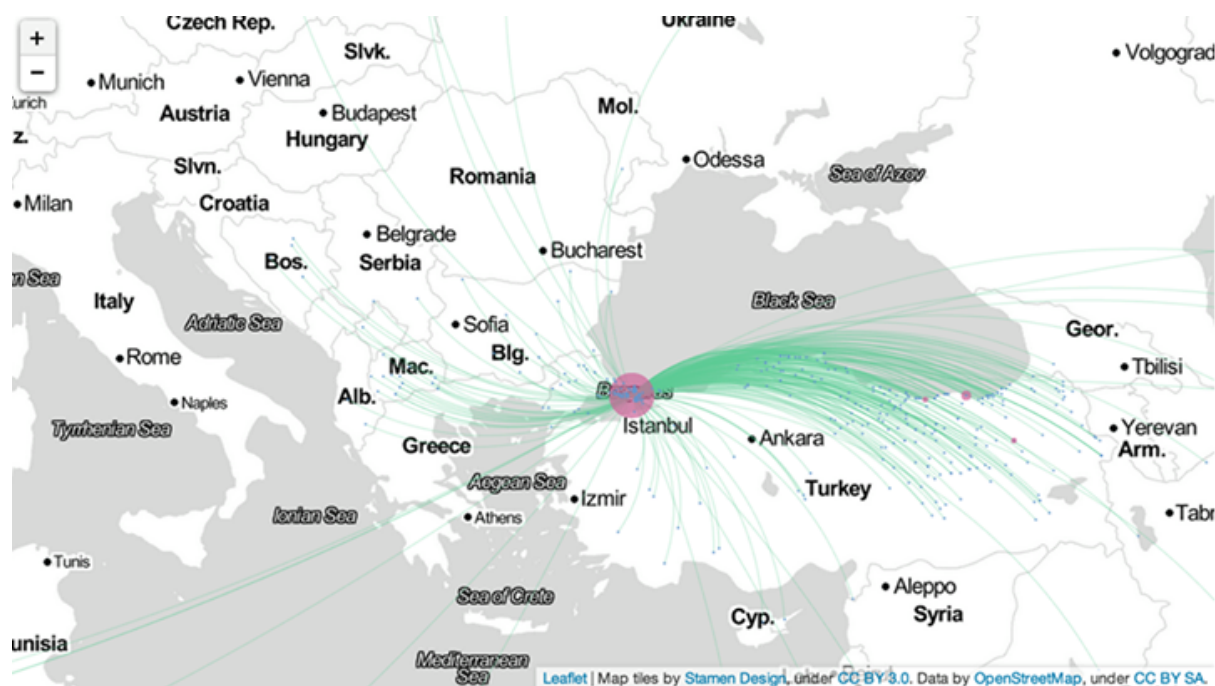
Different types of international coordinated migrations have the United States as destination. We noticed two major origins for these coordinated migrations:

- Migrations from Cuba: For these migrations, the main destination city is Miami. Here we are most likely witnessing the effect of selection bias. Arguably, Cubans who move to the United States are more likely to have access to the Internet and use Facebook than Cubans in Cuba. As a result, the data may be overstating the extent of *coordinated* migration originating from Cuba. Nonetheless, it is reasonable to infer that individuals who emigrate from Cuba are most likely moving to Miami.
- Migrations from Mexico: For these migrations, there are several destination cities in the United States (notably Chicago, Houston, Dallas and Los Angeles). We interpret this phenomenon as a *chain migration*: a person first moves and is then joined by other persons from the same hometown. However, the migration is done somewhat independently for people originating from different hometowns.



Coordinated migration in North America

Istanbul arrives as one of the cities with the largest number of coordinated migrations. A large proportion of the migrations come from other parts of Turkey, while the rest originates from East Europe. We believe that these migrations have cultural and political motives, on top of economical ones. For instance, we observe migration from Bulgaria (with a considerable Turkish minority) and from majority-Muslim Bosnia. For additional clarity, the visualization below only shows coordinated migrations with Istanbul as their destination.



Coordinated migration to Istanbul

A few exceptions and biases worth noting:

Individuals who did not list both their hometown and current city are not taken into account in the study. The results are influenced by the ease of access to Facebook in different parts of the world, and the amount of information shared by users from different cultures. An individual moving to an area with easier access to Facebook may fill in his/her profile retro-actively, whereas he/she might never have created an account if he/she had not moved.

Conclusion:

Facebook offers a wealth of data suitable for the study of human mobility. In particular, the city-level accuracy offers the possibility of mapping internal and international migrations alongside each other, which cannot be done easily through traditional surveys. There are many more interesting questions that can be addressed using this data set. We will further look into specific types of migrations and hope to come back with more results soon! Stay tuned!