Natural experiments in online social network assembly

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+ Sam Way (Colorado), Johan Ugander (Stanford), Aaron Clauset (Colorado)
Assembling the facebook: using heterogeneity to understand online social network assembly

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online social networks
Assembling the Facebook:
using heterogeneity to understand online social networks

General
Linkedin

Niche
HR.com

Defunct
Myspace
Friendster
Orkut
Academia.edu
Tribe.net
online social networks ≠ (offline) social networks
online social network assembly
Community composition
Ordering effects
Context
Competition within & between systems
Natural limits on growth
Arrival (product adoption)

online social network assembly
Community composition
Ordering effects
Context
Competition within & between systems
Natural limits on growth
Arrival (product adoption)

online social network assembly

Endogenous & exogenous
online, offline, social, behavioral, cultural, structural & design-based mechanisms
online social network assembly

What does assembly look like?
online social network assembly

What does assembly look like?
Why is it hard to measure?
online social network assembly

What does assembly look like?
Why is it hard to measure?
What processes are actually at play, supposing we could observe them?
social search vs. social browsing

Lampe et al. (2006)
online social network assembly

What does assembly look like?
Why is it hard to measure?
What processes are actually at play, supposing we could observe them?

offline & online
present & historical
implicit: endogenous & exogenous
“Classes are being skipped. Work is being ignored. Students are spending hours in front of the computer in utter fascination. Thefacebook.com craze has swept through campus.”

-- The Stanford Daily, 03/05/2004
What Is thefacebook.com?

Thefacebook.com is an expanding online directory that connects students, alumni, faculty and staff through social networks at colleges and universities. This online directory allows for user connections on the basis of friendship, courses and social networks (including intra and inter-school networks), and has a built-in messaging system.

User Profile

Each thefacebook.com user maintains and updates a profile that includes:

1. Contact Information

2. Personal Information
   relationship status and procurement, political views, clubs, jobs and favorite music, books, movies and quote

3. Course Information
   the site has a built-in database of school courses and concentrations and automatically builds a user’s class schedule

4. Picture

Additionally, thefacebook.com automatically adds to each user profile links to school news articles that refer to the user, the last user away-message in the AIM system and the last user access location (the site has a built-in database of school dormitories and halls).
Our Audience – The College Addiction

There are 15 million college students in the United States. With an estimated purchasing power that exceeds $85 billion, college students have money in their pockets for your services and products. This year they will spend $21 billion on restaurants and food, $9 billion on automobiles, $5 billion on clothes, $4 billion on phones and $46 billion on other amenities. College students are also active job seekers.

User Base Demographics*

<table>
<thead>
<tr>
<th>Total Users</th>
<th>70,000*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivy-League</td>
<td>55%</td>
</tr>
<tr>
<td>Other Schools</td>
<td>45%</td>
</tr>
<tr>
<td>Students</td>
<td>87%</td>
</tr>
<tr>
<td>Alumni</td>
<td>11%</td>
</tr>
<tr>
<td>Faculty and Staff</td>
<td>2%</td>
</tr>
<tr>
<td>Men</td>
<td>48%</td>
</tr>
<tr>
<td>Women</td>
<td>52%</td>
</tr>
<tr>
<td>Age 18 to 24</td>
<td>92%</td>
</tr>
</tbody>
</table>

Usage Growth Rate

The growth rate of the total number of users is increasing, with the addition of 10,000 thefacebook.com members in the first week of April, 2004.

The percentage of daily unique users has slightly increased through time.

The monthly traffic in pageviews has grown through time in proportion to the growth rate of the user base.

"I have a new addiction. It is powerful. It is disturbing. It is thefacebook.com."

-- The Daily Pennsylvanian, 03/25/04

*Based on March 2004 Monthly Statistics
*Based on April 19, 2004
Our Schools – The Expansion

Thefacebook.com was launched on February 4, 2004 at Harvard University. As of April 19, 2004, the expansion of thefacebook.com network has yielded the following member schools:

Ivy-League

<table>
<thead>
<tr>
<th>Launch Date</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 4, 2004</td>
<td>Harvard University</td>
</tr>
<tr>
<td>February 24, 2004</td>
<td>Columbia University</td>
</tr>
<tr>
<td>March 1, 2004</td>
<td>Yale University</td>
</tr>
<tr>
<td>March 7, 2004</td>
<td>Dartmouth University</td>
</tr>
<tr>
<td>March 7, 2004</td>
<td>Cornell University</td>
</tr>
<tr>
<td>March 14, 2004</td>
<td>University of Pennsylvania</td>
</tr>
<tr>
<td>April 4, 2004</td>
<td>Brown University</td>
</tr>
<tr>
<td>April 4, 2004</td>
<td>Princeton University</td>
</tr>
</tbody>
</table>

Other Schools

<table>
<thead>
<tr>
<th>Launch Date</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 26, 2004</td>
<td>Stanford University</td>
</tr>
<tr>
<td>March 14, 2004</td>
<td>MIT</td>
</tr>
<tr>
<td>March 21, 2004</td>
<td>New York University</td>
</tr>
<tr>
<td>March 21, 2004</td>
<td>Boston University</td>
</tr>
<tr>
<td>April 4, 2004</td>
<td>UC Berkeley</td>
</tr>
<tr>
<td>April 11, 2004</td>
<td>Duke University</td>
</tr>
<tr>
<td>April 11, 2004</td>
<td>Georgetown University</td>
</tr>
<tr>
<td>April 11, 2004</td>
<td>University of Virginia</td>
</tr>
<tr>
<td>April 19, 2004</td>
<td>Tufts University</td>
</tr>
<tr>
<td>April 19, 2004</td>
<td>Boston College</td>
</tr>
<tr>
<td>April 19, 2004</td>
<td>Northeastern University</td>
</tr>
<tr>
<td>April 19, 2004</td>
<td>University of Illinois</td>
</tr>
</tbody>
</table>

The Expansion Plan

The mission of thefacebook.com is to expand to include most of the schools in the United States. By September 1, 2004, thefacebook.com network will have more than 200 member schools.
http://thefacebook.com

Saved 5,568 times between February 12, 2004 and January 27, 2015.

PLEASE DONATE TODAY. Your generosity preserves knowledge for future generations. Thank you.
Welcome to Thefacebook!

Thefacebook is an online directory that connects people through social networks at colleges.

We have opened up Thefacebook for popular consumption at Harvard, Columbia, Stanford, Yale, Cornell, Dartmouth, UPenn, MIT, and now BU and NYU.

Your facebook is limited to your own college or university.

You can use Thefacebook to:
- Search for people at your school
- Find out who is in your classes
- Look up your friends' friends
- See a visualization of your social network

To get started, click below to register. If you have already registered, you can log in.
The Facebook expands to over 100 university networks

Thefacebook.com launches at Harvard

Friendster launches

LinkedIn launches

MySpace launches

Facebook drops the "the"

Facebook100 data captured

Facebook launches News Feed

Facebook open to everyone

Harvard

Columbia

Stanford

Yale

Cornell, Dartmouth

UPenn, MIT

NYU, BU

Brown, Princeton, UC Berkeley

Duke, Georgetown, UVA

BC, Tufts, Northeastern, Illinois

Florida, Wellesley, Michigan, Michigan State, Northwestern

UCLA

Emory, UNC, Tulane, UChicago, Rice

WashU

UC Davis, UC San Diego

USC

Caltech, UC Santa Barbara

Rochester, Bucknell

Williams, Amherst, Swarthmore, Wesleyan, Oberlin, Middlebury, Hamilton, Bowdoin

Vanderbilt, Carnegie Mellon, Georgia, South Florida, Central Florida, Florida State, GWU, Johns Hopkins

Syracuse, Notre Dame, Maryland

Maine, Smith, UC Irvine, Villanova, Virginia Tech, UC Riverside, Cal Poly, Mississippi, Michigan Tech, UCSC, Indiana, Vermont, Auburn, U San Fran, Wake Forest, Santa Clara, American, Haverford, William & Mary, Miami, James Madison, UT Austin, Simmons, Binghamton, Temple, Texas A&M, Vassar, Pepperdine, Wisconsin, Colgate, Rutgers, Howard, UConn, UMass,aylor, Penn State, Tennessee, Lehigh, Oklahoma, Reed, Brandeis

Trinity (and 9 others)
online social network data

- Facebook100
  - 100 U.S. university networks
  - Users = 1,208,316
  - Undirected friendships = 93,969,074
  - Annotated user data:
    - Gender
    - Status (faculty/undergraduate/etc.)
    - Year of graduation
    - High school
    - Major
    - Dorm

augmented data

• Introduced:
  – Start dates
  – Graduation dates
  – Introduction of Facebook to campuses

• Estimated full-time undergraduate enrollment
  – National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education

• Within-sample surveys circa 2005 snapshot
  – demographics, social capital, self esteem and friending strategies
  – privacy, profile information & sharing
    Acquisti and Gross (2006)
  – social grooming & who doesn’t join Facebook
    Tufekci (2008)
  – Facebook friending habits online & offline
    Mayer and Puller (2008)
population heterogeneity in age, size mean geodesic up, clustering down
heterogeneity in size, age, adoption
natural experiments in network assembly

- **Facebook100**
  - Observed in single snapshot, early Sept 2005
  - *Facebook expanded to these first 100 networks during February-September 2004*

![Access to Facebook](image1)

Access to Facebook

![Start of 2005-06 school year](image2)

Start of 2005-06 school year
natural experiments in network assembly

- Facebook100
  - Observed in single snapshot, early Sept 2005
  - Facebook expanded to these first 100 networks during February-September 2004

1. Networks are of different vintages

2. Expansion spanned the end of the 2003-2004 school year [present/historical]

3. Beginning of 2005 school year spanned the snapshot of the data [offline/online]
natural experiments in network assembly

- Facebook100
  - Observed in single snapshot, early Sept 2005
  - Facebook expanded to these first 100 networks during February-September 2004

Access to Facebook

<table>
<thead>
<tr>
<th>Date of Facebook Access (2004)</th>
<th>Number of schools on Facebook</th>
</tr>
</thead>
</table>

Start of 2005-06 school year

<table>
<thead>
<tr>
<th>Start of School Year (2005)</th>
<th>Number of schools in session</th>
</tr>
</thead>
</table>
adoption tracks with time on campus

++ time on campus
younger
shared geography,
present interactions

-- time on campus
older
historical interactions
networks matured towards similar end states
class of 2009 natural experiment

The graph shows the number of schools in session from August to October 2005. The number of schools in session increases from 0 in August to approximately 100 by October. The graph is divided into two sections: offline and online. The offline section is represented in white, and the online section is represented in blue. The transition from offline to online occurs around September.
classes with more time on campus had higher adoption
degree distributions & social strategies change with more time on campus
degree distributions & social strategies change with more time on campus
Unique timing & historical context of Facebook’s emergence created useful heterogeneities
Unique timing & historical context of Facebook’s emergence created useful heterogeneities

Heterogeneities (population, treatment) can reveal underlying social processes
takeaways

• Context matters
• Assembly questions abound
  – Network maturity vs. growth, densification; Shortest paths follow Backstrom et al. (2012)
  – $N>1$
• Natural experiments reveal heterogeneities in online/offline, present/historical processes
  – Social browsing (before shared environment) vs. social search (after)
  – Shared physical environment increases adoption
  – Networks mature at different rates towards similar end states
THANK YOU

Questions?

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