

A CROSS-COUNTRY INVESTIGATION OF USER CONNECTION PATTERNS IN ONLINE SOCIAL NETWORKS



Christine Bauer & Markus Schedl
Johannes Kepler University Linz, Austria
christine.bauer@jku.at | markus.schedl@jku.at
christinebauer.eu | <http://www.cp.jku.at/people/schedl/>

This research is supported
by the Austrian Science
Fund (FWF): V579.



52nd Hawaii International Conference on System Science (HICSS 2019)
11 January 2019, Grand Wailea, Maui, HI

MARSHALL MCLUHAN COINED THE CONCEPT OF THE GLOBAL VILLAGE

“The new electronic interdependence recreates the world in the image of a global village.”

Today, online social networks (e.g., Facebook, Instagram, Twitter) have become important means for global social exchange.

Marshall McLuhan (1962). *The Gutenberg Galaxy*. Toronto, Canada: University of Toronto Press.

Marshall McLuhan (1964). *Understanding Media: The Extensions of Man*. Toronto, Canada: MacGraw-Hill.

THE MAIN RESEARCH QUESTION

Has the
global village
become a reality
in online social networks?

LIMITATIONS OF EXISTING RESEARCH (=RESEARCH GAP)

Social connectedness in online social networks has repeatedly been target of research.

However,

- Acknowledgment: nature of user connections may vary across online social networks.
But: Majority of research focuses on **Facebook**.
- Comparison of a **small set of countries** only.
- Work that compares a large set of countries
 - focuses on **structure of the social graph** or
 - discusses connections on the **level of the individual** for a small set of users.

“USER CONNECTION PATTERNS” IN OUR RESEARCH

- Bidirectional user-to-user connections (“friendships”) → symmetric social graph
- Information on the user’s country c
- Calculate connections for pairs of countries:
For each country c ,
the share of user connections
maintained with other users in c
is compared to the share maintained
with users from other countries
(for each of the other countries).

THE SPECIFIC RESEARCH QUESTIONS

RQ 1 What user connection patterns exist across countries?

RQ 1a Which are the countries whose users have mainly **within-country user connections**?
Which are the ones that show **transnational connection behavior**?

RQ 1b What are the most important **“attractor” countries**?
(i.e., countries whose users are substantially more often the target of a friendship connection than other countries)

RQ 1c Is country attractiveness correlated with **cultural aspects**?

RQ 2

Are connection patterns (within-country vs. transnational) **comparable between different online social networks**?

AN ANALYSIS OF CROSS-COUNTRY USER CONNECTIONS OF THREE DIFFERENT ONLINE SOCIAL NETWORKS



an online social network for **music** enthusiasts



an online social network for **photography**



a **general-purpose** online social network

	OSN	No. users	No. connections
our retrieved datasets for the analysis	Last.fm	55,191	1,087,662
	500px	109,904	3,308,081
	Facebook	106,249	166,129

APPROACH TO ANSWER RQ1A

- For each country c , the share of user connections maintained with other users in c is compared to the share maintained with users from other countries:

For each pair of countries, c_1 and c_2 , we compute the share of users in c_1 that are connected to users in c_2 .

- This yields a (per-row) normalized country connection matrix.
- We consider the top 20 countries in terms of total number of users.



	AU	BR	BY	CA	CZ	DE	ES	FI	FR	IT	JP	MX	NL	NO	PL	RU	SE	UA	UK	US
AU	44.92%	2.66%	0.35%	2.28%	0.32%	2.60%	0.72%	0.86%	0.89%	0.90%	0.69%	0.80%	1.24%	0.66%	1.75%	2.90%	1.01%	0.71%	7.01%	16.47%
BR	0.37%	76.04%	0.20%	0.59%	0.21%	1.53%	0.57%	0.53%	0.48%	0.80%	0.41%	0.81%	0.47%	0.20%	1.73%	1.78%	0.41%	0.49%	2.00%	4.08%
CA	0.55%	2.18%	50.99%	0.59%	0.49%	2.38%	0.52%	0.57%	0.64%	0.73%	0.40%	0.44%	0.52%	0.21%	2.62%	17.12%	0.40%	4.85%	2.14%	3.71%
BY	2.08%	3.85%	0.34%	29.01%	0.36%	3.47%	0.93%	0.88%	1.40%	1.11%	0.94%	0.99%	1.28%	0.55%	2.02%	3.58%	1.14%	1.01%	6.71%	26.46%
CZ	0.44%	2.10%	0.44%	0.55%	64.21%	2.36%	0.45%	0.66%	0.71%	0.93%	0.36%	0.48%	0.67%	0.31%	2.65%	3.48%	0.45%	1.17%	2.85%	3.84%
DE	0.68%	2.86%	0.40%	0.99%	0.44%	56.79%	0.98%	1.12%	1.08%	1.23%	0.59%	0.70%	1.28%	0.51%	2.51%	3.74%	0.94%	1.05%	3.82%	6.89%
ES	0.60%	3.38%	0.28%	0.85%	0.27%	3.12%	54.45%	0.88%	1.07%	1.74%	0.67%	2.05%	1.06%	0.33%	2.22%	2.71%	0.70%	0.63%	4.29%	6.25%
FI	0.57%	2.55%	0.25%	0.64%	0.32%	2.88%	0.71%	65.27%	0.65%	0.90%	0.77%	0.56%	0.83%	0.38%	2.14%	3.16%	1.14%	0.80%	3.00%	4.92%
FR	0.96%	3.72%	0.45%	1.66%	0.56%	4.50%	1.40%	1.05%	38.60%	1.79%	1.28%	1.10%	1.32%	0.54%	3.44%	5.75%	1.12%	1.40%	5.52%	9.12%
IT	0.62%	3.90%	0.32%	0.83%	0.46%	3.21%	1.43%	0.92%	1.13%	54.96%	0.69%	0.81%	1.11%	0.46%	2.62%	3.44%	0.77%	0.88%	4.44%	6.41%
JP	0.91%	3.88%	0.34%	1.35%	0.34%	2.96%	1.06%	1.51%	1.55%	1.32%	47.12%	1.05%	1.14%	0.66%	2.93%	3.98%	0.88%	1.13%	4.14%	9.08%
MX	0.81%	5.91%	0.29%	1.11%	0.35%	2.74%	2.53%	0.85%	1.04%	1.20%	0.81%	46.68%	0.82%	0.30%	2.57%	3.11%	0.68%	0.69%	3.09%	8.82%
NL	0.88%	2.38%	0.24%	0.99%	0.34%	3.48%	0.91%	0.88%	0.87%	1.15%	0.61%	0.57%	57.20%	0.61%	2.60%	2.60%	0.89%	0.69%	4.53%	7.26%
NO	1.08%	2.29%	0.22%	0.98%	0.36%	3.15%	0.65%	0.92%	0.81%	1.10%	0.82%	0.48%	1.39%	55.68%	2.77%	2.81%	2.06%	0.86%	4.76%	7.56%
PL	0.27%	1.94%	0.26%	0.35%	0.30%	1.51%	0.42%	0.50%	0.50%	0.60%	0.35%	0.39%	0.58%	0.27%	76.87%	1.98%	0.35%	0.70%	2.37%	2.62%
RU	0.51%	2.23%	1.93%	0.69%	0.44%	2.51%	0.57%	0.83%	0.93%	0.88%	0.53%	0.53%	0.64%	0.30%	2.21%	62.80%	0.50%	4.84%	2.67%	4.88%
SE	1.00%	2.92%	0.26%	1.23%	0.32%	3.57%	0.83%	1.69%	1.02%	1.11%	0.66%	0.65%	1.23%	1.25%	2.21%	2.79%	53.96%	0.76%	4.56%	8.25%
UA	0.49%	2.44%	2.17%	0.77%	0.59%	2.81%	0.53%	0.83%	0.90%	0.90%	0.60%	0.47%	0.67%	0.37%	3.12%	19.22%	0.53%	46.09%	2.61%	4.81%
UK	1.59%	3.24%	0.31%	1.66%	0.47%	3.32%	1.17%	1.02%	1.15%	1.47%	0.72%	0.68%	1.44%	0.66%	3.42%	3.44%	1.05%	0.85%	47.52%	13.37%
US	1.76%	3.11%	0.25%	3.09%	0.30%	2.82%	0.81%	0.79%	0.90%	1.00%	0.74%	0.92%	1.09%	0.50%	1.78%	2.97%	0.89%	0.74%	6.29%	59.77%

APPROACH TO ANSWER RQ1B

We define
an **attractor measure** for a country c
that models the (relative) amount of users from
countries other than c that are attracted to
establish connections with users in c .

Median of all shares of user connections from
other countries maintained with users in c .

APPROACH TO ANSWER RQ1C (PART 1/2)

Concerning the role of culture for a country's attractiveness, we compute **Spearman's rank order correlations** between each country's attractor value and each of the corresponding cultural dimensions by Hofstede.

APPROACH TO ANSWER RQ1C (PART 1/2)

HOFSTEDE'S CULTURAL DIMENSIONS, EXPLAINING THE DIFFERENCES IN BELIEFS AND BEHAVIOUR ACROSS NATIONAL CULTURES

Individualism vs. Collectivism

whether people have a preference for being left alone to look after themselves or want to remain in a closely knitted network

Power Distance

extent to which members who are less powerful in a society accept and also expect that the distribution of power takes place unequally

Uncertainty Avoidance

describes the extent to which people in society are not at ease with ambiguity and uncertainty

Masculinity vs. Femininity

masculinity: a society's preference for heroism, achievement and material reward for attaining success; femininity: preference for modesty, cooperation and caring for the weak

Long-Term vs. Short-Term Orientation

inclination of a society toward searching for virtue; short-term orientation pertains to those societies that are strongly inclined toward the establishment of the absolute truth

Indulgence vs. Restraint

the degree to which societies can exercise control over their impulses and desires

Hofstede, G., Culture's Values, Behaviors, Institutions, and Organizations across Nations, Sage, Thousand Oaks, 2001.

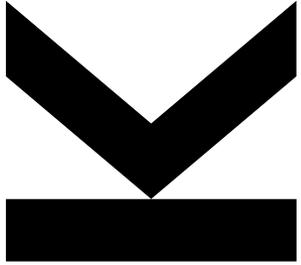
Hofstede, G., G.J. Hofstede, and M. Minkov, Cultures and Organizations: Software of the Mind, McGraw-Hill, New York, NY, 2010.

APPROACH TO ANSWER RQ2

Comparing the three online social networks, we compute **Pearson's correlation coefficients** between each country's normalized country connection for each combination of the three online social networks.

Country	LFM-FB	LFM-500px	FB-500px
AU	-0.237	0.701	0.013
BR	0.996	0.654	0.642
BY	0.843		
CA	0.262	0.934	0.220
CZ	0.997		
DE	0.905	0.879	0.814
ES	-0.105	0.605	-0.156
FI	0.975		
FR	0.728	0.866	0.581
IT	0.992	0.747	0.679
JP	0.424	0.795	0.800
MX	0.992		
NL	0.925	0.659	0.578
NO	0.592	0.719	0.670
PL	0.771	0.439	0.569
RU	-0.065	0.888	-0.074
SE	0.885	0.489	0.429
UA	0.337	0.662	0.380
UK	0.848	0.754	0.718
US	0.915	0.962	0.897
Mean	0.649	0.734	0.485

RESULTS



THE THREE ONLINE SOCIAL NETWORKS IN CONTEXT

The country pairs with the strongest user connections on **Last.fm** and **500px** typically

- share the **same language** (e.g., Australia–United States, Canada–United States, United Kingdom–United States) or
- have a **shared second official language** in their countries (e.g., Belarus–Russia, Ukraine–Russia).

On **Facebook**, in contrast, the strongest user connections are typically

cross-language
(e.g., Canada–The Netherlands, Japan–United States, Spain–United Kingdom, Ukraine–France).

Differences between the strongest and weakest within-country numbers are far less pronounced in **500px** compared to **Last.fm**; and far less pronounced compared to **Facebook**.

RQ1A: WHICH ARE THE COUNTRIES WHOSE USERS HAVE MAINLY WITHIN-COUNTRY USER CONNECTIONS (I.E., CONNECT WITH USERS WITHIN THEIR OWN COUNTRY)? WHICH ARE THE ONES THAT SHOW TRANSNATIONAL CONNECTION BEHAVIOR?

The connection patterns vary across online social networks to a high degree.

e.g., Brazil:

- **Last.fm**: large share of within-country connections
- **Facebook**: even more so
- **500px**: rather low in terms of within-country user connections

e.g., Russia:

- high values on the topic-specific OSN **Last.fm** and **500px**
- **Facebook**: the country with the lowest within-country user connection share

RQ1B: WHAT ARE THE MOST IMPORTANT “ATTRACTOR” COUNTRIES? (I.E., COUNTRIES WHOSE USERS ARE SUBSTANTIALLY MORE OFTEN THE TARGET OF A FRIENDSHIP CONNECTION THAN OTHER COUNTRIES)

- In all online social networks: United States → strongest attractor country (Last.fm 7.07%; 500px 13.44%; Facebook 7.45%)
- On Last.fm and Facebook, the measure ranges at about the same level; the distances to the respective next highest value are different, though.
- **Last.fm**: 2nd-highest attractor value United Kingdom (4.22%).
- **Facebook**: distance to 2nd-highest attractor is larger (Germany 3.09%).
- **500px**: United States’ attractor value much higher (13.44%), followed by Germany (7.48%) and Russia (7.24%).

	AU	BR	BY	CA	CZ	DE	ES	FI	FR	IT	JP	MX	NL	NO	PL	RU	SE	UA	UK	US
last.fm	0.75%	2.89%	0.32%	0.99%	0.35%	2.92%	0.82%	0.88%	0.92%	1.10%	0.68%	0.69%	1.10%	0.48%	2.58%	3.30%	0.88%	0.85%	4.22%	7.07%
500px	2.59%	1.38%		4.22%		7.48%	2.30%		4.57%	4.28%	2.02%		2.09%	1.27%	1.90%	7.24%	1.24%	2.15%	4.67%	13.44%
facebook	0.46%	0.37%	0.19%	0.39%	0.07%	3.09%	0.26%	0.61%	2.64%	1.46%	0.53%	0.28%	0.73%	0.95%	2.18%	0.00%	0.00%	1.20%	1.83%	7.45%

RQ1C: IS COUNTRY ATTRACTIVENESS CORRELATED WITH CULTURAL ASPECTS?

Weak to moderate correlations between attractor measures and cultural variables **individualism** and **masculinity** (in particular for Facebook and 500px).

Users seem to be particularly attracted by countries that score high in Hofstede's cultural dimension **individualism**.

- **Facebook**: correlation is moderate ($\rho = 0.497$)
- **Last.fm**: correlation is weak to medium ($\rho = 0.301$)
- **500px**: correlation is weak to medium ($\rho = 0.341$)

Positive correlations for the dimension **masculinity**.

- **Facebook**: correlation is medium ($\rho = 0.375$)
- **Last.fm**: correlation is very weak ($\rho = 0.114$)
- **500px**: correlation is medium ($\rho = 0.409$)

RQ2: ARE CONNECTION PATTERNS (I.E., WITHIN-COUNTRY VS. TRANSNATIONAL) COMPARABLE BETWEEN DIFFERENT ONLINE SOCIAL NETWORKS?

Connection patterns vary across the analyzed online social networks

Connection patterns on Last.fm and 500px are in line with each other

Differences to Facebook

We can't draw strong conclusions whether there are analogies in connection patterns between specialized OSN (Last.fm and 500px) vs. general-purpose online social network (Facebook).

DIFFERENCES BETWEEN THE THREE ONLINE SOCIAL NETWORKS

The average within-country connection share highly differs

- Last.fm (54.45%)
- Facebook (39.79%)
- 500px (15.38%)

Hence, music enthusiasts more likely to stay among their peers in the same country than photographers.

Potential explanation

- Music preferences are influenced by cultural background and market structures → people with similar interests are likely from the same country.
- The community of photographers may interact based on photo scenes or photography techniques → aspects that are not country-specific.

PRACTICAL IMPLICATIONS FOR PERSONALIZED SYSTEMS

Alleviate the new-user cold start problem in recommender systems:

Trigger initial recommendations based on the typical connection patterns of users in the target user's country

- Collaborative filtering techniques could be extended by a social tie strength filtering component.
- Users with similar cross-country connection patterns could be clustered and served by a collaborative filtering engine specifically trained on the cluster of the target user.

People recommender systems:

Within/Cross-country connections based on interest/need

- Target users' needs to stay with others in the same country or to establish connections outside of their own country (e.g., plans to go abroad for a year), recommenders could adjust the distribution of recommended people inside and outside of his or her country accordingly.

ANSWER TO THE MAIN RESEARCH QUESTION

The analyzed online social networks are far from representing a “global village”.

CONTRIBUTIONS

Contribution to research area of social network analysis

Answering the general question whether the global village has become a reality in online social networks

Better understand user connection patterns in online social networks

Practical implications for personalized systems and recommender systems

Advancements in user modeling

Alleviate the new-user cold start problem in recommender systems

Trigger initial recommendations based on the typical connection patterns of users in the target user's country

A CROSS-COUNTRY INVESTIGATION OF USER CONNECTION PATTERNS IN ONLINE SOCIAL NETWORKS



Christine Bauer & Markus Schedl
Johannes Kepler University Linz, Austria
christine.bauer@jku.at | markus.schedl@jku.at
christinebauer.eu | <http://www.cp.jku.at/people/schedl/>

This research is supported
by the Austrian Science
Fund (FWF): V579.



52nd Hawaii International Conference on System Science (HICSS 2019)
11 January 2019, Grand Wailea, Maui, HI

	AU	BR	BY	CA	CZ	DE	ES	FI	FR	IT	JP	MX	NL	NO	PL	RU	SE	UA	UK	US
AU	44.92%	2.66%	0.35%	2.28%	0.32%	2.60%	0.72%	0.86%	0.89%	0.90%	0.69%	0.80%	1.24%	0.66%	1.75%	2.90%	1.01%	0.71%	7.01%	16.47%
BR	0.37%	76.04%	0.20%	0.59%	0.21%	1.53%	0.57%	0.53%	0.48%	0.80%	0.41%	0.81%	0.47%	0.20%	1.73%	1.78%	0.41%	0.49%	2.00%	4.08%
BY	0.55%	2.18%	50.99%	0.59%	0.49%	2.38%	0.52%	0.57%	0.64%	0.73%	0.40%	0.44%	0.52%	0.21%	2.62%	17.12%	0.40%	4.85%	2.14%	3.71%
CA	2.08%	3.85%	0.34%	29.01%	0.36%	3.47%	0.93%	0.88%	1.40%	1.11%	0.94%	0.99%	1.28%	0.55%	2.02%	3.58%	1.14%	1.01%	6.71%	26.46%
CZ	0.44%	2.10%	0.44%	0.55%	64.21%	2.36%	0.45%	0.66%	0.71%	0.93%	0.36%	0.48%	0.67%	0.31%	2.65%	3.48%	0.45%	1.17%	2.85%	3.84%
DE	0.68%	2.86%	0.40%	0.99%	0.44%	56.79%	0.98%	1.12%	1.08%	1.23%	0.59%	0.70%	1.28%	0.51%	2.51%	3.74%	0.94%	1.05%	3.82%	6.89%
ES	0.60%	3.38%	0.28%	0.85%	0.27%	3.12%	54.45%	0.88%	1.07%	1.74%	0.67%	2.05%	1.06%	0.33%	2.22%	2.71%	0.70%	0.63%	4.29%	6.25%
FI	0.57%	2.55%	0.25%	0.64%	0.32%	2.88%	0.71%	65.27%	0.65%	0.90%	0.77%	0.56%	0.83%	0.38%	2.14%	3.16%	1.14%	0.80%	3.00%	4.92%
FR	0.96%	3.72%	0.45%	1.66%	0.56%	4.50%	1.40%	1.05%	38.60%	1.79%	1.28%	1.10%	1.32%	0.54%	3.44%	5.75%	1.12%	1.40%	5.52%	9.12%
IT	0.62%	3.90%	0.32%	0.83%	0.46%	3.21%	1.43%	0.92%	1.13%	54.96%	0.69%	0.81%	1.11%	0.46%	2.62%	3.44%	0.77%	0.88%	4.44%	6.41%
JP	0.91%	3.88%	0.34%	1.35%	0.34%	2.96%	1.06%	1.51%	1.55%	1.32%	47.12%	1.05%	1.14%	0.66%	2.93%	3.98%	0.88%	1.13%	4.14%	9.08%
MX	0.81%	5.91%	0.29%	1.11%	0.35%	2.74%	2.53%	0.85%	1.04%	1.20%	0.81%	46.68%	0.82%	0.30%	2.57%	3.11%	0.68%	0.69%	3.09%	8.82%
NL	0.88%	2.38%	0.24%	0.99%	0.34%	3.48%	0.91%	0.88%	0.87%	1.15%	0.61%	0.57%	57.20%	0.61%	2.60%	2.60%	0.89%	0.69%	4.53%	7.26%
NO	1.08%	2.29%	0.22%	0.98%	0.36%	3.15%	0.65%	0.92%	0.81%	1.10%	0.82%	0.48%	1.39%	55.68%	2.77%	2.81%	2.06%	0.86%	4.76%	7.56%
PL	0.27%	1.94%	0.26%	0.35%	0.30%	1.51%	0.42%	0.50%	0.50%	0.60%	0.35%	0.39%	0.58%	0.27%	76.87%	1.98%	0.35%	0.70%	2.37%	2.62%
RU	0.51%	2.23%	1.93%	0.69%	0.44%	2.51%	0.57%	0.83%	0.93%	0.88%	0.53%	0.53%	0.64%	0.30%	2.21%	62.80%	0.50%	4.84%	2.67%	4.88%
SE	1.00%	2.92%	0.26%	1.23%	0.32%	3.57%	0.83%	1.69%	1.02%	1.11%	0.66%	0.65%	1.23%	1.25%	2.21%	2.79%	53.96%	0.76%	4.56%	8.25%
UA	0.49%	2.44%	2.17%	0.77%	0.59%	2.81%	0.53%	0.83%	0.90%	0.90%	0.60%	0.47%	0.67%	0.37%	3.12%	19.22%	0.53%	46.09%	2.61%	4.81%
UK	1.59%	3.24%	0.31%	1.66%	0.47%	3.32%	1.17%	1.02%	1.15%	1.47%	0.72%	0.68%	1.44%	0.66%	3.42%	3.44%	1.05%	0.85%	47.52%	13.37%
US	1.76%	3.11%	0.25%	3.09%	0.30%	2.82%	0.81%	0.79%	0.90%	1.00%	0.74%	0.92%	1.09%	0.50%	1.78%	2.97%	0.89%	0.74%	6.29%	59.77%
Attractor	0.75%	2.89%	0.32%	0.99%	0.35%	2.92%	0.82%	0.88%	0.92%	1.10%	0.68%	0.69%	1.10%	0.48%	2.58%	3.30%	0.88%	0.85%	4.22%	7.07%

500PX

500PX

	AU	BR	CA	DE	ES	FR	IT	JP	NL	NO	PL	RU	SE	UA	UK	US
AU	11.69%	1.39%	4.48%	7.15%	2.22%	4.33%	4.38%	2.43%	2.07%	1.29%	1.82%	6.01%	1.23%	1.97%	4.88%	16.60%
BR	2.39%	14.74%	4.24%	6.98%	2.50%	4.24%	3.99%	1.80%	1.85%	1.06%	1.73%	8.75%	1.20%	2.70%	4.25%	14.05%
CA	2.72%	1.35%	15.25%	7.01%	2.18%	4.62%	3.76%	1.97%	1.99%	1.19%	1.76%	7.18%	1.18%	2.12%	4.87%	18.25%
DE	2.34%	1.24%	4.08%	21.60%	2.25%	4.80%	4.28%	1.90%	2.20%	1.24%	1.87%	7.55%	1.25%	2.24%	4.41%	13.05%
ES	2.62%	1.55%	4.14%	6.94%	11.47%	4.67%	4.28%	2.20%	2.22%	1.38%	1.99%	7.51%	1.43%	2.46%	4.68%	12.77%
FR	2.44%	1.31%	4.22%	8.01%	2.47%	17.60%	4.64%	2.09%	2.08%	1.22%	1.91%	7.48%	1.24%	2.16%	4.48%	12.25%
IT	2.62%	1.51%	4.06%	7.88%	2.59%	5.03%	15.24%	2.24%	2.19%	1.39%	1.93%	6.31%	1.31%	2.10%	4.65%	12.81%
JP	2.71%	1.57%	4.23%	6.84%	2.17%	4.49%	4.56%	15.70%	2.12%	1.37%	1.65%	5.05%	1.23%	1.71%	4.38%	13.50%
NL	2.36%	1.41%	4.09%	9.01%	2.28%	4.79%	4.75%	2.11%	13.34%	1.33%	1.87%	6.42%	1.34%	2.09%	4.82%	13.39%
NO	2.71%	1.06%	4.31%	7.38%	2.13%	4.47%	4.03%	1.67%	2.10%	15.17%	1.88%	7.30%	1.81%	2.11%	4.68%	14.18%
PL	2.22%	1.17%	3.87%	8.74%	2.29%	4.83%	3.88%	1.64%	2.06%	1.22%	10.91%	11.97%	1.26%	3.86%	4.41%	12.40%
RU	2.22%	1.62%	3.50%	7.02%	2.36%	4.09%	4.07%	1.93%	2.01%	1.15%	1.99%	21.25%	1.20%	4.48%	4.21%	11.71%
SE	2.56%	1.32%	4.26%	7.78%	2.48%	4.54%	4.46%	2.07%	2.42%	1.78%	2.12%	7.15%	9.67%	2.27%	5.53%	14.44%
UA	2.19%	1.29%	3.65%	7.60%	2.32%	4.05%	3.86%	1.74%	1.87%	1.18%	2.31%	16.41%	1.20%	11.13%	3.93%	11.38%
UK	2.84%	1.38%	4.40%	7.59%	2.45%	4.60%	4.58%	2.06%	2.32%	1.29%	1.94%	6.48%	1.32%	2.02%	14.46%	15.59%
US	2.82%	1.46%	5.17%	7.22%	2.22%	4.19%	4.05%	1.98%	2.04%	1.23%	1.75%	7.03%	1.21%	2.13%	4.92%	26.89%
Attractor	2.59%	1.38%	4.22%	7.48%	2.30%	4.57%	4.28%	2.02%	2.09%	1.27%	1.90%	7.24%	1.24%	2.15%	4.67%	13.44%

FACEBOOK



	AU	BR	BY	CA	CZ	DE	ES	FI	FR	IT	JP	MX	NL	NO	PL	RU	SE	UA	UK	US
AU	0.00%	0.00%	4.26%	10.64%	8.51%	4.26%	0.00%	8.51%	4.26%	4.26%	4.26%	0.00%	8.51%	4.26%	6.38%	21.28%	4.26%	2.13%	0.00%	4.26%
BR	0.00%	85.12%	0.00%	0.23%	0.00%	1.35%	0.00%	0.23%	0.23%	7.67%	0.00%	0.56%	0.34%	0.23%	0.00%	0.00%	0.00%	0.56%	0.11%	3.38%
BY	0.87%	0.00%	52.17%	0.43%	0.00%	0.87%	0.43%	0.00%	0.43%	0.00%	0.00%	0.00%	0.00%	0.00%	30.00%	4.35%	0.00%	3.04%	1.74%	5.65%
CA	0.87%	0.35%	0.17%	5.57%	0.00%	0.35%	0.00%	0.17%	0.70%	0.00%	0.00%	0.17%	58.36%	0.00%	1.92%	0.00%	0.17%	0.17%	2.96%	28.05%
CZ	2.19%	0.00%	0.00%	0.00%	86.34%	1.09%	0.00%	0.55%	0.55%	0.55%	0.55%	0.00%	0.00%	1.09%	0.00%	0.00%	0.00%	0.00%	1.64%	5.46%
DE	0.34%	2.03%	0.34%	0.34%	0.34%	42.06%	1.01%	10.64%	11.99%	1.86%	0.51%	0.51%	2.53%	12.33%	1.69%	0.00%	1.18%	0.84%	2.03%	7.43%
ES	0.00%	0.00%	1.85%	0.00%	0.00%	11.11%	0.00%	1.85%	5.56%	3.70%	5.56%	0.00%	11.11%	14.81%	7.41%	0.00%	0.00%	1.85%	35.19%	0.00%
FI	0.96%	0.48%	0.00%	0.24%	0.24%	15.11%	0.24%	64.27%	1.20%	1.20%	1.44%	0.48%	0.48%	0.24%	0.00%	1.92%	0.00%	0.00%	0.96%	10.55%
FR	0.43%	0.43%	0.22%	0.86%	0.22%	15.30%	0.65%	1.08%	28.45%	0.43%	1.08%	1.08%	1.72%	3.88%	17.67%	0.43%	0.00%	15.73%	5.17%	5.17%
IT	0.27%	9.25%	0.00%	0.00%	0.14%	1.50%	0.27%	0.68%	0.27%	81.50%	0.27%	0.14%	0.41%	0.68%	0.68%	0.00%	0.00%	0.54%	0.95%	2.45%
JP	2.50%	0.00%	0.00%	0.00%	1.25%	3.75%	3.75%	7.50%	6.25%	2.50%	17.50%	3.75%	0.00%	0.00%	0.00%	1.25%	0.00%	1.25%	2.50%	46.25%
MX	0.00%	0.98%	0.00%	0.20%	0.00%	0.59%	0.00%	0.39%	0.98%	0.20%	0.59%	81.14%	0.00%	0.00%	0.39%	0.00%	0.00%	0.39%	0.20%	13.95%
NL	0.30%	0.22%	0.00%	25.06%	0.00%	1.12%	0.45%	0.15%	0.60%	0.22%	0.00%	0.00%	65.30%	0.37%	0.15%	0.00%	0.00%	0.15%	1.72%	4.19%
NO	0.96%	0.96%	0.00%	0.00%	0.96%	34.93%	3.83%	0.48%	8.61%	2.39%	0.00%	0.00%	2.39%	27.27%	1.91%	0.00%	0.48%	0.96%	1.91%	11.96%
PL	0.69%	0.00%	15.94%	2.54%	0.00%	2.31%	0.92%	0.00%	18.94%	1.15%	0.00%	0.46%	0.46%	0.92%	32.33%	4.62%	1.15%	1.15%	6.70%	9.70%
RU	14.93%	0.00%	14.93%	0.00%	0.00%	0.00%	0.00%	11.94%	2.99%	0.00%	1.49%	0.00%	0.00%	0.00%	29.85%	1.49%	0.00%	14.93%	0.00%	7.46%
SE	5.56%	0.00%	0.00%	2.78%	0.00%	19.44%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.78%	13.89%	0.00%	44.44%	5.56%	0.00%	5.56%
UA	0.49%	2.44%	3.41%	0.49%	0.00%	2.44%	0.49%	0.00%	35.61%	1.95%	0.49%	0.98%	0.98%	0.98%	2.44%	4.88%	0.98%	17.56%	2.44%	20.98%
UK	0.00%	0.38%	1.53%	6.51%	1.15%	4.60%	7.28%	1.53%	9.20%	2.68%	0.77%	0.38%	8.81%	1.53%	11.11%	0.00%	0.00%	1.92%	26.82%	13.79%
US	0.19%	2.88%	1.25%	15.44%	0.96%	4.22%	0.00%	4.22%	2.30%	1.73%	3.55%	6.81%	5.37%	2.40%	4.03%	0.48%	0.19%	4.12%	3.45%	36.43%
Attractor	0.46%	0.37%	0.19%	0.39%	0.07%	3.09%	0.26%	0.61%	2.64%	1.46%	0.53%	0.28%	0.73%	0.95%	2.18%	0.00%	0.00%	1.20%	1.83%	7.45%

PEARSON'S CORRELATION COEFFICIENTS BETWEEN LAST.FM (LFM) AND FACEBOOK (FB), LAST.FM (LFM) AND 500PX, AND 500PX AND FACEBOOK (FB) CONNECTIONS PER COUNTRY

Country	LFM-FB	LFM-500px	FB-500px
AU	-0.237	0.701	0.013
BR	0.996	0.654	0.642
BY	0.843		
CA	0.262	0.934	0.220
CZ	0.997		
DE	0.905	0.879	0.814
ES	-0.105	0.605	-0.156
FI	0.975		
FR	0.728	0.866	0.581
IT	0.992	0.747	0.679
JP	0.424	0.795	0.800
MX	0.992		
NL	0.925	0.659	0.578
NO	0.592	0.719	0.670
PL	0.771	0.439	0.569
RU	-0.065	0.888	-0.074
SE	0.885	0.489	0.429
UA	0.337	0.662	0.380
UK	0.848	0.754	0.718
US	0.915	0.962	0.897
Mean	0.649	0.734	0.485

- The inclination to connect to users in the same country differs strongly between platforms.
 - The average within-country connection share highly differs between OSN: Last.fm (54.45%), Facebook (39.79%), and 500px (15.38%).
 - Thus: The community of music enthusiasts is much more likely to stay among their peers in the same country than the community of photographers.
 - Potential explanation:
 - Music preferences are influenced by cultural background and market structures → people with similar interests are likely from the same country.
 - The community of photographers may interact based on photo scenes or photography techniques → aspects that are not country-specific.

CHARACTERISTICS OF THE THREE ONLINE SOCIAL NETWORKS

■ Facebook

Large discrepancy between countries with strong within-country connections ($> 50\%$) and countries with rather weak ($< 30\%$) within-country connections.

■ Last.fm

Most countries have a strong within-country connections that are multiple times higher than the rather weak cross-country connections.

■ 500px

The cross-country user connections are generally stronger than on the other two platforms, while the within-country user connections are rather weak.