

Data and Society

Data and Dating – Lecture 21

4/19/20

Today's Class

- Lecture / Discussion
- Student Presentation

Reading for April 22

“EU plan for risk-based AI rules to set fines as high as 4% of global turnover, per leaked draft”, TechCrunch

<https://techcrunch.com/2021/04/14/eu-plan-for-risk-based-ai-rules-to-set-fines-as-high-as-4-of-global-turnover-per-leaked-draft/>

EU plan for risk-based AI rules to set fines as high as 4% of global turnover, per leaked draft

Natasha Lomas @riptari / 9:19 AM EDT • April 14, 2021 [Comment](#)

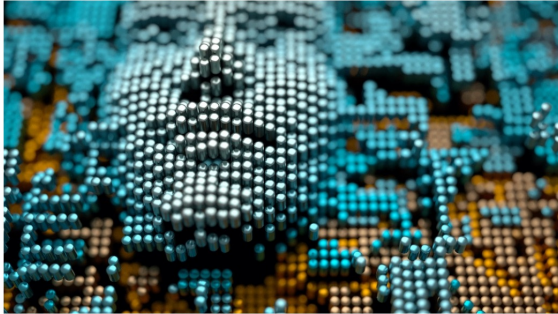


Image Credits: piranka / Getty Images

European Union lawmakers who are drawing up rules for applying artificial intelligence are considering fines of up to 4% of global annual turnover (or €20M, if greater) for a set of prohibited use-cases, according to a [leaked draft](#) of the AI regulation — reported earlier by [Politico](#) — that’s expected to be officially unveiled next week.

The plan to regulate AI has been on the cards for a while. [Back in](#)

Date	Topic	Speaker	Date	Topic	Speaker
1-25	Introduction	Fran	1-28	The Data-driven World	Fran
2-1	Data and COVID-19	Fran	2-4	Data and Privacy -- Intro	Fran
2-8	Data and Privacy – Differential Privacy	Fran	2-11	Data and Privacy – Anonymity / Briefing Instructions	Fran
2-15	NO CLASS / PRESIDENT’S DAY		2-18	NO CLASS	
2-22	Legal Protections	Ben Wizner	2-25	Data and Discrimination 1	Fran
3-1	Data and Discrimination 2	Fran	3-4	Data and Elections 1	Fran
3-8	Data and Elections 2	Fran	3-11	NO CLASS / WRITING DAY	
3-15	Data and Astronomy (Op-Ed due)	Alyssa Goodman	3-18	Data Science	Fran
3-22	Digital Humanities	Brett Bobley	3-25	Data Stewardship and Preservation	Fran
3-29	Data and the IoT	Fran	4-1	Data and Smart Farms	Rich Wolski
4-5	Data and Self-Driving Cars	Fran	4-8	Data and Ethics	Fran
4-12	NO CLASS – WELLNESS DAY	Fran	4-15	Cybersecurity	Bruce Schneier
4-19	Data and Dating	Fran	4-22	Digital Rights in the EU and China	Fran
4-26	Tech in the News	Fran	4-29	NO CLASS	Fran
5-3	Wrap-up / Discussion				

Lecture – Data and Dating

- Who's dating
- Matching Algorithms
- The Business of on-line dating
- TED talk – a data scientist dates on-line

Data and Dating

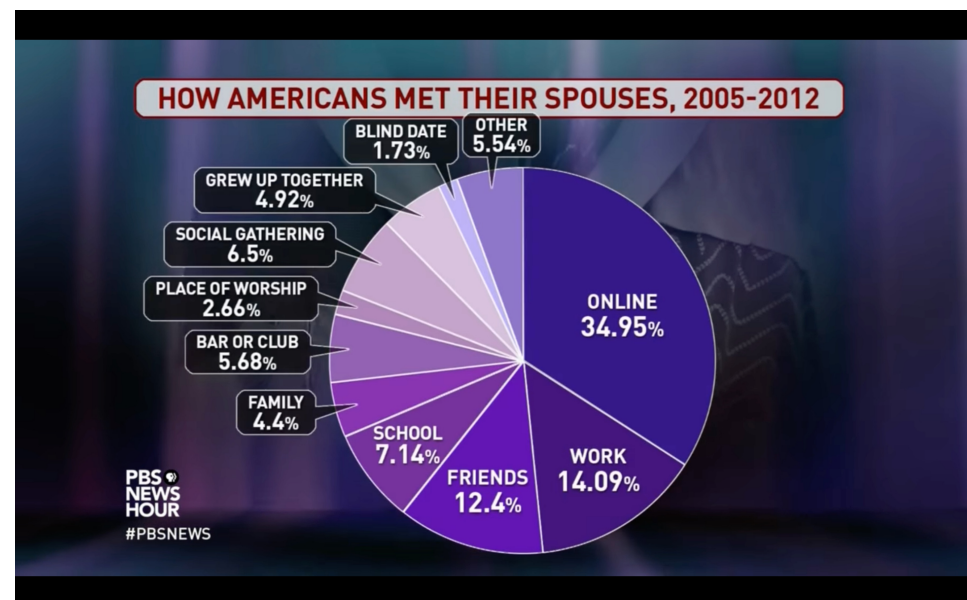
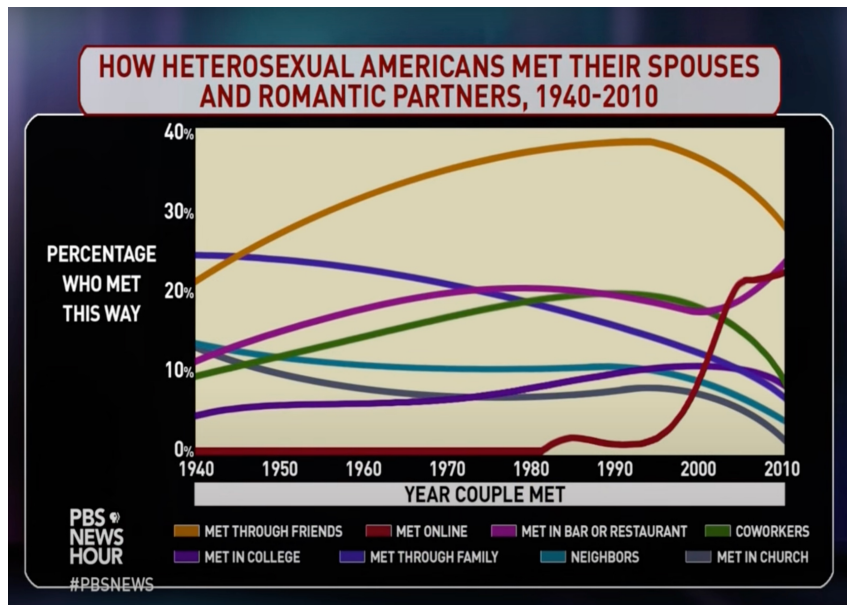
- Paths to relationships
 - Personal contacts in “real world” settings
 - Family arrangement
 - Matchmakers
 - Personal ads
 - On-line sites and apps
- Online dating vs. conventional ways of meeting
 - **Access** – exposure to large pool of romantic partners
 - **Communication** – opportunity to utilize computer-mediated communication before meeting
 - **Matching** – use of an algorithm to select potential partners



From <https://visual.ly/community/infograph/ic/love-and-sex/online-dating-ecosystem>

How Americans met their spouses

(Modern Love, Ansari and Klineberg)



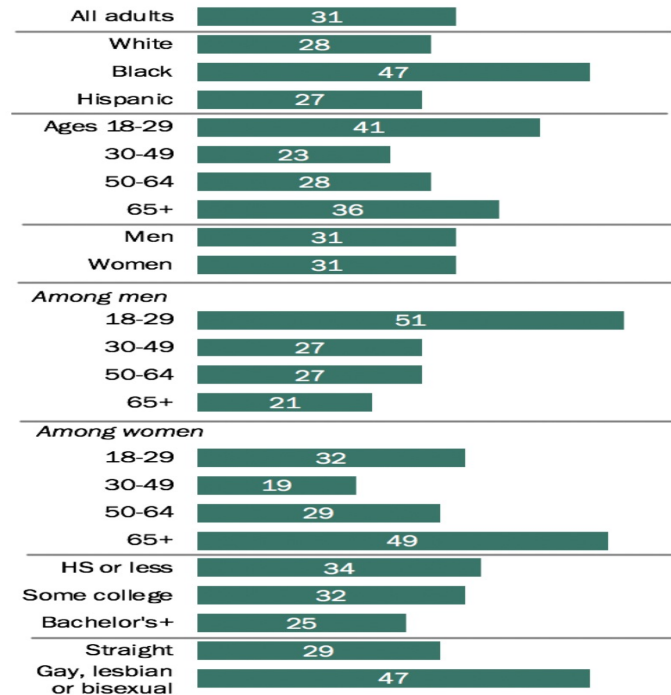
“companionate marriage” → looking for a soul mate

Who is single

Share of U.S. adults who are single varies by demographic groups

Share of U.S. adults who are single varies by demographic groups

% of adults in each group who are single

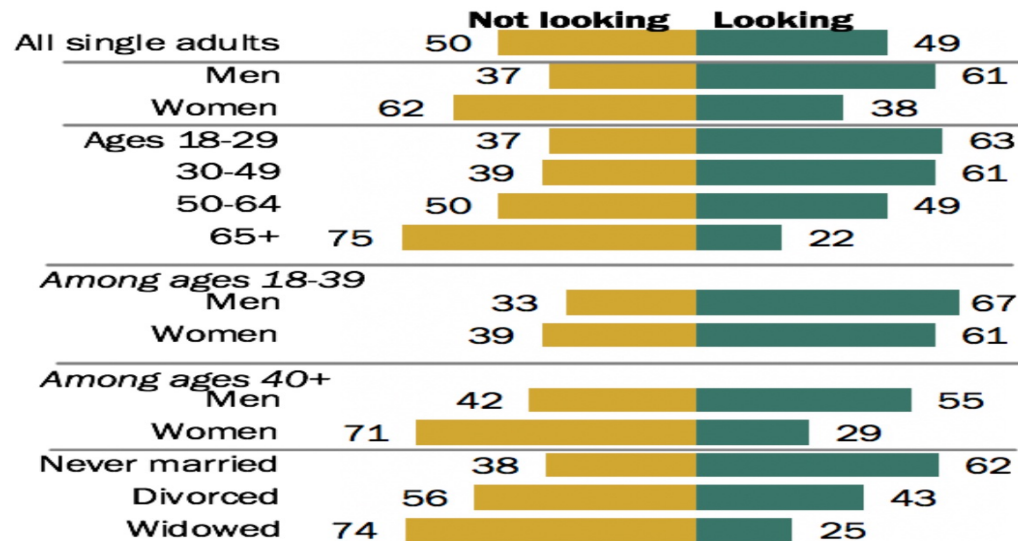


Note: "Single" adults are those who are not married, living with a partner or in a committed romantic relationship. White and Black adults include those who report being only one race and are not Hispanic. Hispanics are of any race. "Some college" includes those with some college, diploma, and those who attended college but did not graduate.

Who is looking

Most older single women are not looking to date

% of single adults in each group saying they are _____ for a committed relationship and/or casual dates



Note: "Single adults" are those who are not married, living with a partner or in a committed romantic relationship. "Divorced" does not include respondents who are separated. Share of respondents who didn't offer an answer not shown.

Source: Survey of U.S. adults conducted Oct. 16-28, 2019.

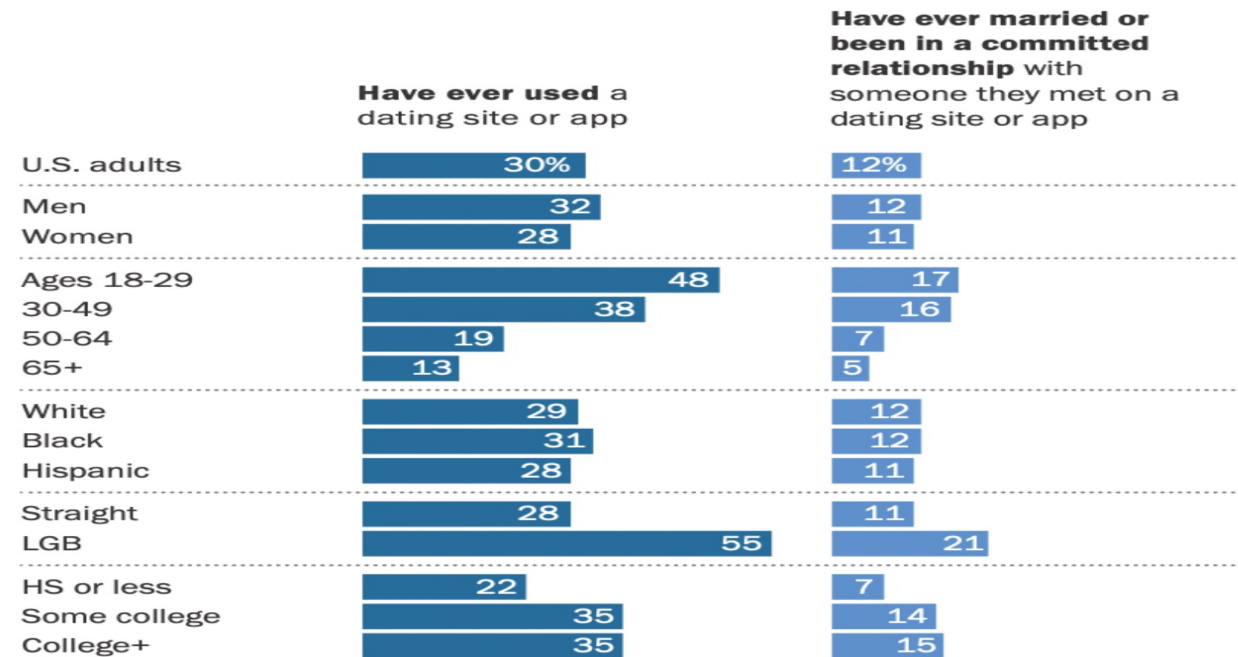
"Nearly Half of U.S. Adults Say Dating Has Gotten Harder for Most People in the Last 10 Years"

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Who is meeting people on-line / demographics

As of 2019, younger Americans and those who are lesbian, gay or bisexual were more likely to date or to find a partner through online platforms

% saying they ...



Note: White and Black adults include those who report being only one race and are not Hispanic. Hispanics are of any race. LGB indicates those who identify as lesbian, gay or bisexual.

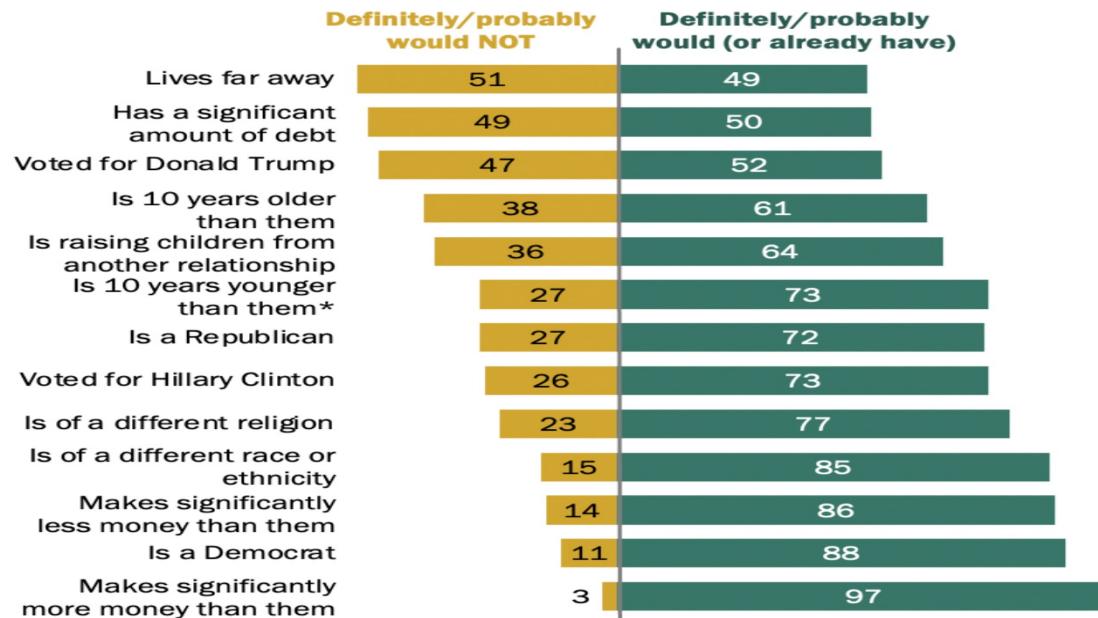
Source: Survey of U.S. adults conducted Oct. 16-28, 2019.
 "The Virtues and Downsides of Online Dating"

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On-line dating preferences

Long distances, debt and voting for Donald Trump topped list of relationship deal-breakers in 2019

% saying they would/would not ever consider being in a committed relationship with someone who _____, among single adults who are looking for a relationship

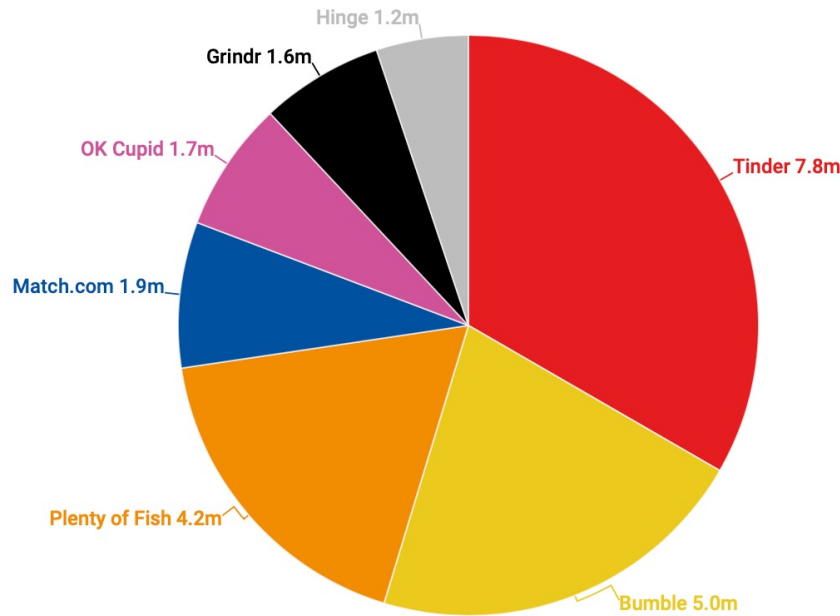


*Shares for "10 years younger than them" are based only on respondents 28 and older.
 Note: "Single adults who are looking for a relationship" are those who are not married, living with a partner or in a committed romantic relationship and have indicated that right now they are looking for: a committed romantic relationship only, or either a committed romantic relationship or casual dates. Share of respondents who didn't offer an answer not shown.
 Source: Survey of U.S. adults conducted Oct. 16-28, 2019.
 "Nearly Half of U.S. Adults Say Dating Has Gotten Harder for Most People in the Last 10 Years"

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Which apps are the most popular?

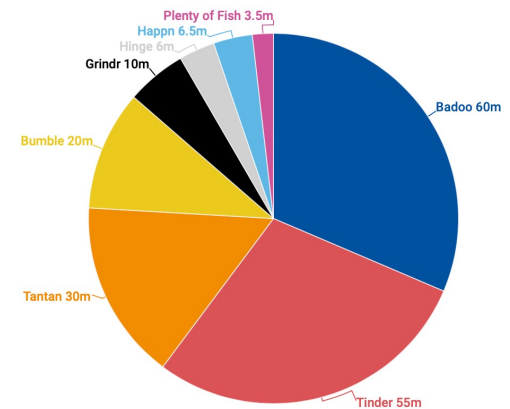
US Dating App Market Share



Share



Global Dating App Market Share



Share

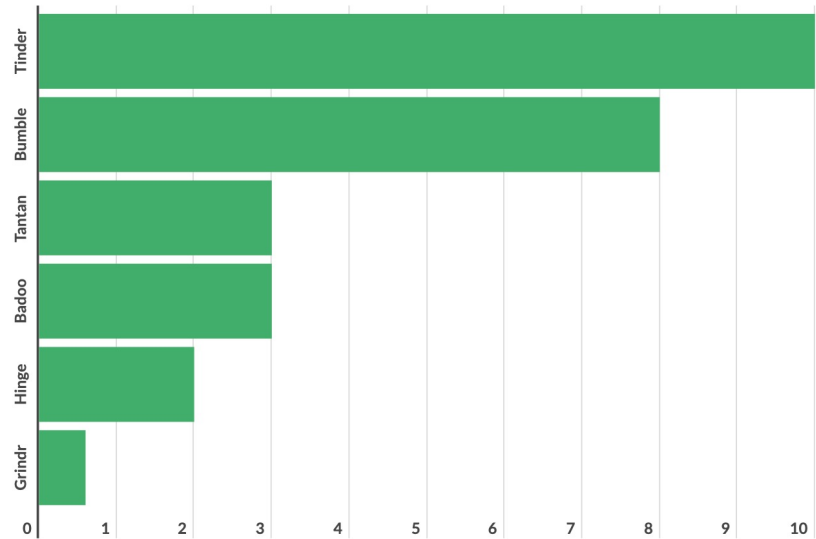


On-line Dating trends – tremendous growth

- Global on-line dating services market expected to grow from ~\$6.5B in 2019 to \$8.9B by the end of 2025
- Highest expected growth demographic: 18-24
- Highest growth demographic in 2019: 25-34
- Projections for next 5 years:
 - Female demographic projected to have highest growth
 - Europe, Middle East and Africa projected to have highest growth

On-line dating is a billion dollar business

Global Dating App Valuations



Sources: Airnow, DSR, Mixpanel

Share



App	Valuation
Tinder	\$10 billion
Bumble	\$4 billion
Tantan	\$3 billion
Badoo	\$3 billion
Hinge	\$2 billion
Grindr	\$0.6 billion

Big conglomerates dominate


- Consolidation in on-line dating companies
 - Match Group
 - Match Group (parent company of Match.com) has acquired OKCupid, PlentyOfFish, Tinder, Hinge, OurTime, BlackPeopleMeet, Match.com, etc.
 - Controlling shareholder is IAC/InterActiveCorp, it's former parent
 - Revenue: 1.7B
 - E-Harmony bought out by EU Dating/Media company

Nearly all of the big dating apps are now owned by the same company

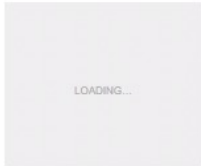
Tinder's parent company has acquired "the relationship app" Hinge.

By Kaitlyn Tiffany | @kalt_tiffany | kaitlyn.tiffany@vox.com | Feb 11, 2018, 1:10pm EST


f t SHARE




Tom Cooper/Getty Images



MOST READ



Paid Intransigent, the bizarre congressional practice that shocked Obama-Cortez, explained



An airline is suing a customer who skipped a leg of his flight to save money.

The Goods
by Vox

Match Group, which operates dating apps like Tinder and OkCupid, completed its acquisition of the 7-year-old app Hinge on Thursday, following its purchase of a majority stake in June 2018.

For years, Hinge has positioned itself as the alternative to Tinder, a way to get away from the shallowness and disappointment of flipping through trading-board profiles in an endless carousel. The self-proclaimed "relationship app," Hinge matched people based on their mutual friends, was supposedly "designed to be deleted," and boasted love as its core company value — purposely decentralizing the gamification central to swiping apps but never quite going after the advanced matchmaking algorithm promises of Match.com or OkCupid.

But in essence, all dating apps sell you the same thing, which is access to people who might

Germany's ProSieben buys U.S. online dating site eharmony

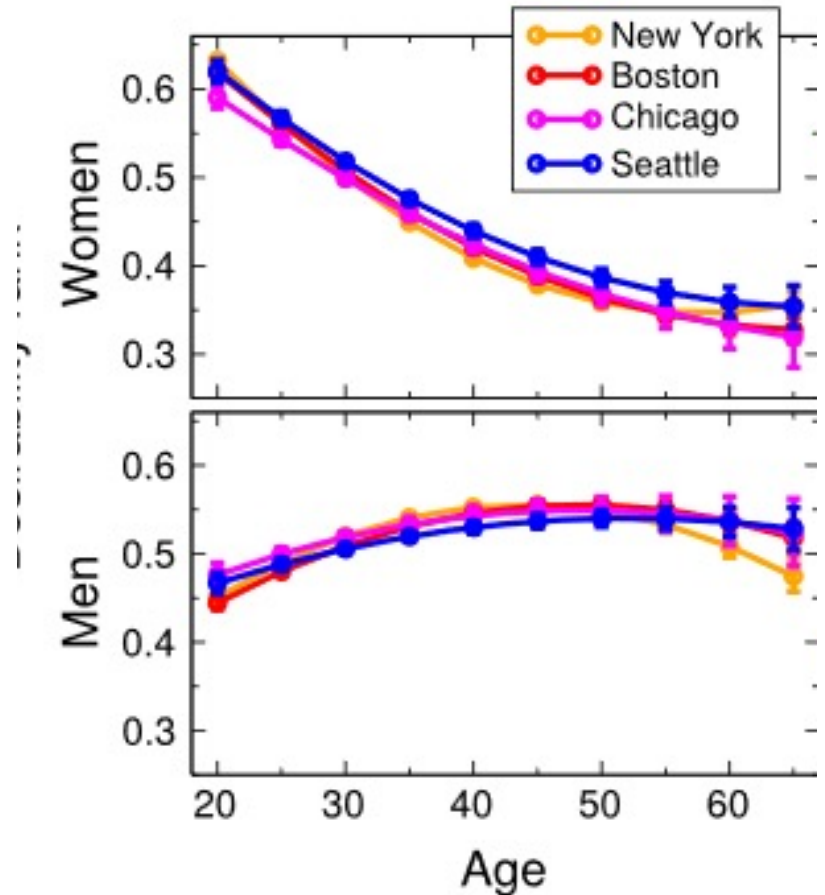
3 MIN READ t f

FRANKFURT/MUNICH (Reuters) - Germany's ProSiebenSat.1 Media said on Monday it had bought U.S. online dating site eharmony, in the first significant deal since it carved out a new e-commerce joint venture with General Atlantic.

ProSiebenSat.1 Media AG

“Desirability” by Age (2018)

- **Desirability** measured by the number of messages a user receives, when and by whom, providing an indication of who finds whom attractive.
 - Measure of reflected desirability similar to PageRank – PageRank scores of desirability calculated to create a ranking metric for the study
 - Metric of desirability based on (messaging) behavior, rather than personal qualities (e.g. attractiveness)
 - Desirability rises if many people contact you and they themselves are desirable.
 - On average, people pursue partners who are roughly 25% more desirable than they themselves are. (Hybrid strategy of “matching” at their own rank and competing for modestly more desirable mates.
- [Data from study of heterosexual U.S. participants in 4 cities from an on-line dating site. <http://advances.sciencemag.org/content/advances/4/8/eaap9815.full.pdf>]



Matching algorithms

- **Matching algorithms generally proprietary and considered a competitive advantage**
- Compatibility matching offered by on-line sites can be in-depth
- Matching algorithms differ in
 - Use of data **self-collected from users**
 - **Other data** about users
 - What **variables considered** and how they are weighted
 - **Method** to determine how desirable is the individual as a relationship partner
 - Site **goal** (e.g. long-term compatibility, hookup)

OKCupid Matching Algorithm (“public”, patented)

- OKCupid Matching algorithm:
 - Members answer questions (>1000 available)
 - Percentage score of the “match” assigned based on
 - Member’s answer
 - What member would like others to answer
 - How important the question is
 - Score represents likelihood that they would be a good match
 - Not all members answer the same questions and most members do not answer all questions

General matching approaches -- Compatibility and complementarity

- Common approaches to matching leverage:
 - **Compatibility:** areas in which you and your potential partner are similar
 - **Complementarity:** areas in which you and your potential partner are different/complementary
- Dating algorithms often leverage these different approaches, typically against a model of what a successful relationship will be like (e.g. having particular attributes, having particular chemistry, etc.)
- Various algorithms may leverage behavioral, anthropological, chemistry, or other models of successful relationships

3 approaches to matching

Table 2. The Variables Measured at the Three Major Scientific Matching Sites and Matching Principles Used

Matching site	Domain	Construct	Variables assessed	Matching principle
eHarmony	Core traits: "defining aspects of who you are that remain largely unchanged throughout your adult life" ¹⁸	Emotional temperament	Self-concept, emotional status, energy, passion	Similarity
		Social style	Character, kindness, dominance, sociability, autonomy, adaptability	Similarity
		Cognitive mode	Intellect, curiosity, humor, artistic passion	Similarity
	Vital Attributes: "based on learning experience, and are more likely to change based on life events and decisions you make as an adult" ¹⁸	Physicality	Energy, passion, vitality and security, industry, appearance	Similarity
		Relationship skills	Communication style, emotion management, conflict resolution	Similarity
		Values and beliefs	Spirituality, family goals, traditionalism, ambition, altruism	Similarity
		Key experiences	Family background, family status, education	Similarity
PerfectMatch			Romantic impulsivity, Personal energy, Outlook, Predictability	Similarity
			Flexibility, Decision-making style, Emotionality, Self-nurturing	Similarity or complementarity
Chemistry	Sex hormones	Testosterone	Director personality type	Complementarity
		Estrogen	Negotiator personality type	Complementarity
	Neurotransmitters	Dopamine	Explorer personality type	Similarity
		Serotonin	Builder personality type	Similarity

¹⁸From www.eharmony.com/why/dimensions

eHarmony algorithmic approach

- **E-Harmony General approach**

- Algorithms developed based on
 - interviews conducted with married couples to see what variables might be relevant to predicting success in long-term relationships.
 - Psychometric tests performed on large sample of couples
- Algorithm based on survey with 13 sections and 300 items.
 - Survey captures 29 dimensions that allegedly predict long-term relationship success.
 - Traits are distinguished as core traits (unlikely to change in adulthood) and vital attributes (which may change based on learning and experience)
- Behavioral data on site (how long spent on site, how long to respond to an email, how people contacted respond, etc.) used by the company to predict how users will respond to proposed matches
- E-Harmony's matchmaking software gathers **600 data points** for each user

PerfectMatch algorithmic approach

- **PerfectMatch approach**

- Developed in part by sociologist Pepper Schwartz
- Clients traits analyzed as whether they are similar or complementary
- PerfectMatch seeks to leverage both similarity and complementary traits, claiming that couples are more compatible when they are similar on romantic impulsivity, personal energy, outlook, and predictability and when they are different on flexibility, decision-making style, emotionality, and self-nurturing.

Chemistry.com algorithmic approach

- **Chemistry approach**

- Developed by Anthropologist Helen Fisher
- Clients typed according to 4 personality types (Explorer, Builder, Negotiator, Director), 3 of which are linked to 2 sex hormones (testosterone and estrogen) and 2 neurotransmitters (dopamine and serotonin).
- Survey contains around 60 items (including a question about the length of one's index finger compared to the ring finger, allegedly indicating testosterone level)
- Users are shown visual representations and asked for interpretation as well as answering questions

Privacy – dating information often considered public and shareable

Excerpted Privacy Policy for OKCupid

(<https://www.okcupid.com/legal/privacy#how-we-use-information>)

- **Information they collect** includes data from partners
- **Information they use:**
 - “We may use your information where we have legitimate interests to do so.”
- **Information shared with**
 - Other users
 - Service providers and partners
 - “We may also share information with partners who distribute and assist us in advertising our services. For instance, we may share limited information on you in hashed, non-human readable form to advertising partners.”
 - With other Match Group businesses
 - For corporate transactions
 - “We may transfer your information if we are involved, whether in whole or in part, in a merger, sale, acquisition, divestiture, restructuring, reorganization, dissolution, bankruptcy or other change of ownership or control.”

What privacy?

- New FB dating app: Facebook “says it won’t use any Dating information for advertising”; info will be kept separate from a user’s primary FB profile
 - Location, etc. still collected
 - A primary goal is to keep you on FB more often
- Dating apps data:
 - Sexual preferences, name, occupation, what you’re looking for, etc. (direct data from you)
 - Inferences about racial preferences, and other characteristics and preferences (data from how you use the site)
 - Location data, contacts, wifi and network connections (how / when you log in)

How Private Is Your Online Dating Data?

As Facebook launches its new dating service, here’s a look at what dating apps do with your personal information

By Thomas Germain
September 21, 2019

75 SHARES



Facebook Dating made its official debut in the United States this month, marking the tech giant's entry into yet another online business—and raising

Cybersecurity -- Some Dating App Vulnerabilities and Breaches during the Pandemic

- **Hacker exposed the data of 2.28 M MeetMindful users**
 - File posted on a hacker forum included full names, email addresses, birth dates, location, IP addresses, etc.
- **Grindr, OKCupid, Bumble and others were vulnerable to a patched bug**
 - Vulnerability allowed threat actors to inject malicious code into the applications, allowing them to access the hosting application and other apps on the same mobile device
- **Bumble vulnerability possibly exposed 100 M users' data**
 - API vulnerability exposed sensitive data including Facebook information, location, weight, height, personal characteristics, etc.
- **Fraud, scams, sextortion, data breaches, etc.**

Data-mining into a relationship

“How I hacked on-line dating”, Amy Webb
(17:23 min)

https://www.ted.com/talks/amy_webb_how_i_hacked_online_dating/up-next

Lecture 21 Sources (not already on slides)

- Online dating: A critical analysis from the perspective of psychological science, Sage Journals, <http://journals.sagepub.com/stoken/rbtf/cK9EB6/4zQ0AM/full>
- “Aspirational pursuit of mates online in dating markets”, Science, <http://advances.sciencemag.org/content/advances/4/8/eaap9815.full.pdf>
- Heartbreak and Hacking: Dating apps in the pandemic, Security Boulevard, <https://securityboulevard.com/2021/04/heartbreak-and-hacking-dating-apps-in-the-pandemic/>
- Online Dating Services Market Research Report by Services, by Subscription, by Age Group, by Gender - Global Forecast to 2025 - Cumulative Impact of COVID-19, GlobeNewswire, <https://www.globenewswire.com/news-release/2021/04/08/2206692/0/en/Online-Dating-Services-Market-Research-Report-by-Services-by-Subscription-by-Age-Group-by-Gender-Global-Forecast-to-2025-Cumulative-Impact-of-COVID-19.html>
- Dating Statistics, Pew Research, https://www.pewresearch.org/social-trends/2020/08/20/a-profile-of-single-americans/psdt_08-19-20_dating-relationships-015/
- Dating App Revenue and Usage Statistics, <https://www.businessofapps.com/data/dating-app-market/#1>
- “How private is your on-line dating data?”, Consumer Reports, <https://www.consumerreports.org/privacy/how-private-is-your-online-dating-data/>

Presentations



Upcoming Presentations

April 22

- **“What a gambling app knows about you”**, New York Times, <https://www.nytimes.com/2021/03/24/technology/gambling-apps-tracking-sky-bet.html>
- **“Can computer algorithms learn to fight wars ethically?”**, Washington Post, https://www.washingtonpost.com/magazine/2021/02/17/pentagon-funds-killer-robots-but-ethics-are-under-debate/?no_nav=true&tid=a_classic-iphone

Today's Presentation

April 19

- **“This cuffing season, it’s time to consider the privacy of dating apps”**, Brookings Institution, <https://www.brookings.edu/blog/techtank/2020/11/20/this-cuffing-season-its-time-to-consider-the-privacy-of-dating-apps/> (Jeff)