The Economics of Privacy

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8th Technion Summer School on Cyber and Computer Security, September 2020

Agenda

1) A brief history

2) Conventional wisdoms vs. unresolved issues

3) Some partial conclusions

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2) Conventional wisdoms vs. unresolved issues

3) Some partial conclusions

The evolution of the economics of privacy

- Early 1980s
  - The Chicago School
- Mid 1990s
  - The IT revolution
- 2000s and onward
  - Expansion and fragmentation

Anonymity

Confidentiality

Solitude

Secrecy

Control over information

Privacy

Information security

Disguise

Obscurity

Seclusion

Autonomy

Right to be left alone

Anonymity

Confidentiality

Solitude

Secrecy

Control over information

a dialectic and dynamic process of
"boundary regulation"

Privacy

Information security

Disguise

Obscurity

Seclusion

Autonomy

Right to be left alone

The Economics of Privacy

By RICHARD A. POSNER*

The concept of "privacy" has received a good deal of attention from lawyers, political scientists, sociologists, philosophers and psychologists, but until recently very little from economists. This neglect is on the mend (see, for example, my 1978, 1979a articles and forthcoming book, chs. 9–11; George Stigler), and in this paper I will report on the economic research on privacy in which I and others have been engaged.

Some definitional clarification is necessary at the outset. Privacy is used today in at least three senses. First, it is used to mean the concealment of information; indeed, this is its most common meaning today. Second, it is used to mean peace and quiet, as when someone complains that telephone solicitations are an invasion of his privacy. Third, it is used as a synonym for freedom and autonomy; it is in this sense that the Supreme Court has used the word in subsuming the right to have an abortion under the right of privacy (see my 1979b article, pp. 190–200).

The third meaning of privacy need detain us only briefly. To affix the term privacy to human freedom and autonomy (as in Jack Hirshleifer) is simply to relabel an old subject—not to identify a new area for economic research. The second meaning of the word privacy set out above invites a slightly novel application of economics. It suggests an economic reason why certain (cerebral) workers have private offices and other (manual) workers do not, why aversion to noise is associated with rising education, and why certain low-level invasions of a person's "private space" (for example, shoving a person roughly but without hurting him) are tortious (see my forthcoming book, ch. 10). But the range of economic applications in this area seems limited.

The first meaning of privacy set out above—privacy as concealment of information—seems the most interesting from an economic standpoint. There is a rich and growing literature on the economics of information. It would seem that the same economic factors that determine search behavior by workers and consumers might also determine investments in obtaining, and in shielding, private information. This insight (emphasized in my 1978 article) provides the starting point for the economic analysis of privacy.

To relate the economics of privacy to the economics of information in as clear a fashion as possible, consider the example of the employer searching across employees and the employee searching across employers. The employer is looking for certain traits in an employee that may not be obvious, things like honesty, diligence, loyalty, and good physical and mental health. To the extent that the employee is deficient in one or more of these characteristics, he has an incentive—strictly analogous to the incentive of a seller of goods to conceal product defects—to conceal these deficiencies. That is, he has an incentive to invoke a "right of privacy" if the employer tries to "pry" into his private life.

The concealment of personal characteristics in the employment contest retards rather than promotes the efficient sorting of employees to employers. By reducing the amount of information available to the "buyer" in the labor market (the employer), it reduces the efficiency of that market. The analysis can easily be generalized, moreover, to other markets, some of them "noneconomic," in which private information is concealed. An example is the marriage "market." The efficient sorting of females to males in that market is impeded if either spouse conceals material personal information. The extended courtship that remains typical of the marriage market may be due in part to the efforts of prospective spouses to conceal their deficiencies from each other.

*University of Chicago Law School.

The early days: Posner

- Privacy as concealment of information
  - Individuals with negative traits (e.g., low quality employees) have interest in hiding them
  - Individuals with positive traits have interest in showing them
  - Reducing information available to "buyers" in the market (e.g., employers) reduces efficiency
- Costs of concealment borne by others
  - E.g., when privacy of sex-offenders is protected
- Extends argument to non-market behavior
  - E.g., marriage
- Bottom line: Privacy is re-distributive and reduces efficiency

The early days: Stigler

- Exchange of information will lead to desirable economic outcomes independently of ownership of data
  - E.g.: If I am a “good” debtor, I want this information to be known; if I am a “bad” debtor, I want to keep it secret
  - Suppose I am a bad debtor: then, whether I hide information or information about me is reported, I will pay higher rates (no information == bad information)
- Also, Stigler believes in a specific model of data ownership
  - Information about a person may have been costly acquired by another entity – thus it may rightly “belong” to that entity

The mid 1990s: Varian

- Externalities (positive and negative) arise due to the secondary use of information
- Digitization of information creates novel challenges: collapsing marginal costs of data collection/storage render semi-private information fully public
- Proposal: define property rights in private information in ways that allow consumers to retain control over how information about them is used
  - And, make it costly to access certain digital information

The mid 1990s: Noam

- In absence of transaction costs in trading data, initial assignment of privacy rights is arbitrary from viewpoint of economic efficiency (building on Coase)
  - Encryption
    - "The existence of encryption may largely determine who has to pay whom, not whether something will happen"
    - In fact, encryption at most makes parties other than the data subject pay. Hence, it redistributes wealth to consumers

The mid 1990s: Laudon

- “Markets and Privacy,” CACM, 1996
  - (One of the) first to propose personal data markets / data warehouses

2000s and onwards

- Expansion and fragmentation
  - Increased modeling sophistication
  - Diversification of focus
  - Emergence of empirical analyses
  - Emergence of applied behavioral economic research
  - And, of course, the parallel emergence of the economics of information security (see, e.g., WEIS)

Journal of Economic Literature 2016, 54(2), 1–53
http://dx.doi.org/10.1257/jel.54.2.1

The Economics of Privacy†

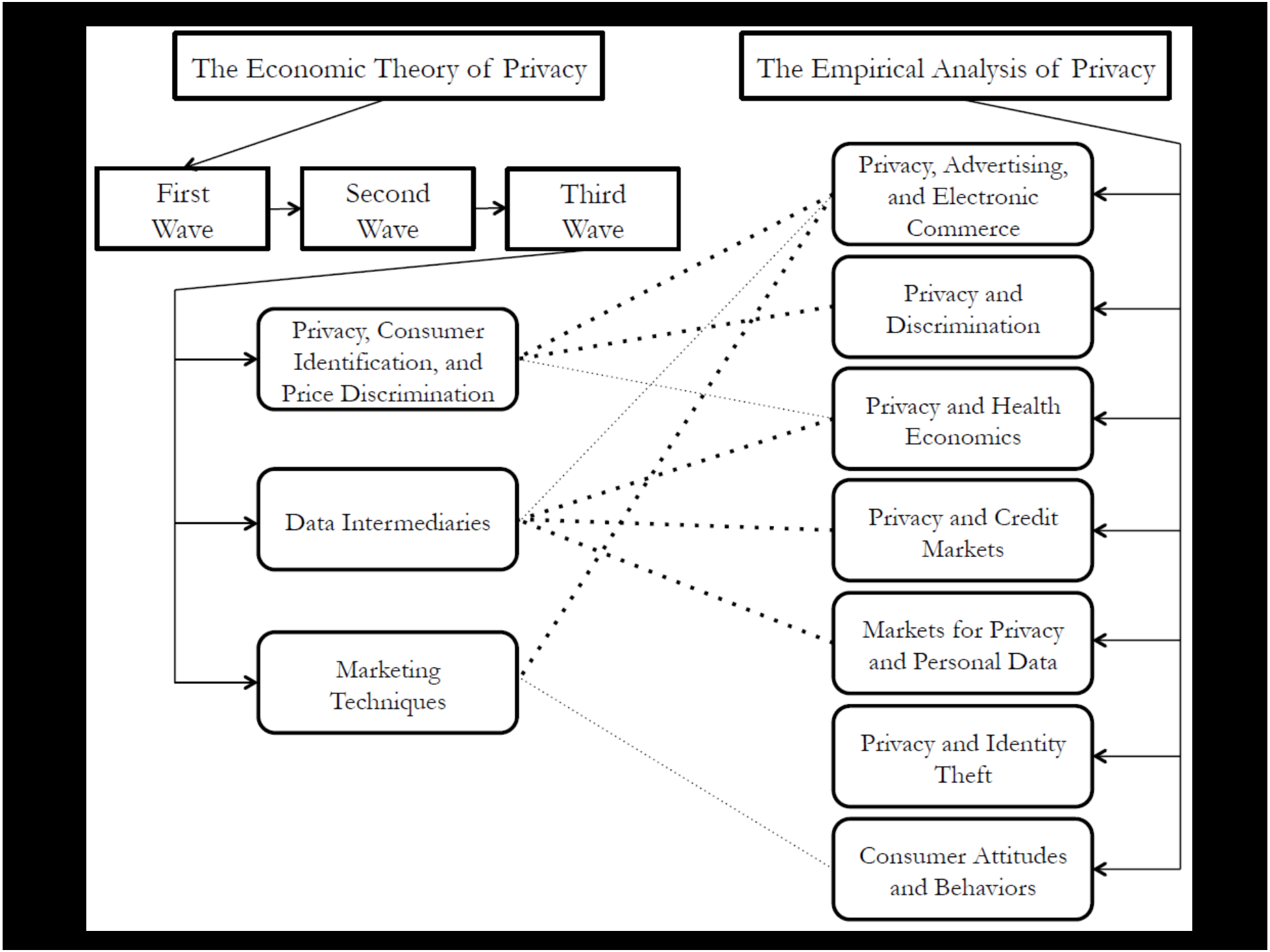
Alessandro Acquisti, Curtis Taylor, and Liad Wagman*

This article summarizes and draws connections among diverse streams of theoretical and empirical research on the economics of privacy. We focus on the economic value and consequences of protecting and disclosing personal information, and on consumers' understanding and decisions regarding the trade-offs associated with the privacy and the sharing of personal data. We highlight how the economic analysis of privacy evolved over time, as advancements in information technology raised increasingly nuanced and complex issues associated with the protection and sharing of personal information. We find and highlight three themes that connect diverse insights from the literature. First, characterizing a single unifying economic theory of privacy is hard, because privacy issues of economic relevance arise in widely diverse contexts. Second, there are theoretical and empirical situations where the protection of privacy can both enhance and detract from individual and societal welfare. Third, in digital economies, consumers' ability to make informed decisions about their privacy is severely hindered because consumers are often in a position of imperfect or asymmetric information regarding when their data is collected, for what purposes, and with what consequences. We conclude the article by highlighting some of the ongoing issues in the privacy debate of interest to economists. (*JEL* D82, D83, G20, I10, L13, M31, M37)

1. *Why an Economics of Privacy*

The value and regulation of information assets have been among the most interesting areas of economic research since Friedrich Hayek's 1945 treatise on the use of knowledge in society. Contributions to what has become known as the field of *information economics* have been among the most influential, insightful, and intriguing in the

"The Economics of Privacy," Acquisti, Taylor, and Wagman, *Journal of Economic Literature*, 2016


The Economic Theory of Privacy
The Empirical Analysis of Privacy
First Wave
Second Wave
Third Wave
Privacy, Consumer Identification, and Price Discrimination
Data Intermediaries
Marketing Techniques
Privacy, Advertising, and Electronic Commerce
Privacy and Discrimination
Privacy and Health Economics
Privacy and Credit Markets
Markets for Privacy and Personal Data
Privacy and Identity Theft
Consumer Attitudes and Behaviors

Several open questions

- What are the costs of privacy intrusions?
  - Tangible vs. intangible harms
- What is the "optimal" amount of privacy protection?
  - And, for which stakeholder?
- Who should be responsible for achieving that "optimal" amount of privacy?
  - Individuals (informed consent, market choices)?
  - The market (self-regulation)?
  - Government (regulation)?
- Are there privacy market failures?
  - Do revealed preferences capture actual privacy preferences? Do they capture actual privacy harm?

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Farrell (2012): privacy as…

an intermediate good

a final good

Farrell (2012): privacy as…

an intermediate good

Identity theft, price discrimination, discrimination, blackmailing, adverse profiling, other objective harms (Calo 2013)….

a final good

Psychological discomfort, stigma, loss of autonomy, infringement on freedom, other subject harms….

an intermediate good

the economic impact of privacy…

welfare allocation (“micro” angle)

aggregate welfare (“macro” angle)

welfare allocation

Posner/Stigler: privacy is redistributive

… but so is the lack of privacy

Varian (1996): consumers would rationally want telemarketers to know what products they are interested in, but not how much they are interested in those products

Taylor (2004), Acquisti and Varian (2005)

Under tracking and targeting, myopic customers get price discriminated in intertemporal dynamic pricing model

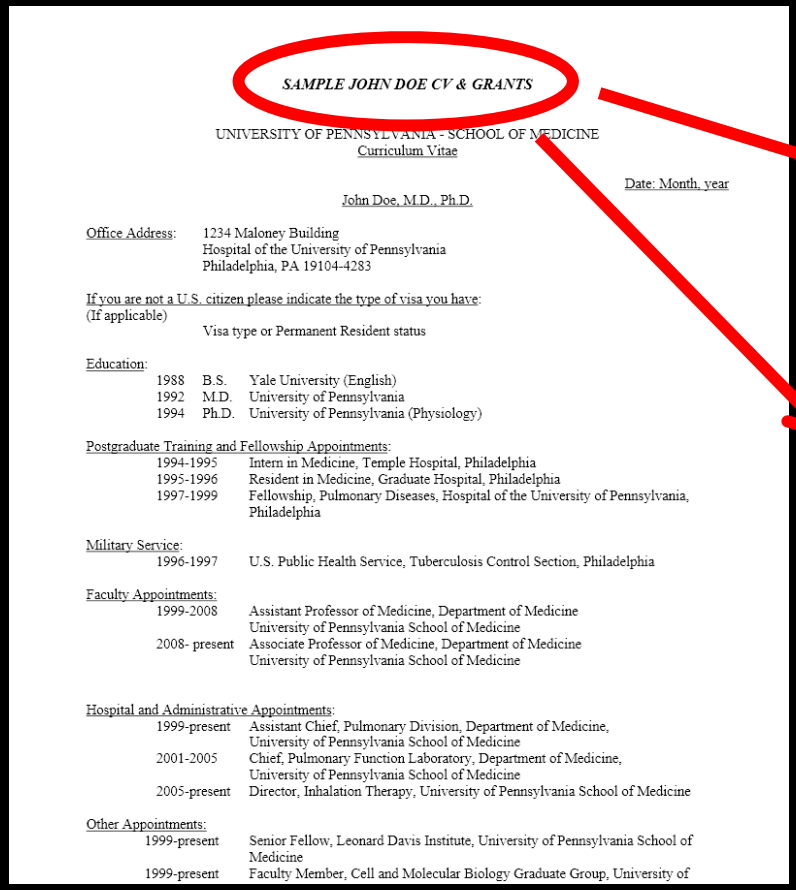
I.e., in absence of privacy protection, consumers are worse off

Note: we are talking first degree price discrimination:

all consumers (high and low) pay their reservation prices

From the standpoint of welfare allocation and individual self-interest: there is an obvious, rational economic argument for privacy as a private good

Note: here we construe privacy as control over protection and sharing of data - not as mere hiding of data



SAMPLE JOHN DOE CV & GRANTS

UNIVERSITY OF PENNSYLVANIA - SCHOOL OF MEDICINE
Curriculum Vitae

Date: Month, year

John Doe, M.D., Ph.D.

Office Address: 1234 Maloney Building
Hospital of the University of Pennsylvania
Philadelphia, PA 19104-4283

If you are not a U.S. citizen please indicate the type of visa you have:
(If applicable)
Visa type or Permanent Resident status

Education:

1988	B.S.	Yale University (English)
1992	M.D.	University of Pennsylvania
1994	Ph.D.	University of Pennsylvania (Physiology)

Postgraduate Training and Fellowship Appointments:

1994-1995	Intern in Medicine, Temple Hospital, Philadelphia
1995-1996	Resident in Medicine, Graduate Hospital, Philadelphia
1997-1999	Fellowship, Pulmonary Diseases, Hospital of the University of Pennsylvania, Philadelphia

Military Service:

1996-1997	U.S. Public Health Service, Tuberculosis Control Section, Philadelphia

Faculty Appointments:

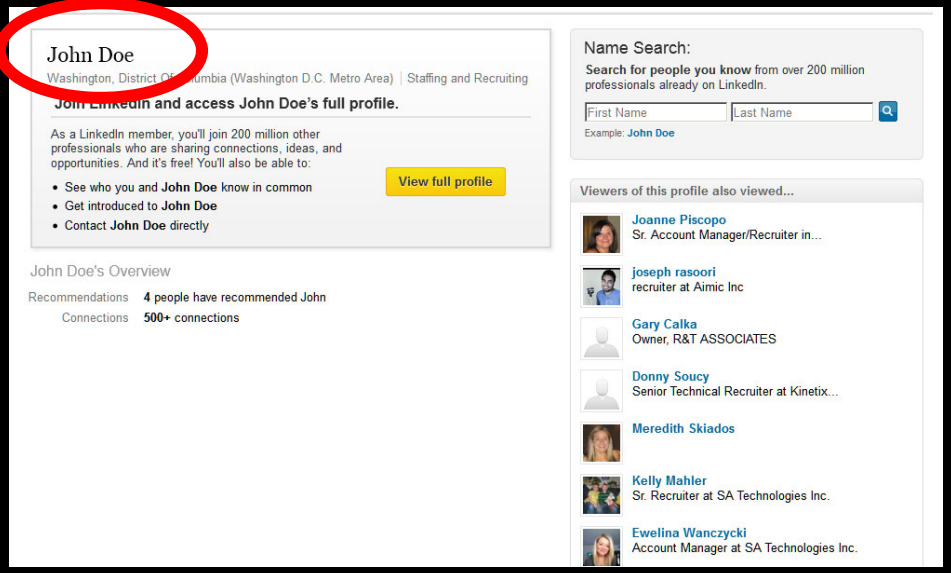
1999-2008	Assistant Professor of Medicine, Department of Medicine University of Pennsylvania School of Medicine
2008- present	Associate Professor of Medicine, Department of Medicine University of Pennsylvania School of Medicine

Hospital and Administrative Appointments:

1999-present	Assistant Chief, Pulmonary Division, Department of Medicine, University of Pennsylvania School of Medicine
2001-2005	Chief, Pulmonary Function Laboratory, Department of Medicine, University of Pennsylvania School of Medicine
2005-present	Director, Inhalation Therapy, University of Pennsylvania School of Medicine

Other Appointments:

1999-present	Senior Fellow, Leonard Davis Institute, University of Pennsylvania School of Medicine
1999-present	Faculty Member, Cell and Molecular Biology Graduate Group, University of



"An Experiment in Hiring Discrimination via Online Social Networks,"
Alessandro Acquisti and Christina Fong , *Management Science*, 2020

Callback rates

In conservative-leaning U.S. states, Muslim candidate over 6 times less likely than Christian candidate to be called for an interview

"An Experiment in Hiring Discrimination via Online Social Networks,"
Alessandro Acquisti and Christina Fong , *Management Science*, 2020

From the standpoint of welfare allocation and individual self-interest: there is an obvious, rational economic argument for privacy as a private good

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But what about aggregate welfare – i.e., the collective value of personal information collection?

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When is privacy welfare-enhancing/decreasing?

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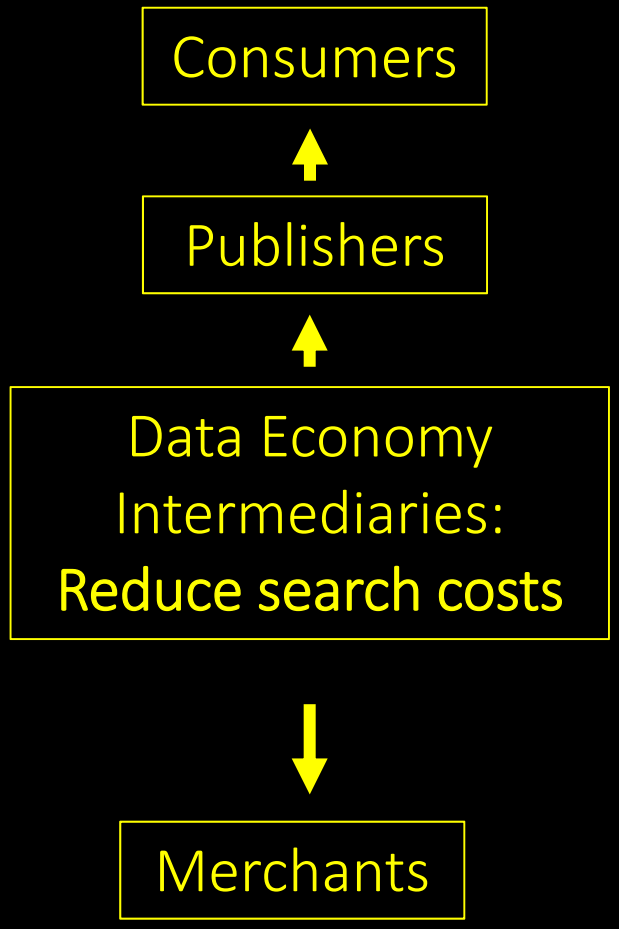
"Targeting is not only good for consumers […] it's a rare win for everyone. […] It ensures that ad placements display content that you might be interested in rather than ads that are irrelevant and uninteresting. […] Advertisers achieve […] a greater chance of selling the product. Publishers also win as […] behavioral targeting increases the value of the ad placements."

David Nelson, quoted in AdExchanger, 2011

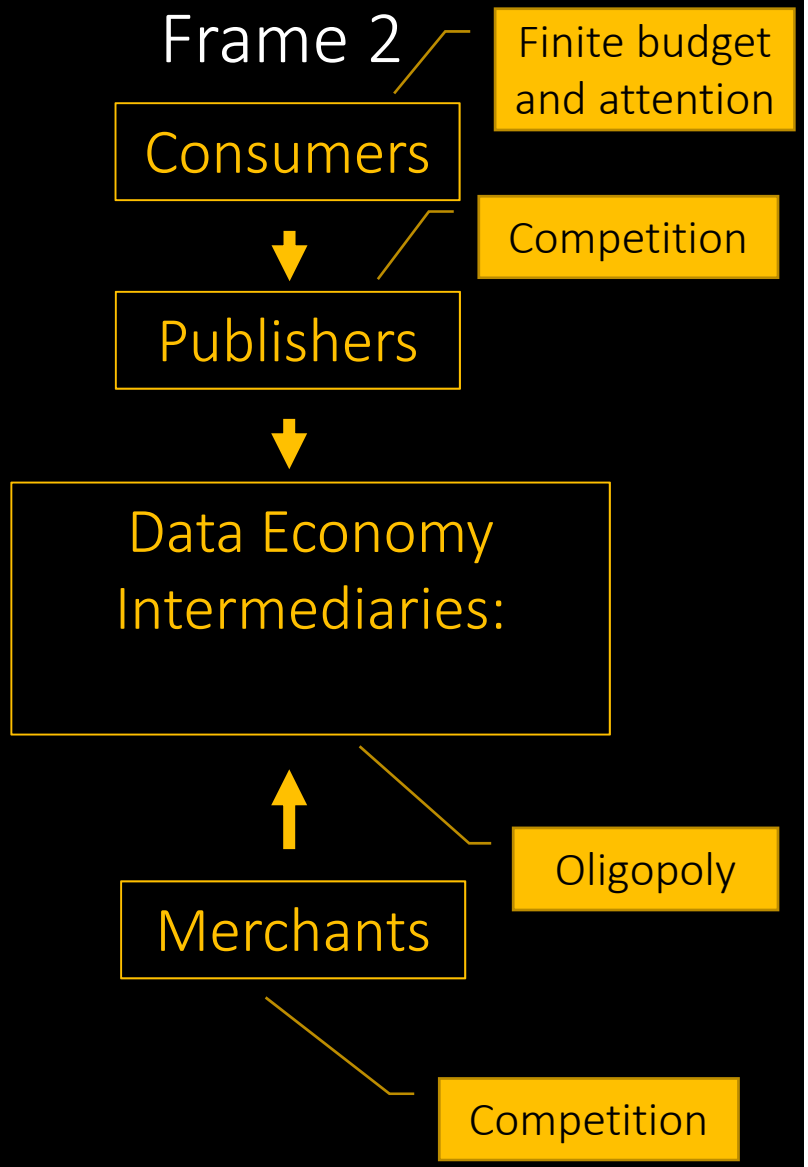
Online advertising:

Frame 1

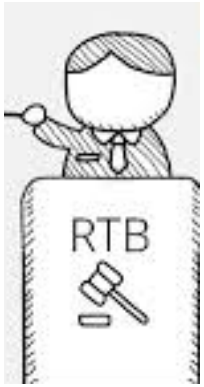


Online advertising:

Frame 2

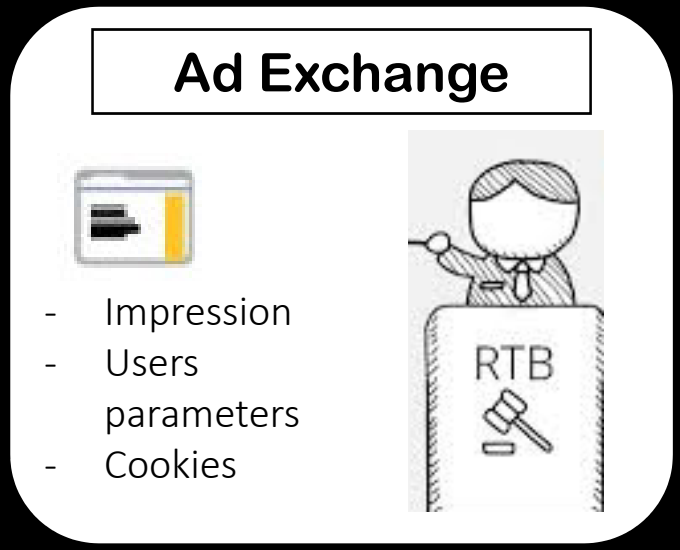


Ad Exchange



What Are the Welfare Implications of Targeted Advertising?

Veronica Marotta, Kaifu Zhang, Alessandro Acquisti. Under review.



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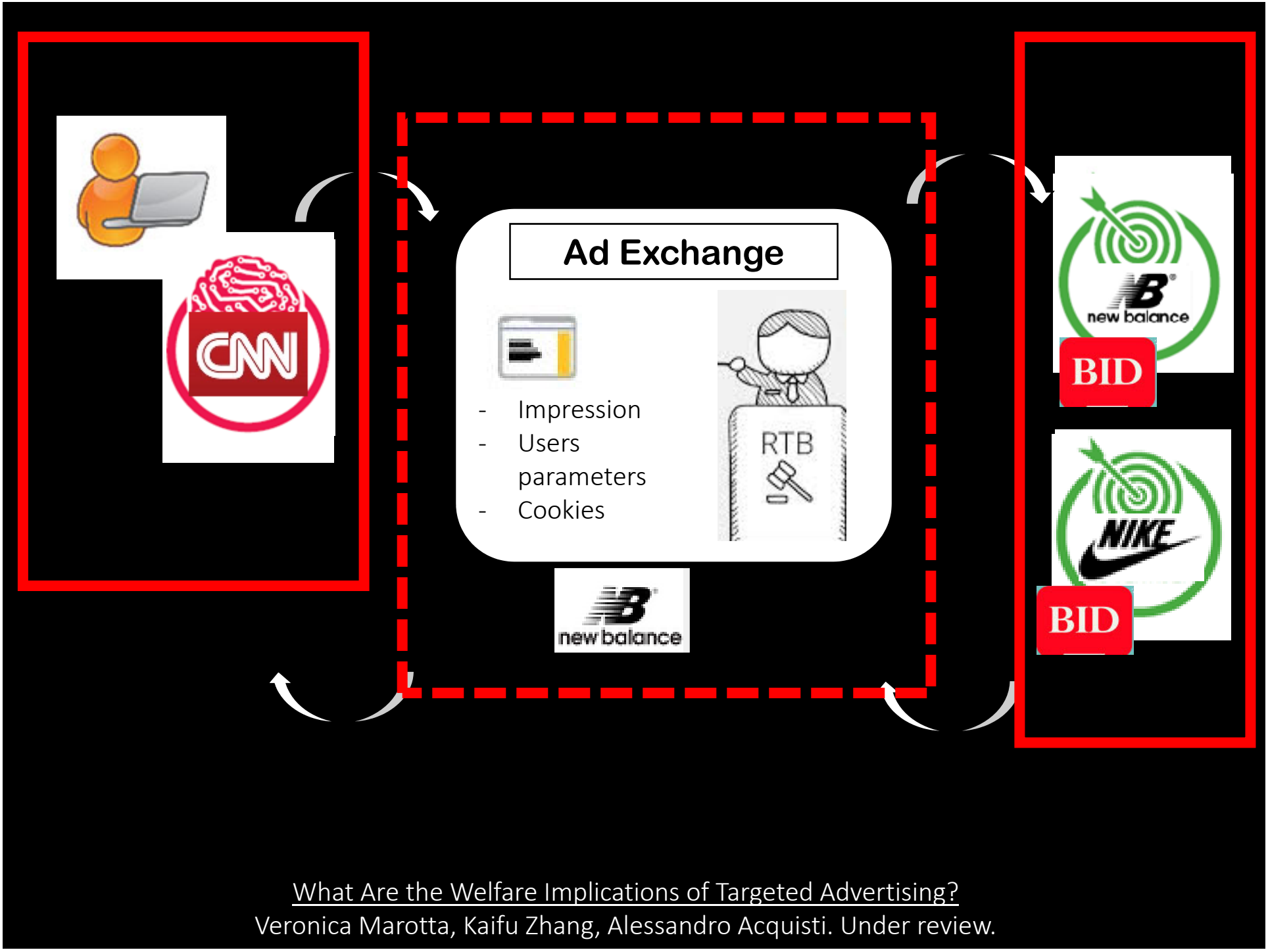

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Consumers' Preference
Indifferent
Vertical Information
Horizontal Information

Preferred information regimes for advertisers and intermediary, given consumers' preferences

What Are the Welfare Implications of Targeted Advertising?
Veronica Marotta, Kaifu Zhang, Alessandro Acquisti. Under review.

The allocation of surplus from behavioral tracking and targeted advertising can change dramatically with the amount and type of data collected – consumers benefit from some information being shared, but not other

The Online Advertising Market Puzzle

Advertising revenues in US reached $88 billion in 2017 *(IAB, 2017)*

However, revenues for about 40% of publishers stagnant or shrinking *(Econsultancy, 2015)*

Following GDPR, NYT focused on contextual /geographical targeting w/out experiencing ad revenues drop (Digiday 2019a)

2019 poll of publisher executives: for 45% of respondents behavioral ad targeting hadn't produced notable benefit; for 23% it caused ad revenues to decline (Digiday, 2019b)

"Online Tracking and Publishers' Revenues: An Empirical Analysis,"
Veronica Marotta, Vibhanshu Abhishek, and Alessandro Acquisti, *WEIS,* 2019.

How do publishers' ad revenues change when the ads they display are behaviorally targeted?

Advertisers' willingness to pay increases if they can target audiences (Chen and Stallert, 2014; Board, 2009)

Ad price increases, publisher's revenue increases

When targeting audiences, advertisers reach narrow markets with reduced competition (Levin and Milgrom, 2010; Hummel and McAfee, 2016)

Ad price decreases, publisher's revenue decreases

"Online Tracking and Publishers' Revenues: An Empirical Analysis,"
Veronica Marotta, Vibhanshu Abhishek, and Alessandro Acquisti, *WEIS,* 2019.

We leveraged a large data set shared by a media conglomerate, owner of a large number of online publishers

We estimated revenue changes when website visitors' cookies are, or are not, available (and therefore behavioral targeting of display ads is, or is not, possible)

2 million advertising transactions, over 60 different websites

- Date and time
- Ad's features (size, type, ...)
- Urls where ads shown
- Advertisers' names
- Visitors' geo-location and device features
- Publishers' revenues
- Cookie's information (or absence)

"Online Tracking and Publishers' Revenues: An Empirical Analysis,"
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What we found

Raw mean revenues were indeed higher when cookie is present

However, we use Augmented Inverse Probability Weighting (Robins et al., 1994) to deal with self-selection and control for other factors (e.g. contextual targeting)

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We find that the net average revenue increase specifically attributable to cookies is about 4%

Is the increase *economically* significant?

- The increase in revenue obtained through the use of cookies comes at a cost for the publisher: infrastructure costs, data management costs, fees, costs imposed by data regulations...
- And, it comes at the cost of users' privacy
- Furthermore:

"Online Tracking and Publishers' Revenues: An Empirical Analysis,"
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Google is also planning a policy change that would severely undermine news gathering. The company is **reportedly considering restricting third-party cookies** in its Chrome web browser, which it could announce as soon as its annual conference on May 7. Cookies are the largely unseen infrastructure on which the online marketplace runs. Cookies allow websites that provide free content to also collect anonymized data on users' interests, giving advertisers critical information about the market for their products. This value exchange is necessary to support nearly every site on the internet, but it is the lifeblood of digital journalism. An online advertisement without a third-party cookie sells for just 2 percent of the cost of the same ad with the cookie.

Laura Bassett, The American Prospect, May 6, 2019

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Who benefits from the data economy?

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Economic Theory: Privacy as source of economic inefficiency

Obstacles to data sharing create economic inefficiencies

Posner (1978, 1981); Stigler (1980)

Economic Theory: Privacy as *protection from* inefficiency

In absence of regulation, excessive data collection harms economic efficiency

E.g., competition pushes firms to invest more than socially optimal amount in gathering consumer data; competitive pressure leads to divergence between private and social marginal benefits of information acquisition

Hirshleifer (1971); Taylor (2008); Burke, Taylor, Wagman (2011); Hermalin and Katz (2006)

Empirical evidence: Privacy and innovation

Privacy regulation reduces technology adoption

Miller and Tucker (2009, …)

Privacy regulation increases technology adoption

Adjerid, Acquisti, Telang, Padman, Adler-Minstein (2015)

(The key seems to be *what type* of regulation)

Empirical evidence: Data sharing and EMR

Adoption of advanced EMR leads to a 27% decline in patient safety events

Hydari, Telang, Marella (2015)

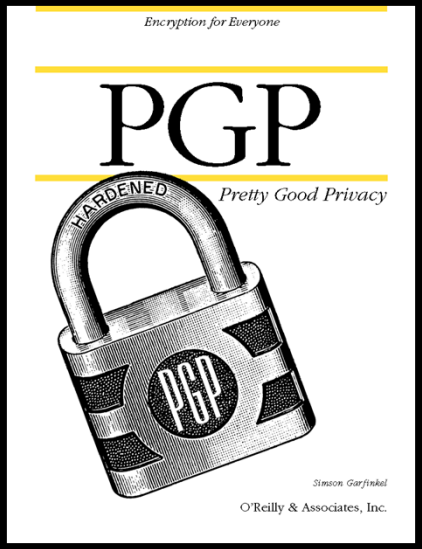
Adoption of advanced EMR increases outpatient charges by 12%

Romanosky, Adjerid, Weber (2015)


tor.eff.org


WhiteHat Aviator
https://www.whitehatsec.com/securebro
PROTECTED
Aviator™
The most secure web browser online
www.Neowin.net


DuckDuckGo


Encryption for Everyone
PGP
Pretty Good Privacy
HARDENED
PGP
Simson Garfinkel
O'Reilly & Associates, Inc.

Privacy Enhancing Technologies (PETs) allow, among other things

- Authentication without identification…
- Private information retrieval…
- Searches in encrypted spaces…
- Operations on encrypted spaces…
- Privacy-preserving data mining, collaborative filtering, targeted advertising…

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Who bears the costs of privacy
protection?

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facebook Sign Up

Email or Phone | Password | Log In

Keep me logged in | Forgot your password?

Delivering More Control and Transparency

By Matt Hicks on Thursday, August 27, 2009 at 7:08am

This morning, we announced plans to give you more control over your information and to help you make more informed choices about privacy. We'll be making a series of improvements that include notifications and information about privacy settings and practices, additions to Facebook's privacy policy, and technical changes designed to give people more transparency and control over the information they provide to third-party applications.

These planned changes are a result of collaborative discussions we've had with the Office of the Privacy Commissioner of Canada, which has spent more than a year reviewing Facebook's privacy policies and controls. You can read more about their announcement here. If you are a developer, you can read more about the potential impact for applications here.

The improvements we announced today are in addition to the tests we began in July of simpler privacy settings and tools for migrating people to the new controls. Those tests continue and we hope to roll them out to more of you in the coming months.

Notes by Facebook

All Notes

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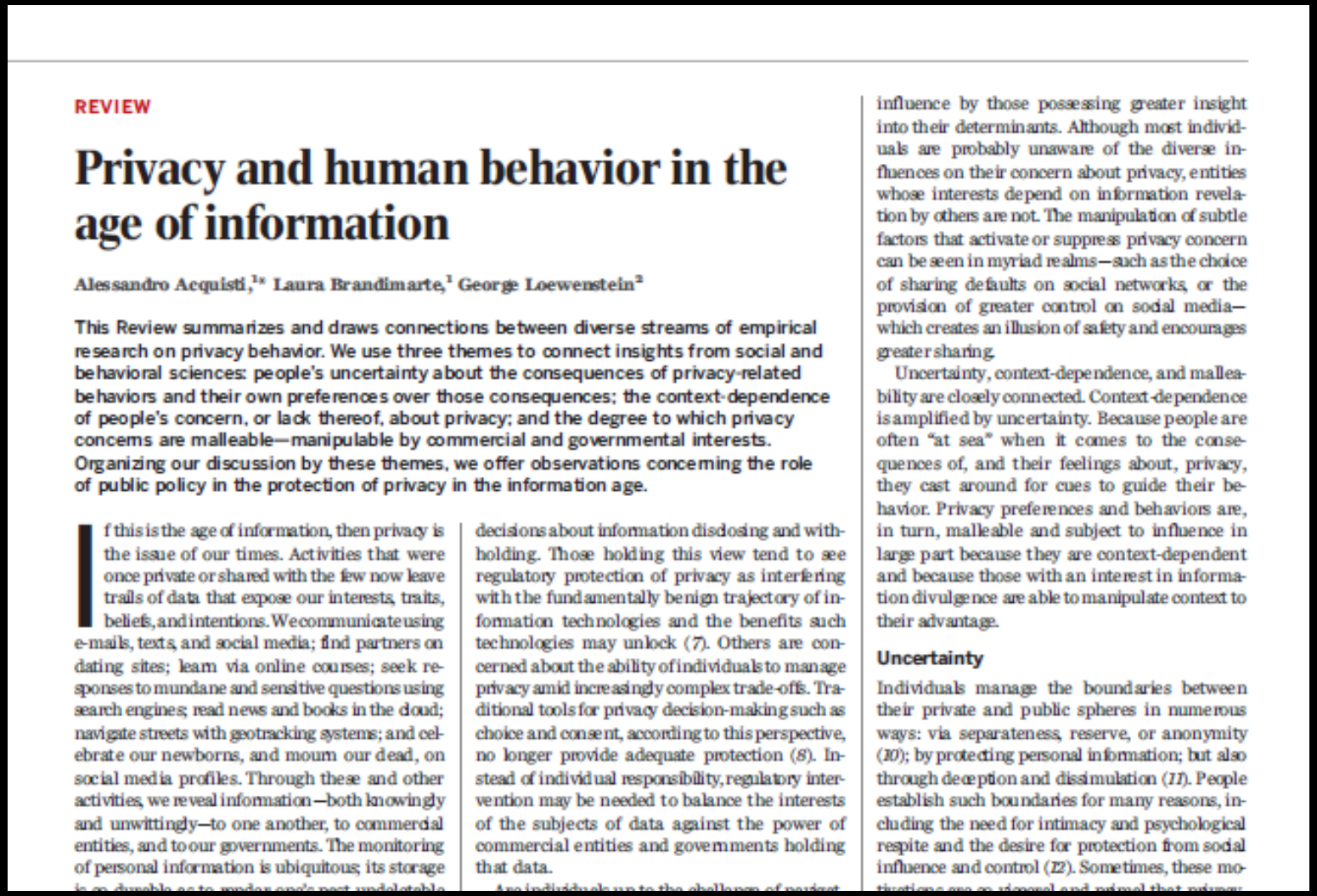
(Privacy) decision making hurdles for consumers

1) Asymmetric information
2) Bounded rationality
3) Heuristics and biases



REVIEW

Privacy and human behavior in the age of information

Alessandro Acquisti,[1]* Laura Brandimarte,[1] George Loewenstein[2]

This Review summarizes and draws connections between diverse streams of empirical research on privacy behavior. We use three themes to connect insights from social and behavioral sciences: people's uncertainty about the consequences of privacy-related behaviors and their own preferences over those consequences; the context-dependence of people's concern, or lack thereof, about privacy; and the degree to which privacy concerns are malleable—manipulable by commercial and governmental interests. Organizing our discussion by these themes, we offer observations concerning the role of public policy in the protection of privacy in the information age.

If this is the age of information, then privacy is the issue of our times. Activities that were once private or shared with the few now leave trails of data that expose our interests, traits, beliefs, and intentions. We communicate using e-mails, texts, and social media; find partners on dating sites; learn via online courses; seek responses to mundane and sensitive questions using search engines; read news and books in the cloud; navigate streets with geotracking systems; and celebrate our newborns, and mourn our dead, on social media profiles. Through these and other activities, we reveal information—both knowingly and unwittingly—to one another, to commercial entities, and to our governments. The monitoring of personal information is ubiquitous; its storage is so durable as to render one's past indelectable

decisions about information disclosing and withholding. Those holding this view tend to see regulatory protection of privacy as interfering with the fundamentally benign trajectory of information technologies and the benefits such technologies may unlock (*7*). Others are concerned about the ability of individuals to manage privacy amid increasingly complex trade-offs. Traditional tools for privacy decision-making such as choice and consent, according to this perspective, no longer provide adequate protection (*8*). Instead of individual responsibility, regulatory intervention may be needed to balance the interests of the subjects of data against the power of commercial entities and governments holding that data.

Are individuals up to the challenge of navigat-

influence by those possessing greater insight into their determinants. Although most individuals are probably unaware of the diverse influences on their concern about privacy, entities whose interests depend on information revelation by others are not. The manipulation of subtle factors that activate or suppress privacy concern can be seen in myriad realms—such as the choice of sharing defaults on social networks, or the provision of greater control on social media—which creates an illusion of safety and encourages greater sharing.

Uncertainty, context-dependence, and malleability are closely connected. Context-dependence is amplified by uncertainty. Because people are often "at sea" when it comes to the consequences of, and their feelings about, privacy, they cast around for cues to guide their behavior. Privacy preferences and behaviors are, in turn, malleable and subject to influence in large part because they are context-dependent and because those with an interest in information divulgence are able to manipulate context to their advantage.

Uncertainty

Individuals manage the boundaries between their private and public spheres in numerous ways: via separateness, reserve, or anonymity (*10*); by protecting personal information; but also through deception and dissimulation (*11*). People establish such boundaries for many reasons, including the need for intimacy and psychological respite and the desire for protection from social influence and control (*12*). Sometimes, these motivations are so visceral and primal that privacy

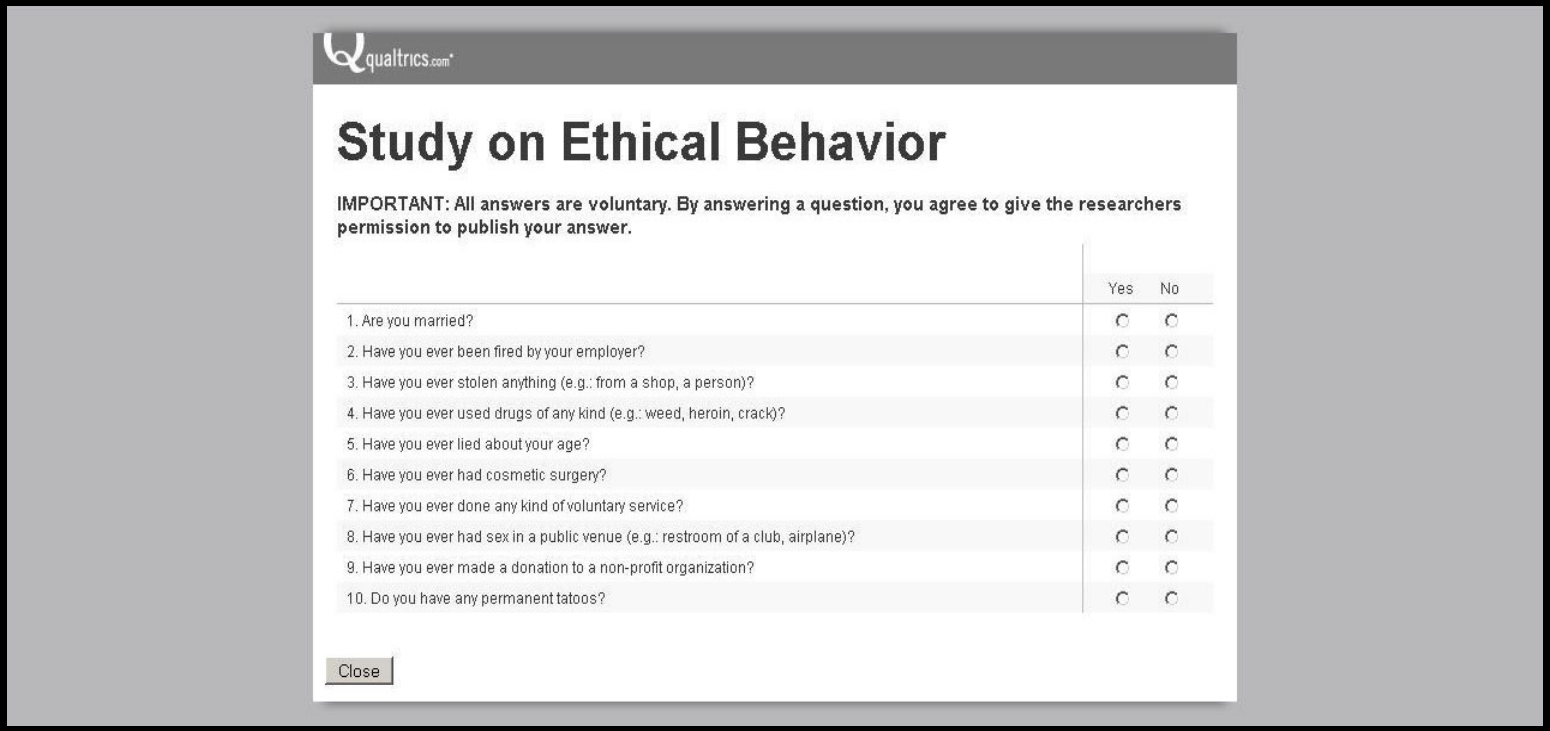
"Privacy and Human Behavior in the Age of Information," Acquisti, Brandimarte, and Loewenstein, *Science*, 2015

Control :: Privacy

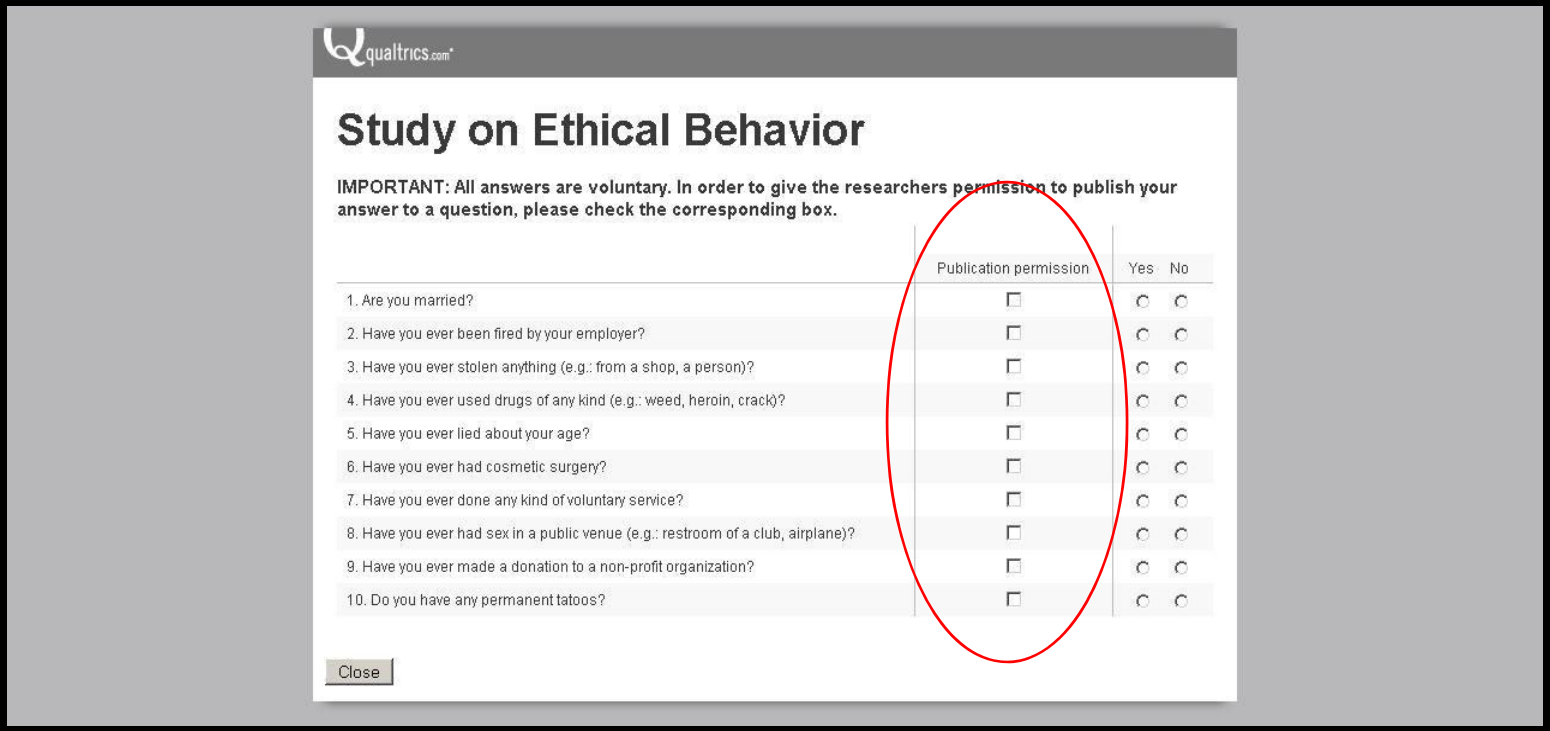
+

Control :: Privacy

-



"Misplaced Confidences: Privacy and the Control Paradox," Laura Brandimarte, Alessandro Acquisti, and George Loewenstein. *Social Psychological and Personality Science,* 2013



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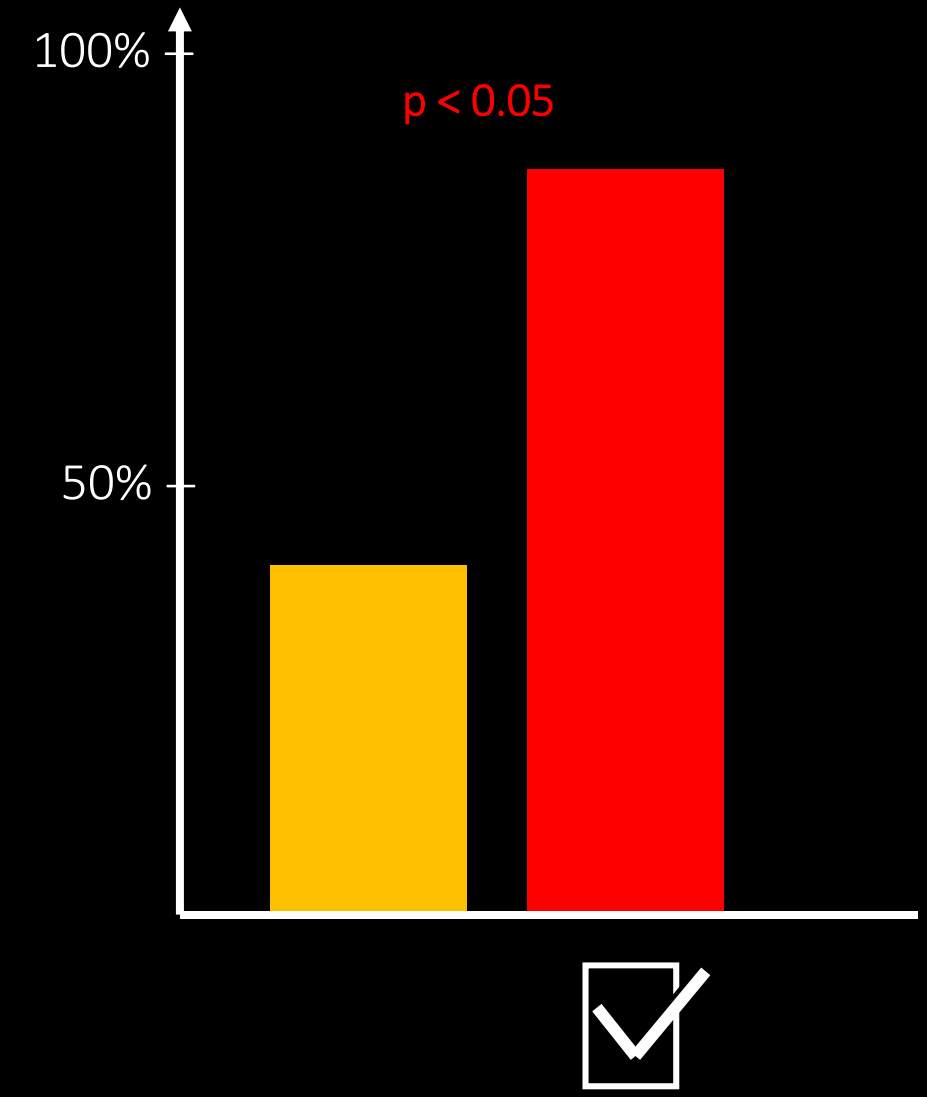
Response rates



"Misplaced confidences: Privacy and the control paradox," Laura Brandimarte, Alessandro Acquisti, and George Loewenstein. *Social Psychological and Personality Science,* 2013

Because of significant and widespread decision making hurdles, the preferred tools of market-based approaches to privacy - transparency and control - are at best necessary, but certainly not sufficient, tools for privacy protection

Privacy concerns are puzzling
for economists

Sharing personal data
is an economic win-win

Loss of privacy is the price to pay
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Market forces are able to achieve
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Can consumers make self-
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Sharing personal data is an economic win-win

Loss of privacy is the price to pay for the benefits of big data

Market forces are able to achieve desirable levels of privacy

When is privacy welfare-enhancing/decreasing?

Who benefits from the data economy?

Who bears the costs of privacy protection?

Can consumers make self-interested privacy decisions?

Agenda

1) A brief history of the economics of privacy
2) Conventional wisdoms vs. unresolved issues
3) Some partial conclusions

Some partial conclusions (1/3)

- At the micro level (individual consumer welfare), the rational, self-interested economic argument for privacy protection is clear
- At the macro level (aggregate, societal welfare), the effects are much more nuanced

Some partial conclusions (2/3)

- In fact: positive, negative, indeterminate economic effects of privacy protection all possible - depending on context
  - Effects nuanced and context dependent
  - Economics effects depend on specific type of protection (among other things)
- Still, thanks to both theoretical and empirical evidence, we should dispel the myth that privacy protection is inherently depressing welfare / innovation / growth
  - In fact, PETs *may* allow us to have the cake and eat it too

Some partial conclusions (3/3)

- Also, note what we have (deliberately) ignored in this talk:
  - Second-order, long-term ramifications of privacy choices
  - Non-economic dimensions: Privacy is also about self-expression, intimacy, civility, human dignity, autonomy, freedom, …

For more information

- Google/Bing: economics privacy
- Visit: http://www.heinz.cmu.edu/~acquisti/economics-privacy.htm
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