Design Trade-offs
in Personalization versus Privacy

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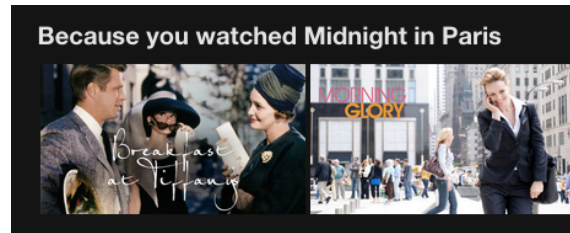
"Traditional" personalization on the World Wide Web

Category	Percent
Tailored email alerts	64%
Customized content	48%
Account access	48%
Personal productivity tools	23%
Wish lists	23%
Product recommendations	23%
Saved links	20%
Express transactions	16%
Targeted marketing/advertising	11%
Custom pricing	9%
Personalized content through non-PC devices	7%
News clipping services	5%

Hello, Kobsa, Alfred. We have DVD Recommendations for you.

Kobsa,'s Gold Box
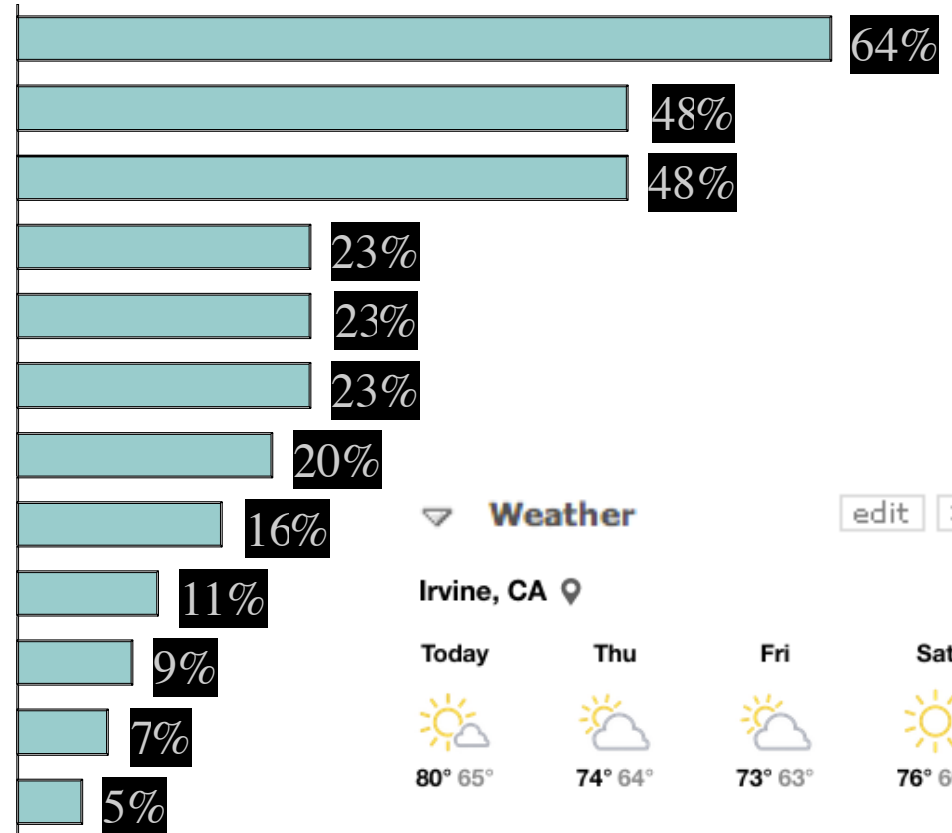
Weather   edit ✕

Irvine, CA

	Today	Thu	Fri	Sat
	80° 65°	74° 64°	73° 63°	76° 60°

Recommendations for you in Patio, Lawn & Garden

Because you watched Midnight in Paris

My Recent Quotes

Symbol	Change	Last	News	Charts
▲ GM	+0.30	31.05		
▲ AAPL	+4.23	135.30		
▲ MSFT	+0.51	28.81		
▲ $QSGDEV	+1.75	1,138.22		

Percent of 44 companies interviewed (multiple responses accepted)

Personalization delivers benefits for both users and providers

Jupiter Communications, 1998: Personalization at 25 e-commerce sites boosted the number of new customers by 47% in the first year, and revenues by 52%.

Nielsen NetRatings, 1999:
- Registered visitors to portal sites spend over 3 times longer at their home portal than other users, and view 3 to 4 times more pages at their portal
- E-commerce sites offering personalized services convert significantly more visitors into buyers than those that don't.

Choicestream 2004 - 2009:
- 80% interested in personalized content
- 60% willing to spend a least 2 minutes answering questions about themselves

Tam & Hong, 2007: Users who received personalized music recommendations downloaded twice as much music, rated it higher, and browsed less for it

Eric Schmidt, 2011: 20-30% of Amazon purchases and 60% of Netflix views are a result of personalized recommendations

Accenture, 2016: >50% are more likely to shop at a retailer in store or online that
- recognizes them by name.
- recommends options for them based on their past purchases or
- knows their purchase history.

Downside of personalization

Personalized systems collect significantly more personal data than regular systems, since the data is needed for personalization. Moreover,

- the collected data often is not used at the moment, but is rather "laid in store" for possible future personalization.
- personal data is often collected in a very inconspicuous manner, so users don't notice its collection.

- Users "agree" to this collection of personal data via blanket permissions

Privacy concerns remain very high...

BUSINESS IMPACT REMAINS HIGH

Due to privacy concerns this year

51% have not clicked an online ad

44% withheld personal info

32% not downloaded an app/product

28% stopped an online transaction
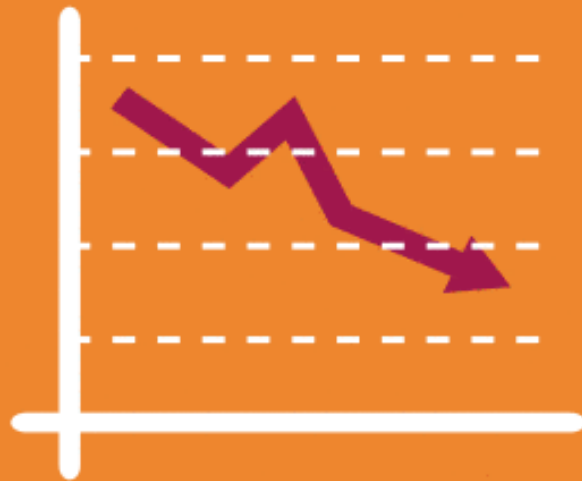
74% have limited their online activity in the last year due to privacy concerns

36% have stopped using a website

29% have stopped using an app

47% said this was because they were asked to provide too much info

Either Personalization or Privacy?

Balancing Privacy with Personalization

Privacy vs. Personalization: A Delicate Balance

- Personal data of users are indispensable for personalization
- Users are reluctant to give out personal data

☛ **Tradeoff between privacy and personalization?**

Privacy

Personalization

print this article | e-mail a colleague

Personalization Vs. Privacy Debate Heating Up

> > > ClickZ News

Reconcile personalization with privacy

1. Find technical variants of personalization methods that are more privacy-friendly (e.g., using "privacy-enabling technologies")

2. Find new forms of user interface and interaction design that
   - Increase transparency of personal data usage
   - Empower users to make informed privacy decisions

   "Privacy interventions"

   (ca. 2005)

Researching privacy interventions in the design of user interfaces and user interaction

Privacy Intervention	Analysis methods used
"Transparency and Choice": 1. Contextualized communication of privacy practices 2. User control over personalization methods	3 control/treatment comparisons
Different personalization provider characteristics	Structural equation modeling Elaboration likelihood model
Different justifications for data disclosure	Linear regression
Different autofill paradigms	Structural equation modeling

Current communication of privacy practices

Get to Know Us
Careers
Investor Relations
Press Releases
Amazon and Our Planet
Amazon in the Community
Amazon Devices

Make Money with Us
Sell on Amazon
Sell Your Services on Amazon
Sell Your Apps on Amazon
Become an Affiliate
Advertise Your Products
Self-Publish with Us
› See all

Amazon Payment Products
Amazon.com Rewards Visa Card
Amazon.com Store Card
Amazon.com Corporate Credit Line
Shop with Points
Credit Card Marketplace
Amazon Currency Converter

Let Us Help You
Your Account
Shipping Rates & Policies
Amazon Prime
Returns & Replacements
Manage Your Content and Devices
Help

amazon.com

Australia Brazil Canada China France Germany India Italy Japan Mexico Netherlands Spain United Kingdom

6pm
Score deals
on fashion brands

AbeBooks
Rare Books
& Textbooks

ACX
Audiobook Publishing
Made Easy

AfterSchool.com
Kids' Sports, Outdoor
& Dance Gear

Alexa
Actionable Analytics
for the Web

AmazonFresh
Groceries & More
Right To Your Door

Amazon Local
Great Local Deals
in Your City

AmazonSupply
Business, Industrial
& Scientific Supplies

Amazon Web Services
Scalable Cloud
Computing Services

Audible
Download
Audio Books

BeautyBar.com
Prestige Beauty
Delivered

Book Depository
Books With Free
Delivery Worldwide

Bookworm.com
Books For Children
Of All Ages

Casa.com
Kitchen, Storage
& Everything Home

ComiXology
Thousands of
Digital Comics

CreateSpace
Indie Print Publishing
Made Easy

Diapers.com
Everything
But The Baby

DPReview
Digital
Photography

East Dane
Designer Men's
Fashion

Fabric
Sewing, Quilting
& Knitting

Goodreads
Book reviews
& recommendations

IMDb
Movies, TV
& Celebrities

Junglee.com
Shop Online
in India

Kindle Direct Publishing
Indie Digital Publishing
Made Easy

Look.com
Kids' Clothing
& Shoes

MYHABIT
Private Fashion
Designer Sales

Shopbop
Designer
Fashion Brands

Soap.com
Health, Beauty &
Home Essentials

TenMarks.com
Math Activities
for Kids & Schools

Vine.com
Everything
to Live Life Green

Wag.com
Everything
For Your Pet

Warehouse Deals
Open-Box
Discounts

Woot!
Discounts and
Shenanigans

Yoyo.com
A Happy Place
To Shop For Toys

Zappos
Shoes &
Clothing

Conditions of Use   Privacy Notice   Interest-Based Ads   © 1996-2015, Amazon.com, Inc. or its affiliates

Current communication of privacy practices

Help & Customer Service

Amazon.com Privacy Notice

Search Help   Go

‹ All Help Topics

Security & Privacy

E-mails from Amazon.com

Supply Chain Standards

Amazon.com Privacy Notice

Conditions of Use

Choose a Strong Password

Protect Your System

Public PGP Key

Report a Security Issue

Your Amazon.com Bill of Rights

Supported Browsers

Quick Solutions

Track or Manage Purchases

Manage Payment Options

Return or replace items

Change Name, E-mail, or
    Password

Manage Address Book

Manage Your Content and
    Devices

Last updated: March 3, 2014. To see what has changed, click here.

Amazon.com knows that you care how information about you is used and shared, and we appreciate your trust that we will do so carefully and sensibly. This notice describes our privacy policy. **By visiting Amazon.com, you are accepting the practices described in this Privacy Notice.**

- What Personal Information About Customers Does Amazon.com Gather?
- What About Cookies?
- Does Amazon.com Share the Information It Receives?
- How Secure Is Information About Me?
- What About Third-Party Advertisers and Links to Other Websites?
- Which Information Can I Access?
- What Choices Do I Have?
- Are Children Allowed to Use Amazon.com?
- Does Amazon.com Participate in the Safe Harbor Program?
- Conditions of Use, Notices, and Revisions
- Examples of Information Collected

What Personal Information About Customers Does Amazon.com Gather?

The information we learn from customers helps us personalize and continually improve your Amazon experience. Here are the types of information we gather.

- **Information You Give Us:** We receive and store any information you enter on our Web site or give

Our counterproposal: A design pattern for personalized websites that collect user data

Design patterns constitute descriptions of best practices based on research and application experience. They give designers guidelines for the efficient and effective design of user interfaces.

Every personalized site that collects user data should include the following elements on every page:

1. ***Traditional Link* to Global Communication of Privacy Practices**
   - Still necessary for legal reasons

2. **Contextualized Local Communication of Privacy Practices and Personalization Benefits**
   - Break long privacy policies into small, understandable pieces
   - Relate them specifically to the current context
   - Explain privacy practices as well as personalization benefits
   - Preferably for each entry field for personal information

An example webpage based on the proposed design pattern

Traditional link to a privacy statement

VIEW BASKET | WISH LIST | YOUR ACCOUNT | HELP

BOOKS | ELECTRONICS & PHOTO | MUSIC | DVD | VIDEO | SOFTWARE | PC & VIDEO GAMES

YOUR SELECTION

You currently have a choice of **1,000,000** books.

MORE TO EXPLORE

Privacy
We protect your personal data

Personalization
We want to give you a personal service

Our Security Guarantee
Your security ranks first

Associates
Earn money from your web site

Amazon Web Services
Build websites, applications or tools using Amazon Web Services.

Payments
Payment options with Amazon

Sell now!
Offer items for sale. Free, fast and easy!

Gift services
Have even more fun making presents

Review raffle
The first reviewer may be a winner!

Amazon.de mobile
Shop while on the go with your cell phone

You currently have a choice of 1,000,000 books. We can better tailor the selection to your needs if we receive additional information.

We would like to use cookies to record the order in which you visit our web pages (clickstream). Do you agree with this?

○ Yes
○ No
○ No answer

Explanation of personalization benefits

What are your benefits?
We would like to give you an even more satisfying experience, which is optimized for your screen and your browser. If you choose not to accept cookies, you will not be able to use such important options as 1-Click® shopping and "New for You".

What happens with your data?
Your personal data will remain anonymous. If you agree to accept cookies, we will be able to improve our site and to better present our products and services. We are also interested in recuring navigation patterns. You can always change your decision to accept cookies.

Please enter your favorite author or book title:

[   ]

☐ No answer

Explanation of privacy practices

What are your benefits?
When selecting books for you we take your favorite authors into account as well as other suitable books.

What happens with your data?
These data will be stored under a pseudonym, and then aggregated and analyzed. The contents of our web pages will be adapted to you. Your data will not be shared with others.

When buying a book, do you pay more attention to the text on the back cover or to the name of the author?

○ Text on the back cover (short description)
○ Author
○ No answer

Controlled behavioral experiment to validate the merits of our design proposal

Why a controlled experiment?

– In the area of privacy, stated attitudes (e.g., stated privacy concern) and stated behavioral intent do not predict actual privacy behaviors very well.

– Our study therefore focused on users' actual privacy-related behaviors, but also polled participants' privacy-related attitudes.

Experimental Procedures

1. Instructions to subjects

- "Testing experimental new version of a well-known online bookstore"
- Answering questions to allegedly obtain better book recommendations
- No obligation to answer any question, but helpful for better recommendation.
- Data that subjects entered would purportedly be available to company
- Possibility to buy one of the recommended books with a 70% discount.

2. Answering interest questions in order to "filter the selection set" (*pseudonymous*)

- 32 questions with 86/64 answer options become presented (some free-text)
- Most questions were about users' interests (a very few were fairly sensitive)
- All "make sense" in the context of filtering books that are interesting for readers
- Answering questions decreased the "selection counter" in a systematic manner
- After nine pages of data entry, users are encouraged to review their entries.

Experimental Procedures (cont'd)

3. "Recommendation" of 50 books (pseudonymous)

- 50 predetermined books are displayed (popular fiction, politics, travel, sex and health advisories)
- Selected based on their low price and their presumable attractiveness for students
- Prices of all books are visibly marked down by 70%, resulting in out-of-pocket expenses between €2 and €12 for a book purchase.
- Extensive information on every book available

4. Purchase of one book (identified)

- Subjects may purchase one book if they wish
- Those who do are asked for their names, shipping and payment data (bank account or credit card charge).

5. Completing questionnaires

6. Verification of name, address and bank data (if book purchased)

Baseline version with no contextual explanations

Links to original privacy state-
ment (split into privacy, security
and personalization notice)

"Selection counter"

amazon.de

🛒 | WUNSCHZETTEL | MEIN KONTO | HILFE

BÜCHER | ELEKTRONIK & FOTO | KÜCHE & HAUSHALT | MUSIK | DVD | VIDEO | SOFTWARE | COMPUTER & VIDEOSPIELE

Ihre Auswahl

Sie haben momentan
eine Auswahl von
1000000 Büchern.

ENTDECKEN

Datenschutz
Ihre persönlichen Daten sind
bei uns geschützt

Personalisierung
Wir möchten Ihnen einen
persönlichen Service bieten

Sicherheitsgarantie
Ihre Sicherheit steht bei uns
an erster Stelle

Partnerprogramm
Geld verdienen mit Ihrer
Website

Amazon Web Services
Erstellen Sie Websites,
Applikationen oder Tools mit
Amazon Web Services

Kaufen & Zahlen
Zahlungsmöglichkeiten bei
Amazon.de

Sie haben zur Zeit eine Auswahl von 1000000 Büchern. Mit weiteren Informationen können wir die Auswahl der
Bücher noch besser an Ihre Bedürfnisse anpassen.

**Wir möchten gerne Cookies zur Aufzeichnung der Reihenfolge Ihres Aufrufs unserer
Internetseiten (Clickstream) speichern. Sind Sie damit einverstanden?**

○ ja
○ nein
○ keine Angabe

Geben Sie bitte Ihren Lieblingsautor oder -buchtitel ein:

[   ]

☐ keine Angabe

**Worauf achten Sie beim Buchkauf mehr: Angaben auf dem Buchrücken oder Name des
Autors?**

○ Angaben auf dem Buchrücken (Kurzbeschreibung)
○ Autor
○ keine Angabe

(zurück) (weiter)

Treatment version with contextualized explanations

Links to original privacy state-ment (split into privacy, security and personalization notice)

"Selection counter"

amazon.de

WUNSCHZETTEL | MEIN KONTO | HILFE

BÜCHER | ELEKTRONIK & FOTO | KÜCHE & HAUSHALT | MUSIK | DVD | VIDEO | SOFTWARE | COMPUTER & VIDEOSPIELE

Ihre Auswahl

Sie haben momentan eine Auswahl von **1000000** Büchern.

Sie haben zur Zeit eine Auswahl von 1000000 Büchern. Mit weiteren Informationen können wir die Auswahl der Bücher noch besser an Ihre Bedürfnisse anpassen.

ENTDECKEN

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Ihre persönlichen Daten sind bei uns geschützt

Personalisierung
Wir möchten Ihnen einen persönlichen Service bieten

Sicherheitsgarantie
Ihre Sicherheit steht bei uns an erster Stelle

Partnerprogramm
Geld verdienen mit Ihrer Website

Amazon Web Services
Erstellen Sie Websites, Applikationen oder Tools mit Amazon Web Services

Kaufen & Zahlen
Zahlungsmöglichkeiten bei Amazon.de

Jetzt verkaufen!
Kostenlos Artikel zum Verkauf anbieten. Schnell und einfach!

Geschenkservice
So macht Schenken noch mehr Spaß

Rezensions-Gewinnspiel
Wer zuerst schreibt, gewinnt!

Wir möchten gerne Cookies zur Aufzeichnung der Reihenfolge Ihres Aufrufs unserer Internetseiten (Clickstream) speichern. Sind Sie damit einverstanden?

○ ja
○ nein
○ keine Angabe

Welchen Nutzen haben Sie davon?
Wir wollen Ihnen in Zukunft einen noch besseren Onlineauftritt bieten, der optimiert ist für ihren Bildschirm und für Ihren Browser. Wenn Sie keine Cookies verwenden, sind Sie nicht in der Lage, so wichtige Features wie 1-Click®-Kaufen und "Neu für Sie" zu nutzen.

Was geschieht mit den Daten?
Ihre persönlichen Informationen verbleiben anonym. Ihr Einverständnis, Cookies zu akzeptieren, ermöglicht uns, unsere Site zu verbessern und Produkte und Dienstleistungen besser zu präsentieren. Weiterhin sind wir daran interessiert, Ihr wiederholtes Navigationsverhalten zu analysieren. Sie können Ihre Entscheidung, Cookies zu akzeptieren, jederzeit revidieren.

Contextualized short description of relevant personalization benefits (derived from original privacy statement)

Geben Sie bitte Ihren Lieblingsautor oder -buchtitel ein:

☐ keine Angabe

Contextualized short description of relevant privacy practices (taken from original privacy statement)

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Wir berücksichtigen bei der Auswahl Ihren Lieblingsautoren und weitere, passende Bücher.

Was geschieht mit den Daten?
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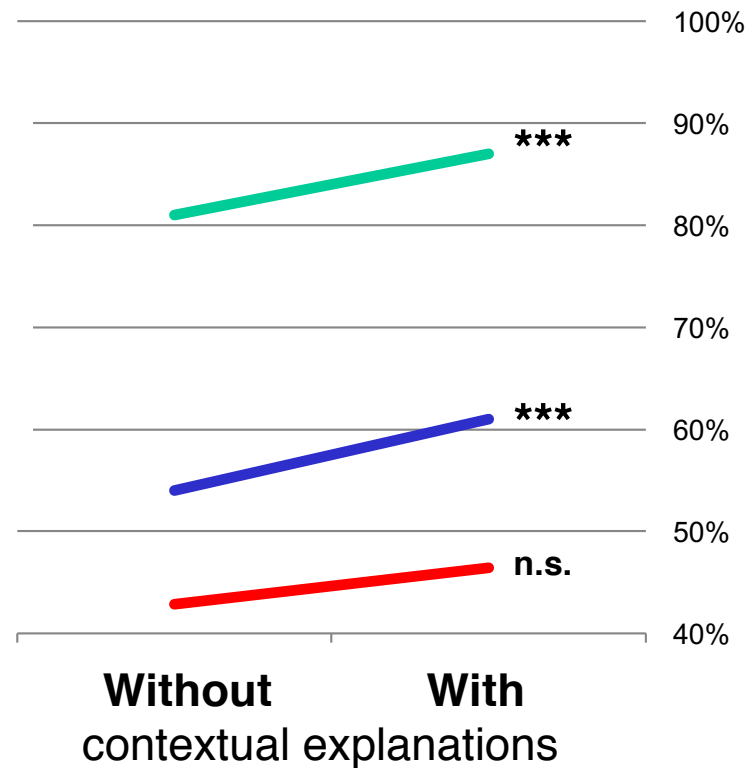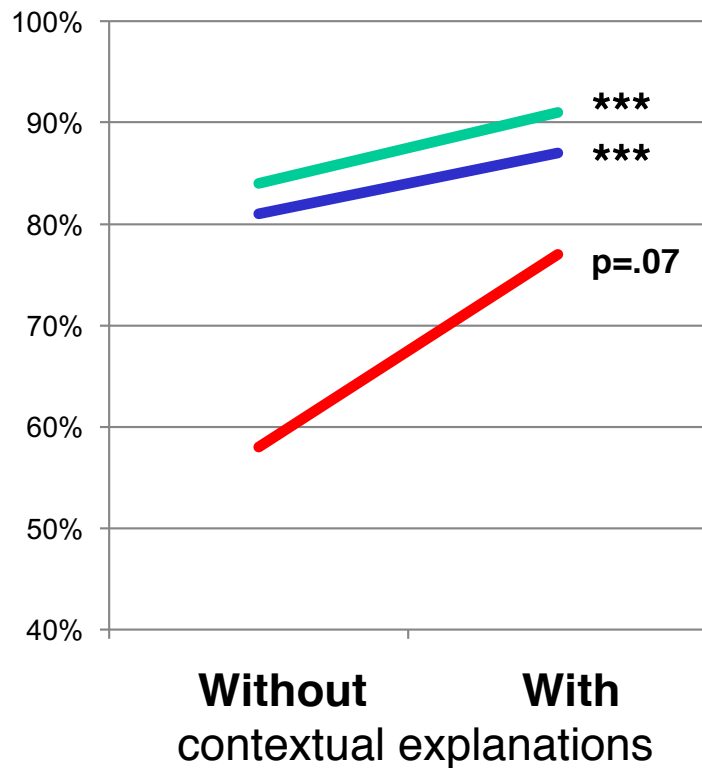○ Angaben auf dem Buchrücken (Kurzbeschreibung)
○ Autor

Search [_____] [All Products ▼] [Go!]

BOOK CHOICES

You currently have a choice of **1,000,000** books.

BROWSE

Data Protection
Your personal data is protected by us

Personalization
We want to offer you a personalized service

Security
Your security is our top priority

Affiliation
Earn money with your website

Buy & Figures
Payment by Amazon.com

Gift Services
This makes gifts even more fun!

Reviews
Write reviews to win exciting prizes!

Amazon.com on

QUICK TIP
You can change your privacy preferences anytime in the privacy control panel on the right-hand side.

1.) Please enter a login name (your name or a pseudonym)

○ Login name: [_____]
○ No answer

2.) How old are you?

○ 18-20
○ 21-25
○ 26-30
○ 31-35
○ 36-40
○ 41-50
○ 51-60
○ >60
○ No answer

3.) What is your occupation / degree program?

○ Occupation / degree program: [_____]
○ No answer

4.) What are your hobbies? (Check all that apply.)

☐ Sport
☐ Music
☐ Model making
☐ Computers

PRIVACY CONTROL

Your privacy preferences determine how we personalize book selections for you

1. Your Privacy Preferences

Check any item that you allow:
☐ Use your data for other purposes ⓘ
☐ Keep your usage data longer ⓘ
☑ Track what you do on our site ⓘ
☐ Use your location data ⓘ
☐ Merge your usage and identity data ⓘ

2. How do we personalize then?

Legend: ✔ use, ✖ not use

✖ Clustering ⓘ
✔ Rule-based reasoning I ⓘ
✖ Rule-based reasoning II ⓘ
✔ Incremental learning ⓘ
✖ One-time learning I ⓘ
✖ One-time learning II ⓘ

Different privacy interventions, similar results

Will **any permanently visible** privacy-friendly inter-vention on this website achieve the same effect?

Will **any permanently visible** privacy-friendly inter-vention on this website achieve the same effect?

amazon.de

BÜCHER | ELEKTRONIK & FOTO | KÜCHE & HAUSHALT | MUSIK | DVD | VIDEO | SOFTWARE | COMPUTER & VIDEOSPIELE

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Rezensions-Gewinnspiel
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○ keine Angabe

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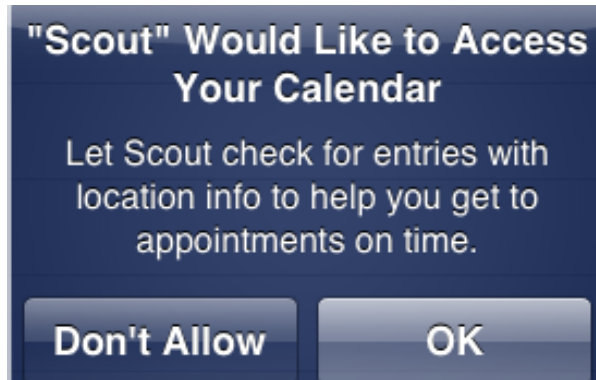
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○ Angaben auf dem Buchrücken (Kurzbeschreibung)
○ Autor

Was it the content that triggered subjects' behaviors, or superficial "privacy cues"?

"Scout" Would Like to Access Your Calendar

Let Scout check for entries with location info to help you get to appointments on time.

Don't Allow   OK

Tan et al. (CHI 2014): Participants granted permissions 12% more often when purpose was displayed, *independent of its content.*

Request	Agree rate
"Excuse me, I have 5 pages. May I use the Xerox machine?"	60%
+ "...because I am in a hurry"	94%
+ "...because I need to make copies"	93%

(Langer et al., 1972)

Study with different fictitious personalization providers

Instructions to subjects:

Download and test an Android app that analyzes what users do on their smartphones and gives personalized recommendations.
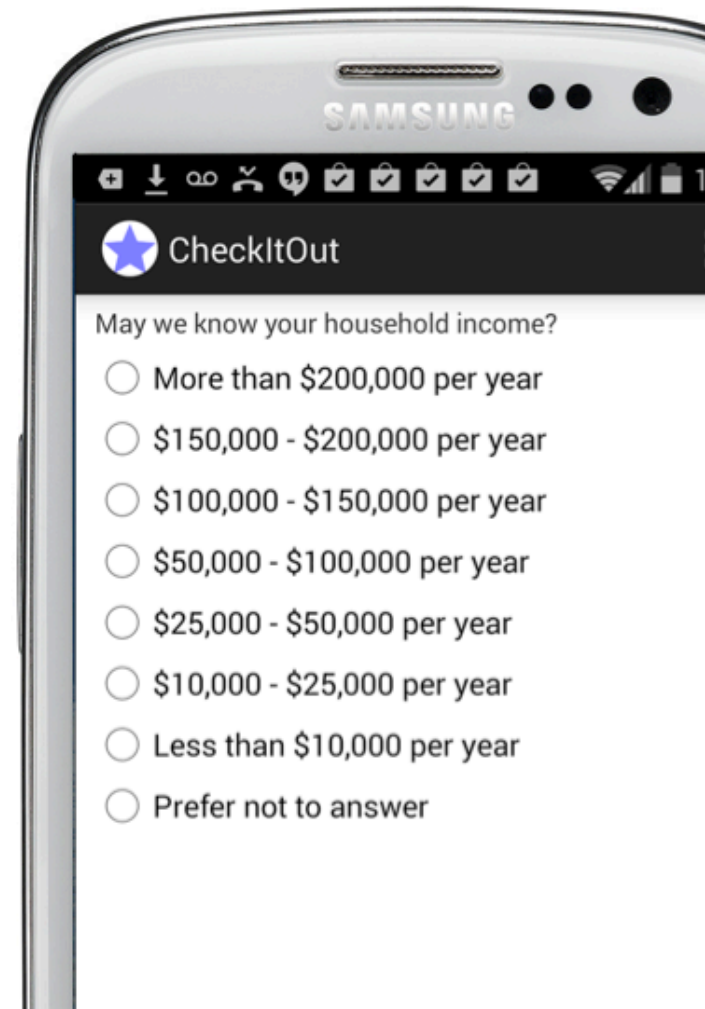
Four conditions:

- **Client-side Personalization**: "all data will be kept on your smartphone, and not be shared with anyone else."

- **3 "server-side" conditions**: "all data will be sent to Amazon / American Personalization / the Cloud, and not be shared with anyone else."

Extensive instruction and comprehension tests regarding the personalization services and the location of data storage.

Seq. #	Item	Disclosure
	Demographics data	
1	Phone data plan	94.9%
3	Household composition	87.4%
5	Field of work	91.5%
7	Housing situation	85.9%
9	Relationship status	93.6%
11	Children	90.0%
13	Household income	80.8%
15	Household savings	66.7%
17	Household debt	68.5%
19	Race	93.1%
21	Political preferences	82.8%
23	Workout routine	85.1%

	Context data	
2	Recommendation browsing	79.5%
4	Location	50.5%
6	App usage	72.8%
8	App usage location	56.2%
10	App usage time	70.5%
12	Web browsing	56.9%
14	Calendar data	49.7%
16	E-mail messages	16.4%
18	Phone model	83.3%
20	Accelerometer data	58.2%
22	Microphone	17.9%
24	Credit card purchases	0.0%

CheckItOut

May we know your household income?

○ More than $200,000 per year
○ $150,000 - $200,000 per year
○ $100,000 - $150,000 per year
○ $50,000 - $100,000 per year
○ $25,000 - $50,000 per year
○ $10,000 - $25,000 per year
○ Less than $10,000 per year
○ Prefer not to answer

Main attitudinal constructs
(items based on prior studies)

Subjective construct	Items	Factor loading
Self-anticipated satisfaction with Check-it-Out (SAT) Alpha: 0.92 AVE: 0.751	Check-it-Out is useful	0.898
	Using Check-it-Out makes me happy	0.885
	Using Check-it-Out is annoying	−0.703
	Overall, I am satisfied with Check-it-Out	0.925
	I would recommend Check-it-Out to others	0.903
System-specific privacy concern (SPC) Alpha: 0.76 AVE: 0.660	Check-it-Out has too much information about me	0.756
	I find the questions intrusive that Check-it-Out asks me	0.847
Perceived privacy protection (PPP) Alpha: 0.95 AVE: 0.887	I feel my personal data is safe [on my smartphone / at American Personalization / at Amazon / in the Cloud].	0.917
	I feel [my smartphone / American Personalization / Amazon / the Cloud] will not share my personal data with anyone.	0.954
	I feel my interests will be protected when my personal data is [on my smartphone / with American Personalization / with Amazon / in the Cloud].	0.953

Causal pathways on behavior cancel each other out
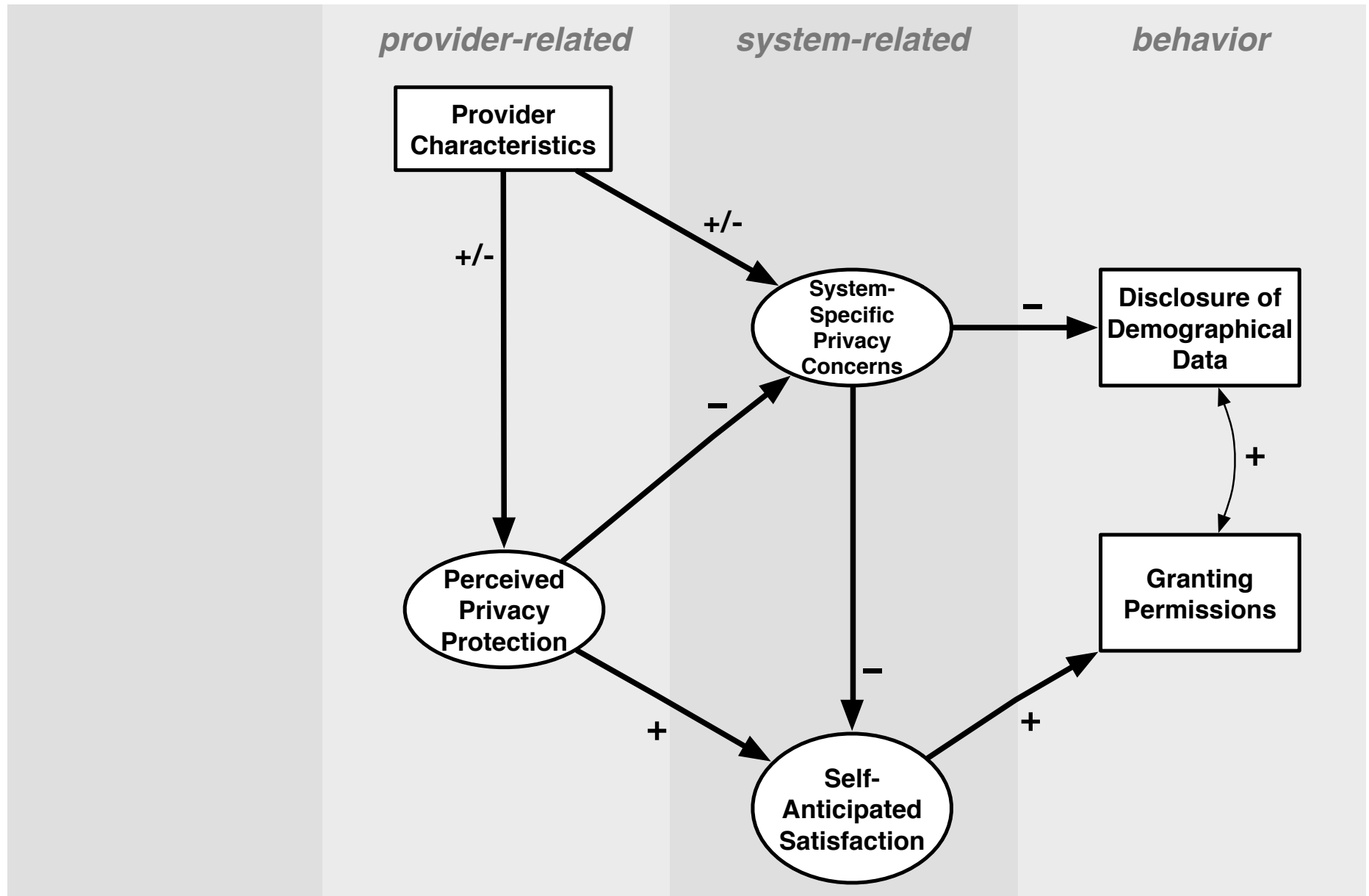
Elaboration Likelihood Model (Petty & Cacioppo)
How are persuasive messages processed?

Central route

- Triggers higher levels of thought ("elaboration")

- Taken under conditions of high involvement (motivation, knowledge, ability, time)

Peripheral route

- Decisions made "thoughtlessly", based on "superficial" cues (source attractiveness, colors, music, humor)

- Taken under conditions of low involvement
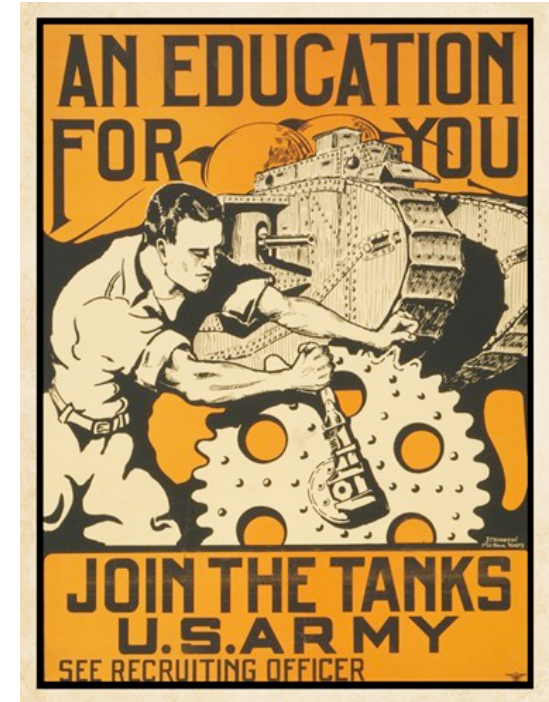
Privacy-related personality traits may influence processing route

General privacy concern (which affects motivation)

- **high** privacy concern: central route
- **low** privacy concern: peripheral route

Privacy-related self-efficacy (which affects ability)

- **high** self-efficacy: central route
- **low** self-efficacy: peripheral route

☞ Study subjects with high/low general privacy concern and high/low privacy-related self-efficacy

Personality traits have some direct effects
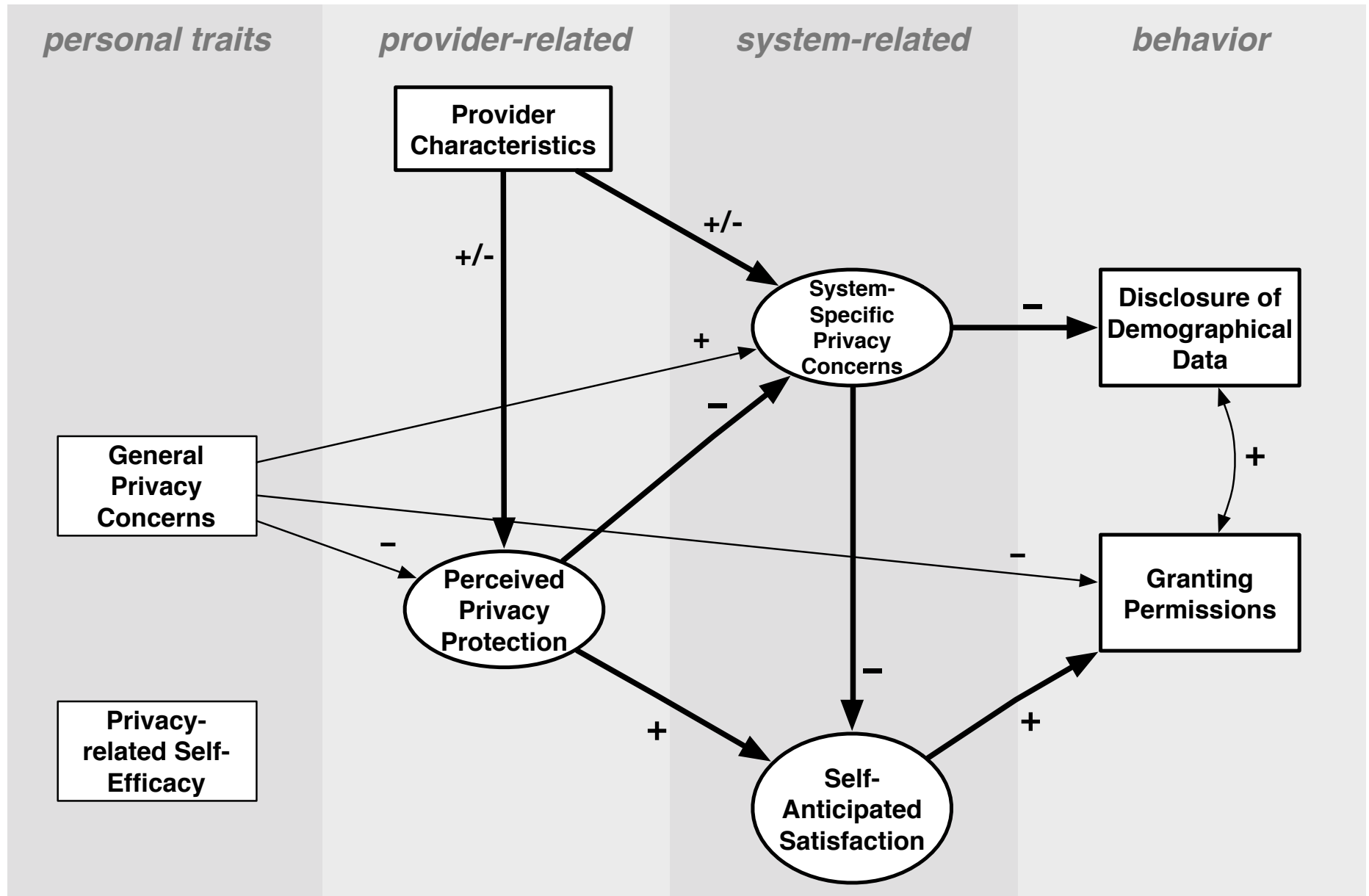
personal traits *provider-related* *system-related* *behavior*
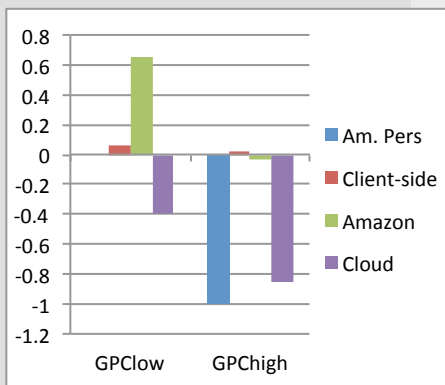
Provider Characteristics

+/-

+/-

System-Specific Privacy Concerns

−

Disclosure of Demographical Data

+

−

General Privacy Concerns

−

Perceived Privacy Protection

−

+

Granting Permissions

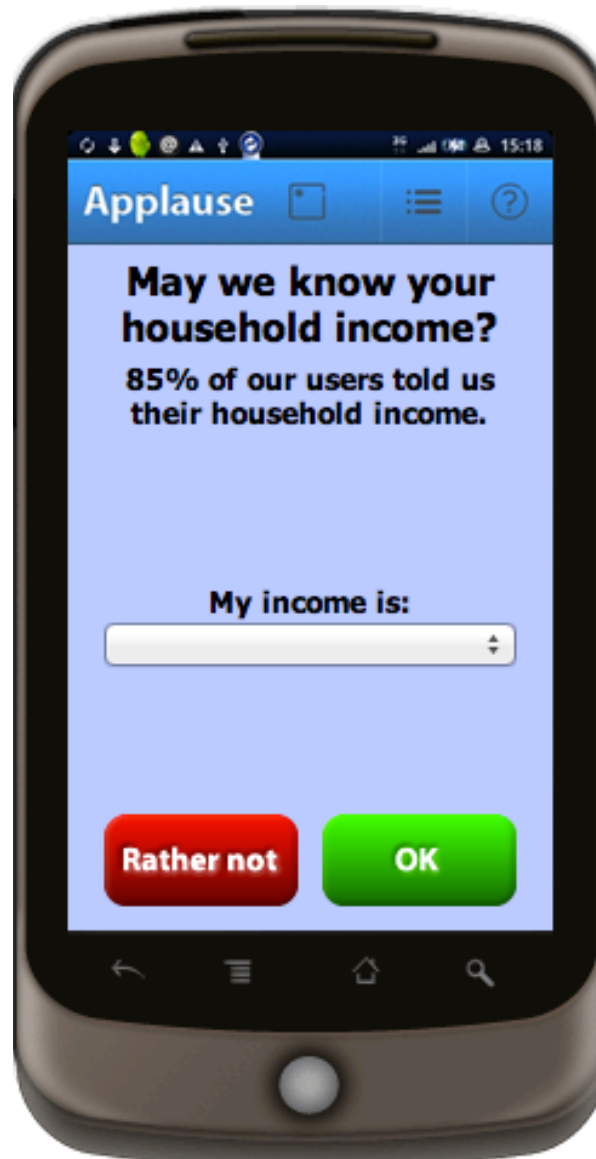Privacy-related Self-Efficacy

+

−

+

Self-Anticipated Satisfaction
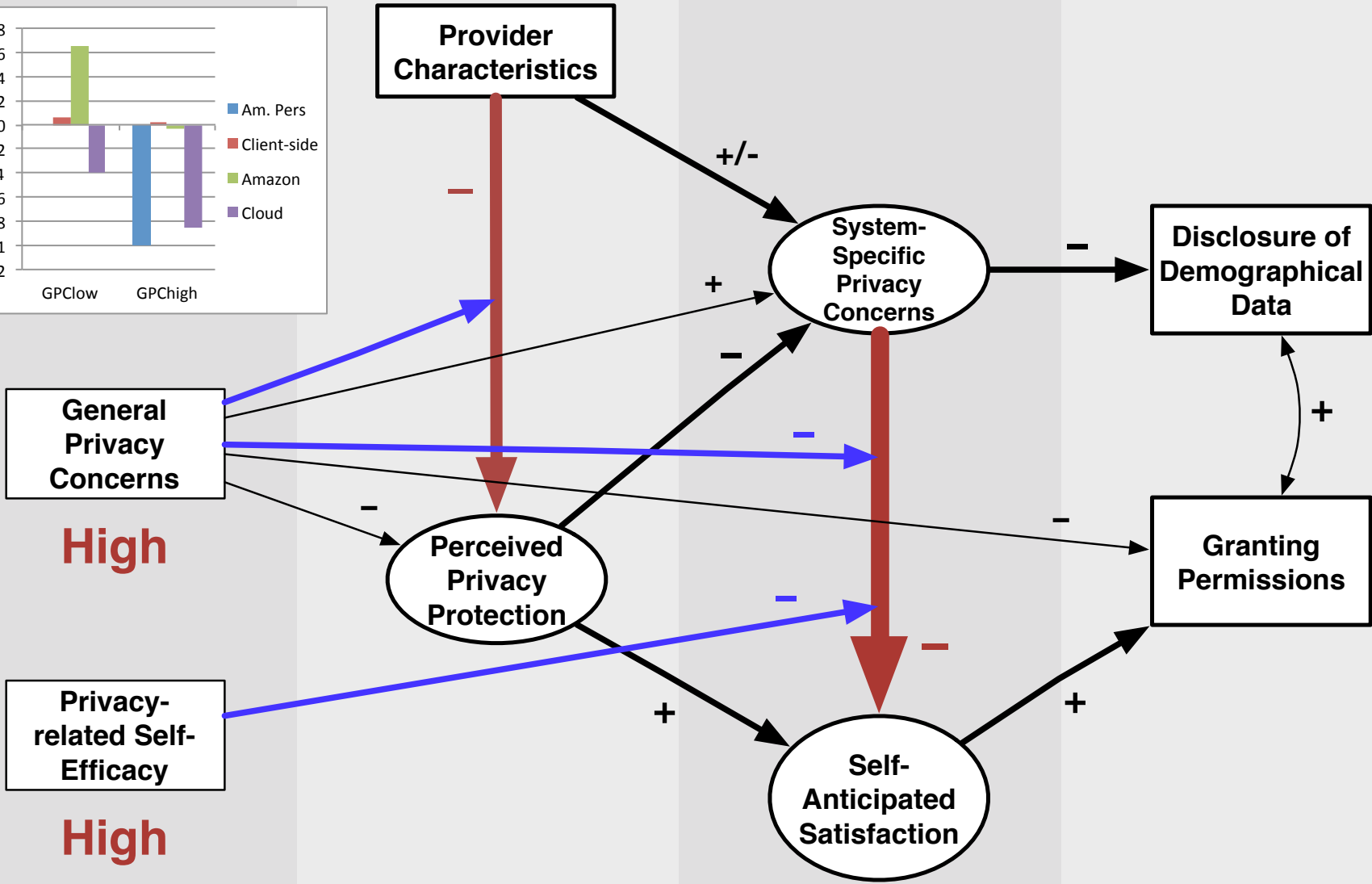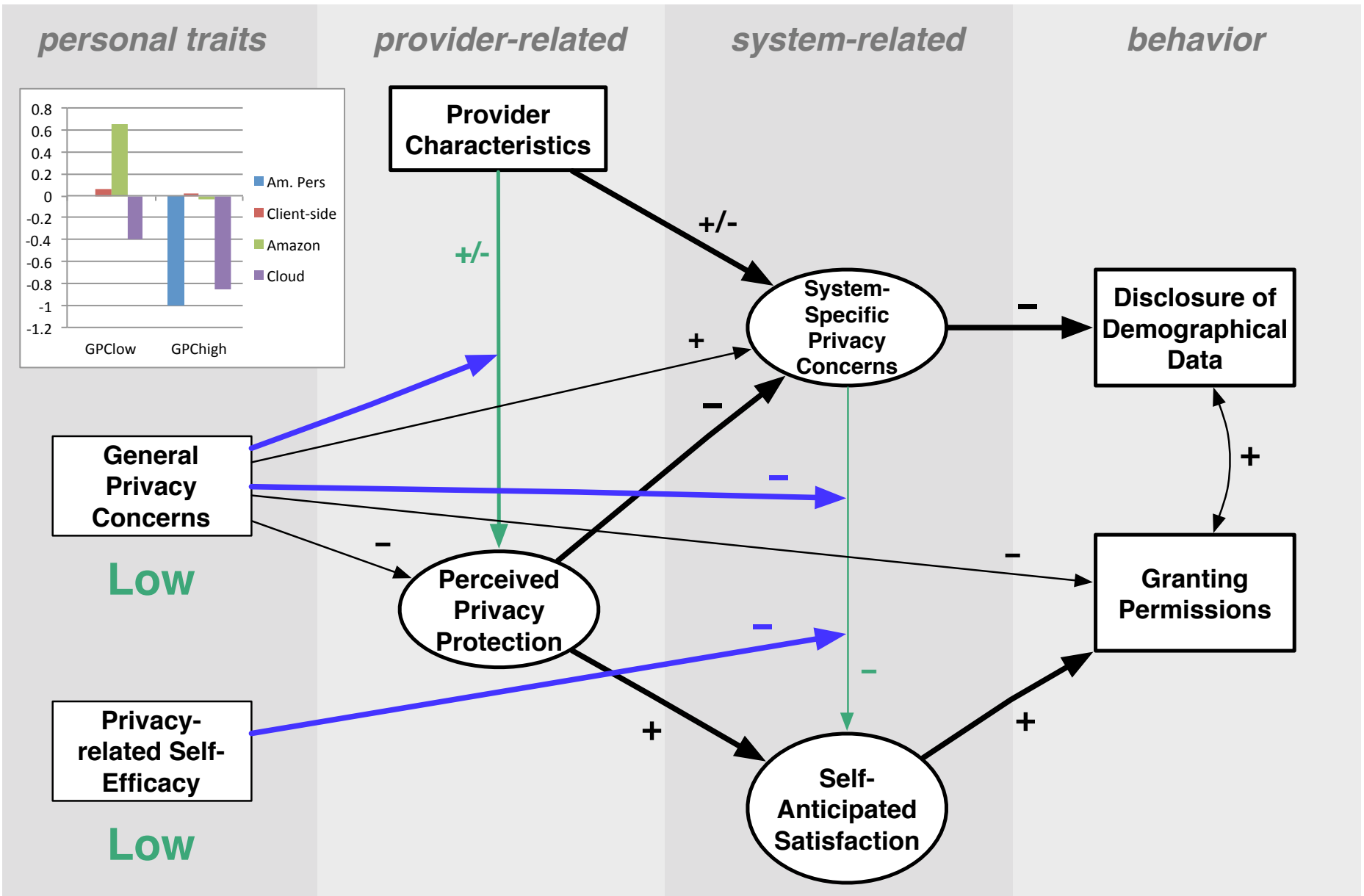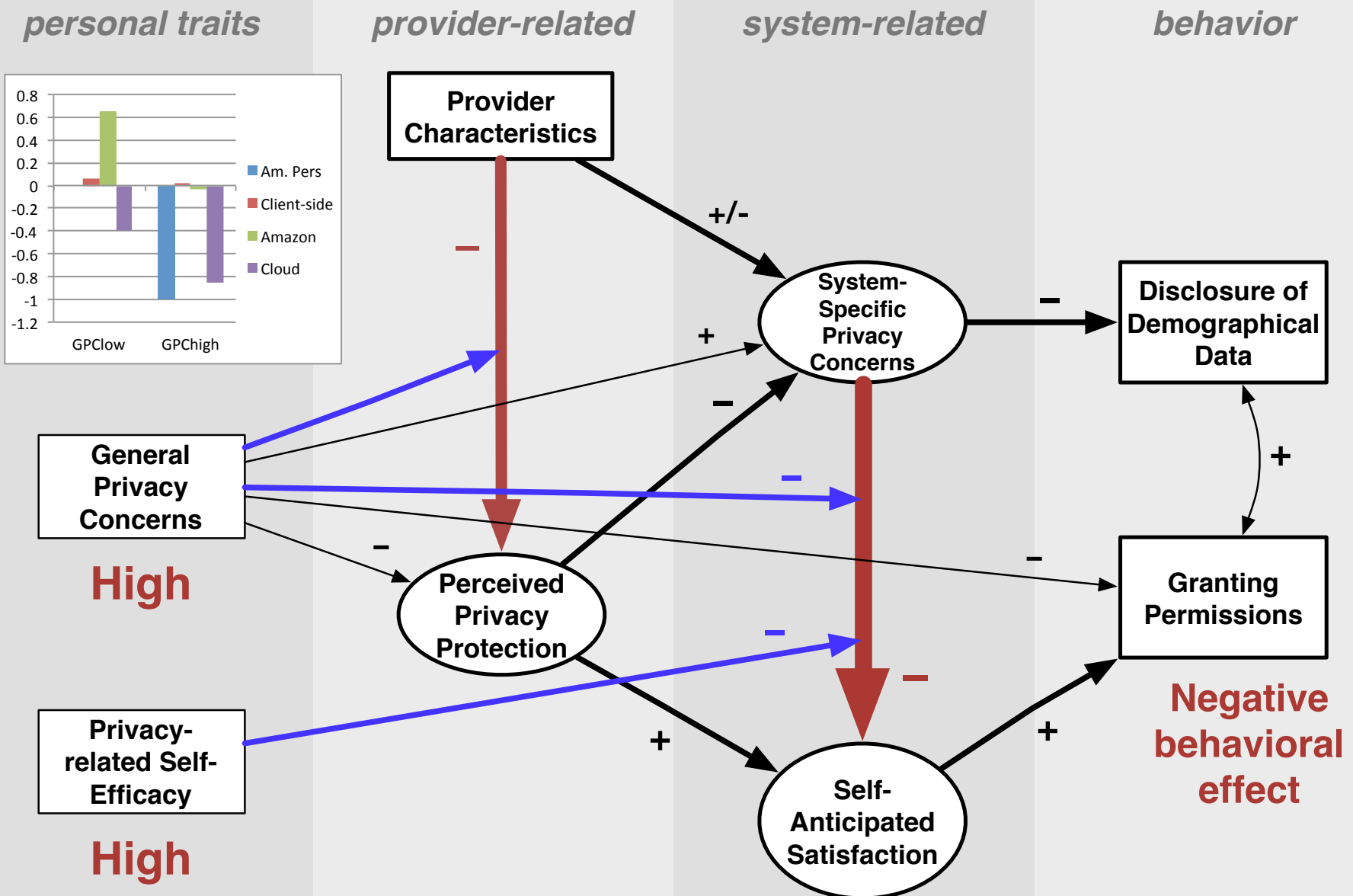
Studying the effect of justifications on data disclosure
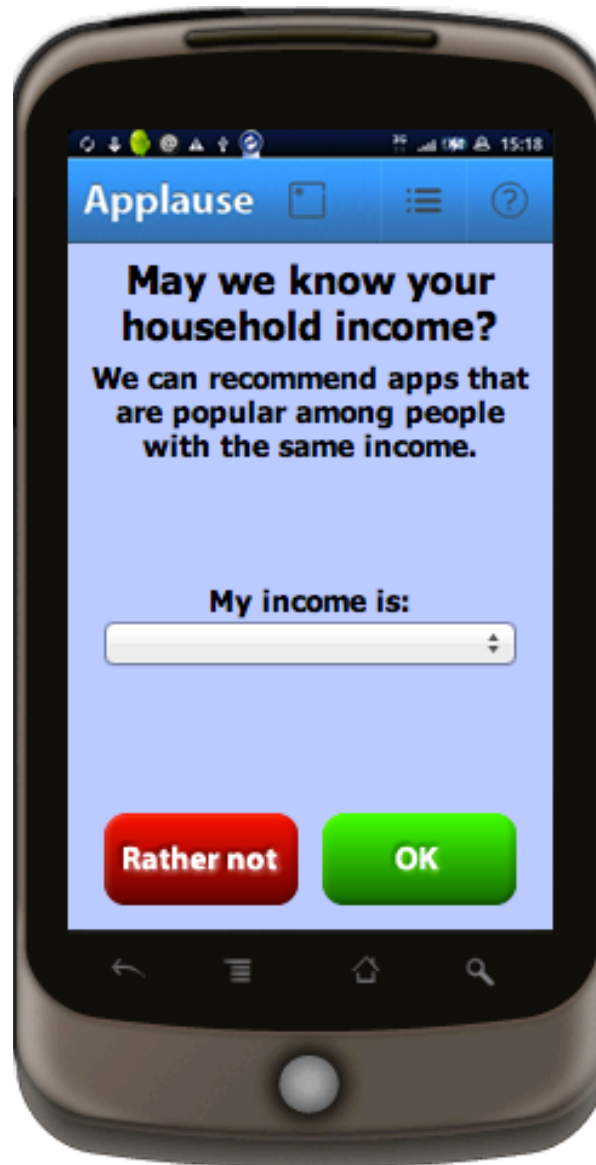
No justification
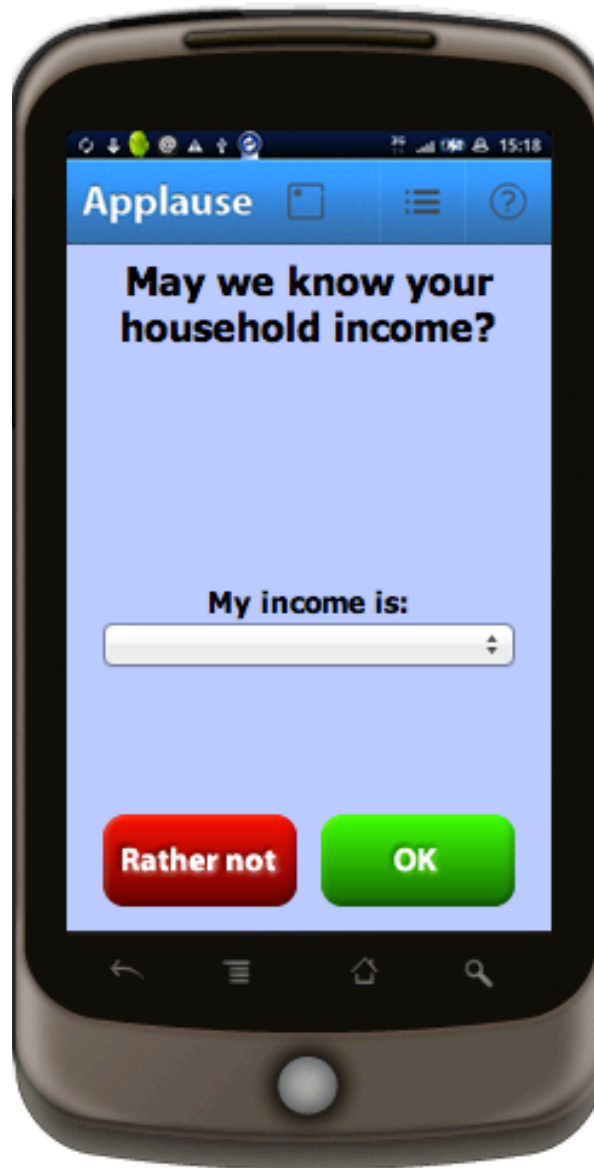
Disclosure request – Social cues
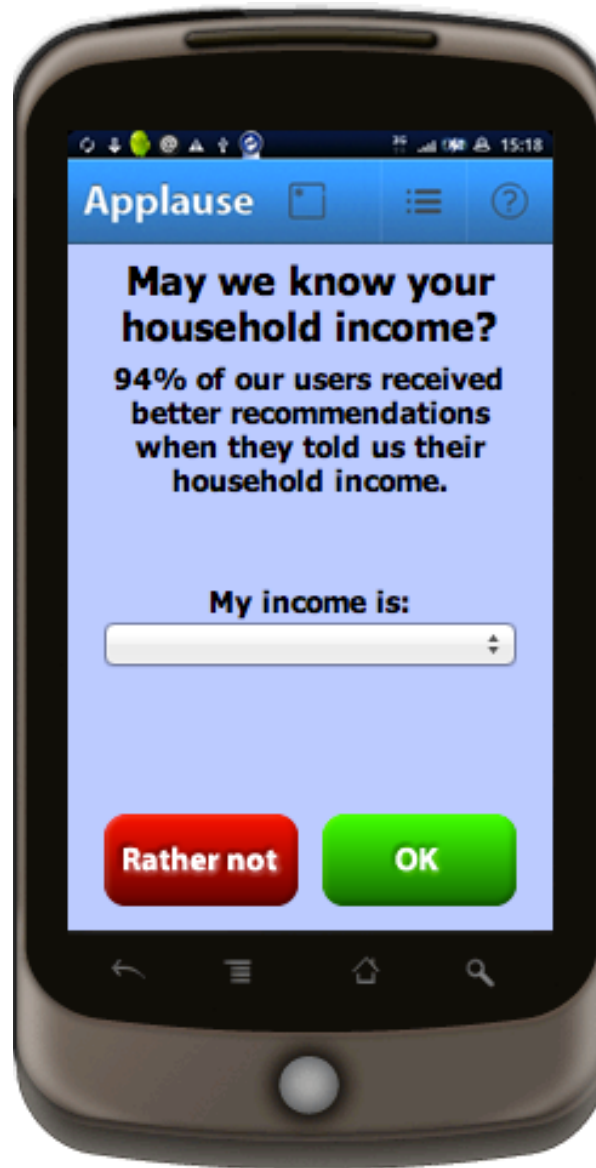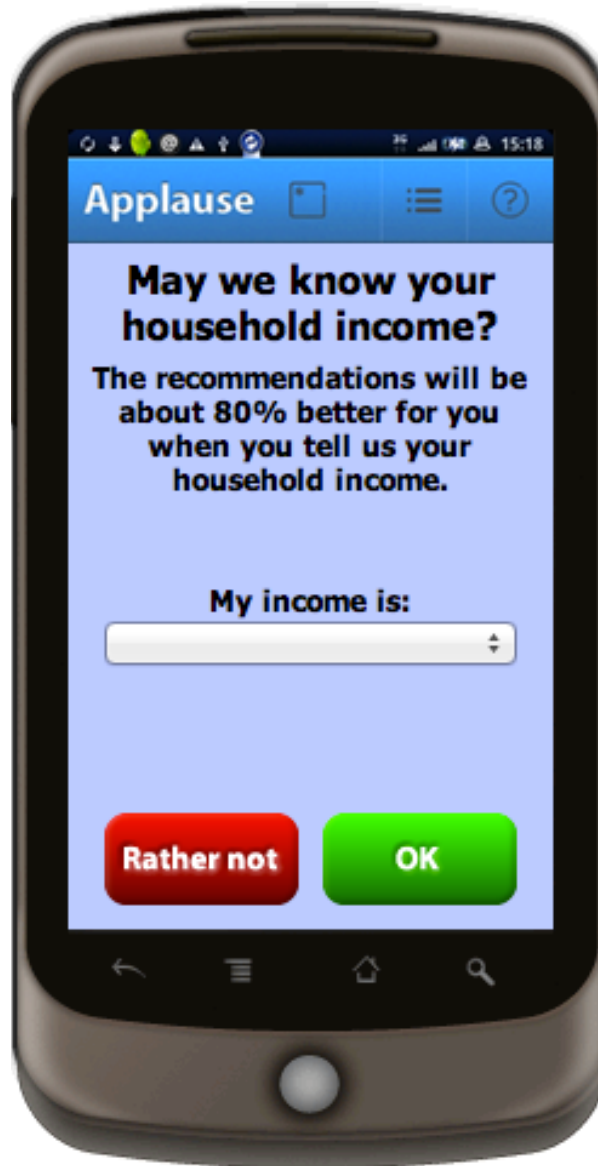
Disclosure request – Explanation of use

Adjusting privacy-related system behavior once user has been classified

Best strategies for MALES with LOW disclosure tendency	
Goal	*Best strategy*
High demographics disclosure	Demographics first, 'explanation' justification.
High context data disclosure	Context first, no justification.
High overall disclosure	Context first, 'useful for you' justification.
High satisfaction	Context first, 'useful for others' justification or demographics first, 'useful for you' justification.
All of the above	Demographics first, no justification.

Best strategies for FEMALES with LOW disclosure tendency	
Goal	*Best strategy*
High demographics disclosure	Demographics first, 'number of others' justification.
High context data disclosure	Context first, 'useful for you' justification.
High overall disclosure	Demographics first, 'explanation' justification.
High satisfaction	Context first, 'useful for you' justification.
All of the above	Demographics first, 'explanation' justification.

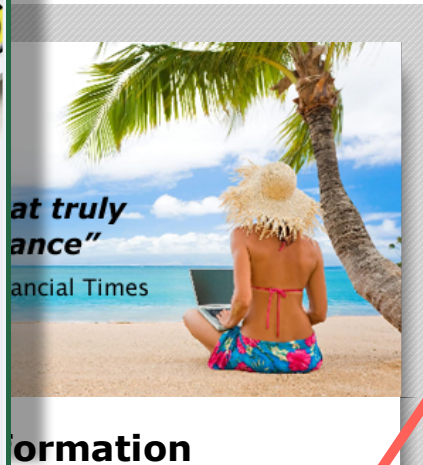# Different autofill paradigms have different effects on disclosure

- • 25% less disclosed
- • No default effect
- • **Purpose taken into account in disclosure decisions**

Reconcile personalization with privacy

1. ["privacy-enabling technologies"]

2. Find new forms of user interface and interaction design that
   - Increase transparency of personal data usage
   - Empower users to make informed privacy decisions

   "Privacy interventions"

   (ca. 2005)

Conclusions regarding privacy interventions in user interface and interaction design

- Providing transparency, choice or control at the interface with regard to privacy **inherently biases the user**

- Bias can go in either direction, depending on diverse user characteristics

- Interventions may trigger higher levels of thought (elaboration), and improve users' privacy decision making, or rather serve as a superficial feel-good cue ("privacy placebo").

☞ **Privacy interventions may or may not have the intended effect, and often the effect is different for different people.**

☞ **We need to study their effects extremely carefully before deploying them into practice.**

Using Process Tracing to Improve Household IoT Users' Privacy Decisions

Challenge:

How can users manage the privacy settings of an interconnected set of household IoT applications?

Solution:

Uncover users' processes to better understand how, why and when users' privacy decisions are suboptimal

Methods: Eye tracking, process tracing, utility mapping, machine learning

Create and test a simple, central interface that integrates privacy settings across all devices within a household

Methods: UI design, default profiles, implementation, in-home evaluation

Antecedents	Attitudes	Behavior	Decision context
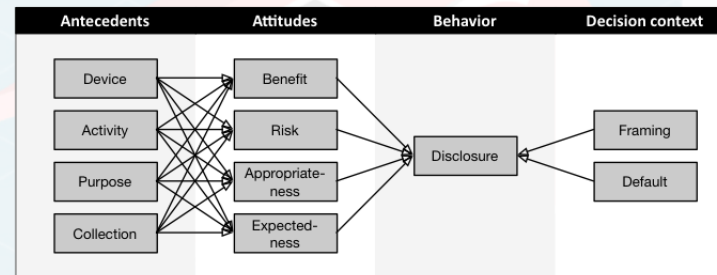
The camera of X shares data about (see more ⇨)	The camera of X shares data about	your presence	Which room you are in	How active you are
☑ With your other devices (see more ⇩)	With Device Y	☑ stored locally ☑ stored in the cloud	☑ stored locally ☑ stored in the cloud	☑ stored locally ☑ stored in the cloud
	With Device Z	...	...	...
☑ With your manufacturers (see more ⇩)	With manufacturer A	...	...	...
	With manufacturer B	...	...	...
☑ With other parties (see more ⇩)	With third party P	...	...	...
	With third party Q	...	...	...

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Scientific Impact:

For privacy: first study to attempt to improve the privacy decision process itself

For decision sciences: develop support of decisions where outcomes are vague, uncertain, and emotionally laden

Broader Impact:

Develop a technique to study the "decidability" of privacy setting interfaces

Centralize and simplify the privacy setting interfaces of existing IoT devices

Account for cultural and regulatory differences

Joint work with…

- Max Teltzrow
- Yang Wang
- Bart Knijnenburg
- Hichang Cho
- Ben Livshits
- Martijn Willemsen