

Breaking echo chambers with personalized news

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- ▶ New technologies enable digital media platforms (e.g. Google News) to collect and analyze personal data
- ▶ Platforms can and will provide different information customized for different users.

Question: Will these digital platforms provide personalized news that challenge our existing view of the world, or will they simply provide news that pander to it (“echo chambers”, “filter bubbles”)?

Are echo chambers real?

- ▶ Empirical findings of online news consumption:
 - ▶ Flaxman, Goel, and Rao (2016): users of social media and search engines consume a bigger variety of news and read a higher percentage of opposing articles
 - ▶ Gentzkow, Shapiro (2011): ideology segregation of online news consumption is low and not growing
 - ▶ Boxell, Gentzkow, Shapiro (2017): greater internet use is not associated with faster growth of political polarization

This paper: a micro-theory foundation to the empirical findings

- ▶ A game between a click-maximizing media platform and a truth-seeking user
- ▶ The media platform's optimal strategy is to recommend news that *contradict* a user's existing bias.

Key features of the model

1. Role of the platform is to filter and select news (and not to produce original news)
2. Platform's news selection is personalized
3. Two-step news consumption: free headline; click for details
4. Platform maximizes clicks
5. User consumes news to learn the true state of the world (and not for entertainment)

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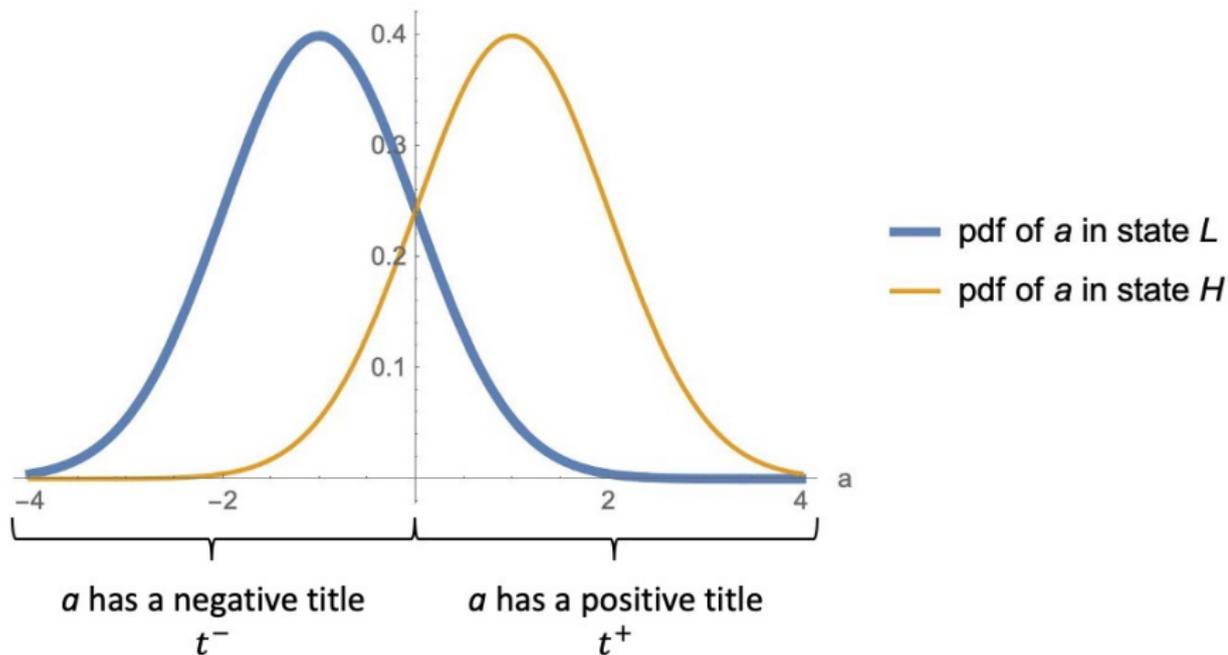
Feature 1. Role of the platform is to filter and select news

- ▶ State of the world, $\omega \in \{L, H\}$
- ▶ In each state, there is a distribution of articles such that each article $a \in \mathbb{R}$ is an i.i.d. signal about the true state with the following conditional normal distribution

$$a \sim \begin{cases} N(\mu, \sigma) & \text{when } \omega = H \\ N(-\mu, \sigma) & \text{when } \omega = L \end{cases}$$

- ▶ Each article a is associated with a title t such that

$$t(a) = \begin{cases} t^+ & \text{when } a \geq 0 \\ t^- & \text{when } a < 0 \end{cases}$$



The platform chooses whether to recommend a negative article or a positive article.

Feature 1. Role of the platform is to filter and select news

Feature 2. Platform's news selection is personalized

- ▶ The platform design an algorithm that recommends either a positive or a negative article to the user conditional on the true state ω , the user's prior belief p_0 , and the user's preferences.
- ▶ If the platform decides to recommend a positive (negative) article, it randomly draws an article from the distribution of articles with that title and send it to the user.

Feature 3. Two-step news consumption: free headline; click for details

- ▶ The user initially sees only the title t ; she must click on the title (which incurs a cost) in order to learn the associated article a .

Feature 4. Platform maximizes clicks

- ▶ The platform gets payoff 1 if the user chooses to click on the recommended title and 0 otherwise.

Feature 5. User consumes news to learn the true state of the world (and not for entertainment)

The truth-seeking user makes two choices sequentially.

1. Choose whether to pay a cost c in order to click on the recommended title and obtain its associated signal a
2. Choose a binary action, either h or l , that best matches her posterior belief about the true state of the world.

	$\omega = H$	$\omega = L$	$\omega = H$	$\omega = L$
choose h	0	$-u_1$	$-c$	$-u_1 - c$
choose l	$-u_2$	0	$-u_2 - c$	$-c$
	no click		click	

She chooses action h if and only if $\Pr(H) \geq \frac{u_1}{u_1 + u_2} \equiv p_d$.

User prefers the opposite title

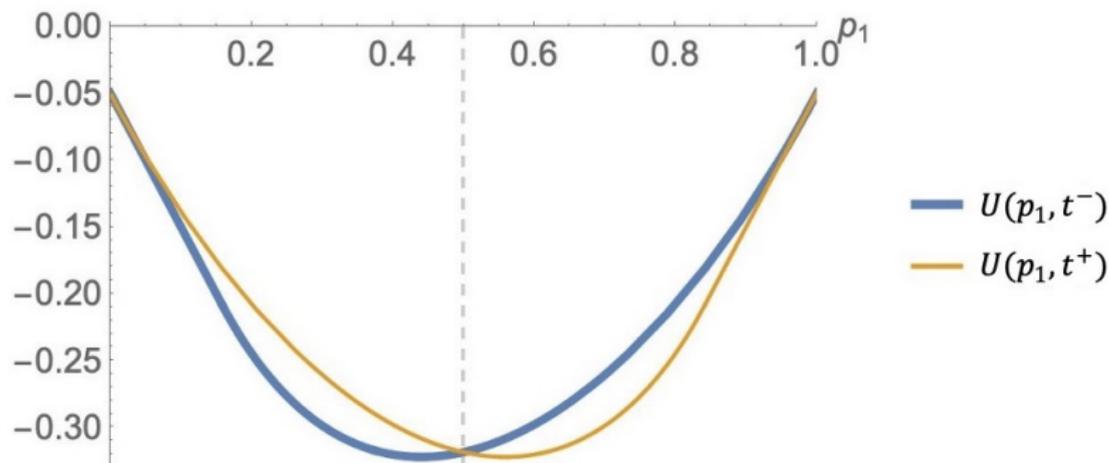


Figure: Example: $p_d = \frac{1}{2}$, $\mu = \sigma = 1$, $c = 0.05$

Given the user's interim belief p_1 , $U(p_1, t^+)$ is her expected utility if she clicks on a positive title; $U(p_1, t^-)$ is her expected utility if she clicks on a negative title.

Theorem

Given interim belief p_1 ,

$$\begin{cases} U(p_1, +) = U(p_1, -) & \text{when } p_1 \in \{0, p_d, 1\} \\ U(p_1, +) > U(p_1, -) & \text{when } p_1 \in (0, p_d) \\ U(p_1, +) < U(p_1, -) & \text{when } p_1 \in (p_d, 1) \end{cases}$$

Why does the user prefer the opposite title?

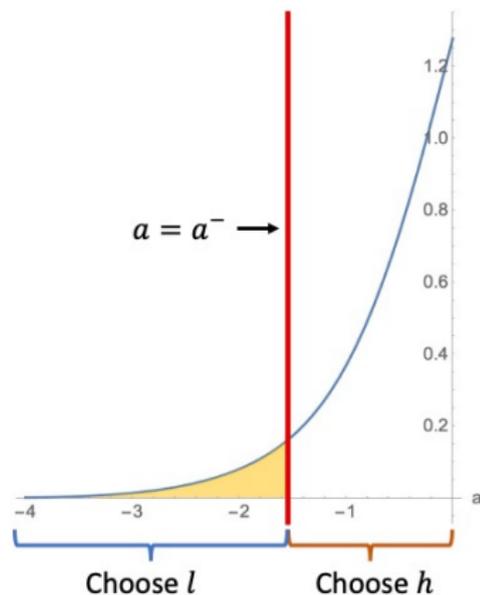
Information is useless if it has no impact on our action.

Example: $p_1 = 0.9$ (user is very confident that the true state is H), $\mu = 1$, $\sigma = 1$, $u_1 = u_2 = 1$

- ▶ The user's default action is h
- ▶ If she clicks on a positive title then, regardless of a , she will always choose her default action h . The information from a negative article is useless.
- ▶ If she clicks on a negative title, she will switch to action l iff. $a < -1.93$. The information from a negative article is useful.

What if both types of articles are useful?

Expected density of negative articles



Expected density of positive articles

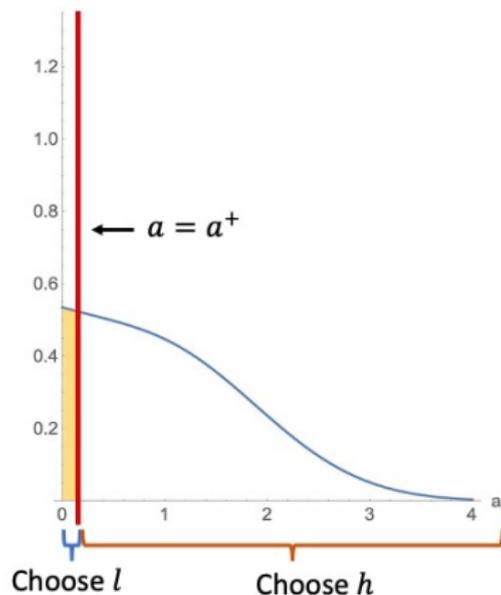


Figure: Expected distribution of negative and positive articles when $p_1 = 0.8$, $\mu = 1$, $\sigma = 1$, $u_1 = u_2 = 1$.

Example

Under her current belief, Ann inclines to vote for the current national leader in the next round of election. Before she casts her vote, she sees these two headlines:

1. “Mr. President’s **Failures** During the Coronavirus Crisis.”
2. “Mr. President’s **Successes** During the Coronavirus Crisis.”

Between the two headlines, **she is more interested in the first.** However, **she believes the article behind the second headline is more credible.**

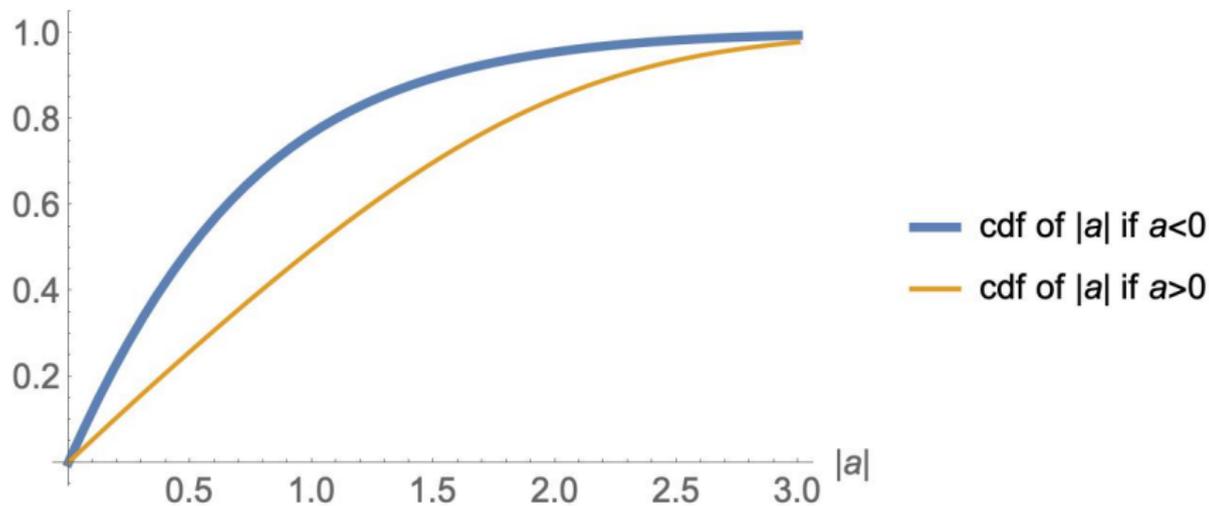


Figure: When $p_1 = 0.8$, the expected distribution of $|a|$ for positive a first-order stochastically dominates the expected distribution of $|a|$ for negative a .

Proposition

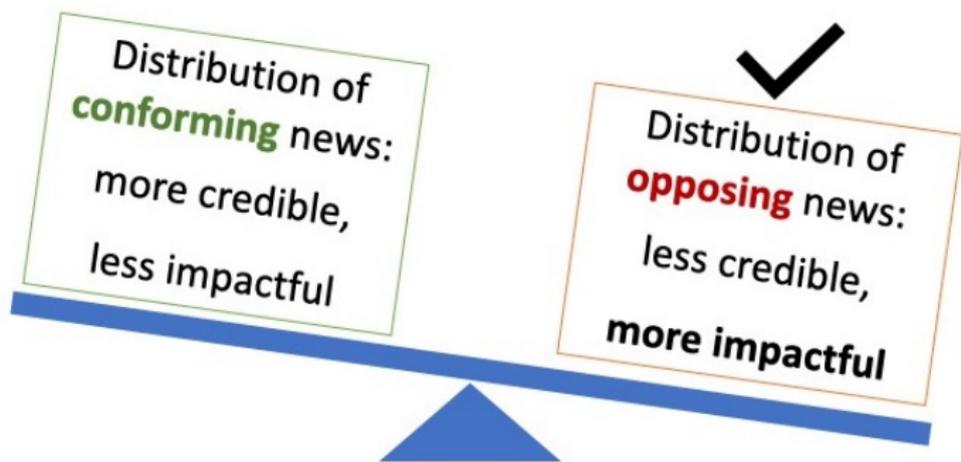
Let $p_d = \frac{1}{2}$. Given p_1 , let G^+ be the expected c.d.f. of $|a|$ given $a > 0$ and G^- be the expected c.d.f. of $|a|$ given $a < 0$.

Then,

if $p_1 < \frac{1}{2}$, $G^+(|a|) < G^-(|a|)$ for all $|a| > 0$;

if $p_1 > \frac{1}{2}$, $G^+(|a|) > G^-(|a|)$ for all $|a| > 0$.

Comparing two **distributions** of articles:



- ▶ The assumption of **Feature 3: two-step news consumption: free headline; click for details** is crucial for this tradeoff to exist.

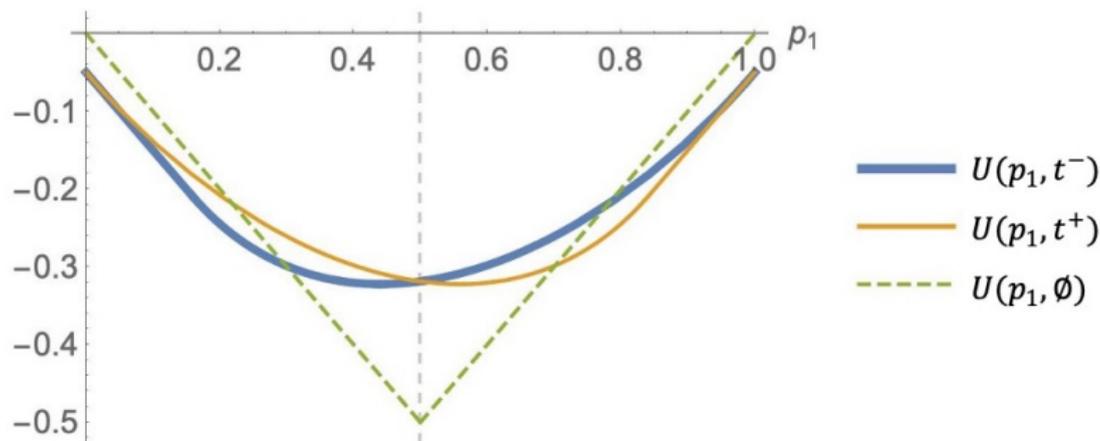
- ▶ If a news outlet **directly gives away the whole news report in one step** (e.g., newspapers and cable TV channels), then the consumer no longer needs to evaluate and choose the potential value of the news.

The following papers all show that

- ▶ Effectively, the news outlet acts as an advisor that recommends either action h or l to the consumer
 - ▶ The news outlet's optimal strategy is to feature **conforming** news
1. Gentzkow and Shapiro (2006 JPE): news outlet produces conforming news because they want to build a reputation for being credible
 2. Suen (2004 EJ): news outlet produces conforming news because consumers will to subscribe to a like-minded advisor
 3. Hu, Li, Segal (2020): media produce news that endorses a voter's own-party candidate more often

Return to our platform's problem

Given p_1 , let $u(p_1, \emptyset)$ denote the expected utility of the user when she does not click on the recommended title.



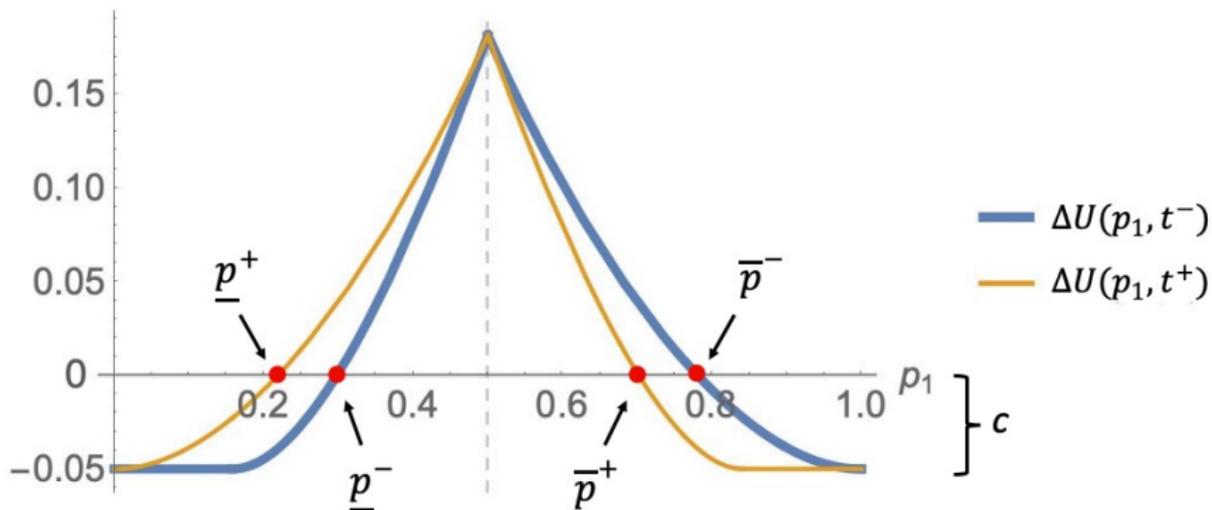


Figure: Gain from clicking on a positive and a negative title when $p_d = \frac{1}{2}$, $\mu = 1$, $\sigma = 1$, $c = 0.05$.

Platform's optimization

Theorem

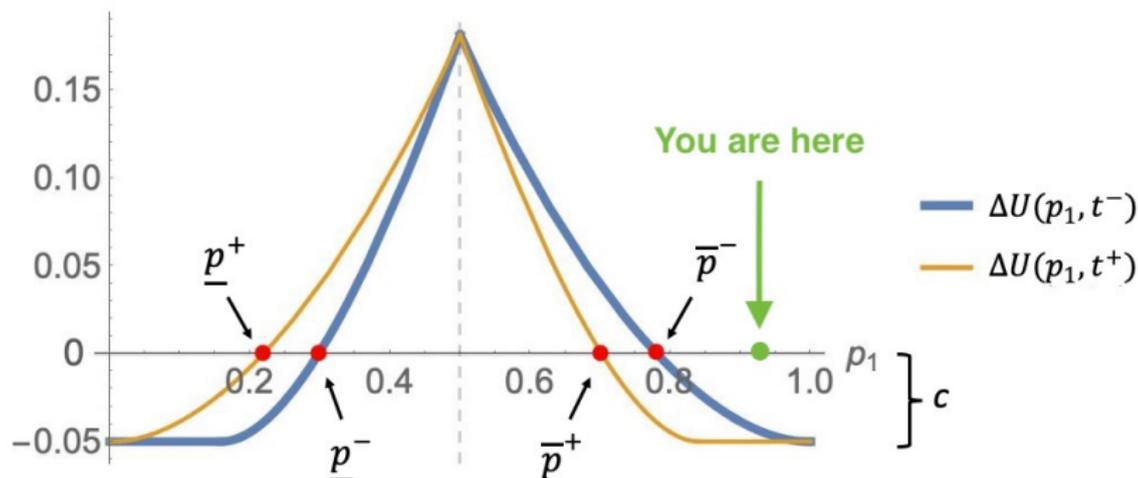
When $p_0 \in [\underline{p}^+, \bar{p}^-]$,

it is optimal for the platform to always recommend a title that opposes the user's default action, and

it is not optimal for the platform to always recommend a title that conforms to the user's default action.

Strategy for extreme beliefs

When prior belief $p_0 < \underline{p}^+$ or $p_0 > \bar{p}^-$



By Kamenica and Gentzkow (2011), optimal algorithm either reveals the true state or makes the user indifferent between clicking and not clicking.

Theorem

When $p_0 \notin [\underline{p}^+, \bar{p}^-]$, the platform-optimal algorithm is state-dependent has the following feature:

The platform always sends the opposing title when p_0 contradicts the true state. If p_0 is consistent with the true state, it still sends the opposing title with positive probability. The user clicks if and only if she sees the opposing title. In this case, her intermediate belief is either \underline{p}^+ or \bar{p}^- (whichever is closer to p_0).

Without changing the user's ex-ante expected utility, this algorithm increases the user's ex-ante probability of clicking.

Conclusion

Contrary to popular belief, it is optimal for a click-maximizing platform to recommend news articles that contradict its user's current bias. This is because

- ▶ the user benefits more from information that can potentially change her mind
- ▶ the platform can strategically recommend the opposite news to shatter user's confidence about the true state, thus increasing her demand for information.

This theory explains why, empirically, echo chambers do not exist and users of Google News consume a higher percentage of opposing articles

Extension: biased taste for news

"I just like reading positive news more than negative news."

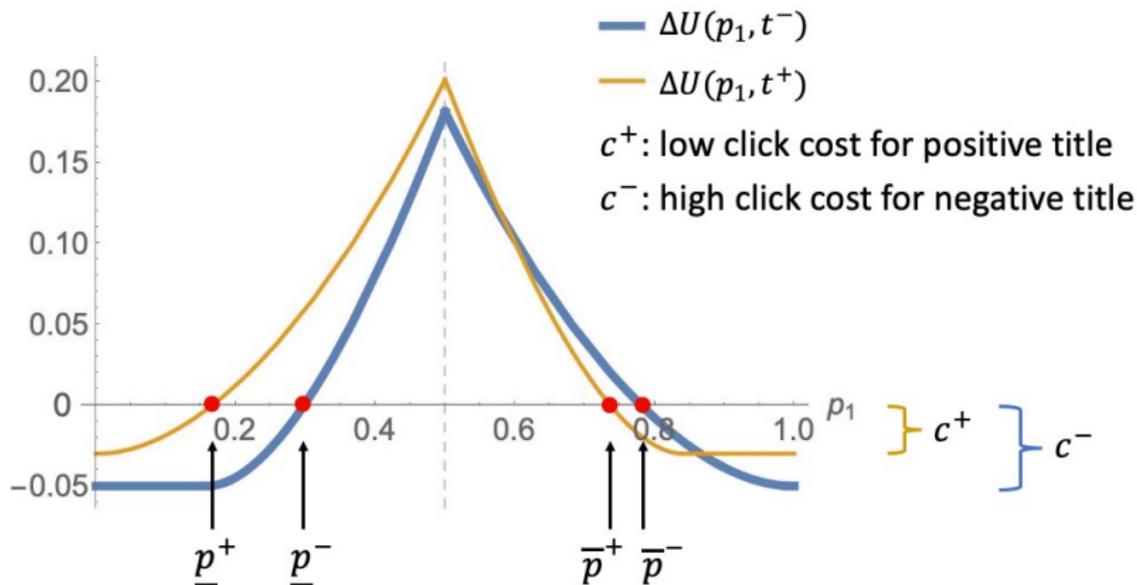


Figure: $\Delta U(p_1, t^-)$ and $\Delta U(p_1, t^+)$ when the user has a biased taste for positive articles

“I dislike news that contradict my current view.”

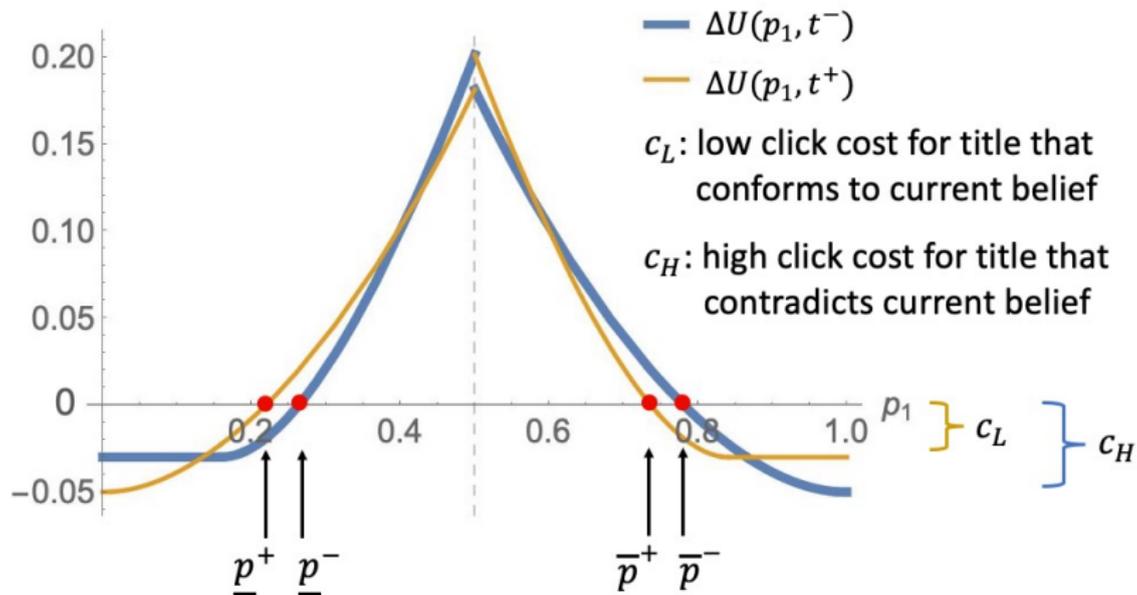


Figure: $\Delta U(p_1, t^-)$ and $\Delta U(p_1, t^+)$ when the user has a biased taste for articles that conform to her existing belief