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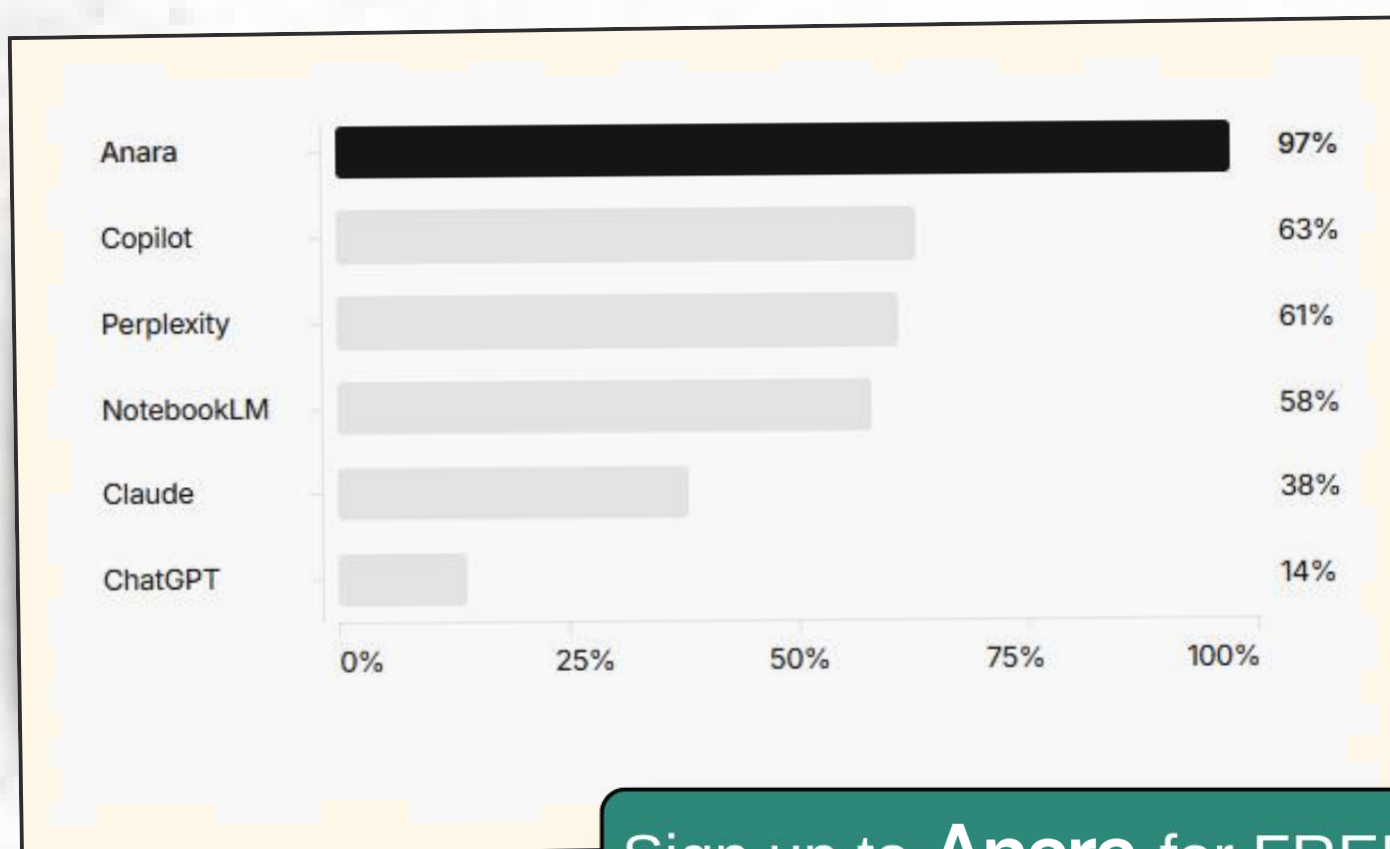
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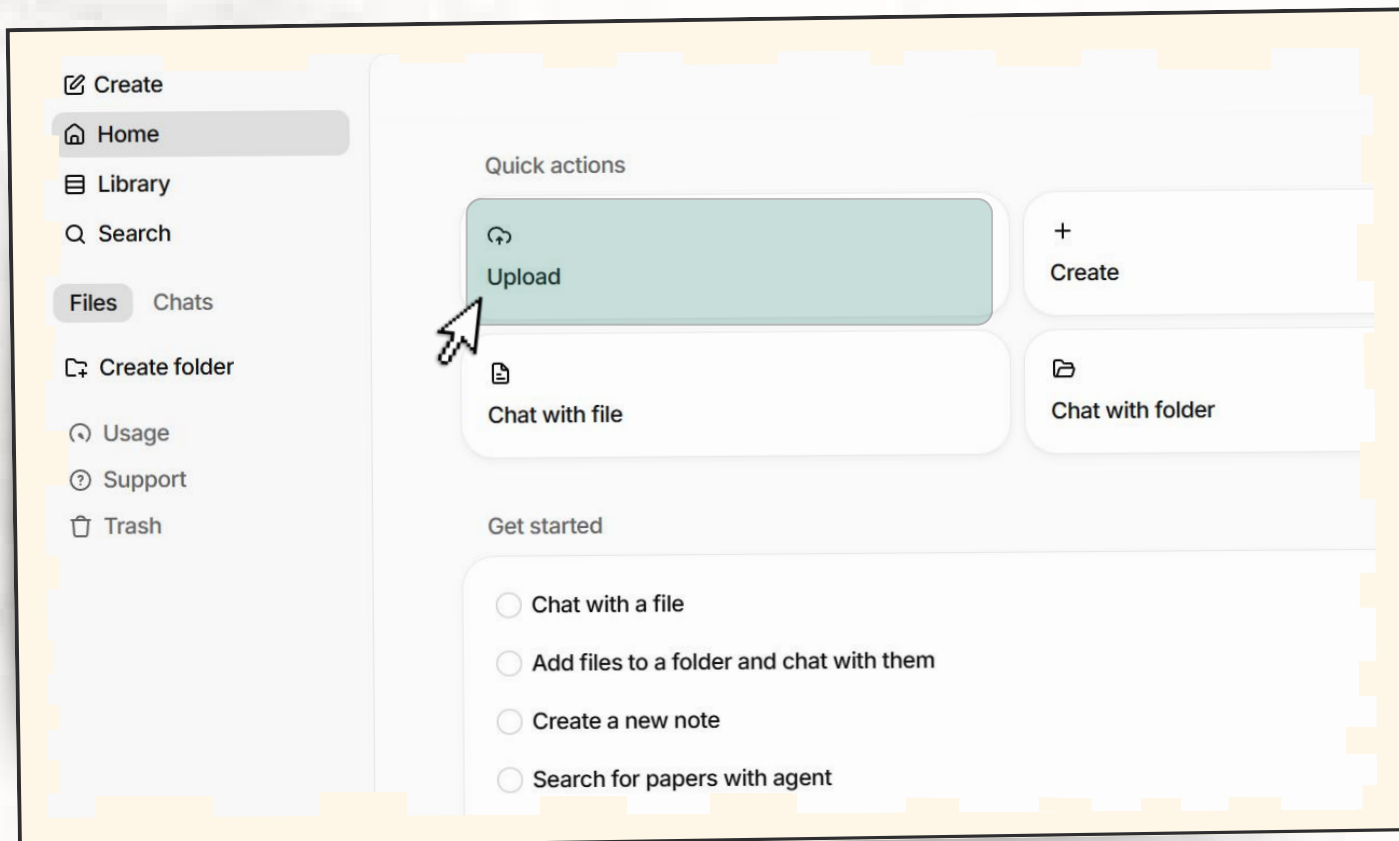
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Ask One Question

- Instead of opening 20 files, ask Anara exactly what you need
- **For example:**
“What are the best 10 points to learn from this book”

The screenshot displays the Anara interface. On the left, a research paper titled "Nudging in Human-Computer Interaction" is visible, including authors Ana Caraban, Evangelos Karapanos, and Daniel Gonçalves. The right side of the interface features a chat window with a summary of the paper and a list of suggested questions. A chat input box at the bottom contains the text: "What are the best 10 points to learn from this book".

23 W A Review of Technology-Mediated Nudging in Human-Computer Interaction

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ABSTRACT
Ten years ago, Thaler and Sunstein introduced the notion of nudging to talk about how subtle changes in the 'choice architecture' can alter people's behaviors in predictable ways. This idea was eagerly adopted in HCI and applied in multiple contexts, including health, sustainability and privacy. Despite this, we still lack an understanding of how to design effective technology-mediated nudges. In this paper we present a systematic review of the use of nudging in HCI research with the goal of laying out the design space of technology-mediated nudging—the why (i.e., which cognitive biases do nudges combat) and the how (i.e., what exact mechanisms do nudges employ to incur behavior change). All in all, we found 23 distinct mechanisms of nudging, grouped in 6 categories, and leveraging 15 different cognitive biases. We present these as a framework for technology-mediated nudging, and discuss the factors shaping nudges' effectiveness and their ethical implications.

CCS CONCEPTS
• Human-centered computing → Human computer interaction.

KEYWORDS
Nudging, Behavioral Economics, Persuasive Technology.

ACM Reference Format:
Ana Caraban, Evangelos Karapanos, Daniel Gonçalves, and Pedro Campos. 2019. 23 Ways to Nudge: A Review of Technology-Mediated Nudging in Human-Computer Interaction. In *CHI Conference on Human Factors in Computing Systems Proceedings (CHI 2019)*, May 4–9, 2019, Glasgow, Scotland UK. ACM, New York, NY, USA, 15 pages. <https://doi.org/10.1145/3296605.3300733>

1 INTRODUCTION
With the uptake of Personal Informatics (PI) and Behavior Change Technologies (BCT) in research and their diffusion in the commercial world, researchers have increasingly noted the inability of these tools to sustain user engagement. Studies have repeatedly highlighted high abandonment rates [37, 62, 63] and researchers have opted to understand why this happens [61] [28] and how to develop design strategies that sustain user engagement [37], [56], [59].

All this makes sense, as sustained user engagement is crucial to the function of personal informatics as behavior change tools. For instance, research has repeatedly shown that individuals quickly relapse to their old habits once they stop to monitor their behaviors (see [9] for a review). Yet, while finding ways to sustain user engagement is a way forward, and it has received some empirical support (see [37] as an example), researchers have also asked whether such technologies could rely less on users' will and capacity to engage with the technology and regulate their behaviors (e.g., [1], [63]).

Most PI and BCT tools are, as Lee et al. [63] argue, information-centric. They assume that people lack the knowledge in order to successfully implement changes in their behaviors and the role of the tool is to support people in logging, reviewing, and reflecting upon their behaviors. This emphasis on reflection as the means to behavior change has recently been noted by Adams et al. [1] who found 94% of behavior change technologies published in HCI to tap to the so-called *reflective mind*, rather than the fast and automatic mental processes that are estimated to guide 95% of our daily decisions.

Summary
This systematic review of 71 HCI studies explores how "technology-mediated nudging"—subtle alterations to choice architecture—can improve user behavior...

Quick actions **Suggested questions**

Breakdown How does the distinction between automatic and reflective systems shape technology-mediated nudges design strategies?

Practice questions

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23 Ways to Nudge

“What are the best 10 points to learn from this book”

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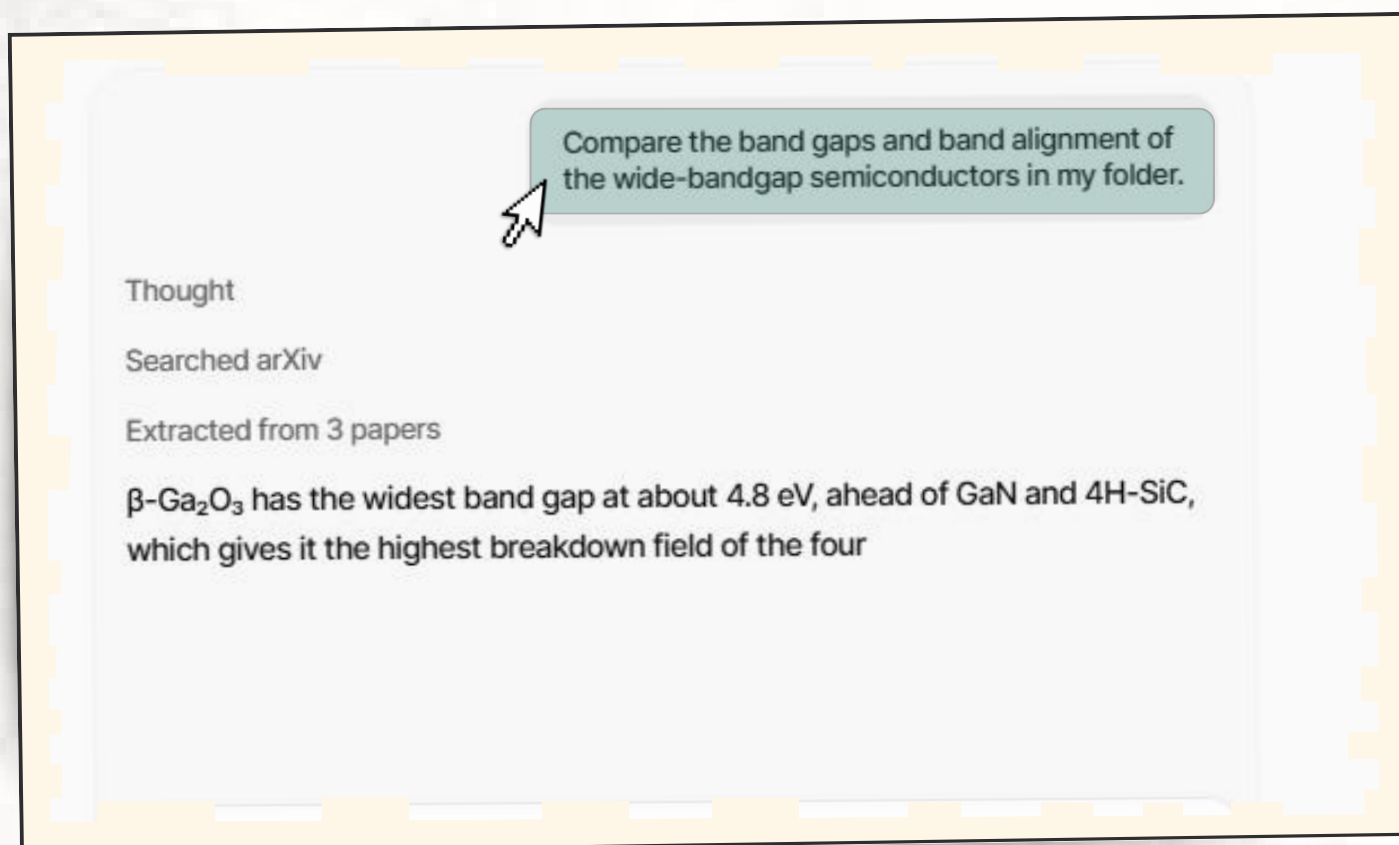




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 - Read the original context

The screenshot displays the Anara interface. On the left, a document preview shows text from a paper by Ana Caraban et al. (2019) titled '23 Ways to Nudge: A Review of Technology-Mediated Nudging in Human-Computer Interaction'. The right panel shows a list of sources with a table of metadata.

#	Source	Authors
1	The effectiveness of nudging: A meta-analys...	—
2	23 Ways to Nudge	Ana Caraban
3	Nudging toward vaccination: a systematic re...	Mark Donald
4	The Theory and Practice of Nudging: Changi...	Ivo Vlaev, Do...

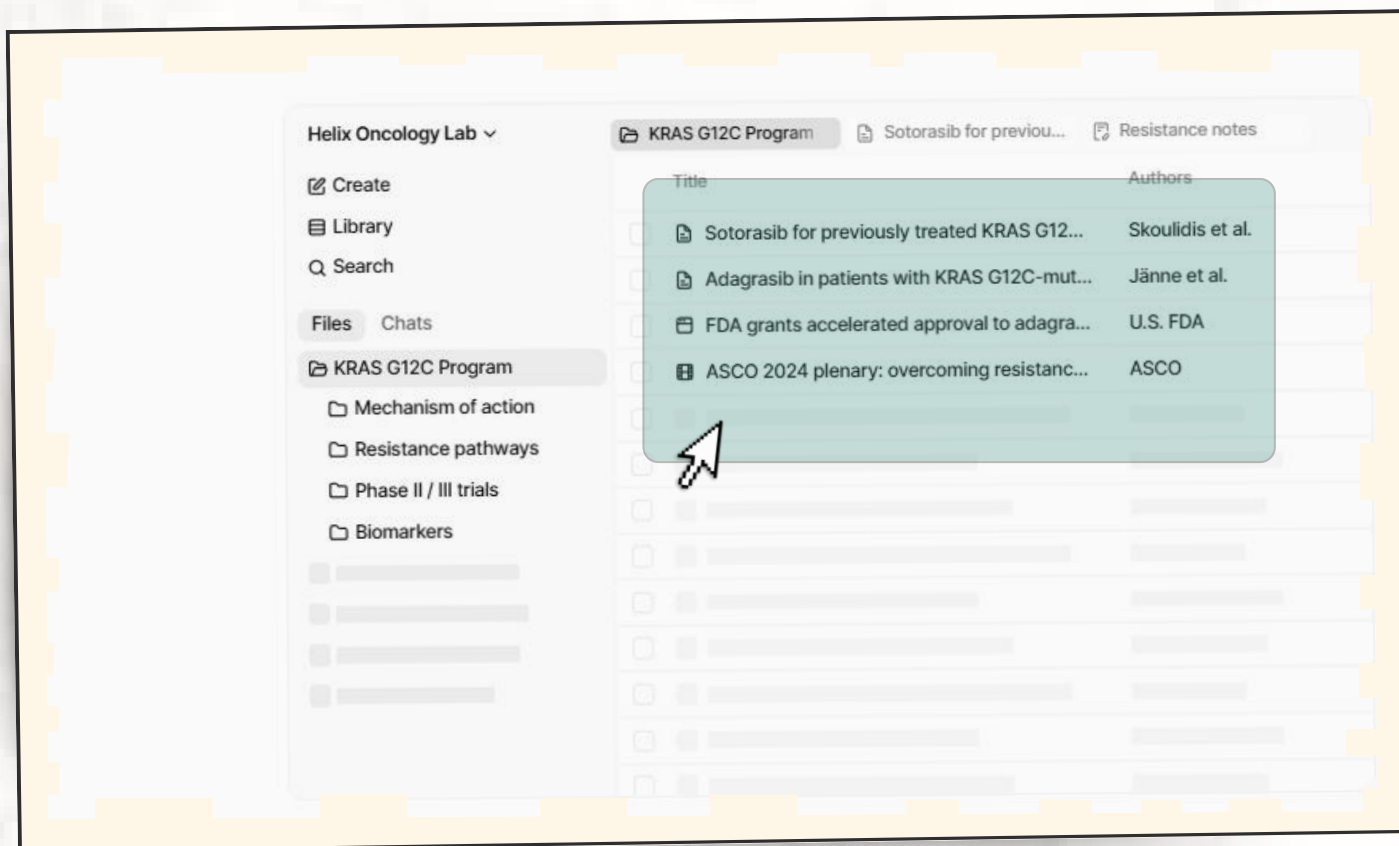
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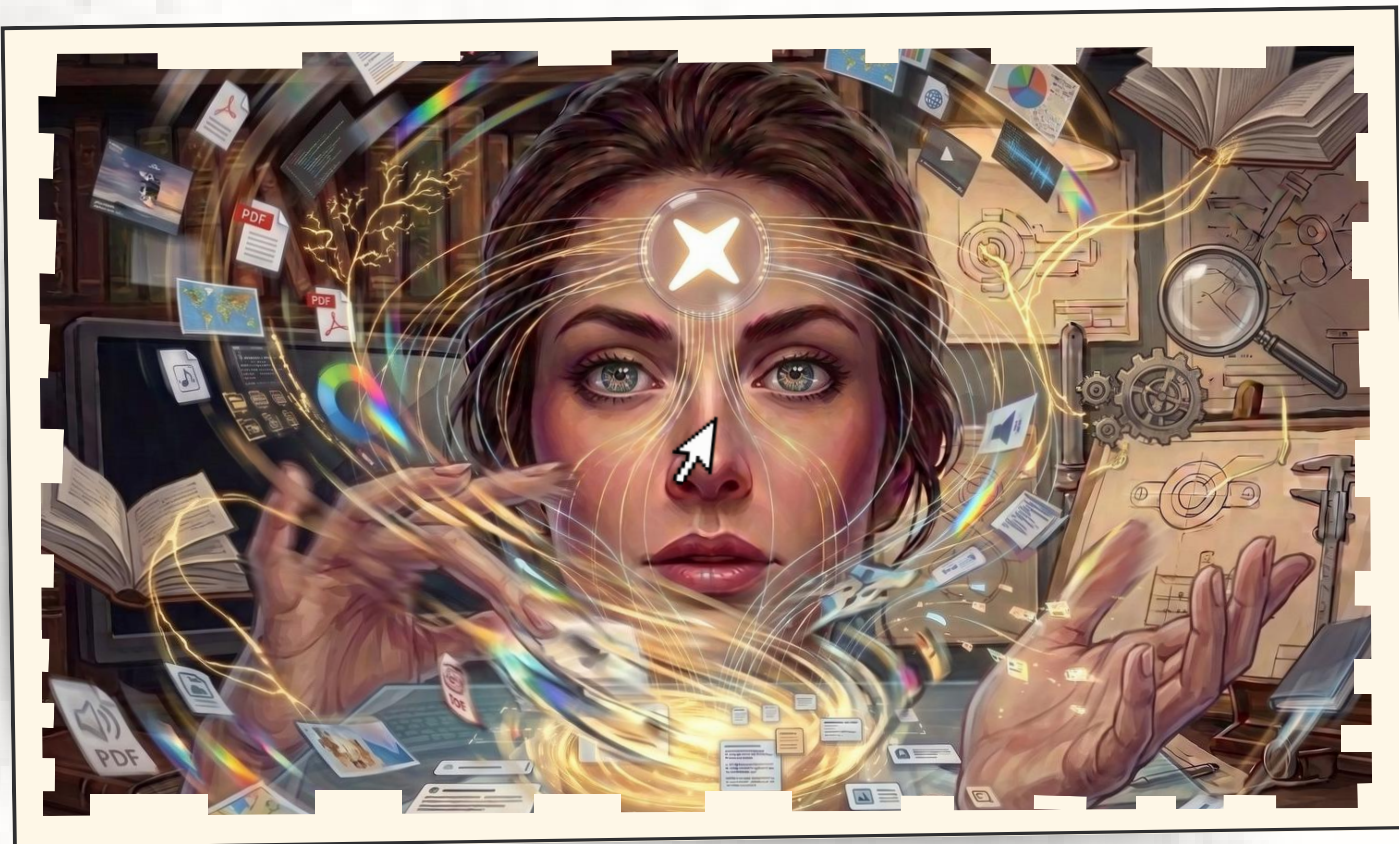
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☐	In vivo partial reprogramming alters...	Browder et al.	Nature Aging
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Transformer lineage

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Yamanaka factors...
and the web, last

Thought

Searched the web



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