Designing People+AI Systems

Human-AI Interaction

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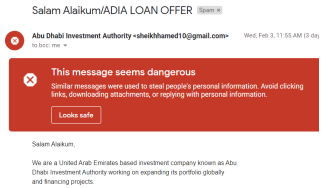
e-Lite

Summary

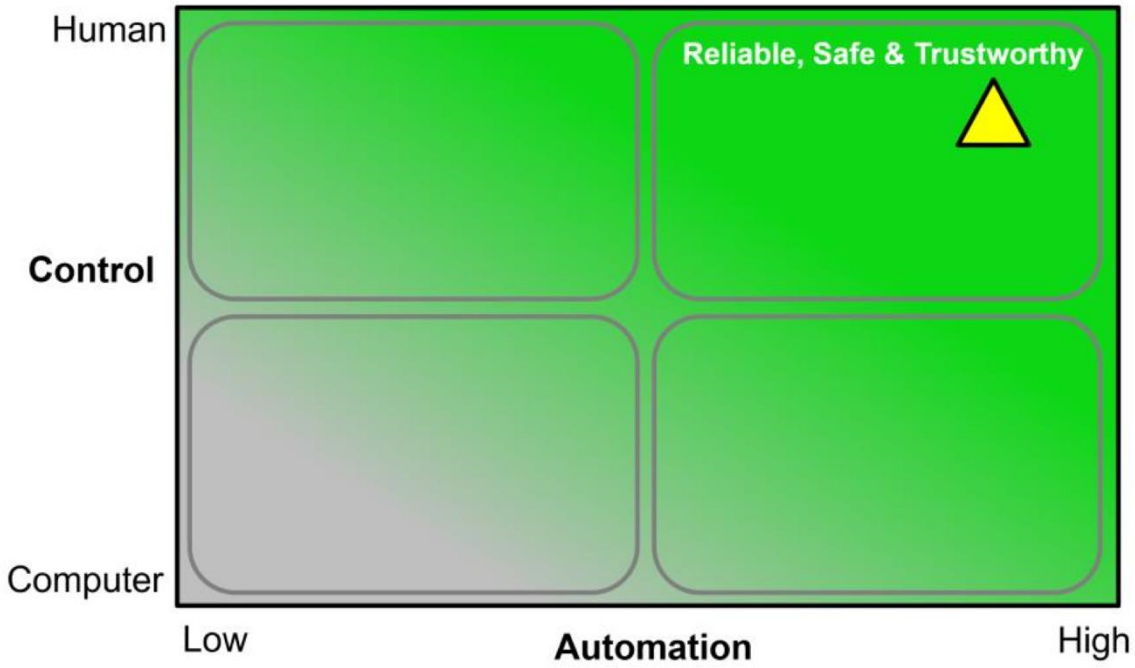
- Paradigms for Human-AI Interaction
- AI: Risks, Benefits, and User Tolerance
- Choosing the People+AI Path: Guidelines for Human-AI Interaction
- Design & Evaluation Workshop
  - You will work in groups: https://docs.google.com/spreadsheets/d/1mxKcUw_5fp5aXnwNJC8BArlyjRYH8qbB-zEk6-XaZPc/

Interaction Paradigms

Human-Centered AI Framework



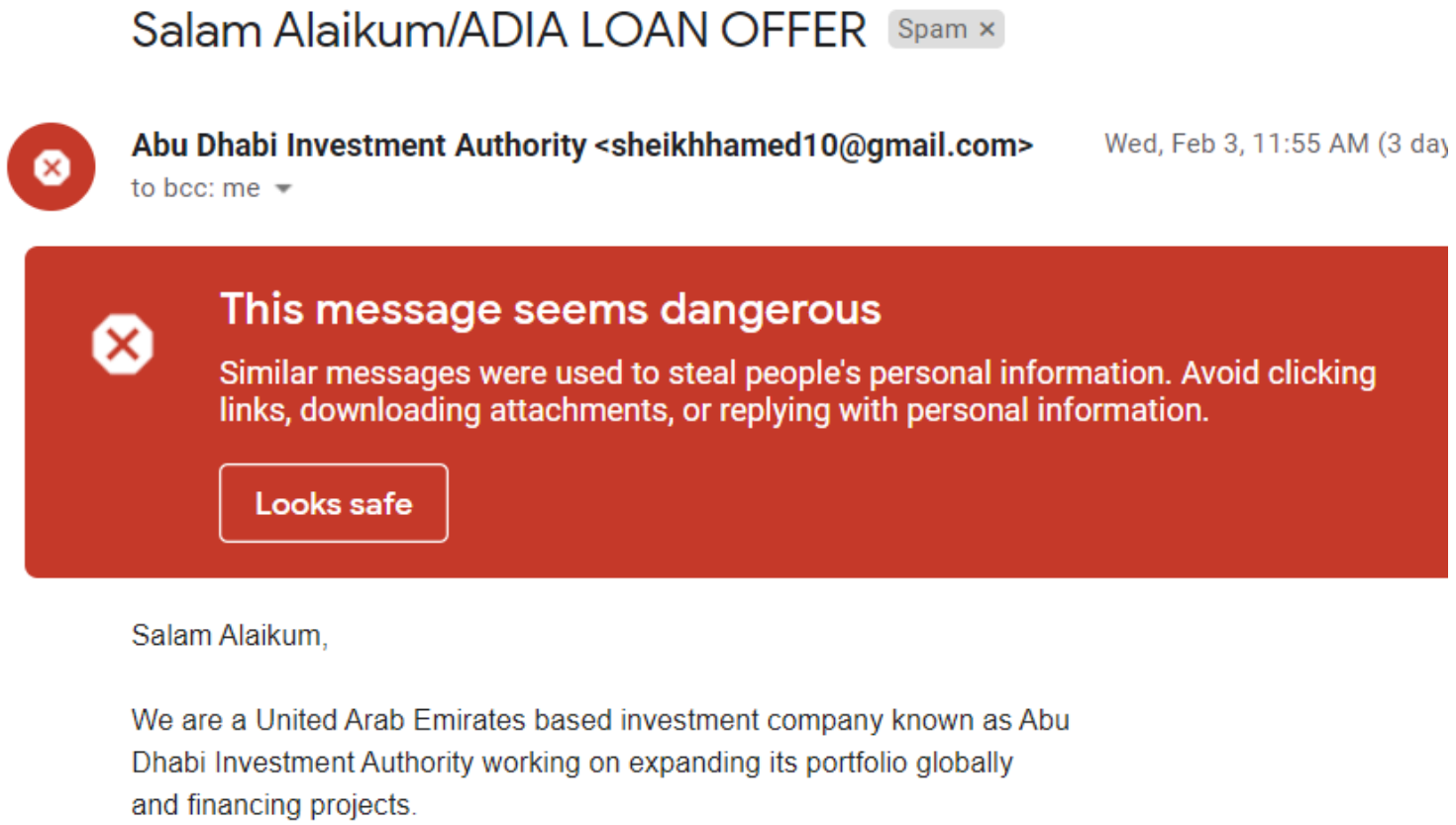
- What if do we move to a 2D framework?



Ben Shneiderman, *Human-Centered Artificial Intelligence: Reliable, Safe & Trustworthy*. 2020. International Journal of Human-Computer Interaction. https://doi.org/10.1080/10447318.2020.1741118

Gmail spam filter

- No input needed
- User can override decisions already taken by the system



Google Nest thermostat

- Initial set up
- Automatic learning (very sensitive in the first two weeks, much less after)
- Continuous adjustments in time

https://www.youtube.com/watch?v=20367DapHlc

Google Nest thermostat

- Automatic learning (very sensitive in the first two weeks, much less after)
- Continuous adjustments in time

Pattern of temperature changes	How it changes your thermostat's schedule
Two weekdays in a row (Monday and Tuesday)	All weekdays (Monday to Friday)
Same day two weeks in a row (two Mondays in a row)	That day of the week (every Monday)
Two weekend days in row (Saturday and Sunday)	All weekend days (Saturday and Sunday)
Two days in a row including a weekday and a weekend (Friday and Saturday)	All seven days of the week (Monday to Sunday)

Amazon Alexa

- Vocal commands in natural language
- Vocal responses and actions

https://www.youtube.com/watch?v=Ymewnb3gJJQ

Amazon Alexa

- *Sorry, I'm having problems in understanding you right now…*

https://www.youtube.com/watch?v=XQCHoKAq9xA

Google Home

https://www.youtube.com/watch?v=e2R0NSKtVA0

Jibo

- Emotional attachment object
- Emphatic communication

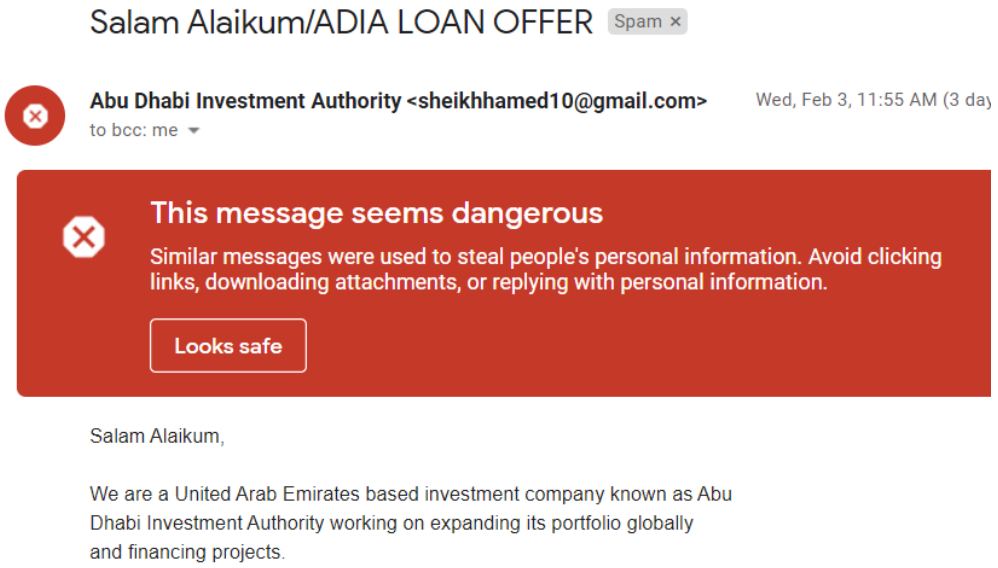
https://www.youtube.com/watch?v=FB53BIrTFdw

Jibo

- Emotional attachment object
- Emphatic communication

https://www.youtube.com/watch?v=XS0Alc7cZ2Q

AI-based systems as smart tools



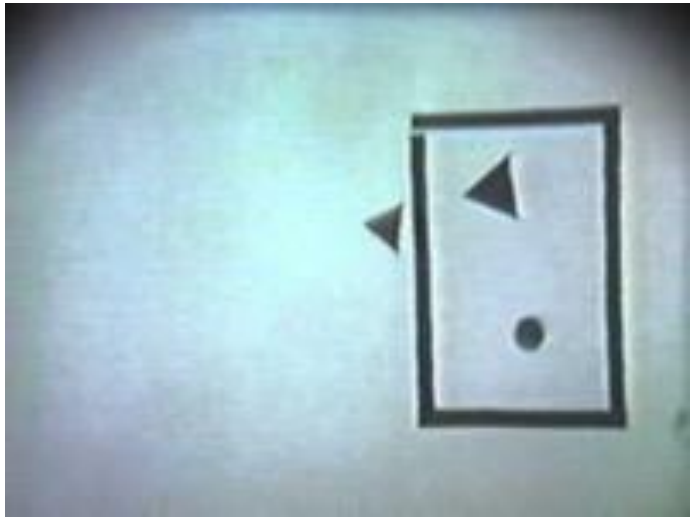
AI-based systems as smart tools

- Digital technologies are Cognitive Artifacts: physical objects designed to display or operate about information for enhancing human cognition (Norman, 1991; Hutchins, 2002)
- *Cognitive Artifacts + Artificial Intelligence = smart tools*
  - look like standard GUIs
  - aim to alleviate some tasks by acting autonomously
  - users are meant to be in control through the interface
  - might be confusing in terms of autonomy vs control because of probabilistic model

AI-based systems as artificial companions

AI-based systems as artificial companions

- Interaction with intelligent systems based on the metaphor of human-human interaction
- Human beings are coded to adopt an intentional stance
  - a tendency to anthropomorphize tools (e.g. Heider-Simmel illusion): yet, that does not imply that we actually believe that tools are intelligent (Reeves and Nass, 1996)
- There is evidence that anthropomorphic features increases UX
  - anthropomorphic features increase trust in an automated car (Waytz, Heafner, and Epley 2014)
  - expression of emotions improves efficacy in collaborative decision making tasks (de Melo, Gratch, and Carnevale 2015)

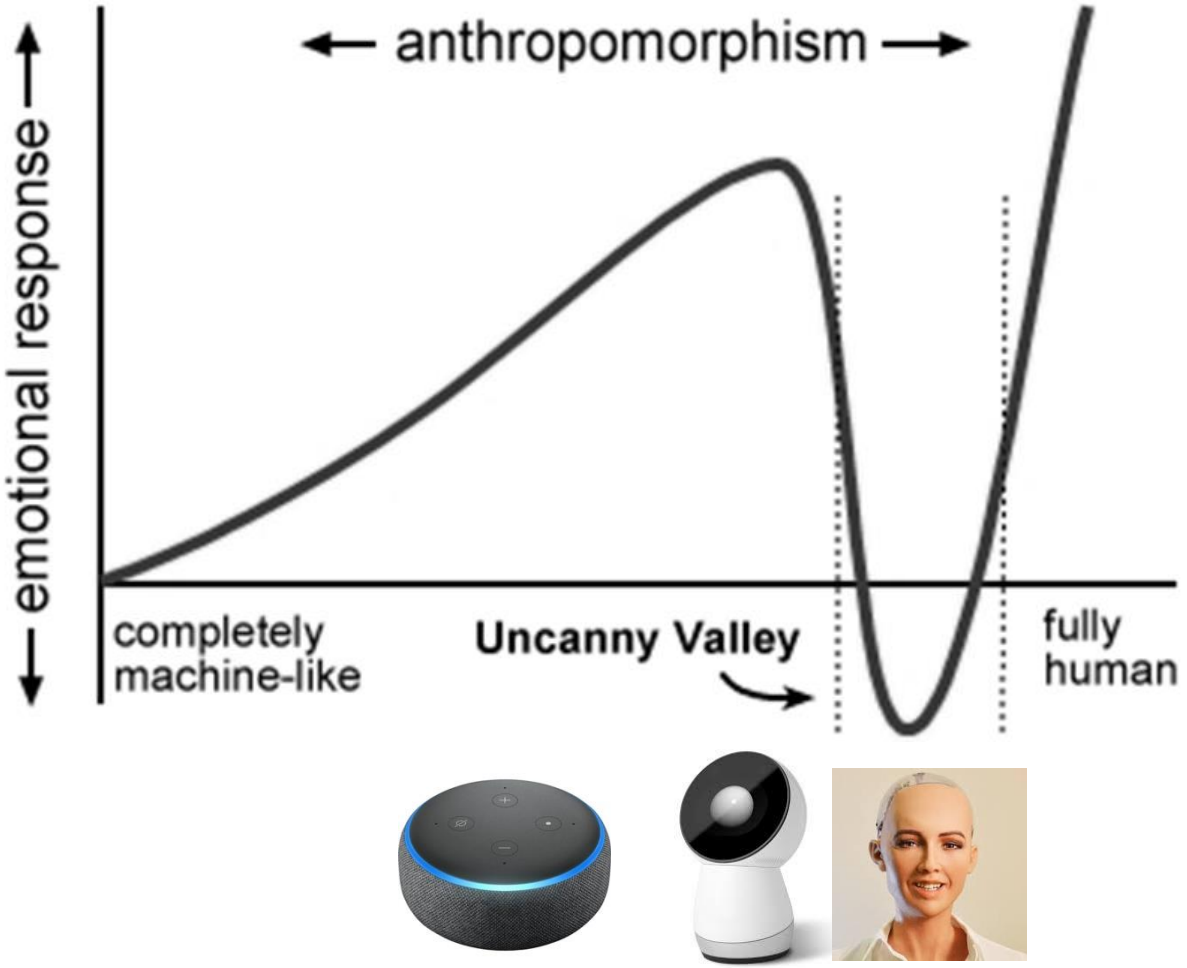


Heider-Simmel Illusion (1944)

AI-based systems as artificial companions

- Yet, in the long term, UX can worsen
  - the presence of an anthropomorphized helper reduces enjoyment in games (Kim et al., 2016)
  - over-reliance and over-trust can in the long term bring to security and safety issues (Chung et al., 2017)
- Small aspects can induce larger and unwanted effects, e.g. people attribute negative stereotypes to female-presenting chatterbots more often than they do to male-presenting chatterbots (Brahnam & De Angeli, 2012)
- Keep attention to the **Uncanny Valley**!

AI-based systems as artificial companions



Summing up

Smart Tools

- Smarter but less predictable than objects
- Opaque mental model
- Principles of Interaction Design
- New principles to manage AI

Artificial Companions

- Almost but not like humans
- Encourage social attribution
- Uncanny valley
- Different principles

AI: Risks, Benefits, and User Tolerance

What is Different in Interactive AI Systems?

- AI-based systems are typically performed under **uncertainty**
  - often producing false positives and false negatives
- They may demonstrate unpredictable behaviors that can be *disruptive*, *confusing*, *offensive*, and even *dangerous* for users

Low-stake Examples

- **Relevance** errors
  - Airbnb suggesting "fun local activities" when you are traveling for a funeral
  - Exercise app suggesting "time to get up and walk!" when you are seated on a long car trip
- **Multiple** users, **similar** input
  - Use Spotify to play 1970s pop jams at a thematic party
  - Use Spotify to play your favorite study jams at home
  - Use Spotify to hate-listen to <insert here an artist you dislike> with your roommate

What music should Spotify recommend this account play?

What Are The Stakes For AI Failure?

User: low stakes

- AI feature is annoying or interrupting
- AI feature is often wrong
- AI feature is useless

User: high stakes

- AI causes active harm (e.g., recidivism prediction or hiring prediction)
- AI reveals information someone wanted kept private
- AI shows offensive content

Product/Service organization

- Users stop using your app/service because of poor AI performance
- Bad press or legal troubles
- Bad reviews discouraging others from using the app/service

Traditional Guidelines and AI

- AI-based systems can also violate established usability guidelines of traditional user interface design
  - for instance: consistency or error prevention
- Many AI components are inherently **inconsistent**
  - they may respond differently to the same text input over time (e.g., autocompletion systems suggesting different words after language model updates)
  - or behave differently from one user to the next (e.g., search engines returning different results due to personalization)

What is an AI-based System?

- Artificial intelligence (AI) refers to systems that display intelligent behaviour **by analysing their environment** and **taking actions** – with some degree of **autonomy** – to achieve specific goals.

AI for Europe, COM/2018/237 https://www.europeansources.info/record/communication-artificial-intelligence-for-europe/

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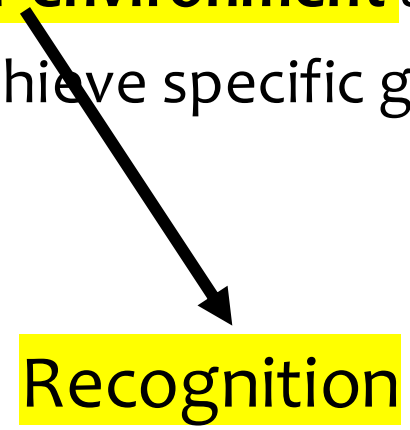

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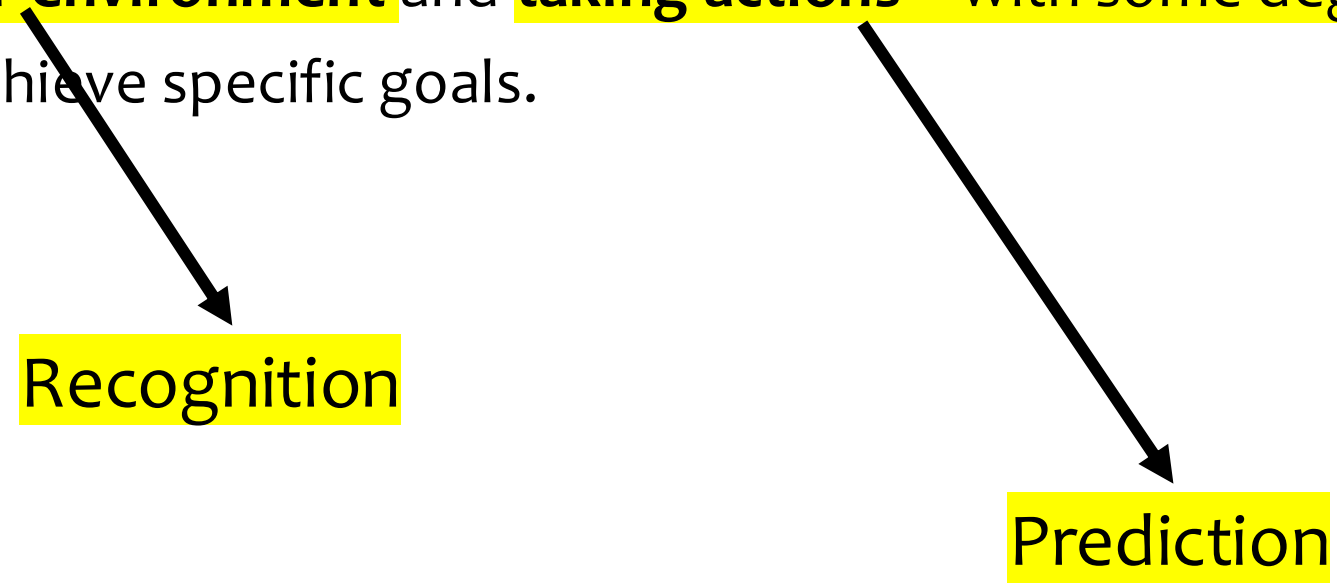

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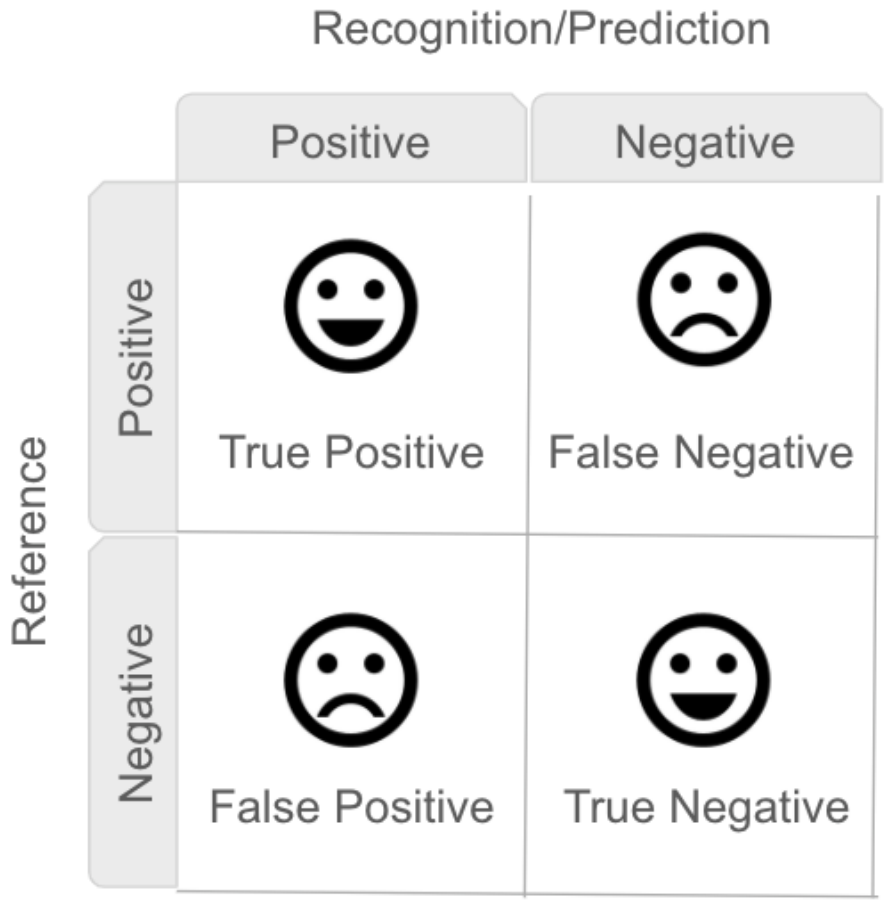
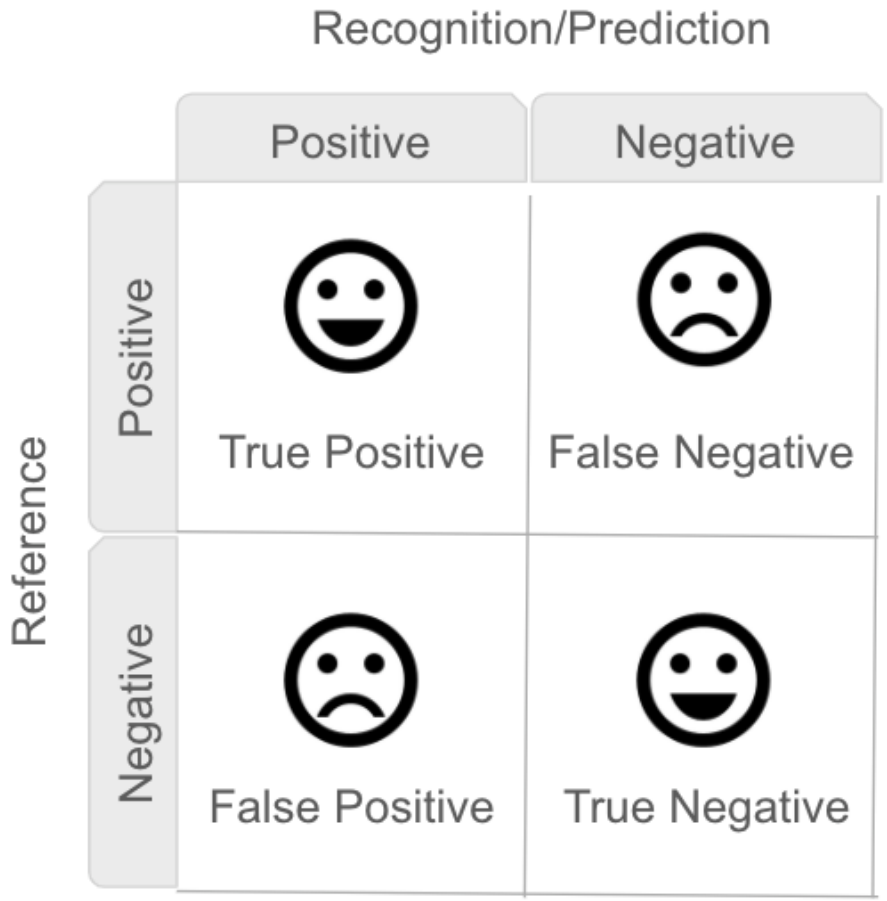
Optimizing for Precision vs. Optimizing for Recall



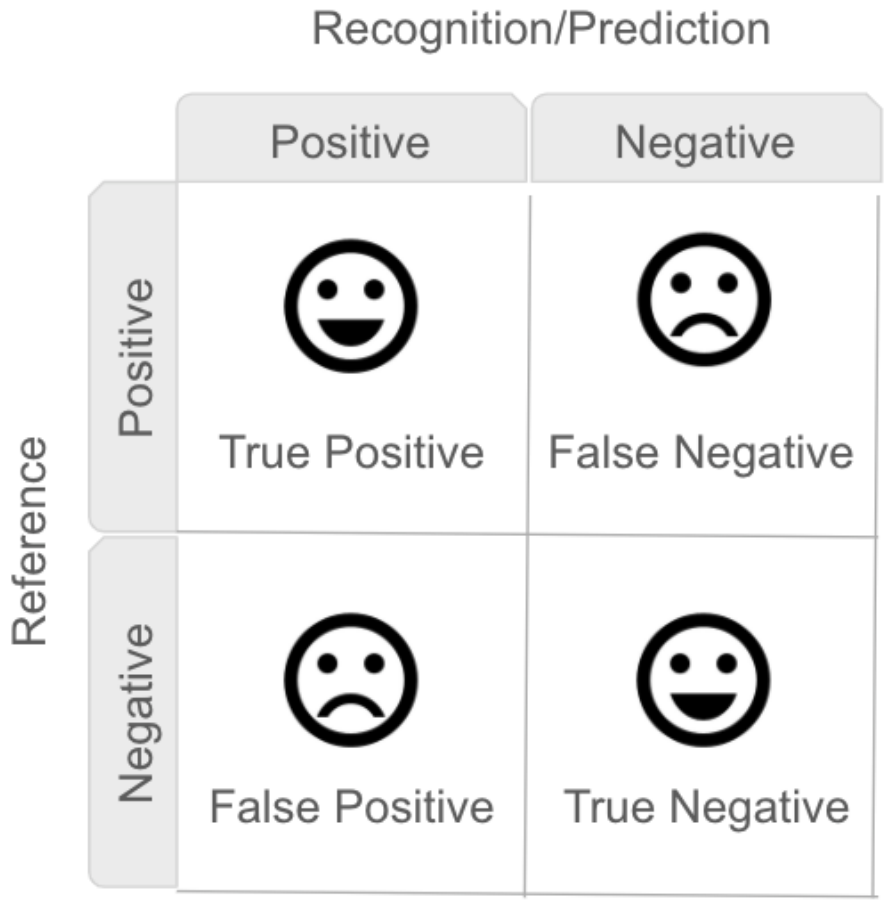
Optimizing for Precision vs. Optimizing for Recall



PRECISION =

RECALL =

Optimizing for Precision vs. Optimizing for Recall

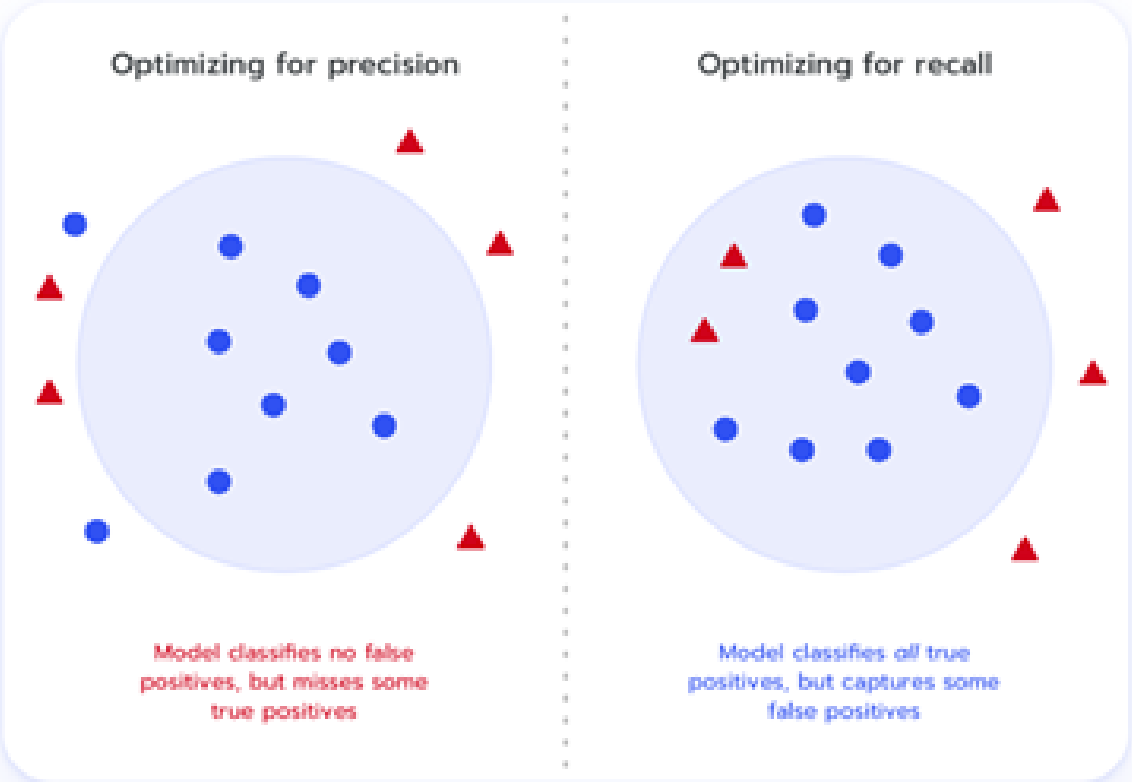


PRECISION = TP / (TP + FP)

RECALL = TP / (TP + FN)

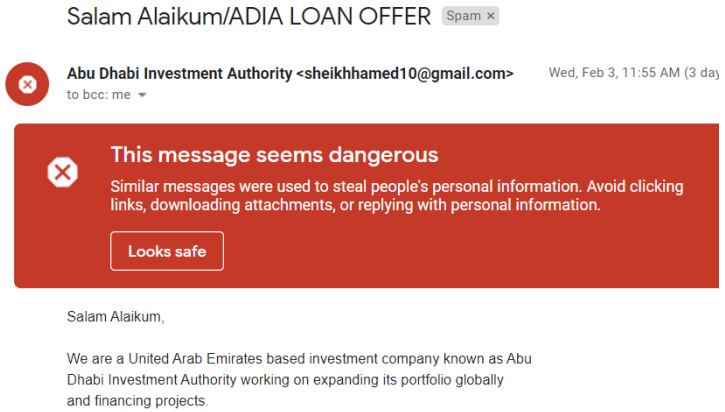
Optimizing for Precision vs. Optimizing for Recall

The worst thing is a false alarm



The worst thing is missing a positive

Should we optimizing for precision or recall?



1. Gmail spam filter

2. Google nest

3. Alexa

4. Jibo

How Can We Design Interactive AI Systems?

- By shifting from measuring **only** algorithm performance to evaluating human performance and satisfaction, with **human-centered** and participatory approaches (for evaluation, too)
- Deciding when "to AI" and when "not to AI"
- Understanding when to automate (i.e., replace the user) and when to augment users' capabilities
- Balancing the uncertainty of AI systems with proper expectations and feedback

"To AI or not to AI?"

- After identifying **user needs** and understanding *how* you can solve each of those needs
- Ask yourselves: can AI solve the user need in a unique way? Why?

AI probably better	AI probably **not** better
❑ The core experience requires recommending different content to different users.	❑ The most valuable part of the core experience is its predictability regardless of context or additional user input.
❑ The core experience requires prediction of future events.	❑ The cost of errors is very high and outweighs the benefits of a small increase in success rate.
❑ Personalization will improve the user experience.	❑ Users, customers, or developers need to understand exactly everything that happens in the code.
❑ User experience requires natural language interactions.	❑ Speed of development and getting to market first is more important than anything else, including the value using AI would provide.
❑ Need to recognize a general class of things that is too large to articulate every case.	❑ People explicitly tell you they don't want a task automated or augmented.
❑ Need to detect low occurrence events that are constantly evolving.	
❑ An agent or bot experience for a particular domain.	
❑ The user experience doesn't rely on predictability.	

source: https://pair.withgoogle.com/worksheet/user-needs.pdf

source: https://developer.apple.com/design/human-interface-guidelines/machine-learning/overview/roles/

AI Features Meet Users

"Human-centered AI focuses on amplifying, augmenting, and enhancing human performance in ways that make systems **reliable**, **safe**, and **trustworthy**"

- User *tolerance* to AI features depends on the role(s) of the feature
- **Critical** or **Complementary**
  - if a system can still work without the feature that AI enables, AI is complementary
- **Proactive** or **Reactive**
  - Proactive: it provides results without people requesting it to do so
  - Reactive: it provides results when people ask for them or when they take certain actions
- **Visible** or **Invisible**
- **Dynamic** or **Static**
  - how features evolve over time

User Tolerance: Critical or Complimentary

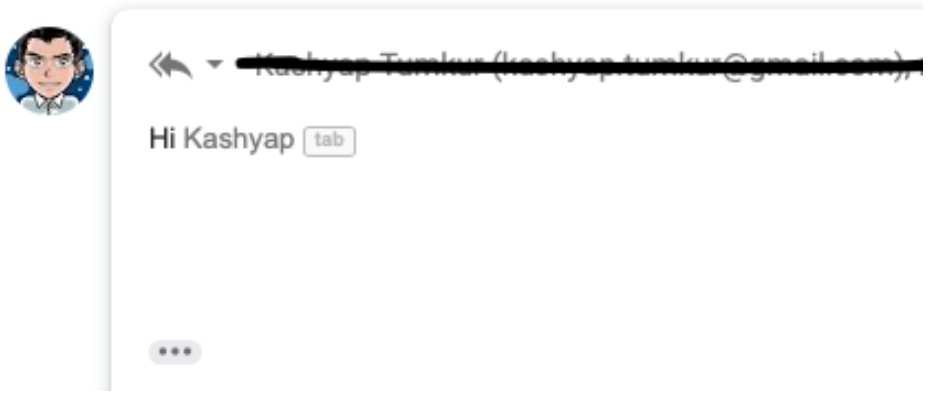
- In general, the more **critical** an app feature is, the more people *need* accurate and reliable results
- On the other hand, if a **complementary** feature delivers results that are not always of the highest quality, people *may* be more forgiving
- Examples
  - Face ID -> critical or complementary?
  - Word suggestions (on smartphones keyboards) -> critical or complementary?
  - What happens if they fail?

User Tolerance: Proactive or Reactive

- **Proactive** features can prompt new tasks and interactions by providing unexpected, sometimes serendipitous results
- **Reactive** features typically help people as they perform their current task
- Because people *do not ask* for the results that a proactive feature provides, they may have *less* tolerance for low-quality information
  - such features have more potential to be *annoying*

User Tolerance: Proactive or Reactive

- Proactive features can be helpful
  - in small amounts
  - at the "right" moment
  - if they are easy to dismiss



User Tolerance: Visible or Invisible

- People's impression of the **reliability** of results can differ depending on whether a feature is *visible* or *invisible*
- With a **visible** feature, people form an opinion about the feature's reliability as they choose from among its results
- It is *harder* for an **invisible** feature to communicate its reliability — and potentially receive *feedback* — because people may not be aware of the feature at all
- Examples?

User Tolerance: Dynamic or Static

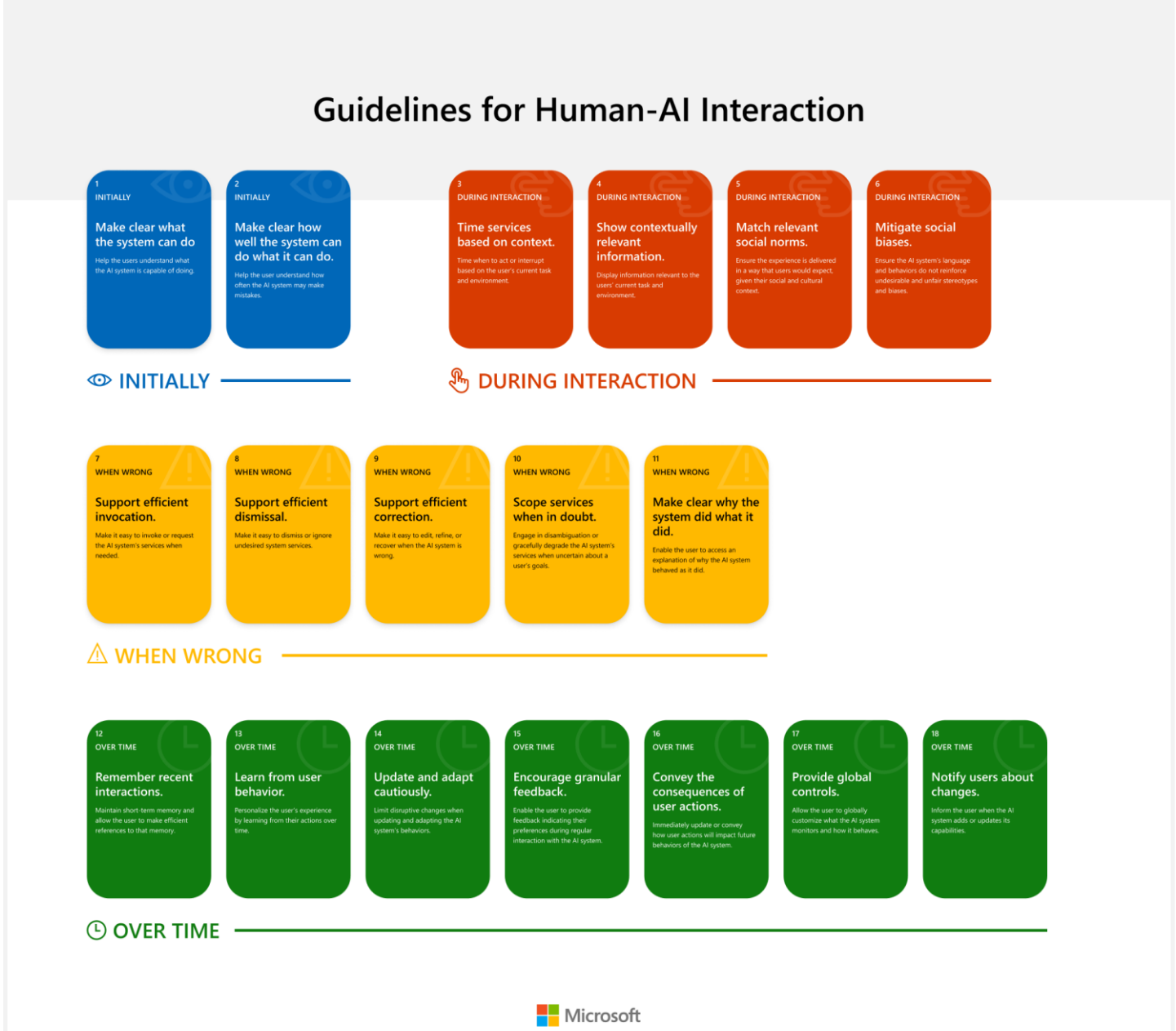
- **Dynamic** features are those that improve as people interact with the system
  - e.g., face recognition for unlocking the phone
- **Static** features *optionally* improve with a new system update
  - e.g., the quality of face recognitions in the photo library on a smartphone
- Such improvements affect other parts of the user experience
  - dynamic features often incorporate some forms of *calibration* and *feedback* (either implicit or explicit)
  - static features may not
- Depending on the feature, such updates can modify the perceived reliability, safety, and/or trustworthiness of a system

User Tolerance To Give Feedback

- Do not *overuse* feedback requests or users will get annoyed
  - People would not like to feel like the AI is so stupid that it needs their help
- Save for **high stakes** failure, is possible

Choosing the People+AI Path

Guidelines for mitigating risks, increasing tolerance, and highlighting benefits



By Microsoft Research: https://www.microsoft.com/en-us/research/project/guidelines-for-human-ai-interaction/

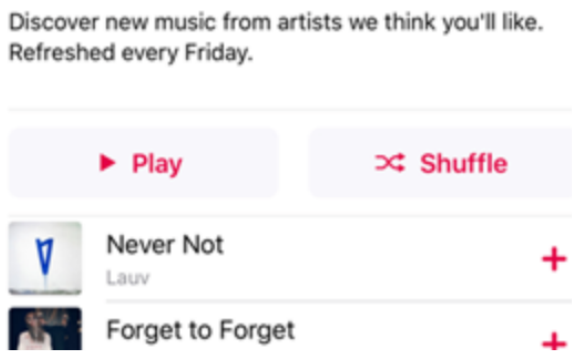
2

INITIALLY

Make clear how well the system can do what it can do.

Help the user understand how often the AI system may make mistakes.

EXAMPLE IN PRACTICE



The recommender in **Apple Music** uses language such as "we think you'll like" to communicate uncertainty.

Make clear how well the system can do what it can do. 2

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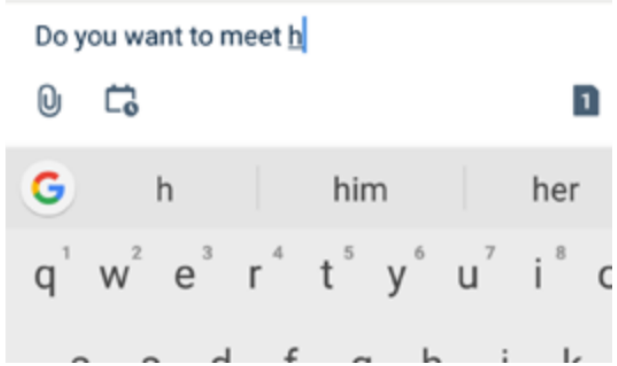
DURING INTERACTION

Mitigate social biases.

Ensure the AI system's language and behaviors do not reinforce undesirable and unfair stereotypes and biases.

EXAMPLE IN PRACTICE



The predictive keyboard for **Android** suggests both genders when typing a pronoun starting with the letter "h."

Mitigate social biases. 6

9

WHEN WRONG

Support efficient correction.

Make it easy to edit, refine, or recover when the AI system is wrong.

EXAMPLE IN PRACTICE

When **Bing** automatically corrects spelling errors in search queries, it provides the option to revert to the query as originally typed with one click.

Support efficient correction. 9

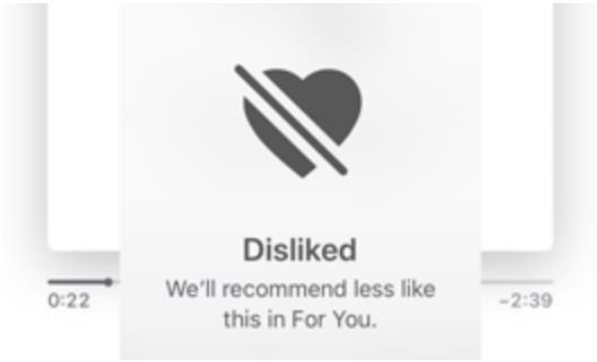
16

OVER TIME

Convey the consequences of user actions.

Immediately update or convey how user actions will impact future behaviors of the AI system.

EXAMPLE IN PRACTICE



Upon tapping the like/dislike button for each recommendation in **Apple Music**, a pop-up informs the user that they'll receive more/fewer similar recommendations.

Convey the consequences of user actions. 16

Other Guidelines

- Google's People+AI Guidebook: https://pair.withgoogle.com/guidebook/
- Apple's Human Interface Guidelines for Machine Learning: https://developer.apple.com/design/human-interface-guidelines/machine-learning/
- Microsoft's Human-AI eXperience Toolkit: https://www.microsoft.com/en-us/haxtoolkit/

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