

Cognitive AI Assistants

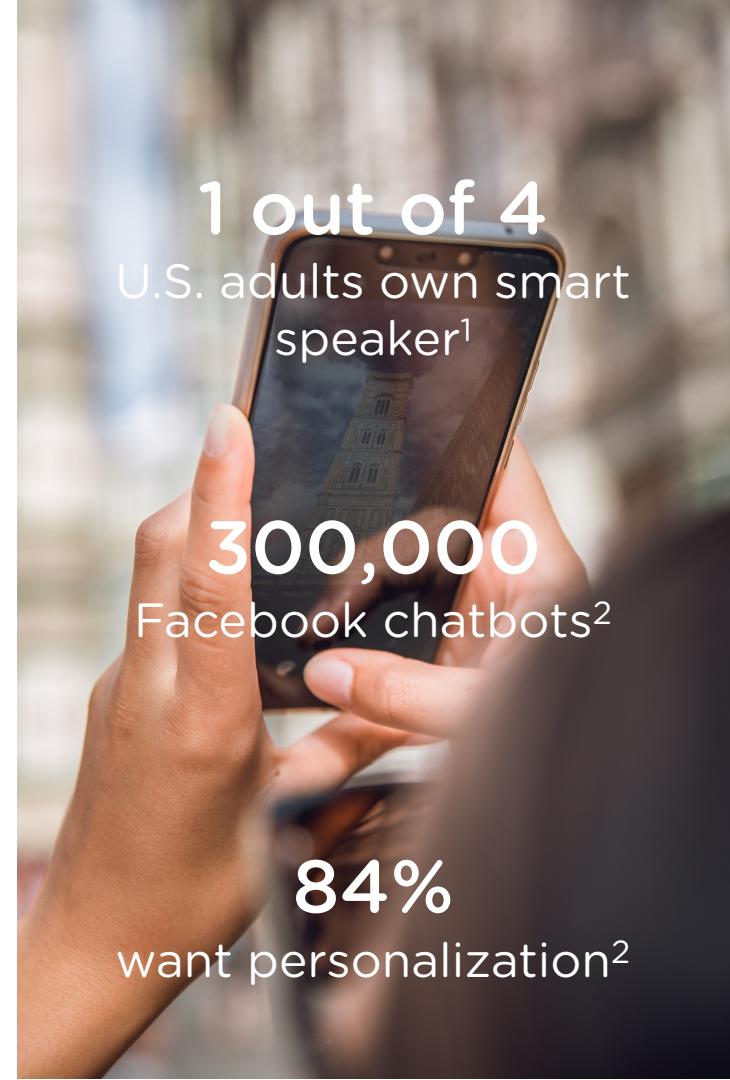
A new generation of AI companions

Michelle Zhou
Juji, Inc.

FACT

AI Assistants are everywhere

- convenient
- novelty
- social desirability



1. marketingland.com

2. Facebook 2018

3. Forrester user survey

How can I help you?

If you are a chatbot, why
cannot you just chat instead
of showing me so many
buttons?

I don't have the answer to
that question right now

Were you asking about one
of these topics?

Contact a Human

Download Resources

Calculate savings

Ask me something



The Challenges

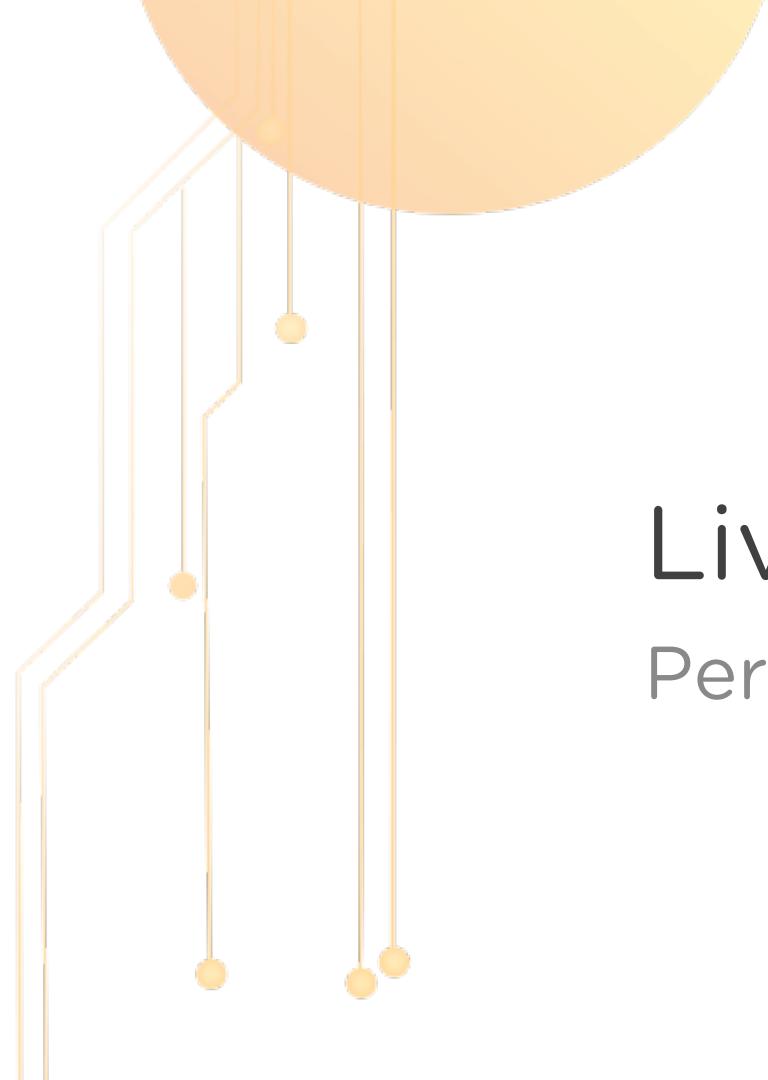
- limited intelligence
 - transactional
 - little "soft skills"
 - impersonal
- costly to build and maintain

Cognitive AI Assistants

A new generation of AI
companions

cognitive intelligence to
facilities long-term engagement

no-coding, rapid setup
to democratize AI



Live Demo

Personal Wellness Assistant

Cognitive Intelligence

advanced, human-like artificial intelligence that enables AI to understand, remember, communicate, and learn

soft skills

**Learning +
Decision Making**

**Language
Skills**

**Attention +
Memory**

communication
skills

Cognitive Intelligence

good communications helps establish connections and maintain relationships

soft skills

Learning +
Decision Making

**Language
Skills**

Attention +
Memory

communication
skills

Eğeci, İ. S., & Gençoz, T. (2006). Factors associated with relationship satisfaction: Importance of communication skills. *Contemporary family therapy*, 28(3), 383-391.

Language Skills

interpret user input to perform multiple types of tasks

- open-ended
- procedural

semantic interpretation

information extraction

The image shows a messaging application interface with two users: Kai and Julia. Kai is represented by a blue circular profile picture and a grey speech bubble. Julia is represented by a green circular profile picture and a green speech bubble. The conversation goes as follows:

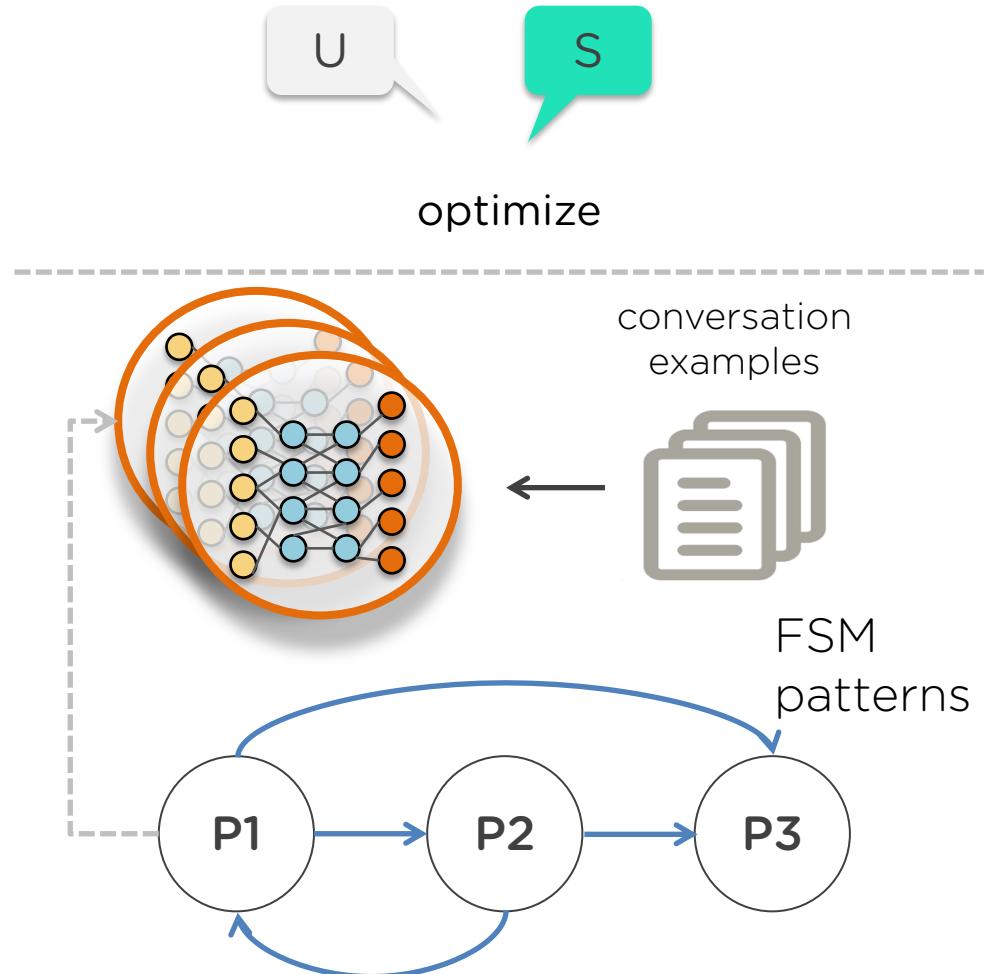
- Kai: What happened that made you feel this way?
- Julia: BTW, I just changed my insurance recently, could you update it for me?
- Kai: I can certainly help.
- Kai: What's your new insurance company name and policy number?
- Julia: It's Athena and the policy number is 12345678
- Kai: Okay. Just to confirm, the insurance company is: Athena; and the policy number is: 12345678

There are also three small, semi-transparent user icons in the corners of the slide.

Modeling Language Skills

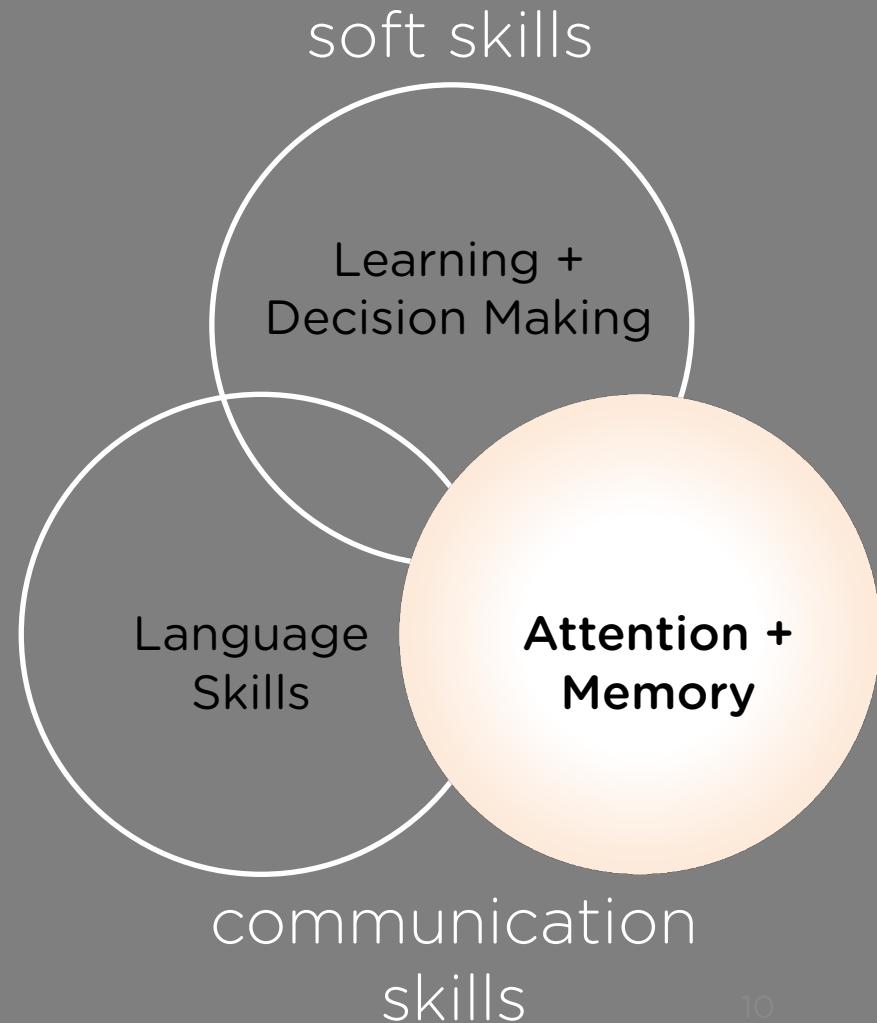
- neuro-symbolic approaches
- open to third-party learning models

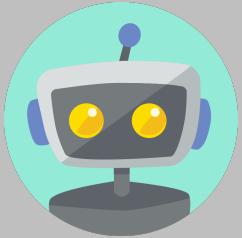
Xiao, Z., Zhou, M. X., Chen, W., Yang, H., & Chi, C. (2020, April). If I Hear You Correctly: Building and Evaluating Interview Chatbots with Active Listening Skills. In Proc. 2020 CHI (pp. 1-14).



Cognitive Intelligence

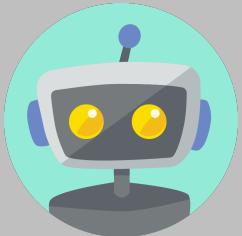
good communications helps establish connections and maintain relationships





What would you like to do in your spare time?

what about you?



What's your favorite movie?

what about you?

Attention + Memory

attention is context-sensitive

Attention + Memory

must maintain attention
and memory to
maintain context

- ensure task success
- ensure user satisfaction

The image shows a messaging interface with two users: Kai and Michelle. Kai's messages are in grey bubbles, and Michelle's messages are in green bubbles. A grey person icon is positioned next to Kai's messages, and a green person icon is positioned next to Michelle's messages.

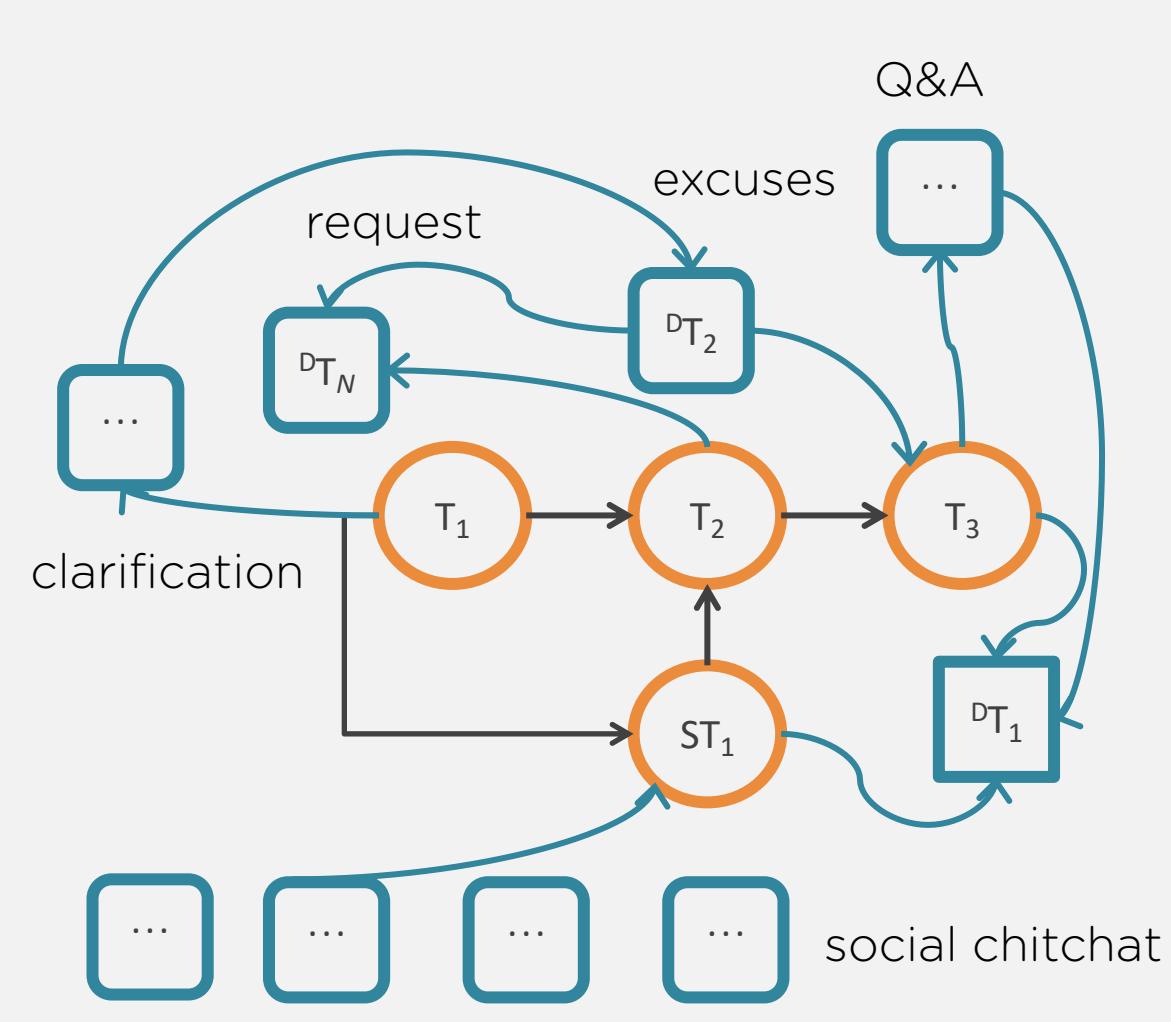
Kai: What happened today?

Michelle: Could you help me make an appointment to see my doctor?

Kai: Certainly. Let me get some quick info from you first so I can best route your request to my human teammate.

Kai: Do you have a fever now?

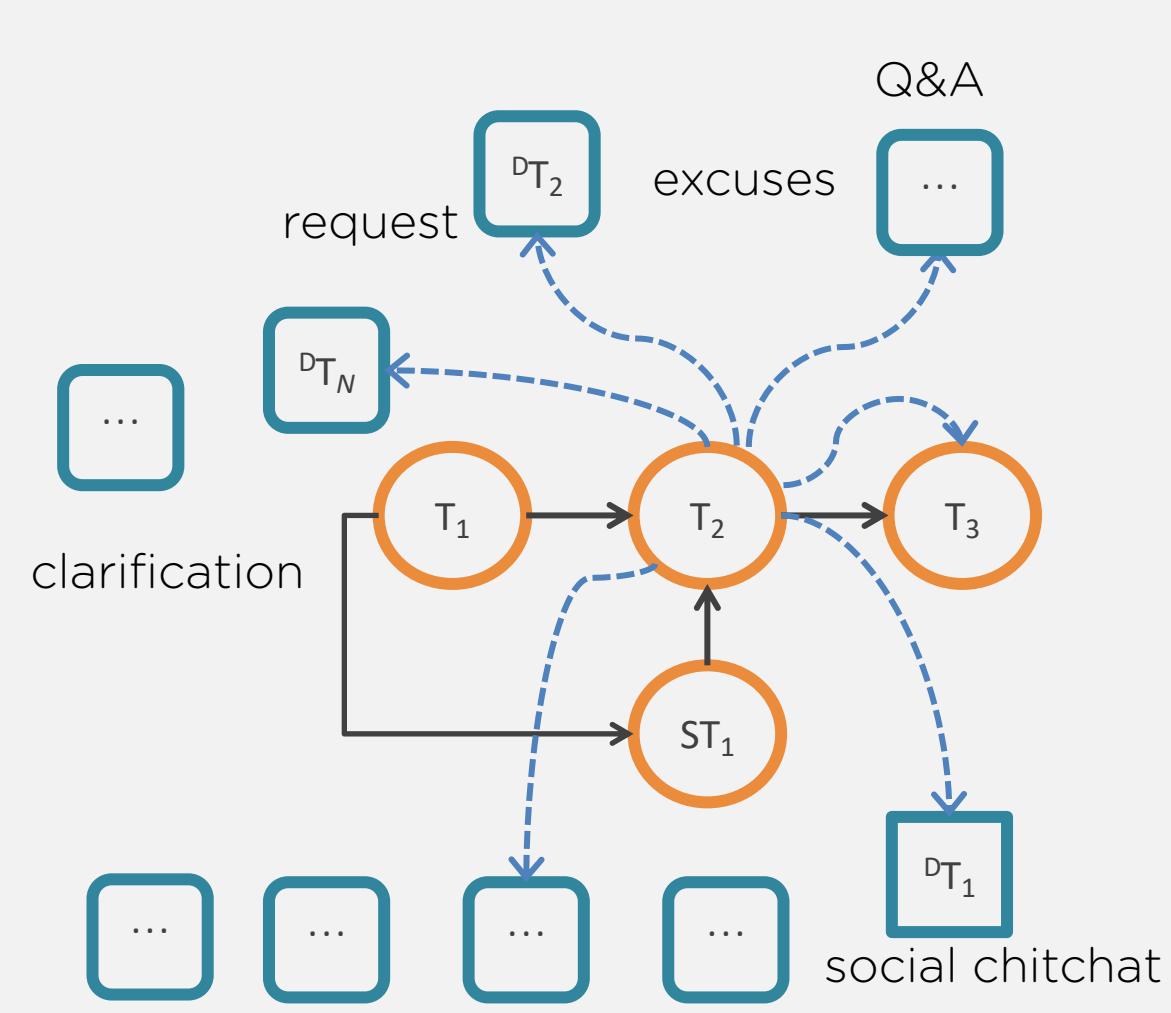
Michelle: no



Attention + Memory

virtually an unlimited
number of attentions

complex contexts as
users frequently shift
attention



Attention + Memory

policy-driven,
optimization-based
approach to manage
attention

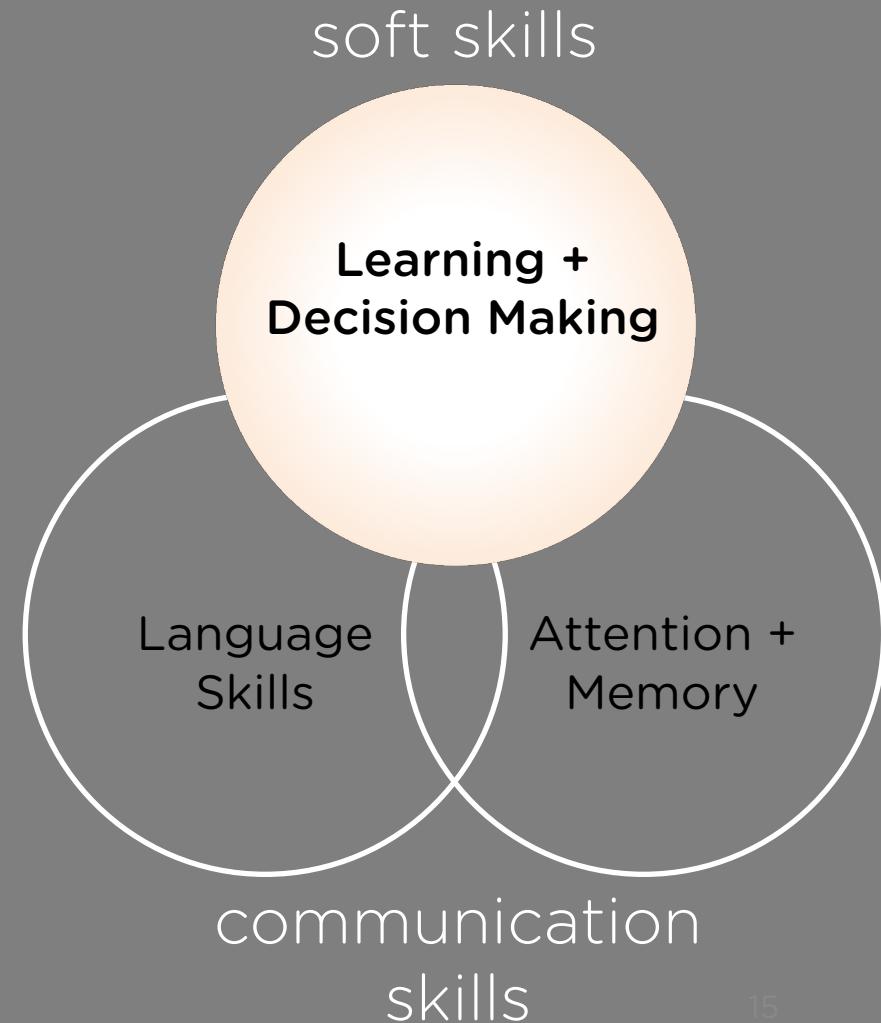
$$S = (\upsilon, \tau, \gamma, \Pi)$$

auto-manage contexts
& transitions

Cognitive Intelligence

Social-emotional intelligence impacts relationship building and satisfaction

Lopes, P. N., Salovey, P., & Straus, R. (2003). Emotional intelligence, personality, and the perceived quality of social relationships. *Personality and individual Differences*, 35(3), 641-658.



Learning + Decision Making

- read between the lines to learn about users deeply
- personalize decision making to better help and guide users

James 12:27:55 AM
I have tremendous perseverance and great analytical skills. My background in the field has given me a unique set of experiences I am excited to bring to the company.

Kaya
I went ahead and analyzed your personality for you. I looked for patterns in the text from your social media and our chat. It's my duty to help users understand themselves better, after all!

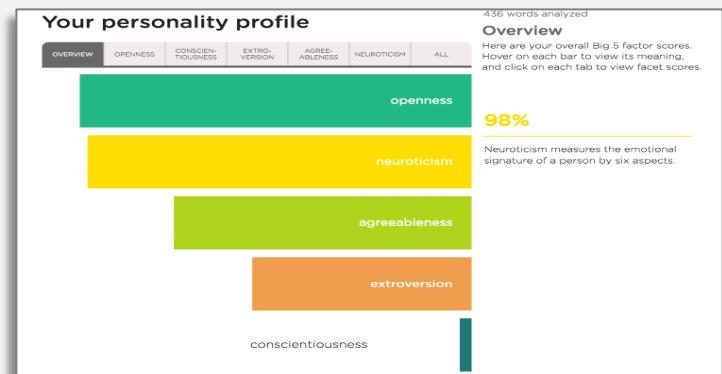
Kaya
I'm curious, what do you think of my assessment? Agree with it, not sure, or disagree?

James 12:28:04 AM
Well, overall it's pretty accurate. However, there are a few minor things I disagree with: I don't think I'm that neurotic. But maybe you do know me better than I know myself.

read between the lines

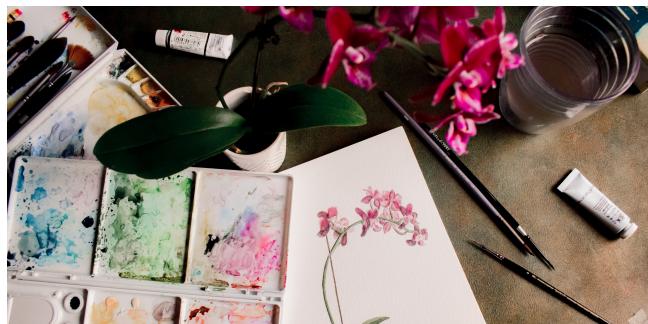
infer personality insights

Big 5 Personality

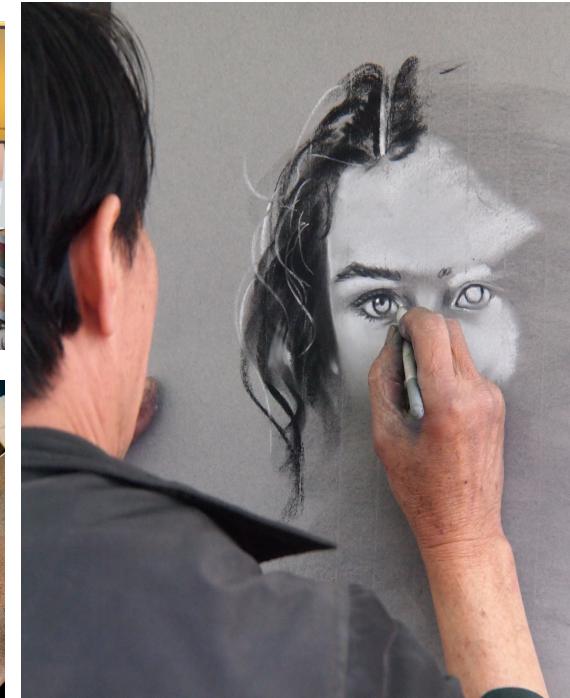


Personality Insights

emotional and social intelligence
how you handle life's challenges



passions + interests
what you like to do



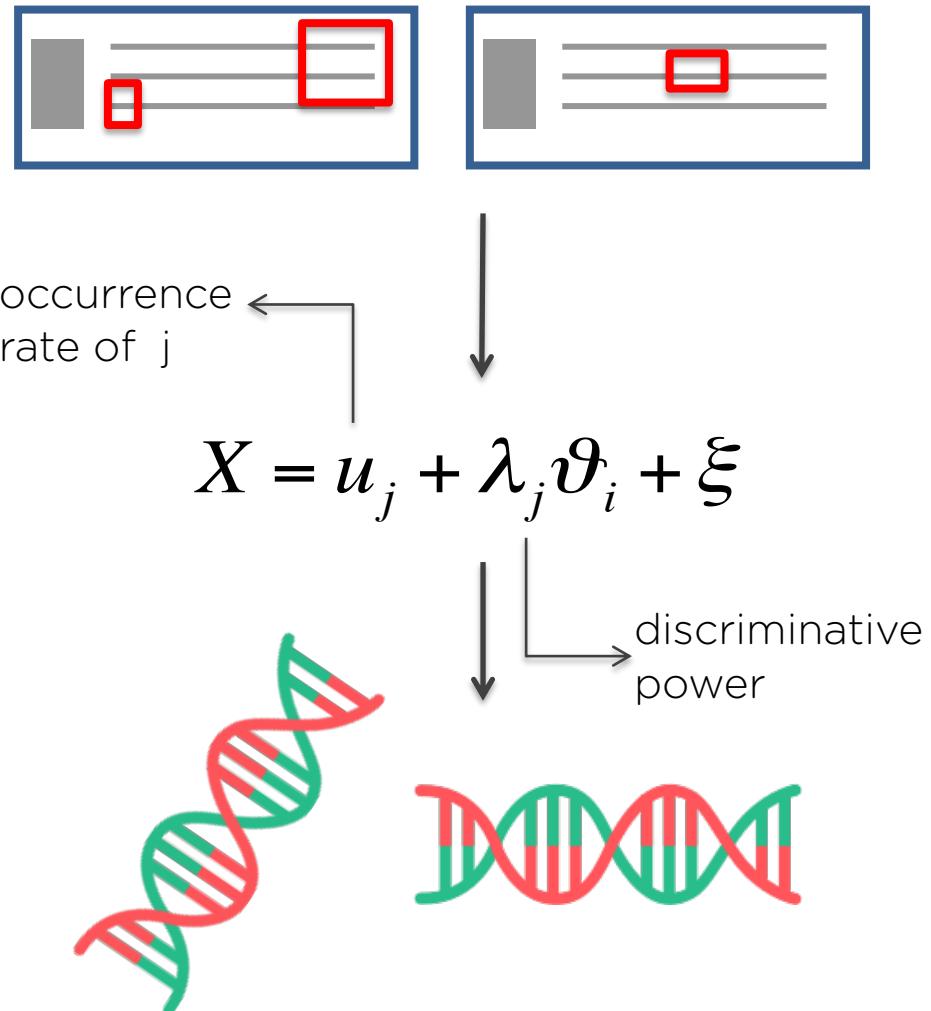
talents + skills
what you are good at

Read between the Lines

big data analytics +
latent trait theory (IRT)

evidence-based trait
analysis

[Zhou, M. X., Mark, G., Li, J., & Yang, H. (2019). Trusting virtual agents: The effect of personality. ACM Transactions on Interactive Intelligent Systems (TiiS), 9(2-3), 1-36.]



Personalize Decision Making

- personalize conversations and guidance
- exhibit emotional and social intelligence (explainable AI)



Customer A:
assertive
impatient

I understand you wish to get some quick info. Here is a summary.



Customer B:
meticulous
indecisive

To help you make decisions, may I suggest a product comparison?

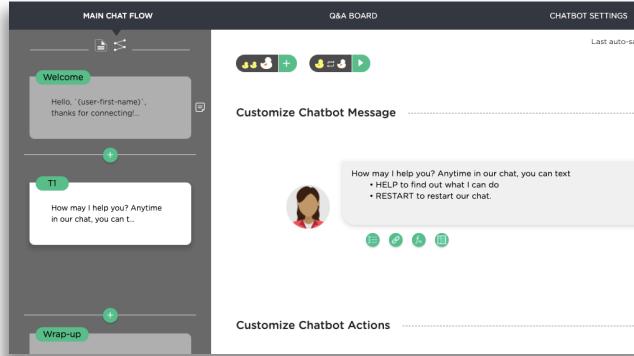


Democratizing Cognitive AI Assistants

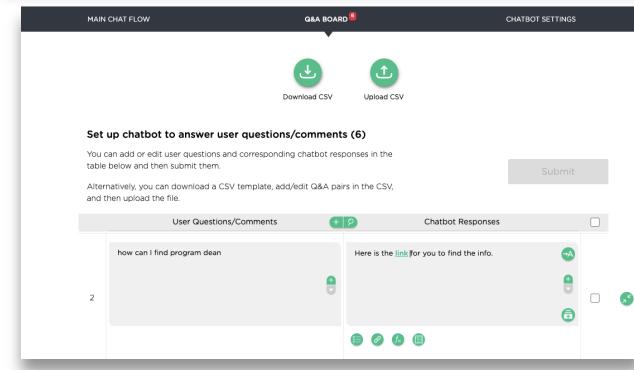
NO AI or engineering skills required.
NO coding required.

Rapid Setup and Deployment

STEP 1
define a main chat flow

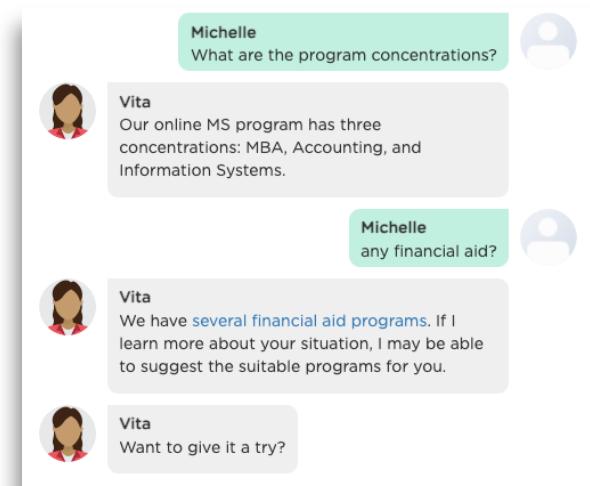


STEP 2
Upload Q&A pairs



STEP 3

auto-generate a chatbot with out-of-the-box cognitive intelligence



Evaluating Cognitive AI Assistants

Usefulness -----
(function)

[Xiao, Z., Zhou, M. X., Liao, Q. V., Mark, G., Chi, C., Chen, W., & Yang, H. (2020). Tell Me About Yourself: Using an AI-Powered Chatbot to Conduct Conversational Surveys with Open-ended Questions. ACM Transactions on Computer-Human Interaction (TOCHI), 27(3), 1-37.]

Usability -----
(form)



Example Metrics
Task Completion Rate Engagement Duration Repetition Informativeness
Language Skills Attention + Memory Learning/Decision Making Soft Skills
Abandon Rate User Sentiment User Satisfaction Rating
Level of Empathy Hate Speech Rate User Trust Rating

Auto-Evaluation: Debugging Chatbot

6.22 min

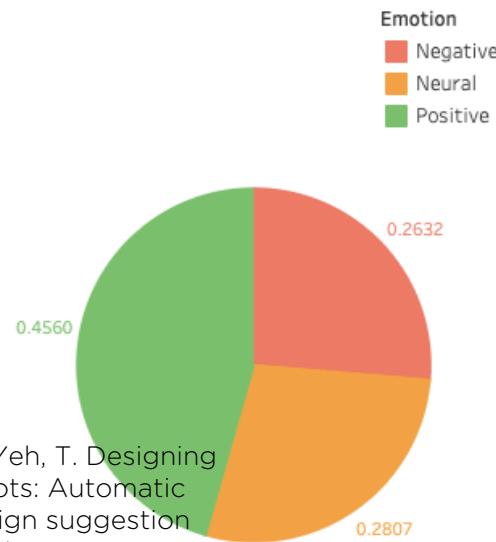
72.2 words

3.93 out of 5

4.17 out of 5



User Sentiment from Direct Feedback Eliciting Question



[Han, X., Zhou, M.X., and Yeh, T. Designing effective interview chatbots: Automatic chatbot profiling and design suggestion generation for chatbot debugging. To appear in CHI 2021]

Keyword from responses with **positive** sentiment



Keyword from responses with **negative** sentiment





An Open Challenge

How long can your AI assistant engage with users?

AI Teammate • AI Learning Companion • AI Wellness Companion

[Xiao, Z., Zhou, M. X., & Fu, W. T. (2019, March). Who should be my teammates: Using a conversational agent to understand individuals and help teaming. In Proc. of IUI 2019 (pp. 437-447).]



Association for
Computing Machinery

CALL FOR PAPERS

ACM Transactions on Interactive Intelligent Systems

An ACM journal for research about intelligent systems that people interact with

Editor-in-Chief

Michelle X. Zhou, Juji Inc., USA

Information for Contributors

ACM Transactions on Interactive Intelligent Systems is an ACM premier journal featuring research on intelligent systems that people interact with. TiIS publishes articles on research concerning the design, development, and evaluation of interactive systems that incorporate certain form of machine intelligence. Such interactive intelligent systems are associated with two defining characteristics: intelligence and interactivity. An article can address these two defining characteristics in any of several complementary views, with a focus on (a) the intelligent technology, (b) the interaction of users with the system, or (c) both aspects at the same time.

Research on interactive intelligent systems covers a wide variety of research topics. TiIS welcomes relevant submissions from all of these topic areas, and its board of Associate Editors has been selected with the goal of ensuring expert reviewing of all relevant submissions. The following list of topics, though representative, is not exhaustive; and different terms are sometimes used to describe the areas. In some of these areas only a fraction of the research that is conducted concerns interactive intelligent systems. Therefore, not every manuscript that falls into one of these topics is relevant to TiIS.

Machine Intelligence for Novel User Interfaces

- Augment Reality and Virtual Reality
- Multimodal interfaces
- Natural language interfaces
- Embodied conversational agents
- Computer graphical interfaces
- Accessible computing

Machine Intelligence for Interactive Systems

- Crowd computing
- Recommender systems
- Information retrieval
- Intelligent learning environments

Machine Intelligence for Developing and Testing User Interfaces

- Model-based design of user interfaces
- Automated usability testing

Machine Intelligence on More Than One Level

- Information visualization and visual analytics
- Human-robot interaction
- Semantic technologies
- User modeling for adaptive and personalized systems
- Internet of Things
- Ubiquitous computing
- Mobile computing
- Games
- Knowledge capture

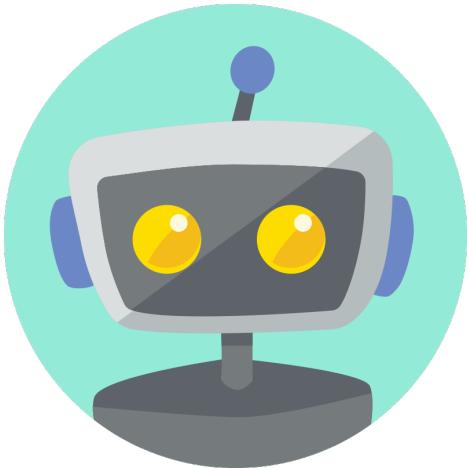
For further information and to submit your manuscript,
visit <https://tiis.acm.org>.

Special issue on long-term AI companionship?

Contact: mzhou@acm.org

Summary

Cognitive AI Assistants as Long-Term Companions



AI Safety



AI Ethics



Companion Evaluation

[Gou et al. 2014; Wang et al. 2015; Ferwerda 2015; Berkovsky et al. 2020; Dotti et al. 2020]

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