SUBJECTIVE DEBATE AS CONVERSATIONAL SEARCH

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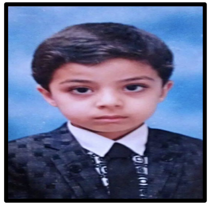
WHO AM I?



- Industrial Engineering, B.Sc & M.Sc.
  (FAU University Erlangen-Nürnberg)

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1. Incorporate human opinions and preferences in conversational agents in CSS.

2. Enhance conversational agent's ability to communicate and reason through storytelling and narratives in CIS.

3. Develop human-like evaluation approaches for conversational AI systems.

TALK OUTLINE

OpinionConv: Conversational Product Search with Grounded Opinions

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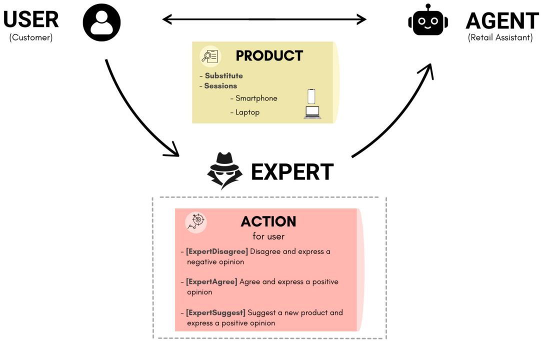

AI Debate over Product Reviews: Revealing User Preferences through Adversarial Sales Dialogue

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CONVERSATIONAL SEARCH SCENARIOS

When searching for products:

How may I help you?

I’m looking for a smartphone.

Sure, what **operating system** do you prefer?

I want an Android.

OK, and any preference on **screen size**?

Larger than 5 inches.

…

- Sequence of Q & A between the sales assistant (agent) and the customer (user) about **product features**. [1]

When searching for products:

How about the quality of its camera?

This is an excellent phone; it takes **high-quality pictures**,operating system easy to handle, but it's battery life lacks a little.

What about the Oneplus 2? I don't know how they did it, but they really managed to create a phone **with robust life** and **low battery drain**.

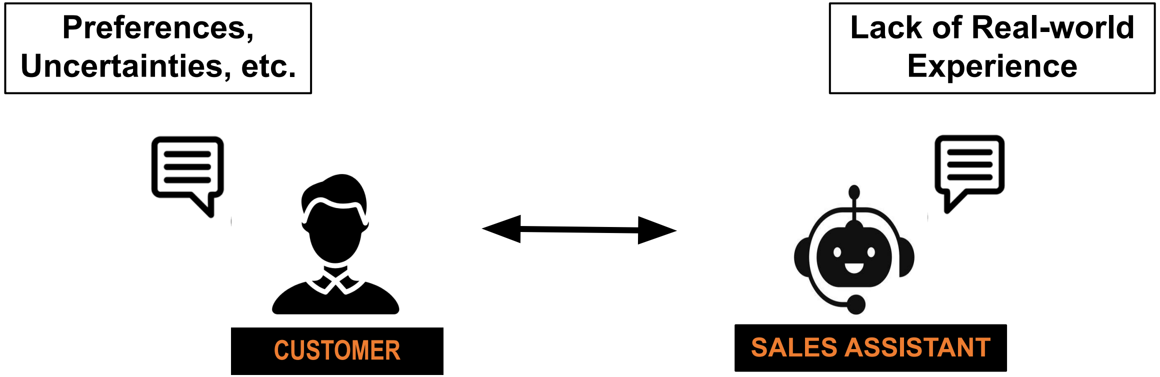
Yes, I agree. This phone might also be a good choice, but you **hear some criticism from tech "critics"** on the web **about its camera and the pixel density.**

I see…

[1] Yongfeng Zhang et al., 2018. Towards conversational search and recommendation: System ask, user respond.

MOTIVATION

- When searching for products, subjective experiences of others play a crucial role in making informed decisions.



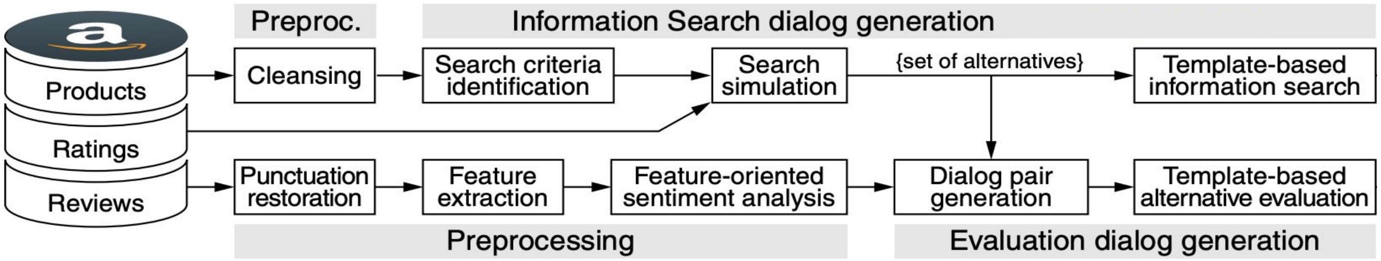
- We used a five-stage process that summarizes **customer decision making process**: [2]

(1) Recognize a need
(2) Search for information about potential products
(3) Evaluate and compares these alternatives
(4) Proceed to make a purchase decision
(5) Exhibit post-decision behaviors.

[2] Philip Kotler and Kevin Lane Keller. 2015. Marketing management.

OpinionConv - PIPELINE

- Product category: ***Cell Phones and Accessories***

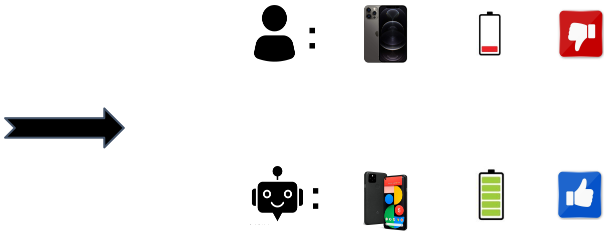


- Design **7 Question–Answer and Opinion–Opinion pairs** using different *Negotiation Tactics* [3]
- Devise **14 Conversation Templates** using conversational negotiation strategies

- Simulate:

  > Sales assistant

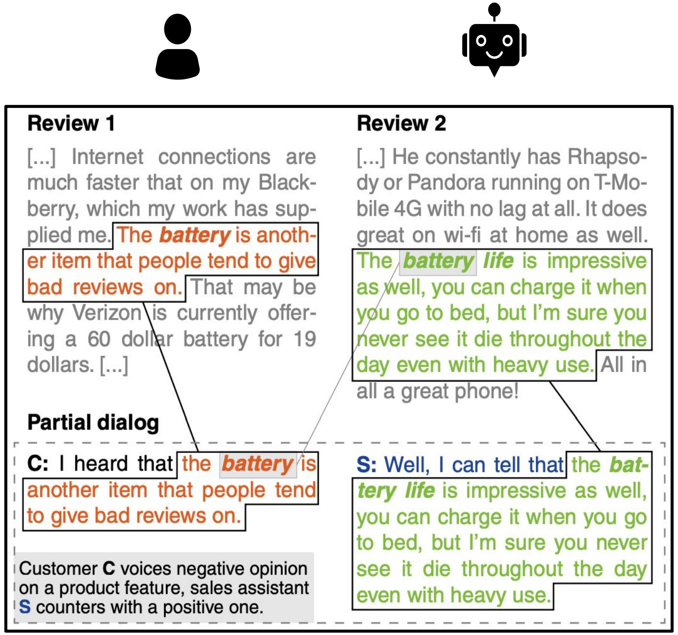
  > Customer



Deny - Switch Product

[3] He He, et al., 2018. Decoupling strategy and generation in negotiation dialogues.

OpinionConv - GENERATION



An example of an opinionated dialog pair generation step

Deny - Disagreements

Pair	Principle	Action	Example
Deny–Switch Product	Insist on position	Express negative sentiment	**B:** What I know about its battery is that the battery keeps draining because the phone is constantly looking for network signal.
	Invent options for mutual gain	Recommend a new product	**S:** If the battery is important for you, we can offer this product: Axon 7 is the same price as OnePlus 3, but it has slightly bigger battery.
Request–Inform	Focus on interests	Look for more information	**B:** What do you think about its speakers?
	Build trust	Express positive sentiment	**S:** It has dual front-facing speakers with good quality.
Search–Agreement	Focus on interests	Search for alternatives	**B:** I heard about this phone: Galaxy S4 that has a super-fast processor and a good battery life.
	Build trust	Confirm consumer's preference	**S:** Yes, that's true. This phone is also a good choice with the one premium hardware, great software and a reasonable price.

An example of the combination of dialog pairs in a conversation template

- Total number of conversations generated by OpinionConv: **195,614**

OpinionConv

Customer decision process (Kotler and Keller, 2015)	**Generated opinionated conversation for product search** (**S** = sales assistant, **C** = customer)	**Negotiation strategy** (Conversation template ID: 4)
Problem/need recognition	(not relevant for conversation generation)	Initiative
Information search Example reproduced from Zhang et al., 2018, Figure 1.	**S:** How may I help you? **C:** Can you find me a mobile phone? **S:** Sure, what ***operating system*** do you prefer? **C:** I want an Android. **S:** OK, and any preference on ***screen size***? **C:** Larger than 5 inches. **S:** Do you have requirements on ***storage capacity***? **C:** I want at least 64 GB. **S:** And any preference on ***phone color***? **C:** Not particularly.	Sales assistant Search dialog Sequence of questions and answers between the sales assistant **S** and the customer **C** about ***product features***, until a small set of alternatives remains.
Evaluation of alternatives Focus of this paper	**S:** What about the Samsung Galaxy S6? It's availabe for $228.89.	Prompt — **S** makes an offer.
	C: I like it's design, but it costs too much. Do you have any cheaper ones? **S:** Yes! I have this one for you. The Sony Xperia X. It's cheaper; $117.13.	Customer Price negotiation **C** asks for cheaper options, **S** makes a cheaper offer.
	C: Sounds good! **C:** How does its ***operating system*** handle? **S:** The Sony Xperia X is an excellent phone, good ***connectivity***, ***operating system*** easy to handle, it takes highy-quality ***pictures***, but it's ***battery life*** lacks a little.	Request–Inform **C** asks about a ***product feature***. **S** responds with a positive opinion about it.
	C: What about the Oneplus 2? I don't know how they did it, but they managed to create a phone with robust ***life*** and low ***battery drain***. **S:** Yes, I agree. This phone might also be a good choice, but you hear some criticism from tech "critics" on the web about its ***camera*** and the ***pixel density***, etc.	Search–Warning **C** asks about an alternative due to a positive opinion on one of its features. **S** responds with a negative opinion on a different feature.
	C: I see. The ***camera*** quality is important to me.	Reaction — **C** agrees.
	C: Given the ***price*** of the Sone Xperia X, I would have expected ***capacitive buttons***. **S:** For a sim-free ***price*** under $200 it's one of the most affordable options out there and a good smartphone.	Deny–Disagreement **C** voices a negative opinion about a product feature (price). **S** disagrees.
Purchase decision	**C:** Alright, I'll buy the Sony Xperia X.	Decision — **C** decides.
Post purchase behavior	(not relevant for conversation generation)	

OpinionConv - Evaluation

Study 1: Importance of Opinions in Product Search

- We showed participants two variants of generated sales conversation:
  - Variant 1 is focused on the customer’s preferences and requirements.
  - Variant 2 starts similarly, but then continues with an opinionated discussion.

Q: Which of the two variants would you as a customer hold with the sales assistant while searching for a smartphone?”

- **83%** of the participants of study 1 preferred variant 2 over the variant 1.

Prolific

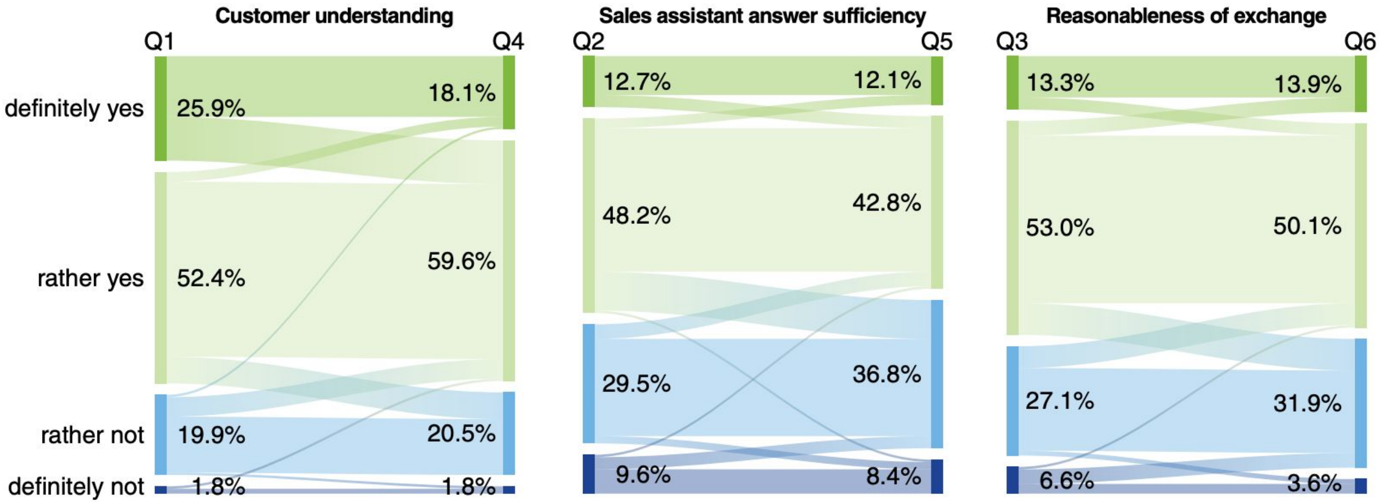
Measure	Characteristics	Study 1 (N=100)	Study 2 (N=420)
Gender	Males	41.0%	31.0%
	Females	58.0%	69.0%
	Non-binary	1.0%	0.0%
Age	25 to 34 years	35.0%	38.0%
	35 to 44 years	28.0%	30.1%
	18 to 24 years	21.0%	15.7%
	55 to 64 years	6.0%	13.3%
	45 to 54 years	5.0%	1.8%
	65 years or older	5.0%	1.2%

Demographics of study participants

OpinionConv - Evaluation

Study 2: Perceptions of Dialog Realism

- For each of **14** conversation templates: **10** examples
- For each example **3** participants were asked
- First, we inform participants, they are reading a transcript of a real conversation. **Q1, Q2, Q3**
- Then, we reveal the truth and declare that the conversation they just read, was not a real but an automatically generated one. **Q4, Q5, Q6**



CONCLUSION

- We introduced **OpinionConv**, a new conversation generation pipeline that generates opinionated multi-turn conversations for product search.

- **OpinionConv** was mainly designed to **incorporate** subjective narratives into conversational product search and to **control** both the dialog coherence and the information to be mentioned in the utterances.

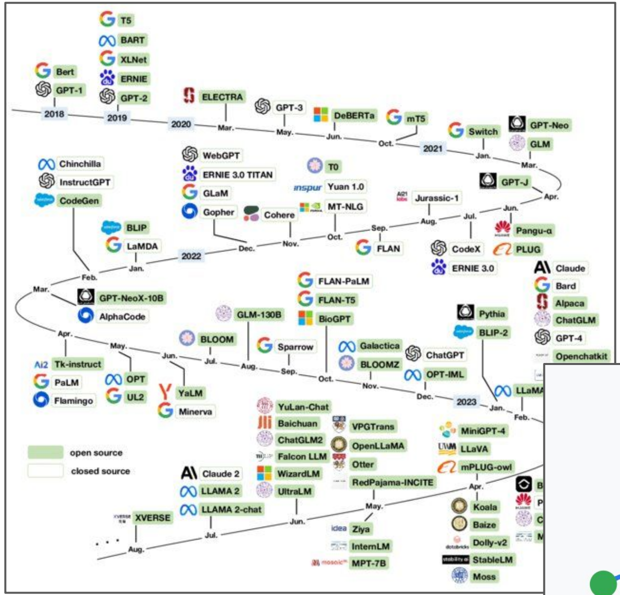
- We also observed three key concerns raised in the human evaluation:

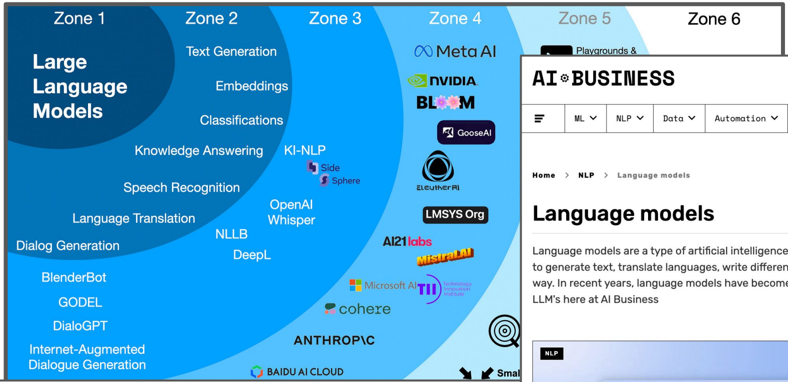
(1) Some features are of no interest to be discussed:
e.g.," Why would the person asks the sales assistant about colours? That seems out of the ordinary."

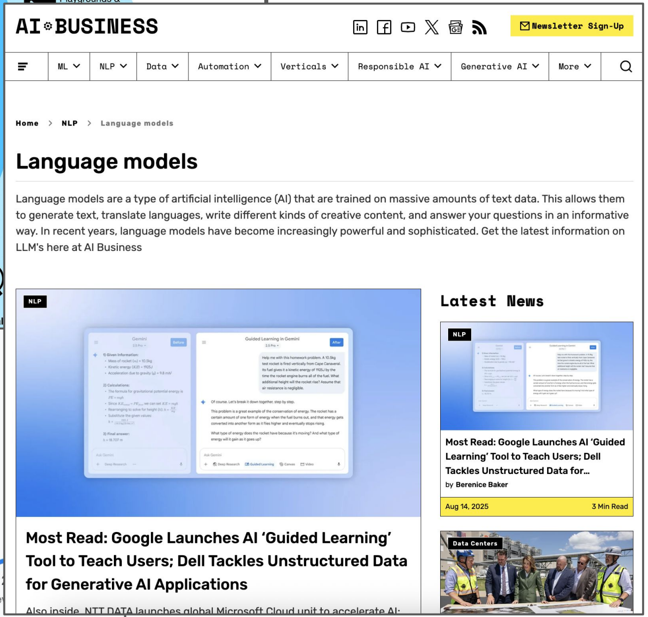
(2) Some participants judge the conversations based on their personal experience with real sales assistants:
e.g., *"As always in marketing strategies, he [the sales assistant] was just trying to sell a phone not what he [the customer] wanted."*

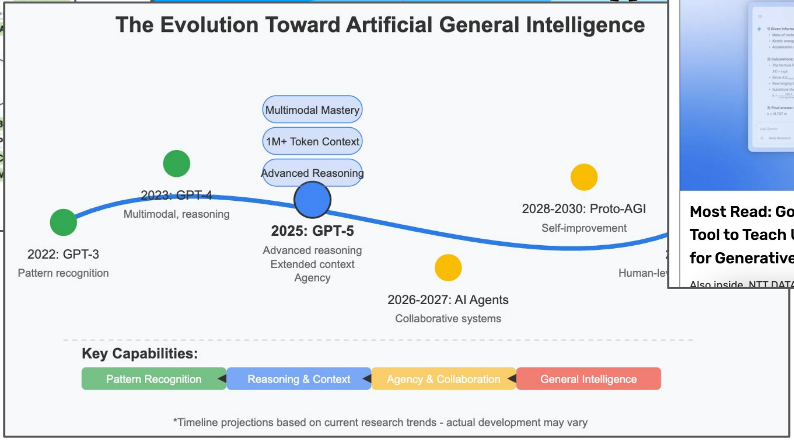
(3) A stronger argumentation is expected by some participants
e.g., "stating that it's 'bright and good quality' would not be convincing enough for me to buy the product."

LARGE LANGUAGE MODELS



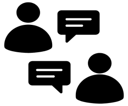




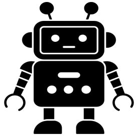


TOOLS - LLMs

Interaction

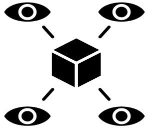


Agents

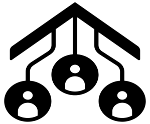


Feedback

Perspective



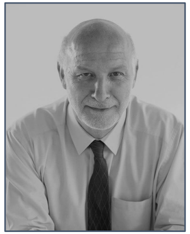
Alignment



- Human-centered LLMs should be in every stage:

SUBJECTIVITY & INTERACTION

How Human Subjectivity Forms?



About

Peter Fonagy, CBE, FBA, FAcSS, FMedSci is a Hungarian-born British psychoanalyst and clinical psychologist. He studied clinical psychology at University College London. Wikipedia

Place of birth: Budapest, Hungary

Education: University College London (1971–1974)

h-index: 181

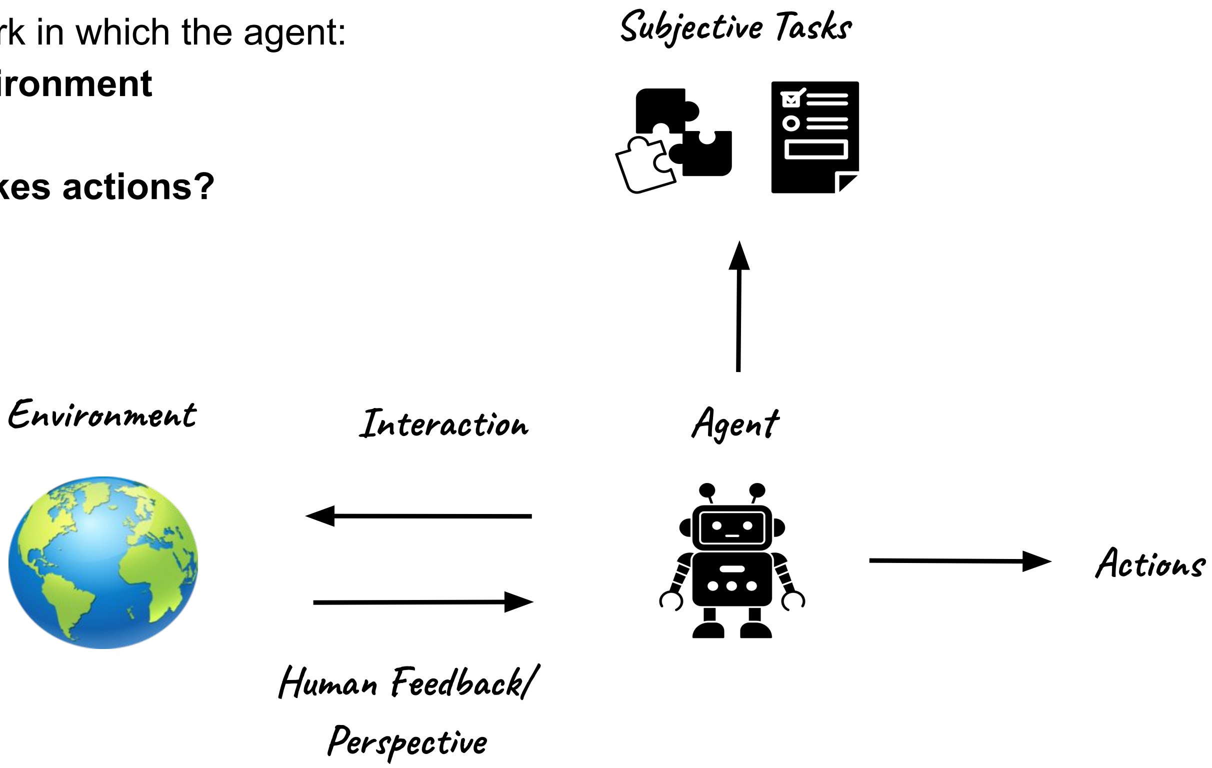
Affiliation: University College London

Research interests: Borderline personality disorder, Psychotherapy Outcomes, Attachment Theory, Psychoanalysis

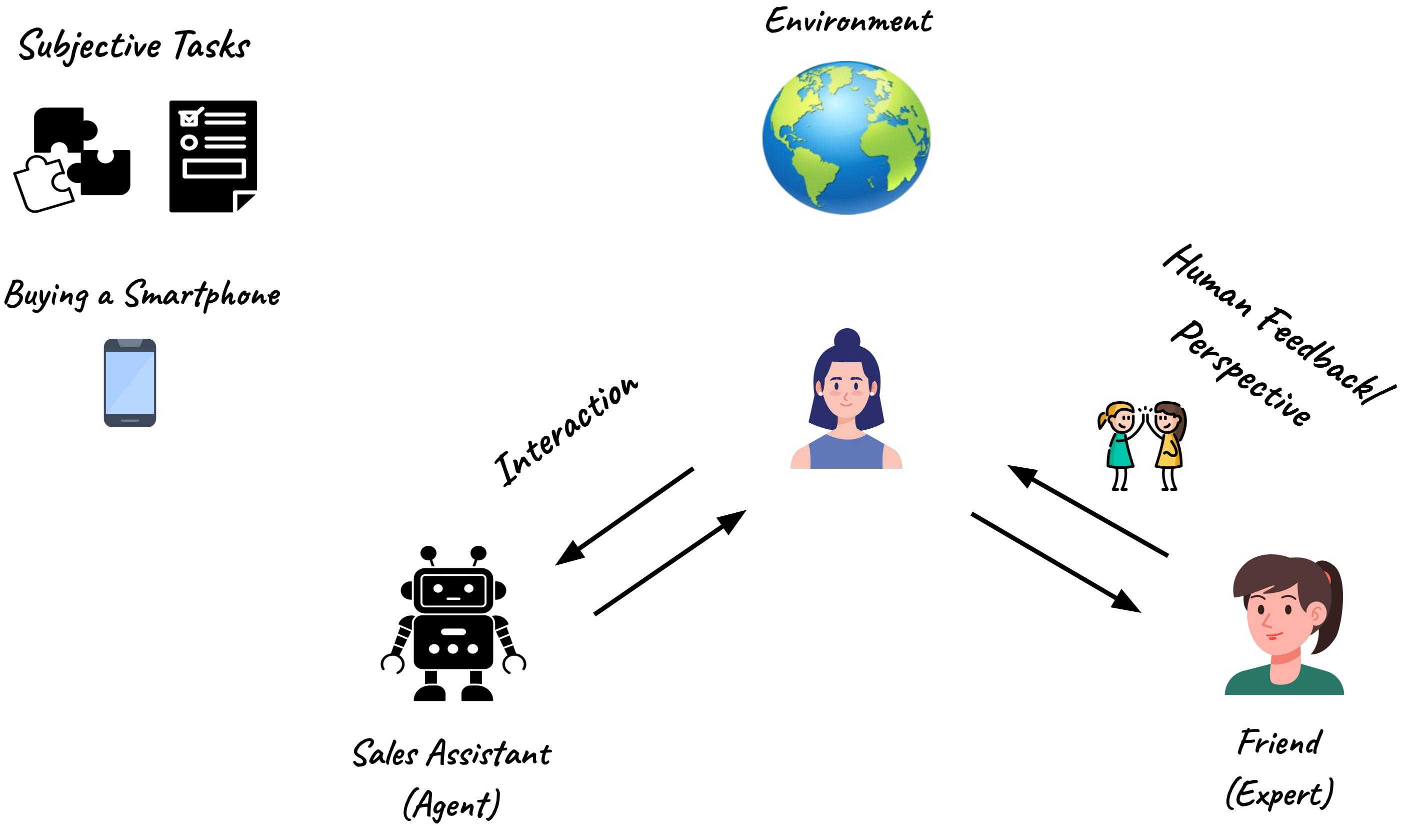
"It's an intensely social thing ***(Interaction)****. We find ourselves in the eyes and face of another person … in somebody else's mind* ***(Feedback)****. We find our thoughts and our feelings represented and we internalize that representation* ***(Alignment)*** *and combine it with our experience* ***(memory)*** *to create a* ***HUMAN SUBJECTIVITY*** *that we take for granted… This becomes the building block of our subjectivity that is us* ***(Human)*** *… That is something that all of us need just to* ***walk through a human world*** *to be able to collaborate with people* ***(Interaction)****."*

FRAMEWORK

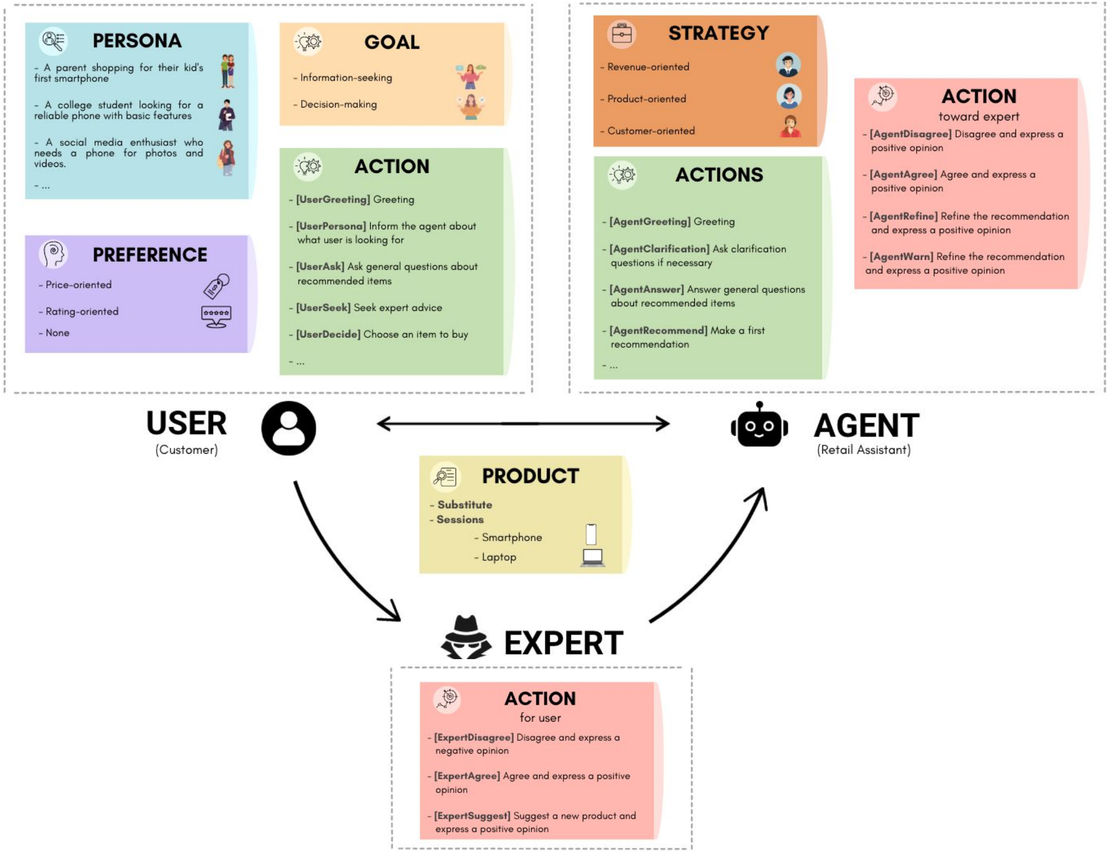
- What if we design a framework in which the agent:
    - **Interacts with the environment**
    - **Get feedback**
- **To learns when and how takes actions?**



PROPOSED FRAMEWORK



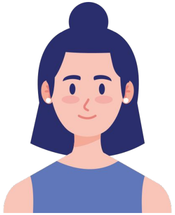
SIMULATION FRAMEWORK

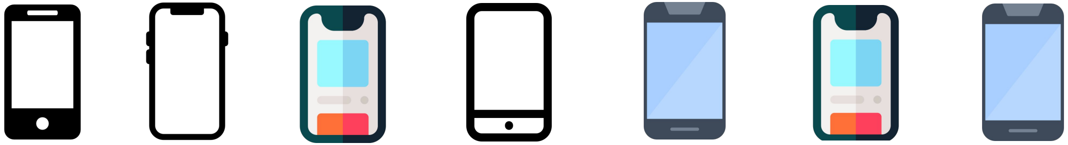


IDEAL CASE!

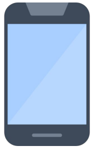
USER INFORMATION

PRODUCT INFORMATION + PRODUCT REVIEWS





USER DECISION

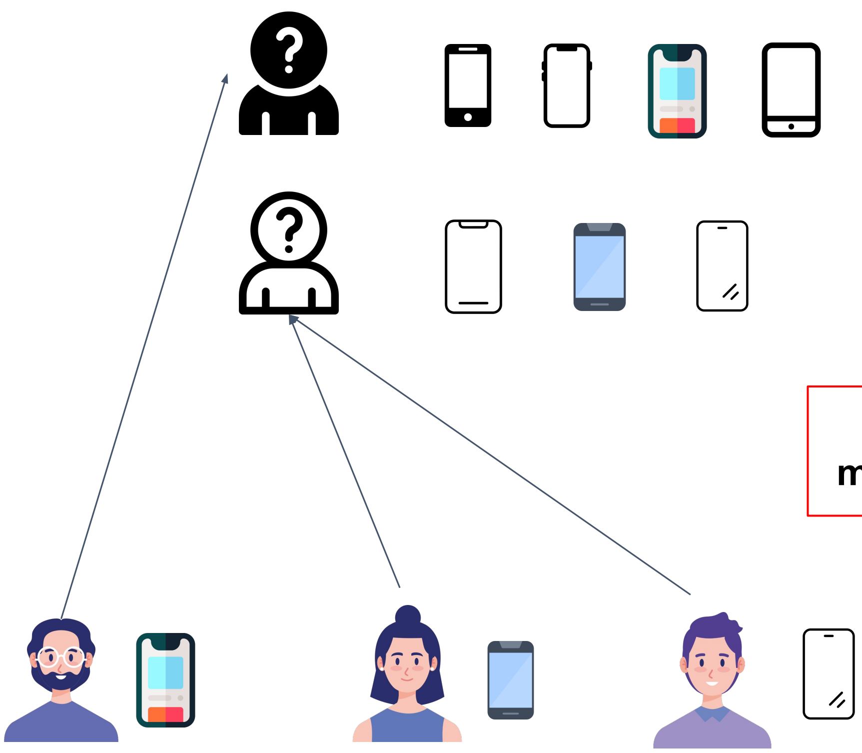


DATASET - SESSIONS

UNIVERSITÄT BONN
LAMARR INSTITUTE FOR MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Amazon Clicks

USER A



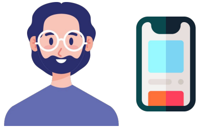
USER B

Amazon Reviews

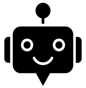
Amazon KDD Cup '23
Shopping Session Dataset
Build Multilingual Recommendation Systems
$21,000 Cash Prize Pool + $10,500 AWS Credit Pool
ACM SIGKDD 2023 Workshop

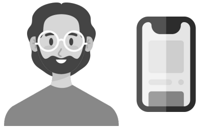
How to make user A (in clicks) more similar to user B (in reviews)?

PERSONA GENERATION



The phone was ok. About a month in it started having **Bluetooth connection issues**. Android auto couldn't connect. Smart watch would also lose connection. I also had issues **with screen recording.** If you screen record certain things, the recorder would automatically get stuck and not finish the recording. I would definitely not recommend this phone at all. Do not buy.





A tech-savvy individual who relies heavily on **functionality for both work and personal use**, using multiple devices and relying on features like screen recording.

DATASET - ACTIONS

USER
(Customer)

ACTION

- **[UserGreeting]** Greeting
- **[UserPersona]** Inform the agent about what user is looking for
- **[UserAsk]** Ask general questions about recommended items
- **[UserSeek]** Seek expert advice
- **[UserDecide]** Choose an item to buy
- ...

AGENT
(Sales Assistant)

ACTIONS

- **[AgentGreeting]** Greeting
- **[AgentClarification]** Ask clarification questions if necessary
- **[AgentAnswer]** Answer general questions about recommended items
- **[AgentRecommend]** Make a first recommendation
- ...

ACTION
toward expert

- **[AgentDisagree]** Disagree and express a positive opinion
- **[AgentAgree]** Agree and express a positive opinion
- **[AgentRefine]** Refine the recommendation and express a positive opinion
- **[AgentWarn]** Refine the recommendation and express a negative opinion

EXPERT

ACTION
for user

- **[ExpertDisagree]** Disagree and express a negative opinion
- **[ExpertAgree]** Agree and express a positive opinion
- **[ExpertSuggest]** Suggest a new product and express a positive opinion

DATASET - ACTIONS

“Mhm...” – Conversational Strategies For Product Search Assistants

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(c) Dialogue Act	Explanation
Interaction Structuring	Utterances to structure the conversation
Opening	Utterances that indicate the beginning or end of the conversation
Question	Utterances that aim to acquire information from the conversation partner
Inform	Utterances that serve to inform, explain, answer, justify, elaborate or make statements
Agreement	Utterances that agree and disagree with a previously made statement or plan
Confirmation	Utterances that explicitly answer a closed question
Suggest	Signifying that one wants the other to consider a proposition that concerns both conversation partners
Offer	Signifying that one wants the other to consider an offer that most of the times concerns only the speaker
Request	Signifying that one uses to ask the other to do something
Auto	The speaker believes to have (in)correctly understood what has been said before, including literal repetition
Allo	The speaker (dis)confirms that the other one has correctly understood what has been said before
Think-aloud[3]	Utterances about actions related to the task (category added by the authors, not present in the original scheme of [7])

Table 1: Coding schemata used in the user study to analyze the content in the recipe (a) and laptop (b) domain and the conversational structure (c) in both domains.

MG-ShopDial: A Multi-Goal Conversational Dataset for e-Commerce

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Table 4: Schemata for intent (top) and goal annotation (bottom).

Intent	Description
Greetings	Indicates the beginning or end of the conversation
Interaction structuring	Utterances that make the conversation structured and natural (e.g., thanking, stalling)
Disclose	The client discloses information about what they are looking for
Clarification question	The agent asks a question to make sure it understands correctly a previous statement
Other question	Asks a question that is not a clarification question (e.g., factoid, follow-up questions)
Elicit preferences	The agent asks a question to find the client’s preferences (e.g., the color of an item, the budget)
Recommend	The agent recommends one or several items to the client
Answer	A participant gives an answer to the other participant’s information request
Explain	Provides an explanation to a previous statement (e.g., justifies suggestion or rejection of an item)
Positive feedback	Expresses positive feedback (e.g., confirmation, accept a recommendation)
Negative feedback	Expresses negative feedback (e.g., disagreement, rejection of a recommendation)
Other	Does not fit other labels
Conversational goal	**Description**
Search	The client wants to find more information on a product or specific topic. The agent answers the client’s request for information. This can take form of casual (why/how), unanswerable, or complex questions that require multiple interactions (e.g., follow-up, sub-questions) and their answers.
Recommendation	The agent elicits the client’s preferences. The agent makes a recommendation based on the client’s need and preferences. The client discloses what they are looking for or their preferences intentionally or as answer to the agent’s questions.
Question answering (QA)	A participant asks a factoid (what/when/who/where), confirmation (yes/no), or listing question about a product or specific topic. The other participant replies with a fact-based and short answer.
Meta-communication	Makes the conversation fluid and natural but is not necessary to complete the goal of the conversation (i.e., chit-chat).

DATASET - ACTIONS

Table 1: Negotiation tactics used in dialog pair templates (P=product, F=feature).

Dialog pair template	Description of negotiation tactic
Request–Inform Question: P-1, F-A, neutral Answer: P-1, F-A, positive	Customer asks about the sales assistant's view on a feature of a product. Sales assistant expresses positive view on it.
Deny–Disagreement Opinion: P-1, F-A, negative Opinion: P-1, F-A, positive	Customer expresses negative opinion on a feature of a product. Sales assistant disagrees and expresses positive opinion on it.
Deny–Switch Product Opinion: P-1, F-A, negative Opinion: P-2, F-A, positive	Customer expresses negative opinion on a feature of a product. Sales assistant switches the product and expresses positive opinion on the same feature wrt. new product.
Deny–Switch Feature Opinion: P-1, F-A, negative Opinion: P-1, F-B, positive	Customer expresses negative opinion on a feature of a product. Sales assistant disagrees and expresses positive opinion on a different feature of the same product.
Search–Agreement Opinion: P-1, F-A, positive Opinion: P-1, F-A, positive	Customer expresses positive opinion on a feature of a product. Sales assistant agrees and expresses another positive opinion it.
Search–Switch Feature Opinion: P-1, F-A, positive Opinion: P-1, F-B, positive	Customer expresses positive opinion on a feature of a product. Sales assistant agrees and expresses positive opinion on different features of the same product.
Search–Warning Opinion: P-1, F-A, positive Opinion: P-1, F-B, negative	Customer expresses positive opinion on a feature of a product. Sales assistant warns the user and expresses negative opinion on different features of the same product.

DEMO

<DEMO: EXAMPLE OF CONVERSATION>

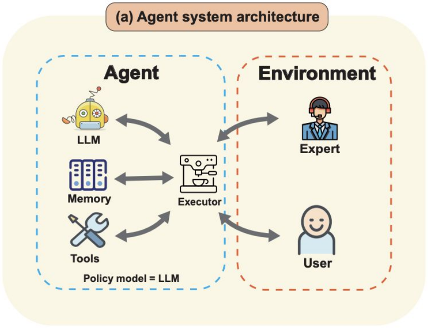
NEXT STEPS

- Extending Dataset, e.g., Laptop

- Designing an Adversarial Sales Dialogue, e.g., two Sales Assistants Agents with two different strategies

- Defining cost for actions, e.g., SEEK ADVICE Action

- Finally, a Reinforcement Learning Framework of LLM Agents for Subjective Reasoning



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THANK YOU!

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