

An Analysis of Mixed Initiative and Collaboration in Information-Seeking Dialogues

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Conversational Search

- × information-seeking support via a dialog interaction
- × “**Of key interest** to us is *mixed initiative*: At different times in the conversation, the human or the agent may take initiative...The system and user both can take initiative **as appropriate.**” (Radlinski & Craswell, 2017)

Mixed Initiative

- × What is an **initiative** in conversation?
- × How well should it be **mixed**?
- × How can we **measure** initiative?

Mixed Initiative

- × a **distribution** of participants' **contributions** to the dialogue development
- × 2 participants: **Seeker** and **Assistant**
- × speaker takes initiative by
 - × determining dialogue **topic** (Stein et al., 1999)
 - × seizing control by issuing a **question** or request (Walker & Whittaker, 1990)

ConversationShape

For each conversation participant:

- × **Information** (# frequent tokens introduced)
- × **Question** (# questions introduced)
- × **Repetition** (# repeated tokens + # anaphors)
- × **Flow** = Repetition - Information

Sample Conversation (ReDial)

(A) Hey! What kind of movies do you like to watch?

(S) I'm big on indie romance and dramas

(A) Ok what's your favorite movie?

(A) Staying with that genre, have you seen
@88487 or @104253

(A) Those are two good ones

(S) When I was a kid I liked horror like @181097

(A) @Misery is creepy but good. I only recently got
into horror.

Sample Conversation (ReDial)

(A) Hey! What kind of **movies** do you like to watch?

(S) I'm big on indie romance and dramas

(A) Ok what's your favorite **movie**?

(A) Staying with **that** genre, have you seen
@88487 or **@104253**

(A) Those are two good ones

(S) When I was a kid I liked **horror** like **@181097**

(A) **@Misery** is creepy but good. I only recently got
into **horror**.

ConversationShape Computation

$$\text{QuestionA} = 3 / 7 = 0.43$$

$$\text{QuestionS} = 0$$

$$\text{Question} = (0.43 + 0) / 2 = 0.22$$

$$\Delta\text{Question} = (0.43 - 0) / (0.43 + 0) = 1$$

$$\text{InformationA} = \text{InformationS} = 1/7 = 0.14$$

$$\text{Information} = 0.14$$

$$\Delta\text{Information} = 0$$

ConversationShape Computation

$$\text{RepetitionA} = 2/7 = 0.29$$

$$\text{RepetitionS} = 0$$

$$\text{Repetition} = 0.29 / 2 = 0.15$$

$$\Delta\text{Repetition} = 1$$

$$\text{Flow} = \text{Repetition} - \text{Information}$$

$$\text{FlowA} = 0.29 - 0.14 = 0.15$$

$$\text{FlowS} = 0 - 0.14 = -0.14$$

ConversationShape Result

Question = 0.22

Δ Question = 1

Repetition = 0.15

Δ Repetition = 1

Information = 0.14

Δ Information = 0

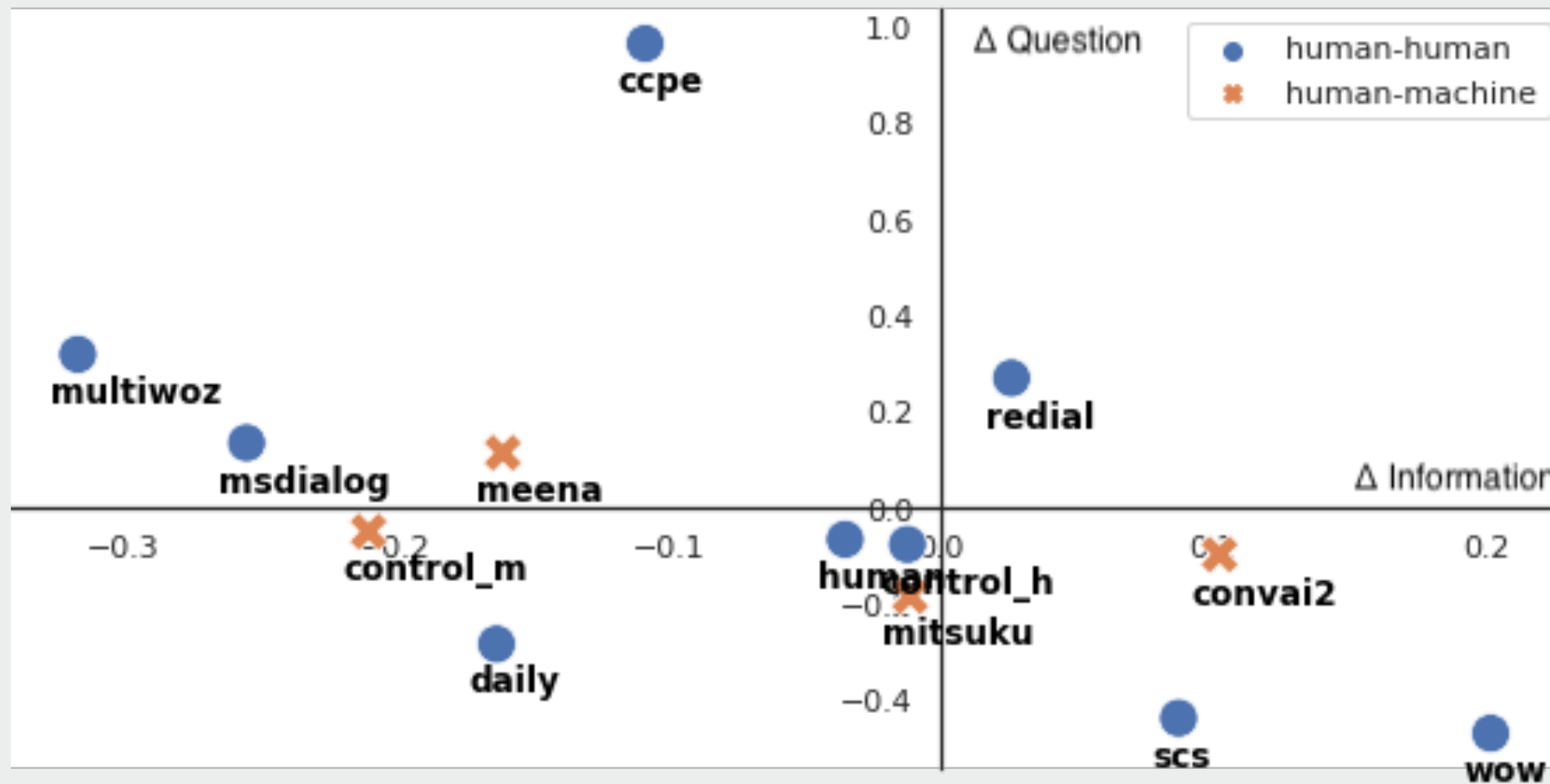
FlowA = 0.15

FlowS = - 0.14

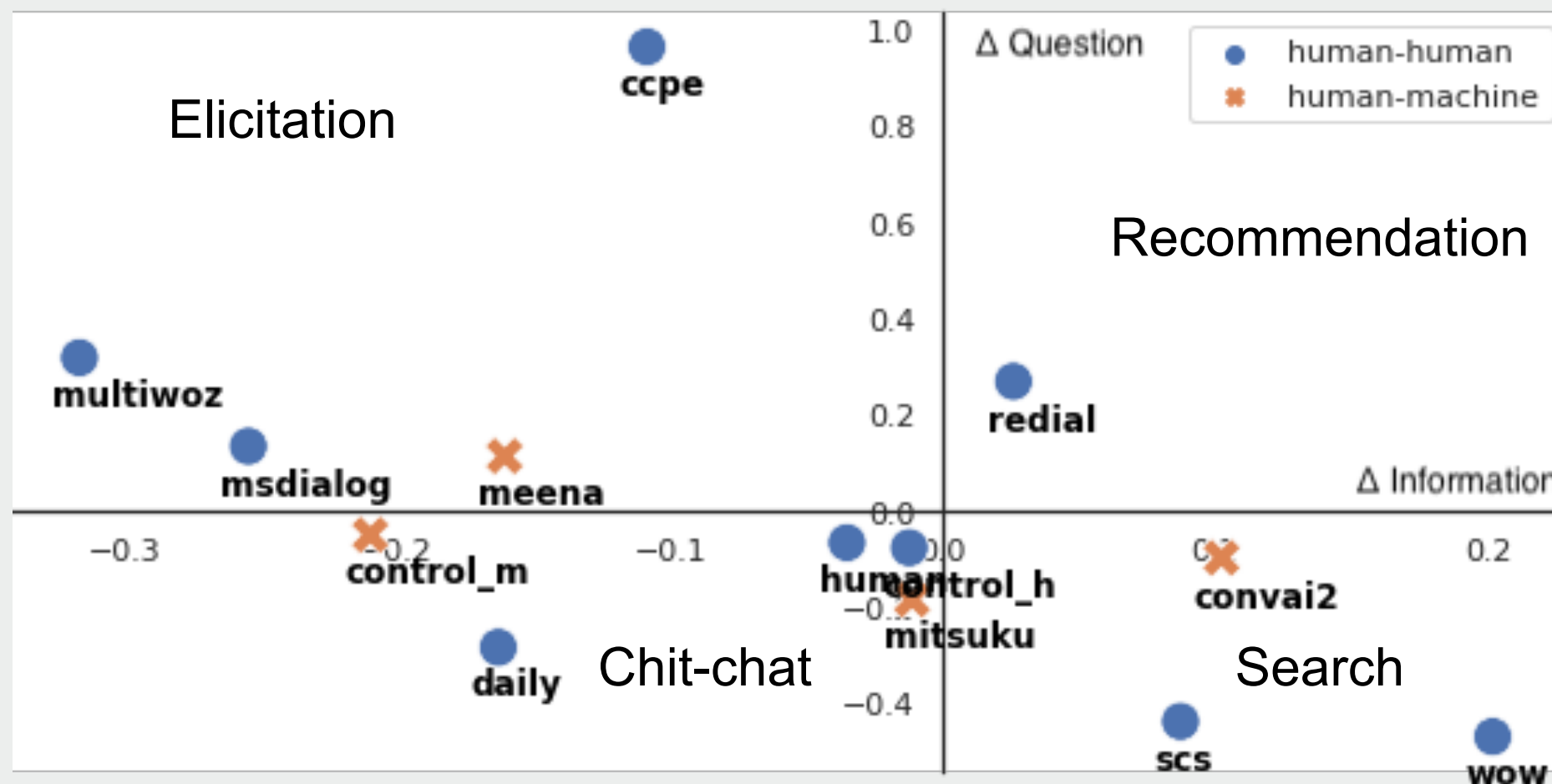
10 Datasets (97k dialogues)

- × SCS (37) — spoken conversational search
- × Redial (10K) — conversational recommendation
- × CCPE-M (502) — preference elicitation
- × MSDialog (35.5K) — response ranking
- × WoW (22.3K) — wizzard of Wikipedia
- × MultiWOZ (10.4K) — task-oriented
- × DailyDialog (11K) — human chit-chat
- × Control (3.2K + 102) — machine chit-chat
- × ConvAI2 (3.5K) — machine chit-chat
- × Meena (91 + 100 + 95)— machine chit-chat

Dialogue Types



Dialogue Types



Conclusions

- × What is an initiative in conversation?
 - × distribution of **information** and **questions**
- × How well should it be mixed?
 - × depends on the **dialogue type**
- × How can we measure initiative?
 - × **ConversationShape**

Future Work

- × develop dialogue models that **balance** initiative
 - × **objective** (reward) function
- × model **semantic** relations between words
 - × predict **individual** conversation success