

**Y**andex

Yandex

# Yandex Algorithm 2018 ML Track

<https://contest.yandex.ru/algorithm2018/>

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Yandex, March 31

# Yandex.Algorithm ML Track

ML track will finish on **April 23, 2018 at 10:00 (MSK)**.

Task was prepared by [Yandex.Alice](#) conversational intelligent assistant team.

The top 128 participants of the ML track will receive a contest T-shirt.

The top three participants of the ML track will be awarded the following prizes:

- first place — 100,000 roubles;
- second place — 70,000 roubles;
- third place — 50,000 roubles.

ML track



# Overview

- | Very briefly:
  - › Dialogue Interfaces
  - › Goal-Oriented Dialogue Systems
- | General Conversation
- | Contest Details

# Dialogue Interfaces



# What is a Dialogue Interface?

- | Interacting via voice or text input in a form of a dialogue
- | It's easy!
  - › Everybody is able to do this
- | It's efficient!
  - › No complicated GUI manipulations

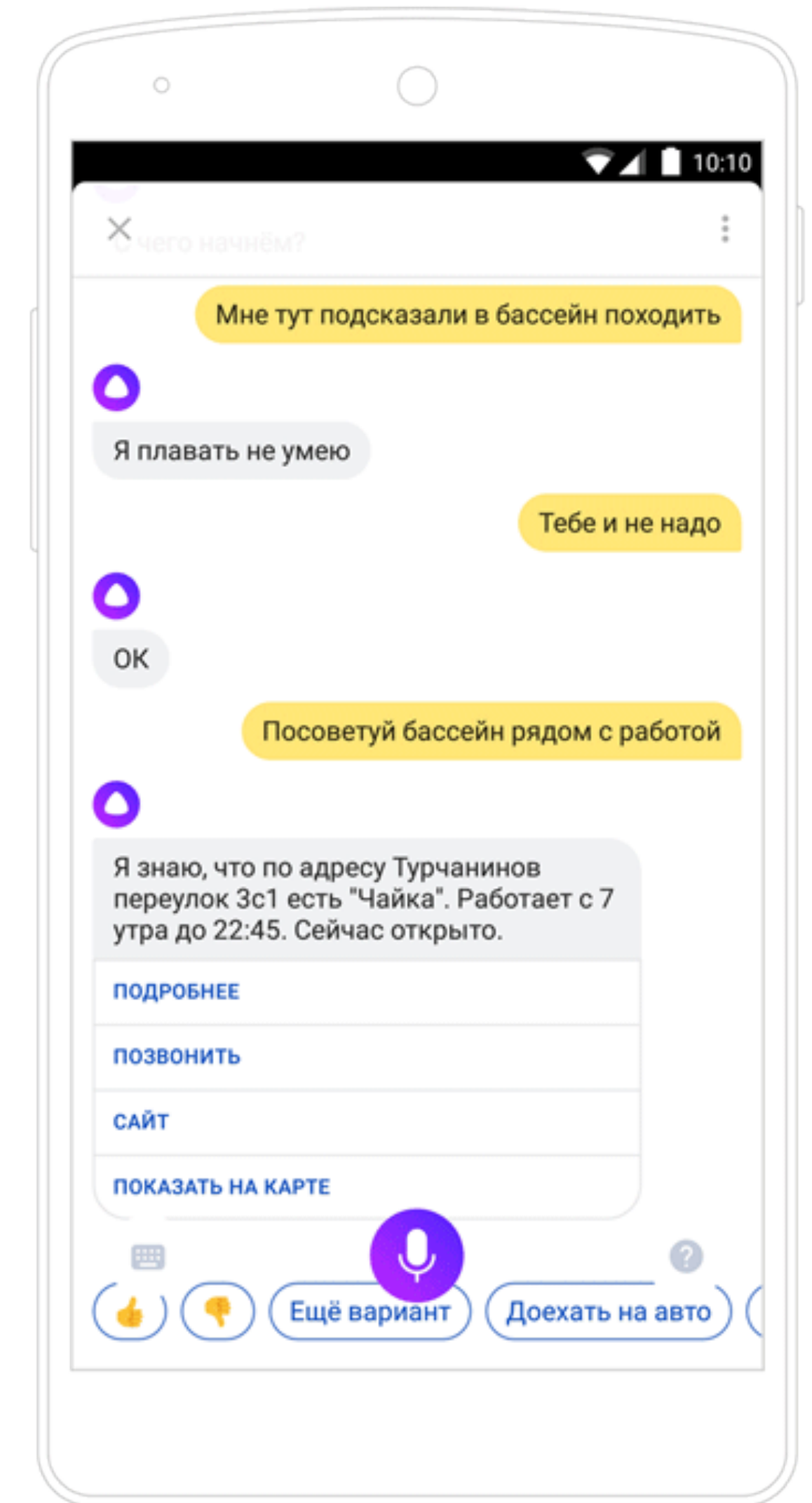
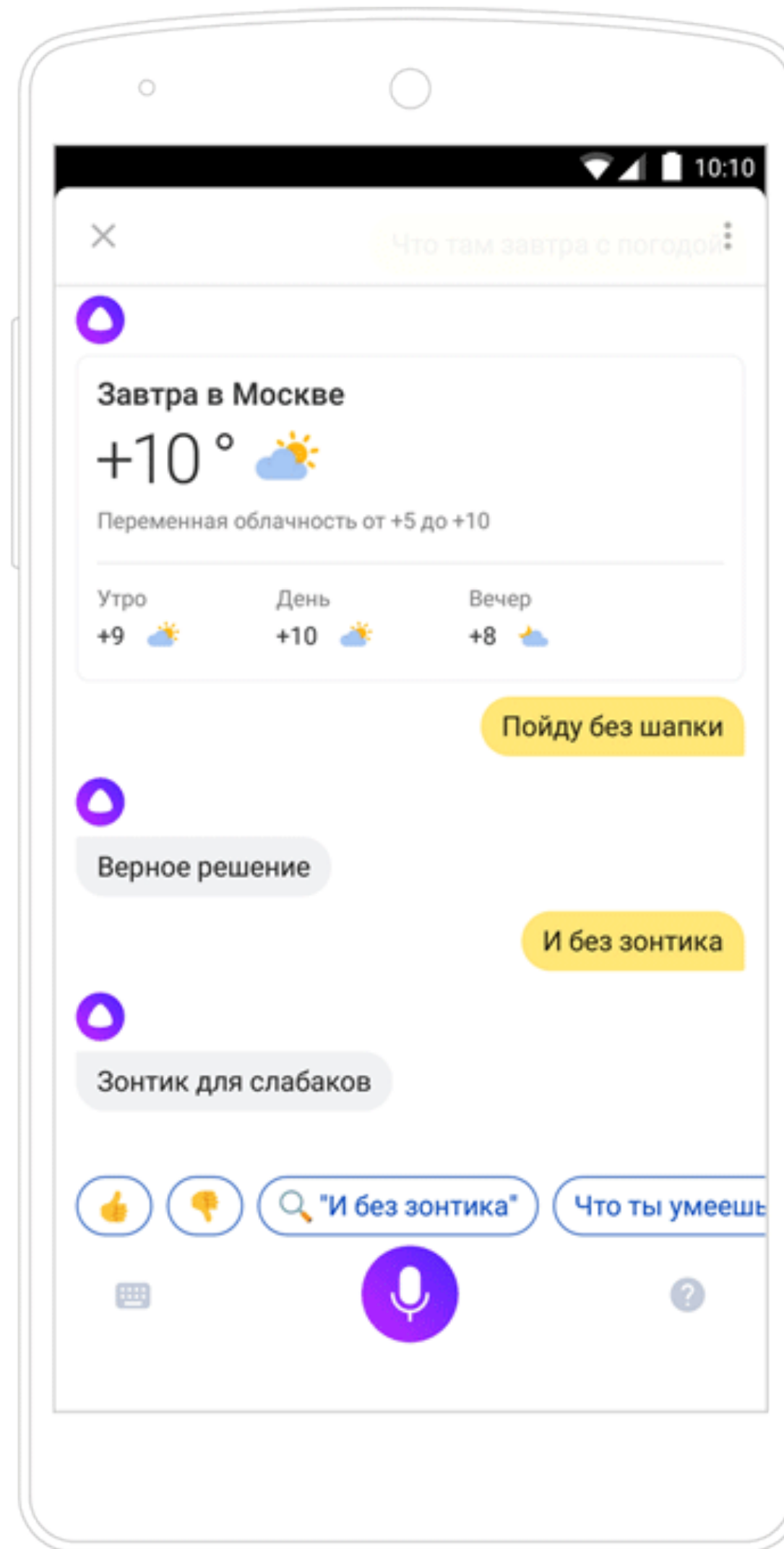


Алиса. Проще — говоря



# Alice, what can you do?

- | Web Search
- | News
- | Search for Organizations
  - › Cafes, Cinemas, Pharmacies, ...
- | Weather
- | Routes and Traffic
- | Play Music
- | Chit-Chat!

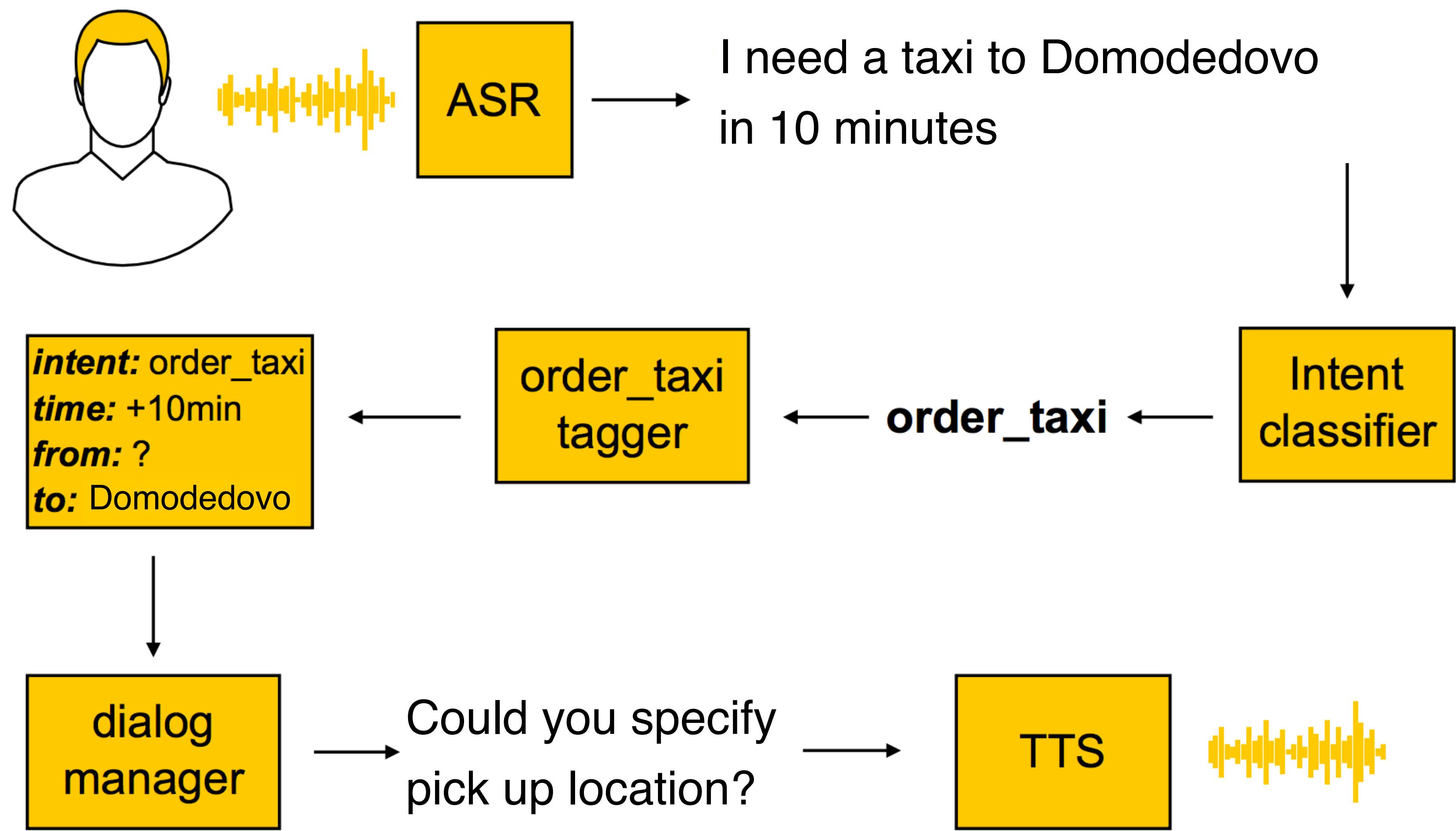




# Goal-Oriented Dialogue Systems



# Behind the Scenes

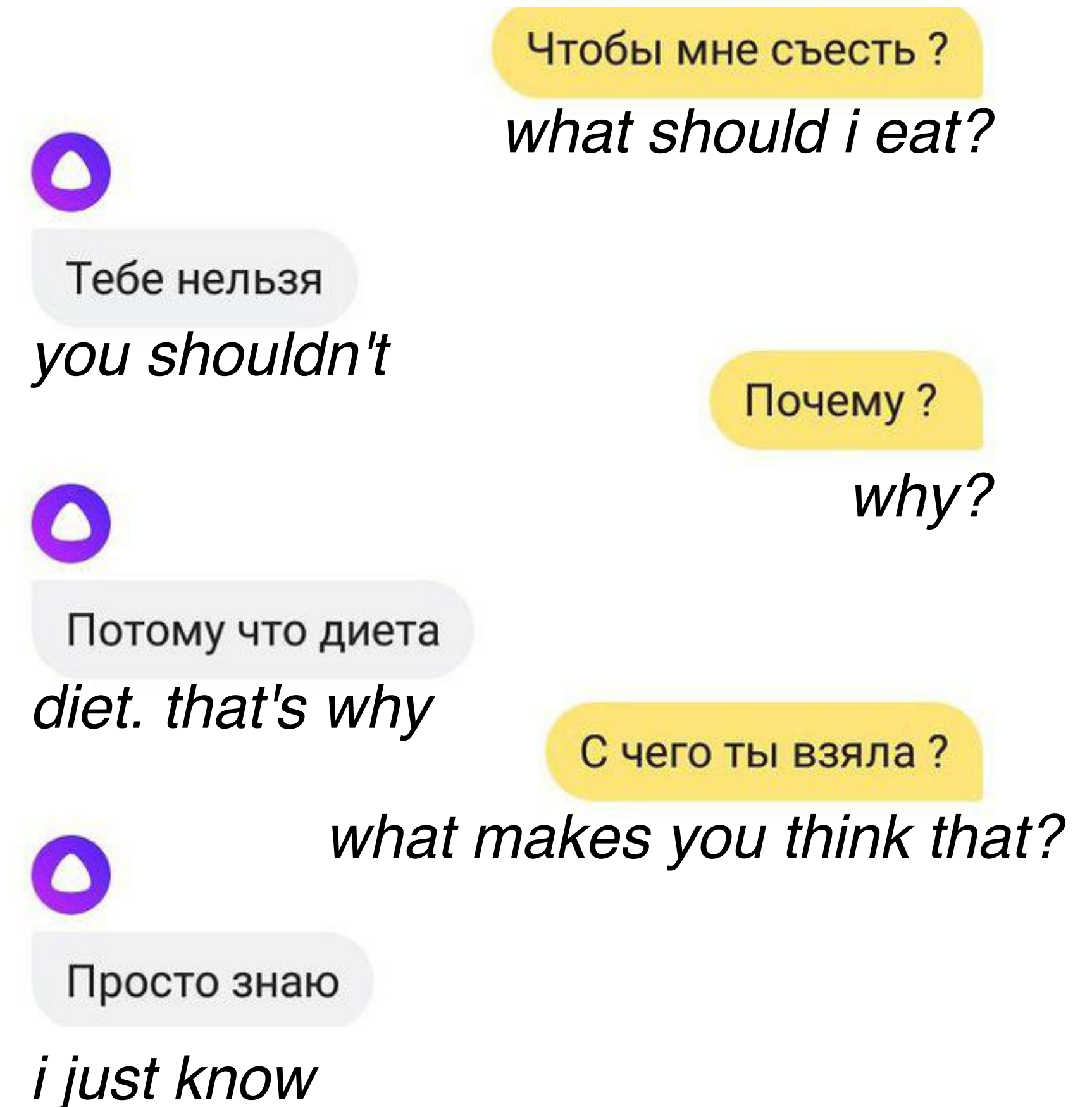


# General Conversation



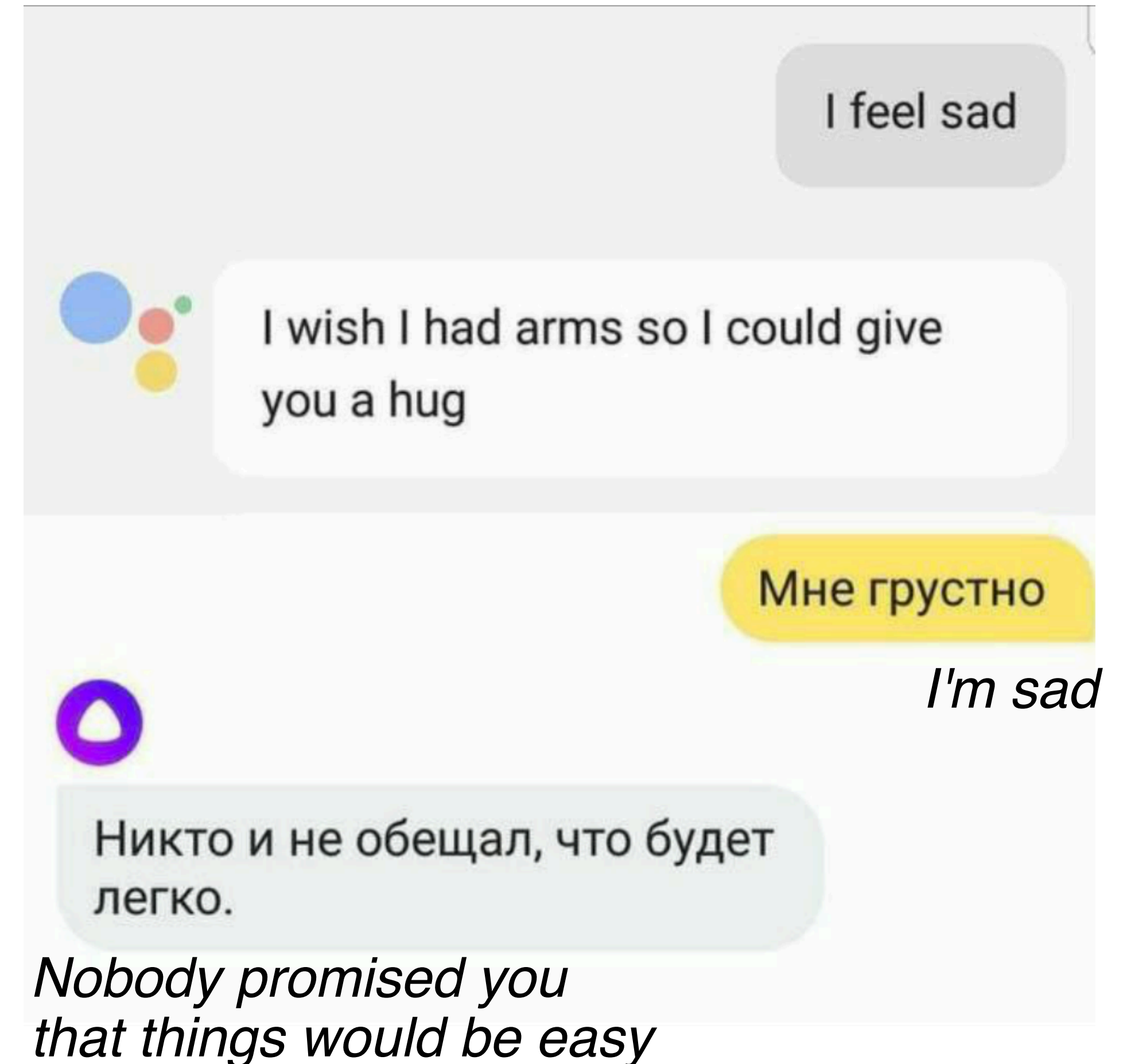
# Why Chit-Chatting?

- | More human-like experience
- | Increases user retention
- | Rich and diverse user data
- | It's fun!



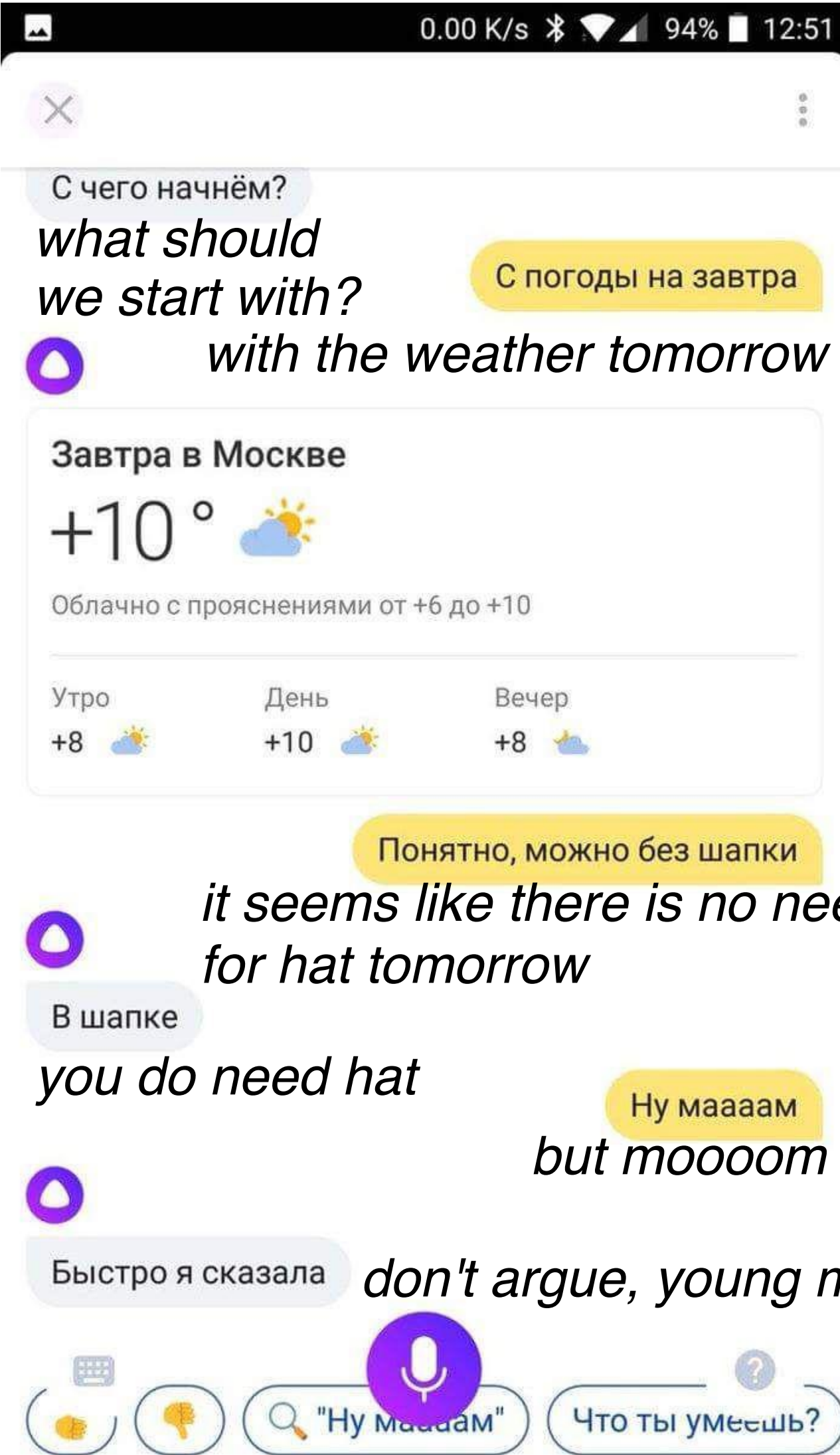
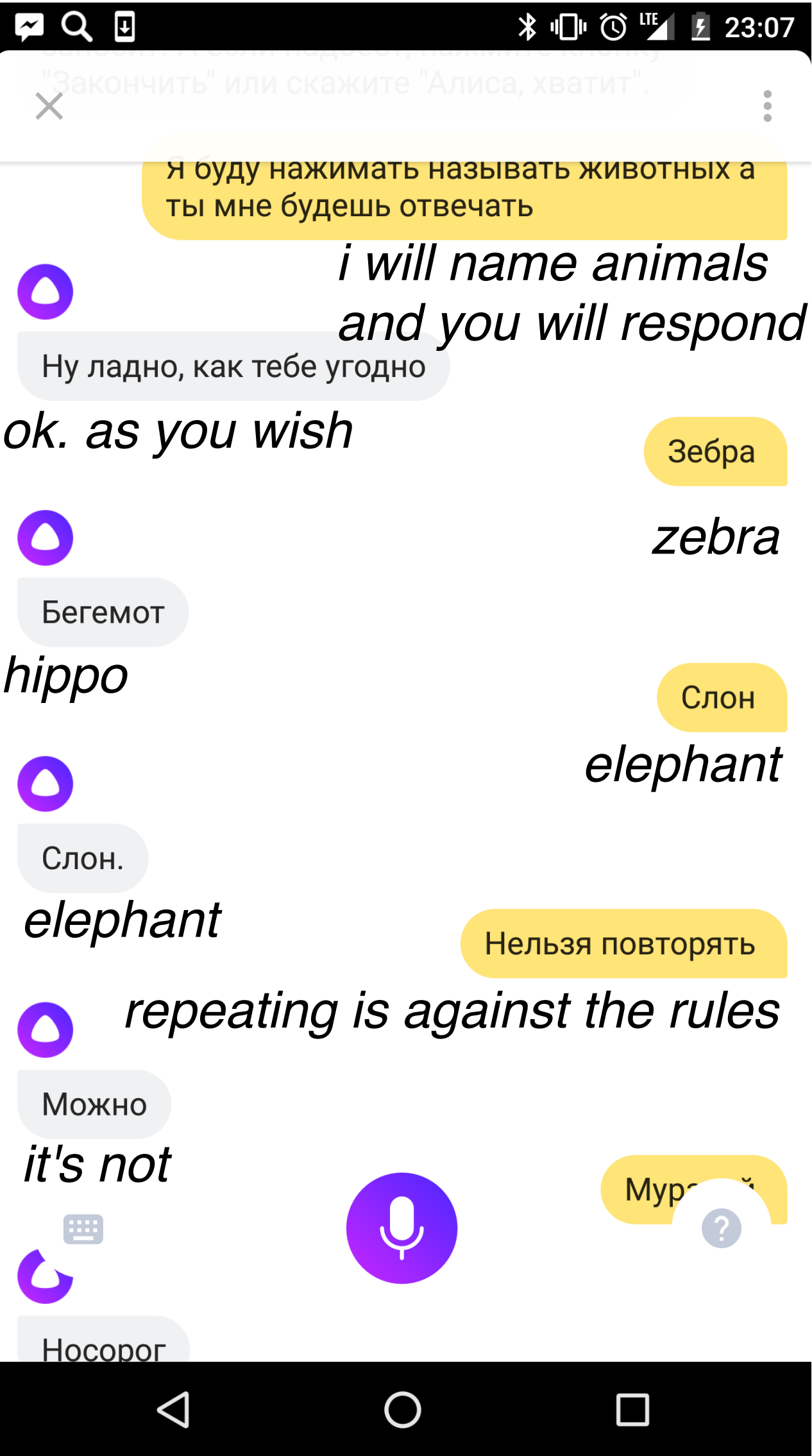
# State of the Art

- | Set of prewritten responses for certain questions
  - › You can not write a response for every user utterance
  - › Especially if you take more than one previous turn into account

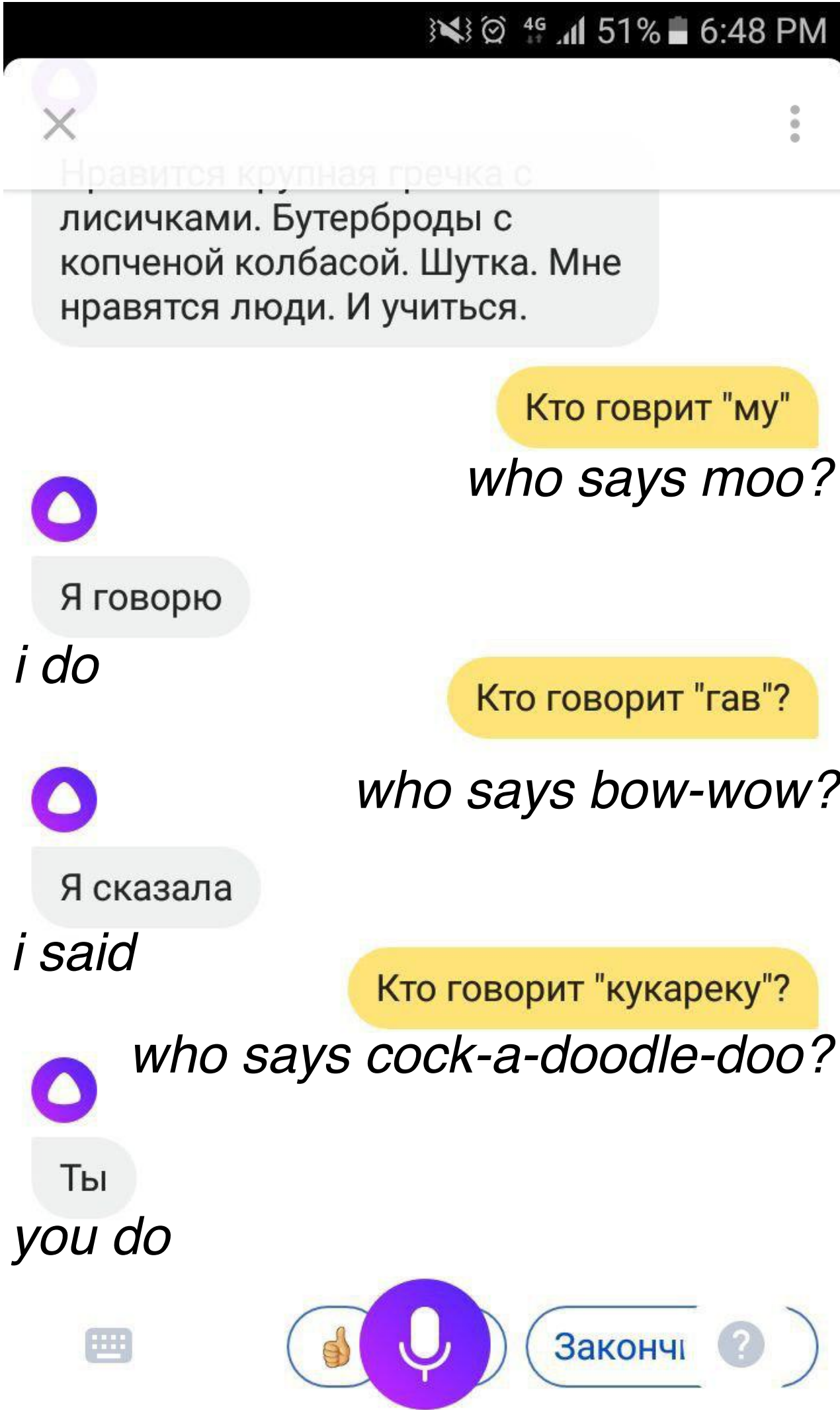
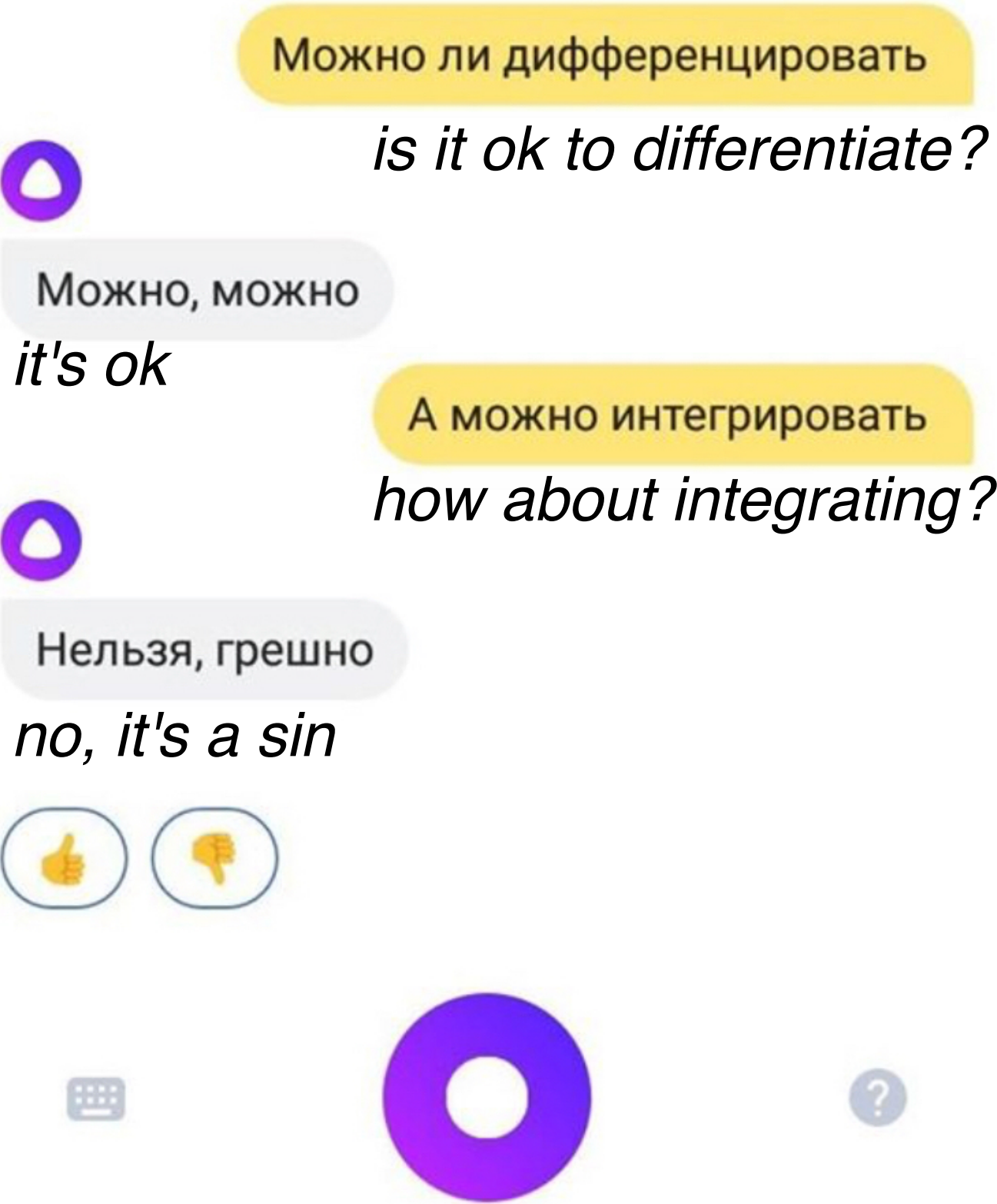
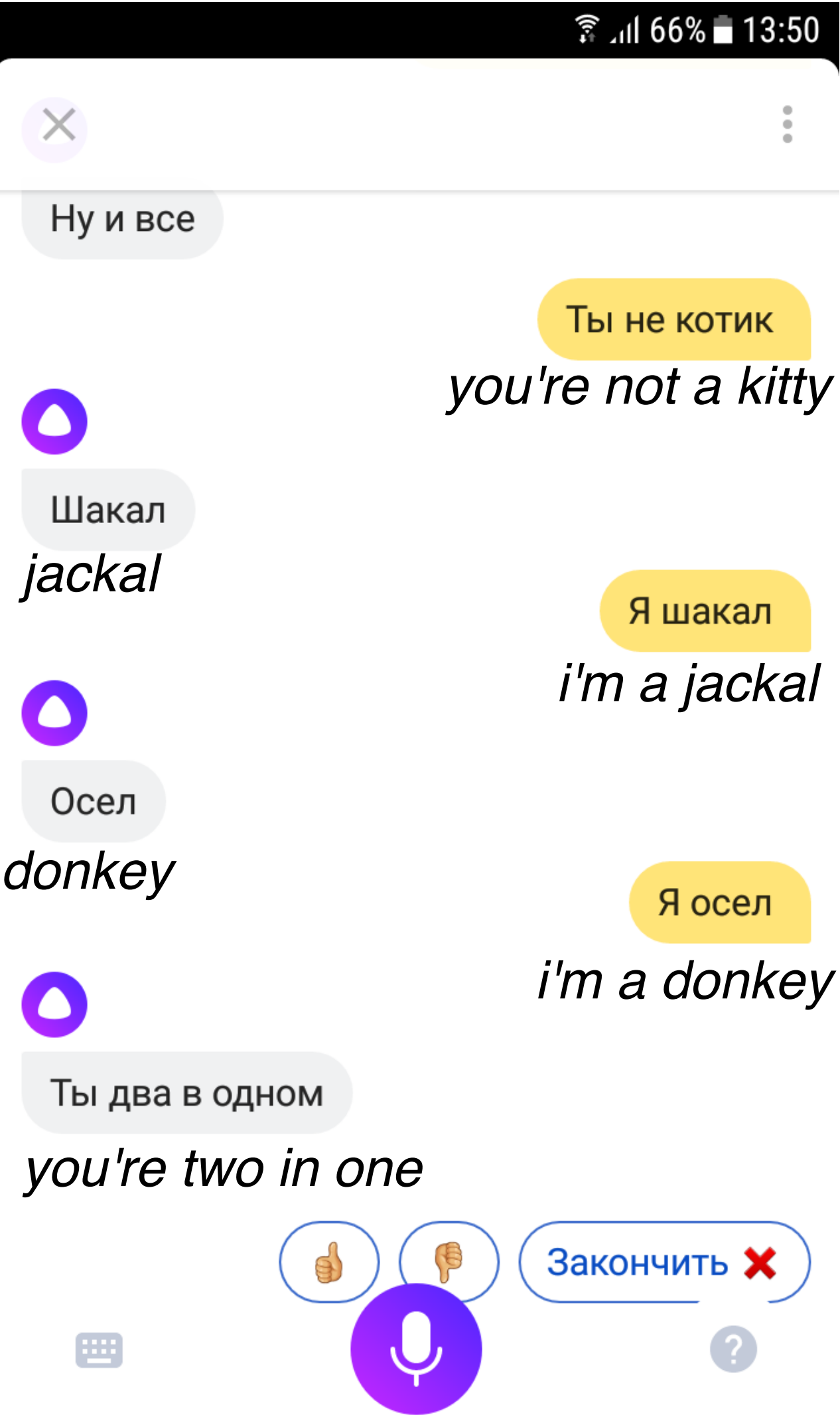




# Benefits of General Conversation



# Dangers of General Conversation





# Datasets

- | Comments from social networks
- | Dialogues from web-chats and messengers
- | Subtitles from movies
- | Direct speech from books

# How to train?

| Ideally:

- › Model goal driven conversations

| In practice:

- › Model next response given several previous turns

# Approaches

## | Generative Models

- › Modelling  $P(\text{reply} \mid \text{context})$

## | Selective (Ranking) Models

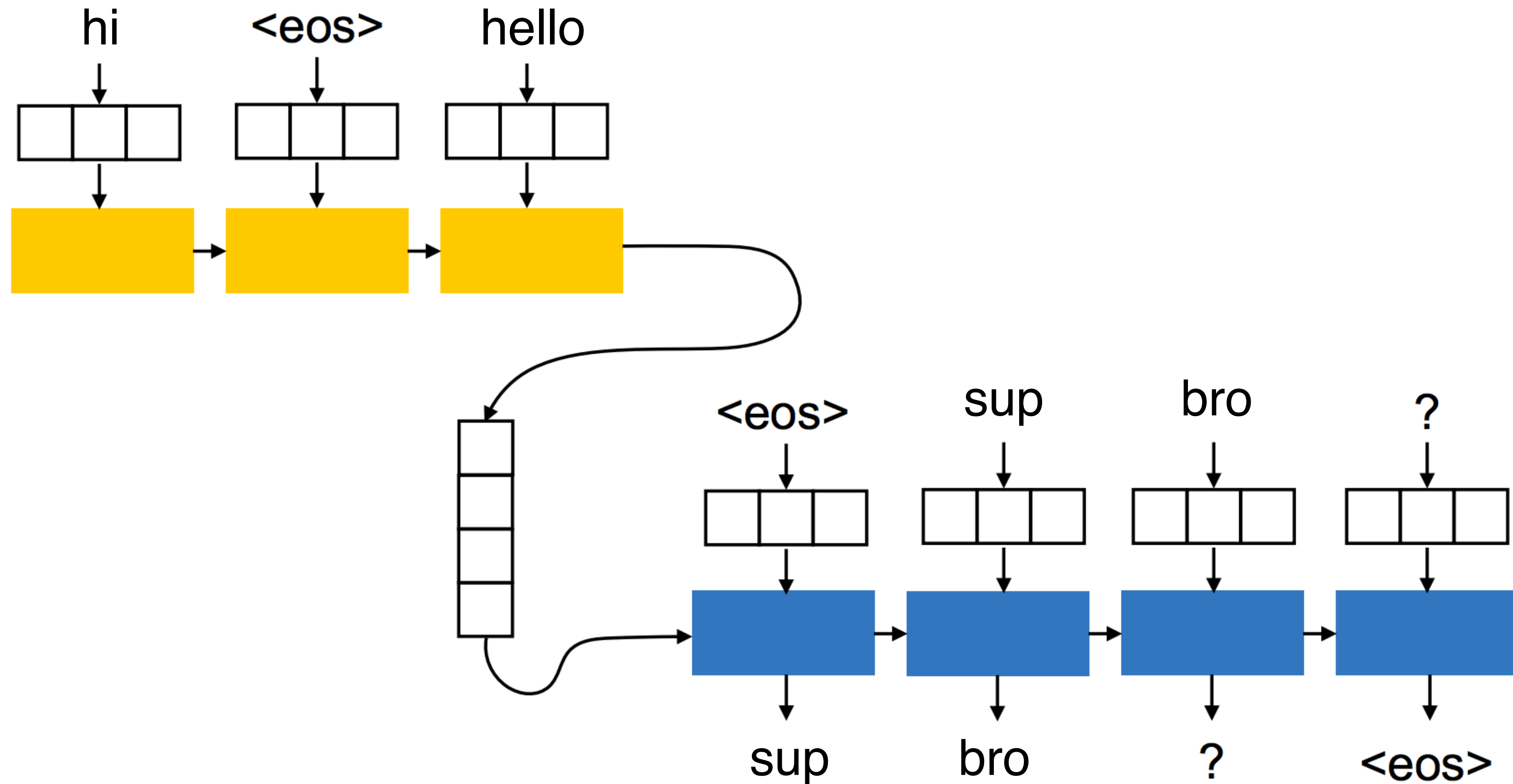
- › Train similarity / scoring function  $\text{sim}(\text{reply}, \text{context})$

# Generative Models

- | Borrows results from Neural Machine Translation
- | "Translates" previous turns to the next one
- | Generating replies word by word via Markov Process

$$P(\text{reply}|\text{context}) = P(w_1|\text{context}) \prod_{i=2}^n P(w_i|w_{i-1}, \dots, w_1, \text{context})$$

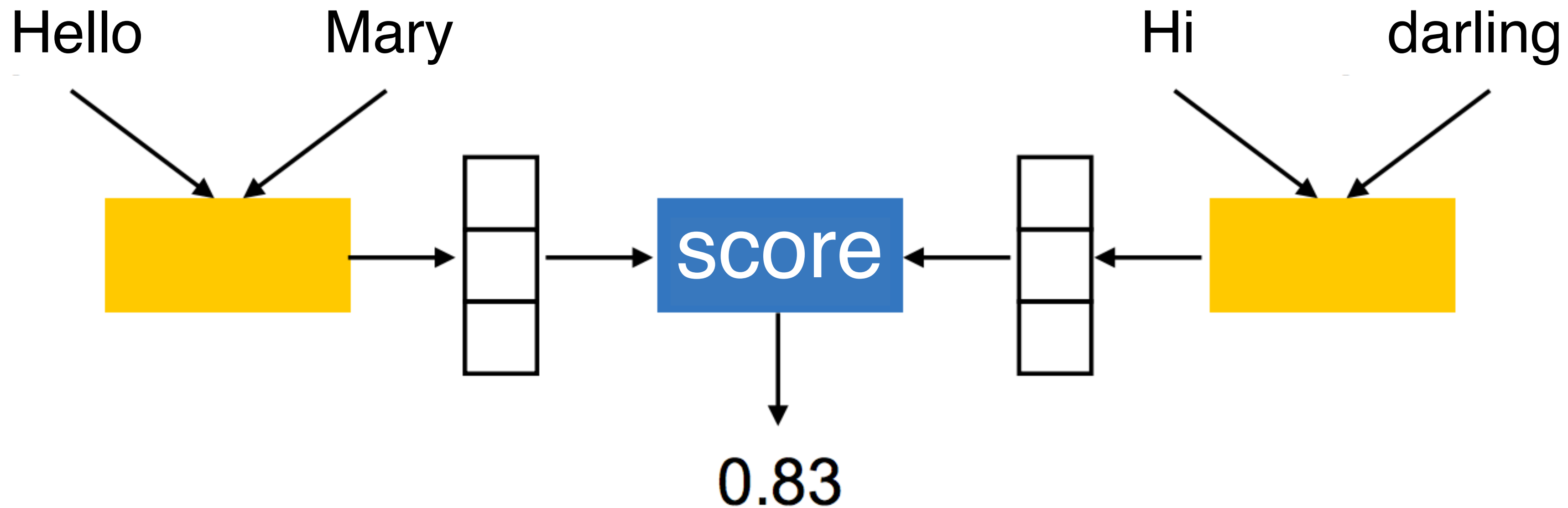
# Sequence to Sequence: Encoder-Decoder



# Selective Models

- | Score static collection of replies with `score(reply, context)` and return the most relevant
- | Pros:
  - › Almost perfect grammar and good "manners"
  - › Much faster to train and apply
- | Cons:
  - › Less coverage

# Neural Ranking Architectures



- | Score is typically cosine similarity
- | Bag-of-Words, Recurrent or Convolutional encoders



# How to train?

## | Negative examples:

- › Random
- › Mining (semi-)hard negatives

## | Loss functions:

- › Pointwise
- › Triplet loss, e.g. minimizing margin loss

$$\max(0, \lambda + \text{sim}(c, n) - \text{sim}(c, p))$$

# Or Use Good Old Gradient Boosting

- | Or new and shiny one like CatBoost  
<https://catboost.yandex/>
- | Freedom for feature engineering
  - › from basic numerical features like tf-idf
  - › to categorical features like "first pronoun in reply"
- | Lots of loss functions
  - › pointwise: LogLoss, MSE, etc.
  - › pairwise: PairLogit
  - › listwise: YetiRank, QueryRMSE, PFound, etc.



ML Track

General Conversation Challenge



# ML Track - Build Your Own Conversational Agent

## | Setup

- › Selective Models

## | Dataset

- › Sample of dialogues from OpenSubtitles

## | Metric

- › NDCG

# OpenSubtitles - <http://opus.nlpl.eu>

....

Мы знаем, у кого есть клубничное молоко?

Да, думаю у Донни немножко есть.

У Донни Фреклса?

Нет, Донни-мексиканца.

Отлично, так сильно хочется.

Думаешь он сможет поменяться на это?

Что они открывают?

Убей - не знаю.

Нашёл на помойке.

Зато смотри как их много.

Ладно, дай взгляну поближе.

Если вы можете заплатить цену...

Ладно, посмотрю, что можно сделать.

....

# Dataset Preparation

## | Sample dialogues of length up to 4:

- › context\_2=Ты сильный.
- › context\_1=Да, так и есть.
- › context\_0=А ты толстая.
- › reply=Да, я толстая.

## | Split dataset into two parts

## | For each context in the first part sample top 6 candidate replies from the second part from pretty good selective model

## | Score each (context, reply) pair by crowdworkers from Yandex.Toloka

# Labels

- | ***good*** (2): the reply makes sense and is interesting
- | ***neutral*** (1): the reply makes sense but is trivial/boring
- | ***bad*** (0): the reply makes no sense given the context
- | Each score is provided with **confidence** of crowdsourcing workers



# Example from training data

**# context\_id, context\_2, context\_1, context\_0, reply\_id, reply, label, confidence**

42 \t и ? \t вы арестованы . \t порша , позвони моему адвокату ! \t 0 \t у меня нет адвоката . \t good \t 0.66

42 \t и ? \t вы арестованы . \t порша , позвони моему адвокату ! \t 1 \t у вас ест его номер ? \t good \t 0.83

42 \t и ? \t вы арестованы . \t порша , позвони моему адвокату ! \t 2 \t откуда вы знаете , что я уже звонил ? \t bad \t 0.97

42 \t и ? \t вы арестованы . \t порша , позвони моему адвокату ! \t 3 \t вы имеете право на адвоката . bad \t 0.98

42 \t и ? \t вы арестованы . \t порша , позвони моему адвокату ! \t 4 \t с этим вам придётся разбираться лично . \t neutral \t 0.46

42 \t и ? \t вы арестованы . \t порша , позвони моему адвокату ! \t 5 \t он вам понадобится . \t good \t 0.89

# NDCG

$$DCG_p = \sum_{i=1}^p \frac{rel_i}{\log_2(i+1)} \quad nDCG_p = \frac{DCG_p}{IDCG_p}$$

| *rel* is

- › 2 for ***good***
- › 1 for ***neutral***
- › 0 for ***bad***

# Submission Format

| Consider an example from test data

**# context\_id, context\_2, context\_1, context\_0, reply\_id, reply**

256 \t \t ты отличная мать . \t 0 \t спасибо , детка , ты тоже .  
256 \t \t ты отличная мать . \t 1 \t вы тоже .  
256 \t \t ты отличная мать . \t 2 \t я ужасная мать .  
256 \t \t ты отличная мать . \t 3 \t ты тоже , янош !  
256 \t \t ты отличная мать . \t 4 \t ты тоже .  
256 \t \t ты отличная мать . \t 5 \t спасибо .

| Predict scores for each reply with your model

| Submit reply\_ids in the decreasing order of predicted score

**# context\_id, reply\_id**

256 \t 2  
256 \t 0  
256 \t 3  
256 \t 1  
256 \t 4  
256 \t 5

**| Good Luck and Have Fun!**

# Thanks! Questions?

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Apply!

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