

# Do we really need a conversational interface? Some challenges in designing for conversational interaction

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*Conversational interfaces are all around us*

**CNN** [Settings] [Close]

There's a lot going on in the world. I can send you daily updates with top stories, or you can message me directly about a topic you're interested in, like "politics" or "tech," and I'll send you the latest.

Ok, let's get started. Here are some options 📌

[Daily update 📌] [Breaking news ⚡] [Next]

[Menu] | Type a message...

**Google Now**      **Siri**      **Cortana**

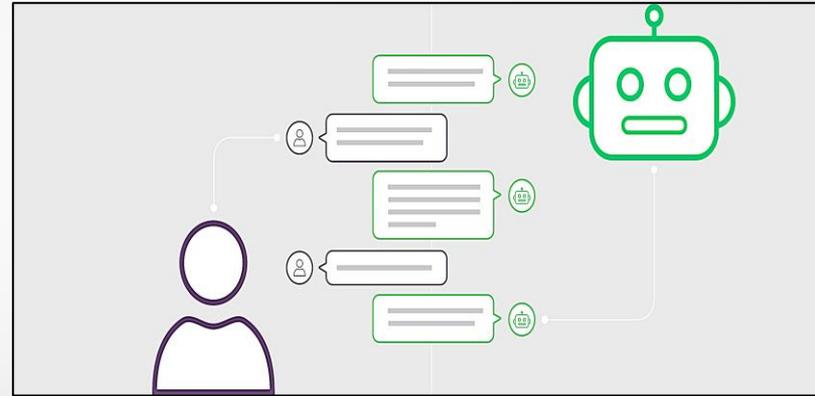
The image shows three mobile devices displaying search results for "Statue of Liberty". On the left, a Samsung phone shows Google Now results with a map and links for "Call", "Directions", and "Website". In the middle, an iPhone shows Siri search results with a "Search the web" prompt. On the right, a Windows phone shows Cortana search results with a "Here is what I found" header and detailed information about the Statue of Liberty National Monument.



# What is a conversational interface?

A conversational interface allows users to interact with services and devices in a *conversational style*

i.e. by taking turns in a dialog to accomplish a task or engage in a conversation



This provides a different (possibly easier) and more intuitive way to do things e.g. simply ask a query as opposed to navigating menus and drop-down boxes



*Conversational interfaces – the bad news!!*

*" ... CUI is the worst thing that has happened to usability since MS-DOS"*



Alex Mohebbi Why conversational interfaces are taking us back to the Dark Ages of usability

# Intelligent Assistants Have Poor Usability

*Usability testing finds that both voice-only and screen-based intelligent assistants work well only for **very limited, simple queries that have fairly simple, short answers***

Raluca Budiu and Page Laubheimer, Nielsen Norman Group. July 22, 2018



*Observing users struggle with the AI interfaces felt like a **return to the dark ages of the 1970s**: the need to memorize cryptic commands, oppressive modes, confusing content, inflexible interactions — basically an unpleasant user experience*

Raluca Budiu and Page Laubheimer, Nielsen Norman Group.  
July 22, 2018



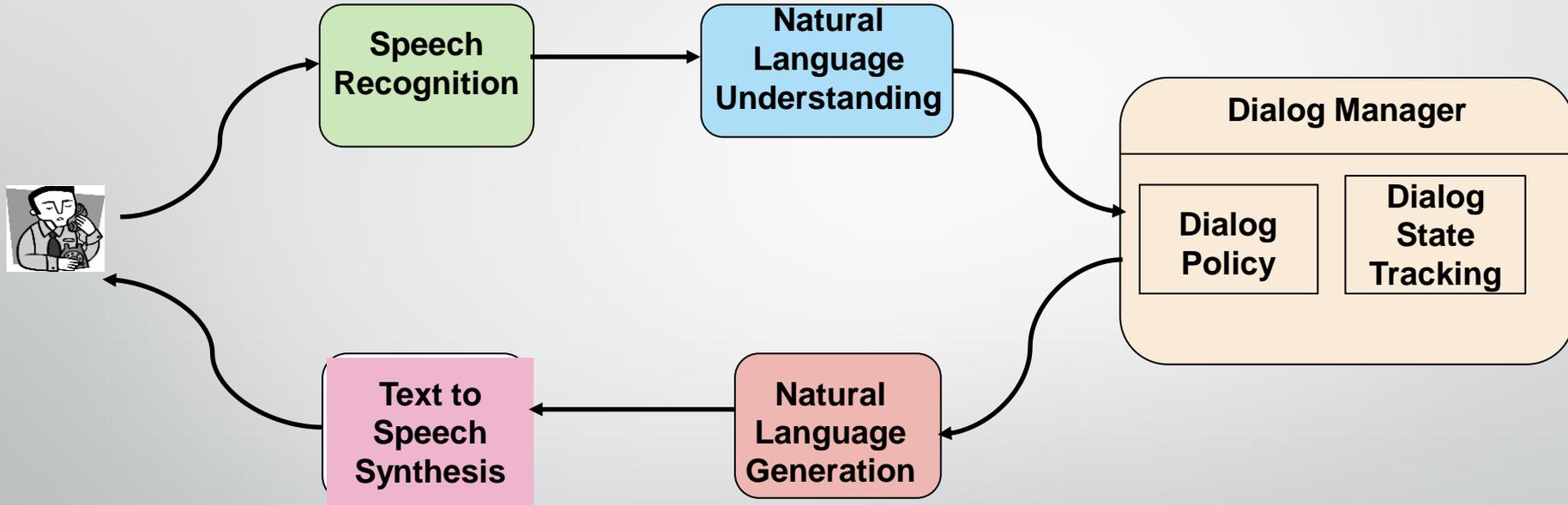
*Part of the misfire with the conversational aspect of bots has to do with the fact that **natural language processing** and **artificial intelligence** are not yet accomplished at managing human-like conversations.*

Ted Livingston: Bots are better without conversation, Medium, Aug 16, 2016



*The technology of conversational interfaces*

# Modular architecture



# Natural Language Understanding (NLU)

Current NLU engines e.g. Dialogflow, Alexa, etc support the Intent-Entity-Context-Response (IECR) paradigm

Combination of AI/Machine learning and hand-crafting

Can the system understand if the user's input is unconstrained as in natural conversation?

Many systems avoid NLU problems by using pre-determined user responses (quick replies)

- easy to interpret but do not give the user a full choice of response

# Dialog Management / Conversation Flow

## One-shot queries

Similar to voice search

User controls the dialog

User has to include all required information in the query

*User: What's the weather forecast for Frankfurt for tomorrow*

**System: In Frankfurt tomorrow it will be mostly sunny with a high of 23 and a low of 9**

*User: What about Belfast*

**System: In Belfast tomorrow there will be scattered showers with a high of 17 and a low of 12**

# Dialog Management / Conversation Flow

## Slot-filling

The system asks questions to collect the values for a series of slots that are required in order to complete the task

Book\_flight

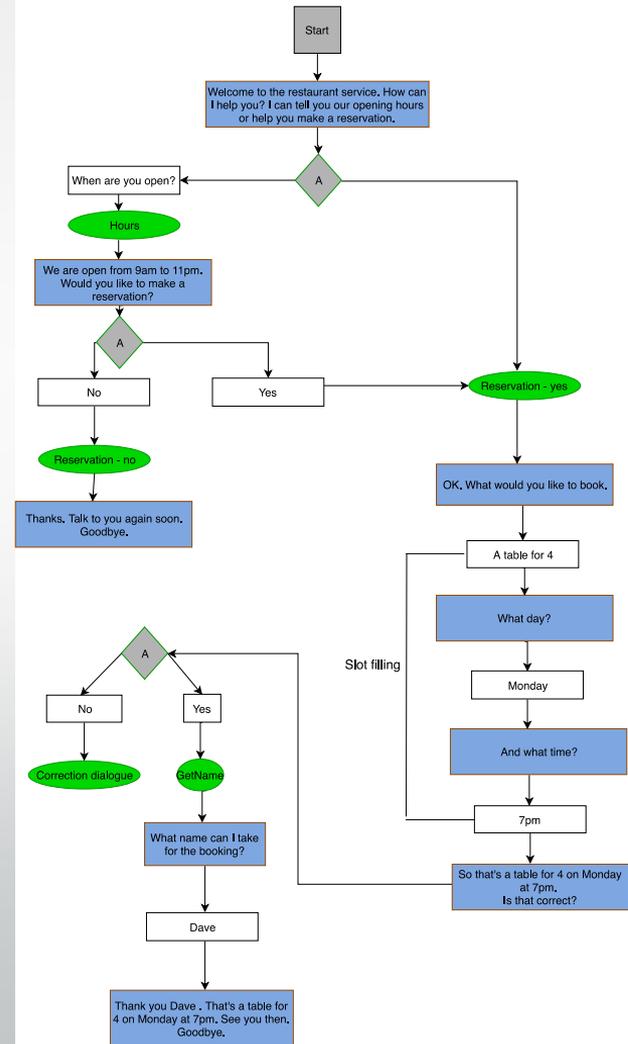
To: *unknown*  
From: *unknown*  
Date: *unknown*  
Time: *unknown*

# Dialog Management / Conversation Flow

## Conversation flow diagram

The dialog follows a pre-determined path

What happens if the user or the system want to deviate from the path?



## Deviating from the path

The system inserts a query about the user's input because something is missing or ambiguous

User: I am looking for a restaurant nearby

System: What kind of food would you like?

User: What time does the bus leave for San Jose?

System: Do you mean the express bus or the regular one?

# Deviating from the path

User requests repetition or clarification, changes or corrects something, ...

System: what kind of food would you like?

User: what are my choices?

# Reinforcement learning

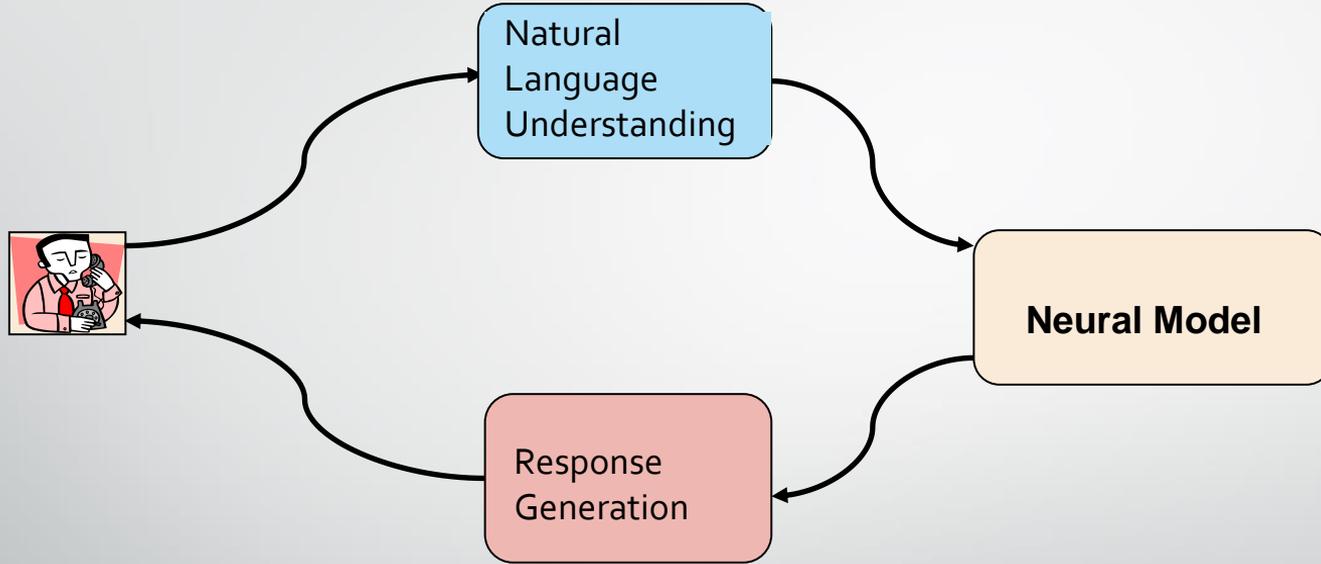
The system learns a dialog policy – which action to take at each choice point in the dialog

Example - Deciding whether to confirm a user's input or move on

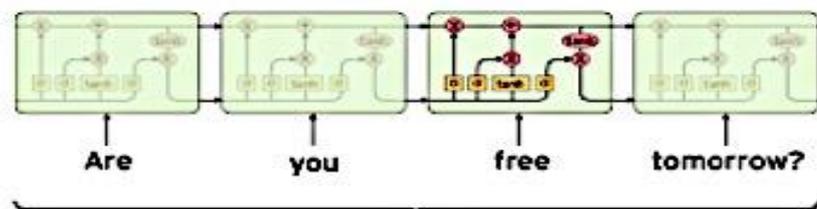
The system learns an optimal policy based on feedback from multiple interactions

Problem that policy optimization quickly becomes intractable

# Neural dialog – end-to-end, seq2seq



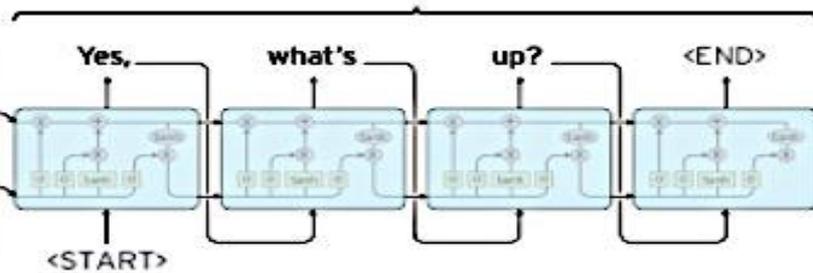
## ENCODER



Incoming Email

thought vector

Reply



DECODER

# Some issues with deep learning for conversational systems

Requires large amounts of training data but there is not much suitable training data available

Limited use of context – applies only to the immediate history of the current utterance

Lack of explicit long-term memory – leads to semantic inconsistency in responses

Tendency to produce bland and uninformative utterances that have higher probability in the training data e.g. ‘that’s great’, “I don’t know”

# Symbolic AI – example of plan recognition for collaborative dialogue

(Scenario: it is 10pm, user wants to catch the next bus to Suwon)

User: *Do you know when is the next bus to Suwon?*

*Yes*

*The next bus leaves tomorrow at 5am*

*Sorry, the last bus has left for the evening. You will have to take a bus to Seongnam and then transfer to the bus to Suwon. The bus leaves here from bay number 6 at 11pm.*



To provide the third answer the system has to infer the user's high level goal of wanting to be in Suwon that evening

Technologies required for collaborative dialog

- Representation of plans and intentions
- Reasoning over plans and intentions
- Ontologies to store background knowledge

See research on advanced dialog systems at Rochester (James Allen) and Monash (Phil Cohen)

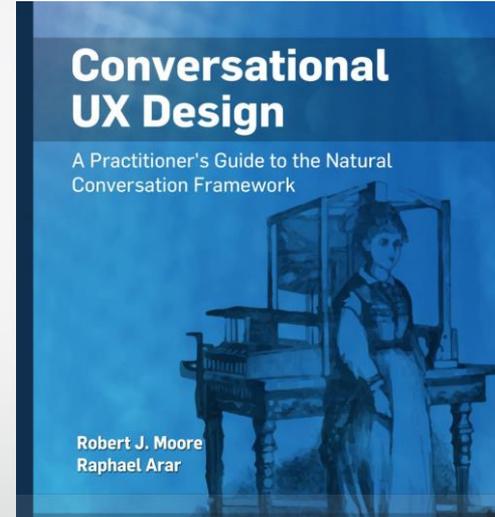
# Modelling the sequential mechanics of conversation

## Natural Conversation Framework (NCF)

- a design framework for conversation

## Library of generic conversational UX patterns

- based on natural patterns from human conversation as documented in the Conversation Analysis literature



# Takeaways

There is a lot of activity in Conversational AI but there is a long way to go

*"Conversational AI is one of the most challenging problems in the artificial intelligence field ...it is still Day One for Conversational AI"*

Research is currently focused on deep learning approaches combined with deep reinforcement learning

Need to integrate neural and symbolic approaches (neuro-symbolic AI)

# Takeaways

Most work on conversational agents focuses on issues of design and implementation (technology driven)

Need to focus also on co-creation and user involvement (UX driven)

We need to know how the systems are actually used e.g. if the interactions are successful, what users do when they are not, what did users think of the interactions



**CONVERSATIONS 2019**

3<sup>rd</sup> INTERNATIONAL WORKSHOP ON  
CHATBOT RESEARCH

Thank you for listening

