

NLP Introduction for Smartphone Users and Developers

Bob Igo

Digital Arc Systems

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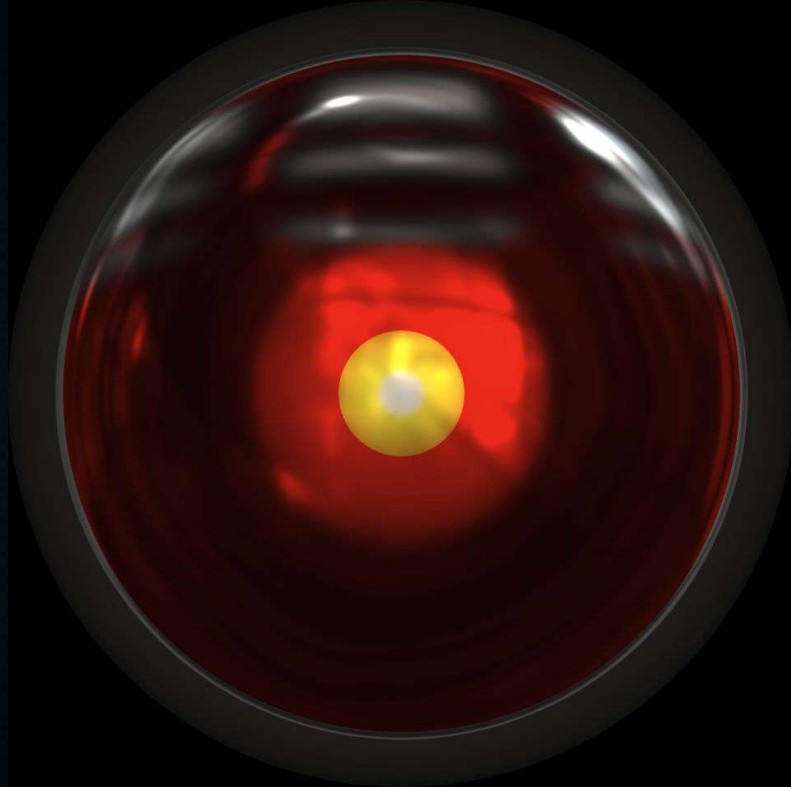
What is Natural Language Processing?

- Examples First
 - Interactive Fiction
 - Zork, etc.
 - Spellcheck
 - Grammar checkers
 - Google Search
 - Android / Siri / Cortana
 - ...
 - NCC-1701's computer



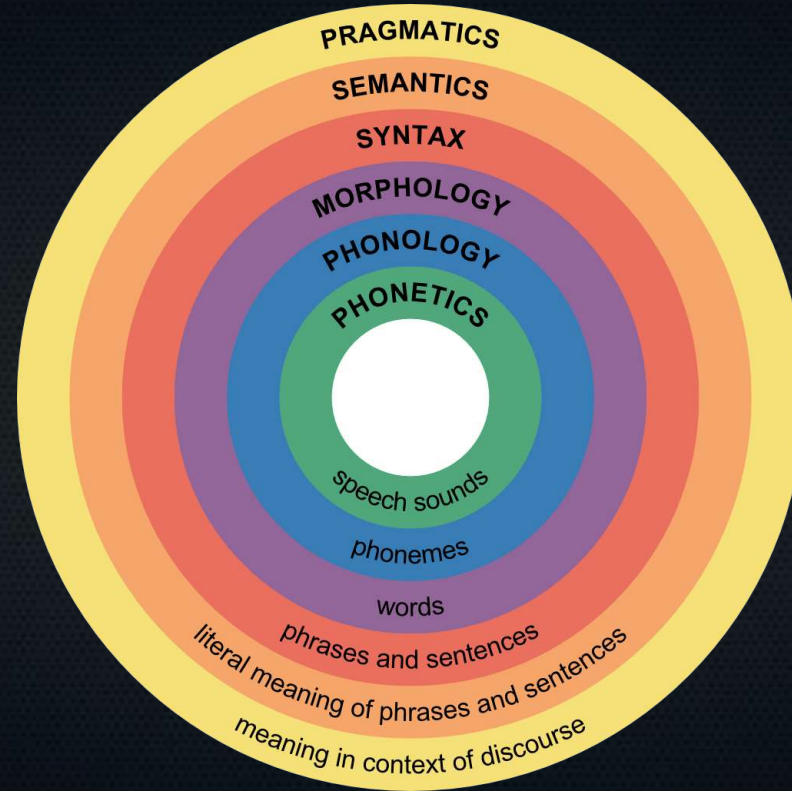
http://www.matanyahorowitz.com/images/5/50/Robot_reading.jpg

What is NLP?



- Any time an algorithm is consuming or generating human language, it's NLP.

NLP Layers



Phonetics/Phonology



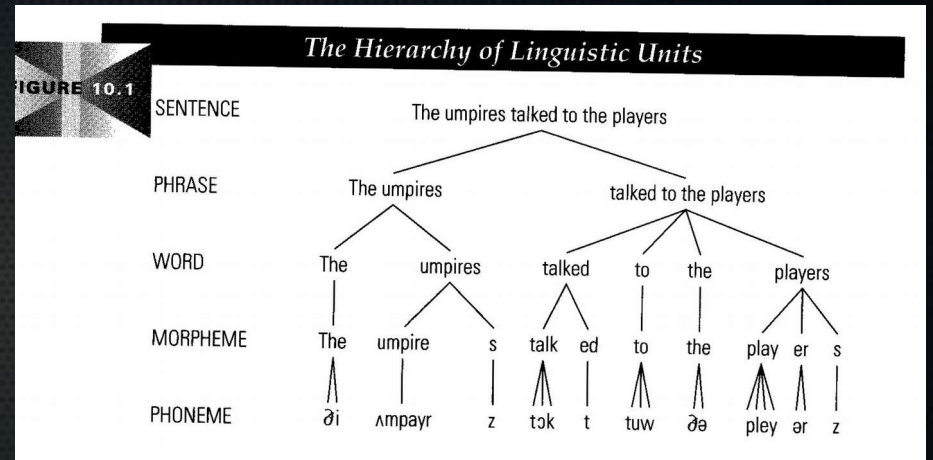
- ajæmkold -> "I am cold."

http://www.politicsforum.org/images/flame_warriors/flame_41.php

<http://upodn.com/phon.asp>

Morphology

- "I am cold." →
 - i+PN
 - be+V+Sg+Fp+Present
 - cold+ADJ



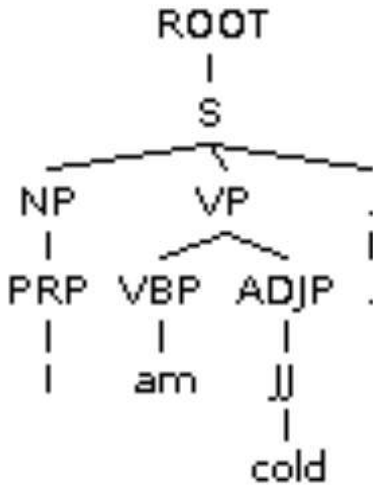
<https://www.uic.edu/classes/psych/psych352jw/c17.html>

<https://code.google.com/p/foma/wiki/MorphologicalAnalysisTutorial>

Syntax

- Sentence diagrams!

```
(ROOT
  (S
    (NP (PRP I))
    (VP (VBP am)
      (ADJP (JJ cold))))
  (. .)))
```



Semantics

- Semi-real example:

(*A-BE

(argument-class theme+attribute)

(tense present)

(punctuation period)

(attribute

(*P-COLD

(degree positive)))

(theme

(*O-PRONOUN

(person first)

(number singular)))

)



Semantics

- Real example: Insert the tray into the printer.

```
(*A-INSERT
 (argument-class agent+theme)
 (mood imperative)
 (punctuation period)
 (q-modifier
  (*Q-goal_INT0
   (case
    (*K-INT0)
    (object
     (*O-PRINTER
      (number singular)
      (reference definite)))
    (role goal)))
 (tense present)
 (theme
  (*O-TRAY
   (number singular)
   (reference definite))))
```

- "Interlingua"

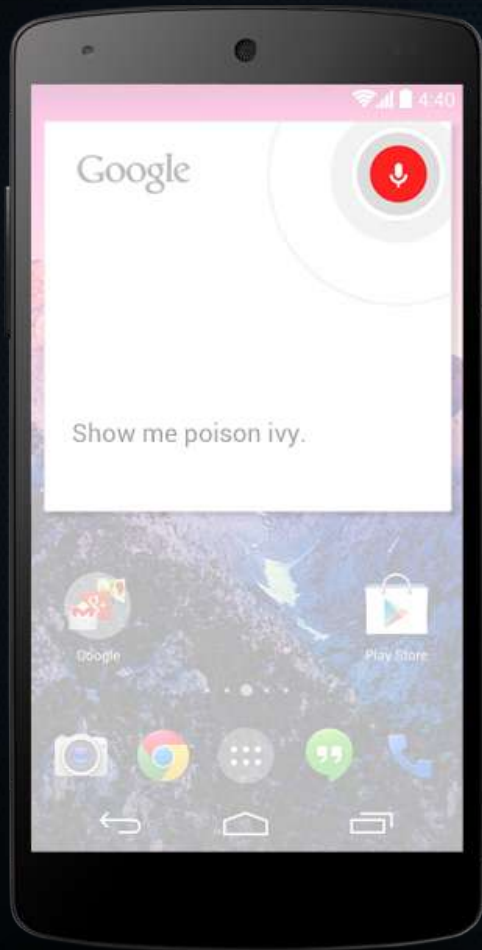
- <http://www.cs.cmu.edu/~teruko/KANT-ir-description.html>
- <http://www.lti.cs.cmu.edu/Research/Kant/PDF/mts3-nofoot.pdf>

Pragmatics

- Context matters.
- Are you in a house?
 - turn down the AC / turn up the heat
- Are you outside in winter?
 - find the closest heated building and navigate to it
- Are you ill?
 - call your doctor?
 - call in sick?



NLP on Smartphones

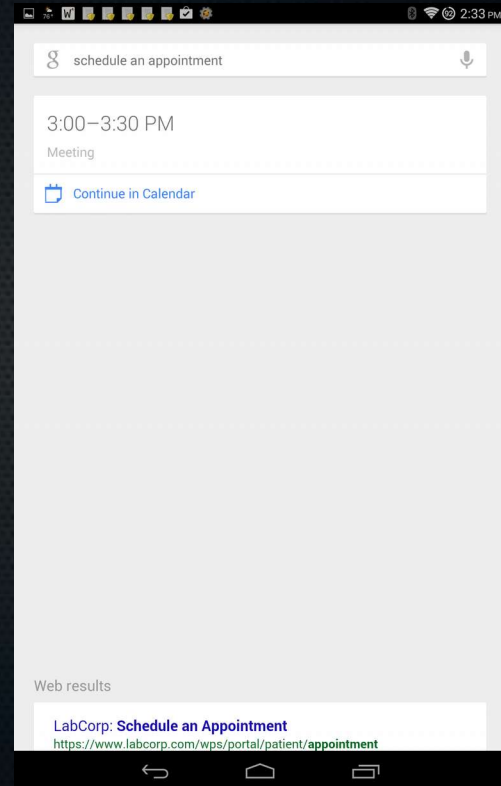


- How does all of that work on your phone?

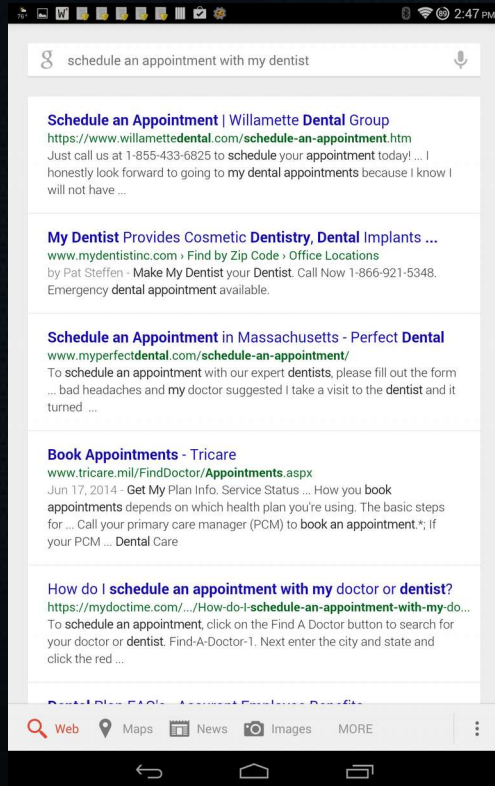
http://www.google.com/nexus/images/nexus-5-new/moments/moment_android_phone_2400.png

Android Voice Actions: A Tale of Two Meanings

- Helpful



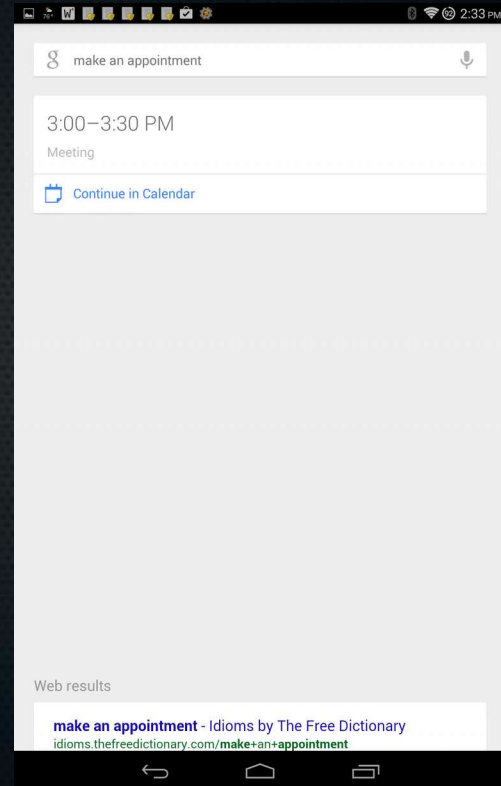
Android Voice Actions: A Tale of Two Meanings



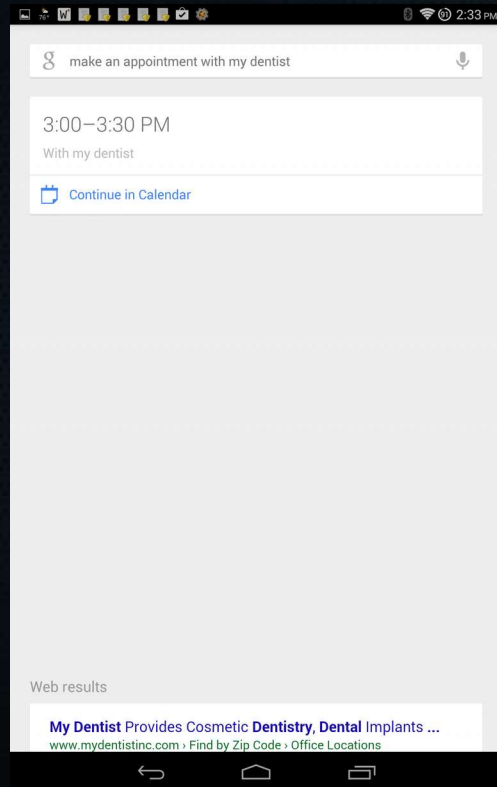
- Not helpful
 - Why does "with my dentist" make it fall back to a web search?

Android Voice Actions: Two More Meanings

- "make" and "schedule" appear to be interchangeable, right?



Android Voice Actions: Two More Meanings



- "with my dentist" doesn't break when you use "make"
 - Still doesn't really know what to do with "with my dentist"

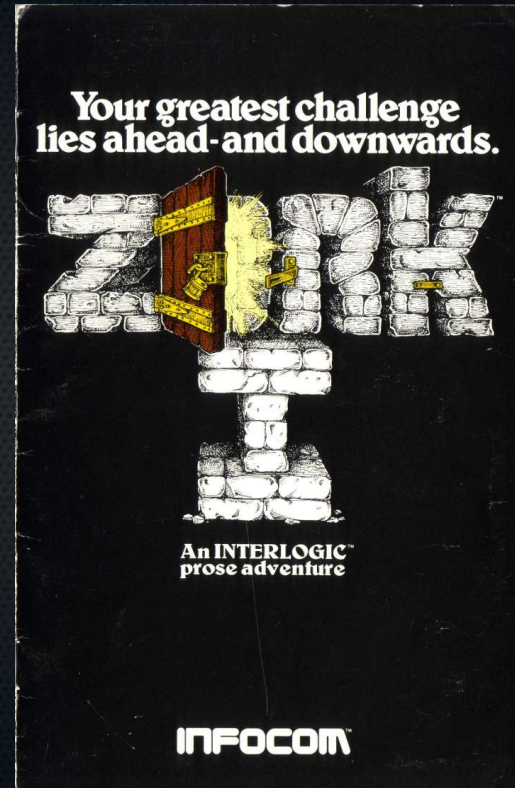
Speech Input Support in Android Wear

Show heart rate	"OK Google, what's my heart rate?" "OK Google, what's my bpm?"	Action <code>vnd.google.fitness.VIEW</code> Mime Type <code>vnd.google.fitness.data_type/com.google.heart_rate.bpm</code>
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- As a developer, you can tie into Intents that are very simple semantic pairs
 - Typically an action and a MIME type target
 - Supports multiple languages

Mobile Voice Commands: Parlor Tricks

- "schedule an appointment *with my dentist*" != "schedule an appointment"
- "make an appointment *with my dentist*" == "make an appointment"
- Why is there no semantic API for developers?



Mobile Voice Commands: Parlor Tricks



http://www.funnyjunk.com/funny_pictures/3833914/Asperger+King/

- Current production "voice assistant" technology seems to rely a lot on hardcoded phrasing.
- If there is a semantic model being built, it's not being used.

What I'd Like to See

- At a minimum: Let developers register apps to handle *meanings*.
- E.g. "schedule/make an appointment":
 - (*A-SCHEDULE*
(argument-class agent+theme)
(mood imperative)
(tense present)
(theme
(*0-APPOINTMENT
(number singular)
(reference indefinite))))))
- By registering for the base semantic model directly, the user is free to rephrase or add parameters (e.g. "with my dentist").

What I'd Like to See

- Some minimal pragmatics would be really useful.
 - A skeletal appointment with "my dentist" isn't as useful as knowing who my dentist is.
 - If I already have a dental appointment scheduled, remind me and ask to proceed or cancel.
 - Offer to call my dentist to complete the task.

