Synthetic Agent Relationship Adaptation Via Meta-Dialog

What people expect from an intelligent agent

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Who Am I?

- Emmett Coin
  - Industrial Poet
    - Rugged solutions via compact and elegant techniques
    - Focused on creating more powerful and richer dialog methods
  - ejTalk
    - Frontiers of Human-Computer conversation
      - What does it take to “talk with the machine”?
      - Can we make it meta?
Ideas this talk should provoke…

- History and context dynamically modify dialog.
  - How it simplifies dialog design.
  - Why it improves conversational efficiency.
- Deconstructing big problems into manageable chunks.
  - How reassembling makes the whole greater than the sum of the chunks.
- Remembering and appropriate behavior
  - Why it improves consistency.
  - I know that you know that I know …
- What do we expect from a real conversation?
Meta is a part of Automaticity

- Automaticity:
  - The fluent processing of information that requires little effort or attention.
  - The ability to do things without occupying the mind with the low level details required.
  - Knowing how to do something so well that you do not have to think about it while doing it.
  - The delegation of behavioral nuance.
  - Less micro-management.
  - Second nature
  - Riding a bike
“Automatic” Implies

- Rules
  - Proven algorithms
  - Describable by a formalism
  - High level semantics – derivable syntax

- Delegation
  - Relinquish control to a “separate” intelligence
  - Trust it will be accomplished
  - Accept a “high-level” activity summary.
How Dialogs Adapt Now

- Often they just don’t
  - That’s easy…
- Some use “N\textsuperscript{th} re-prompt” or “no-input” features
  - Handle errors and get back on track
  - Adapt just to lead you “back on the rails”
- Others will design in “collapsing” or “telescoping” prompts
  - Shorten evermore repetitious prompts in specific state
  - A small step in the right direction
- Where does this lead?
  - New Wants in the future?
Grice’s Conversational Maxims

- Things that make a conversation feel more “real”
  - Truth (do not lie or invent)
  - Quantity (enough info – no more)
  - Relation (relevance)
  - Manner (avoid confusion, be brief and clear)
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Meta Dialog

Computer: {generate=>systemSignOn}  [ System starts ]
Human: Hello, Cassandra.
Computer: {generate=>openingHello} {find=>userName}
[ Some period of non-conversational time ]
Human: Cassandra, you there?
Computer: {generate=>iAmHere}
Human: What’s the date for my SpeechTEK presentation?
Computer: That’s {date=>queryDate}.
Human: Do I have any meetings on the following Friday?
Computer: {date=>targetDate} is completely free.
Human: Okay, schedule a meeting with Chris at 11am.
Computer: Okay, a meeting with Chris at {timeDate=>targetTimeDate}.
[ Another long pause … ]
Human: Are you there Cassandra?
Computer: {generate=>iAmHere}
Human: Goodbye Cassandra.
Computer: {generate=>systemSignOff}  [System shuts down]
Raw Dialog

Computer: Cassandra here, let’s get started!  [System starts]
Human: Hello, Cassandra.
Computer: Greetings Emmett.

[Some period of non-conversational time]
Human: Cassandra, you there?
Computer: Yes, what do you need?
Human: What’s the date for my SpeechTEK presentation?
Computer: That’s Tuesday August 19, 2008.
Human: Do I have any meetings on the following Friday?
Computer: Friday, August 22\textsuperscript{nd} is completely free.
Human: Okay, schedule a meeting with Chris at 11am.
Computer: Okay, a meeting with Chris at 11am on the 22\textsuperscript{nd}.

[Another long pause …]
Human: Are you there Cassandra?
Computer: Of course, I’m still here.
Human: Goodbye Cassandra.
Computer: Bye for now.  [System shuts down]
What the Blackbox Provides

- Delegation of appropriateness
  - Operate at a purely semantic level.
- Consistency of behavior
  - Adaptation happens the same everywhere and every time
- Simplification of dialog design
  - No need to create different states for adaptive variations
Dialog Network
Dialog Network
Dialog Network
Dialog Network
Dialog Network
Adaptation with Experience
or Been There, Done That (BTDT)

- When people work together they always adapt their interaction style over time.
- Adaptation is about
  - Learning
  - Forgetting
- It is rude not to adapt (non-Griceian)
  - Wasting your partner’s time
  - Underestimating their intelligence
Searching for a Diagnosis
(troubleshooting a cable modem)

DataTransferProblem

The yellow light on the right side of the modem blinks when transmitting. Is it blinking now?

- Yes
- No
- Not Sure
Searching for a Diagnosis
(troubleshooting a cable modem)

DataTransferProblem

{Meta:is_data_light_blinking:}

Yes

No

Not Sure
MetaText Levels: One Approach

- Introductory
  - 1st Time visit
  - Purpose and rational
- Tutorial
  - How to do it
  - Expectations
- Beginner
  - Walk me thru it
  - Use all the terms
- Normal
  - Just right
  - I know what I’m doing
- Expert
  - Cut to the chase
  - Just as short as makes sense
We need to check if the data is being transmitted. The yellow light on the right side of the modem box should be blinking now. Is it?

The yellow light on the right side of the modem blinks when transmitting. Is it blinking now?

Is the yellow modem transmit light blinking?

Is the yellow transmit light blinking?

Is transmit blinking?
<is_data_light_blinking>
  <val>Is the data transfer light blinking?</val>
  <intro>
    <val>We need to check if the data is being transmitted. The yellow light on the right side of the modem box should be blinking now. Is it?</val>
  </intro>
  <tutorial>
    <val>The yellow light on the right side of the modem blinks when transmitting. Is it blinking now?</val>
  </tutorial>
  <beginner>
    <val>Is the yellow modem transmit light blinking?</val>
  </beginner>
  <normal>
    <val>Is the yellow transmit light blinking?</val>
  </normal>
  <expert>
    <val>Is transmit blinking?</val>
  </expert>
</is_data_light_blinking>
Dialog Network
Navigating the meta-levels

- How to track expertise
  - Visit count is a good start
  - But human memory fades with time

- Meta makes it easier to build
  - Thinking Meta is like thinking O-O
  - Divides the work naturally
Tracking Expertise

(learnRate = 0.7)
Tracking Expertise

\(\text{learnRate} = 1.2, \text{forgetRate} = 1.1\)
Tracking Expertise

(learnRate = 0.6, forgetRate = 0.07)
Summary

- Humans adapt all the time.
- Makes conversation more efficient and it sounds more natural.
- Simplifies dialog design by encapsulating (hiding) the complexity.
- As synthetic agents become longer term companions they will (must) behave more like a human.
- This functionality is easy to incorporate.
Remember

- **Delegation** at a semantic level
- Syntax is **Derived** in realtime
- **Consistency** of behavior over the entire system
- Simplifies dialog design (**Divide/Conquer**)
- Creates a more **Natural** experience
- Greater than the sum of the parts (**Emergent Behavior**)
You are getting very sleepy...

- Delegation
- Derived
- Consistency
- Divide/Conquer
- Natural
- Emergent Behavior
Thank you
Further Areas for Refinement

- Response to common conversational courtesy.
- Human variability
- Anticipation of a goal
Meta Makes It Better

- More Natural
  - The user experience will be less rigid
- Easier to Author
  - Like all systems based on delegation (e.g. military) each level has a manageable amount of detail to react to
- Automatic?
  - People only drive a manual transmission car for fun (it usually costs more too!)
- What are the rules?
  - As subtle and sophisticated as needed but sensibly contained