Outline

- Overview of ICT
- Dialogue Genres
- ICT Conversational Systems and Architectures
  - Question-answering characters: Sgt Star & Interfaces
  - Transaction Dialogue: Radiobots
  - Bargaining Dialogue: TACQ
  - Multiparty Negotiation Dialogue: MRE & SASO
Overview of ICT

- Part of University of Southern California (USC)
  - basic and applied research in immersive technologies to advance and maintain the state-of-the-art for human synthetic training experiences so compelling that participants will react as if they are real.
  - Partnership of academic research community with entertainment industry
  - Founded in 1999
  - http://ict.usc.edu/
ICT Research Areas

- **Graphics**
  - Make objects and people look real

- **Mixed Reality**
  - Immersive environments that engage the full palette of human senses

- **Virtual Humans**
  - Simulate the human element

- **Social Simulation**
  - Simulate groups of people, populations

- **Learning and Therapeutic Sciences**
  - Design and manage the experience for effective learning and therapy

- **Systems Engineering and Integration**
  - Leverage game engines and digital assets for prototype development
Spoken Dialogue: Participating in Conversation

- **Understanding Human Language**
  - What does a person say?
  - What does the speech mean?
    - In context of current interaction
      - What did the person try to accomplish?
      - In terms the virtual human can understand

- **Integrating Language & Managing Dialogue**
  - How does speech affect virtual human?
    - What new information is provided? What updates have to be done?
    - What opportunities are opened for addressing vhuman goals?
    - What new obligations and threats must be managed?
    - How is this information communicated to other modules
      - (e.g., planning, emotion)?

- **Producing Language**
  - Deciding when to speak (or listen or act)
  - Deciding what to say
    - choosing the appropriate meaning
  - Deciding how to say it
    - so partner can understand it
    - So expression seems natural
Theory of Dialogue?

- The Blind Men and the Elephant
  
  The first blind man put out his hand and touched the elephant’s side. “How smooth!” he said. “An elephant is like a wall.”

- The second blind man touched the trunk. “How round! An elephant is like a snake.”

- The third blind man touched the tusk. "How sharp! An elephant is like a spear.”

- The fourth blind man touched the leg. "How tall and straight! An elephant is like a tree.”

- The fifth blind man touched the ear. "How wide! An elephant is like a fan.”

- The sixth blind man touched the tail. "How thin! An elephant is like a rope.”

- Dialogue is air/railroad booking
- Dialogue is direction giving
- Dialogue is small-talk/story telling
- Dialogue is meeting planning
- Dialogue is call-routing
- (multiparty) Dialogue is meetings
Dialogue Genres: Matching the Problem with the Solution

- There is no “one-size fits all” solution
  - Natural language dialogue is an “AI-complete” problem
    - Need all knowledge and human-level reasoning for the general case

- But many types of dialogues can be handled!
  - Many sub-problems can be (and have been!) solved for practical purposes
    - E.g., limited voice menu, database retrieval
  - Many proposed techniques: ranges of applicability, resource requirements, generality, accuracy, costs (development time and runtime), scalability

- Dialogue Genre taxonomy
  - Analyze complexities and requirements of domain and pair with best processing methods
Aspects of Taxonomy of Dialogue System Genres

- Goals of Dialogue System
- Complexity of Behavior
- Context for Dialogue
- Type of User
Goals of Dialogue Agent

- **External view (black box)**
  - Surface behavior
  - Holistic performance/acceptability

- **Internal view (glass box)**
  - Internal coherence/representational fidelity
  - Fidelity of a subsystem
Complexity of Behavior

- Simple isolated phenomenon or function
  - e.g. backchannel
- Toy domains
- Simple tasks
- More complex tasks
- Extended interaction/multiple tasks
Dialogue Context

- In the wild, or controlled/manipulated for experiment
- Participants
  - Individual differences: skills, beliefs, goals, culture, personality, etc
- Activity
- Location
- Artifacts
- Noise
Degrees of robustness: type of user

- Demo
- Trained user
- Motivated user
- General populace
- Red team
Spiral methodology:

- For a given system, start with simple version
- Then Add
  - more robustness,
  - more accurate model of phenomena,
  - more complex phenomena handled,
  - more complex tasks handled
What should go in computational dialogue model?

Not full theory:
- too complex
  - Hard to calculate
  - Too slow
- not needed
  - Only some aspects will come up in any interaction
Which Razor?

- **History of Shaving**

- Represent only with evidence from data
  - Represent only if functional consequence
  - Represent only if simplest way to achieve consequence
  - Represent only if necessary function for task
ICT Conversational Systems

Advanced Research

Natural Language Dialogue Processing

Transitioned Training Technology

Question Answering Characters

Mission-related Military Dialogue

Clinical Psych Diagnosis

Group Conversation Characters

Dr. Perez
SASO-ST, SASO-EN

Elder-Al-Hassan
SASO-EN

Amani & Mohammed
Tactical Questioning

Hassan
Tactical Questioning

SGT, Medic
Mission Rehearsal Exercise

SGO LT Moleno
Second Life
Army Island

C3IT
Cultural training

SDO LT Moleno
Sudan Information
Activeworlds

Ahmad Wani
Sudan

Justina
Virtual Patient

Justin
Virtual Patient

IOTA JFETS
Call for Fire

DARPA Deep Green
COA input

Be a Reporter

SGT Star

SGT Blackwell
Dialogue Genres & Architectures for ICT Dialogue Agents

- **Question-answering characters**
  - Be interviewed
  - Respond in character

- **Transaction Dialogue**
  - Exchange information
  - Perform requested service

- **Bargaining Dialogue**
  - Beliefs, Goals, Policies
  - Deceptive & Uncooperative Behavior

- **Negotiation**
  - Assess alternative courses of action
  - Proposing and reacting to proposals
  - Coming to agreement

- **Background Conversation**
  - Group conversation simulation
  - Personality and cultural influence on behavior

- **Mediated Conversation**
  - Translator
  - Moderator
  - IUI for backend
Evolution of Virtual Human Dialogue Capabilities

- Basic MRE → Advanced MRE → SASO-ST → SASO-EN
- Negotiation
- Text generation
- Radiobot → IOTA
- Classification technology
- Dialogue manager
- TACQ 1
- SGT Blackwell
  - ASC’04
- Be a reporter
- TACQ 2
- SGT Blackwell
  - ASC’06
- Question Answering
- TACQ 3
- C3IT
- Virtual Patient
- SGT Star
- Text generation
- Grounding Model
- Dialogue manager
- Bargaining Dialogue
- Compliance Model
Examples of ICT Question-answering Characters

SGT Star

SGT Blackwell

C3IT/TACQ: Raed

BMOS Interfaces Ada & Grace

Be a Reporter
SGT STAR
(from LABTV segment)
NPCEditor

- Unified tool for Question-answering Character language interaction
  - Authoring environment: input questions, answers, links
  - Trainable Cross-language relevance model classifier
  - Runtime environment
    - Accepts a variety of message inputs include ASR interface, email & chat
    - Limited dialogue manager settings
    - Output text or virtual human message formats (FML/BML)

- Now part of Virtual Human toolkit
  - Available free for Academic Research Use:
    - [http://vhtoolkit.ict.usc.edu/index.php/Main_Page](http://vhtoolkit.ict.usc.edu/index.php/Main_Page)
Who are you? Oh, I'm Sergeant Star! I'm a virtual character. Maybe you've seen me before on the web at Go.Army dot com. But there, I'm stuck looking like this. But now with a brilliant blend of pixels, polygons and programming, coupled with real time animation and spoken word interface, I can do my very best to answer your questions on Army careers. And my lips move when I do it.
Cross-Language Relevance Model

(Leuski et al, Sigdial 2006)

- Relevance Model: $P(w|R)$ - prob that a random word from appropriate answer is $w$. $P(w|R) \sim \text{apprx} P(w|Q)$

- Estimate $P(w|Q)$ - prob observing word $w$ in an answer given question

$$P(w|Q) = \frac{\sum_s \alpha_{As}(w) \prod_{i=1}^{m} \pi_{Qs}(q_i)}{\sum_s \prod_{i=1}^{m} \pi_{Qs}(q_i)}$$

- Estimate $P(w|A)$ - prob observing word $w$ in an answer given answer

$$P(w|A) = \alpha_A(w)$$

$$\alpha_x(w) = \lambda\alpha \frac{\#(w, x)}{|x|} + (1 - \lambda\alpha) \frac{\sum_s \#(w, x)}{\sum_s |x|}$$

- Compare two probabilities: Minimize $D(p_q|p_a)$

$$D(p_q|p_a) = \sum_{w \in V} P(w|Q) \log \frac{P(w|Q)}{P(w|A)}$$

NPCEditor: Sgt Star Chat view

Anybody: what's your name

Sgt star: Who me? Oh, I'm Sergeant Star! I'm a virtual character. Maybe you've seen me before on the web at Go_Army.com. But there, I'm stuck looking like this. But, now with a brilliant blend of pixels, polygons and programming, coupled with real time animation and spoken word interface, I can do my very best to answer your questions on Army careers. And my lips move when I do it.
Ada & Grace at Boston Museum of Science
Ada & Grace at Boston Museum of Science
Second Life: Staff Duty Officer Moleno
(Jan et al IVA 2009)
Transaction-dialogue: Radiobots for Simulation

Minor MRE Radio Characters

- Dialogue systems play role of Radio operators in military simulation
- Trainee-Interface to simulation for structured tasks, e.g.
  - 9-line medevac call
  - Artillery Call for Fire.

Radiobots for JFETS
JFETS-IOTA Radiobots

- Goal: Automating Radio Calls for Fire in the JFETS Environment
Example Radiobot Interactions

G91: steel one niner this is gator niner one , adjust fire over ,
S19: gator nine one this is steel one nine , adjust fire out ,
G91: grid four five one , three six four over
S19: grid four five one three six four out ,
G91: one z_s_u in the open , i_c_m in effect over ,
S19: one z_s_u in the open , i_c_m in effect out .
S19: message to observer . kilo alpha high explosive four rounds . adjust fire target number alpha bravo one zero zero over ,
G91: message to observer , kilo alpha , high explosive in effect four rounds , target number alpha bravo one zero zero break ,
S19: shot over ,
G91: shot out ,
S19: splash over ,
G91: splash out

G91: steel one nine this is gator nine one , adjust fire polar over ,
S19: gator nine one this is steel one nine , adjust fire polar out ,
G91: direction five nine seven zero , distance four eight zero over ,
S19: direction five nine seven zero , distance four eight zero out ,
G91: one b_m_p in the open , d_p_i_c_m in effect over .
S19: one b_m_p in the open . i_c_m in effect out .
S19: message to observer . kilo bravo high explosive four rounds . adjust fire target number alpha bravo one thousand two over
G91: message to observer , kilo alpha quick in effect h_e four rounds , target number alpha bravo one thousand two over ,
S19: shot target number alpha bravo one zero zero two over ,
G91: shot out ,
IOTA Language Processing

Human Voice ➔ (raw sound data)

Speech Recognizer ➔ Text

steel one nine this is gator nine one tank in the open over

Interpreter

Dialogue Moves and Parameters

identification
  fdc-id       = steel one nine
  fo-id        = gator nine one
  target description
  target-type   = tank
  target-description = in the open

Dialogue Manager ➔ GUI Command

Template Generation and Text-To-Speech

gator nine one this is steel one nine tank in the open out
Language Processing: Interpretation

<table>
<thead>
<tr>
<th>ID</th>
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<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>FIRE</th>
<th>FIRE</th>
<th>FIRE</th>
<th>OVER</th>
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<tbody>
<tr>
<td>Steel</td>
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<td>niner</td>
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<td>is</td>
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<td>niner</td>
<td>one</td>
<td>adjust</td>
<td>fire</td>
<td>polar</td>
<td>over</td>
<td></td>
</tr>
</tbody>
</table>

Training Data

Conditional Random Fields

\[
P(y|x) = \frac{1}{Z(x)} \exp \left\{ \sum_i \lambda_i f_i(y, x) \right\}
\]
Language Processing: Dialogue Management

**Information State approach:**
- Information important to the dialogue
- Rules for actions based on incoming and existing information

**Example Information:**
**Mission Information**
- **Warning Order**: fire for effect
- **Target Location**: grid 456372
- **Target Description**: bmp in the open

**Adjust Information**
- **Drop/Add**: - 5 0 (drop five zero)
- **Left/Right**: 0 (none)
- **Kind of Adjust**: fire for effect
- **Phase**: adjusting

**Example Rule:**
- If incoming move is a target description
  - reply to RTO: confirmation of target description
- if enough mission information exists:
  - send mission to simulator
Tracks evidence of *grounding*: how well the information is mutually understood.
- Rule-based system developed from corpus analysis
- Useful for determining:
  - Exactly what information the trainee grounded and to what extent
  - Whether problems should be handled mid-dialogue or in After Action Review
  - How strict the dialogues should be (as determined by the operator)

**Example:**
- **IOTA**: Message to observer, *kilo, two rounds*, target number alpha bravo zero zero one, over.
- **Trainee**: Roger, message to observer, target number alpha bravo zero zero one, out.

System Performance
(Robinson et al Army Science Conference 2006 )

- **Speech Recognition component**
  - Word Error Rate: 9.7%
  - F-score: 0.93

- **Interpreter component**
  - F-score: 0.98 on transcribed data
  - F-score: 0.93 on Speech Recognition output

- **Task completion (entire system)**
  - With human operator supervision: 97.5%
  - With no human operator supervision: 85.5%
Bargaining Dialogue

When to use?

- Too complex for Text Q&A classification (Semantic Content, sequences, context, deception)
- Not straightforward transaction (uncooperative, policies)
- Not essential to have Planning, detailed emotion, complex semantics, detailed negotiation

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Utterance</th>
<th>Dialogue Move</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trainee</td>
<td>Who is collecting the tax?</td>
<td>Question about tax collector</td>
</tr>
<tr>
<td>Hassan</td>
<td>My family's safety is very important to me.</td>
<td>Elicitation of family protection</td>
</tr>
<tr>
<td>Trainee</td>
<td>We can protect your family.</td>
<td>Offer of family protection</td>
</tr>
<tr>
<td>Hassan</td>
<td>Indeed, you might say that I collect the taxes.</td>
<td>Assertion about tax collector</td>
</tr>
</tbody>
</table>
TACQ: Tactical Questioning
HUMINT: Human Intelligence

- Tactical Questioning dialogues are those in which small-unit military personnel, usually on patrol, hold conversations with individuals to produce information of military value (Army 2006)

- "As you speak to these young [Iraqi] men, appeal to their sense of honor and make them feel important." (Paul, 2006)

- **Genre Source material:**
  - Matthew C. Paul, "Tactical Questioning: Human Intelligence Key to Counterinsurgency Campaigns", Infantry Magazine, Jan-Feb 2006
  - William Wunderle, "Through the Lens of Cultural Awareness: A Primer for US Armed Forces Deploying to Arab and Middle Eastern Countries"
Dialogue Fragment with Hassan

Trainee  I’d like to talk about the marketplace

Hassan  I hope you do not expect me to tell you anything

Trainee  I just want to know why people aren’t using the marketplace

Hassan  I don’t feel like answering that

Trainee  I think you know something about a tax

Hassan  I am simply doing business. It is rude of you to imply otherwise
TACQ Version 3 Architecture

- Voice
  - ASR
    - Tone
    - Emotion
  - Anaphora Resolution
    - text
  - NLU
    - Dialogue act
      - Domain Knowledge Base
      - Dialogue Manager
        - Grounding
        - Compliance tracking
        - Response Generation
        - Networks
      - NLG
        - Dialogue act
          - text
          - Style Generation
          - text
          - Authoring Tools

Reply
TACQ Video Presentation
Dialogue Management: Compliance

- When should the character comply (ex: provide useful information)?

- Developed domain-specific model of emotions and social interactions
  - rules define how speech acts affect emotions. ex: social talk by the trainee increases social bonding
  - rules define how the emotions combine to create mood of compliance. ex: if respect and social bonding are above a threshold, comply

Dialogue Management: Deciding on a Reply

- Use networks to track subdialogues
  - tracks state of questions being discussed, offers made/resolved, etc
  - suggest possible replies
  - defines constraints that must be satisfied for a given reply to be made

Dialogue Management and Personality

- Allow character authors to use dialogue manager parameters to express a character's personality
  - updating emotions
  - types of replies made

- Studying the extent to which humans can identify personality expressed through dialogue behavior
  - to what extent do other issues (voice, gesture) interact?
  - what kinds of personalities can be identified?

Grounding in Dialogue Management

- Grounding improves dialogues
  - track degrees of groundedness of dialogue topics
  - make grounding utterance when material is not grounded enough
  - in human-user experiments, such virtual humans are perceived as making more appropriate responses

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<tr>
<td>Hassan</td>
<td>So, you ask about the tax collector. My family's safety is very important to me.</td>
<td>Grounding: Repetition Elicitation of family protection</td>
</tr>
</tbody>
</table>

Antonio Roque and David Traum, "Improving a Virtual Human Using a Model of Degrees of Grounding," International Joint Conference on Artificial Intelligence (IJCAI) 2009.
Surface Text

not yet no i don't understand what is this tax you are referring to . are you col + ah who is collecting the tax

who is collecting the tax at the market ?

ok well maybe could you just tell me a little about the town. i understand that there is a ah tax being levied

ah do you know what's being taxed ?

i'm actually just trying to find out about the tax and why it's being levied or if ah you know where (xxx)

do you know anything about the tax

i see. well the money that who else who is the sunny you referred to i guess i'm not i didn't realize that there was someone else involved.

alright so we've heard that somebody is levying taxes

alright so we've heard that somebody is levying taxes is that true

do you know anything about somebody levying taxes
Evaluation

- Two characters have been built by non-experts within a few weeks (Amani & Assad)

- Amani domain size:
  - Amani 89 DAs linked to 98 utterances
  - Player 113 DAs linked to 681 utterances

- Preliminary evaluation of DA schema (Artstein et al, 2009)
  - A total of unique 224 player’s utterances were linked to most appropriate DA
  - Initially 50% coverage (improved to 80%)

- West Point Sessions
  - Surveys (one student: “Felt like the most realistic exercise in class, first time interacting with locals”)
  - Domain expansion
  - Evaluation of expanded domain (in progress)
Negotiation Characters: Increasing Capabilities

- Multiparty: Advanced MRE
- Bilateral: Basic MRE
- Cooperative: SASO-EN
- Non-cooperative: SASO-ST

More difficult
Virtual Human Task Model
(Traum et al AAMAS 2003)

- **Basic Types**
  - States
    - Object-id
    - Attribute
    - Value
    - Polarity
    - Concerns
    - Belief
    E.g.: :object-id clinic :attribute location :value market :polarity positive
  - Tasks
    - Pre, Add, Delete (states)
    - Case roles (event, agent, theme, location, source, destination, instrument, path)

- **Reasoning**
  - Goals
  - Plans
  - Intentions
  - Alternative Courses of Action

- **Contact** (make, break)
- **Attention** (show, request, accept)
- **Conversation** (begin, join, leave, end)
  - Turn-taking (take, hold, release, assign)
  - Initiative (take, assign, release)
  - Utterance
    - Main Function (assert, request, suggest, order, offer, promise, info-request, …)
    - Relational (answer, accept, reject, avoid, hold, …)
    - Features: speaker, addressee, overhearer, referent, content
      - Polarity (positive, negative)
    - Grounding (initiate, continue, acknowledge, repair, request repair, …)
    - Topic (set topic, set subtopic, close topic)
- **Social**
  - Obligations & Commitments
  - Relationships
  - Social Roles
MRE Team-Negotiation Example
Sgt’s Negotiation Behavior

Focus=1
Lt: U9 “secure a landing zone”
Committed(lt,7,sgt), 7 authorized, Obl(sgt,U9)
Sgt: U10 “first we should secure the assembly area”
Disparaged(sgt, 7,lt), endorsed(sgt,2.lt), grounded(U9)
Lt: U11“secure the area”
Committed(lt,2,sgt), 2 authorized, Obl(sgt,U11),grounded(U10)
Sgt: U12“yes sir”
Committed(sgt,2,lt), grounded(U11), Push(2,focus)
Goal7:Announce(2,{1sldr,2sldr,3sldr,4sldr})
Goal8: Start-conversation(sgt, ,{1sldr,2sldr,...},2)
  Goal8 --> Sgt: U21 “Squad leaders listen up!”
  Goal7 --> Sgt: U22 “I want 360 degree security”
  Committed(sgt,2,{1sldr,2sldr,3sldr,4sldr})
Push(3, focus)
Goal9:authorize 3
  Goal9 --> Sgt: U23“1st squad take 12-4”
  Committed(sgt,3, {1sldr,2sldr,3sldr,4sldr}), 3 authorized
Pop(3), Push(4)
  Goal10: authorize 4
  Goal10 --> Sgt: U24“2nd squad take 4-8”
  Committed(sgt,4, {1sldr,2sldr,3sldr,4sldr}), 4 authorized
Pop(4)
  ... A10: Squads move
  Grounded(U21-U26)
  ends conversation about 2, Happened(2)
Push(7,Focus)
Selecting Acts to Perform

- **Considerations:**
  - Current Topic, orientation and strategy
  - The turn
  - Initiative level
  - Obligations to ground
  - Obligations to repair
  - Degree of understanding of prior utterances
  - (potential) obligations to address info-request
  - Beliefs about true answers
  - Agent Goals

- Recognition: how well did system ‘understand’?:
  - Speech recognition
  - Language understanding
  - Speech Act
  - Addressee

- Appropriateness: how correct was system response?
  - High Inter-rater reliability: 0.9K (for 4 raters)
SASO-EN Virtual Humans
SASO-EN Multiparty Negotiation
(Traum et al IVA 2008)

- Set of Strategies
- Multiparty
  - Each agent has strategy
  - Trust toward each party
- Multi-issue
  - Appraisal for each alternative
    - Potential strategy for each
  - Topic tracking
    - Strategy for current topic is active

- Negotiation Considerations
  - Trust
    - If too low, disengage
  - Plan Assessment
    - Appraisal variables
    - Flaws
    - Relative utility
  - Dialogue Assessment
    - Topic
    - Control
    - Commitments
3-party negotiation Dialogue: Not very cooperative

C: hello gentlemen
D: hello captain
E: hello captain
C: thank you for meeting me
E: how may I help you?
C: i have orders to move this clinic to a camp near the US base
D: we need to help the victims of this conflict you started
C: i understand but it is imperative that we move the clinic out of this area
D: do you see that girl over there her mother was killed by American gunfire today
C: it is not safe here
D: look at these people they are injured because of your operations
C: i have my orders to move you to the camp
D: elder i think staying at the market would be best
E: we have many matters to attend to
C: i understand
E: captain you would do better to protect the town
C: we cannot protect you here
E: we must stop this killing insanity
E: i must refuse
D: i would have to refuse this decision
E: i must leave thank you
D: i must go now
SASO-EN: More Cooperative Interaction
SASO-EN Multiparty Negotiation
(Traum et al IVA 2008)

- **Set of Strategies**
- **Multiparty**
  - Each agent has strategy
  - Trust toward each party
- **Multi-issue**
  - Appraisal for each alternative
    - Potential strategy for each
  - Topic tracking
    - Strategy for current topic is active

- **Negotiation Considerations**
  - **Trust**
    - If too low, disengage
  - **Plan Assessment**
    - Appraisal variables
    - Flaws
    - Relative utility
SASO Vhuman Trust Model
(Traum et al, IVA 2005)

- **Trust as function of multiple factors:**
  - Familiarity - (part of cognitive consideration) can I expect someone to behave properly
  - Solidarity - (joint purpose) to what extent does other have shared purpose with self
  - Credibility - (part of ethical consideration) does agent make (only) claims that are
    - Believable
    - Verifiably true
    - Turn out to be true

- **Trust dynamically computed**
  - Displays of solidarity/opposed goals
  - Credible/incredible statements
  - Show empathy, polite behavior, behave according to conventions

- **Use of trust**
  - accept assertions as truth (e.g., Perrault, Cohen & Allen)
  - Negotiate in good faith
  - Continue engagement
  - Acceptance of empathy
Implementing Negotiation Strategies

- **Orientations result from appraisal of negotiation**
  - Reified negotiation “task”
  - Interactions with goals and plans

- **Strategies chosen as part of coping**
  - Entry & exit conditions

- **Strategies associated with communicative behavior**
  - Base posture and gesture set
  - Choice of dialogue moves
    - Speech act and realization
    - Initiative, topic selection, and type of grounding feedback
    - Affective tone
  - Aspects of interpretation
    - Charitability of interpretation
    - Assumptions vs clarification
## Negotiation Strategies:
### Appraising the topic

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<tr>
<th></th>
<th>topic</th>
<th>Control</th>
<th>Utility</th>
<th>Potential</th>
<th>Trust</th>
<th>Commitment</th>
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<tbody>
<tr>
<td><strong>Find issue</strong></td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>some</td>
</tr>
<tr>
<td><strong>Avoid</strong></td>
<td>+</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td>some</td>
</tr>
<tr>
<td><strong>Attack</strong></td>
<td>+</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td>some</td>
</tr>
<tr>
<td><strong>Negotiate</strong></td>
<td>+</td>
<td>--</td>
<td>--</td>
<td>+</td>
<td></td>
<td>some</td>
</tr>
<tr>
<td><strong>Advocate</strong></td>
<td>+</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td>some</td>
</tr>
<tr>
<td><strong>Success</strong></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>moderate</td>
</tr>
<tr>
<td><strong>Failure</strong></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very low</td>
</tr>
</tbody>
</table>
Behaving according to Strategies

- **No topic**
  - Find topic

- **Avoid**
  - Change topic
  - Try to leave

- **Attack**
  - State flaws
  - Propose better alternatives
  - Ad hominem

- **Negotiate**
  - State flaws
  - Propose solutions
  - Offer bargains

- **Advocate**
  - Propose actions
  - Address flaws
  - Offer commitment

- **Success**
  - Move on

- **Failure**
  - Move on
How to Win Friends and Influence Virtual People

- **Gain Trust**
  - Familiarity
    - Do the right things
    - Show you know how to behave
  - Credibility
    - Say believable things
    - Stand by your word
  - Solidarity
    - Want the right things
    - Show alignment in goals

- **Manage Interaction**
  - Don’t lose control
  - Set the agenda
  - React to what they are saying

- **Solve Problems**
  - Offer resources
  - Commit to important actions
  - Remove obstacles
  - Consider alternatives
  - Win-win situations
NL Dialogue Processing: best techniques for genre & sub-task

**Understand language**
- Semantic parsing

**Manage dialogue**
- Rule-based reasoning

**Generate language**
- Statistical & Grammar-based generation

**Negotiation**
- Semantic classification

**Bargaining Dialogue**
- Finite-state policies

**Transaction Dialogue**
- Information extraction

**Question Answering**
- Follow protocol

- Text classification

- Keep history

- Recorded answers
Factors in Choosing the right architecture

- Complexity of domain
  - Type of task
  - Size of task
  - Requirements on understanding
- Authorability of resources
- Robustness needed
- Depth of modeling
Thank You

- Questions?