

Situating human-machine dialogue in the social world

David Traum | 7/24/2013

USC

 **ICT**
INSTITUTE FOR CREATIVE TECHNOLOGIES

-
- **Theme of symposium so far: what is language about**
 - How to understand language in terms of images/video/action
 - How to understand images/video/action as language

 - **Also important**
 - Who is communicating
 - to whom,
 - why,
 - under what conditions

USC-ICT Conversational virtual humans



SGT, Medic
Mission Rehearsal Exercise



Dr. Perez
SASO-ST,
SASO-EN

Elder-Al-Hassan
SASO-EN



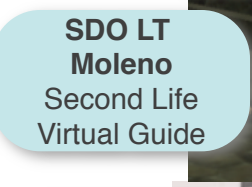
Amani & Mohammed
Tactical Questioning



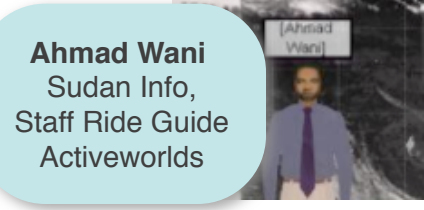
Hassan
Tactical Questioning



C3IT
Cultural training



SDO LT Moleno
Second Life
Virtual Guide



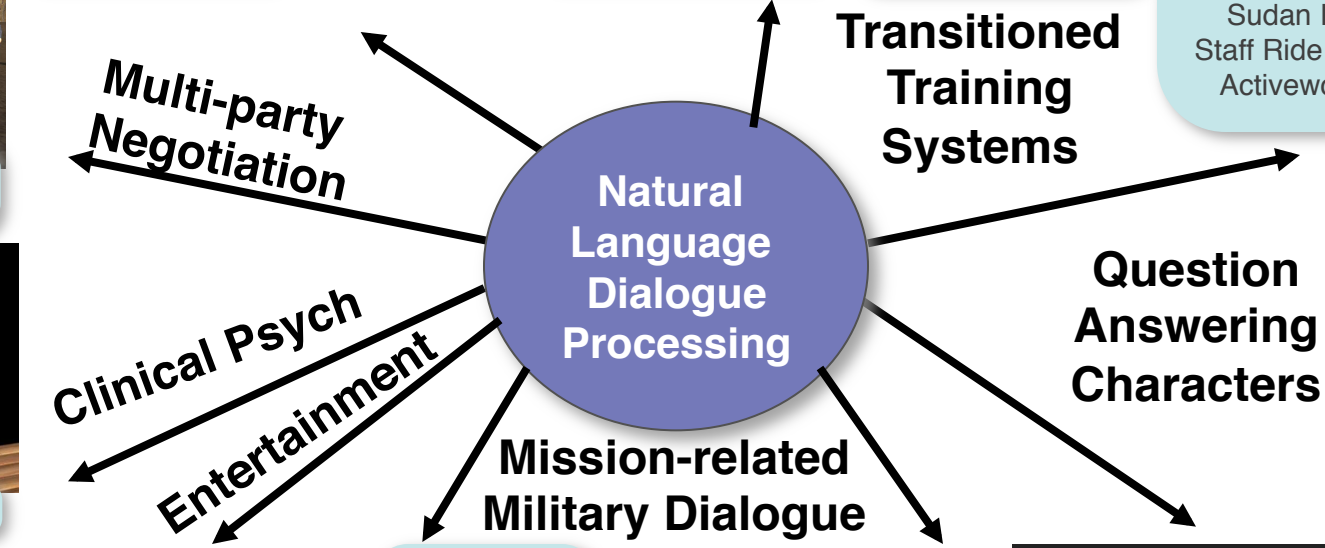
Ahmad Wani
Sudan Info,
Staff Ride Guide
Activeworlds



Group Conversation Characters



SimCoach



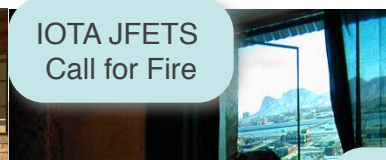
SGT Star



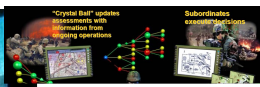
Justin & Justina
Virtual Patients



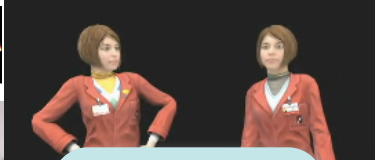
Utah, Harmony & Rio
Gunslinger



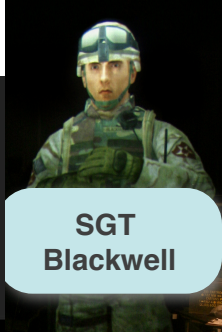
IOTA JFETS
Call for Fire



DARPA Deep Green
COA input



Boston Museum of Science Twins



SGT Blackwell

Dialogue Genres for ICT Dialogue Agents

- **Branching Narrative (INOTS/ELITE)**
 - Limited choices linked to learning objectives
- **Question-answering characters (Sgt Star, Twins)**
 - Be interviewed
 - Respond in character
- **Helpful Interviewer (Simcoach/SimSensei)**
 - Information state
 - Dialogue routines
- **Hybrid Story (Gunslinger, CHAOS)**
 - Different modes at different choice points
- **Transaction Dialogue (Radiobots)**
 - Exchange information
 - Perform requested service
- **Bargaining Dialogue (TACQ, Deception detection)**
 - Beliefs, Goals, Policies
 - Deceptive & Uncooperative Behavior
- **Negotiation (MRE, SASO)**
 - Assess alternative actions
 - Negotiation strategies
 - Coming to agreement
- **Background (MRE, Vigor)**
 - Group conversation simulation
 - Personality and cultural influence on behavior
- **Mediated Conversation (Transonics, CHAOS, Deep Green)**
 - IUI for backend
 - Translator
 - Moderator

Speech act distribution (Traum 2000 Journal of Semantics)

- Frequency of understanding and answer acts, within tasks, across subject populations

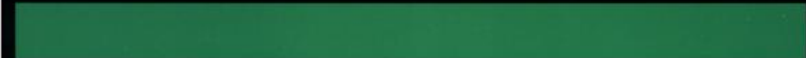
Damsl TRAINS	Damsl Monroe	SWBD-Damsl Switchboard	HCRC HCRC Maptask	HCRC DCIEM Maptask	Verbmobil II Verbmobil English	Verbmobil II Verbmobil German	Verbmobil I Verbmobil I German
statement 45.9	51.4	49	explain 7.9	7.9	Inform,... 22.8	21.2	12.2
info-request 15.2	9.9	questions 4.9	query,check,align 23.5	20.3			
action-dir,oo 12.2	12.9	0.7	instruct 15.6	15.2	request,suggest 26.0	27.0	32
commit,offer 23.8	16.8	0.1			commit 0.5	0.8	
conventional 2.5	0.6	1.4			13.4	15.6	16.5
answer 14.7	8.4	3	reply,clarify 22.8	20	feedback 15.2	9.8	0.6
accept 30.0	23.0	5			accept,confirm 10.3	12.3	13.5
reject 2.2	0.5	0.2			reject,explained 3.3	4.4	8.2
other agree 3.6	1.8	0.3			clarify 2.3	1.9	8.9
Understanding 30.2	28.5	23	acknowledge 20.5	28.1	backchannel 3.6	3.3	
non-understand 1.2	0.5	0.1					

Table 1: Percentage Distributions of Dialogue Acts in Corpus Coding

Copyrighted Material

THE CONSTRUCTION OF SOCIAL REALITY

John R. Searle



Making

The Social

WORLD

The Structure of Human Civilization

JOHN R. SEARLE

Copyrighted Material

Semantics is Hard: Free Range Chickens



What is free range mayonnaise?



What is free range mayonnaise?

mayonnaise made from **free range eggs**



So, what are free range eggs?

eggs from free range chickens



What about “free range tuna salad”?

- **What is “free range”?**
 - ~~The salad?~~
 - The tuna?
 - ~~The mayo~~
 - ~~eggs~~ —
 - chicken?

Prior Work: Larson 87



“Now! ... *That* should clear up
a few things around here!”

“The Elk is called Erik”



Elk Hunters: Be Aware of Your Target!

Moose can be found in the same habitat as elk in Colorado. Make sure you know the difference between these two species, so you don't accidentally kill a moose. Use your binoculars, not scopes. Don't just look at the animal's antlers; study the entire head before you shoot.

Elk & Moose Comparison



Bull Elk

- Slender snout
- Pale yellow rump
- Chestnut-brown neck
- Reddish, lighter brown body
- Darker legs
- Antlers not palmated
- Obvious brow tines coming off main beam.

Cow Elk

- Slender snout
- Pale yellow rump
- Chestnut-brown neck
- Reddish, lighter brown body
- Darker legs

Confusing Calves

Be very careful you don't mistake a moose calf with an antlerless elk. Young moose have a reddish coat, similar to elk!

Bull Moose

- Dark, black-brown body
- Overhanging snout, bulbous nose
- Larger bell (beard) on throat
- Whitish-gray legs
- Palmated antlers with tines

Cow Moose

- Dark, black-brown body
- Overhanging snout, bulbous nose
- Bell (beard) on throat
- Whitish-gray legs

You Can Stop Poaching

Your Wildlife - Your Loss
Turn In a Poacher
1-877-COLO-OGT
1-877-265-6648



ILLUSTRATIONS BY © ROBERT NIKAKS
COURTESY OF MONTANA, FISH, WILDLIFE AND PARKS

“The Elk is called Erik”

Wapiti?	Europe	Elk
Elk	America	Moose



What is it?



Moose

Or Elk?

Elk Crossing



Zebra Crossing



Pelican Crossing



Anwo.com Animal World



This is a
Pelican Crossing



Types of pedestrian crossings in the UK

There are currently five types of formal pedestrian crossings used in the United Kingdom
ZEBRA crossings are marked by black and white painted strips across the road and flashing amber beacons.

PELICAN crossings have red/amber/green signals facing drivers, and red man/green man signal heads on the opposite side of the road to the pedestrians waiting to cross. A pedestrian push button unit operates these.

PUFFIN crossings differ from Pelican crossings as they do not have a flashing green man/flashing amber signal. The overall crossing time is established each time by on-crossing pedestrian detectors.

TOUCAN crossings are designed for both pedestrians and cyclists and are typically used adjacent to a cycle-path (Cyclists are not allowed to cross the road using Zebra, Pelican or Puffin crossings). There is a green cycle symbol alongside the green man.

PEGASUS crossings are similar to Toucan crossings but have a red/green horse symbol and higher mounted push buttons to allow horse riders to cross.

- See more at: http://www.devon.gov.uk/index/transportroads/traffic/pedestrian_crossings/types_of_pedestrian_crossings.htm#sthash.t1hUk8uJ.dpuf

Semantics is hard,.... But is it necessary

- **Only Sometimes!**
- **Pragmatics is the key.**
- **Clark & Wilkes-Gibbs '86: Grounding Criterion:**
 - Contributor and partners mutually believe that partners understood contributor to a degree sufficient for the current purposes



Believable group conversation simulation (Jan & Traum AAMAS 2007)

Character information state and personality model

The screenshot shows a software interface with a 'File' menu and a 'Characters' section. The 'Characters' section has an 'Execute' button and a 'Character' dropdown menu set to 'Sashim'. There are 'Add' and 'Remove' buttons. Below this are five sliders with numerical values: talkativeness (0.64), transparency (0.40), confidence (0.53), interactivity (0.29), and verbosity (0.58). At the bottom, there are tabs for 'Personality', 'Culture', 'Relationships', and 'Scene'. The 'Personality' tab is active, showing a list of status variables: inConversation: true, speaking: true, gazing: away, dialog group: Zaman, speaking: false, gazing: away, moving: false, location: -15.6849 6.1914, in group noise level: 0.0, out of group noise level: 0.0, on scene: true. Below the 'Personality' tab, there is another 'Character' dropdown set to 'Kasem' with 'Add' and 'Remove' buttons. A 'Chara...' dropdown is set to 'Sashim', and a relationship dropdown is open, showing options: Stranger, Stranger, Acquaintance, Friend (highlighted), and Family.

Group Conversation: A new character joins the conversation



“Interfaces” (Twins) exhibit at Boston Museum of Science (Swartout et al IVA 2010, Traum et al 2012)



DCAPS SimSensei



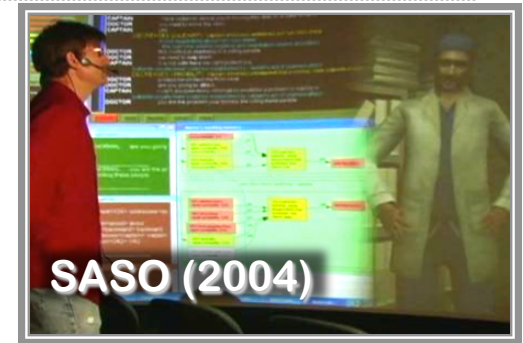
Virtual Human Negotiation: Capability-advancing prototypes



Decision-making



Multi-party Interaction



Non-cooperative
Negotiation



Multi-party negotiation



Persuasion and Conflict resolution

Mision Rehearsal Exercise: How to answer?



Descriptions of Events that happened here (that SGT knows about):

You just drove up, sir.

I assembled the troops at the rendezvous point.

The medic started treating the boy.

We got out of our humvees.

There was an accident.

Misison Rehearsal Exercise: How to answer?



Use Recency:

You just drove up, sir.

I assembled the troops at the rendezvous point.

The medic started treating the boy.

We got out of our humvees.

There was an accident.

Misison Rehearsal Exercise: How to answer?



Eliminate Common Knowledge:

~~You just drove up, sir.~~

I assembled the troops at the rendezvous point.

The medic started treating the boy.

We got out of our humvees.

There was an accident.

Mission Rehearsal Exercise: How to answer?



Use Emotional appraisal model
(highest concern):

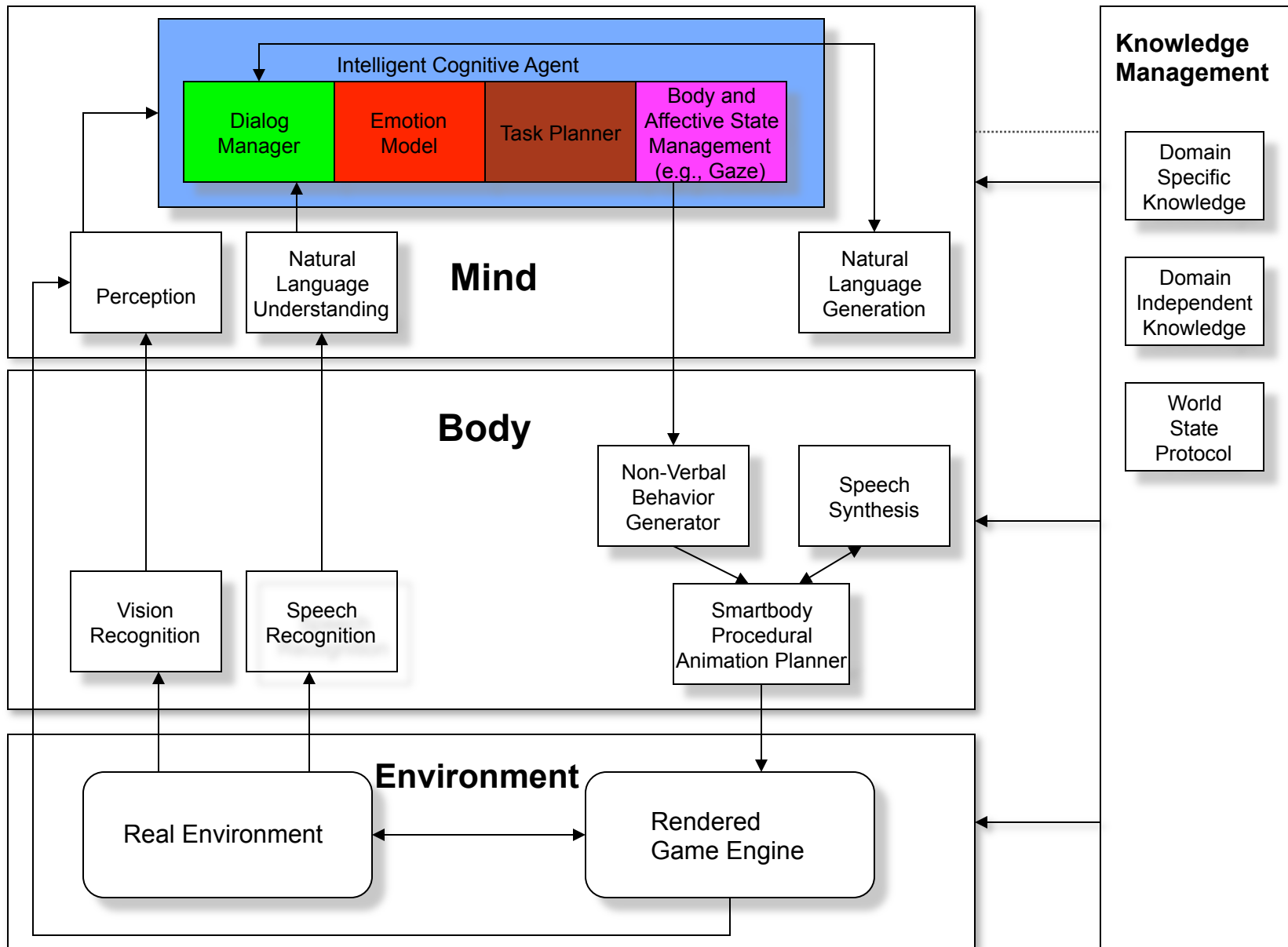
~~You just drove up, sir.~~

~~I assembled the troops at the
rendezvous point.~~

~~The medic started treating the
boy.~~

~~We got out of our humvees.~~

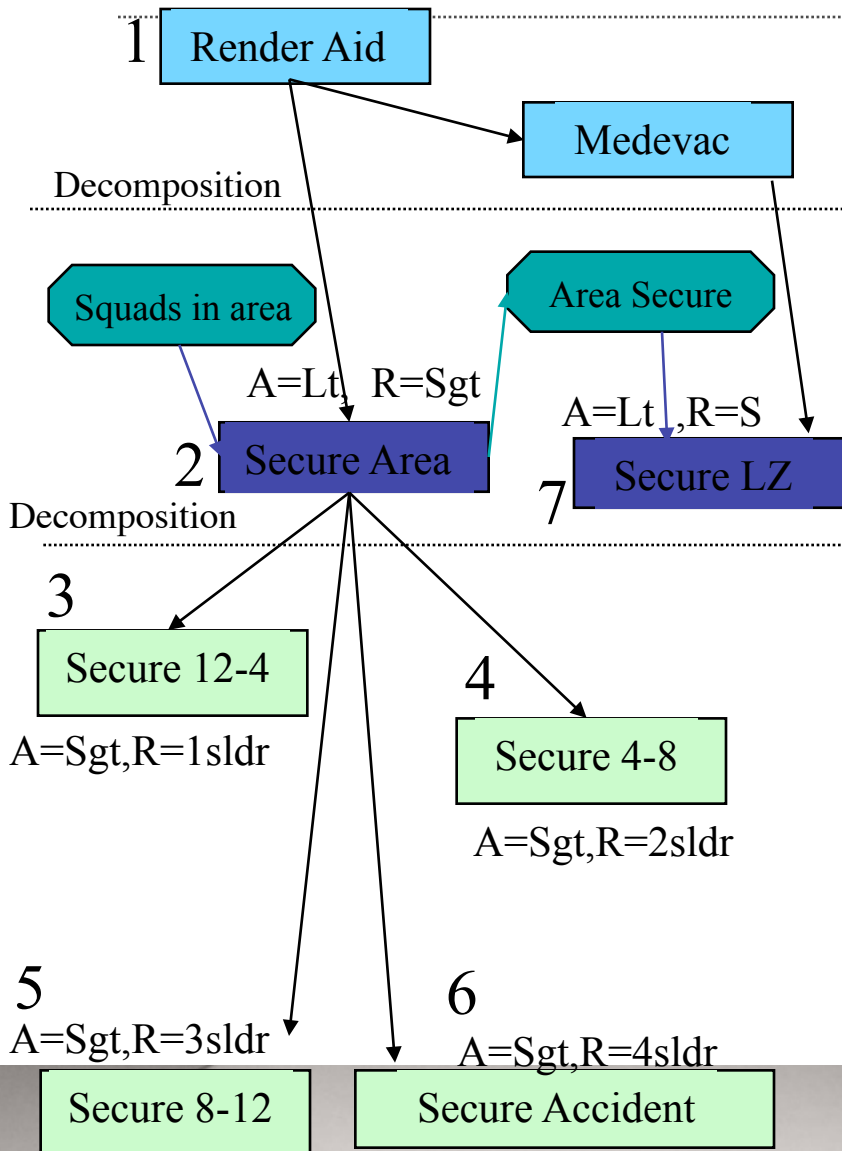
There was an accident.



Information State Model

Layer	Info State Components	Dialogue Acts
Contact	Participant contact	Make-contact, break-contact
attention	Participant focus	Show, request, accept
conversation	Conversation, topic, participants	Start-conversation, end-conversation, confirm-start, deny-start, identify-topic, join, leave
Turn-taking	Conversation turn	Take-turn, keep-turn, hold-turn, release-turn, assign-turn
initiative	Conversation initiative	Take-initiative, release-initiative
grounding	Conversation CGUs	Initiate, continue, acknowledge repair, cancel, request-repair
Core	Social State (obligations, commitments, trust) Conversation QUD, Negotiation, CGU contents	Forward: assert, info-req, order, request, thank, greeting, closing, express, check, suggest, promise, offer, apology, encourage, accuse, intro-topic, avoid
		Backward: accept, reject, address, answer, divert, counterpropose, hold, check, clarify-parameter, redirect

Sgt's Negotiation Behavior



Focus=1

Lt: U9 "secure a landing zone"

Committed(lt,7,sgt), 7 authorized, Obl(sgt,U9)

Sgt: U10 "sir first we should secure the assembly area"

Disparaged(sgt, 7,lt), endorsed(sgt,2.lt), grounded(U9)

Lt: U11 "secure the assembly area"

Committed(lt,2,sgt), 2 authorized, Obl(sgt,U11),grounded(U10)

Sgt: U12 "understood 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 "give me 360 degree security here"

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

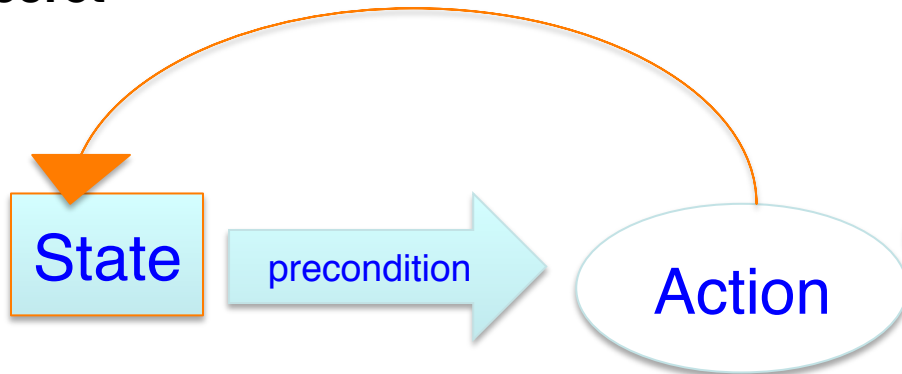
Grounded(U21-U26)

ends conversation about 2, Happened(2)

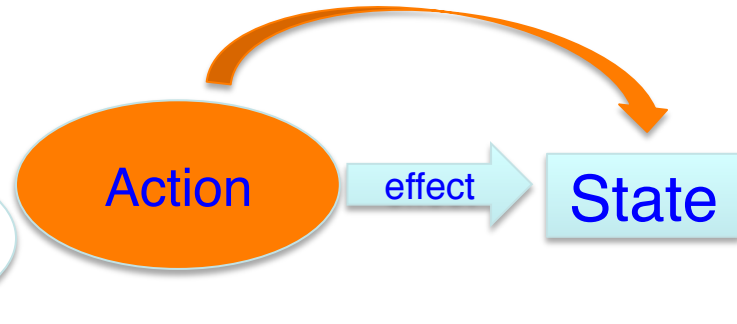
Push(7,Focus)

Secrecy Inference rules

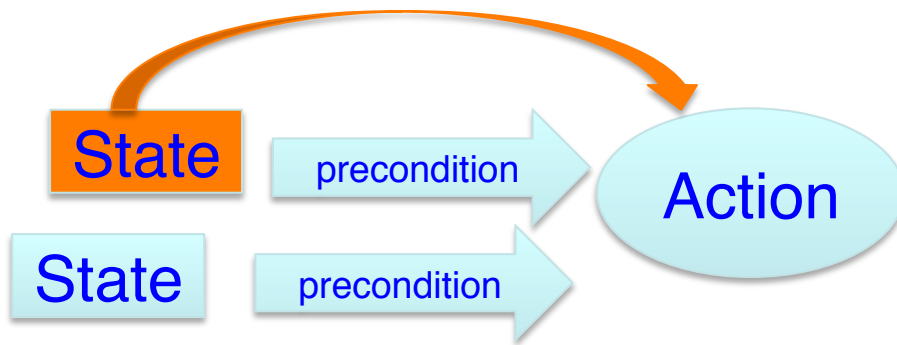
Sole pre-condition for a secret action is secret



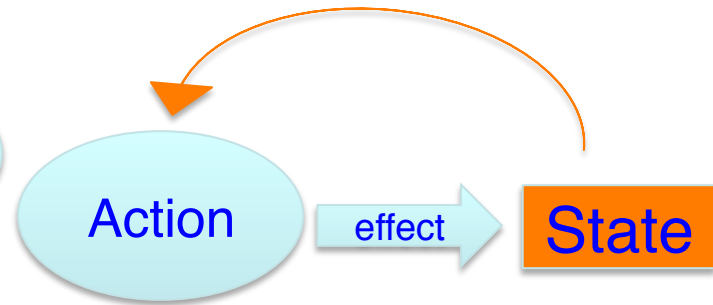
Effect that can only be achieved by a secret action is secret



Action with a secret pre-condition is secret



The only action that can establish/remove a secret effect is secret



NL Dialogue Processing: best techniques for genre & sub-task



Negotiation

Understand language

Semantic parsing

Manage dialogue

Rule-based reasoning

Generate language

Statistical & Grammar-based generation

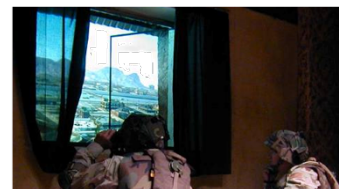


Bargaining Dialogue

Semantic classification

Finite-state policies

Classification + style filter generation

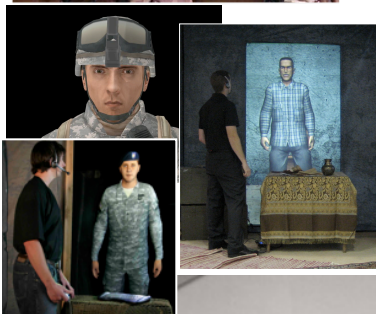


Transaction Dialogue

Information extraction

Follow protocol

Template-based



Question Answering

Text classification

Keep history

Recorded answers

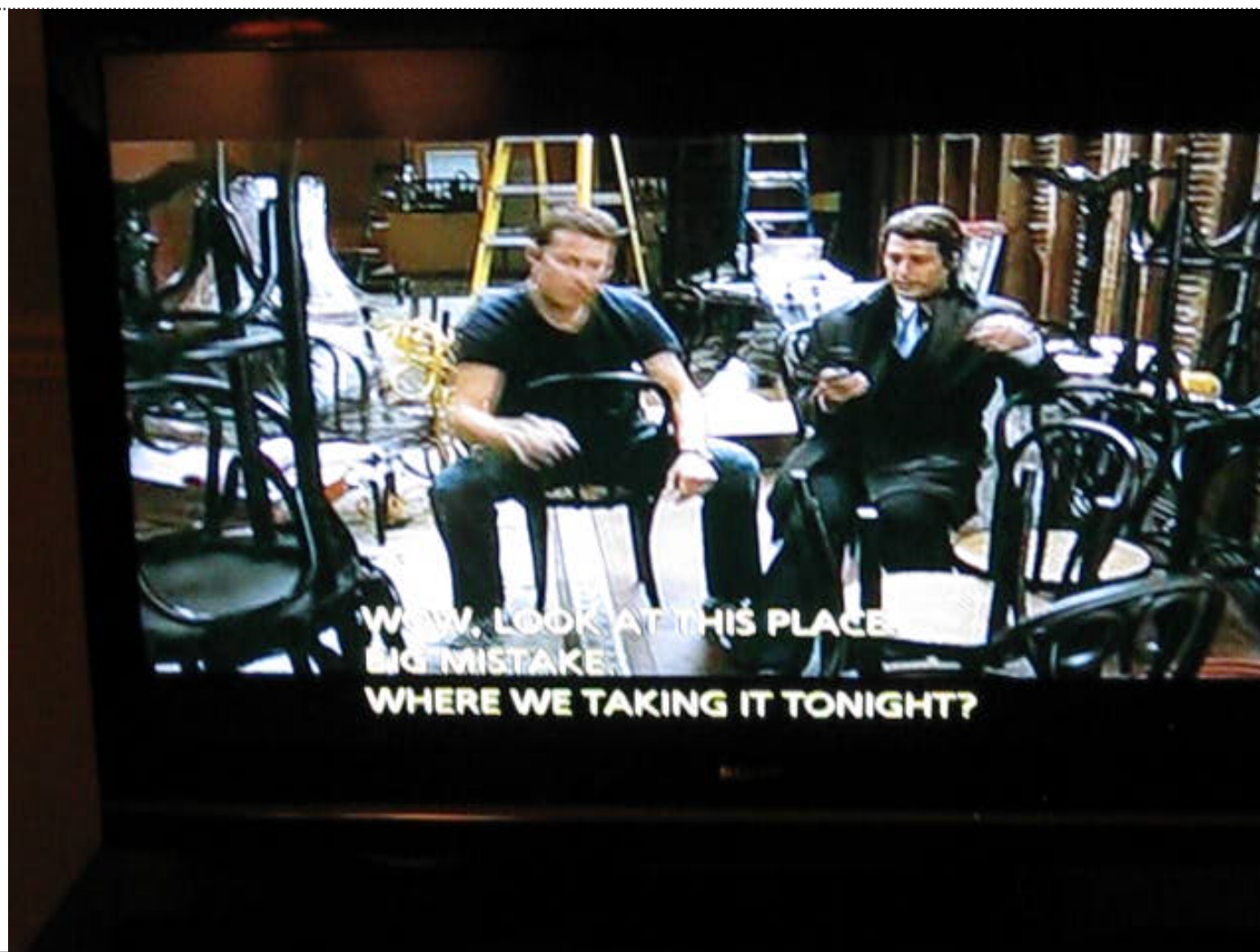
Understanding Levels

- **Background characters: Group participation structure, turn-taking**
- **Twins: classification to best answer**
- **SimSensei: specialized classifiers for**
 - Speech act, sentiment, polarity, specific features, multi-modal behaviors
- **MRE/SASO: semantic parsing/plan-related inference**

General-purpose understanding, or domain/task/genre/situation-specific?

- **Start with simple/small domain**
 - useful for interaction with real users, not “toy”
 - “cheating” is good!
 - when you can get away with it
 - Something stupid that sort of works is better than something “smart” that doesn’t work at all
 - Replace when you have something better
 - Doing it “right” will pay off in the end
 - invites serendipity
 - Easier to generalize
- **Combine/re-use where possible**
- **Unified synthesis**
 - Easier once you know how each domain works individually than starting out

Can we match human-level conversation?



From "I hate Valentine's Day"

Model for Human-Robot Interaction



Thanks
