Integrating Direction in Soar Believable Synthetic Characters

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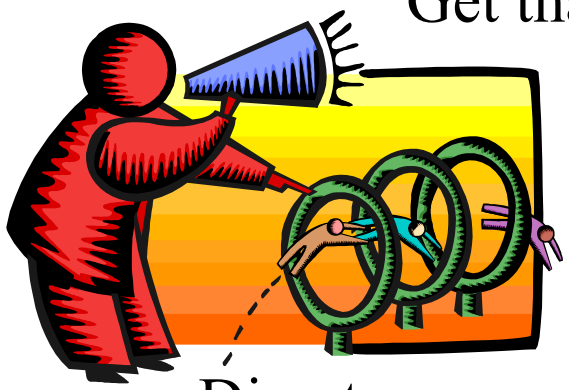
Get that guy out of the room!

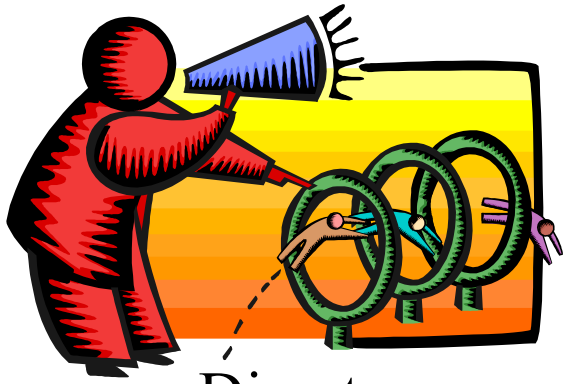


Director

Example

Synthetic Characters

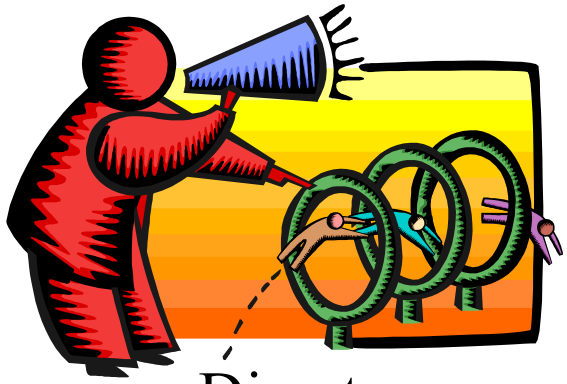
(a murder is about to happen in that room that the user should not see)



Director

Example

Let's Stage a fight!

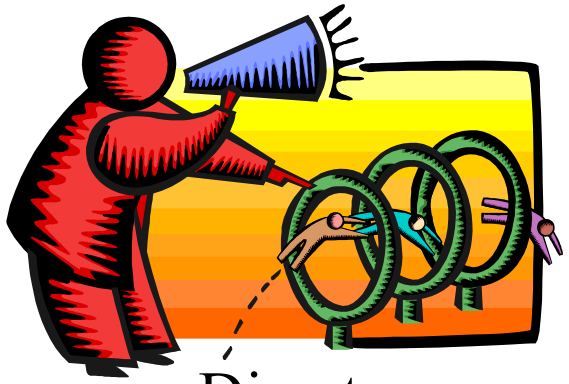


Director

Example

Somebody help!

Example



Director

Hero

Stop, you Hooligans!

Introduction

- Game developers want to
  - Create immersive virtual worlds, inhabited by autonomous characters
  - Dynamically determine narrative structure
- Synthetic Characters Challenge
  - Autonomous, directable, and believable
  - Inherent conflict between *autonomy* and *directability*
  - ***Must deal with this conflict without breaking believability***

Why This Problem is Difficult

- Non-continuous or inexplicable behavior
- How actions relate to each other requires deeper knowledge
- Commitments made at agent design stage deeply influence accepting direction
- Nebulous requirements that need to be formalized
  - "Natural" integration
  - Coherent behavior
  - Believable agents

Research Plan

- Outline requirements of believability
- Outline requirements of directability
- Propose strategies on integration of direction
- Implement agent capabilities outlined to test integration of direction
- Develop criteria to evaluate integration
  - Both objective and subjective
- Implement a suite of test agents with varying degrees of abilities

Requirements of a Believable Synthetic Character

- Plausible performance
  - Sub-optimal, realistic errors, reactive to context, contextually driven, more than purely reactive
- Continuity of behavior
- Coherence between actions over time
- Evident intentionality
- Limited perception and management of perceptual resources
- "Personality Rich" and personality consistent
  - Conforms to user perception, predictable
- Displays or approximates emotionally driven behavior
- Past actions influence current/future ones
  - Some form of memory or learning
- Pragmatically based NL interaction
- Embodiment

Requirements of Directability

- Handle full range of directable commands
- Recognize conflicts between direction and current goals/behavior
- Resolve and avoid conflicts
- Explain resulting changes in behavior
- Don’t break believability requirements

Possible Capabilities for Believability

- Necessary as a first step
  - Determines what integration strategies are available
- Try to meet requirements previously listed
- Leverage other believable agents work
- Use previous work in learning by instruction for natural language portion

Directive Commands

- Which ones would be useful?
  - What does the director want to achieve via direction to a synthetic character?
- Some possible classes of commands:
  - pursue high-level goal
  - perform intermediate action or low-level behavior
  - have emotion/attitude towards object
  - interfere with user achievement of goal
  - assist user towards goal
  - provide information

Criteria for Successful Integration

- Consistent with overall personality
  - How do we define an action consistent with personality?
  - Action set formulation? [Knight]
- Consistent with role of character
  - Represent responsibilities and typical actions of role
- Coherency between actions over time

Coherency

- How do we define coherency
  - Actions make sense given previous actions (explainable)
  - Actions are consistent with goals of an agent's personality or role in the environment
- Coherency Requirements

Coherency Requirements

- If a goal is evident, actions should appear to work towards satisfying the goal
- If there is a goal switch, there should be an evident reason for the new goal
- If there is a goal switch, there should be a reason why the new goal is more important than the old one
- If there is emotional motivation in current behavior, it should be consistent with new behavior or there should be an evident reason why emotion changes

What is Difficult About These Situations?

- Determining goal interaction/conflict
- Determine whether a new goal is a valid thing to do
- Determining what to do with current or previous goal
- Communicating intention of switches
- Maintaining consistency with personality, emotion, previous actions.

Approach

- **Step 1**: Classification of conflict or interaction (25%)
- **Step 2**: Choose response (65%)
- **Step 3**: Implement response (10%)

- = 100% of our effort

More Detailed Example

- Hero enters room
- Butler takes the hero's coat.
- [Director instructs butler agent to get hero to the salon]
- [Butler finds several coinciding goals among which:
  - Offer drink in salon
  - Show hero interesting object in salon
  - Ask hero to follow him to salon without a reason
  - Grab hero, tie him up and carry him to Salon]
- [Butler chooses response 1 (most consistent with role, i.e. more believable)]
- [Butler decides to finish current goal of taking the hero's coat]
- Butler takes hero's coat and hangs
- Butler asks hero to go to Salon to have a drink.
- Hero agrees to go to salon for a drink.
- [Direction is satisfied]

Taxonomy of Goal Relationships

- Conflicting goals
  - Contextually
  - Temporally
  - Spatially
  - Emotionally
  - Personality
- Coinciding goals
  - Explicit
  - Opportunistic
- Non-interacting goals

- Different relationships have responses associated with them
- Note: We may have multiple conflict types occurring

Dealing with Conflicts

- Search for opportunistic coinciding goals
- Choose one of the responses found above
- Determine whether to finish current goal
- Determine whether to finish old goal

Choosing a response

- Utilize current goal coincidence
- Use operator preference knowledge
- Prime a situation where coinciding goal to be generated
  - Fight example
- Cheat, create a situation
- Preference mechanism

Evaluating Coherency

- Objective
  - Number of goal switches
  - Number of abrupt switches
  - Whether an explanation can be generated
- Subjective
  - Have people play and get feedback
  - Distributed implementation can hide which characters are synthetic

Experiments

- Create many different agents with different levels of capabilities
  - Isolate and group components to test effectiveness and interactions
- Drama manager not necessary
- NL could also be avoided in the same way if our NL system proves insufficient
- SOAR-ESCAPE environment

Related Work

- Oz work at Carnegie-Mellon, Zoesis [Bates, et al.]
- Phoebe Sengers thesis on communicating intentions
- Animate Agents[Hayes-Roth]
- Improv [NYU]
- Pedagogical Agents [Jack]
- Soar, Soar, Soar, Soar

- Planning
  - Opportunistic
  - Plan re-use
  - Reactive planning
  - Real-time planning
  - Plan repair
  - Plan coordination
  - Interleaved planning
- Argumentation systems
- Perceptual resource management [Freed]

Nuggets and Coals

- Nuggets
  - Brings together many different AI technologies
  - Should be widely applicable to various game types
    - RPG's, MMORPG's, adventure, interactive fiction
    - Educational software, training simulations
  - Allows computer scientists to play with a lot of cool humanities and drama concepts
- Coals
  - Brings together many different AI technologies
  - A lot of very nebulous requirements
  - Starting with many strong assumptions
  - Preliminary, may be ambitious