Building Applications Using Only Demonstration

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Outline

- Introduction
- Interaction Techniques
- Video
- Inferencing
- Conclusion

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Purpose

- Create games without programming.
- Target audience
  - Artists
  - Children
  - Teachers
- No written language at all - programs created solely through demonstration.

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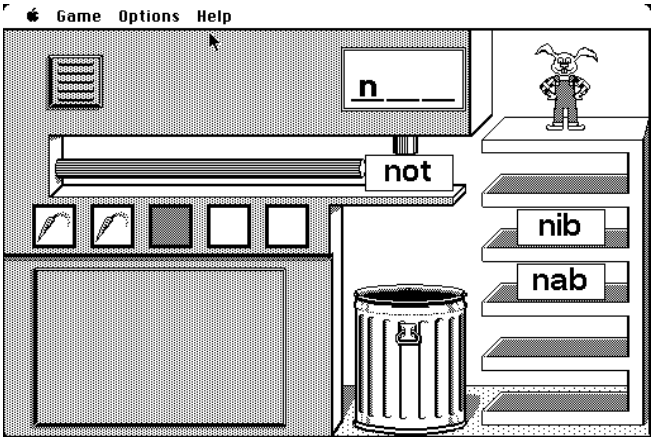
Example: Reader Rabbit



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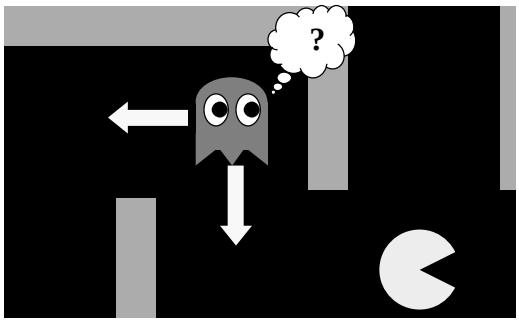
Conditions

- Relationship can be formed between arbitrary objects.
  - Relating a toggle switch to decide which way to move.



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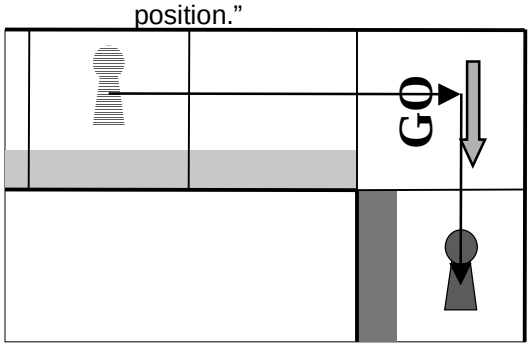
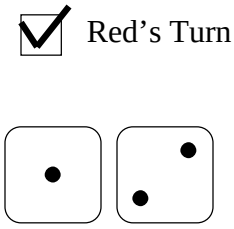
Expression Chain

- Expressions form chain of relationships.
  - In Monopoly, the position to move a piece is, “the square the sum of the dice’s number of squares from the original position.”





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Interaction Techniques

- Nudges
  - Do Something, Stop That
  - Hint highlighting
- Guide Objects
- Temporal Ghosts
- Cards and Decks

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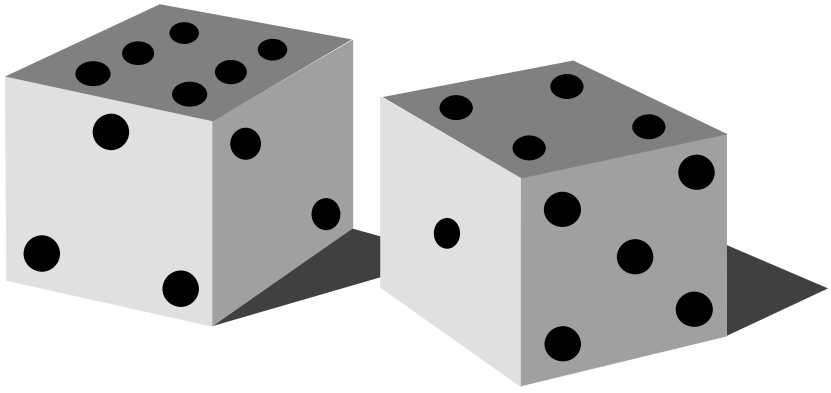
Video



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Inferencing

- Internal Language
- Stages of Inferencing

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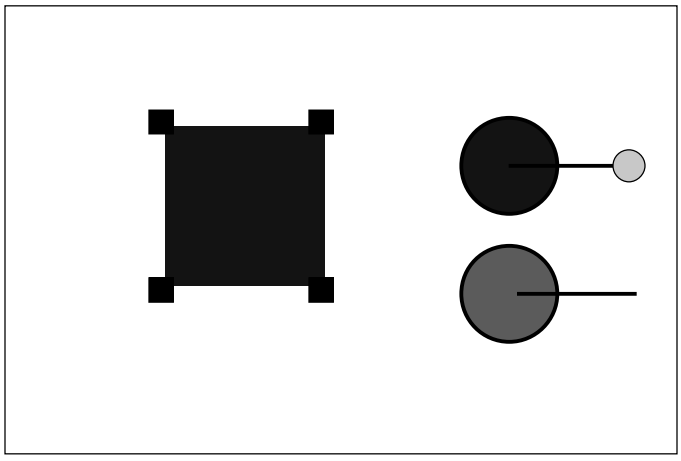
Example



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Internal Language

- Events
  - Signify when something happens.
  - Amulet “command objects.”
- Actions
  - Changes state of application.
  - Smaller set of simplified events.
- Descriptions
  - Expressions for action’s parameters.

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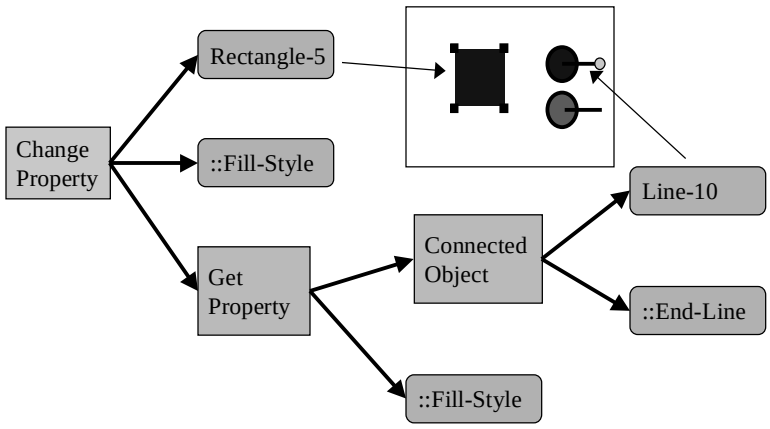
Original Behavior



Actions Descriptions

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Translation

- Read events from history list.
- Eliminate redundant and inconsequential events.
- Convert events to actions.

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Matching Actions

- Matches actions in trace to original behavior.
  - unordered
  - not many (three or four)
- Considerations
  - degree to which actions match
  - priority of actions in original behavior
  - actions which create new objects

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Recursive Difference

- Propagates changes to descriptions.
- Each description contains heuristics for comparing values.
- Builds an And/Or tree result.

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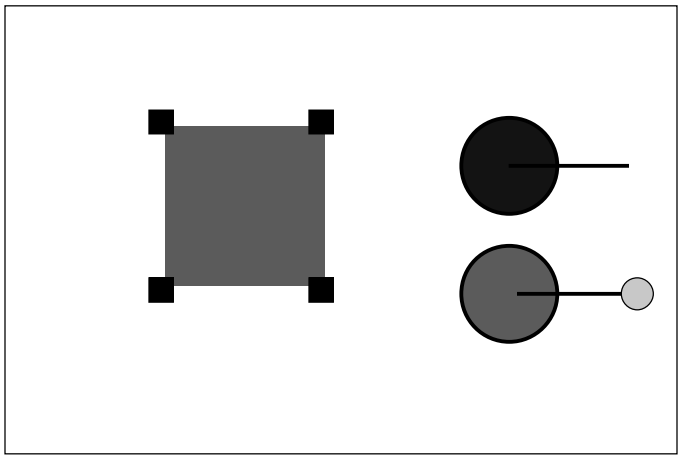
Difference Propagation



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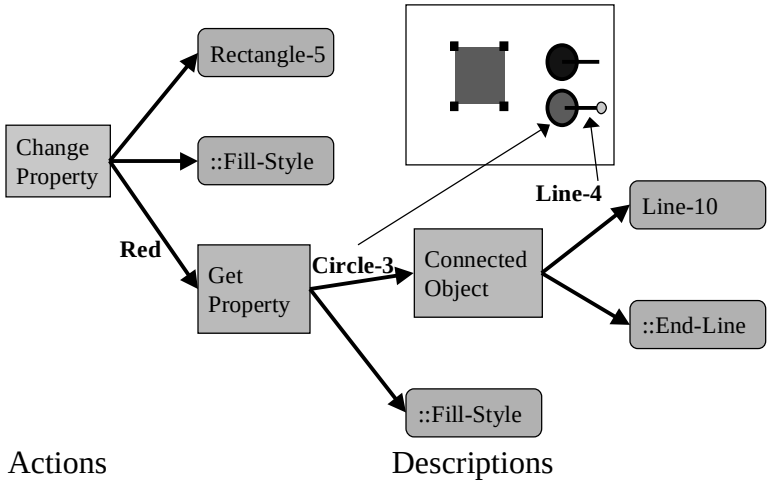
Difference Propagation



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Code Generation

- Resolves each value difference by creating a new description.
  - Search for previous description.
  - Use heuristics to generate description from highlighted objects.
  - Assemble values into a table and use Decision Tree learning.

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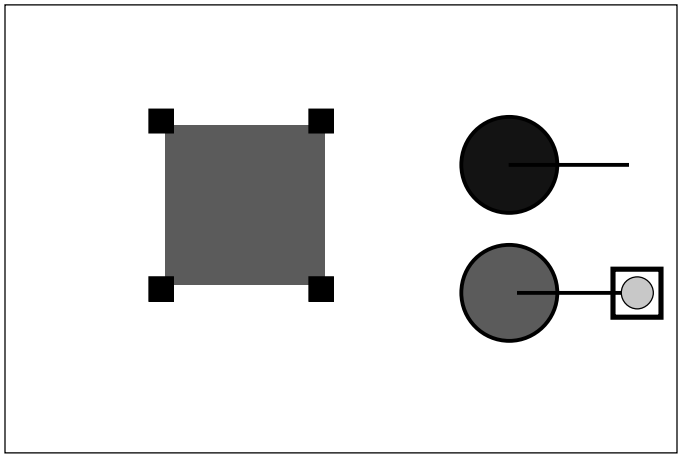
Code From Hints



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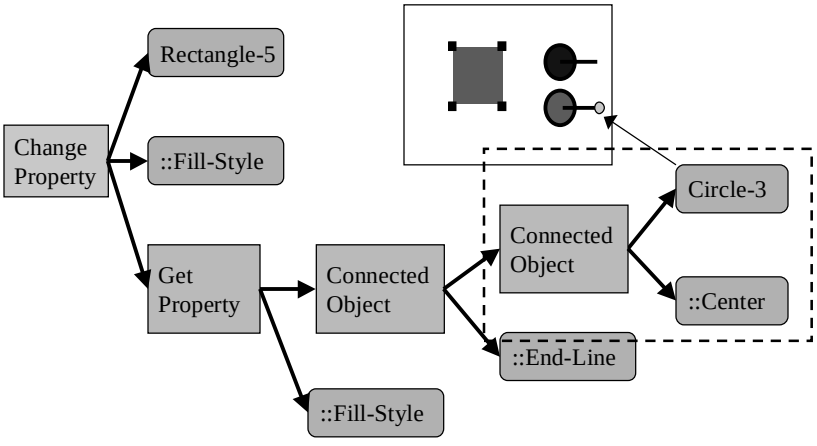
Code From Hints



Actions Descriptions

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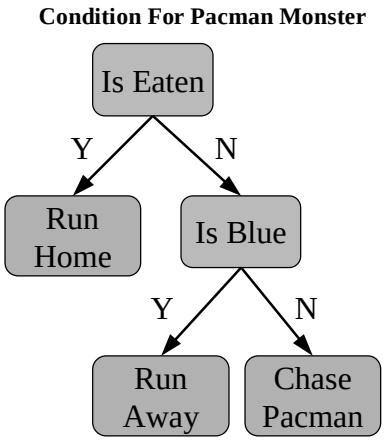
Decision Trees

- Group disparate choices into one description.
- Generate attributes using code heuristics and hint highlighting.
- Build table of examples that relate code choices to attributes.



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Related Work

- Programming-by-demonstration
  - Pavlov (Wolber), Grizzly Bear (Frank), Marquise (Myers, *et al*), Demo II (Fischer, *et al*), Cima (Maulsby)
- Application Builders
  - Click & Create (Coral), Macromedia Director, Visual Basic
- Artificial Intelligence
  - Decision Tree (Quinlan), Plan Recognition (Van Lehn)

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Future Work

- Continued Work
  - Gamut Chess
  - Usability study
- Issues
  - Feedback for just inferred relationships
  - Display for language
  - Higher-level inferencing

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Conclusion

- Developer can show important features directly using guide objects.
- Nudges and hint highlighting are simple and efficient.
- Combining multiple inferencing algorithms is effective.

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