How do you naturally express your programming ideas?

Embracing Informality and Ambiguity

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the world is complex, so

Say what you know, and not more.

By forcing us to use precise vocabulary, software development makes us say too much.

Proposal In Brief

- Development tools should let us talk about our programs in many ways.
  - Different degrees of formality
  - Different degrees of ambiguity
- Interactively develop rich mappings: an ecosystem of different representations

"You don't understand anything until you learn it more than one way."
Marvin Minsky

When we can be informal and ambiguous, software will:

- Be easier to develop
- Adapt to new situations
- Behave reasonably when things go wrong

Clarifying Terms...

- Specs and tests are formal but ambiguous.
- Formal = controlled semantics; incl. programming languages.
- Managed, intentional ambiguity

When we can be informal,

Developing Software is Easier

- Computer helps earlier in design
- Formality forces premature commitment
- **Can communicate in more natural language**
  (not just write code that *looks like* English)
- **Let computer help evaluate multiple ways of solving a problem**

How?

- Understand the informal representations
- Map to increasingly formal specs, code, and tests
- Learn by reading existing code (just like good programmers do today)
- Semi-automatic, example-driven iterative refinement

Informal, Ambiguous Natural Language

(goals, high-level characteristics)

Common Sense and Domain Specific Knowledge

Implementation Characteristics

Concrete Implementations

demo in SCRATCH

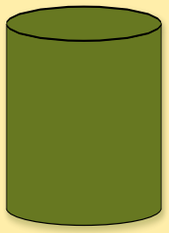
opportunities for photo/ video editing, PIM, etc.

track

move with arrow keys

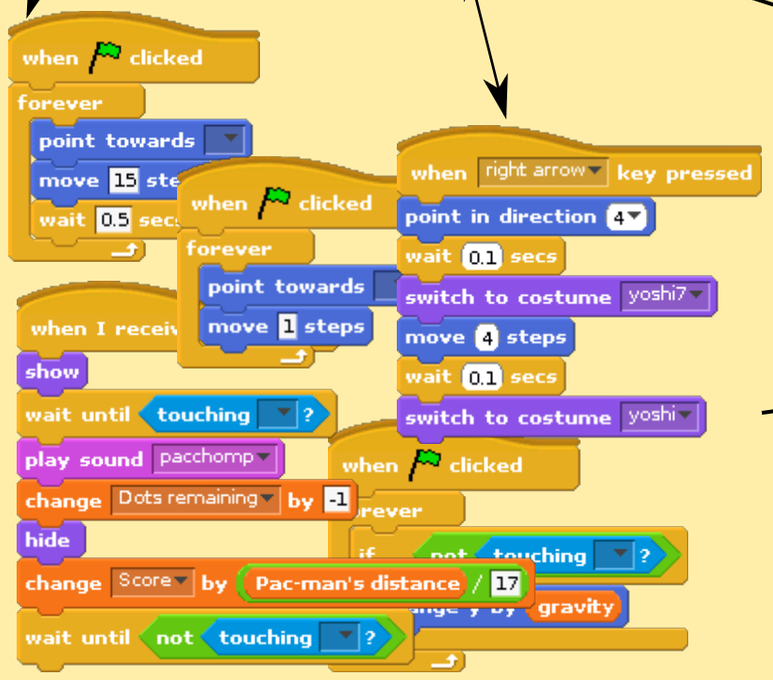
projectile motion

bouncing



ConceptNet

Child doForever > forward_
Sibling forward_ ~ pointTowards_
Clump [forward_ pointTowards_]
Presence doForever
Containment FlagHat doForever



Joint inference using Blending

ProcedureSpace

When we can be informal,

Software will adapt to new situations

- Software in the complex and rich real world
- Real life is more nuanced than any **programmer can plan** (or just wait, it'll change)
- User considerations impact even backend
- Software must act appropriately in a variety of situations

How?

- Software that knows about everyday life
  - crowdsourcing (ConceptNet)
  - hand-coding (Cyc)
  - learn from sensors, social media, etc.
- Context-appropriate behavior: continuously evaluate against informal representations

When we can be informal,

Software will fail intelligently

- If software always failed in expected ways, explicit failure handling would be merely tedious
- Enumerating failure scenarios impossible in complex systems.
- A system that only works one way can fail in many ways

Failing Intelligently

- try alternative approaches
- central problem-solving knowledgebase
- informed defaults for unspecified details
- suggest possible failure scenarios and reasonable courses of action

Discuss...

- When we can be informal and ambiguous, software will
  - Be easier to develop
  - Adapt to new situations
  - Behave reasonably when things go wrong
- Development tools should permit artifacts at different degrees of formality and ambiguity, and interactively develop rich mappings among them