Why do we need context?
Why isn't explicit I/O good enough?

Sensitivity to context is an important component of intelligent human behavior.

Requiring explicit human input and human attention to output is expensive in the user interface.

Users may not know what input to give, what output to expect.

Input and output may not occur sequentially.

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Why do we need context? Why isn't explicit I/O good enough?

Systems may be embedded in devices which depend on time or physical location

Systems may be history-dependent

We want to take more advantage of sensory information
What can we do with context-sensitive applications?

- Systems may sense the environment
- Systems may gather input for themselves
- Systems may decide which aspects of a situation are really important
- Systems may modify context to facilitate future interactions
- Systems may infer user intent from user actions and state
Abstraction in programming languages

\((+ \ x \ 3)\) is an expression dependent on \(x\)
\(x\) is the context

\((\text{lambda} \ (x) \ (+ \ x \ 3))\)

is an expression which is context-independent [dependent on nothing]
Abstraction in Grammars

Context-free grammars

\[ <\text{e-mail}> := <\text{person}> @ <\text{host}> \]

Context-sensitive grammars

\[ <\text{number1}> + <\text{number2}> := \text{Add}(<\text{number1}>, <\text{number2}>) \]
\[ <\text{string1}> + <\text{string2}> := \text{Concat}(<\text{string1}>, <\text{string2}>) \]

• Data type is context
Context for software agents

Agents can watch user interactions to gather context
Agents can infer user intent from context
Agents can help users deal with "context overload"
  Decide when and where parts of context are relevant
Agents can put useful things into the user's context
Context for computing devices in the physical world

"Things that Think", UbiComp, Wearables, Smart Rooms

Physical world necessitates focusing on task, not tools

Physical world opens up opportunity to sense context from environment
Context and User Interface Design

Good user interfaces put relevant context "at hand"

The goal of Information Visualization is to provide a visual context

Focus + Context displays help user deal with complexity and ambiguity

Presentation of information can be context-dependent

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Context in Learning by Example

The "data description" problem for programming by example

Advice for generalization
Machine Learning and formal approaches to context

Inductive learning
Explanation-based learning
Bayesian neural, genetic, statistical learning
Sequence Induction
Context for User Modeling

Every program has an Implicit User Model
Explicit user models can be static or dynamic
User models can adapt to user behavior and interactions
Background knowledge as context

The "size matters" approach
The rule-based approach
The mining approach
The incremental learning approach
The reactive approach
Philosophical, linguistic, mathematical approaches to context

Warning: Entering high complexity zone
Situated systems
Circumscription
Activity theory
Pragmatics (from Linguistics)
Psychological and social perspectives

Computers as social actors
Affective input as context
Anthropormorphization