A call-by-need basis

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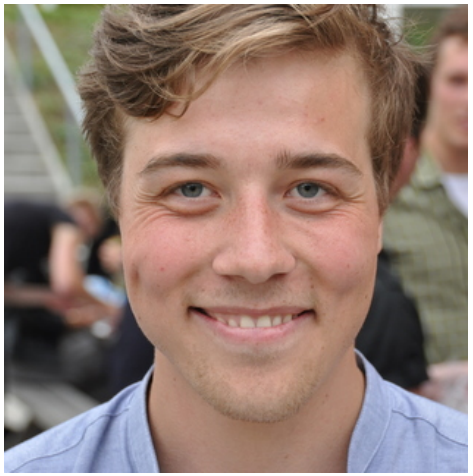
& Ian Zerny (now at Google)



Programming-languages Group

23 May 2014

Reminders (1/4)

- A programming language

  is a notation for expressing computations.

Analogy: language and thought.

Reminders (1/4)

- A programming language

  is a notation for expressing computations.

- Programs are written in this notation.

Analogy: recipes in a cookbook.

Reminders (2/4)

Syntactic units:

- expressions
- commands / statements
- declarations
- types
- etc.

Reminders (3/4)

Named and parameterized syntactic units:

- functions
- procedures / methods
- modules
- classes
- etc.

Reminders (4/4)

Formal and actual parameters:

- call by value
- call by name
- call by need
- etc.

The topic of this talk: call by need

A notation to express computations that are

- demand driven, and
- where intermediate results are memoized.

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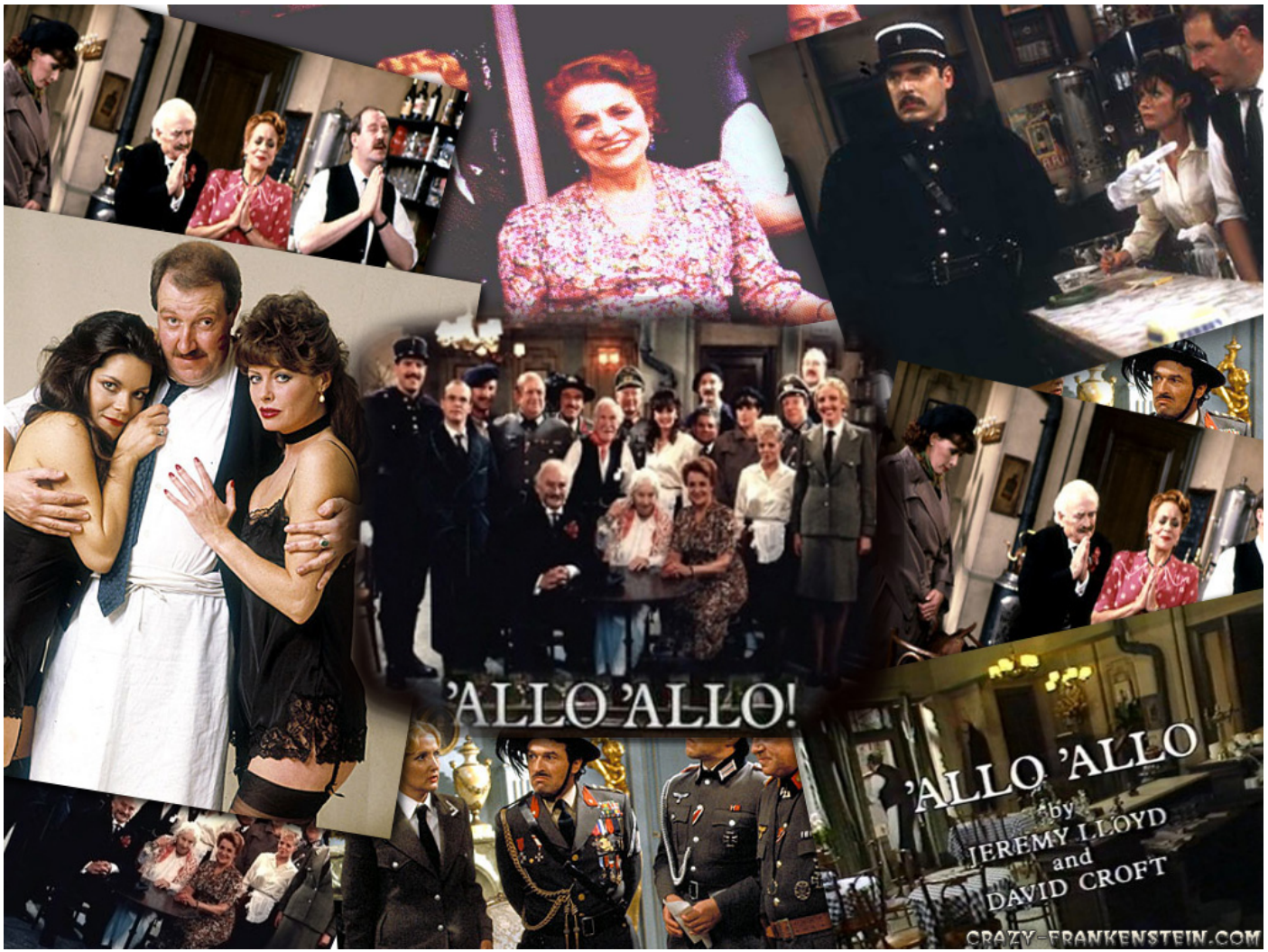
Are there any questions?

Pay attention: I will say zis only once



The two key features of call by need

- demand-driven computation
- memoization of intermediate results

A bewildering amount of related work

- in theory (semantics)
- in practice (implementation)
- in the middle (abstract machines)

Theory and practice of call by need

- In theory, we know why it works.
- In practice, we know how to make it works.

But do theory and practice agree?

Surprisingly, nobody knew.

Our contribution

A grand unified account of call by need

solving

a problem that was open since the 1970's.

Our unified account

Surprisingly simple in retrospect:

- The syntactic correspondence and
  the functional correspondence,
  as developed here at AU.
- Lock-step equivalence (bisimilarity),
  as taught here at AU.

And also, non-trivially: K.I.S.S.

Impact

- peer-reviewed articles in conferences
- peer-reviewed articles in journals
- tips of the hat in various scientific blogs
- followup peer-reviewed articles by others
- invited talks for Olivier
- elite-research funding for Ian

Another sort of impact

- Path-dependent types in Scala.
- Wild cards in Java.

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Good bye, Erik.

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Good bye, Erik.

And thanks.