Contextual Typing

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Type Inference and what we believe ...

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  - unambitious in complete type inference;
  - the places to put the annotations should be easy to predict;

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  - better error report;
  - better performance;
  - etc.

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- Guidelines are easy to follow;

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- Guidelines are easy to follow;
  - for language designers;
  - and programmers;

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Type Inference and what we believe ...

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- Type information propogation is local;
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- Scalability is necessary;
- Implementation can be easily derived.

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- Types are propogated to neighbouring expressions;

Bidirectional Typing: Problems

- Trade-off between expressive power and backtracking;
  - more expressive, less syntax-directness;
  - all-or-nothing inference strategy;
- Unclear annotatability and rule duplication;
- Inexpressive subsumption.

Our Proposal: Contextual Typing

- Quantitative Type Assignment Systems (QTASs);
  - as a specification for programmers;
  - tells you where the annotations are needed;
  - parametrised with a counter: $\Gamma \vdash_n e : A$
- Syntax-directed Algorithmic Type Systems;
  - is decidable;
  - parametrised with a context: $\Gamma \vdash \Sigma \Longrightarrow e \Longrightarrow A$

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Recap

- Contextual typing is a lightweight approach to type inference
  - that exploits partially known contextual information;
- It enables several improvements over bidirectional typing

Code Block

```
infer :: Int → Int → Int

infer n1 n2 = n1 + n2
```