Idioms for Interaction

Concurrency Workshop, INI, 11th August 2022
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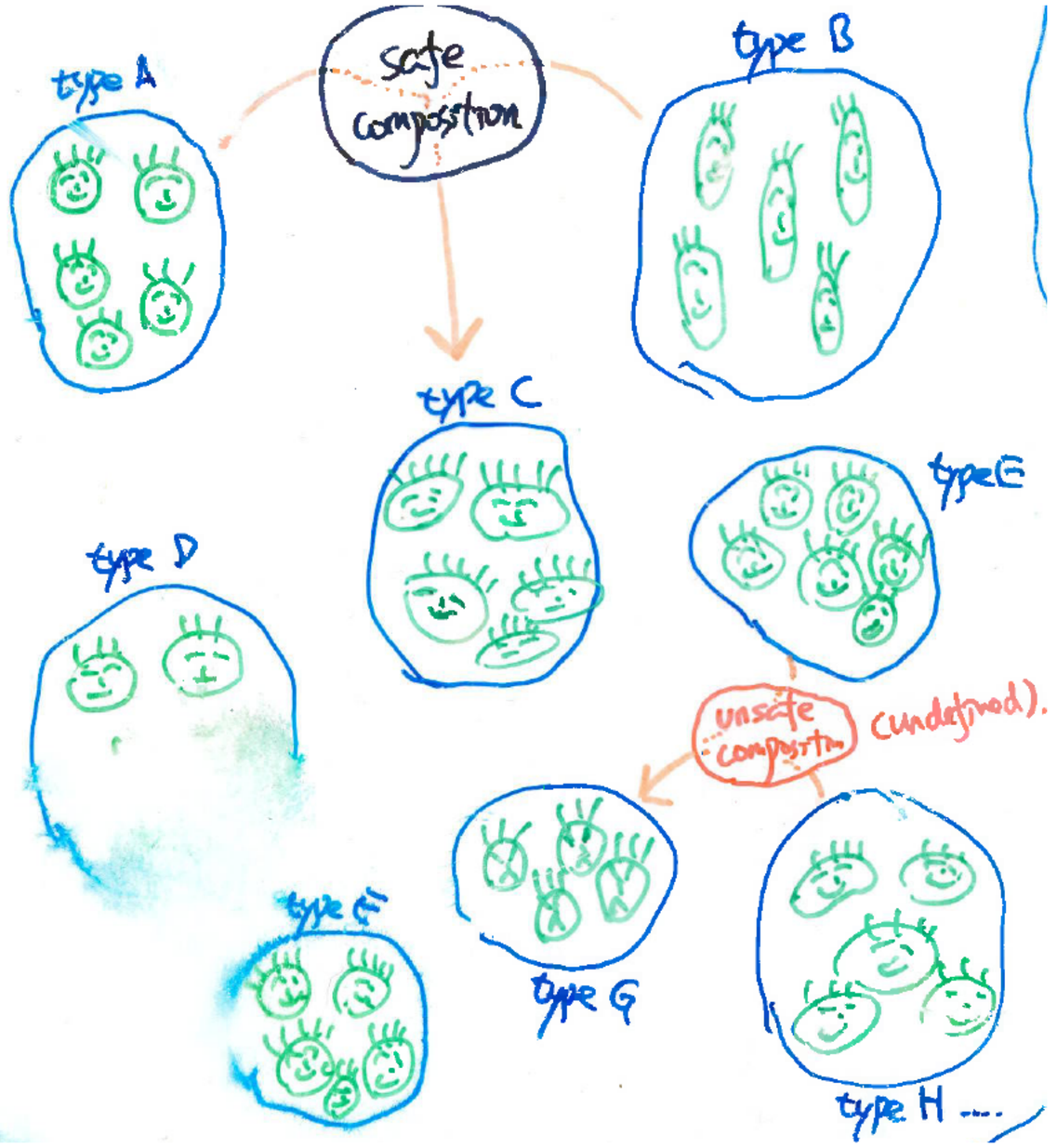
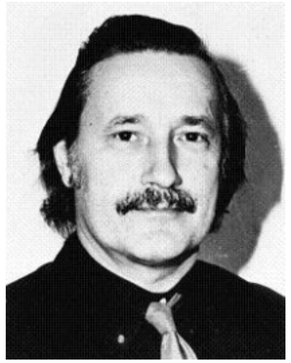


Idioms for Interaction

from Conventional to Concurrent/Distributed Programming



1916-1975

- **Christopher Strachey** (sequential computation)
  - ***Types*** = **abstract computation (data types, polymorphism)**
  - **Structured programming = High-level programming**
- **Session types** (concurrency & communication)
  - Structured programming = ***protocols***

Session Idioms: Sequencing, Branching and Selection

Intermediate Summary ! Two idioms.

(1) Sequential Value Passing.

$a!(x_1 \cdots x_n).P \mid \overline{a}:(v_1 \cdots v_n).Q$

$\rightarrow \approx P[\vec{v}/\vec{x}] \mid Q$

(2) Branching/Selection.

$a:[(\alpha).P_1]\&(\beta).P_2) \mid \overline{a}:\mathrm{inl}(\langle\gamma\rangle.Q)$

$\rightarrow \approx P_1[\vec{v}/\vec{x}) \mid Q.$

cf. $(\lambda(x_1,..x_n).M)\langle N_1,..,N_n\rangle \twoheadrightarrow M[\vec{N}/\vec{x}]$

$\left(\begin{array}{l}\text{case } x \text{ of}\\ \quad \mathrm{inl}(y) \Rightarrow M_1\\ \quad \mathrm{inl}(z) \Rightarrow M_2\end{array}\right) \mathrm{inl}(N) \twoheadrightarrow M_1[N/y]$

- dyadicity.
- sharing/interference.

Summary

Functions

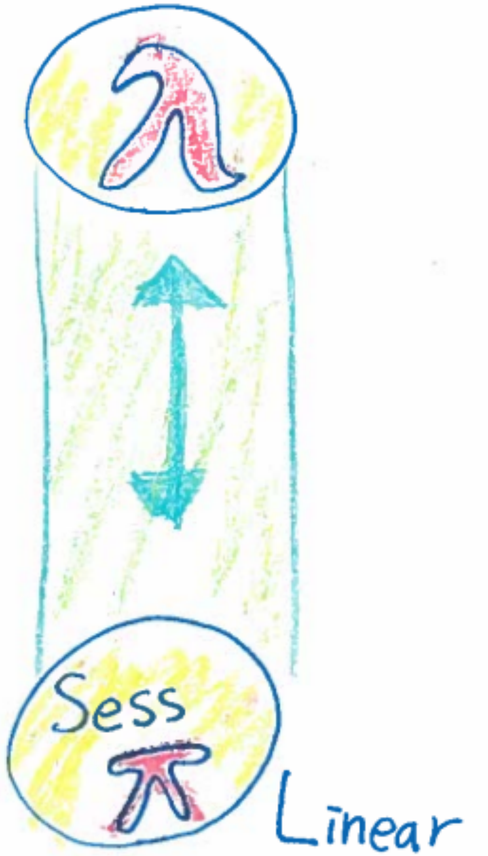
Message Passing

Linear Logic

Summary

SAD?

Functions



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LL-based

- Use Sess π to articulate boarder computations

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LL-Based Session Types

- Balzer and Pfenning, Manifest sharing with session types, ICFP'17
- Rocha and Caires, Propositions-as-types and shared state, ICFP'21
- Zien et al, Client-server sessions in linear logic, ICFP'21
- Frumin et al, A propositions-as-sessions interpretation of bunched implications in channel-based concurrency, OOPSLA'22

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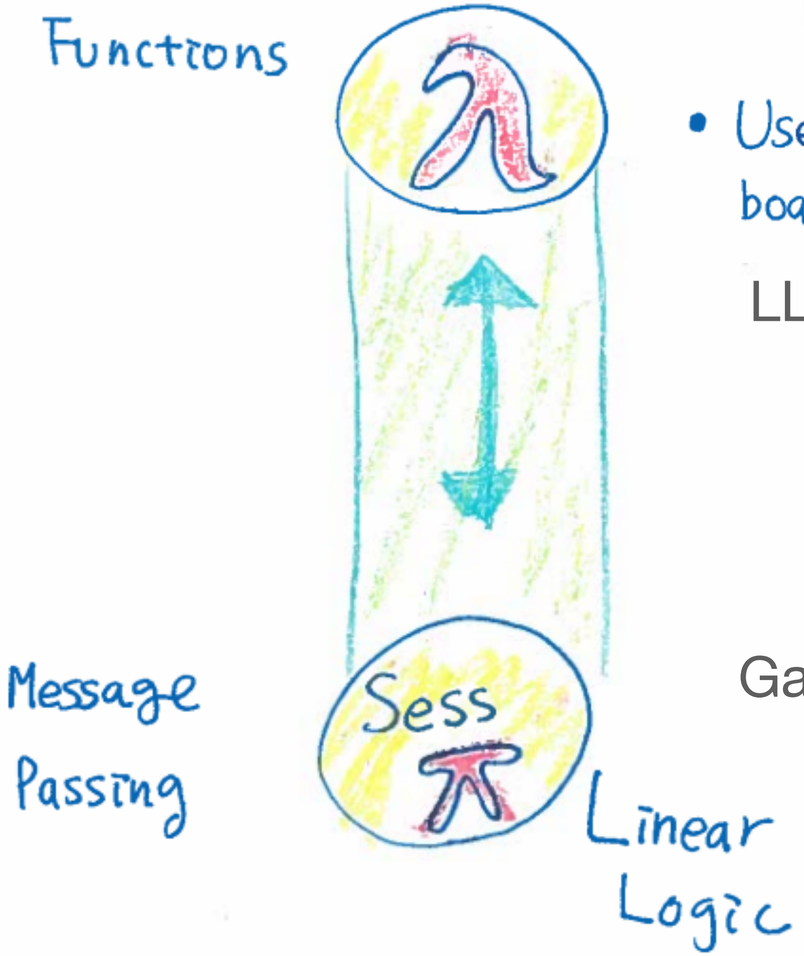

- Use LL-based Sess π to articulate boarder computations

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Game Semantics

- Rideau and Winskel, Concurrent strategies, LICS'11
- Ghica and Tzevelekos, System level game semantics, ETCS'12
- Vale et al, Layered and object-based game semantics, POPL'22