Programming in Vinyl

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FOBO

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Records in GHC 7.8

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$$\frac{\Gamma \vdash M.S \rightsquigarrow \{\vec{rs}\} \quad \Gamma \vdash N.T \rightsquigarrow \{\vec{rs}\} \quad \Gamma \vdash x : M.S}{\Gamma \nvdash x : N.T}$$

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data R = R { x :: X }

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data R = R { x :: X }
data R' = R' { x :: X } −− ˆ *Error*

Records in GHC 7.8

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anticompositional

Records in Standard ML

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slightly better

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$$\frac{\Gamma \vdash x : \{\vec{ss}\} \quad \Gamma \vdash ts \in \text{permutations}(\vec{ss})}{\Gamma \vdash x : \{\vec{ts}\}}$$

Records in OCaml

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- structural
- endowed with a subtyping relation
- but more importantly...

Records in OCaml

row polymorphic

Row Polymorphism

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Pick out the parts you care about, and quantify the rest.
— Someone wise

Row Polymorphism

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NOPE

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$$\frac{x : \{a : A; \vec{rs}\}}{f(x) : \{a : A, b : B; \vec{rs}\}}$$

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Roll Your Own in Haskell

```
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data Rec :: [*] → * where
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class s ∈ (rs :: [*])
(=:) : s ::: t → t → Rec '[ s ::: t ]
```

Roll Your Own in Haskell

data (s :: Symbol) ::: (t :: $*$) = Field

data Rec :: [$*$] $\rightarrow$ $*$ **where**
RNil :: Rec '[]
(:&) :: !t $\rightarrow$!(Rec rs) $\rightarrow$ Rec ((s ::: t) ': rs)

class s $\in$ (rs :: [$*$])
(=:) : s ::: t $\rightarrow$ t $\rightarrow$ Rec '[s ::: t]
($<$+$>$) : Rec ss $\rightarrow$ Rec ts $\rightarrow$ Rec (ss ++ ts)

Roll Your Own in Haskell

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$$\frac{x :: \text{"a"} ::: A \in \vec{rs} \implies \text{Rec } \vec{rs}}{f\ x :: (\text{"a"} ::: A \in \vec{rs}, \text{"b"} ::: B \in \vec{rs}) \implies \text{Rec } \vec{rs}}$$

Universes à la Tarski

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- The Tarski universe $\mathcal{U}$ is a set, but the ambient universe **Type** may not necessarily be.

An Example Universe

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$$\frac{}{\Gamma \vdash \mathcal{F} : \textbf{Type}} \qquad \frac{\Gamma \vdash n : \mathbb{N}}{\Gamma \vdash \mathrm{fin}(n) : \mathcal{F}} \qquad \frac{\Gamma \vdash s : \mathcal{F}}{\Gamma \vdash [\![s]\!]_{\mathcal{F}} : \textbf{Type}}$$

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- Statics:

$$\frac{}{\Gamma \vdash \mathcal{F} : \textbf{Type}} \qquad \frac{\Gamma \vdash n : \mathbb{N}}{\Gamma \vdash \mathsf{fin}(n) : \mathcal{F}} \qquad \frac{\Gamma \vdash s : \mathcal{F}}{\Gamma \vdash [\![s]\!]_{\mathcal{F}} : \textbf{Type}}$$

- Dynamics:

$$\frac{}{\Gamma \vdash [\![\mathsf{fin}(n)]\!]_{\mathcal{F}} \mapsto \mathsf{rec}_{\mathbb{N}}(n; s)}$$