Introduction to Vinyl

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data R = R { x :: X }
data R' = R' { x :: X } -- ^ Error
```

Structural Typing

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- Record types may be characterized *structurally*

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Roll Your Own in Haskell

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lens : s ::: t ∈ rs ⇒ s ::: t → Lens' (Rec rs) t
```

Roll Your Own in Haskell

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```
f :: Rec (”foo” ::: A ’: rs)
   → Rec (”bar” ::: B ’: ”foo” ::: A ’: rs)
```

Universes à la Tarski

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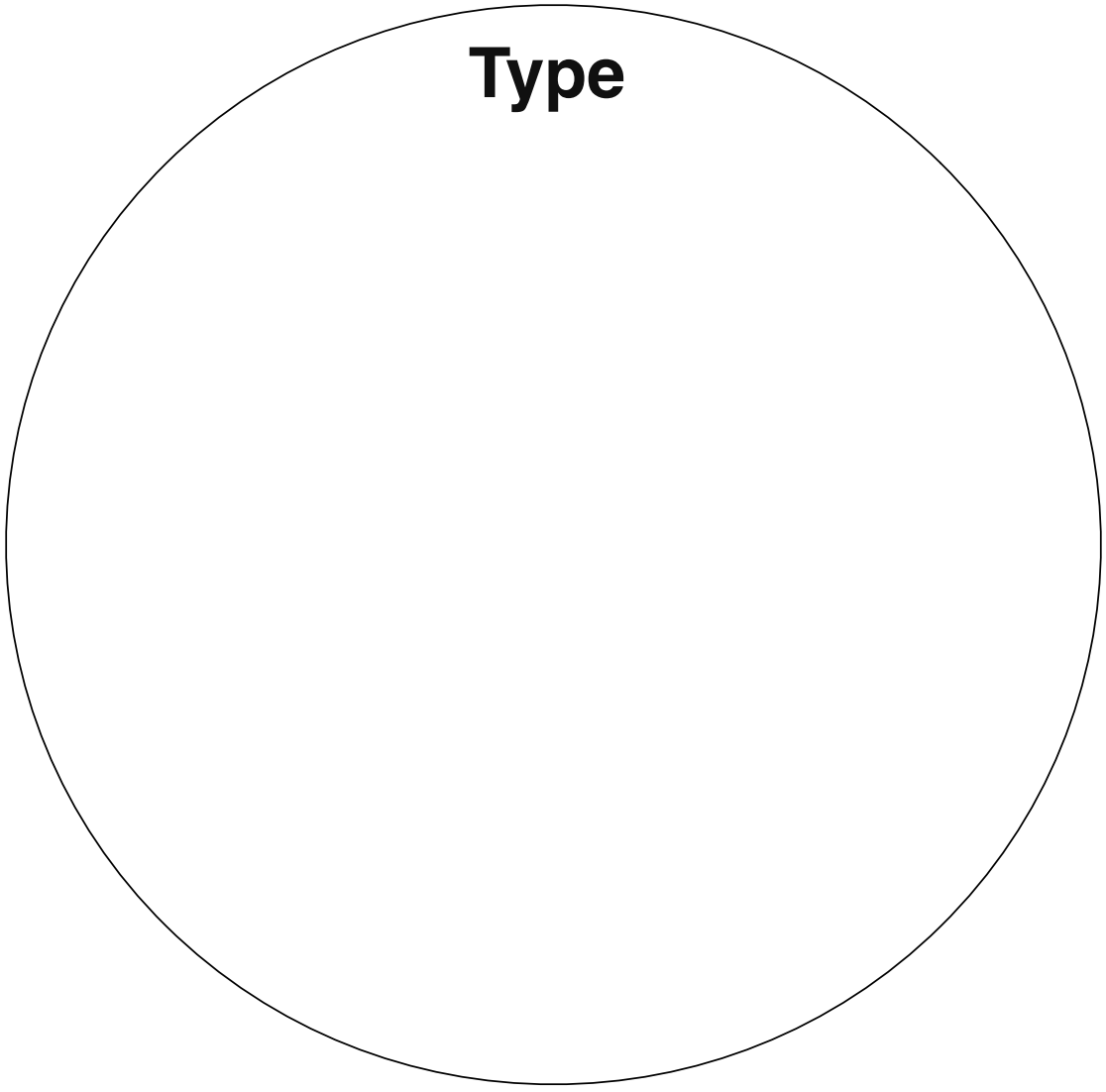
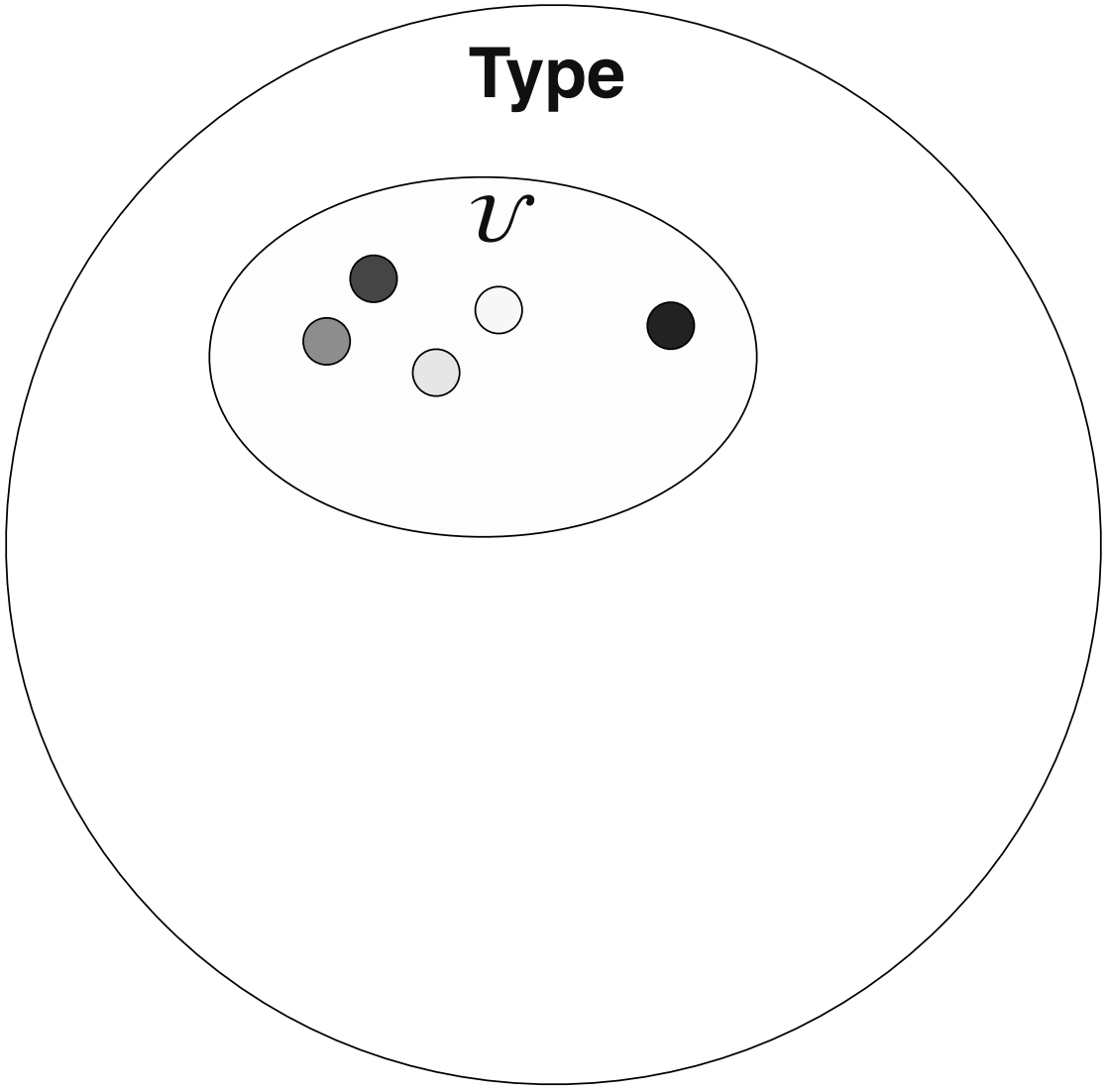
$$\frac{\Gamma \vdash s : \mathcal{U}}{\Gamma \vdash El_{\mathcal{U}}(s) : \text{Type}}$$

Universes à la Tarski



Universes à la Tarski



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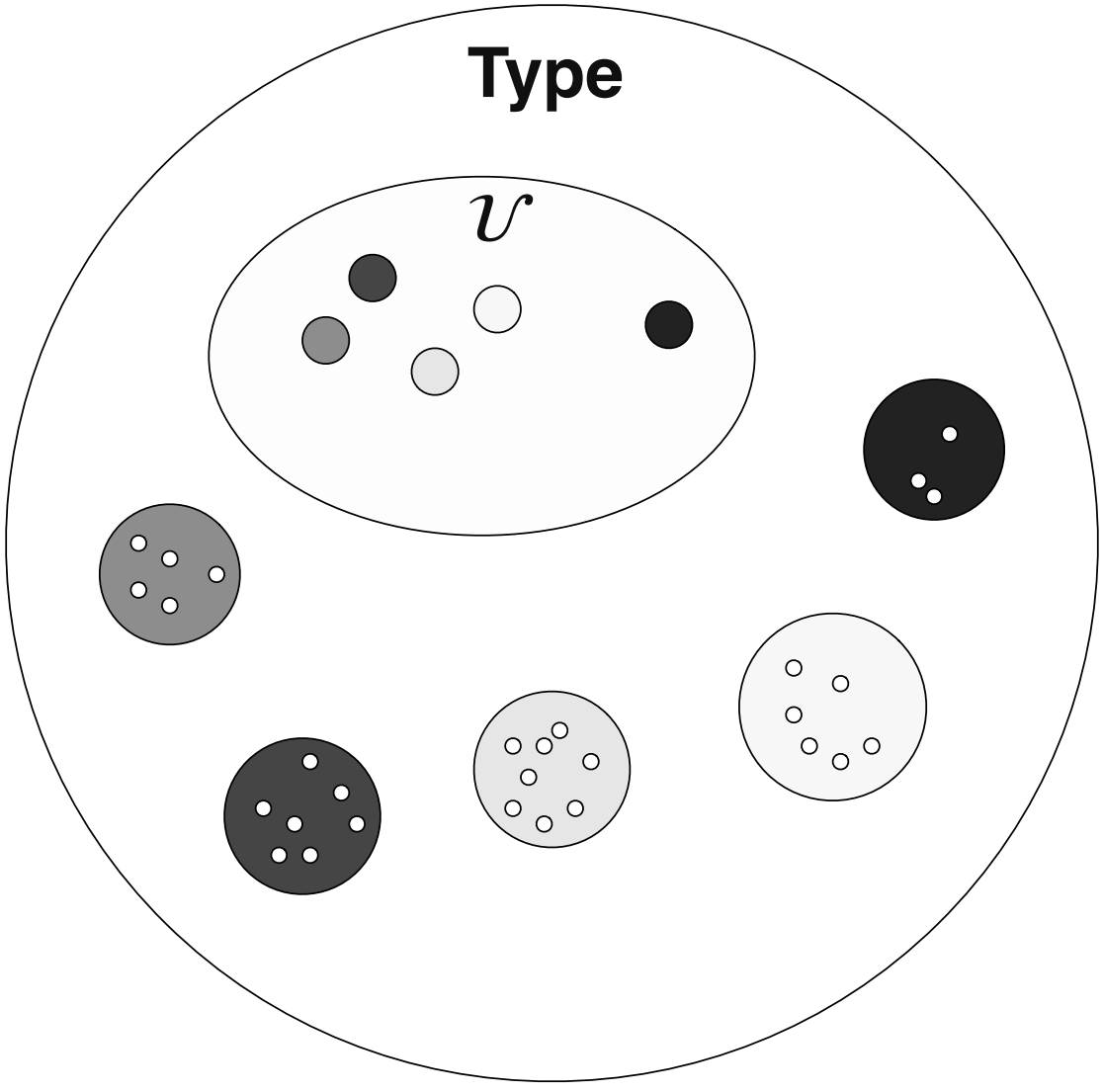

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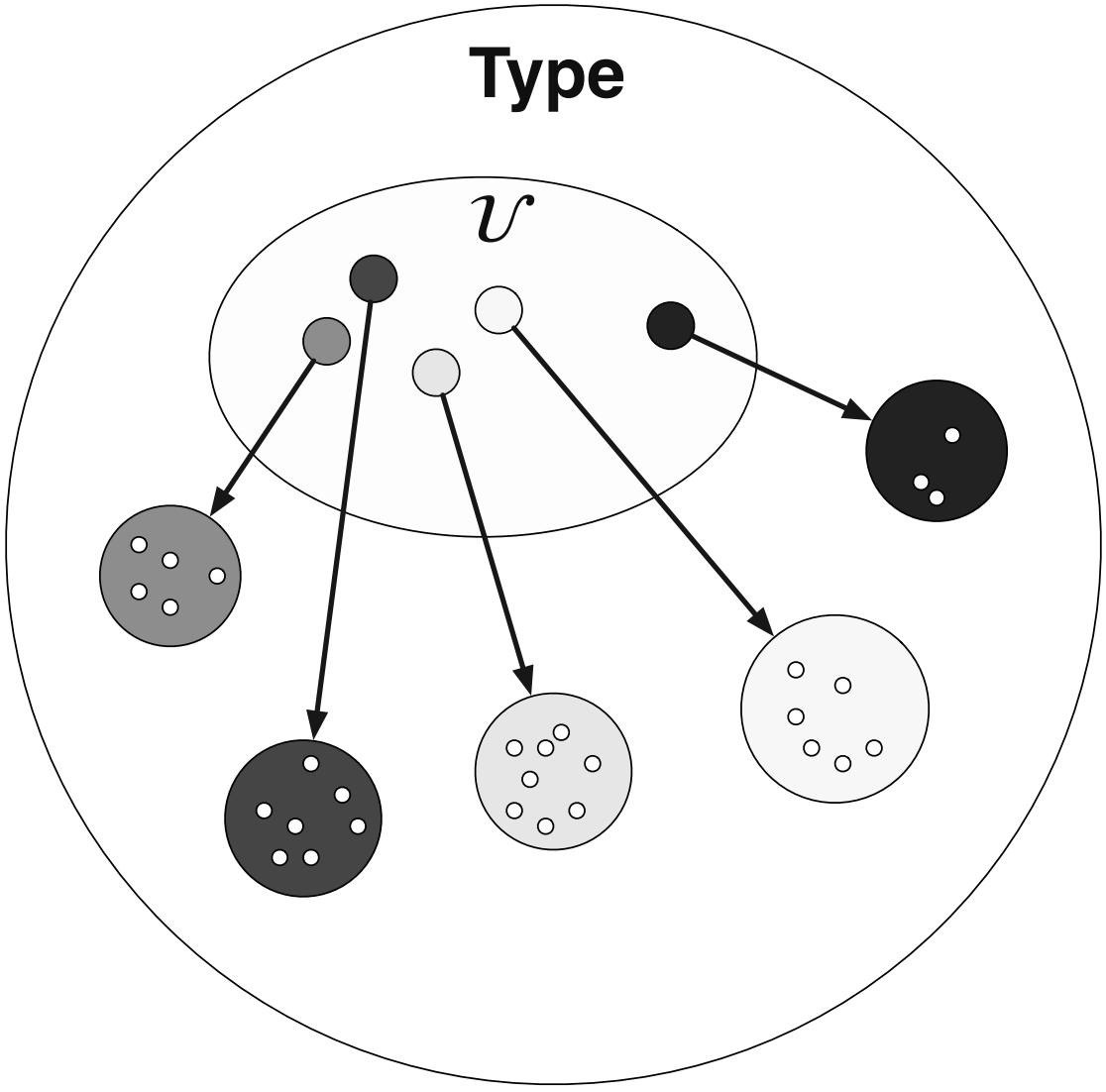

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ex :: HList [ℤ, Bool, String]
ex = 34 :& True :& ”vinyl” :& RNil
```

Effects inside records

data Rec :: (TyFun $\mathcal{U}$ $*$ $\to$ $*$) $\to$ ($*$ $\to$ $*$) $\to$ [$\mathcal{U}$] $\to$ $*$ **where**
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Effects inside records

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data Rec :: (TyFun 𝒰 ∗ → ∗) → (∗ → ∗) → [ 𝒰 ] → ∗ where
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(⇚): sing r → f (el_𝒰 $ r) → Rec el_𝒰 f '[r]
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(⊛) :: $\text{Rec}_{\mathcal{U}}$ (Lift $(\rightarrow)$ f g) rs $\rightarrow$ $\text{Rec}_{\mathcal{U}}$ f rs $\rightarrow$ $\text{Rec}_{\mathcal{U}}$ g rs

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rtraverse ::
  Applicative h
    $\Rightarrow$ (f $\rightsquigarrow$ h $\circ$ g)
    $\rightarrow$ $\text{Rec}_{\mathcal{U}}$ f rs
    $\rightarrow$ h ($\text{Rec}_{\mathcal{U}}$ g rs)

Demonstration