termvar, x, y, d	Term-level variable			
holevar, h	Hole			
term_value, v	::=			Term value
	|	$\langle v_1 \,,\, \overline{v_2} \rangle_{H}$		Ampar
	|	$@h$		Destination
	|	$()$		Unit
	|	$\mathsf{Inl}\; v$		Left variant for sum
	|	$\mathsf{Inr}\; v$		Right variant for sum
	|	$(v_1 \,,\, v_2)$		Product
	|	$\rrbracket^{m}\; v$		Exponential
	|	$\lambda x \,.\, t$		Linear function
	|	(v)	S	
$\overline{\text{extended\_value}}$, $\overline{v}$	::=			Store value
	|	v		Term value
	|	h		Hole
	|	$\mathsf{Inl}\; \overline{v}$		Left variant with val or hole
	|	$\mathsf{Inr}\; \overline{v}$		Right variant with val or hole
	|	$(\overline{v_1} \,,\, \overline{v_2})$		Product with val or hole
	|	$\rrbracket^{m}\; \overline{v}$		Exponential with val or hole
	|	$(\overline{v})$	S	
	|	$\overline{v}[e]$	M	
term, t, u	::=			Term
	|	v		Term value
	|	x		Variable
	|	$t \succ u$		Application
	|	$t \succ \mathbf{case}\; () \mapsto u$		Pattern-match on unit
	|	$t \succ \mathbf{case}\; \{ \mathsf{Inl}\; x_1 \mapsto u_1 \,,\; \mathsf{Inr}\; x_2 \mapsto u_2 \}$		Pattern-match on sum
	|	$t \succ \mathbf{case}\; (x_1 \,,\, x_2) \mapsto u$		Pattern-match on product
	|	$t \succ \mathbf{case}\; \rrbracket^{m}\; x \mapsto u$		Pattern-match on exponential
	|	$t \succ \mathbf{mapL}\; x \mapsto u$		Map over the left side of the ampar
	|	$\mathbf{to}_{\ltimes}\; t$		Wrap t into a trivial ampar
	|	$\mathbf{from}_{\ltimes}\; t$		Extract value from trivial ampar
	|	$\mathbf{alloc}_{A}$		Return a fresh "identity" ampar object
	|	$t \triangleleft ()$		Fill destination with unit
	|	$t \triangleleft \mathsf{Inl}$		Fill destination with left variant
	|	$t \triangleleft \mathsf{Inr}$		Fill destination with right variant
	|	$t \triangleleft (,)$		Fill destination with product constructor
	|	$t \triangleleft \rrbracket^{m}$		Fill destination with exponential constructor
	|	$t \triangleleft\!\bullet\, u$		Fill destination with root of ampar u
	|	(t)	S	
	|	$t[\mathit{sub}]$	M	
sub	::=			Variable substitution
	|	$x := v$		
	|	$\mathit{sub}_1, \mathit{sub}_2$		
	|	sub	S	
effect, e	::=			Effect
	|	ε		No effect
	|	$h := \overline{v}$		
	|	$e_1 \cdot e_2$		
	|	e	S	

type, A, B	::=			Type
	|	$\mathsf{1}$		Unit
	|	$\mathsf{A}_1 \oplus \mathsf{A}_2$		Sum
	|	$\mathsf{A}_1 \otimes \mathsf{A}_2$		Product
	|	$!^{m}\ \mathsf{A}$		Exponential
	|	$\mathsf{A}_1 \rtimes \mathsf{A}_2$		Ampar type (consuming A_1 yields A_2)
	|	$\mathsf{A}_1\ {}_{m}\!\!\to \mathsf{A}_2$		Linear function
	|	${}^{m}\lfloor \mathsf{A} \rfloor$		Destination
	|	(A)	S	
multiplicity, m, n	::=			Multiplicity (Semiring with product $\cdot$)
	|	ν		Born now. Identity of the product
	|	$\uparrow$		One scope older
	|	∞		Infinitely old / static. Absorbing for product
	|	$m_1 \cdot m_2$		Semiring product
	|	(m)	S	
typing_context, Δ	::=			Typing context
	|	Γ		
	|	H		
	|	$\Gamma \sqcup \mathrm{H}$		
	|	$m \cdot \Delta$		Increase age of bindings by m
	|	(Δ)	S	
pos_context, Γ	::=			Positive typing context
	|	$\emptyset$		
	|	{pos_assigns}		
	|	$\Gamma_1 \sqcup \Gamma_2$		
	|	$m \cdot \Gamma$		Increase age of bindings by m
	|	(Γ)	S	
	|	_	M	
pos_assign, pa	::=			Positive type assignment
	|	$\mathtt{x} :_{m} \mathsf{A}$		Variable
	|	$@\mathtt{h} :_{m} {}^{n}\lfloor \mathsf{A} \rfloor$		Destination (m is its own age; n is the age of values it accepts)
pos_assigns	::=			Positive type assignments
	|	pa		
	|	pa, pos_assigns		
neg_assign, na	::=			Negative type assignment
	|	$\mathtt{h} :^{n} \mathsf{A}$		Hole (n is the age of values it accepts, its own age is undefined)
neg_assigns	::=			Negative type assignments
	|	na		
	|	na, neg_assigns		
neg_context, H	::=			Negative typing context
	|	$\emptyset$		
	|	{neg_assigns}		
	|	$\mathrm{H}_1 \sqcup \mathrm{H}_2$		
	|	$@^{-1}\Gamma$		Inverse the sign of the context
	|	$m \cdot \mathrm{H}$		Increase age of bindings by m

	|	(H)	S
	|	_	M
eff_app	::=		Effect application
	|	e, $\overline{\mathrm{v}}_{\mathrm{H}}$	
	|	**apply** (eff_app)	
	|	e $\hat{:}$ eff_app	
terminals	::=		
	|	$\multimap$	
	|	$\rtimes$	
	|	$\mapsto$	
	|	$()$	
	|	Inl	
	|	Inr	
	|	$(,)$	
	|	$\triangleleft$	
	|	$\triangleleft\!\!\bullet$	
	|	$:=$	
	|	$\cdot$	
	|	$\sqcup$	
	|	$\emptyset$	
	|	$\exists$	
	|	$\neq$	
	|	$\leq$	
	|	$\in$	
	|	$\notin$	
	|	$\subset$	
	|	$\vdash$	
	|	$\Vdash$	
	|	$\mid$	
	|	$\Downarrow$	
formula	::=		
	|	judgement	
Ctx	::=		
	|	x $\in$ **names** (Δ)	
	|	h $\in$ **names** (Δ)	
	|	x $\notin$ **names** (Δ)	
	|	h $\notin$ **names** (Δ)	
	|	**fresh** x	
	|	**fresh** h	
	|	pos_assign $\in \Gamma$	
	|	neg_assign $\in \mathrm{H}$	
	|	**onlyPositive** (Δ)	
	|	**onlyNegative** (Δ)	
Eq	::=		
	|	$\mathbf{A}_1 = \mathbf{A}_2$	
	|	$\mathbf{A}_1 \neq \mathbf{A}_2$	
	|	$\mathrm{t} = \mathrm{u}$	
	|	$\mathrm{t} \neq \mathrm{u}$	

	|	$\Delta_1 = \Delta_2$
	|	$\textbf{names}(\Delta_1) \cap \textbf{names}(\Delta_2) = \emptyset$
Ty	::=	
	|	$\Delta \Vdash \mathsf{e}$
	|	$\Gamma \vdash \mathsf{v} \mid \mathsf{e} : \mathbf{A}$
	|	$\Delta \Vdash \bar{\mathsf{v}} : \mathbf{A}$
	|	$\Gamma \vdash \mathsf{t} : \mathbf{A}$
Sem	::=	
	|	$\mathrm{H}_1 = \mathrm{H}_2$ "Inverse sign of context" operation
	|	$\mathsf{eff\_app}_1 = \mathsf{eff\_app}_2$ (we assume effect lists are ε-terminated)
	|	$\mathsf{t} \Downarrow \mathsf{v} \mid \mathsf{e}$
judgement	::=	
	|	Ctx
	|	Eq
	|	Ty
	|	Sem
user_syntax	::=	
	|	termvar
	|	holevar
	|	$\frac{\text{term\_value}}{\text{extended\_value}}$
	|	term
	|	sub
	|	effect
	|	**type**
	|	*multiplicity*
	|	typing_context
	|	pos_context
	|	pos_assign
	|	pos_assigns
	|	neg_assign
	|	neg_assigns
	|	neg_context
	|	eff_app
	|	terminals

$\boxed{\mathsf{x} \in \textbf{names}\,(\Delta)}$

$\boxed{\mathtt{h} \in \textbf{names}\,(\Delta)}$

$\boxed{\mathsf{x} \notin \textbf{names}\,(\Delta)}$

$\boxed{\mathtt{h} \notin \textbf{names}\,(\Delta)}$

$\boxed{\textbf{fresh}\,\mathsf{x}}$

$\boxed{\textbf{fresh}\,\mathtt{h}}$

$\boxed{\mathsf{pos\_assign} \in \Gamma}$

$\boxed{\mathsf{neg\_assign} \in \mathrm{H}}$

$\boxed{\textbf{onlyPositive}\,(\Delta)}$

$\boxed{\textbf{onlyNegative}\,(\Delta)}$

$\boxed{\mathbf{A}_1 = \mathbf{A}_2}$

$\boxed{\mathsf{A}_1 \neq \mathsf{A}_2}$

$\boxed{\mathsf{t} = \mathsf{u}}$

$\boxed{\mathsf{t} \neq \mathsf{u}}$

$\boxed{\Delta_1 = \Delta_2}$

$\boxed{\mathbf{names}(\Delta_1) \cap \mathbf{names}(\Delta_2) = \emptyset}$

$\boxed{\Delta \Vdash \mathsf{e}}$

$$\frac{}{\emptyset \,{\scriptstyle\sqcup}\, \emptyset \Vdash \varepsilon} \quad \textsc{TyEff\_NoEff}$$

$$\frac{\begin{array}{l}\Gamma \,{\scriptstyle\sqcup}\, \mathrm{H} \Vdash \overline{\mathsf{v}} : \mathsf{A} \\ \mathtt{h} \notin \mathbf{names}\,(\Gamma)\end{array}}{m\cdot((n\cdot\uparrow)\cdot\Gamma \sqcup \{@\mathtt{h} :_{\nu} {}^{n}\lfloor \mathsf{A} \rfloor\} \,{\scriptstyle\sqcup}\, {}^{n\cdot}\mathrm{H}) \Vdash \mathtt{h} := \overline{\mathsf{v}}} \quad \textsc{TyEff\_Single}$$

$$\frac{\begin{array}{l}\Gamma_1 \,{\scriptstyle\sqcup}\, \mathrm{H}_1 \sqcup @^{-1}\Gamma_{22} \Vdash \mathsf{e}_1 \\ \Gamma_{21} \sqcup \Gamma_{22} \,{\scriptstyle\sqcup}\, \mathrm{H}_2 \Vdash \mathsf{e}_2 \\ \mathbf{names}(\Gamma_1 \,{\scriptstyle\sqcup}\, \mathrm{H}_1) \cap \mathbf{names}(\Gamma_{21} \,{\scriptstyle\sqcup}\, \mathrm{H}_2) = \emptyset\end{array}}{\Gamma_1 \sqcup \Gamma_{21} \,{\scriptstyle\sqcup}\, \mathrm{H}_1 \sqcup \mathrm{H}_2 \Vdash \mathsf{e}_1 \cdot \mathsf{e}_2} \quad \textsc{TyEff\_Union}$$

$\boxed{\Gamma \vdash \mathsf{v} \mid \mathsf{e} : \mathsf{A}}$

$$\frac{\begin{array}{l}\Gamma_{11} \sqcup \Gamma_{12} \vdash \mathsf{v} : \mathsf{A} \\ \Gamma_2 \,{\scriptstyle\sqcup}\, @^{-1}\Gamma_{12} \Vdash \mathsf{e} \\ \mathbf{names}(\Gamma_{11}) \cap \mathbf{names}(\Gamma_2) = \emptyset\end{array}}{\Gamma_{11} \sqcup \Gamma_2 \vdash \mathsf{v} \mid \mathsf{e} : \mathsf{A}} \quad \textsc{TyCmd\_Cmd}$$

$\boxed{\Delta \Vdash \overline{\mathsf{v}} : \mathsf{A}}$

$$\frac{}{\emptyset \,{\scriptstyle\sqcup}\, \{\mathtt{h} :^{\nu} \mathsf{A}\} \Vdash \mathtt{h} : \mathsf{A}} \quad \textsc{TyValExt\_Hole}$$

$$\frac{}{\{@\mathtt{h} :_{\nu} {}^{n}\lfloor \mathsf{A} \rfloor\} \,{\scriptstyle\sqcup}\, \emptyset \Vdash @\mathtt{h} : {}^{n}\lfloor \mathsf{A} \rfloor} \quad \textsc{TyValExt\_Dest}$$

$$\frac{}{\emptyset \,{\scriptstyle\sqcup}\, \emptyset \Vdash () : \mathbf{1}} \quad \textsc{TyValExt\_Unit}$$

$$\frac{\Gamma \,{\scriptstyle\sqcup}\, \mathrm{H} \Vdash \overline{\mathsf{v}} : \mathsf{A}_1}{\Gamma \,{\scriptstyle\sqcup}\, \mathrm{H} \Vdash \mathsf{Inl}\,\overline{\mathsf{v}} : \mathsf{A}_1 \oplus \mathsf{A}_2} \quad \textsc{TyValExt\_Inl}$$

$$\frac{\Gamma \,{\scriptstyle\sqcup}\, \mathrm{H} \Vdash \overline{\mathsf{v}} : \mathsf{A}_2}{\Gamma \,{\scriptstyle\sqcup}\, \mathrm{H} \Vdash \mathsf{Inr}\,\overline{\mathsf{v}} : \mathsf{A}_1 \oplus \mathsf{A}_2} \quad \textsc{TyValExt\_Inr}$$

$$\frac{\begin{array}{l}\Gamma_1 \,{\scriptstyle\sqcup}\, \mathrm{H}_1 \Vdash \overline{\mathsf{v}_1} : \mathsf{A}_1 \\ \Gamma_2 \,{\scriptstyle\sqcup}\, \mathrm{H}_2 \Vdash \overline{\mathsf{v}_2} : \mathsf{A}_2 \\ \mathbf{names}(\Gamma_1 \,{\scriptstyle\sqcup}\, \mathrm{H}_1) \cap \mathbf{names}(\Gamma_2 \,{\scriptstyle\sqcup}\, \mathrm{H}_2) = \emptyset\end{array}}{\Gamma_1 \sqcup \Gamma_2 \,{\scriptstyle\sqcup}\, \mathrm{H}_1 \sqcup \mathrm{H}_2 \Vdash (\overline{\mathsf{v}_1}, \overline{\mathsf{v}_2}) : \mathsf{A}_1 \otimes \mathsf{A}_2} \quad \textsc{TyValExt\_Prod}$$

$$\frac{\Gamma \,{\scriptstyle\sqcup}\, \mathrm{H} \Vdash \overline{\mathsf{v}} : \mathsf{A}}{m\cdot\Gamma \,{\scriptstyle\sqcup}\, {}^{m\cdot}\mathrm{H} \Vdash \mathclose{)}^{m}\,\overline{\mathsf{v}} : !^{m}\,\mathsf{A}} \quad \textsc{TyValExt\_Exp}$$

$$\frac{\begin{array}{l}\Gamma_1 \,{\scriptstyle\sqcup}\, \emptyset \Vdash \mathsf{v}_1 : \mathsf{A}_1 \\ \Gamma_2 \,{\scriptstyle\sqcup}\, @^{-1}\Gamma_1 \Vdash \overline{\mathsf{v}_2} : \mathsf{A}_2\end{array}}{\Gamma_2 \,{\scriptstyle\sqcup}\, \emptyset \Vdash \langle \mathsf{v}_1, \overline{\mathsf{v}_2} \rangle_{\mathrm{H}} : \mathsf{A}_1 \ltimes \mathsf{A}_2} \quad \textsc{TyValExt\_Ampar}$$

$$\frac{\Gamma \sqcup \{\mathsf{x} :_{m} \mathsf{A}_1\} \vdash \mathtt{t} : \mathsf{A}_2}{\Gamma \,{\scriptstyle\sqcup}\, \emptyset \Vdash \lambda\mathsf{x}\,.\,\mathtt{t} : \mathsf{A}_1 \,{}_{m}\!\!\to \mathsf{A}_2} \quad \textsc{TyValExt\_Lambda}$$

$\boxed{\Gamma \vdash \mathtt{t} : \mathsf{A}}$

$$\frac{\Gamma \,{\scriptstyle\sqcup}\, \emptyset \Vdash \mathsf{v} : \mathsf{A}}{\Gamma \vdash \mathsf{v} : \mathsf{A}} \quad \textsc{TyTerm\_Val}$$

$$\frac{}{\{\mathsf{x} :_{\nu} \mathsf{A}\} \vdash \mathsf{x} : \mathsf{A}}\ \textsc{TyTerm\_VarNow}$$

$$\frac{}{\{\mathsf{x} :_{\infty} \mathsf{A}\} \vdash \mathsf{x} : \mathsf{A}}\ \textsc{TyTerm\_VarInf}$$

$$\frac{\begin{array}{l}\Gamma_1 \vdash \mathsf{t} : \mathsf{A}_1 \\ \Gamma_2 \vdash \mathsf{u} : \mathsf{A}_1\ {}_{m}\!\!\to \mathsf{A}_2 \\ \mathsf{names}(\Gamma_1) \cap \mathsf{names}(\Gamma_2) = \emptyset\end{array}}{m\cdot\Gamma_1 \sqcup \Gamma_2 \vdash \mathsf{t} \succ \mathsf{u} : \mathsf{A}_2}\ \textsc{TyTerm\_App}$$

$$\frac{\begin{array}{l}\Gamma_1 \vdash \mathsf{t} : \mathbf{1} \\ \Gamma_2 \vdash \mathsf{u} : \mathsf{B} \\ \mathsf{names}(\Gamma_1) \cap \mathsf{names}(\Gamma_2) = \emptyset\end{array}}{\Gamma_1 \sqcup \Gamma_2 \vdash \mathsf{t} \succ \mathsf{case}\ () \mapsto \mathsf{u} : \mathsf{B}}\ \textsc{TyTerm\_PatUnit}$$

$$\frac{\begin{array}{l}\Gamma_1 \vdash \mathsf{t} : \mathsf{A}_1 \oplus \mathsf{A}_2 \\ \Gamma_2 \sqcup \{\mathsf{x}_1 :_{m} \mathsf{A}_1\} \vdash \mathsf{u}_1 : \mathsf{B} \\ \Gamma_2 \sqcup \{\mathsf{x}_2 :_{m} \mathsf{A}_2\} \vdash \mathsf{u}_2 : \mathsf{B} \\ \mathsf{names}(\Gamma_1) \cap \mathsf{names}(\Gamma_2) = \emptyset\end{array}}{m\cdot\Gamma_1 \sqcup \Gamma_2 \vdash \mathsf{t} \succ \mathsf{case}\ \{\, \mathsf{Inl}\, \mathsf{x}_1 \mapsto \mathsf{u}_1\,,\ \mathsf{Inr}\, \mathsf{x}_2 \mapsto \mathsf{u}_2 \,\} : \mathsf{B}}\ \textsc{TyTerm\_PatSum}$$

$$\frac{\begin{array}{l}\Gamma_1 \vdash \mathsf{t} : \mathsf{A}_1 \otimes \mathsf{A}_2 \\ \Gamma_2 \sqcup \{\mathsf{x}_1 :_{m} \mathsf{A}_1, \mathsf{x}_2 :_{m} \mathsf{A}_2\} \vdash \mathsf{u} : \mathsf{B} \\ \mathsf{names}(\Gamma_1) \cap \mathsf{names}(\Gamma_2) = \emptyset\end{array}}{m\cdot\Gamma_1 \sqcup \Gamma_2 \vdash \mathsf{t} \succ \mathsf{case}\ (\mathsf{x}_1\,,\ \mathsf{x}_2) \mapsto \mathsf{u} : \mathsf{B}}\ \textsc{TyTerm\_PatProd}$$

$$\frac{\begin{array}{l}\Gamma_1 \vdash \mathsf{t} : {!^{m'}}\, \mathsf{A} \\ \Gamma_2 \sqcup \{\mathsf{x} :_{m\cdot m'} \mathsf{A}_1\} \vdash \mathsf{u} : \mathsf{B} \\ \mathsf{names}(\Gamma_1) \cap \mathsf{names}(\Gamma_2) = \emptyset\end{array}}{m\cdot\Gamma_1 \sqcup \Gamma_2 \vdash \mathsf{t} \succ \mathsf{case}\ \rrparenthesis^{m'}\, \mathsf{x} \mapsto \mathsf{u} : \mathsf{B}}\ \textsc{TyTerm\_PatExp}$$

$$\frac{\begin{array}{l}\Gamma_1 \vdash \mathsf{t} : \mathsf{A}_1 \ltimes \mathsf{A}_2 \\ \uparrow\cdot\Gamma_2 \sqcup \{\mathsf{x} :_{\nu} \mathsf{A}_1\} \vdash \mathsf{u} : \mathsf{B} \\ \mathsf{names}(\Gamma_1) \cap \mathsf{names}(\Gamma_2) = \emptyset\end{array}}{\Gamma_1 \sqcup \Gamma_2 \vdash \mathsf{t} \succ \mathsf{mapL}\, \mathsf{x} \mapsto \mathsf{u} : \mathsf{B} \ltimes \mathsf{A}_2}\ \textsc{TyTerm\_MapAmpar}$$

$$\frac{\begin{array}{l}\Gamma_1 \vdash \mathsf{t} : {}^{n}\lfloor \mathsf{A}_2 \rfloor \\ \Gamma_2 \vdash \mathsf{u} : \mathsf{A}_1 \ltimes \mathsf{A}_2 \\ \mathsf{names}(\Gamma_1) \cap \mathsf{names}(\Gamma_2) = \emptyset\end{array}}{\Gamma_1 \sqcup (n\cdot\uparrow)\cdot\Gamma_2 \vdash \mathsf{t} \triangleleft\!\bullet\, \mathsf{u} : \mathsf{A}_1}\ \textsc{TyTerm\_FillComp}$$

$$\frac{\Gamma \vdash \mathsf{t} : {}^{n}\lfloor \mathbf{1} \rfloor}{\Gamma \vdash \mathsf{t} \triangleleft () : \mathbf{1}}\ \textsc{TyTerm\_FillUnit}$$

$$\frac{\Gamma \vdash \mathsf{t} : {}^{n}\lfloor \mathsf{A}_1 \oplus \mathsf{A}_2 \rfloor}{\Gamma \vdash \mathsf{t} \triangleleft \mathsf{Inl} : {}^{n}\lfloor \mathsf{A}_1 \rfloor}\ \textsc{TyTerm\_FillInl}$$

$$\frac{\Gamma \vdash \mathsf{t} : {}^{n}\lfloor \mathsf{A}_1 \oplus \mathsf{A}_2 \rfloor}{\Gamma \vdash \mathsf{t} \triangleleft \mathsf{Inr} : {}^{n}\lfloor \mathsf{A}_2 \rfloor}\ \textsc{TyTerm\_FillInr}$$

$$\frac{\Gamma \vdash \mathsf{t} : {}^{n}\lfloor \mathsf{A}_1 \otimes \mathsf{A}_2 \rfloor}{\Gamma \vdash \mathsf{t} \triangleleft (,) : {}^{n}\lfloor \mathsf{A}_1 \rfloor \otimes {}^{n}\lfloor \mathsf{A}_2 \rfloor}\ \textsc{TyTerm\_FillProd}$$

$$\frac{\Gamma \vdash \mathsf{t} : {}^{n}\lfloor {!^{n'}}\, \mathsf{A} \rfloor}{\Gamma \vdash \mathsf{t} \triangleleft \rrparenthesis^{n'} : {}^{n\cdot n'}\lfloor \mathsf{A} \rfloor}\ \textsc{TyTerm\_FillExp}$$

$$\frac{}{\emptyset \vdash \mathsf{alloc}_{\mathsf{A}} : {}^{\nu}\lfloor \mathsf{A} \rfloor \ltimes \mathsf{A}}\ \textsc{TyTerm\_Alloc}$$

$$\frac{\Gamma \vdash \mathsf{t} : \mathsf{A}}{\Gamma \vdash \mathsf{to}_{\ltimes}\, \mathsf{t} : \mathbf{1} \ltimes \mathsf{A}}\ \textsc{TyTerm\_ToAmpar}$$

$$\frac{\Gamma \vdash t : 1 \ltimes A}{\Gamma \vdash \mathsf{from}_{\ltimes}\, t : A}\quad \textsc{TyTerm\_FromAmpar}$$

$\boxed{H_1 = H_2}$ "Inverse sign of context" operation

$$\frac{}{@^{-1}\emptyset = \emptyset}\quad \textsc{AtApp\_Empty}$$

$$\frac{}{@^{-1}(\{@h :_m {}^{n}\lfloor A \rfloor\} \sqcup \Gamma) = \{h :^{m \cdot n} A\} \sqcup @^{-1}\Gamma}\quad \textsc{AtApp\_Rec}$$

$\boxed{\mathsf{eff\_app}_1 = \mathsf{eff\_app}_2}$ (we assume effect lists are ε-terminated)

$$\frac{}{\mathsf{apply}\,(\varepsilon,\ \overline{v}_H) = \varepsilon,\ \overline{v}_H}\quad \textsc{EffApp\_NoEff}$$

$$\frac{h \notin \mathsf{names}\,(H)}{\mathsf{apply}\,(h \coloneqq \overline{v_2} \cdot e,\ \overline{v_1}_H) = h \coloneqq \overline{v_2} \mathbin{\hat{\cdot}} \mathsf{apply}\,(e,\ \overline{v_1}_H)}\quad \textsc{EffApp\_WindUp}$$

$$\frac{\begin{array}{c} \_ \sqcup H' \Vdash \overline{v_2} : A \\ \mathsf{names}(H \sqcup \{h :^{n} A\}) \cap \mathsf{names}(H') = \emptyset \end{array}}{\mathsf{apply}\,(h \coloneqq \overline{v_2} \cdot e,\ \overline{v_1}_{H \sqcup \{h :^{n} A\}}) = \mathsf{apply}\,(e,\ \overline{v_1}[h \coloneqq \overline{v_2}]_{H \sqcup n \cdot H'})}\quad \textsc{EffApp\_Fill}$$

$\boxed{t \Downarrow v \mid e}$

$$\frac{}{v \Downarrow v \mid \varepsilon}\quad \textsc{BigStep\_Val}$$

$$\frac{\begin{array}{c} t_1 \Downarrow v_1 \mid e_1 \\ t_2 \Downarrow \lambda x\,.\,u \mid e_2 \\ u[x \coloneqq v_1] \Downarrow v_3 \mid e_3 \end{array}}{t_1 \succ t_2 \Downarrow v_3 \mid e_1 \cdot e_2 \cdot e_3}\quad \textsc{BigStep\_App}$$

$$\frac{\begin{array}{c} t_1 \Downarrow () \mid e_1 \\ t_2 \Downarrow v_2 \mid e_2 \end{array}}{t_1 \succ \mathsf{case}\,() \mapsto t_2 \Downarrow v_2 \mid e_1 \cdot e_2}\quad \textsc{BigStep\_PatUnit}$$

$$\frac{\begin{array}{c} t \Downarrow \mathsf{Inl}\, v_1 \mid e_1 \\ u_1[x_1 \coloneqq v_1] \Downarrow v_2 \mid e_2 \end{array}}{t \succ \mathsf{case}\,\{\,\mathsf{Inl}\, x_1 \mapsto u_1\,,\ \mathsf{Inr}\, x_2 \mapsto u_2\,\} \Downarrow v_2 \mid e_1 \cdot e_2}\quad \textsc{BigStep\_PatInl}$$

$$\frac{\begin{array}{c} t \Downarrow \mathsf{Inr}\, v_1 \mid e_1 \\ u_2[x_2 \coloneqq v_1] \Downarrow v_2 \mid e_2 \end{array}}{t \succ \mathsf{case}\,\{\,\mathsf{Inl}\, x_1 \mapsto u_1\,,\ \mathsf{Inr}\, x_2 \mapsto u_2\,\} \Downarrow v_2 \mid e_1 \cdot e_2}\quad \textsc{BigStep\_PatInr}$$

$$\frac{\begin{array}{c} t \Downarrow (v_1\,,\,v_2) \mid e_1 \\ u[x_1 \coloneqq v_1, x_2 \coloneqq v_2] \Downarrow v_2 \mid e_2 \end{array}}{t \succ \mathsf{case}\,(x_1\,,\,x_2) \mapsto u \Downarrow v_2 \mid e_1 \cdot e_2}\quad \textsc{BigStep\_PatProd}$$

$$\frac{\begin{array}{c} t \Downarrow \langle v_1\,,\,\overline{v_2}\rangle_H \mid e_1 \\ u[x \coloneqq v_1] \Downarrow v_3 \mid e_2 \\ e_3,\ \overline{v_4}_{H'} = \mathsf{apply}\,(e_2,\ \overline{v_2}_H) \end{array}}{t \succ \mathsf{mapL}\, x \mapsto u \Downarrow \langle v_3\,,\,\overline{v_4}\rangle_{H'} \mid e_1 \cdot e_3}\quad \textsc{BigStep\_MapAmpar}$$

$$\frac{\mathsf{fresh}\, h}{\mathsf{alloc}_A \Downarrow \langle @h\,,\,h\rangle_{\{h :^{\nu} A\}} \mid \varepsilon}\quad \textsc{BigStep\_Alloc}$$

$$\frac{t \Downarrow v \mid e}{\mathsf{to}_{\ltimes}\, t \Downarrow \langle ()\,,\,v\rangle_{\emptyset} \mid e}\quad \textsc{BigStep\_ToAmpar}$$

$$\frac{t \Downarrow \langle ()\,,\,v\rangle_{\emptyset} \mid e}{\mathsf{from}_{\ltimes}\, t \Downarrow v \mid e}\quad \textsc{BigStep\_FromAmpar}$$

$$\frac{\mathsf{t} \Downarrow @\mathtt{h} \mid \mathsf{e}}{\mathsf{t} \triangleleft () \Downarrow () \mid \mathsf{e} \cdot \mathtt{h} \coloneqq ()} \quad \text{BigStep\_FillUnit}$$

$$\frac{\begin{array}{c}\mathsf{t} \Downarrow @\mathtt{h} \mid \mathsf{e} \\ \textbf{fresh}\ \mathtt{h}'\end{array}}{\mathsf{t} \triangleleft \mathsf{Inl} \Downarrow @\mathtt{h}' \mid \mathsf{e} \cdot \mathtt{h} \coloneqq \mathsf{Inl}\ \mathtt{h}'} \quad \text{BigStep\_FillInl}$$

$$\frac{\mathsf{t} \Downarrow @\mathtt{h} \mid \mathsf{e}}{\mathsf{t} \triangleleft \mathsf{Inr} \Downarrow @\mathtt{h}' \mid \mathsf{e} \cdot \mathtt{h} \coloneqq \mathsf{Inr}\ \mathtt{h}'} \quad \text{BigStep\_FillInr}$$

$$\frac{\begin{array}{c}\mathsf{t} \Downarrow @\mathtt{h} \mid \mathsf{e} \\ \textbf{fresh}\ \mathtt{h}_1 \\ \textbf{fresh}\ \mathtt{h}_2\end{array}}{\mathsf{t} \triangleleft (,) \Downarrow (@\mathtt{h}_1, @\mathtt{h}_2) \mid \mathsf{e} \cdot \mathtt{h} \coloneqq (\mathtt{h}_1, \mathtt{h}_2)} \quad \text{BigStep\_FillProd}$$

$$\frac{\begin{array}{c}\mathsf{t} \Downarrow @\mathtt{h} \mid \mathsf{e}_1 \\ \mathsf{u} \Downarrow \langle \mathsf{v}_1 \,{}_{\mathbf{,}}\, \overline{\mathsf{v}_2} \rangle_{\mathrm{H}} \mid \mathsf{e}_2\end{array}}{\mathsf{t} \triangleleft\!\bullet \mathsf{u} \Downarrow \mathsf{v}_1 \mid \mathsf{e}_1 \cdot \mathsf{e}_2 \cdot \mathtt{h} \coloneqq \overline{\mathsf{v}_2}} \quad \text{BigStep\_FillComp}$$

```
Definition rules:         51 good     0 bad
Definition rule clauses: 127 good     0 bad
```