

Side Effects

A side effect is behavior visible outside of information flow into or out of a function / expression.

$$FbS \vdash \langle S, e \rangle \Rightarrow \langle S, v \rangle$$

where S is a mapping
from cell ids to values

$v ::= \dots \mid c$

$e ::= \dots \mid \text{Ref } e \mid !e \mid e := e$

$S ::= \{ c \mapsto v, \dots \}$

Control flow side-effects: exceptions

Why throw exceptions: complaining about invalid input?
file not found?

Communicate that the question asked can't be answered.

try do this
 ↪

except FileNotFoundError as e:
 ↪ do this if above fails

FbX /

$v ::= \dots \mid \#l \ v \mid \text{Raised } v$
 $e ::= \dots \mid \#l \ e \mid \text{Raise } e \mid \text{Try } e \text{ With } \#l \ x \rightarrow e$

Rules for Try With?

$\text{Raise } (\#A \ 5) \Rightarrow \text{Raised } (\#A \ 5)$

$2 + \text{Raise } (\#A \ 5) \Rightarrow \text{Raised } (\#A \ 5)$

$(\text{Function } n \rightarrow n + \text{Raise } (\#A \ 5)) \ 4 \Rightarrow \text{Raised } (\#A \ 5)$

$\text{Try } \text{Raise } (\#A \ 5) \text{ With } \#A \ n \rightarrow n \Rightarrow 5$

$\text{Try } \text{Raise } (\#A \ 5) \text{ With } \#B \ n \rightarrow n \Rightarrow \text{Raised } (\#A \ 5)$

$\forall v. v_1 \neq \text{Raised } v$

$\begin{array}{c} \text{+} \\ \text{Propagate} \\ \text{Right} \end{array} \frac{e_1 \Rightarrow v_1 \quad e_2 \Rightarrow \text{Raised } v_2 \quad v_1 \text{ not of form } \text{Raised } v}{e_1 + e_2 \Rightarrow \text{Raised } v_2}$	$\begin{array}{c} \text{+} \\ \text{Propagate} \\ \text{Left} \end{array} \frac{e_1 \Rightarrow \text{Raised } v_1}{e_1 + e_2 \Rightarrow \text{Raised } v_1}$
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$\begin{array}{c} \text{Try} \\ \text{Succeed} \end{array} \frac{e \Rightarrow v \quad v \text{ not of form } \text{Raised } v'}{\text{Try } e \text{ With } \#l \ x \rightarrow e' \Rightarrow v}$	$\begin{array}{c} \text{Try} \\ \text{With} \end{array} \frac{e_1 \Rightarrow \text{Raised } v_2 \quad v_1 = \#l \ v_3 \quad e_2[v_3/x] \Rightarrow v_4}{\text{Try } e_1 \text{ With } \#l \ x \rightarrow e_2 \Rightarrow v_4}$
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$$\begin{array}{c} \text{Try} \\ \text{Propagate} \end{array} \frac{e_1 \Rightarrow \text{Raised } v_1 \quad v_1 = \#l_1 \ v_3 \quad l_1 \neq l_2}{\text{Try } e_1 \text{ With } \#l_2 \ x \rightarrow e_2 \Rightarrow \text{Raised } v_1}$$