

# Small Model [Ravi Kini]

## Model Source

[Burning Down The Chippy](#) (Derry Girls S01E02)

## Domain

$D_t = \{0, 1\}$

$D_e = \{\text{Erin, Orla, Clare, Michelle, James, Fionnula, Mary, Sarah, Colm, alcohol, curtains, fire extinguisher, scented candle, radiator}\}$

## Interpretation Function

$I = [$

$p_e \rightarrow \text{Erin}$

$p_o \rightarrow \text{Orla}$

$p_c \rightarrow \text{Clare}$

$p_m \rightarrow \text{Michelle}$

$p_j \rightarrow \text{James}$

$p_f \rightarrow \text{Fionnula}$

$p_y \rightarrow \text{Mary}$

$p_s \rightarrow \text{Sarah}$

$p_l \rightarrow \text{Colm}$

$i_a \rightarrow \text{alcohol}$

$i_c \rightarrow \text{curtains}$

$i_e \rightarrow \text{fire extinguisher}$

$i_n \rightarrow \text{scented candle}$

$i_r \rightarrow \text{radiator}$

// unary predicates

teenager  $\rightarrow \{\text{Erin, Orla, Clare, Michelle, James}\}$

adult  $\rightarrow \{\text{Fionnula, Mary, Sarah, Colm}\}$

female  $\rightarrow \{\text{Erin, Orla, Clare, Michelle, Fionnula, Mary, Sarah}\}$

male  $\rightarrow \{\text{James, Colm}\}$

extinguisher  $\rightarrow \{\text{fire extinguisher}\}$

curtain  $\rightarrow \{\text{curtains}\}$

```
scentedCandle→    {scented candle}
radiator    →    {radiator}
panic      →    {Erin, Clare}
shocked    →    {Fionnula}
longWinded →    {Colm}
// binary predicates
drink      →    {<Michelle, alcohol>, <Fionnula, alcohol>}
drop      →    {<Michelle, alcohol>}
tie        →    {<Erin, radiator>, <Orla, radiator>, <Clare, radiator>, <Michelle, radiator>, <James, radiator>}
// ternary predicates
spray      →    {<James, fire extinguisher, curtains>}
]
```

## Lexical Entries

### Nouns (NP)

⟨Clare⟩ =  $p_c(e)$   
⟨Michelle⟩ =  $p_m(e)$   
⟨James⟩ =  $p_j(e)$   
⟨Fionnuala⟩ =  $p_f(e)$   
⟨Colm⟩ =  $p_l(e)$   
⟨alcohol⟩ =  $i_a(e)$   
⟨fire extinguisher⟩ =  $\lambda x.\text{extinguisher}(x)(<e, t>)$   
⟨curtains⟩ =  $\lambda x.\text{curtain}(x)(<e, t>)$   
⟨man⟩ =  $\lambda x.\text{man}(x)(<e, t>)$   
⟨someone⟩ =  $\lambda P.\exists z P(z)(<<e, t>, t>)$   
⟨scented candle⟩ =  $\lambda x.\text{scentedCandle}(x)(<e, t>)$   
⟨teen⟩ =  $\lambda x.\text{teen}(x)(<e, t>)$   
⟨radiator⟩ =  $\lambda x.\text{radiator}(x)(<e, t>)$

### Verbs (V)

⟨panicked⟩ =  $\lambda x.\text{panic}(x)(<e, t>)$   
⟨drank⟩ =  $\lambda y.\lambda x.\text{drink}(x, y)(<e, <e, t>>)$   
⟨sprayed⟩ =  $\lambda z.\lambda y.\lambda x.\text{spray}(x, z, y)(<e, <e, <e, t>>>)$   
⟨was⟩ =  $\lambda P.P(<<e, t>, <e, t>>)$   
⟨is⟩ =  $\lambda P.P(<<e, t>, <e, t>>)$   
⟨dropped⟩ =  $\lambda y.\lambda x.\text{drop}(x, y)(<e, <e, t>>)$   
⟨tied⟩ =  $\lambda y.\lambda x.\text{tie}(x, y)(<e, <e, t>>)$

### Adjectives (AP)

⟨shocked⟩ =  $\lambda x.\text{shocked}(x)(<e, t>)$   
⟨long-winded⟩ =  $\lambda x.\text{longWinded}(x)(<e, t>)$

### Determiners (D)

⟨the⟩ =  $\lambda P.\iota x.P(x)(<<e, t>, e>)$   
⟨a⟩ =  $\lambda P.P(<<e, t>, <e, t>>)$   
⟨every⟩ =  $\lambda Q.\lambda P.\forall z Q(z) \rightarrow P(z)(<<e, t>, <<e, t>, t>>)$   
⟨a⟩ =  $\lambda P\lambda Q.\exists x P(x) \wedge Q(x)(<<e, t>, <<e, t>, t>>)$

### Prepositions (P)

⟨at⟩ =  $\lambda x.x(<e, e>)$   
⟨to⟩ =  $\lambda x.x(<e, e>)$

## Translations

|             |  |
|-------------|--|
| Sentence    | Clare panicked. [intransitive, true]   |
| Lambda Tree | <p> <math>\text{panic}(p_c)</math><br/> <math>t</math><br/> <b>S</b><br/> Clare panicked. </p> <p> <math>p_c</math><br/> <math>e</math><br/> <b>NP</b><br/> Clare </p> <p> <math>\lambda x.\text{panic}(x)</math><br/> <math>\langle e, t \rangle</math><br/> <b>VP</b><br/> panicked </p> |

|             |   |
|-------------|---|
| Sentence    | Michelle drank alcohol. [transitive, true]  |
| Lambda Tree | <p> <math>\text{drink}(p_m, i_a)</math><br/> <math>t</math><br/> <b>S</b><br/> Michelle drank alcohol. </p> <p> <math>p_m</math><br/> <math>e</math><br/> <b>NP</b><br/> Michelle </p> <p> <math>\lambda x. \text{drink}(x, i_a)</math><br/> <math>\langle e, t \rangle</math><br/> <b>VP</b><br/> drank alcohol </p> <p> <math>\lambda y. \lambda x. \text{drink}(x, y)</math><br/> <math>\langle e, \langle e, t \rangle \rangle</math><br/> <b>V</b><br/> drank </p> <p> <math>i_a</math><br/> <math>e</math><br/> <b>NP</b><br/> alcohol </p> |

|             |  |
|-------------|--|
| Sentence    | James sprayed the fire extinguisher at the curtains. [ditransitive, true]  |
| Lambda Tree | <p> <math>\text{spray}(p_j, \lambda x.\text{extinguisher}(x), \lambda z.\text{curtain}(z))</math><br/> <math>t</math><br/> <b>S</b><br/> James sprayed the fire extinguisher at the curtains. </p> <p> <math>p_j</math><br/> <math>e</math><br/> <b>NP</b><br/> James </p> <p> <math>\lambda y.\text{spray}(y, \lambda x.\text{extinguisher}(x), \lambda z.\text{curtain}(z))</math><br/> <math>\langle e, t \rangle</math><br/> <b>VP</b><br/> sprayed the fire extinguisher at the curtains </p> <p> <math>\lambda z.\lambda y.\text{spray}(y, \lambda x.\text{extinguisher}(x), z)</math><br/> <math>\langle e, \langle e, t \rangle \rangle</math><br/> <b>VP</b><br/> sprayed the fire extinguisher </p> <p> <math>\lambda x.\text{curtain}(x)</math><br/> <math>e</math><br/> <b>PP</b><br/> at the curtains </p> <p> <math>\lambda z.\lambda y.\lambda x.\text{spray}(x, z, y)</math><br/> <math>\langle e, \langle e, \langle e, t \rangle \rangle \rangle</math><br/> <b>V</b><br/> sprayed </p> <p> <math>\lambda x.\text{extinguisher}(x)</math><br/> <math>e</math><br/> <b>DP</b><br/> the fire extinguisher </p> <p> <math>\lambda x.x</math><br/> <math>\langle e, e \rangle</math><br/> <b>P</b><br/> at </p> <p> <math>\lambda x.\text{curtain}(x)</math><br/> <math>e</math><br/> <b>DP</b><br/> the curtains </p> <p> <math>\lambda P.\lambda x.P(x)</math><br/> <math>\langle \langle e, t \rangle, e \rangle</math><br/> <b>D</b><br/> the </p> <p> <math>\lambda x.\text{extinguisher}(x)</math><br/> <math>\langle e, t \rangle</math><br/> <b>NP</b><br/> fire extinguisher </p> <p> <math>\lambda P.\lambda x.P(x)</math><br/> <math>\langle \langle e, t \rangle, e \rangle</math><br/> <b>D</b><br/> the </p> <p> <math>\lambda x.\text{curtain}(x)</math><br/> <math>\langle e, t \rangle</math><br/> <b>NP</b><br/> curtains </p> |

|             |  |
|-------------|--|
| Sentence    | Fionnula was shocked. [predicative adjective, true]  |
| Lambda Tree | <p>shocked(<math>p_f</math>)<br/> <math>t</math><br/> <b>S</b><br/> Fionnula was shocked.</p> <p><math>p_f</math><br/> <math>e</math><br/> <b>NP</b><br/> Fionnula</p> <p><math>\lambda x.shocked(x)</math><br/> <math>\langle e, t \rangle</math><br/> <b>VP</b><br/> was shocked</p> <p><math>\lambda P.P</math><br/> <math>\langle \langle e, t \rangle, \langle e, t \rangle \rangle</math><br/> <b>V</b><br/> was</p> <p><math>\lambda x.shocked(x)</math><br/> <math>\langle e, t \rangle</math><br/> <b>AP</b><br/> shocked</p> |

|             |   |
|-------------|---|
| Sentence    | Colm is a long-winded man. [modifier adjective, true]   |
| Lambda Tree | <pre> graph TD     S["longWinded(p_l) ∧ man(p_l)<br/>t<br/>S<br/>Colm is a long-winded man."]     NP1["p_l<br/>e<br/>NP<br/>Colm"]     VP["λx.longWinded(x) ∧ man(x)<br/>&lt;e, t&gt;<br/>VP<br/>is a long-winded man"]     V["λP.P<br/>&lt;&lt;e, t&gt;, &lt;e, t&gt;&gt;<br/>V<br/>is"]     DP["λx.longWinded(x) ∧ man(x)<br/>&lt;e, t&gt;<br/>DP<br/>a long-winded man"]     D["λP.P<br/>&lt;&lt;e, t&gt;, &lt;e, t&gt;&gt;<br/>D<br/>a"]     NP2["λx.longWinded(x) ∧ man(x)<br/>&lt;e, t&gt;<br/>NP<br/>long-winded man"]     AP["λx.longWinded(x)<br/>&lt;e, t&gt;<br/>AP<br/>long-winded"]     NP3["λx.man(x)<br/>&lt;e, t&gt;<br/>NP<br/>man"]     S --- NP1     S --- VP     VP --- V     VP --- DP     DP --- D     DP --- NP2     NP2 --- AP     NP2 --- NP3     NP3 --- t1["&lt;e, t&gt;"]     NP3 --- t2["&lt;e, t&gt;"] </pre> |



|             |  |
|-------------|--|
| Sentence    | Someone dropped a scented candle. [existential quantifier, false]  |
| Lambda Tree | <p> <math>\exists z \exists x \text{ scentedCandle}(x) \wedge \text{drop}(z, x)</math><br/> <math>t</math><br/> <b>S</b><br/> Someone dropped a scented candle. </p> <p> <math>\lambda P. \exists z P(z)</math><br/> <math>\langle\langle e, t \rangle, t \rangle</math><br/> <b>NP</b><br/> Someone </p> <p> <math>\lambda y. \exists x \text{ scentedCandle}(x) \wedge \text{drop}(y, x)</math><br/> <math>\langle e, t \rangle</math><br/> <b>VP</b><br/> dropped a scented candle </p> <p> <math>\lambda Q_{\langle\langle e, t \rangle, t \rangle} \lambda y. Q(\lambda z. \text{drop}(y, z))</math><br/> <math>\langle\langle\langle e, t \rangle, t \rangle, \langle e, t \rangle\rangle</math><br/> RAISE-0<br/> <math>\lambda z. \lambda y. \text{drop}(y, z)</math><br/> <math>\langle e, \langle e, t \rangle \rangle</math><br/> <b>V</b><br/> dropped </p> <p> <math>\lambda Q. \exists x \text{ scentedCandle}(x) \wedge Q(x)</math><br/> <math>\langle\langle e, t \rangle, t \rangle</math><br/> <b>DP</b><br/> a scented candle </p> <p> <math>\lambda P \lambda Q. \exists x P(x) \wedge Q(x)</math><br/> <math>\langle\langle e, t \rangle, \langle\langle e, t \rangle, t \rangle\rangle</math><br/> <b>D</b><br/> a </p> <p> <math>\lambda x. \text{scentedCandle}(x)</math><br/> <math>\langle e, t \rangle</math><br/> <b>NP</b><br/> scented candle </p> |

|             |   |
|-------------|---|
| Sentence    | Every teen was tied to the radiator. [universal quantifier, true]   |
| Lambda Tree | <p> <math>\forall z.teen(z) \rightarrow tie(z, \iota x.radiator(x))</math><br/> <math>t</math><br/> <math>S</math><br/>     Every teen was tied to the radiator.   </p> <p> <math>\lambda P.\forall z.teen(z) \rightarrow P(z)</math><br/> <math>\langle\langle e, t \rangle, t \rangle</math><br/> <math>D</math><br/>     Every teen   </p> <p> <math>\lambda x.teen(x)</math><br/> <math>\langle e, t \rangle</math><br/> <math>NP</math><br/>     teen   </p> <p> <math>\lambda P.P</math><br/> <math>\langle\langle e, t \rangle, \langle e, t \rangle\rangle</math><br/> <math>V</math><br/>     was   </p> <p> <math>\lambda y.tie(y, \iota x.radiator(x))</math><br/> <math>\langle e, t \rangle</math><br/> <math>V</math><br/>     tied to the radiator   </p> <p> <math>\lambda z.\lambda y.tie(y, z)</math><br/> <math>\langle e, \langle e, t \rangle \rangle</math><br/> <math>V</math><br/>     tied   </p> <p> <math>\iota x.radiator(x)</math><br/> <math>e</math><br/> <math>PP</math><br/>     to the radiator   </p> <p> <math>\lambda x.x</math><br/> <math>\langle e, e \rangle</math><br/> <math>P</math><br/>     to   </p> <p> <math>\iota x.radiator(x)</math><br/> <math>e</math><br/> <math>DP</math><br/>     the radiator   </p> <p> <math>\lambda P.\iota x.P(x)</math><br/> <math>\langle\langle e, t \rangle, e \rangle</math><br/> <math>D</math><br/>     the   </p> <p> <math>\lambda x.radiator(x)</math><br/> <math>\langle e, t \rangle</math><br/> <math>NP</math><br/>     radiator   </p> |