Appendix B

Trace of the System

In this appendix, we give a full trace of the example that was presented in section 7.1, where the system acted as the direction giver.

To make the trace readable, we have formatted it in several ways. Lines have been formatted so that they will fit on the page. Lines that have been broken are marked by the continuation `-` at the start of the line. When a plan derivation or list of actions is a parameter in a proposition, they are represented by a variable `Vn` where `n` is an integer. The values of any variables in a proposition follow the proposition. We have also added section titles which correspond to those in section 7.1.

Prolog represents certain propositions differently than they are in mathematical formalism. Lambda expressions of the form $\lambda X \cdot \mathrm{Prop}$ are represented as:

```
X^Prop
```

Lambda extraction, $(\lambda X \cdot \mathrm{Prop})(Y)$, is represented as:

```
apply(X^Prop,Y)
```

Furthermore unbound Prolog variables are represented as `_n`, where `n` is an integer.

B.1 Initialization

```
New Value of giver is system
New Value of recipient is user
User Model: Adding Proposition
category(highway1,highway)

User Model: Adding Proposition
called(highway1,128)

User Model: Adding Proposition
category(street1,street)

User Model: Adding Proposition
called(street1,2A)

User Model: Adding Proposition
category(avenue1,avenue)

User Model: Adding Proposition
called(avenue1,Mass)

User Model: Adding Proposition
category(street2,street)

User Model: Adding Proposition
called(street2,Lowell)

User Model: Adding Proposition
category(avenue2,avenue)

User Model: Adding Proposition
called(avenue2,Bartlett)

User Model: Adding Proposition
category(town1,town)

User Model: Adding Proposition
called(town1,Newton)

User Model: Adding Proposition
category(exit1,exit)

User Model: Adding Proposition
called(exit1,2A)

User Model: Adding Proposition
category(inter1,intersection)

User Model: Adding Proposition
called(inter1,Mass Avenue)

User Model: Adding Proposition
category(inter2,intersection)
```

```
User Model: Adding Proposition
called(inter2,Lowell Street)

User Model: Adding Proposition
has(inter2,sign1)

User Model: Adding Proposition
has(inter2,lights1)

User Model: Adding Proposition
category(inter3,intersection)

User Model: Adding Proposition
called(inter3,Bartlett Avenue)

User Model: Adding Proposition
category(building1,building)

User Model: Adding Proposition
called(building1,Academy)

User Model: Adding Proposition
category(sign1,sign)

User Model: Adding Proposition
category(lights1,traffic_lights)

User Model: Adding Proposition
world([sign1,town1,street1,inter1,inter2,street2,building1])

User Model: Adding Proposition
salient_category(5,town)

User Model: Adding Proposition
salient_category(4,highway)

User Model: Adding Proposition
salient_category(3,avenue)

User Model: Adding Proposition
salient_category(3,street)

User Model: Adding Proposition
salient_category(3,exit)

User Model: Adding Proposition
salient_category(2,traffic_lights)

User Model: Adding Proposition
salient_category(1,intersection)

User Model: Adding Proposition
salient_category(1,sign)

User Model: Adding Proposition
salient_category(1,building)

User Model: Adding Proposition
```

```
salient_category(0,_13727)

User Model: Adding Proposition
salient_property(1,town,_13885^called(_13885,_13921))

User Model: Adding Proposition
salient_property(2,highway,_14231^called(_14231,_14267))

User Model: Adding Proposition
salient_property(2,avenue,_14577^called(_14577,_14613))

User Model: Adding Proposition
salient_property(2,street,_14923^called(_14923,_14959))

User Model: Adding Proposition
salient_property(2,exit,_15269^called(_15269,_15305))

User Model: Adding Proposition
salient_property(3,intersection,traffic_lights,_15623^_15640^has(_15623,_15640))

User Model: Adding Proposition
salient_property(2,intersection,sign,_180950^_180967^has(_180950,_180967))

User Model: Adding Proposition
salient_property(2,intersection,_181384^called(_181384,_181420))

User Model: Adding Proposition
salient_property(0,_181722,_181733)

User Model: Adding Proposition
salient_property(0,_181907,_181918,_181929)

User Model: Adding Proposition
confidence_threshold(intersection,2)

User Model: Adding Proposition
place(town1,[highway1],[,(270,,(highway1,+(1)))])

User Model: Adding Proposition
place(exit1,[highway1,street1],[,(0,,(street1,+(1))),,(90,,(highway1,-1)),,(270,,(highway1,+(
  - 1)))])

User Model: Adding Proposition
place(inter1,[street1,avenue1],[,(0,,(street1,+(1))),,(90,,(avenue1,+(1))),,(180,,(street1,
  - -1)),,(270,,(avenue1,-1))])

User Model: Adding Proposition
place(inter2,[street1,street2],[,(0,,(street1,+(1))),,(90,,(street2,+(1))),,(180,,(street1,
  - -1)),,(270,,(street2,-1))])

User Model: Adding Proposition
place(inter3,[street2,avenue2],[,(0,,(avenue2,-1)),,(90,,(street2,+(1))),,(180,,(avenue2,+(
  - 1))),,(270,,(street2,-1))])

User Model: Adding Proposition
place(building1,[avenue2],[,(0,,(street2,-1))])

User Model: Adding Proposition
path(highway1,[town1,exit1])
```

```
User Model: Adding Proposition
path(street1,[exit1,inter1,inter2])

User Model: Adding Proposition
path(avenue1,[inter1])

User Model: Adding Proposition
path(street2,[inter2,inter3])

User Model: Adding Proposition
path(avenue2,[inter3,building1])
```

B.2 Constructing "*Go to the Lowell Street Intersection.*"

```
New Value of route_origin is here(exit1,street1,+1)
New Value of route is route([goto(exit1,inter2,street1,+1,1)])
New Value of route_dest is here(inter2,street1,+1)
===================
Checking Goal Rules
===================

Applying i_rule2
goal(system,knowroute(user,system,route([goto(exit1,inter2,street1,+1,1)])))

==========
Responding
==========

Goal  : knowroute(user,system,route([goto(exit1,inter2,street1,+1,1)]))
Effect: bel(user,goal(system,knowroute(user,system,route([goto(exit1,inter2,street1,+1,1)]))))

---------
Construct
---------

Initial Setup
-------------
Trying: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
New edge added

End of Initialization
---------------------

Expanding (step 0  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),1)],here(inter2,street1,+(
       - 1)))
Trying: directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),1)],here(inter2,street1,+(
         - 1)))
<con>[goto(exit1,inter2,street1,+(1),1)]=[_190930|_190935]
New edge added
Trying: directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),1)],here(inter2,street1,+(
         - 1)))
<con>here(exit1,street1,+(1))=here(inter2,street1,+(1))
*** failed ***
```

```
Expanding (step 1  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),1),_190407)
Trying: direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),1),_190407)
<con>here(exit1,street1,+(1))=here(_191543,_191544,_191545)
<con>goto(exit1,inter2,street1,+(1),1)=goto(exit1,_191553,street1,+(1),_191556)
New edge added
Trying: direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),1),_190407)
<con>here(exit1,street1,+(1))=here(_191543,_191544,_191545)
<con>goto(exit1,inter2,street1,+(1),1)=turn(exit1,street1,+(1),_191555,_191556,_191557)
*** failed ***

Expanding (step 2  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: ref(_191544,inter2)
<ma> ref(_191544,inter2)
New edge added

Expanding (step 3  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: s-goto(entity(1,inter2))
Trying: s-goto(entity(1,inter2))
<con>place(inter2,_194042,_194043)
New edge added

Expanding (step 4  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: set_context(exit1,inter2,street1,+(1))
<ma> set_context(exit1,inter2,street1,+(1))
New edge added

Expanding (step 5  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: refer(entity(1,inter2),_195577)
Trying: refer(entity(1,inter2),_195577)
New edge added

Expanding (step 6  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: s-refer(entity(1,inter2))
Trying: s-refer(entity(1,inter2))
New edge added

Expanding (step 7  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: describe(entity(1,inter2),_199803)
Trying: describe(entity(1,inter2),_199803)
New edge added

Expanding (step 8  active 1)
-----------------------------
```

```
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: context_current(_201510)
<ma> context_current(_201510)
New edge added

Expanding (step 9  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
       - 1,inter2),_203296,_203297,_203298)
Trying: headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
         - 1,inter2),_203296,_203297,_203298)
New edge added

Expanding (step 10  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: s-attrib(entity(1,inter2),_205400^category(_205400,_205404))
Trying: s-attrib(entity(1,inter2),_205400^category(_205400,_205404))
<con>category(inter2,_205404)
New edge added

Expanding (step 11  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_207688^ab(system,
       - user,category(_207688,intersection)),_207668)
<ma> subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_207688^ab(system,
       - user,category(_207688,intersection)),_207668)
New edge added

Expanding (step 12  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: ref(entity(1,inter2),_210291)
<ma> ref(entity(1,inter2),_210291)
New edge added

Expanding (step 13  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: _213751=[category(inter2,intersection)]
<ma> _213751=[category(inter2,intersection)]
New edge added

Expanding (step 14  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: confidence_headnoun(_216154,entity(1,inter2),intersection)
<ma> confidence_headnoun(_216154,entity(1,inter2),intersection)
New edge added

Expanding (step 15  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1,_218597)
Trying: modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1,_218597)
New edge added
Trying: modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1,1)
```

```
<con>[inter1,inter2]=[inter2]
*** failed ***

Expanding (step 16  active 1)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: modifier(entity(1,inter2),[inter1,inter2],_221140,[category(inter2,intersection)],_221142,
       - _221143)
Trying: modifier(entity(1,inter2),[inter1,inter2],_221140,[category(inter2,intersection)],
         - _221142,_221143)
New edge added
Trying: modifier(entity(1,inter2),[inter1,inter2],_221140,[category(inter2,intersection)],
         - _221142,_221143)
New edge added

Expanding (step 17  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: salient_attrib(entity(1,inter2),_224853,[category(inter2,intersection)],_224855)
<ma> salient_attrib(entity(1,inter2),_224853,[category(inter2,intersection)],_224855)
New edge added

Expanding (step 18  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: salient_attrib_rel(entity(1,inter2),_223855,_223856,[category(inter2,intersection)],
       - _223858)
<ma> salient_attrib_rel(entity(1,inter2),_223855,_223856,[category(inter2,intersection)],
       - _223858)
New edge added

Expanding (step 19  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: s-attrib(entity(1,inter2),_227749^called(_227749,Lowell Street))
Trying: s-attrib(entity(1,inter2),_227749^called(_227749,Lowell Street))
<con>called(inter2,Lowell Street)
New edge added

Expanding (step 20  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: s-attrib-rel(entity(1,inter2),entity(2,lights1),_231783^_231786^has(_231783,_231786))
Trying: s-attrib-rel(entity(1,inter2),entity(2,lights1),_231783^_231786^has(_231783,_231786))
<con>has(inter2,lights1)
New edge added

Expanding (step 21  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: subset([inter1,inter2],_234795^ab(system,user,apply(_234805^called(_234805,Lowell Street),
       - _234795)),_234789)
<ma> subset([inter1,inter2],_234795^ab(system,user,apply(_234805^called(_234805,Lowell Street),
       - _234795)),_234789)
New edge added

Expanding (step 22  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
```

```
Need: ref(entity(2,lights1),_237962)
<ma> ref(entity(2,lights1),_237962)
New edge added

Expanding (step 23  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: confidence_attrib(_241269,entity(1,inter2),_241276^called(_241276,Lowell Street))
<ma> confidence_attrib(_241269,entity(1,inter2),_241276^called(_241276,Lowell Street))
New edge added

Expanding (step 24  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: subset([inter1,inter2],_244471^ab(system,user,apply(apply(_244484^_244487^has(_244484,
       - _244487),_244471),lights1)),_244465)
<ma> subset([inter1,inter2],_244471^ab(system,user,apply(apply(_244484^_244487^has(_244484,
       - _244487),_244471),lights1)),_244465)
New edge added

Expanding (step 25  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: confidence_add(_248713,1,2)
<ma> confidence_add(_248713,1,2)
New edge added

Expanding (step 26  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: refer(entity(2,lights1),_252086)
Trying: refer(entity(2,lights1),_252086)
New edge added

Expanding (step 27  active 2)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_255211)
Trying: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection
         - )],3,_255211)
New edge added
Trying: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection
         - )],3,3)
<con>[inter2]=[inter2]
<con>confidence_exceed(entity(1,inter2),3)
New edge added

Expanding (step 28  active 3)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: s-refer(entity(2,lights1))
Trying: s-refer(entity(2,lights1))
New edge added

Expanding (step 29  active 3)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: null
```

```
New edge added

Expanding (step 30  active 3)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: modifier(entity(1,inter2),[inter2],_263909,[called(inter2,Lowell Street),category(inter2,
       - intersection)],_263911,_263912)
Trying: modifier(entity(1,inter2),[inter2],_263909,[called(inter2,Lowell Street),category(inter2,
         - intersection)],_263911,_263912)
New edge added
Trying: modifier(entity(1,inter2),[inter2],_263909,[called(inter2,Lowell Street),category(inter2,
         - intersection)],_263911,_263912)
New edge added

Expanding (step 31  active 4)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: _270450=here(inter2,street1,+(1))
<ma> _270450=here(inter2,street1,+(1))
New edge added

Expanding (step 32  active 4)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: salient_attrib(entity(1,inter2),_275080,[called(inter2,Lowell Street),category(inter2,
       - intersection)],_275082)
<ma> salient_attrib(entity(1,inter2),_275080,[called(inter2,Lowell Street),category(inter2,
       - intersection)],_275082)
*** failed ***
No edges added

Expanding (step 33  active 3)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: salient_attrib_rel(entity(1,inter2),_273826,_273827,[called(inter2,Lowell Street),category(
       - inter2,intersection)],_273829)
<ma> salient_attrib_rel(entity(1,inter2),_273826,_273827,[called(inter2,Lowell Street),category(inter2
       - ,intersection)],_273829)
New edge added

Expanding (step 34  active 3)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
Trying: directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
<con>[]=[_287166|_287171]
*** failed ***
Trying: directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
<con>here(inter2,street1,+(1))=here(inter2,street1,+(1))
<con>[]=[]
New edge added

Expanding (step 35  active 3)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: s-attrib-rel(entity(1,inter2),entity(3,lights1),_283375^_283378^has(_283375,_283378))
Trying: s-attrib-rel(entity(1,inter2),entity(3,lights1),_283375^_283378^has(_283375,_283378))
<con>has(inter2,lights1)
New edge added
```

```
Expanding (step 36  active 3)
-----------------------------
Head: describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
Need: null
New edge added


Constructed Plan
----------------
describe-route(route([goto(exit1,inter2,street1,+(1),1)]))
 +-directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),1)],here(inter2,street1,+(
    - 1)))
   +-direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),1),here(inter2,street1,+(
   |  - 1)))
   | +-ref(entity(1,inter2),inter2)
   | +-s-goto(entity(1,inter2))
   | +-set_context(exit1,inter2,street1,+(1))
   | +-refer(entity(1,inter2),3)
   | | +-s-refer(entity(1,inter2))
   | | +-describe(entity(1,inter2),3)
   | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
   | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
   | |   |  - 1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
   | |   | +-s-attrib(entity(1,inter2),_294018^category(_294018,intersection))
   | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
   | |   | |  - _294018^ab(system,user,category(_294018,intersection)),[inter1,inter2])
   | |   | +-ref(entity(1,inter2),inter2)
   | |   | +-[category(inter2,intersection)]=[category(inter2,intersection)]
   | |   | +-confidence_headnoun(1,entity(1,inter2),intersection)
   | |   +-modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1,3)
   | |     +-modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,intersection)],[
   | |     |  - called(inter2,Lowell Street),category(inter2,intersection)],2)
   | |     | +-salient_attrib(entity(1,inter2),_294004^called(_294004,Lowell Street),[category(inter2,
   | |     | |  - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)])
   | |     | +-s-attrib(entity(1,inter2),_294004^called(_294004,Lowell Street))
   | |     | +-subset([inter1,inter2],_295845^ab(system,user,apply(_294004^called(_294004,
   | |     | |  - Lowell Street),_295845)),[inter2])
   | |     | +-confidence_attrib(2,entity(1,inter2),_294004^called(_294004,Lowell Street))
   | |     +-confidence_add(3,1,2)
   | |     +-modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,
   | |        - intersection)],3,3)
   | |       +-null
   | +-here(inter2,street1,+(1))=here(inter2,street1,+(1))
   +-directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
     +-null

Actions to be fed to generator
------------------------------
s-attrib(entity(1,inter2),_294004^called(_294004,Lowell Street))
 s-attrib(entity(1,inter2),_294018^category(_294018,intersection))
 s-refer(entity(1,inter2))
 s-goto(entity(1,inter2))

User Model: Adding Proposition
plan(system,p1,knowroute(user,system,route([goto(exit1,inter2,street1,+(1),1)])))

Pushing to focus stack: focus(p1,p1,knowroute(user,system,route([goto(exit1,inter2,street1,+(
  - 1),1)])))
```

```
User Model: Adding Proposition
achieve(p1,p1,knowroute(user,system,route([goto(exit1,inter2,street1,+(1),1)])))

Pushing to focus stack: focus(p1,p13,mb(system,user,place(inter2,_294352,_294353)))
User Model: Adding Proposition
achieve(p1,p13,mb(system,user,place(inter2,_294352,_294353)))

Pushing to focus stack: focus(p1,p20,identify(user,system,entity(1,inter2)))
User Model: Adding Proposition
achieve(p1,p20,identify(user,system,entity(1,inter2)))

Pushing to focus stack: focus(p1,p29,mb(system,user,category(inter2,intersection)))
User Model: Adding Proposition
achieve(p1,p29,mb(system,user,category(inter2,intersection)))

Pushing to focus stack: focus(p1,p44,mb(system,user,called(inter2,Lowell Street)))
User Model: Adding Proposition
achieve(p1,p44,mb(system,user,called(inter2,Lowell Street)))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying c_rule2
User Model: Adding Proposition
cstate(system,user,p1,knowroute(user,system,route([goto(exit1,inter2,street1,+(1),1)])))

===================
Checking Goal Rules
===================

Applying g_rule3
goal(system,mb(system,user,achieve(p1,p44,mb(system,user,called(inter2,Lowell Street)))))

Pre-empting the planning for this goal
```

B.3 Understanding "*Does it have a sign?*"

```
=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p1)

Initial Setup
-------------
Adding inactive edge:
Head: s-accept(p1)
Acts: s-accept(p1)

Adding active edge:
Head: accept-plan(_363213)
Need: s-accept(_363213)
```

```
Adding config (from active edge):
Active:   accept-plan(_363213)
Inactive: s-accept(p1)

End of Initial Setup
--------------------

Applying config (0 left, step 1)
----------------------------------
Active:   accept-plan(_363213)
Inactive: s-accept(p1)

Adding inactive edge:
Head: accept-plan(p1)
Acts: s-accept(p1)

*** Agenda Empty ***

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

accept-plan(p1)
 +-s-accept(p1)

--------
Evaluate
--------

<con> achieve(p1,p44,mb(system,user,called(inter2,Lowell Street)))
Assuming achieve(p1,p44,mb(system,user,called(inter2,Lowell Street))) due to effects


Inferred Plan
-------------

_364311:accept-plan(p1)
 +-_364336:s-accept(p1)

User Model: Adding Proposition
plan(user,p65,mb(system,user,achieve(p1,p44,mb(system,user,called(inter2,Lowell Street)))))

Pushing to focus stack: focus(p65,p65,mb(system,user,achieve(p1,p44,mb(system,user,called(inter2,
  - Lowell Street)))))
User Model: Adding Proposition
achieve(p65,p65,mb(system,user,achieve(p1,p44,mb(system,user,called(inter2,Lowell Street)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p65,p65,mb(system,user,achieve(p1,p44,mb(system,user,called(inter2,
  - Lowell Street)))))
User Model: Adding Proposition
mb(system,user,achieve(p1,p44,mb(system,user,called(inter2,Lowell Street))))
```

```
Applying m_accept_rule1
Popping from focus stack: focus(p1,p44,mb(system,user,called(inter2,Lowell Street)))
User Model: Adding Proposition
mb(system,user,called(inter2,Lowell Street))

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p1)

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

accept-plan(p1)
 +-s-accept(p1)

--------
Evaluate
--------

<con> achieve(p1,p29,mb(system,user,category(inter2,intersection)))
Assuming achieve(p1,p29,mb(system,user,category(inter2,intersection))) due to effects


Inferred Plan
-------------

_370999:accept-plan(p1)
 +-_371024:s-accept(p1)

User Model: Adding Proposition
plan(user,p72,mb(system,user,achieve(p1,p29,mb(system,user,category(inter2,intersection)))))

Pushing to focus stack: focus(p72,p72,mb(system,user,achieve(p1,p29,mb(system,user,category(inter2,
  - intersection)))))
User Model: Adding Proposition
achieve(p72,p72,mb(system,user,achieve(p1,p29,mb(system,user,category(inter2,intersection)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p72,p72,mb(system,user,achieve(p1,p29,mb(system,user,category(inter2,
  - intersection)))))
User Model: Adding Proposition
mb(system,user,achieve(p1,p29,mb(system,user,category(inter2,intersection))))

Applying m_accept_rule1
```

```
Popping from focus stack: focus(p1,p29,mb(system,user,category(inter2,intersection)))
User Model: Adding Proposition
mb(system,user,category(inter2,intersection))

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-postpone(p1)

Initial Setup
-------------
Adding inactive edge:
Head: s-postpone(p1)
Acts: s-postpone(p1)

Adding active edge:
Head: postpone-plan(_377958)
Need: s-postpone(_377958)

Adding config (from active edge):
Active:   postpone-plan(_377958)
Inactive: s-postpone(p1)

End of Initial Setup
--------------------

Applying config (0 left, step 1)
----------------------------------
Active:   postpone-plan(_377958)
Inactive: s-postpone(p1)

Adding inactive edge:
Head: postpone-plan(p1)
Acts: s-postpone(p1)

*** Agenda Empty ***

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

postpone-plan(p1)
 +-s-postpone(p1)

--------
Evaluate
--------

<con> not(installment(p1))
<con> error(p1,p20,_379035)
Assuming error(p1,p20,_379035) due to effects
```

```
postponing evaluation of constraint(p1,_379040,_379035)
<con> yield(p1,_379040,[])
<con> constraint(p1,p53,_379035)
<con> content(p1,p53,_379053)
<con> modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,3)=modifiers(_379060,_379061,_379062,_379063,_379064)


Inferred Plan
-------------

_379250:postpone-plan(p1)
 +-_379300:s-postpone(p1)

User Model: Adding Proposition
plan(user,p79,mb(system,user,error(p1,p20,p55)))

Pushing to focus stack: focus(p79,p79,mb(system,user,error(p1,p20,p55)))
User Model: Adding Proposition
achieve(p79,p79,mb(system,user,error(p1,p20,p55)))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p79,p79,mb(system,user,error(p1,p20,p55)))
User Model: Adding Proposition
mb(system,user,error(p1,p20,p55))



User Model: Adding Proposition
confidence_threshold(intersection,6)

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-suggest(p1,V1)
          V1=s-attrib-rel(entity(1,_389343),_389354,_389357^_389360^has(_389357,_389360))
             s-refer(_389354)
             s-attrib(_389354,_389375^category(_389375,sign))

Initial Setup
-------------
Adding inactive edge:
Head: s-suggest(p1,V1)
      V1=s-attrib-rel(entity(1,_389847),_389843,_389849^_389852^has(_389849,_389852))
         s-refer(_389843)
         s-attrib(_389843,_389867^category(_389867,sign))
Acts: s-suggest(p1,V1)
      V1=s-attrib-rel(entity(1,_389847),_389843,_389849^_389852^has(_389849,_389852))
         s-refer(_389843)
         s-attrib(_389843,_389867^category(_389867,sign))
```

```
Adding active edge:
Head: suggest-expand-plan(_390802)
Need: s-suggest(_390802,_390871)

Adding config (from active edge):
Active:   suggest-expand-plan(_390802)
Inactive: s-suggest(p1,V1)
          V1=s-attrib-rel(entity(1,_389847),_389843,_389849^_389852^has(_389849,_389852))
             s-refer(_389843)
             s-attrib(_389843,_389867^category(_389867,sign))

End of Initial Setup
--------------------

Applying config (0 left, step 1)
----------------------------------
Active:   suggest-expand-plan(_390802)
Inactive: s-suggest(p1,V1)
          V1=s-attrib-rel(entity(1,_389847),_389843,_389849^_389852^has(_389849,_389852))
             s-refer(_389843)
             s-attrib(_389843,_389867^category(_389867,sign))

Adding inactive edge:
Head: suggest-expand-plan(p1)
Acts: s-suggest(p1,V1)
      V1=s-attrib-rel(entity(1,_392105),_392101,_392107^_392110^has(_392107,_392110))
         s-refer(_392101)
         s-attrib(_392101,_392125^category(_392125,sign))

*** Agenda Empty ***

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

suggest-expand-plan(p1)
 +-salience_suggest_actions(p1,_394668,_394700,[s-attrib-rel(entity(1,_395003),_394999,_395005^
 |  - _395008^has(_395005,_395008)),s-refer(_394999),s-attrib(_394999,_395023^category(_395023,sign))]
 |  - )
 +-s-suggest(p1,V1)
   V1=s-attrib-rel(entity(1,_394720),_394716,_394722^_394725^has(_394722,_394725))
      s-refer(_394716)
      s-attrib(_394716,_394740^category(_394740,sign))

--------
Evaluate
--------

<con> error(p1,p20,_394675)
<con> constraint(p1,_394680,p55)
<con> yield(p1,p53,[])
<con> content(p1,p53,_394693)
<con> modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,3)=modifiers(_394700,_394701,_394702,_394703,_394704)
<ma>  salience_suggest_actions(p1,p20,entity(1,inter2),[s-attrib-rel(entity(1,_401889),_401885,
```

```
    - _401891^_401894^has(_401891,_401894)),s-refer(_401885),s-attrib(_401885,_401909^category(
    - _401909,sign))])
```

```
Inferred Plan
-------------

_395736:suggest-expand-plan(p1)
 +-_395781:salience_suggest_actions(p1,p20,entity(1,inter2),[s-attrib-rel(entity(1,inter2),entity(
 |  - _404541,_404542),_404544^_404547^has(_404544,_404547)),s-refer(entity(_404541,_404542)),s-attrib
 |  - (entity(_404541,_404542),_404568^category(_404568,sign))])
 +-_395786:s-suggest(p1,V1)
   V1=s-attrib-rel(entity(1,inter2),entity(_402805,_402806),_394722^_394725^has(_394722,_394725))
      s-refer(entity(_402805,_402806))
      s-attrib(entity(_402805,_402806),_394740^category(_394740,sign))

User Model: Adding Proposition
plan(user,p91,mb(system,user,suggest(p1,p20,[s-attrib-rel(entity(1,inter2),entity(_407825,
  - _407826),_407828^_407831^has(_407828,_407831)),s-refer(entity(_407825,_407826)),s-attrib(entity(
  - _407825,_407826),_407852^category(_407852,sign))])))

Pushing to focus stack: focus(p91,p91,mb(system,user,suggest(p1,p20,[s-attrib-rel(entity(
  - 1,inter2),entity(_411538,_411539),_411541^_411544^has(_411541,_411544)),s-refer(entity(
  - _411538,_411539)),s-attrib(entity(_411538,_411539),_411565^category(_411565,sign))])))
User Model: Adding Proposition
achieve(p91,p91,mb(system,user,suggest(p1,p20,[s-attrib-rel(entity(1,inter2),entity(_412407,
  - _412408),_412410^_412413^has(_412410,_412413)),s-refer(entity(_412407,_412408)),s-attrib(entity(
  - _412407,_412408),_412434^category(_412434,sign))])))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p91,p91,mb(system,user,suggest(p1,p20,[s-attrib-rel(entity(
  - 1,inter2),entity(_414086,_414087),_414089^_414092^has(_414089,_414092)),s-refer(entity(
  - _414086,_414087)),s-attrib(entity(_414086,_414087),_414113^category(_414113,sign))])))
User Model: Adding Proposition
mb(system,user,suggest(p1,p20,[s-attrib-rel(entity(1,inter2),entity(_414880,_414881),_414883^
  - _414886^has(_414883,_414886)),s-refer(entity(_414880,_414881)),s-attrib(entity(_414880,
  - _414881),_414907^category(_414907,sign))]))
```

B.4 Constructing "*Yes, it does, and it also has traffic lights.*"

```
===================
Checking Goal Rules
===================

Applying g_rule2
goal(system,mb(system,user,replace(p1,_213560)))

==========
Responding
==========

Goal  : mb(system,user,replace(p1,_213560))
Effect: bel(user,goal(system,mb(system,user,replace(p1,_213560))))
```

```
---------
Construct
---------

Initial Setup
-------------
Trying: replace-plan(p1)
<con>error(p1,p20,_214131)
<con>constraint(p1,_214136,p55)
<con>step(p1,_214142,p53)
<con>content(p1,p39,_214149)
<con>modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1,3)=modifier(
       - _214156,_214157,_214158)
*** failed ***
Trying: expand-plan(p1)
<con>error(p1,p20,_214131)
<con>constraint(p1,_214136,p55)
<con>yield(p1,p53,[])
<con>content(p1,p53,_214149)
<con>modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)],
       - 3,3)=modifiers(_214156,_214157,_214158,_214159,_214159)
<con>length([inter2],_214165)
<con>>(1,1)
*** failed ***
Trying: expand-plan(p1)
<con>error(p1,p20,_214131)
<con>constraint(p1,_214136,p55)
<con>yield(p1,p53,[])
<con>content(p1,p53,_214149)
<con>modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)],
       - 3,3)=modifiers(_214156,_214157,_214158,_214159,_214159)
<con>not(confidence_exceed(entity(1,inter2),3))
<con>suggest(p1,p20,_214173)
New edge added
Trying: expand-plan(p1)
<con>error(p1,p20,_214131)
<con>constraint(p1,_214136,p55)
<con>yield(p1,p53,[])
<con>content(p1,p53,_214149)
<con>modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)],
       - 3,3)=modifiers(_214156,_214157,_214158,_214159,_214159)
<con>not(confidence_exceed(entity(1,inter2),3))
<con>not(suggest(p1,p20,_214175))
*** failed ***

End of Initialization
---------------------

Expanding (step 0  active 1)
----------------------------
Head: expand-plan(p1)
Need: construct(modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,
       - intersection)],3,_214111),_214103,V1,_214105)
      V1=s-attrib-rel(entity(1,inter2),entity(_214137,_214138),_214140^_214143^has(_214140,
          - _214143))
         s-refer(entity(_214137,_214138))
         s-attrib(entity(_214137,_214138),_214164^category(_214164,sign))
```

```
Invoking construct recursively

---------
Construct
---------

Initial Setup
-------------
Trying: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection
         - )],3,_214111)
New edge added
Trying: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection
         - )],3,3)
<con>[inter2]=[inter2]
<con>confidence_exceed(entity(1,inter2),3)
*** failed ***

End of Initialization
---------------------

Expanding (step 0  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_216273)
Need: modifier(entity(1,inter2),[inter2],_216233,[called(inter2,Lowell Street),category(inter2,
       - intersection)],_216235,_216236)
Trying: modifier(entity(1,inter2),[inter2],_216233,[called(inter2,Lowell Street),category(inter2,
         - intersection)],_216235,_216236)
New edge added
Trying: modifier(entity(1,inter2),[inter2],_216233,[called(inter2,Lowell Street),category(inter2,
         - intersection)],_216235,_216236)
New edge added

Expanding (step 1  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_217512)
Need: salient_attrib(entity(1,inter2),_217428,[called(inter2,Lowell Street),category(inter2,
       - intersection)],_217430)
<ma> salient_attrib(entity(1,inter2),_217428,[called(inter2,Lowell Street),category(inter2,
       - intersection)],_217430)
*** failed ***
No edges added

Expanding (step 2  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_217288)
Need: salient_attrib_rel(entity(1,inter2),_217180,_217181,[called(inter2,Lowell Street),category(
       - inter2,intersection)],_217183)
<ma> salient_attrib_rel(entity(1,inter2),_217180,_217181,[called(inter2,Lowell Street),category(inter2
       - ,intersection)],_217183)
New edge added

Expanding (step 3  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_219301)
Need: s-attrib-rel(entity(1,inter2),entity(4,lights1),_219188^_219191^has(_219188,_219191))
```

```
Trying: s-attrib-rel(entity(1,inter2),entity(4,lights1),_219188^_219191^has(_219188,_219191))
<con>has(inter2,lights1)
New edge added

Expanding (step 4  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_220716)
Need: ref(entity(4,lights1),_220619)
<ma> ref(entity(4,lights1),_220619)
New edge added

Expanding (step 5  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_222247)
Need: subset([inter2],_222167^ab(system,user,apply(apply(_222180^_222183^has(_222180,_222183),
       - _222167),lights1)),_222163)
<ma> subset([inter2],_222167^ab(system,user,apply(apply(_222180^_222183^has(_222180,_222183),
       - _222167),lights1)),_222163)
New edge added

Expanding (step 6  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_223914)
Need: refer(entity(4,lights1),_223863)
Trying: refer(entity(4,lights1),_223863)
New edge added

Expanding (step 7  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_225436)
Need: s-refer(entity(4,lights1))
Trying: s-refer(entity(4,lights1))
New edge added

Expanding (step 8  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_227098)
Need: describe(entity(4,lights1),_227047)
Trying: describe(entity(4,lights1),_227047)
New edge added

Expanding (step 9  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_228831)
Need: context_current(_228753)
<ma> context_current(_228753)
New edge added

Expanding (step 10  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_231704)
Need: headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
```

```
       - 4,lights1),_231618,_231619,_231620)
Trying: headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
         - 4,lights1),_231618,_231619,_231620)
New edge added

Expanding (step 11  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_233883)
Need: s-attrib(entity(4,lights1),_233739^category(_233739,_233743))
Trying: s-attrib(entity(4,lights1),_233739^category(_233739,_233743))
<con>category(lights1,_233743)
New edge added

Expanding (step 12  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_236192)
Need: subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_236082^ab(system,
       - user,category(_236082,traffic_lights)),_236062)
<ma> subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_236082^ab(system,
       - user,category(_236082,traffic_lights)),_236062)
New edge added

Expanding (step 13  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_238825)
Need: ref(entity(4,lights1),_238730)
<ma> ref(entity(4,lights1),_238730)
New edge added

Expanding (step 14  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_241248)
Need: _241164=[category(lights1,traffic_lights)]
<ma> _241164=[category(lights1,traffic_lights)]
New edge added

Expanding (step 15  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_243651)
Need: confidence_headnoun(_243576,entity(4,lights1),traffic_lights)
<ma> confidence_headnoun(_243576,entity(4,lights1),traffic_lights)
New edge added

Expanding (step 16  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_247119)
Need: modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights)],2,_247061)
Trying: modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights)],2,_247061)
New edge added
Trying: modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights)],2,2)
<con>[lights1]=[lights1]
<con>confidence_exceed(entity(4,lights1),2)
New edge added
```

```
Expanding (step 17  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_249621)
Need: null
New edge added

Expanding (step 18  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_250450)
Need: modifier(entity(4,lights1),[lights1],_250364,[category(lights1,traffic_lights)],_250366,
       - _250367)
Trying: modifier(entity(4,lights1),[lights1],_250364,[category(lights1,traffic_lights)],_250366,
         - _250367)
New edge added
Trying: modifier(entity(4,lights1),[lights1],_250364,[category(lights1,traffic_lights)],_250366,
         - _250367)
New edge added

Expanding (step 19  active 3)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_252857)
Need: confidence_attrib_rel(_252817,entity(1,inter2),entity(4,lights1),_252828^_252831^has(
       - _252828,_252831))
<ma> confidence_attrib_rel(_252817,entity(1,inter2),entity(4,lights1),_252828^_252831^has(
       - _252828,_252831))
New edge added

Expanding (step 20  active 3)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_256555)
Need: salient_attrib(entity(4,lights1),_256425,[category(lights1,traffic_lights)],_256427)
<ma> salient_attrib(entity(4,lights1),_256425,[category(lights1,traffic_lights)],_256427)
*** failed ***
No edges added

Expanding (step 21  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_255658)
Need: salient_attrib_rel(entity(4,lights1),_255504,_255505,[category(lights1,traffic_lights)],
       - _255507)
<ma> salient_attrib_rel(entity(4,lights1),_255504,_255505,[category(lights1,traffic_lights)],
       - _255507)
*** failed ***
No edges added

Expanding (step 22  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_259150)
Need: confidence_add(_259136,3,3)
<ma> confidence_add(_259136,3,3)
New edge added
```

```
Expanding (step 23  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_263513)
Need: modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,Lowell Street),category(
       - inter2,intersection)],6,_263513)
Trying: modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,Lowell Street),category
         - (inter2,intersection)],6,_263513)
New edge added
Trying: modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,Lowell Street),category
         - (inter2,intersection)],6,6)
<con>[inter2]=[inter2]
<con>confidence_exceed(entity(1,inter2),6)
*** failed ***

Expanding (step 24  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_266214)
Need: modifier(entity(1,inter2),[inter2],_266169,[has(inter2,lights1),called(inter2,Lowell Street),
       - category(inter2,intersection)],_266171,_266172)
Trying: modifier(entity(1,inter2),[inter2],_266169,[has(inter2,lights1),called(inter2,Lowell Street),
         - category(inter2,intersection)],_266171,_266172)
New edge added
Trying: modifier(entity(1,inter2),[inter2],_266169,[has(inter2,lights1),called(inter2,Lowell Street),
         - category(inter2,intersection)],_266171,_266172)
New edge added

Expanding (step 25  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_270073)
Need: salient_attrib(entity(1,inter2),_269984,[has(inter2,lights1),called(inter2,Lowell Street),
       - category(inter2,intersection)],_269986)
<ma> salient_attrib(entity(1,inter2),_269984,[has(inter2,lights1),called(inter2,Lowell Street),
       - category(inter2,intersection)],_269986)
*** failed ***
No edges added

Expanding (step 26  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_269138)
Need: salient_attrib_rel(entity(1,inter2),_269025,_269026,[has(inter2,lights1),called(inter2,
       - Lowell Street),category(inter2,intersection)],_269028)
<ma> salient_attrib_rel(entity(1,inter2),_269025,_269026,[has(inter2,lights1),called(inter2,
       - Lowell Street),category(inter2,intersection)],_269028)
New edge added

Expanding (step 27  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_273830)
Need: s-attrib-rel(entity(1,inter2),entity(6,sign1),_273717^_273720^has(_273717,_273720))
Trying: s-attrib-rel(entity(1,inter2),entity(6,sign1),_273717^_273720^has(_273717,_273720))
<con>has(inter2,sign1)
New edge added

Expanding (step 28  active 1)
```

```
----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_277151)
Need: ref(entity(6,sign1),_277054)
<ma> ref(entity(6,sign1),_277054)
New edge added

Expanding (step 29  active 1)
----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_281634)
Need: subset([inter2],_281554^ab(system,user,apply(apply(_281567^_281570^has(_281567,_281570),
       - _281554),sign1)),_281550)
<ma> subset([inter2],_281554^ab(system,user,apply(apply(_281567^_281570^has(_281567,_281570),
       - _281554),sign1)),_281550)
New edge added

Expanding (step 30  active 1)
----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_285211)
Need: refer(entity(6,sign1),_285160)
Trying: refer(entity(6,sign1),_285160)
New edge added

Expanding (step 31  active 1)
----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_288643)
Need: s-refer(entity(6,sign1))
Trying: s-refer(entity(6,sign1))
New edge added

Expanding (step 32  active 1)
----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_292215)
Need: describe(entity(6,sign1),_292164)
Trying: describe(entity(6,sign1),_292164)
New edge added

Expanding (step 33  active 1)
----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_296901)
Need: context_current(_296823)
<ma> context_current(_296823)
New edge added

Expanding (step 34  active 1)
----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_300630)
Need: headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
       - 6,sign1),_300544,_300545,_300546)
Trying: headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
         - 6,sign1),_300544,_300545,_300546)
New edge added
```

```
Expanding (step 35  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_304719)
Need: s-attrib(entity(6,sign1),_304575^category(_304575,_304579))
Trying: s-attrib(entity(6,sign1),_304575^category(_304575,_304579))
<con>category(sign1,_304579)
New edge added

Expanding (step 36  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_308938)
Need: subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_308828^ab(system,
       - user,category(_308828,sign)),_308808)
<ma> subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_308828^ab(system,
       - user,category(_308828,sign)),_308808)
New edge added

Expanding (step 37  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_314532)
Need: ref(entity(6,sign1),_314437)
<ma> ref(entity(6,sign1),_314437)
New edge added

Expanding (step 38  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_318865)
Need: _318781=[category(sign1,sign)]
<ma> _318781=[category(sign1,sign)]
New edge added

Expanding (step 39  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_323178)
Need: confidence_headnoun(_323103,entity(6,sign1),sign)
<ma> confidence_headnoun(_323103,entity(6,sign1),sign)
New edge added

Expanding (step 40  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_328556)
Need: modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],1,_328498)
Trying: modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],1,_328498)
New edge added
Trying: modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],1,1)
<con>[sign1]=[sign1]
<con>confidence_exceed(entity(6,sign1),1)
New edge added

Expanding (step 41  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_332968)
```

```
Need: null
New edge added

Expanding (step 42  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_334523)
Need: modifier(entity(6,sign1),[sign1],_334437,[category(sign1,sign)],_334439,_334440)
Trying: modifier(entity(6,sign1),[sign1],_334437,[category(sign1,sign)],_334439,_334440)
New edge added
Trying: modifier(entity(6,sign1),[sign1],_334437,[category(sign1,sign)],_334439,_334440)
New edge added

Expanding (step 43  active 3)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_338840)
Need: confidence_attrib_rel(_338800,entity(1,inter2),entity(6,sign1),_338811^_338814^has(
       - _338811,_338814))
<ma> confidence_attrib_rel(_338800,entity(1,inter2),entity(6,sign1),_338811^_338814^has(_338811,
       - _338814))
New edge added

Expanding (step 44  active 3)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_346214)
Need: salient_attrib(entity(6,sign1),_346084,[category(sign1,sign)],_346086)
<ma> salient_attrib(entity(6,sign1),_346084,[category(sign1,sign)],_346086)
*** failed ***
No edges added

Expanding (step 45  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_344591)
Need: salient_attrib_rel(entity(6,sign1),_343395,_343396,[category(sign1,sign)],_343398)
<ma> salient_attrib_rel(entity(6,sign1),_343395,_343396,[category(sign1,sign)],_343398)
*** failed ***
No edges added

Expanding (step 46  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_350717)
Need: confidence_add(_350703,6,2)
<ma> confidence_add(_350703,6,2)
New edge added

Expanding (step 47  active 1)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,_355940)
Need: modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1),called(inter2,
       - Lowell Street),category(inter2,intersection)],8,_355940)
Trying: modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1),called(inter2,
         - Lowell Street),category(inter2,intersection)],8,_355940)
New edge added
Trying: modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1),called(inter2,
```

```
         - Lowell Street),category(inter2,intersection)],8,8)
<con>[inter2]=[inter2]
<con>confidence_exceed(entity(1,inter2),8)
New edge added

Expanding (step 48  active 2)
-----------------------------
Head: modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
       - ,3,8)
Need: null
New edge added

Returning from recursive call to construct

Expanding (step 1  active 1)
-----------------------------
Head: expand-plan(p1)
Need: substitute(p1,p53,V1,_216120,V2)
      V1=modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,
          - intersection)],3,8)
         +-modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),category(inter2,
         |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
         |  - intersection)],3)
         | +-salient_attrib_rel(entity(1,inter2),entity(4,lights1),_216225^_216228^has(_216225,
         | |  - _216228),[called(inter2,Lowell Street),category(inter2,intersection)],[has(inter2,
         | |  - lights1),called(inter2,Lowell Street),category(inter2,intersection)])
         | +-s-attrib-rel(entity(1,inter2),entity(4,lights1),_216225^_216228^has(_216225,
         | |  - _216228))
         | +-ref(entity(4,lights1),lights1)
         | +-subset([inter2],_216349^ab(system,user,apply(apply(_216225^_216228^has(_216225,
         | |  - _216228),_216349),lights1)),[inter2])
         | +-refer(entity(4,lights1),2)
         | | +-s-refer(entity(4,lights1))
         | | +-describe(entity(4,lights1),2)
         | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
         | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
         | |   |  - 4,lights1),[lights1],[category(lights1,traffic_lights)],2)
         | |   | +-s-attrib(entity(4,lights1),_216523^category(_216523,traffic_lights))
         | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
         | |   | |  - _216523^ab(system,user,category(_216523,traffic_lights)),[lights1])
         | |   | +-ref(entity(4,lights1),lights1)
         | |   | +-[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)]
         | |   | +-confidence_headnoun(2,entity(4,lights1),traffic_lights)
         | |   +-modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
         | |      - 2,2)
         | |     +-null
         | +-confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_216225^_216228^has(
         |    - _216225,_216228))
         +-confidence_add(6,3,3)
         +-modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,Lowell Street),
            - category(inter2,intersection)],6,8)
           +-modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(inter2,
           |  - Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),
           |  - called(inter2,Lowell Street),category(inter2,intersection)],2)
           | +-salient_attrib_rel(entity(1,inter2),entity(6,sign1),_216849^_216852^has(_216849,
           | |  - _216852),[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
           | |  - intersection)],[has(inter2,sign1),has(inter2,lights1),called(inter2,Lowell Street),
           | |  - category(inter2,intersection)])
           | +-s-attrib-rel(entity(1,inter2),entity(6,sign1),_216849^_216852^has(_216849,
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        | |  - _216852))
        | +-ref(entity(6,sign1),sign1)
        | +-subset([inter2],_216983^ab(system,user,apply(apply(_216849^_216852^has(_216849,
        | |  - _216852),_216983),sign1)),[inter2])
        | +-refer(entity(6,sign1),1)
        | | +-s-refer(entity(6,sign1))
        | | +-describe(entity(6,sign1),1)
        | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2
        | |   |  - ])
        | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
        | |   |  - entity(6,sign1),[sign1],[category(sign1,sign)],1)
        | |   | +-s-attrib(entity(6,sign1),_217157^category(_217157,sign))
        | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
        | |   | |  - _217157^ab(system,user,category(_217157,sign)),[sign1])
        | |   | +-ref(entity(6,sign1),sign1)
        | |   | +-[category(sign1,sign)]=[category(sign1,sign)]
        | |   | +-confidence_headnoun(1,entity(6,sign1),sign)
        | |   +-modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],1,1)
        | |     +-null
        | +-confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_216849^_216852^has(
        |    - _216849,_216852))
        +-confidence_add(8,6,2)
        +-modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1),called(inter2,
           - Lowell Street),category(inter2,intersection)],8,8)
          +-null
      V2=s-attrib(entity(6,sign1),_217157^category(_217157,sign))
         s-refer(entity(6,sign1))
         s-attrib-rel(entity(1,inter2),entity(6,sign1),_216849^_216852^has(_216849,_216852))
         s-attrib(entity(4,lights1),_216523^category(_216523,traffic_lights))
         s-refer(entity(4,lights1))
         s-attrib-rel(entity(1,inter2),entity(4,lights1),_216225^_216228^has(_216225,_216228))
<ma> substitute(p1,p53,V1,_216120,V2)
      V1=modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,
          - intersection)],3,8)
         +-modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),category(inter2,
         |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
         |  - intersection)],3)
         | +-salient_attrib_rel(entity(1,inter2),entity(4,lights1),_216225^_216228^has(_216225,
         | |  - _216228),[called(inter2,Lowell Street),category(inter2,intersection)],[has(inter2,
         | |  - lights1),called(inter2,Lowell Street),category(inter2,intersection)])
         | +-s-attrib-rel(entity(1,inter2),entity(4,lights1),_216225^_216228^has(_216225,
         | |  - _216228))
         | +-ref(entity(4,lights1),lights1)
         | +-subset([inter2],_216349^ab(system,user,apply(apply(_216225^_216228^has(_216225,
         | |  - _216228),_216349),lights1)),[inter2])
         | +-refer(entity(4,lights1),2)
         | | +-s-refer(entity(4,lights1))
         | | +-describe(entity(4,lights1),2)
         | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
         | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
         | |   |  - 4,lights1),[lights1],[category(lights1,traffic_lights)],2)
         | |   | +-s-attrib(entity(4,lights1),_216523^category(_216523,traffic_lights))
         | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
         | |   | |  - _216523^ab(system,user,category(_216523,traffic_lights)),[lights1])
         | |   | +-ref(entity(4,lights1),lights1)
         | |   | +-[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)]
         | |   | +-confidence_headnoun(2,entity(4,lights1),traffic_lights)
         | |   +-modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
         | |      - 2,2)
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        | |     +-null
        | +-confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_216225^_216228^has(
        |    - _216225,_216228))
        +-confidence_add(6,3,3)
        +-modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,Lowell Street),
           - category(inter2,intersection)],6,8)
          +-modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(inter2,
          |  - Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),
          |  - called(inter2,Lowell Street),category(inter2,intersection)],2)
          | +-salient_attrib_rel(entity(1,inter2),entity(6,sign1),_216849^_216852^has(_216849,
          | |  - _216852),[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
          | |  - intersection)],[has(inter2,sign1),has(inter2,lights1),called(inter2,Lowell Street),
          | |  - category(inter2,intersection)])
          | +-s-attrib-rel(entity(1,inter2),entity(6,sign1),_216849^_216852^has(_216849,
          | |  - _216852))
          | +-ref(entity(6,sign1),sign1)
          | +-subset([inter2],_216983^ab(system,user,apply(apply(_216849^_216852^has(_216849,
          | |  - _216852),_216983),sign1)),[inter2])
          | +-refer(entity(6,sign1),1)
          | | +-s-refer(entity(6,sign1))
          | | +-describe(entity(6,sign1),1)
          | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2
          | |   |  - ])
          | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
          | |   |  - entity(6,sign1),[sign1],[category(sign1,sign)],1)
          | |   | +-s-attrib(entity(6,sign1),_217157^category(_217157,sign))
          | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
          | |   | |  - _217157^ab(system,user,category(_217157,sign)),[sign1])
          | |   | +-ref(entity(6,sign1),sign1)
          | |   | +-[category(sign1,sign)]=[category(sign1,sign)]
          | |   | +-confidence_headnoun(1,entity(6,sign1),sign)
          | |   +-modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],1,1)
          | |     +-null
          | +-confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_216849^_216852^has(
          |    - _216849,_216852))
          +-confidence_add(8,6,2)
          +-modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1),called(inter2,
             - Lowell Street),category(inter2,intersection)],8,8)
            +-null
     V2=s-attrib(entity(6,sign1),_217157^category(_217157,sign))
        s-refer(entity(6,sign1))
        s-attrib-rel(entity(1,inter2),entity(6,sign1),_216849^_216852^has(_216849,_216852))
        s-attrib(entity(4,lights1),_216523^category(_216523,traffic_lights))
        s-refer(entity(4,lights1))
        s-attrib-rel(entity(1,inter2),entity(4,lights1),_216225^_216228^has(_216225,_216228))
New edge added

Expanding (step 2  active 1)
----------------------------
Head: expand-plan(p1)
Need: evaluate(V1)
     V1=_238042:describe-route(_238054)
        +-_238096:directions(_238085,_238078,_238092)
          +-_238124:direction(_238085,_238119,_238138)
          | +-_238168:ref(entity(1,inter2),_238161)
          | +-_238179:s-goto(entity(1,inter2))
          | +-_238251:set_context(_238148,_238161,_238149,_238150)
          | +-_238261:refer(entity(1,inter2),8)
          | | +-_238295:s-refer(entity(1,inter2))
```

```
| | +-_238314:describe(entity(1,inter2),8)
| |   +-_238334:context_current(_238337)
| |   +-_238341:headnoun(_238337,entity(1,inter2),_238355,_238356,_238357)
| |   | +-_238378:s-attrib(entity(1,inter2),_238396^category(_238396,intersection))
| |   | +-_238455:subset(_238337,_238396^ab(_238367,_238374,category(_238396,intersection))
| |   | |  - ,_238355)
| |   | +-_238474:ref(entity(1,inter2),_238478)
| |   | +-_238485:_238356=[category(_256867,intersection)]
| |   | +-_238498:confidence_headnoun(_238357,entity(1,inter2),intersection)
| |   +-_238510:modifiers(entity(1,inter2),_238355,_238356,_238357,8)
| |     +-_238533:modifier(entity(1,inter2),_238355,[inter2],_238356,[called(inter2,
| |     |  - Lowell Street),category(inter2,intersection)],_238550)
| |     | +-_238583:salient_attrib(entity(1,inter2),_238594^called(_238594,Lowell Street),
| |     | |  - _238356,[called(inter2,Lowell Street),category(inter2,intersection)])
| |     | +-_238612:s-attrib(entity(1,inter2),_238594^called(_238594,Lowell Street))
| |     | +-_238689:subset(_238355,_238696^ab(_238572,_238579,apply(_238594^called(
| |     | |  - _238594,Lowell Street),_238696)),[inter2])
| |     | +-_238716:confidence_attrib(_238550,entity(1,inter2),_238594^called(
| |     |    - _238594,Lowell Street))
| |     +-_238734:confidence_add(3,_238357,_238550)
| |     +-_238743:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),
| |        - category(inter2,intersection)],3,8)
| |       +-_238778:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,
| |       |  - Lowell Street),category(inter2,intersection)],[has(inter2,lights1),called(
| |       |  - inter2,Lowell Street),category(inter2,intersection)],3)
| |       | +-_238845:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_238860^
| |       | |  - _238863^has(_238860,_238863),[called(inter2,Lowell Street),category(inter2
| |       | |  - ,intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category
| |       | |  - (inter2,intersection)])
| |       | +-_238896:s-attrib-rel(entity(1,inter2),entity(4,lights1),_238860^
| |       | |  - _238863^has(_238860,_238863))
| |       | +-_238991:ref(entity(4,lights1),lights1)
| |       | +-_239002:subset([inter2],_239011^ab(system,user,apply(apply(_238860^
| |       | |  - _238863^has(_238860,_238863),_239011),lights1)),[inter2])
| |       | +-_239037:refer(entity(4,lights1),2)
| |       | | +-_239071:s-refer(entity(4,lights1))
| |       | | +-_239090:describe(entity(4,lights1),2)
| |       | |   +-_239110:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,
| |       | |   |  - sign1,street1,street2])
| |       | |   +-_239135:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |       | |   |  - street1,street2],entity(4,lights1),[lights1],[category(lights1,
| |       | |   |  - traffic_lights)],2)
| |       | |   | +-_239197:s-attrib(entity(4,lights1),_239215^category(_239215,
| |       | |   | |  - traffic_lights))
| |       | |   | +-_239274:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |       | |   | |  - street1,street2],_239215^ab(system,user,category(_239215,
| |       | |   | |  - traffic_lights)),[lights1])
| |       | |   | +-_239313:ref(entity(4,lights1),lights1)
| |       | |   | +-_239324:[category(lights1,traffic_lights)]=[category(lights1,
| |       | |   | |  - traffic_lights)]
| |       | |   | +-_239342:confidence_headnoun(2,entity(4,lights1),traffic_lights)
| |       | |   +-_239354:modifiers(entity(4,lights1),[lights1],[category(lights1,
| |       | |      - traffic_lights)],2,2)
| |       | |     +-_239418:null
| |       | +-_239441:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),
| |       |    - _238860^_238863^has(_238860,_238863))
| |       +-_239466:confidence_add(6,3,3)
| |       +-_239475:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
| |          - Lowell Street),category(inter2,intersection)],6,8)
```

```
| |         +-_239515:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),
| |         |  - called(inter2,Lowell Street),category(inter2,intersection)],[has(inter2,
| |         |  - sign1),has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
| |         |  - intersection)],2)
| |         | +-_239592:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_239607^
| |         | |  - _239610^has(_239607,_239610),[has(inter2,lights1),called(inter2,
| |         | |  - Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
| |         | |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,
| |         | |  - intersection)])
| |         | +-_239653:s-attrib-rel(entity(1,inter2),entity(6,sign1),_239607^
| |         | |  - _239610^has(_239607,_239610))
| |         | +-_239748:ref(entity(6,sign1),sign1)
| |         | +-_239759:subset([inter2],_239768^ab(system,user,apply(apply(_239607^
| |         | |  - _239610^has(_239607,_239610),_239768),sign1)),[inter2])
| |         | +-_239794:refer(entity(6,sign1),1)
| |         | | +-_239828:s-refer(entity(6,sign1))
| |         | | +-_239847:describe(entity(6,sign1),1)
| |         | |   +-_239867:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,
| |         | |   |  - sign1,street1,street2])
| |         | |   +-_239892:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |         | |   |  - street1,street2],entity(6,sign1),[sign1],[category(sign1,sign)],
| |         | |   |  - 1)
| |         | |   | +-_239954:s-attrib(entity(6,sign1),_239972^category(_239972,sign))
| |         | |   | +-_240031:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |         | |   | |  - street1,street2],_239972^ab(system,user,category(_239972,sign)),[
| |         | |   | |  - sign1])
| |         | |   | +-_240070:ref(entity(6,sign1),sign1)
| |         | |   | +-_240081:[category(sign1,sign)]=[category(sign1,sign)]
| |         | |   | +-_240099:confidence_headnoun(1,entity(6,sign1),sign)
| |         | |   +-_240111:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
| |         | |      - 1,1)
| |         | |     +-_240175:null
| |         | +-_240198:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),
| |         |    - _239607^_239610^has(_239607,_239610))
| |         +-_240223:confidence_add(8,6,2)
| |         +-_240232:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,
| |            - lights1),called(inter2,Lowell Street),category(inter2,intersection)],
| |            - 8,8)
| |           +-_240311:null
| +-_240334:_238138=here(_238161,_238149,_238150)
+-_240346:directions(_238138,_238120,_238092)
  +-_240380:null
```

```
Invoking evaluate from construct

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Evaluate
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<con> _238078=[_315387|_315392]
<con> here(exit1,street1,+(1))=here(_238148,_238149,_238150)
<con> _238119=goto(exit1,_238161,street1,+(1),_238164)
<ma>  ref(entity(1,inter2),_238161)
<con> place(inter2,_238227,_238228)
<ma>  set_context(exit1,inter2,street1,+(1))
<ma>  context_current(_238337)
<con> category(inter2,intersection)
<ma>  subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_238396^ab(system,
       - user,category(_238396,intersection)),_238355)
```

```
<ma>  ref(entity(1,inter2),_238478)
<ma>  _238356=[category(inter2,intersection)]
<ma>  confidence_headnoun(_238357,entity(1,inter2),intersection)
<ma>  salient_attrib(entity(1,inter2),_238594^called(_238594,Lowell Street),[category(inter2,
       - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)])
<con> called(inter2,Lowell Street)
<ma>  subset([inter1,inter2],_238696^ab(system,user,called(_238696,Lowell Street)),[inter2])
<ma>  confidence_attrib(_238550,entity(1,inter2),_238594^called(_238594,Lowell Street))
<ma>  confidence_add(3,1,2)
<ma>  salient_attrib_rel(entity(1,inter2),entity(4,lights1),_238860^_238863^has(_238860,_238863),[
       - called(inter2,Lowell Street),category(inter2,intersection)],[has(inter2,lights1),called(
       - inter2,Lowell Street),category(inter2,intersection)])
<con> has(inter2,lights1)
<ma>  ref(entity(4,lights1),lights1)
<ma>  subset([inter2],_239011^ab(system,user,has(_239011,lights1)),[inter2])
<ma>  context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
<con> category(lights1,traffic_lights)
<ma>  subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_239215^ab(system,
       - user,category(_239215,traffic_lights)),[lights1])
<ma>  ref(entity(4,lights1),lights1)
<ma>  [category(lights1,traffic_lights)]=[category(lights1,traffic_lights)]
<ma>  confidence_headnoun(2,entity(4,lights1),traffic_lights)
<con> [lights1]=[lights1]
<con> confidence_exceed(entity(4,lights1),2)
<ma>  confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_238860^_238863^has(_238860,
       - _238863))
<ma>  confidence_add(6,3,3)
<ma>  salient_attrib_rel(entity(1,inter2),entity(6,sign1),_239607^_239610^has(_239607,_239610),[has(
       - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1
       - ),has(inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)])
<con> has(inter2,sign1)
<ma>  ref(entity(6,sign1),sign1)
<ma>  subset([inter2],_239768^ab(system,user,has(_239768,sign1)),[inter2])
<ma>  context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
<con> category(sign1,sign)
<ma>  subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],_239972^ab(system,
       - user,category(_239972,sign)),[sign1])
<ma>  ref(entity(6,sign1),sign1)
<ma>  [category(sign1,sign)]=[category(sign1,sign)]
<ma>  confidence_headnoun(1,entity(6,sign1),sign)
<con> [sign1]=[sign1]
<con> confidence_exceed(entity(6,sign1),1)
<ma>  confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_239607^_239610^has(_239607,
       - _239610))
<ma>  confidence_add(8,6,2)
<con> [inter2]=[inter2]
<con> confidence_exceed(entity(1,inter2),8)
<ma>  _238138=here(inter2,street1,+(1))
<con> here(inter2,street1,+(1))=here(inter2,street1,+(1))
<con> _238120=[]


Returning from call to evaluate

Expanding (step 3  active 1)
----------------------------
Head: expand-plan(p1)
Need: respond-to-suggestion(p1,[s-attrib-rel(entity(1,inter2),entity(_319561,_319562),_319564^
       - _319567^has(_319564,_319567)),s-refer(entity(_319561,_319562)),s-attrib(entity(_319561,
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       - _319562),_319588^category(_319588,sign))],[s-attrib(entity(6,sign1),_319988^category(
       - _319988,sign)),s-refer(entity(6,sign1)),s-attrib-rel(entity(1,inter2),entity(6,sign1),
       - _320013^_320016^has(_320013,_320016)),s-attrib(entity(4,lights1),_320030^category(
       - _320030,traffic_lights)),s-refer(entity(4,lights1)),s-attrib-rel(entity(1,inter2),entity(
       - 4,lights1),_320055^_320058^has(_320055,_320058))])
Trying: respond-to-suggestion(p1,[s-attrib-rel(entity(1,inter2),entity(_367222,_367223),_367225^
         - _367228^has(_367225,_367228)),s-refer(entity(_367222,_367223)),s-attrib(entity(
         - _367222,_367223),_367249^category(_367249,sign))],[s-attrib(entity(6,sign1),_367649^
         - category(_367649,sign)),s-refer(entity(6,sign1)),s-attrib-rel(entity(1,inter2),entity(
         - 6,sign1),_367674^_367677^has(_367674,_367677)),s-attrib(entity(4,lights1),_367691^category(
         - _367691,traffic_lights)),s-refer(entity(4,lights1)),s-attrib-rel(entity(1,inter2),entity(
         - 4,lights1),_367716^_367719^has(_367716,_367719))])
<con>seteq([s-attrib-rel(entity(1,inter2),entity(_368564,_368565),_368567^_368570^has(_368567,
       - _368570)),s-refer(entity(_368564,_368565)),s-attrib(entity(_368564,_368565),_368591^category(
       - _368591,sign))],[s-attrib(entity(6,sign1),_369009^category(_369009,sign)),s-refer(entity(
       - 6,sign1)),s-attrib-rel(entity(1,inter2),entity(6,sign1),_369034^_369037^has(_369034,
       - _369037)),s-attrib(entity(4,lights1),_369051^category(_369051,traffic_lights)),s-refer(entity
       - (4,lights1)),s-attrib-rel(entity(1,inter2),entity(4,lights1),_369076^_369079^has(
       - _369076,_369079))])
*** failed ***
Trying: respond-to-suggestion(p1,[s-attrib-rel(entity(1,inter2),entity(_367233,_367234),_367236^
         - _367239^has(_367236,_367239)),s-refer(entity(_367233,_367234)),s-attrib(entity(
         - _367233,_367234),_367260^category(_367260,sign))],[s-attrib(entity(6,sign1),_367660^
         - category(_367660,sign)),s-refer(entity(6,sign1)),s-attrib-rel(entity(1,inter2),entity(
         - 6,sign1),_367685^_367688^has(_367685,_367688)),s-attrib(entity(4,lights1),_367702^category(
         - _367702,traffic_lights)),s-refer(entity(4,lights1)),s-attrib-rel(entity(1,inter2),entity(
         - 4,lights1),_367727^_367730^has(_367727,_367730))])
<con>psubset([s-attrib-rel(entity(1,inter2),entity(_368575,_368576),_368578^_368581^has(_368578,
       - _368581)),s-refer(entity(_368575,_368576)),s-attrib(entity(_368575,_368576),_368602^category(
       - _368602,sign))],[s-attrib(entity(6,sign1),_369020^category(_369020,sign)),s-refer(entity(
       - 6,sign1)),s-attrib-rel(entity(1,inter2),entity(6,sign1),_369045^_369048^has(_369045,
       - _369048)),s-attrib(entity(4,lights1),_369062^category(_369062,traffic_lights)),s-refer(entity
       - (4,lights1)),s-attrib-rel(entity(1,inter2),entity(4,lights1),_369087^_369090^has(
       - _369087,_369090))])
New edge added
Trying: respond-to-suggestion(p1,[s-attrib-rel(entity(1,inter2),entity(_367229,_367230),_367232^
         - _367235^has(_367232,_367235)),s-refer(entity(_367229,_367230)),s-attrib(entity(
         - _367229,_367230),_367256^category(_367256,sign))],[s-attrib(entity(6,sign1),_367656^
         - category(_367656,sign)),s-refer(entity(6,sign1)),s-attrib-rel(entity(1,inter2),entity(
         - 6,sign1),_367681^_367684^has(_367681,_367684)),s-attrib(entity(4,lights1),_367698^category(
         - _367698,traffic_lights)),s-refer(entity(4,lights1)),s-attrib-rel(entity(1,inter2),entity(
         - 4,lights1),_367723^_367726^has(_367723,_367726))])
<con>not(subset([s-attrib-rel(entity(1,inter2),entity(_368588,_368589),_368591^_368594^has(
       - _368591,_368594)),s-refer(entity(_368588,_368589)),s-attrib(entity(_368588,_368589),
       - _368615^category(_368615,sign))],[s-attrib(entity(6,sign1),_369017^category(_369017,sign)),
       - s-refer(entity(6,sign1)),s-attrib-rel(entity(1,inter2),entity(6,sign1),_369042^_369045^has(
       - _369042,_369045)),s-attrib(entity(4,lights1),_369059^category(_369059,traffic_lights)),
       - s-refer(entity(4,lights1)),s-attrib-rel(entity(1,inter2),entity(4,lights1),_369084^
       - _369087^has(_369084,_369087))]))
*** failed ***

Expanding (step 4  active 1)
-----------------------------
Head: expand-plan(p1)
Need: partition([s-attrib(entity(6,sign1),_401580^category(_401580,sign)),s-refer(entity(
       - 6,sign1)),s-attrib-rel(entity(1,inter2),entity(6,sign1),_401605^_401608^has(_401605,
       - _401608)),s-attrib(entity(4,lights1),_401622^category(_401622,traffic_lights)),s-refer(entity
       - (4,lights1)),s-attrib-rel(entity(1,inter2),entity(4,lights1),_401647^_401650^has(
       - _401647,_401650))],[s-attrib-rel(entity(1,inter2),entity(6,sign1),_402431^_402434^has(
```

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       - _402431,_402434)),s-refer(entity(6,sign1)),s-attrib(entity(6,sign1),_402455^category(
       - _402455,sign))],_367143)
<ma> partition([s-attrib(entity(6,sign1),_449752^category(_449752,sign)),s-refer(entity(6,sign1)),
       - s-attrib-rel(entity(1,inter2),entity(6,sign1),_449777^_449780^has(_449777,_449780)),s-attrib(
       - entity(4,lights1),_449794^category(_449794,traffic_lights)),s-refer(entity(4,lights1)),
       - s-attrib-rel(entity(1,inter2),entity(4,lights1),_449819^_449822^has(_449819,_449822))],[
       - s-attrib-rel(entity(1,inter2),entity(6,sign1),_450641^_450644^has(_450641,_450644)),s-refer(
       - entity(6,sign1)),s-attrib(entity(6,sign1),_450665^category(_450665,sign))],_367143)
New edge added

Expanding (step 5  active 1)
-----------------------------
Head: expand-plan(p1)
Need: s-affirm(p1,V1)
      V1=s-attrib-rel(entity(1,inter2),entity(6,sign1),_449715^_449718^has(_449715,_449718))
         s-refer(entity(6,sign1))
         s-attrib(entity(6,sign1),_449739^category(_449739,sign))
Trying: s-affirm(p1,V1)
        V1=s-attrib-rel(entity(1,inter2),entity(6,sign1),_13667^_13670^has(_13667,_13670))
           s-refer(entity(6,sign1))
           s-attrib(entity(6,sign1),_13691^category(_13691,sign))
New edge added

Expanding (step 6  active 1)
-----------------------------
Head: expand-plan(p1)
Need: s-actions(p1,V1)
      V1=s-attrib(entity(4,lights1),_205938^category(_205938,traffic_lights))
         s-refer(entity(4,lights1))
         s-attrib-rel(entity(1,inter2),entity(4,lights1),_205963^_205966^has(_205963,_205966))
Trying: s-actions(p1,V1)
        V1=s-attrib(entity(4,lights1),_205938^category(_205938,traffic_lights))
           s-refer(entity(4,lights1))
           s-attrib-rel(entity(1,inter2),entity(4,lights1),_205963^_205966^has(_205963,_205966))
New edge added


Constructed Plan
----------------
expand-plan(p1)
 +-construct(modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,
 |  - intersection)],3,8),V1,V2,V3)
 | V1=modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
 |      - ,3,8)
 |     +-modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),category(inter2,
 |     |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
 |     |  - intersection)],3)
 |     | +-salient_attrib_rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,
 |     | |  - _271645),[called(inter2,Lowell Street),category(inter2,intersection)],[has(inter2,lights1
 |     | |  - ),called(inter2,Lowell Street),category(inter2,intersection)])
 |     | +-s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,_271645))
 |     | +-ref(entity(4,lights1),lights1)
 |     | +-subset([inter2],_272136^ab(system,user,apply(apply(_271642^_271645^has(_271642,
 |     | |  - _271645),_272136),lights1)),[inter2])
 |     | +-refer(entity(4,lights1),2)
 |     | | +-s-refer(entity(4,lights1))
 |     | | +-describe(entity(4,lights1),2)
 |     | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
 |     | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
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|     | |   |  - 4,lights1),[lights1],[category(lights1,traffic_lights)],2)
|     | |   | +-s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
|     | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|     | |   | |  - _271617^ab(system,user,category(_271617,traffic_lights)),[lights1])
|     | |   | +-ref(entity(4,lights1),lights1)
|     | |   | +-[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)]
|     | |   | +-confidence_headnoun(2,entity(4,lights1),traffic_lights)
|     | |   +-modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights)],2,
|     | |      - 2)
|     | |     +-null
|     | +-confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_271642^_271645^has(
|     | |    - _271642,_271645))
|     +-confidence_add(6,3,3)
|     +-modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,Lowell Street),category
|        - (inter2,intersection)],6,8)
|       +-modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(inter2,Lowell Street
|       |  - ),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),called(inter2,
|       |  - Lowell Street),category(inter2,intersection)],2)
|       | +-salient_attrib_rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,
|       | |  - _271671),[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection
|       | |  - )],[has(inter2,sign1),has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
|       | |  - intersection)])
|       | +-s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,_271671))
|       | +-ref(entity(6,sign1),sign1)
|       | +-subset([inter2],_272770^ab(system,user,apply(apply(_271668^_271671^has(_271668,
|       | |  - _271671),_272770),sign1)),[inter2])
|       | +-refer(entity(6,sign1),1)
|       | | +-s-refer(entity(6,sign1))
|       | | +-describe(entity(6,sign1),1)
|       | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
|       | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
|       | |   |  - 6,sign1),[sign1],[category(sign1,sign)],1)
|       | |   | +-s-attrib(entity(6,sign1),_271692^category(_271692,sign))
|       | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|       | |   | |  - _271692^ab(system,user,category(_271692,sign)),[sign1])
|       | |   | +-ref(entity(6,sign1),sign1)
|       | |   | +-[category(sign1,sign)]=[category(sign1,sign)]
|       | |   | +-confidence_headnoun(1,entity(6,sign1),sign)
|       | |   +-modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],1,1)
|       | |     +-null
|       | +-confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_271668^_271671^has(
|       | |    - _271668,_271671))
|       +-confidence_add(8,6,2)
|       +-modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1),called(inter2,
|          - Lowell Street),category(inter2,intersection)],8,8)
|         +-null
| V2=s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,_271671))
|     s-refer(entity(6,sign1))
|     s-attrib(entity(6,sign1),_271692^category(_271692,sign))
| V3=s-attrib(entity(6,sign1),_271692^category(_271692,sign))
|     s-refer(entity(6,sign1))
|     s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,_271671))
|     s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
|     s-refer(entity(4,lights1))
|     s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,_271645))
+-substitute(p1,p53,V1,V2,V3)
| V1=modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(inter2,intersection)]
|      - ,3,8)
|     +-modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),category(inter2,
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|     |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
|     |  - intersection)],3)
|     | +-salient_attrib_rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,
|     | |   - _271645),[called(inter2,Lowell Street),category(inter2,intersection)],[has(inter2,lights1
|     | |   - ),called(inter2,Lowell Street),category(inter2,intersection)])
|     | +-s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,_271645))
|     | +-ref(entity(4,lights1),lights1)
|     | +-subset([inter2],_272136^ab(system,user,apply(apply(_271642^_271645^has(_271642,
|     | |   - _271645),_272136),lights1)),[inter2])
|     | +-refer(entity(4,lights1),2)
|     | | +-s-refer(entity(4,lights1))
|     | | +-describe(entity(4,lights1),2)
|     | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
|     | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
|     | |   |   - 4,lights1),[lights1],[category(lights1,traffic_lights)],2)
|     | |   | +-s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
|     | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|     | |   | |   - _271617^ab(system,user,category(_271617,traffic_lights)),[lights1])
|     | |   | +-ref(entity(4,lights1),lights1)
|     | |   | +-[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)]
|     | |   | +-confidence_headnoun(2,entity(4,lights1),traffic_lights)
|     | |   +-modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights)],2,
|     | |       - 2)
|     | |     +-null
|     | +-confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_271642^_271645^has(
|     | |    - _271642,_271645))
|     +-confidence_add(6,3,3)
|     +-modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,Lowell Street),category
|        - (inter2,intersection)],6,8)
|       +-modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(inter2,Lowell Street
|       |   - ),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),called(inter2,
|       |   - Lowell Street),category(inter2,intersection)],2)
|       | +-salient_attrib_rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,
|       | |   - _271671),[has(inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection
|       | |   - )],[has(inter2,sign1),has(inter2,lights1),called(inter2,Lowell Street),category(inter2,
|       | |   - intersection)])
|       | +-s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,_271671))
|       | +-ref(entity(6,sign1),sign1)
|       | +-subset([inter2],_272770^ab(system,user,apply(apply(_271668^_271671^has(_271668,
|       | |   - _271671),_272770),sign1)),[inter2])
|       | +-refer(entity(6,sign1),1)
|       | | +-s-refer(entity(6,sign1))
|       | | +-describe(entity(6,sign1),1)
|       | |   +-context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2])
|       | |   +-headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],entity(
|       | |   |   - 6,sign1),[sign1],[category(sign1,sign)],1)
|       | |   | +-s-attrib(entity(6,sign1),_271692^category(_271692,sign))
|       | |   | +-subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|       | |   | |   - _271692^ab(system,user,category(_271692,sign)),[sign1])
|       | |   | +-ref(entity(6,sign1),sign1)
|       | |   | +-[category(sign1,sign)]=[category(sign1,sign)]
|       | |   | +-confidence_headnoun(1,entity(6,sign1),sign)
|       | |   +-modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],1,1)
|       | |     +-null
|       | +-confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_271668^_271671^has(
|       | |    - _271668,_271671))
|       +-confidence_add(8,6,2)
|       +-modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1),called(inter2,
|          - Lowell Street),category(inter2,intersection)],8,8)
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|         +-null
| V2=_274664:describe-route(route([goto(exit1,inter2,street1,+(1),_331832)]))
|     +-_274764:directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),_332153)],here(
|         - inter2,street1,+(1)))
|       +-_274832:direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),_274686),here(
|       |   - inter2,street1,+(1)))
|       | +-_274914:ref(entity(1,inter2),inter2)
|       | +-_274925:s-goto(entity(1,inter2))
|       | +-_275037:set_context(exit1,inter2,street1,+(1))
|       | +-_275049:refer(entity(1,inter2),8)
|       | | +-_275083:s-refer(entity(1,inter2))
|       | | +-_275102:describe(entity(1,inter2),8)
|       | |   +-_275122:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
|       | |   |   - street2])
|       | |   +-_275147:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|       | |   |   - entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
|       | |   | +-_275211:s-attrib(entity(1,inter2),_275229^category(_275229,intersection))
|       | |   | +-_275288:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|       | |   | |   - _275229^ab(system,user,category(_275229,intersection)),[inter1,inter2])
|       | |   | +-_275329:ref(entity(1,inter2),inter2)
|       | |   | +-_275340:[category(inter2,intersection)]=[category(inter2,intersection)]
|       | |   | +-_275358:confidence_headnoun(1,entity(1,inter2),intersection)
|       | |   +-_275370:modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],
|       | |       - 1,8)
|       | |     +-_275402:modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,
|       | |     |   - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)],
|       | |     |   - 2)
|       | |     | +-_275461:salient_attrib(entity(1,inter2),_275472^called(_275472,Lowell Street),[
|       | |     | |   - category(inter2,intersection)],[called(inter2,Lowell Street),category(inter2,
|       | |     | |   - intersection)])
|       | |     | +-_275495:s-attrib(entity(1,inter2),_275472^called(_275472,Lowell Street))
|       | |     | +-_275572:subset([inter1,inter2],_275583^ab(system,user,apply(_275472^called(
|       | |     | |   - _275472,Lowell Street),_275583)),[inter2])
|       | |     | +-_275603:confidence_attrib(2,entity(1,inter2),_275472^called(_275472,Lowell Street)
|       | |     |     - )
|       | |     +-_275621:confidence_add(3,1,2)
|       | |     +-_275630:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(
|       | |         - inter2,intersection)],3,8)
|       | |       +-_275665:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),
|       | |       |   - category(inter2,intersection)],[has(inter2,lights1),called(inter2,Lowell Street
|       | |       |   - ),category(inter2,intersection)],3)
|       | |       | +-_275732:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_271642^
|       | |       | |   - _271645^has(_271642,_271645),[called(inter2,Lowell Street),category(inter2,
|       | |       | |   - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(
|       | |       | |   - inter2,intersection)])
|       | |       | +-_275783:s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(
|       | |       | |   - _271642,_271645))
|       | |       | +-_275878:ref(entity(4,lights1),lights1)
|       | |       | +-_275889:subset([inter2],_272136^ab(system,user,apply(apply(_271642^
|       | |       | |   - _271645^has(_271642,_271645),_272136),lights1)),[inter2])
|       | |       | +-_275924:refer(entity(4,lights1),2)
|       | |       | | +-_275958:s-refer(entity(4,lights1))
|       | |       | | +-_275977:describe(entity(4,lights1),2)
|       | |       | |   +-_275997:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
|       | |       | |   |   - street1,street2])
|       | |       | |   +-_276022:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
|       | |       | |   |   - ,street2],entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
|       | |       | |   |   - 2)
|       | |       | |   | +-_276084:s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights
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|       | |         | |   | |  - ))
|       | |         | |   | +-_276161:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
|       | |         | |   | |  - ,street2],_271617^ab(system,user,category(_271617,traffic_lights)),[
|       | |         | |   | |  - lights1])
|       | |         | |   | +-_276200:ref(entity(4,lights1),lights1)
|       | |         | |   | +-_276211:[category(lights1,traffic_lights)]=[category(lights1,
|       | |         | |   | |  - traffic_lights)]
|       | |         | |   | +-_276229:confidence_headnoun(2,entity(4,lights1),traffic_lights)
|       | |         | |   +-_276241:modifiers(entity(4,lights1),[lights1],[category(lights1,
|       | |         | |      - traffic_lights)],2,2)
|       | |         | |     +-_276305:null
|       | |         | +-_276328:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),
|       | |         |    - _271642^_271645^has(_271642,_271645))
|       | |         +-_276353:confidence_add(6,3,3)
|       | |         +-_276362:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
|       | |            - Lowell Street),category(inter2,intersection)],6,8)
|       | |           +-_276402:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(
|       | |           |  - inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
|       | |           |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],
|       | |           |  - 2)
|       | |           | +-_276479:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_271668^
|       | |           | |  - _271671^has(_271668,_271671),[has(inter2,lights1),called(inter2,
|       | |           | |  - Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(inter2
|       | |           | |  - ,lights1),called(inter2,Lowell Street),category(inter2,intersection)])
|       | |           | +-_276540:s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(
|       | |           | |  - _271668,_271671))
|       | |           | +-_276635:ref(entity(6,sign1),sign1)
|       | |           | +-_276646:subset([inter2],_272770^ab(system,user,apply(apply(_271668^
|       | |           | |  - _271671^has(_271668,_271671),_272770),sign1)),[inter2])
|       | |           | +-_276681:refer(entity(6,sign1),1)
|       | |           | | +-_276715:s-refer(entity(6,sign1))
|       | |           | | +-_276734:describe(entity(6,sign1),1)
|       | |           | |   +-_276754:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,
|       | |           | |   |  - sign1,street1,street2])
|       | |           | |   +-_276779:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
|       | |           | |   |  - street1,street2],entity(6,sign1),[sign1],[category(sign1,sign)],
|       | |           | |   |  - 1)
|       | |           | |   | +-_276841:s-attrib(entity(6,sign1),_271692^category(_271692,sign))
|       | |           | |   | +-_276918:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
|       | |           | |   | |  - street1,street2],_271692^ab(system,user,category(_271692,sign)),[
|       | |           | |   | |  - sign1])
|       | |           | |   | +-_276957:ref(entity(6,sign1),sign1)
|       | |           | |   | +-_276968:[category(sign1,sign)]=[category(sign1,sign)]
|       | |           | |   | +-_276986:confidence_headnoun(1,entity(6,sign1),sign)
|       | |           | |   +-_276998:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
|       | |           | |      - 1,1)
|       | |           | |     +-_277062:null
|       | |           | +-_277085:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),
|       | |           |    - _271668^_271671^has(_271668,_271671))
|       | |           +-_277110:confidence_add(8,6,2)
|       | |           +-_277119:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,
|       | |              - lights1),called(inter2,Lowell Street),category(inter2,intersection)],
|       | |              - 8,8)
|       | |             +-_277198:null
|       | +-_277221:here(inter2,street1,+(1))=here(inter2,street1,+(1))
|       +-_277241:directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
|         +-_277299:null
| V3=s-attrib(entity(6,sign1),_271692^category(_271692,sign))
|    s-refer(entity(6,sign1))
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|    s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,_271671))
|    s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
|    s-refer(entity(4,lights1))
|    s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,_271645))
+-evaluate(V1)
| V1=_274664:describe-route(route([goto(exit1,inter2,street1,+(1),_369291)]))
|    +-_274764:directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),_369612)],here(
|        - inter2,street1,+(1)))
|      +-_274832:direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),_274686),here(
|      |   - inter2,street1,+(1)))
|      | +-_274914:ref(entity(1,inter2),inter2)
|      | +-_274925:s-goto(entity(1,inter2))
|      | +-_275037:set_context(exit1,inter2,street1,+(1))
|      | +-_275049:refer(entity(1,inter2),8)
|      | | +-_275083:s-refer(entity(1,inter2))
|      | | +-_275102:describe(entity(1,inter2),8)
|      | |   +-_275122:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
|      | |   |  - street2])
|      | |   +-_275147:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|      | |   |  - entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
|      | |   | +-_275211:s-attrib(entity(1,inter2),_275229^category(_275229,intersection))
|      | |   | +-_275288:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
|      | |   | |  - _275229^ab(system,user,category(_275229,intersection)),[inter1,inter2])
|      | |   | +-_275329:ref(entity(1,inter2),inter2)
|      | |   | +-_275340:[category(inter2,intersection)]=[category(inter2,intersection)]
|      | |   | +-_275358:confidence_headnoun(1,entity(1,inter2),intersection)
|      | |   +-_275370:modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],
|      | |      - 1,8)
|      | |     +-_275402:modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,
|      | |     |  - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)],
|      | |     |  - 2)
|      | |     | +-_275461:salient_attrib(entity(1,inter2),_275472^called(_275472,Lowell Street),[
|      | |     | |  - category(inter2,intersection)],[called(inter2,Lowell Street),category(inter2,
|      | |     | |  - intersection)])
|      | |     | +-_275495:s-attrib(entity(1,inter2),_275472^called(_275472,Lowell Street))
|      | |     | +-_275572:subset([inter1,inter2],_275583^ab(system,user,apply(_275472^called(
|      | |     | |  - _275472,Lowell Street),_275583)),[inter2])
|      | |     | +-_275603:confidence_attrib(2,entity(1,inter2),_275472^called(_275472,Lowell Street)
|      | |     |    - )
|      | |     +-_275621:confidence_add(3,1,2)
|      | |     +-_275630:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(
|      | |        - inter2,intersection)],3,8)
|      | |       +-_275665:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),
|      | |       |  - category(inter2,intersection)],[has(inter2,lights1),called(inter2,Lowell Street
|      | |       |  - ),category(inter2,intersection)],3)
|      | |       | +-_275732:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_271642^
|      | |       | |  - _271645^has(_271642,_271645),[called(inter2,Lowell Street),category(inter2,
|      | |       | |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(
|      | |       | |  - inter2,intersection)])
|      | |       | +-_275783:s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(
|      | |       | |  - _271642,_271645))
|      | |       | +-_275878:ref(entity(4,lights1),lights1)
|      | |       | +-_275889:subset([inter2],_272136^ab(system,user,apply(apply(_271642^
|      | |       | |  - _271645^has(_271642,_271645),_272136),lights1)),[inter2])
|      | |       | +-_275924:refer(entity(4,lights1),2)
|      | |       | | +-_275958:s-refer(entity(4,lights1))
|      | |       | | +-_275977:describe(entity(4,lights1),2)
|      | |       | |   +-_275997:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
|      | |       | |   |  - street1,street2])
```

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|      | |       | |   +-_276022:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
|      | |       | |   |  - ,street2],entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
|      | |       | |   |  - 2)
|      | |       | |   | +-_276084:s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights
|      | |       | |   | |  - ))
|      | |       | |   | +-_276161:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
|      | |       | |   | |  - ,street2],_271617^ab(system,user,category(_271617,traffic_lights)),[
|      | |       | |   | |  - lights1])
|      | |       | |   | +-_276200:ref(entity(4,lights1),lights1)
|      | |       | |   | +-_276211:[category(lights1,traffic_lights)]=[category(lights1,
|      | |       | |   | |  - traffic_lights)]
|      | |       | |   | +-_276229:confidence_headnoun(2,entity(4,lights1),traffic_lights)
|      | |       | |   +-_276241:modifiers(entity(4,lights1),[lights1],[category(lights1,
|      | |       | |      - traffic_lights)],2,2)
|      | |       | |     +-_276305:null
|      | |       | +-_276328:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),
|      | |       |    - _271642^_271645^has(_271642,_271645))
|      | |       +-_276353:confidence_add(6,3,3)
|      | |       +-_276362:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
|      | |          - Lowell Street),category(inter2,intersection)],6,8)
|      | |         +-_276402:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(
|      | |         |  - inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
|      | |         |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],
|      | |         |  - 2)
|      | |         | +-_276479:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_271668^
|      | |         | |  - _271671^has(_271668,_271671),[has(inter2,lights1),called(inter2,
|      | |         | |  - Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(inter2
|      | |         | |  - ,lights1),called(inter2,Lowell Street),category(inter2,intersection)])
|      | |         | +-_276540:s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(
|      | |         | |  - _271668,_271671))
|      | |         | +-_276635:ref(entity(6,sign1),sign1)
|      | |         | +-_276646:subset([inter2],_272770^ab(system,user,apply(apply(_271668^
|      | |         | |  - _271671^has(_271668,_271671),_272770),sign1)),[inter2])
|      | |         | +-_276681:refer(entity(6,sign1),1)
|      | |         | | +-_276715:s-refer(entity(6,sign1))
|      | |         | | +-_276734:describe(entity(6,sign1),1)
|      | |         | |   +-_276754:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,
|      | |         | |   |  - sign1,street1,street2])
|      | |         | |   +-_276779:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
|      | |         | |   |  - street1,street2],entity(6,sign1),[sign1],[category(sign1,sign)],
|      | |         | |   |  - 1)
|      | |         | |   | +-_276841:s-attrib(entity(6,sign1),_271692^category(_271692,sign))
|      | |         | |   | +-_276918:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
|      | |         | |   | |  - street1,street2],_271692^ab(system,user,category(_271692,sign)),[
|      | |         | |   | |  - sign1])
|      | |         | |   | +-_276957:ref(entity(6,sign1),sign1)
|      | |         | |   | +-_276968:[category(sign1,sign)]=[category(sign1,sign)]
|      | |         | |   | +-_276986:confidence_headnoun(1,entity(6,sign1),sign)
|      | |         | |   +-_276998:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
|      | |         | |      - 1,1)
|      | |         | |     +-_277062:null
|      | |         | +-_277085:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),
|      | |         |    - _271668^_271671^has(_271668,_271671))
|      | |         +-_277110:confidence_add(8,6,2)
|      | |         +-_277119:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,
|      | |            - lights1),called(inter2,Lowell Street),category(inter2,intersection)],
|      | |            - 8,8)
|      | |           +-_277198:null
|      | +-_277221:here(inter2,street1,+(1))=here(inter2,street1,+(1))
```

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 |      +-_277241:directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
 |        +-_277299:null
 +-respond-to-suggestion(p1,[s-attrib-rel(entity(1,inter2),entity(6,sign1),_389450^_389453^has(
    - _389450,_389453)),s-refer(entity(6,sign1)),s-attrib(entity(6,sign1),_389474^category(
    - _389474,sign))],[s-attrib(entity(6,sign1),_389882^category(_389882,sign)),s-refer(entity(
    - 6,sign1)),s-attrib-rel(entity(1,inter2),entity(6,sign1),_389907^_389910^has(_389907,
    - _389910)),s-attrib(entity(4,lights1),_389924^category(_389924,traffic_lights)),s-refer(entity(
    - 4,lights1)),s-attrib-rel(entity(1,inter2),entity(4,lights1),_389949^_389952^has(_389949,
    - _389952))])
   +-partition([s-attrib(entity(6,sign1),_390815^category(_390815,sign)),s-refer(entity(6,sign1)),
   |  - s-attrib-rel(entity(1,inter2),entity(6,sign1),_390840^_390843^has(_390840,_390843)),s-attrib(
   |  - entity(4,lights1),_390857^category(_390857,traffic_lights)),s-refer(entity(4,lights1)),
   |  - s-attrib-rel(entity(1,inter2),entity(4,lights1),_390882^_390885^has(_390882,_390885))],[
   |  - s-attrib-rel(entity(1,inter2),entity(6,sign1),_391704^_391707^has(_391704,_391707)),s-refer(
   |  - entity(6,sign1)),s-attrib(entity(6,sign1),_391728^category(_391728,sign))],[s-attrib(entity(
   |  - 4,lights1),_392148^category(_392148,traffic_lights)),s-refer(entity(4,lights1)),s-attrib-rel(
   |  - entity(1,inter2),entity(4,lights1),_392173^_392176^has(_392173,_392176))])
   +-s-affirm(p1,V1)
   | V1=s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,_271671))
   |    s-refer(entity(6,sign1))
   |    s-attrib(entity(6,sign1),_271692^category(_271692,sign))
   +-s-actions(p1,V1)
     V1=s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
        s-refer(entity(4,lights1))
        s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,_271645))

Actions to be fed to generator
------------------------------
s-actions(p1,V1)
 V1=s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
    s-refer(entity(4,lights1))
    s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(_271642,_271645))
 s-affirm(p1,V1)
 V1=s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(_271668,_271671))
    s-refer(entity(6,sign1))
    s-attrib(entity(6,sign1),_271692^category(_271692,sign))

User Model: Adding Proposition
plan(system,p103,mb(system,user,replace(p1,V1)))
 V1=_274664:describe-route(route([goto(exit1,inter2,street1,+(1),_422187)]))
    +-_274764:directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),_422492)],here(
       - inter2,street1,+(1)))
      +-_274832:direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),_274686),here(inter2
      |  - ,street1,+(1)))
      | +-_274914:ref(entity(1,inter2),inter2)
      | +-_274925:s-goto(entity(1,inter2))
      | +-_275037:set_context(exit1,inter2,street1,+(1))
      | +-_275049:refer(entity(1,inter2),8)
      | | +-_275083:s-refer(entity(1,inter2))
      | | +-_275102:describe(entity(1,inter2),8)
      | |   +-_275122:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
      | |   |  - street2])
      | |   +-_275147:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   |  - entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
      | |   | +-_275211:s-attrib(entity(1,inter2),_275229^category(_275229,intersection))
      | |   | +-_275288:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   | |  - _275229^ab(system,user,category(_275229,intersection)),[inter1,inter2])
      | |   | +-_275329:ref(entity(1,inter2),inter2)
      | |   | +-_275340:[category(inter2,intersection)]=[category(inter2,intersection)]
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| |   | +-_275358:confidence_headnoun(1,entity(1,inter2),intersection)
| |   +-_275370:modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],
| |      - 1,8)
| |     +-_275402:modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,
| |     |  - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)],
| |     |  - 2)
| |     | +-_275461:salient_attrib(entity(1,inter2),_275472^called(_275472,Lowell Street),[
| |     | |  - category(inter2,intersection)],[called(inter2,Lowell Street),category(inter2,
| |     | |  - intersection)])
| |     | +-_275495:s-attrib(entity(1,inter2),_275472^called(_275472,Lowell Street))
| |     | +-_275572:subset([inter1,inter2],_275583^ab(system,user,apply(_275472^called(
| |     | |  - _275472,Lowell Street),_275583)),[inter2])
| |     | +-_275603:confidence_attrib(2,entity(1,inter2),_275472^called(_275472,Lowell Street))
| |     +-_275621:confidence_add(3,1,2)
| |     +-_275630:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(
| |        - inter2,intersection)],3,8)
| |       +-_275665:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),
| |       |  - category(inter2,intersection)],[has(inter2,lights1),called(inter2,Lowell Street),
| |       |  - category(inter2,intersection)],3)
| |       | +-_275732:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_271642^
| |       | |  - _271645^has(_271642,_271645),[called(inter2,Lowell Street),category(inter2,
| |       | |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(
| |       | |  - inter2,intersection)])
| |       | +-_275783:s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(
| |       | |  - _271642,_271645))
| |       | +-_275878:ref(entity(4,lights1),lights1)
| |       | +-_275889:subset([inter2],_272136^ab(system,user,apply(apply(_271642^_271645^has(
| |       | |  - _271642,_271645),_272136),lights1)),[inter2])
| |       | +-_275924:refer(entity(4,lights1),2)
| |       | | +-_275958:s-refer(entity(4,lights1))
| |       | | +-_275977:describe(entity(4,lights1),2)
| |       | |   +-_275997:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |       | |   |  - street1,street2])
| |       | |   +-_276022:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |       | |   |  - street2],entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
| |       | |   |  - 2)
| |       | |   | +-_276084:s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
| |       | |   | +-_276161:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |       | |   | |  - street2],_271617^ab(system,user,category(_271617,traffic_lights)),[
| |       | |   | |  - lights1])
| |       | |   | +-_276200:ref(entity(4,lights1),lights1)
| |       | |   | +-_276211:[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)
| |       | |   | |  - ]
| |       | |   | +-_276229:confidence_headnoun(2,entity(4,lights1),traffic_lights)
| |       | |   +-_276241:modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights
| |       | |      - )],2,2)
| |       | |     +-_276305:null
| |       | +-_276328:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_271642^
| |       |    - _271645^has(_271642,_271645))
| |       +-_276353:confidence_add(6,3,3)
| |       +-_276362:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
| |          - Lowell Street),category(inter2,intersection)],6,8)
| |         +-_276402:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(
| |         |  - inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
| |         |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],
| |         |  - 2)
| |         | +-_276479:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_271668^
| |         | |  - _271671^has(_271668,_271671),[has(inter2,lights1),called(inter2,Lowell Street
| |         | |  - ),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),
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| |          | |  - called(inter2,Lowell Street),category(inter2,intersection)])
| |          | +-_276540:s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(
| |          | |  - _271668,_271671))
| |          | +-_276635:ref(entity(6,sign1),sign1)
| |          | +-_276646:subset([inter2],_272770^ab(system,user,apply(apply(_271668^
| |          | |  - _271671^has(_271668,_271671),_272770),sign1)),[inter2])
| |          | +-_276681:refer(entity(6,sign1),1)
| |          | | +-_276715:s-refer(entity(6,sign1))
| |          | | +-_276734:describe(entity(6,sign1),1)
| |          | |   +-_276754:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |          | |   |  - street1,street2])
| |          | |   +-_276779:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
| |          | |   |  - ,street2],entity(6,sign1),[sign1],[category(sign1,sign)],1)
| |          | |   | +-_276841:s-attrib(entity(6,sign1),_271692^category(_271692,sign))
| |          | |   | +-_276918:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
| |          | |   | |  - ,street2],_271692^ab(system,user,category(_271692,sign)),[sign1])
| |          | |   | +-_276957:ref(entity(6,sign1),sign1)
| |          | |   | +-_276968:[category(sign1,sign)]=[category(sign1,sign)]
| |          | |   | +-_276986:confidence_headnoun(1,entity(6,sign1),sign)
| |          | |   +-_276998:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
| |          | |       - 1,1)
| |          | |     +-_277062:null
| |          | +-_277085:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_271668^
| |          |    - _271671^has(_271668,_271671))
| |          +-_277110:confidence_add(8,6,2)
| |          +-_277119:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1)
| |             - ,called(inter2,Lowell Street),category(inter2,intersection)],8,8)
| |            +-_277198:null
| +-_277221:here(inter2,street1,+(1))=here(inter2,street1,+(1))
+-_277241:directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
  +-_277299:null

Pushing to focus stack: focus(p103,p103,mb(system,user,replace(p1,V1)))
 V1=_274664:describe-route(route([goto(exit1,inter2,street1,+(1),_484723)]))
    +-_274764:directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),_485028)],here(
       - inter2,street1,+(1)))
      +-_274832:direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),_274686),here(inter2
      |  - ,street1,+(1)))
      | +-_274914:ref(entity(1,inter2),inter2)
      | +-_274925:s-goto(entity(1,inter2))
      | +-_275037:set_context(exit1,inter2,street1,+(1))
      | +-_275049:refer(entity(1,inter2),8)
      | | +-_275083:s-refer(entity(1,inter2))
      | | +-_275102:describe(entity(1,inter2),8)
      | |   +-_275122:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
      | |   |  - street2])
      | |   +-_275147:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   |  - entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
      | |   | +-_275211:s-attrib(entity(1,inter2),_275229^category(_275229,intersection))
      | |   | +-_275288:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   | |  - _275229^ab(system,user,category(_275229,intersection)),[inter1,inter2])
      | |   | +-_275329:ref(entity(1,inter2),inter2)
      | |   | +-_275340:[category(inter2,intersection)]=[category(inter2,intersection)]
      | |   | +-_275358:confidence_headnoun(1,entity(1,inter2),intersection)
      | |   +-_275370:modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],
      | |       - 1,8)
      | |     +-_275402:modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,
      | |     |  - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)],
      | |     |  - 2)
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| |     | +-_275461:salient_attrib(entity(1,inter2),_275472^called(_275472,Lowell Street),[
| |     | |  - category(inter2,intersection)],[called(inter2,Lowell Street),category(inter2,
| |     | |  - intersection)])
| |     | +-_275495:s-attrib(entity(1,inter2),_275472^called(_275472,Lowell Street))
| |     | +-_275572:subset([inter1,inter2],_275583^ab(system,user,apply(_275472^called(
| |     | |  - _275472,Lowell Street),_275583)),[inter2])
| |     | +-_275603:confidence_attrib(2,entity(1,inter2),_275472^called(_275472,Lowell Street))
| |     +-_275621:confidence_add(3,1,2)
| |     +-_275630:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(
| |        - inter2,intersection)],3,8)
| |       +-_275665:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),
| |       |  - category(inter2,intersection)],[has(inter2,lights1),called(inter2,Lowell Street),
| |       |  - category(inter2,intersection)],3)
| |       | +-_275732:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_271642^
| |       | |  - _271645^has(_271642,_271645),[called(inter2,Lowell Street),category(inter2,
| |       | |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(
| |       | |  - inter2,intersection)])
| |       | +-_275783:s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(
| |       | |  - _271642,_271645))
| |       | +-_275878:ref(entity(4,lights1),lights1)
| |       | +-_275889:subset([inter2],_272136^ab(system,user,apply(apply(_271642^_271645^has(
| |       | |  - _271642,_271645),_272136),lights1)),[inter2])
| |       | +-_275924:refer(entity(4,lights1),2)
| |       | | +-_275958:s-refer(entity(4,lights1))
| |       | | +-_275977:describe(entity(4,lights1),2)
| |       | |   +-_275997:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |       | |   |  - street1,street2])
| |       | |   +-_276022:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |       | |   |  - street2],entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
| |       | |   |  - 2)
| |       | |   | +-_276084:s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
| |       | |   | +-_276161:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |       | |   | |  - street2],_271617^ab(system,user,category(_271617,traffic_lights)),[
| |       | |   | |  - lights1])
| |       | |   | +-_276200:ref(entity(4,lights1),lights1)
| |       | |   | +-_276211:[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)
| |       | |   | |  - ]
| |       | |   | +-_276229:confidence_headnoun(2,entity(4,lights1),traffic_lights)
| |       | |   +-_276241:modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights
| |       | |      - )],2,2)
| |       | |     +-_276305:null
| |       | +-_276328:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_271642^
| |       |    - _271645^has(_271642,_271645))
| |       +-_276353:confidence_add(6,3,3)
| |       +-_276362:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
| |          - Lowell Street),category(inter2,intersection)],6,8)
| |         +-_276402:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(
| |         |  - inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
| |         |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],
| |         |  - 2)
| |         | +-_276479:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_271668^
| |         | |  - _271671^has(_271668,_271671),[has(inter2,lights1),called(inter2,Lowell Street
| |         | |  - ),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),
| |         | |  - called(inter2,Lowell Street),category(inter2,intersection)])
| |         | +-_276540:s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(
| |         | |  - _271668,_271671))
| |         | +-_276635:ref(entity(6,sign1),sign1)
| |         | +-_276646:subset([inter2],_272770^ab(system,user,apply(apply(_271668^
| |         | |  - _271671^has(_271668,_271671),_272770),sign1)),[inter2])
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   | |          | +-_276681:refer(entity(6,sign1),1)
   | |          | | +-_276715:s-refer(entity(6,sign1))
   | |          | | +-_276734:describe(entity(6,sign1),1)
   | |          | |   +-_276754:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
   | |          | |   |  - street1,street2])
   | |          | |   +-_276779:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
   | |          | |   |  - ,street2],entity(6,sign1),[sign1],[category(sign1,sign)],1)
   | |          | |   | +-_276841:s-attrib(entity(6,sign1),_271692^category(_271692,sign))
   | |          | |   | +-_276918:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
   | |          | |   | |  - ,street2],_271692^ab(system,user,category(_271692,sign)),[sign1])
   | |          | |   | +-_276957:ref(entity(6,sign1),sign1)
   | |          | |   | +-_276968:[category(sign1,sign)]=[category(sign1,sign)]
   | |          | |   | +-_276986:confidence_headnoun(1,entity(6,sign1),sign)
   | |          | |   +-_276998:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
   | |          | |      - 1,1)
   | |          | |     +-_277062:null
   | |          | +-_277085:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_271668^
   | |          |    - _271671^has(_271668,_271671))
   | |          +-_277110:confidence_add(8,6,2)
   | |          +-_277119:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1)
   | |             - ,called(inter2,Lowell Street),category(inter2,intersection)],8,8)
   | |            +-_277198:null
   | +-_277221:here(inter2,street1,+(1))=here(inter2,street1,+(1))
   +-_277241:directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
     +-_277299:null
User Model: Adding Proposition
achieve(p103,p103,mb(system,user,replace(p1,V1)))
 V1=_274664:describe-route(route([goto(exit1,inter2,street1,+(1),_504579)]))
    +-_274764:directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),_504884)],here(
       - inter2,street1,+(1)))
      +-_274832:direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),_274686),here(inter2
      |  - ,street1,+(1)))
      | +-_274914:ref(entity(1,inter2),inter2)
      | +-_274925:s-goto(entity(1,inter2))
      | +-_275037:set_context(exit1,inter2,street1,+(1))
      | +-_275049:refer(entity(1,inter2),8)
      | | +-_275083:s-refer(entity(1,inter2))
      | | +-_275102:describe(entity(1,inter2),8)
      | |   +-_275122:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
      | |   |  - street2])
      | |   +-_275147:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   |  - entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
      | |   | +-_275211:s-attrib(entity(1,inter2),_275229^category(_275229,intersection))
      | |   | +-_275288:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   | |  - _275229^ab(system,user,category(_275229,intersection)),[inter1,inter2])
      | |   | +-_275329:ref(entity(1,inter2),inter2)
      | |   | +-_275340:[category(inter2,intersection)]=[category(inter2,intersection)]
      | |   | +-_275358:confidence_headnoun(1,entity(1,inter2),intersection)
      | |   +-_275370:modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],
      | |      - 1,8)
      | |     +-_275402:modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,
      | |     |  - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)],
      | |     |  - 2)
      | |     | +-_275461:salient_attrib(entity(1,inter2),_275472^called(_275472,Lowell Street),[
      | |     | |  - category(inter2,intersection)],[called(inter2,Lowell Street),category(inter2,
      | |     | |  - intersection)])
      | |     | +-_275495:s-attrib(entity(1,inter2),_275472^called(_275472,Lowell Street))
      | |     | +-_275572:subset([inter1,inter2],_275583^ab(system,user,apply(_275472^called(
      | |     | |  - _275472,Lowell Street),_275583)),[inter2])
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| |      | +-_275603:confidence_attrib(2,entity(1,inter2),_275472^called(_275472,Lowell Street))
| |      +-_275621:confidence_add(3,1,2)
| |      +-_275630:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(
| |         - inter2,intersection)],3,8)
| |        +-_275665:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),
| |        |  - category(inter2,intersection)],[has(inter2,lights1),called(inter2,Lowell Street),
| |        |  - category(inter2,intersection)],3)
| |        | +-_275732:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_271642^
| |        | |  - _271645^has(_271642,_271645),[called(inter2,Lowell Street),category(inter2,
| |        | |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(
| |        | |  - inter2,intersection)])
| |        | +-_275783:s-attrib-rel(entity(1,inter2),entity(4,lights1),_271642^_271645^has(
| |        | |  - _271642,_271645))
| |        | +-_275878:ref(entity(4,lights1),lights1)
| |        | +-_275889:subset([inter2],_272136^ab(system,user,apply(apply(_271642^_271645^has(
| |        | |  - _271642,_271645),_272136),lights1)),[inter2])
| |        | +-_275924:refer(entity(4,lights1),2)
| |        | | +-_275958:s-refer(entity(4,lights1))
| |        | | +-_275977:describe(entity(4,lights1),2)
| |        | |   +-_275997:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |        | |   |  - street1,street2])
| |        | |   +-_276022:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |        | |   |  - street2],entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
| |        | |   |  - 2)
| |        | |   | +-_276084:s-attrib(entity(4,lights1),_271617^category(_271617,traffic_lights))
| |        | |   | +-_276161:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |        | |   | |  - street2],_271617^ab(system,user,category(_271617,traffic_lights)),[
| |        | |   | |  - lights1])
| |        | |   | +-_276200:ref(entity(4,lights1),lights1)
| |        | |   | +-_276211:[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)
| |        | |   | |  - ]
| |        | |   | +-_276229:confidence_headnoun(2,entity(4,lights1),traffic_lights)
| |        | |   +-_276241:modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights
| |        | |      - )],2,2)
| |        | |     +-_276305:null
| |        | +-_276328:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_271642^
| |        |    - _271645^has(_271642,_271645))
| |        +-_276353:confidence_add(6,3,3)
| |        +-_276362:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
| |           - Lowell Street),category(inter2,intersection)],6,8)
| |          +-_276402:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(
| |          |  - inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
| |          |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],
| |          |  - 2)
| |          | +-_276479:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_271668^
| |          | |  - _271671^has(_271668,_271671),[has(inter2,lights1),called(inter2,Lowell Street
| |          | |  - ),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),
| |          | |  - called(inter2,Lowell Street),category(inter2,intersection)])
| |          | +-_276540:s-attrib-rel(entity(1,inter2),entity(6,sign1),_271668^_271671^has(
| |          | |  - _271668,_271671))
| |          | +-_276635:ref(entity(6,sign1),sign1)
| |          | +-_276646:subset([inter2],_272770^ab(system,user,apply(apply(_271668^
| |          | |  - _271671^has(_271668,_271671),_272770),sign1)),[inter2])
| |          | +-_276681:refer(entity(6,sign1),1)
| |          | | +-_276715:s-refer(entity(6,sign1))
| |          | | +-_276734:describe(entity(6,sign1),1)
| |          | |   +-_276754:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |          | |   |  - street1,street2])
| |          | |   +-_276779:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
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| |         | |   |  - ,street2],entity(6,sign1),[sign1],[category(sign1,sign)],1)
| |         | |   | +-_276841:s-attrib(entity(6,sign1),_271692^category(_271692,sign))
| |         | |   | +-_276918:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
| |         | |   | |  - ,street2],_271692^ab(system,user,category(_271692,sign)),[sign1])
| |         | |   | +-_276957:ref(entity(6,sign1),sign1)
| |         | |   | +-_276968:[category(sign1,sign)]=[category(sign1,sign)]
| |         | |   | +-_276986:confidence_headnoun(1,entity(6,sign1),sign)
| |         | |   +-_276998:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
| |         | |      - 1,1)
| |         | |     +-_277062:null
| |         | +-_277085:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_271668^
| |         |    - _271671^has(_271668,_271671))
| |         +-_277110:confidence_add(8,6,2)
| |         +-_277119:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1)
| |            - ,called(inter2,Lowell Street),category(inter2,intersection)],8,8)
| |           +-_277198:null
| +-_277221:here(inter2,street1,+(1))=here(inter2,street1,+(1))
+-_13793:directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
  +-_13796:null

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Checking Acceptance and Collaborative Rules
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Applying m_accept_rule1
Popping from focus stack: focus(p103,p103,mb(system,user,replace(p1,V1)))
 V1=_250814:describe-route(route([goto(exit1,inter2,street1,+(1),_270550)]))
    +-_250914:directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),_270855)],here(
       - inter2,street1,+(1)))
      +-_250982:direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),_250836),here(inter2
      |  - ,street1,+(1)))
      | +-_251064:ref(entity(1,inter2),inter2)
      | +-_251075:s-goto(entity(1,inter2))
      | +-_251187:set_context(exit1,inter2,street1,+(1))
      | +-_251199:refer(entity(1,inter2),8)
      | | +-_251233:s-refer(entity(1,inter2))
      | | +-_251252:describe(entity(1,inter2),8)
      | |   +-_251272:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
      | |   |  - street2])
      | |   +-_251297:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   |  - entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
      | |   | +-_251361:s-attrib(entity(1,inter2),_251379^category(_251379,intersection))
      | |   | +-_251438:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   | |  - _251379^ab(system,user,category(_251379,intersection)),[inter1,inter2])
      | |   | +-_251479:ref(entity(1,inter2),inter2)
      | |   | +-_251490:[category(inter2,intersection)]=[category(inter2,intersection)]
      | |   | +-_251508:confidence_headnoun(1,entity(1,inter2),intersection)
      | |   +-_251520:modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],
      | |      - 1,8)
      | |     +-_251552:modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,
      | |     |  - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)],
      | |     |  - 2)
      | |     | +-_251611:salient_attrib(entity(1,inter2),_251622^called(_251622,Lowell Street),[
      | |     | |  - category(inter2,intersection)],[called(inter2,Lowell Street),category(inter2,
      | |     | |  - intersection)])
      | |     | +-_251645:s-attrib(entity(1,inter2),_251622^called(_251622,Lowell Street))
      | |     | +-_251722:subset([inter1,inter2],_251733^ab(system,user,apply(_251622^called(
      | |     | |  - _251622,Lowell Street),_251733)),[inter2])
      | |     | +-_251753:confidence_attrib(2,entity(1,inter2),_251622^called(_251622,Lowell Street))
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| |     +-_251771:confidence_add(3,1,2)
| |     +-_251780:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(
| |        - inter2,intersection)],3,8)
| |       +-_251815:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),
| |       |  - category(inter2,intersection)],[has(inter2,lights1),called(inter2,Lowell Street),
| |       |  - category(inter2,intersection)],3)
| |       | +-_251882:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_251897^
| |       | |  - _251900^has(_251897,_251900),[called(inter2,Lowell Street),category(inter2,
| |       | |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(
| |       | |  - inter2,intersection)])
| |       | +-_251933:s-attrib-rel(entity(1,inter2),entity(4,lights1),_251897^_251900^has(
| |       | |  - _251897,_251900))
| |       | +-_252028:ref(entity(4,lights1),lights1)
| |       | +-_252039:subset([inter2],_252048^ab(system,user,apply(apply(_251897^_251900^has(
| |       | |  - _251897,_251900),_252048),lights1)),[inter2])
| |       | +-_252074:refer(entity(4,lights1),2)
| |       | | +-_252108:s-refer(entity(4,lights1))
| |       | | +-_252127:describe(entity(4,lights1),2)
| |       | |   +-_252147:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |       | |   |  - street1,street2])
| |       | |   +-_252172:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |       | |   |  - street2],entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
| |       | |   |  - 2)
| |       | |   | +-_252234:s-attrib(entity(4,lights1),_252252^category(_252252,traffic_lights))
| |       | |   | +-_252311:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |       | |   | |  - street2],_252252^ab(system,user,category(_252252,traffic_lights)),[
| |       | |   | |  - lights1])
| |       | |   | +-_252350:ref(entity(4,lights1),lights1)
| |       | |   | +-_252361:[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)
| |       | |   | |  - ]
| |       | |   | +-_252379:confidence_headnoun(2,entity(4,lights1),traffic_lights)
| |       | |   +-_252391:modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights
| |       | |      - )],2,2)
| |       | |     +-_252455:null
| |       | +-_252478:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_251897^
| |       |    - _251900^has(_251897,_251900))
| |       +-_252503:confidence_add(6,3,3)
| |       +-_252512:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
| |          - Lowell Street),category(inter2,intersection)],6,8)
| |         +-_252552:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(
| |         |  - inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
| |         |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],
| |         |  - 2)
| |         | +-_252629:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_252644^
| |         | |  - _252647^has(_252644,_252647),[has(inter2,lights1),called(inter2,Lowell Street
| |         | |  - ),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),
| |         | |  - called(inter2,Lowell Street),category(inter2,intersection)])
| |         | +-_252690:s-attrib-rel(entity(1,inter2),entity(6,sign1),_252644^_252647^has(
| |         | |  - _252644,_252647))
| |         | +-_252785:ref(entity(6,sign1),sign1)
| |         | +-_252796:subset([inter2],_252805^ab(system,user,apply(apply(_252644^
| |         | |  - _252647^has(_252644,_252647),_252805),sign1)),[inter2])
| |         | +-_252831:refer(entity(6,sign1),1)
| |         | | +-_252865:s-refer(entity(6,sign1))
| |         | | +-_252884:describe(entity(6,sign1),1)
| |         | |   +-_252904:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |         | |   |  - street1,street2])
| |         | |   +-_252929:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
| |         | |   |  - ,street2],entity(6,sign1),[sign1],[category(sign1,sign)],1)
```

```
  | |          | |   | +-_252991:s-attrib(entity(6,sign1),_253009^category(_253009,sign))
  | |          | |   | +-_253068:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
  | |          | |   | |  - ,street2],_253009^ab(system,user,category(_253009,sign)),[sign1])
  | |          | |   | +-_253107:ref(entity(6,sign1),sign1)
  | |          | |   | +-_253118:[category(sign1,sign)]=[category(sign1,sign)]
  | |          | |   | +-_253136:confidence_headnoun(1,entity(6,sign1),sign)
  | |          | |   +-_253148:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
  | |          | |      - 1,1)
  | |          | |     +-_253212:null
  | |          | +-_253235:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_252644^
  | |          |    - _252647^has(_252644,_252647))
  | |          +-_253260:confidence_add(8,6,2)
  | |          +-_253269:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1)
  | |             - ,called(inter2,Lowell Street),category(inter2,intersection)],8,8)
  | |            +-_253348:null
  | +-_253371:here(inter2,street1,+(1))=here(inter2,street1,+(1))
  +-_253391:directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
    +-_253449:null
User Model: Adding Proposition
mb(system,user,replace(p1,V1))
 V1=_250814:describe-route(route([goto(exit1,inter2,street1,+(1),_306704)]))
    +-_250914:directions(here(exit1,street1,+(1)),[goto(exit1,inter2,street1,+(1),_307009)],here(
       - inter2,street1,+(1)))
      +-_250982:direction(here(exit1,street1,+(1)),goto(exit1,inter2,street1,+(1),_250836),here(inter2
      |  - ,street1,+(1)))
      | +-_251064:ref(entity(1,inter2),inter2)
      | +-_251075:s-goto(entity(1,inter2))
      | +-_251187:set_context(exit1,inter2,street1,+(1))
      | +-_251199:refer(entity(1,inter2),8)
      | | +-_251233:s-refer(entity(1,inter2))
      | | +-_251252:describe(entity(1,inter2),8)
      | |   +-_251272:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
      | |   |  - street2])
      | |   +-_251297:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   |  - entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],1)
      | |   | +-_251361:s-attrib(entity(1,inter2),_251379^category(_251379,intersection))
      | |   | +-_251438:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,street2],
      | |   | |  - _251379^ab(system,user,category(_251379,intersection)),[inter1,inter2])
      | |   | +-_251479:ref(entity(1,inter2),inter2)
      | |   | +-_251490:[category(inter2,intersection)]=[category(inter2,intersection)]
      | |   | +-_251508:confidence_headnoun(1,entity(1,inter2),intersection)
      | |   +-_251520:modifiers(entity(1,inter2),[inter1,inter2],[category(inter2,intersection)],
      | |      - 1,8)
      | |     +-_251552:modifier(entity(1,inter2),[inter1,inter2],[inter2],[category(inter2,
      | |     |  - intersection)],[called(inter2,Lowell Street),category(inter2,intersection)],
      | |     |  - 2)
      | |     | +-_251611:salient_attrib(entity(1,inter2),_251622^called(_251622,Lowell Street),[
      | |     | |  - category(inter2,intersection)],[called(inter2,Lowell Street),category(inter2,
      | |     | |  - intersection)])
      | |     | +-_251645:s-attrib(entity(1,inter2),_251622^called(_251622,Lowell Street))
      | |     | +-_251722:subset([inter1,inter2],_251733^ab(system,user,apply(_251622^called(
      | |     | |  - _251622,Lowell Street),_251733)),[inter2])
      | |     | +-_251753:confidence_attrib(2,entity(1,inter2),_251622^called(_251622,Lowell Street))
      | |     +-_251771:confidence_add(3,1,2)
      | |     +-_251780:modifiers(entity(1,inter2),[inter2],[called(inter2,Lowell Street),category(
      | |        - inter2,intersection)],3,8)
      | |       +-_251815:modifier(entity(1,inter2),[inter2],[inter2],[called(inter2,Lowell Street),
      | |       |  - category(inter2,intersection)],[has(inter2,lights1),called(inter2,Lowell Street),
      | |       |  - category(inter2,intersection)],3)
```

```
| |         | +-_251882:salient_attrib_rel(entity(1,inter2),entity(4,lights1),_251897^
| |         | |  - _251900^has(_251897,_251900),[called(inter2,Lowell Street),category(inter2,
| |         | |  - intersection)],[has(inter2,lights1),called(inter2,Lowell Street),category(
| |         | |  - inter2,intersection)])
| |         | +-_251933:s-attrib-rel(entity(1,inter2),entity(4,lights1),_251897^_251900^has(
| |         | |  - _251897,_251900))
| |         | +-_252028:ref(entity(4,lights1),lights1)
| |         | +-_252039:subset([inter2],_252048^ab(system,user,apply(apply(_251897^_251900^has(
| |         | |  - _251897,_251900),_252048),lights1)),[inter2])
| |         | +-_252074:refer(entity(4,lights1),2)
| |         | | +-_252108:s-refer(entity(4,lights1))
| |         | | +-_252127:describe(entity(4,lights1),2)
| |         | |   +-_252147:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |         | |   |  - street1,street2])
| |         | |   +-_252172:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |         | |   |  - street2],entity(4,lights1),[lights1],[category(lights1,traffic_lights)],
| |         | |   |  - 2)
| |         | |   | +-_252234:s-attrib(entity(4,lights1),_252252^category(_252252,traffic_lights))
| |         | |   | +-_252311:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1,
| |         | |   | |  - street2],_252252^ab(system,user,category(_252252,traffic_lights)),[
| |         | |   | |  - lights1])
| |         | |   | +-_252350:ref(entity(4,lights1),lights1)
| |         | |   | +-_252361:[category(lights1,traffic_lights)]=[category(lights1,traffic_lights)
| |         | |   | |  - ]
| |         | |   | +-_252379:confidence_headnoun(2,entity(4,lights1),traffic_lights)
| |         | |   +-_252391:modifiers(entity(4,lights1),[lights1],[category(lights1,traffic_lights
| |         | |      - )],2,2)
| |         | |     +-_252455:null
| |         | +-_252478:confidence_attrib_rel(3,entity(1,inter2),entity(4,lights1),_251897^
| |         |    - _251900^has(_251897,_251900))
| |         +-_252503:confidence_add(6,3,3)
| |         +-_252512:modifiers(entity(1,inter2),[inter2],[has(inter2,lights1),called(inter2,
| |            - Lowell Street),category(inter2,intersection)],6,8)
| |           +-_252552:modifier(entity(1,inter2),[inter2],[inter2],[has(inter2,lights1),called(
| |           |  - inter2,Lowell Street),category(inter2,intersection)],[has(inter2,sign1),has(
| |           |  - inter2,lights1),called(inter2,Lowell Street),category(inter2,intersection)],
| |           |  - 2)
| |           | +-_252629:salient_attrib_rel(entity(1,inter2),entity(6,sign1),_252644^
| |           | |  - _252647^has(_252644,_252647),[has(inter2,lights1),called(inter2,Lowell Street
| |           | |  - ),category(inter2,intersection)],[has(inter2,sign1),has(inter2,lights1),
| |           | |  - called(inter2,Lowell Street),category(inter2,intersection)])
| |           | +-_252690:s-attrib-rel(entity(1,inter2),entity(6,sign1),_252644^_252647^has(
| |           | |  - _252644,_252647))
| |           | +-_252785:ref(entity(6,sign1),sign1)
| |           | +-_252796:subset([inter2],_252805^ab(system,user,apply(apply(_252644^
| |           | |  - _252647^has(_252644,_252647),_252805),sign1)),[inter2])
| |           | +-_252831:refer(entity(6,sign1),1)
| |           | | +-_252865:s-refer(entity(6,sign1))
| |           | | +-_252884:describe(entity(6,sign1),1)
| |           | |   +-_252904:context_current([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,
| |           | |   |  - street1,street2])
| |           | |   +-_252929:headnoun([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
| |           | |   |  - ,street2],entity(6,sign1),[sign1],[category(sign1,sign)],1)
| |           | |   | +-_252991:s-attrib(entity(6,sign1),_253009^category(_253009,sign))
| |           | |   | +-_253068:subset([avenue1,exit1,highway1,inter1,inter2,lights1,sign1,street1
| |           | |   | |  - ,street2],_253009^ab(system,user,category(_253009,sign)),[sign1])
| |           | |   | +-_253107:ref(entity(6,sign1),sign1)
| |           | |   | +-_253118:[category(sign1,sign)]=[category(sign1,sign)]
| |           | |   | +-_253136:confidence_headnoun(1,entity(6,sign1),sign)
```

```
| |         | |   +-_253148:modifiers(entity(6,sign1),[sign1],[category(sign1,sign)],
| |         | |      - 1,1)
| |         | |     +-_253212:null
| |         | +-_253235:confidence_attrib_rel(2,entity(1,inter2),entity(6,sign1),_252644^
| |         |    - _252647^has(_252644,_252647))
| |         +-_253260:confidence_add(8,6,2)
| |         +-_253269:modifiers(entity(1,inter2),[inter2],[has(inter2,sign1),has(inter2,lights1)
| |            - ,called(inter2,Lowell Street),category(inter2,intersection)],8,8)
| |           +-_253348:null
| +-_253371:here(inter2,street1,+(1))=here(inter2,street1,+(1))
+-_253391:directions(here(inter2,street1,+(1)),[],here(inter2,street1,+(1)))
  +-_253449:null

Popping from focus stack: focus(p1,p20,identify(user,system,entity(1,inter2)))
Popping from focus stack: focus(p1,p13,mb(system,user,place(inter2,_371120,_371121)))
Popping from focus stack: focus(p1,p1,knowroute(user,system,route([goto(exit1,inter2,street1,+(
  - 1),1)])))
removing plan p1 from belief space



User Model: Adding Proposition
plan(system,p123,knowroute(user,system,route([goto(exit1,inter2,street1,+(1),1)])))

Pushing to focus stack: focus(p123,p123,knowroute(user,system,route([goto(exit1,inter2,street1,+(
  - 1),1)])))
User Model: Adding Proposition
achieve(p123,p123,knowroute(user,system,route([goto(exit1,inter2,street1,+(1),1)])))

Pushing to focus stack: focus(p123,p135,mb(system,user,place(inter2,_371120,_371121)))
User Model: Adding Proposition
achieve(p123,p135,mb(system,user,place(inter2,_371120,_371121)))

Pushing to focus stack: focus(p123,p142,identify(user,system,entity(1,inter2)))
User Model: Adding Proposition
achieve(p123,p142,identify(user,system,entity(1,inter2)))

Pushing to focus stack: focus(p123,p180,mb(system,user,has(inter2,lights1)))
User Model: Adding Proposition
achieve(p123,p180,mb(system,user,has(inter2,lights1)))

Pushing to focus stack: focus(p123,p189,identify(user,system,entity(4,lights1)))
User Model: Adding Proposition
achieve(p123,p189,identify(user,system,entity(4,lights1)))

Pushing to focus stack: focus(p123,p198,mb(system,user,category(lights1,traffic_lights)))
User Model: Adding Proposition
achieve(p123,p198,mb(system,user,category(lights1,traffic_lights)))

Pushing to focus stack: focus(p123,p221,mb(system,user,has(inter2,sign1)))
User Model: Adding Proposition
achieve(p123,p221,mb(system,user,has(inter2,sign1)))

Pushing to focus stack: focus(p123,p230,identify(user,system,entity(6,sign1)))
User Model: Adding Proposition
achieve(p123,p230,identify(user,system,entity(6,sign1)))

Pushing to focus stack: focus(p123,p239,mb(system,user,category(sign1,sign)))
User Model: Adding Proposition
```

```
achieve(p123,p239,mb(system,user,category(sign1,sign)))

User Model: Adding Proposition
cstate(system,user,p123,knowroute(user,system,route([goto(exit1,inter2,street1,+(1),1)])))

*** cstate updated ***

===================
Checking Goal Rules
===================

Applying g_rule3
goal(system,mb(system,user,achieve(p123,p239,mb(system,user,category(sign1,sign)))))

Pre-empting the planning for this goal
```

B.5 Understanding "*Okay.*"

```
=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p123)

Initial Setup
-------------
Adding inactive edge:
Head: s-accept(p123)
Acts: s-accept(p123)

Adding active edge:
Head: accept-plan(_490659)
Need: s-accept(_490659)

Adding config (from active edge):
Active:   accept-plan(_490659)
Inactive: s-accept(p123)

End of Initial Setup
--------------------

Applying config (0 left, step 1)
----------------------------------
Active:   accept-plan(_490659)
Inactive: s-accept(p123)

Adding inactive edge:
Head: accept-plan(p123)
Acts: s-accept(p123)

*** Agenda Empty ***

number of plans found: 2
Number of complete plans found: 1
```

```
------------------------
Consider Plan Derivation
------------------------

accept-plan(p123)
 +-s-accept(p123)

--------
Evaluate
--------

<con> achieve(p123,p239,mb(system,user,category(sign1,sign)))
Assuming achieve(p123,p239,mb(system,user,category(sign1,sign))) due to effects


Inferred Plan
-------------

_509223:accept-plan(p123)
 +-_509248:s-accept(p123)

User Model: Adding Proposition
plan(user,p269,mb(system,user,achieve(p123,p239,mb(system,user,category(sign1,sign)))))

Pushing to focus stack: focus(p269,p269,mb(system,user,achieve(p123,p239,mb(system,user,category(sign1
  - ,sign)))))
User Model: Adding Proposition
achieve(p269,p269,mb(system,user,achieve(p123,p239,mb(system,user,category(sign1,sign)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p269,p269,mb(system,user,achieve(p123,p239,mb(system,user,category(
  - sign1,sign)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p239,mb(system,user,category(sign1,sign))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p239,mb(system,user,category(sign1,sign)))
User Model: Adding Proposition
mb(system,user,category(sign1,sign))

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p123)

number of plans found: 2
Number of complete plans found: 1

------------------------
```

```
Consider Plan Derivation
------------------------

accept-plan(p123)
 +-s-accept(p123)

--------
Evaluate
--------

<con> achieve(p123,p230,identify(user,system,entity(6,sign1)))
Assuming achieve(p123,p230,identify(user,system,entity(6,sign1))) due to effects


Inferred Plan
-------------

_516690:accept-plan(p123)
 +-_516715:s-accept(p123)

User Model: Adding Proposition
plan(user,p276,mb(system,user,achieve(p123,p230,identify(user,system,entity(6,sign1)))))

Pushing to focus stack: focus(p276,p276,mb(system,user,achieve(p123,p230,identify(user,system,entity(
  - 6,sign1)))))
User Model: Adding Proposition
achieve(p276,p276,mb(system,user,achieve(p123,p230,identify(user,system,entity(6,sign1)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p276,p276,mb(system,user,achieve(p123,p230,identify(user,system,entity
  - (6,sign1)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p230,identify(user,system,entity(6,sign1))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p230,identify(user,system,entity(6,sign1)))
User Model: Adding Proposition
identify(user,system,entity(6,sign1))

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p123)

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------
```

```
accept-plan(p123)
 +-s-accept(p123)

--------
Evaluate
--------

<con> achieve(p123,p221,mb(system,user,has(inter2,sign1)))
Assuming achieve(p123,p221,mb(system,user,has(inter2,sign1))) due to effects


Inferred Plan
-------------

_525287:accept-plan(p123)
 +-_525312:s-accept(p123)

User Model: Adding Proposition
plan(user,p283,mb(system,user,achieve(p123,p221,mb(system,user,has(inter2,sign1)))))

Pushing to focus stack: focus(p283,p283,mb(system,user,achieve(p123,p221,mb(system,user,has(inter2,
  - sign1)))))
User Model: Adding Proposition
achieve(p283,p283,mb(system,user,achieve(p123,p221,mb(system,user,has(inter2,sign1)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p283,p283,mb(system,user,achieve(p123,p221,mb(system,user,has(inter2,
  - sign1)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p221,mb(system,user,has(inter2,sign1))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p221,mb(system,user,has(inter2,sign1)))
User Model: Adding Proposition
mb(system,user,has(inter2,sign1))

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p123)

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

accept-plan(p123)
```

```
 +-s-accept(p123)

--------
Evaluate
--------

<con> achieve(p123,p198,mb(system,user,category(lights1,traffic_lights)))
Assuming achieve(p123,p198,mb(system,user,category(lights1,traffic_lights))) due to effects


Inferred Plan
-------------

_532474:accept-plan(p123)
 +-_532499:s-accept(p123)

User Model: Adding Proposition
plan(user,p290,mb(system,user,achieve(p123,p198,mb(system,user,category(lights1,traffic_lights)))))

Pushing to focus stack: focus(p290,p290,mb(system,user,achieve(p123,p198,mb(system,user,category(
  - lights1,traffic_lights)))))
User Model: Adding Proposition
achieve(p290,p290,mb(system,user,achieve(p123,p198,mb(system,user,category(lights1,traffic_lights)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p290,p290,mb(system,user,achieve(p123,p198,mb(system,user,category(
  - lights1,traffic_lights)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p198,mb(system,user,category(lights1,traffic_lights))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p198,mb(system,user,category(lights1,traffic_lights)))
User Model: Adding Proposition
mb(system,user,category(lights1,traffic_lights))

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p123)

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

accept-plan(p123)
 +-s-accept(p123)
```

```
--------
Evaluate
--------

<con> achieve(p123,p189,identify(user,system,entity(4,lights1)))
Assuming achieve(p123,p189,identify(user,system,entity(4,lights1))) due to effects


Inferred Plan
-------------

_539514:accept-plan(p123)
 +-_539539:s-accept(p123)

User Model: Adding Proposition
plan(user,p297,mb(system,user,achieve(p123,p189,identify(user,system,entity(4,lights1)))))

Pushing to focus stack: focus(p297,p297,mb(system,user,achieve(p123,p189,identify(user,system,entity(
  - 4,lights1)))))
User Model: Adding Proposition
achieve(p297,p297,mb(system,user,achieve(p123,p189,identify(user,system,entity(4,lights1)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p297,p297,mb(system,user,achieve(p123,p189,identify(user,system,entity
  - (4,lights1)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p189,identify(user,system,entity(4,lights1))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p189,identify(user,system,entity(4,lights1)))
User Model: Adding Proposition
identify(user,system,entity(4,lights1))

=============
Understanding
=============

---------------
Plan Recognizer
---------------

Actions = s-accept(p123)

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

accept-plan(p123)
 +-s-accept(p123)

--------
Evaluate
```

```
--------

<con> achieve(p123,p180,mb(system,user,has(inter2,lights1)))
Assuming achieve(p123,p180,mb(system,user,has(inter2,lights1))) due to effects


Inferred Plan
-------------

_547699:accept-plan(p123)
 +-_547724:s-accept(p123)

User Model: Adding Proposition
plan(user,p304,mb(system,user,achieve(p123,p180,mb(system,user,has(inter2,lights1)))))

Pushing to focus stack: focus(p304,p304,mb(system,user,achieve(p123,p180,mb(system,user,has(inter2,
  - lights1)))))
User Model: Adding Proposition
achieve(p304,p304,mb(system,user,achieve(p123,p180,mb(system,user,has(inter2,lights1)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p304,p304,mb(system,user,achieve(p123,p180,mb(system,user,has(inter2,
  - lights1)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p180,mb(system,user,has(inter2,lights1))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p180,mb(system,user,has(inter2,lights1)))
User Model: Adding Proposition
mb(system,user,has(inter2,lights1))

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Understanding
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Plan Recognizer
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Actions = s-accept(p123)

number of plans found: 2
Number of complete plans found: 1

-------------------------
Consider Plan Derivation
-------------------------

accept-plan(p123)
 +-s-accept(p123)

--------
Evaluate
--------
```

```
<con> achieve(p123,p142,identify(user,system,entity(1,inter2)))
Assuming achieve(p123,p142,identify(user,system,entity(1,inter2))) due to effects


Inferred Plan
-------------

_554457:accept-plan(p123)
 +-_554482:s-accept(p123)

User Model: Adding Proposition
plan(user,p311,mb(system,user,achieve(p123,p142,identify(user,system,entity(1,inter2)))))

Pushing to focus stack: focus(p311,p311,mb(system,user,achieve(p123,p142,identify(user,system,entity(
  - 1,inter2)))))
User Model: Adding Proposition
achieve(p311,p311,mb(system,user,achieve(p123,p142,identify(user,system,entity(1,inter2)))))

===========================================
Checking Acceptance and Collaborative Rules
===========================================

Applying m_accept_rule1
Popping from focus stack: focus(p311,p311,mb(system,user,achieve(p123,p142,identify(user,system,entity
  - (1,inter2)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p142,identify(user,system,entity(1,inter2))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p142,identify(user,system,entity(1,inter2)))
User Model: Adding Proposition
identify(user,system,entity(1,inter2))

=============
Understanding
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Plan Recognizer
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Actions = s-accept(p123)

number of plans found: 2
Number of complete plans found: 1

------------------------
Consider Plan Derivation
------------------------

accept-plan(p123)
 +-s-accept(p123)

--------
Evaluate
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<con> achieve(p123,p135,mb(system,user,place(inter2,_562575,_562576)))
Assuming achieve(p123,p135,mb(system,user,place(inter2,_562575,_562576))) due to effects
```

```
Inferred Plan
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_562354:accept-plan(p123)
 +-_562379:s-accept(p123)

User Model: Adding Proposition
plan(user,p318,mb(system,user,achieve(p123,p135,mb(system,user,place(inter2,_563940,_563941)))))

Pushing to focus stack: focus(p318,p318,mb(system,user,achieve(p123,p135,mb(system,user,place(inter2,
  - _562575,_562576)))))
User Model: Adding Proposition
achieve(p318,p318,mb(system,user,achieve(p123,p135,mb(system,user,place(inter2,_562575,_562576)))))

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Checking Acceptance and Collaborative Rules
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Applying m_accept_rule1
Popping from focus stack: focus(p318,p318,mb(system,user,achieve(p123,p135,mb(system,user,place(inter2
  - ,_566267,_566268)))))
User Model: Adding Proposition
mb(system,user,achieve(p123,p135,mb(system,user,place(inter2,_566267,_566268))))

Applying m_accept_rule1
Popping from focus stack: focus(p123,p135,mb(system,user,place(inter2,_567481,_567482)))
User Model: Adding Proposition
mb(system,user,place(inter2,_567481,_567482))
```