Quantification Annotation Challenge: Test sentences annotated and interpreted in QuantML

1. Some of the students failed the exam.
   Markables: m1=Some of the students, m2=students, m3=failed, m4=the exam, m5=exam

2. The chairman welcomed the committee members to the meeting.
   Markables: m1=The chairman, m2=chairman, m3=welcomed to, m4=the committee members, m5=committee members, m6=the meeting, m7=meeting

3. Are the Marx Brothers famous?
   Markables: m1=Are famous, m2=the Marx Brothers

4. a. Have you [sing] finished the assignment?
   Markables: m1=Have finished, m2=you, m3=the assignment, m4=assignment
   b. Have you [plur] finished the assignments?
   Markables: m1=Have finished, m2=you, m3=the assignments, m4=assignments

5. The editors didn't see a misprint.
   Markables: m1=The editors, m2=editors, m3=see, m4=a misprint, m5=misprint

6. Bert and Alice own an apartment in Acapulco.
   Markables: m1=Bert, m2=Bert and Alice, m3=Alice, m4=own, m5=an apartment, m6=an apartment in Acapulco, m7=apartment, m8=in Acapulco

7. A man who walks in the park whistles.
   Markables: m1=A man, m2=A man who walks in the park, m3=who walks in the park, m4=walks, m5=the park, m6-whistles

8. Mary visits a museum every day.
   Markables: m1=Mary, m2-visits, m3-a museum, m4=museum, m5=every day, m6=day

9. Some people visited the museum in Amsterdam two or three times.
   Markables: m1=Some people, m2=people, m3=visited, m4= the museum in Amsterdam, m5= museum in Amsterdam, m6=museum, m7= in Amsterdam, m8=Amsterdam, m9=two or three times

10. Anne needed to sneeze twice.
    Markables: m1=Anne, m2=needed, m3=sneeze, m4=twice

11. Not all the students passed the exam.
    Markables: m1=all the student, m2=students, m3=passed, m4=the exam, m5=exam

12. Most of the students passed the exam.
    Markables: m1=most of the students, m2=students, m3=passed, m4=the exam, m5=exam

13. Two of the five judges checked all the evidence three times.
    Markables: m1= Two of the five judges, m2=the five judges, m3=judges, m4=all the evidence, m5=evidence, m6=three times

14. Only elderly men and women participate in these exercises.

Markables:

a) m1=elderly men and women, m2=men and women, m3=men, m4=women, m5=participate in, m6=these exercises, m7=exercises

b) m1=elderly men, m2=elderly men and women, m3=men, m4=women, m5=participate in, m6=these exercises, m7=exercises

15. Alex donated two of his books.

Markables: m1=Alex, m2=donated, m3=two of his books, m4=his, m5=his books, m6=books

16. I didn't know that Mary's car broke down.

Markables: m1=I, m2=know, m3=Mary, m4=Mary's, m5= Mary's car, m6=Mary's car broke down, m7='s, m8=car, m9=broke down

17. The headmaster's childrens' toys have disappeared.

Markables: m1=The headmaster, m2=The headmaster's, m3- The headmaster's children, m4=The headmaster's childrens', m5=The headmaster's childrens' toys, m6=headmaster, m7=headmaster's, m8='s, m9=children, m10=childrens', m11=s', m12=toys

18. These machines combine 12 parts.

Markables: m1=These machines, m2=machines, m3=combine, m4=12 parts, m5=parts

19. TWO committee members came in. [emphasis on "two"]

Markables: m1=Two, m2= Two committee members, m3= committee members, m4=came in

20. The boys carried the boxes upstairs.

Markables: m1=Two boys, m2=boys, m3=carried upstairs, m4=the boxes, m5=boxes

21. A train leaves to Boston every hour.

Markables: m1= A train, m2=train, m3=leaves to, m4= Boston, m5=every hour, m6=hour

22. William, have you finished your assignment?

Markables: m1=William, m2=have finished, m3=you, m4=your, m5=your assignment, m6=assignment

23. Have you all finished your assignments?

Markables: m1=Have finished, m2=you all, m3=your assignments, m4=assignments

24. The women did not smile.

Markables: m1=The women, m2=women, m3=did not, m4=smile

25. Hong Kong reports twenty-three new corona virus infections.

Markables: m1=Hong Kong, m2=reports, m3= twenty-three new corona virus infections, m4=new, m5=new corona virus infections, m6=corona, m7= corona virus,m8=corona virus infections, m9=virus, m10=infections

26. One of my farmers adopted four monkeys from Senegal.

Markables: m1=One of my farmers, m2=my, m3=my farmers, m4=farmers, m5=adopted, m6=four

monkeys from Senegal, m7= monkeys from Senegal, m8=monkeys, m9=from, m10=from Senegal, m11=Senegal

27. Anne found an apartment with a balcony that overlooks the main square.

Markables:

m1=Anne, m2=found, m3=an apartment with a balcony that overlooks the main square, m4=apartment with a balcony that overlooks the main square, m5=apartment, m6=with a balcony that overlooks the main square, m7=a balcony that overlooks the main square, m8=balcony, m9=balcony that overlooks the main square, m10=that overlooks the main square, m11=overlooks, m12=the main square, m13=main square, m14=main, m15=square

28. There's debris everywhere.

Markables: m1=There's, m2=debris, m3=everywhere

29. Every man loves his brothers

Markables: m1=every men, m2=men, m3=loves, m4=his, m5=his brothers, m7=brothers

30. Every man loves his mother.

Markables: m1=every men, m2=men, m3=loves, m4=his, m5=his mother, m7=mother

31. More than four hundred ships are waiting to pass through the Suez Canal.

Markables: m1=more than four hundred, m2= more than four hundred ships, m3=ships, m4=are waiting, m5=to pas throughs, m6=to pass through the Suez Canal, m7=the Suez Canal

QC.1 Some of the students failed the exam.

Markables: m1=Some of the students, m2=students, m3=failed, m4=the exam, m5=exam

QuantML annotation (represented using XML-based concrete syntax)

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="some" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="student"/>
<event xml:id="e1" target="#m3" pred="fail"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="exam"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="free"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, fail\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle student,count\rangle\rangle, some, det\rangle\rangle$

$\varepsilon_{P2} = \langle m4, \langle\langle m5, \langle exam,count\rangle\rangle, single, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, free\rangle$,

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$

Semantics: The compositional semantic interpretation is computed using (B42d).

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \rightarrow student_0(x)]$

$I_Q(\varepsilon_{P2}) = [\ y \mid exam_0(y),\ |exam_0| = 1\ ]$

$I_Q(L_{P1}) = [\ X \mid x \in X \rightarrow [\ E \subseteq fail \mid student_0(x),\ e \in E \rightarrow [agent(e,x)\ ]]$

$I_Q(L_{P2}) = [\ y, E \subseteq fail \mid\ |exam_0| = 1,\ exam_0(y),\ e \in E \rightarrow [\ theme(e,y)\ ]]$

$I_Q(\langle A) = I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle = I_Q(L_{P1}) \cup' I_Q(L_{P2})$

$= [\ X, y \mid x \in X \rightarrow [\ E \subseteq fail \mid student_0(x),\ e \in E \rightarrow [agent(e,x),\ theme(e,y)\ ]]]$

QC.2 The chairman welcomed the committee members to the meeting.

Markables:

m1=The chairman, m2=chairman, m3=welcomed to, m4=the committee members, m5=committee, m6=committee members, m7=members, m8=the meeting, m9=meeting

QuantML annotation (represented using XML-based concrete syntax):

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="single"
definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="chairman"/>
<event xml:id="e1" target="#m3" pred="welcome"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="all"
        definiteness="det"/>
<qDomain xml:id="x4" target="#m6" source="#x5" restrictions="#r1"/>
<sourceDomain xml:id="x5" target="#m7" individuation="count" pred="member"/>
<nnMod xml:id="r1" target="#m5 distr="individual" pred="committee"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow"/>
<entity xml:id="x6" target="#m48 domain="#x7" involvement="single"
        definiteness="det"/>
<sourceDomain xml:id="x7" target="#m9" individuation="count" pred="meeting"/>
<participation event="#e1" participant="#x6" semRole="goal" distr="individual"
        evScope="free"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>
<scoping arg1="#x1" arg2="x6" scopeRel="unscoped"/>
<scoping arg1="#x3" arg2="x6" scopeRel="unscoped"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}, \varepsilon_{P3}\}, \{L_{P1}, L_{P2}, L_{P3}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, fail\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle chairman,count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{P2} = \langle m4, \langle\langle m7, \langle member,count\rangle\rangle, \langle m5, \langle committee, individual\rangle\rangle, all, det\rangle\rangle$

$\varepsilon_{P3} = \langle m8, \langle\langle m9, \langle meeting, count\rangle\rangle, single, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, free\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$,

$L_{P3} = \langle \varepsilon_E, \varepsilon_{P3}, Goal, individual, free\rangle$,

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$, $sc_2 = \langle L_{P1}, L_{P3}, unscoped\rangle$, $sc_3 = \langle L_{P2}, L_{P3}, unscoped\rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ x \mid chairman_0(x), |chairman_0| = 1\ ]$

$I_Q(\varepsilon_{P4}) = [\ z \mid meeting_0(z), |meeting_0| = 1\ ]$

$I_Q(\varepsilon_{P3}) = [\ c \mid committee_0(c), |committee_0| = 1\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \leftrightarrow [\ u \mid committee_0(u), |committee_0| = 1, NN(u,y)\ ]\ ]$

Noun-noun modification where the modifying noun N is a relational noun (such as "member") should be interpreted as the predicate 'NN' being the relation denoted by N. Therefore:

$I_Q(L_{P1}) = [\ x, E \subseteq \text{welcome} \mid |\text{chairman}_0| = 1, \text{chairman}_0(x), e \in E \rightarrow [\ \text{agent}(e,x)\ ]]$

$I_Q(L_{P2}) = [\ Y \mid y \in Y \leftrightarrow [\ u \mid \text{committee}_0(u), |\text{committee}_0| = 1, \text{member\_of}(u,y)\ ],$
$\qquad y \in Y \rightarrow \text{theme}(e,y)\ ]]$

$I_Q(L_{P4}) = [\ z, E \subseteq \text{welcome} \mid |\text{meeting}_0| = 1, \text{meeting}_0(z), e \in E \rightarrow [\ \text{goal}(e,z)\ ]]$

$I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}, L_{P3}\}, \{sc_1\}\rangle) = I_Q(L_{P2}) \cup' I_Q(L_{P1}) \cup' I_Q(L_{P4})$

$= [\ x, Y, z \mid \text{chairman}_0| = 1, \text{chairman}_0(x), \text{meeting}_0(z), |\text{meeting}_0| = 1,$
$\qquad y \in Y \leftrightarrow [\ u \mid \text{committee}_0(u), |\text{committee}_0| = 1, \text{member\_of}(u,y)\ ],$
$\qquad y \in Y \rightarrow [\ E \subseteq \text{welcome} \mid \text{agent}(e,x),\ \text{theme}(e,y), \text{goal}(e,z)\ ]]$

QC.3 Are the Marx Brothers famous?

Markables: m1=Are famous, m2=the Marx Brothers, m3= Marx Brothers

Readings:

a. the collective "the Marx Brothers" is famous as such.
b. each of the members of the collective is famous.
c. are Karl Marx and his brothers famous? (similar to b)

Reading a:

QuantML annotation (represented using XML-based concrete syntax):

```
<entity xml:id="x1" target="#m2" domain="#x2" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m3" individuation="count"
        pred="Marx_Brothers"/>
<event xml:id="e1" target="#m1" pred="famous"/>
<participation event="#e1" participant="#x1" semRole="theme" distr="collective"
        evScope="free"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\} \rangle$

$\varepsilon_E = \langle m1, famous \rangle$,

$\varepsilon_{P1} = \langle m2, \langle\langle m3, \langle MarxBrothers,count \rangle\rangle, single, det \rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Theme, collective, free \rangle$

Semantic interpretation, computed according to (B42??).

$I_Q(\varepsilon_{P1}) = [\ X \mid MarxBrothers_0(X),\ |MarxBrothers_0| = 1\ ]$

$I_Q(L_{P1}) = [\ X, E \subseteq famous \mid MarxBrothers_0(X),\ |MarxBrothers_0|=1,\ e \in E \rightarrow theme(e,X)\ ]$

$I_Q(A) = I_Q(L_{P1}) = [\ X, E \subseteq famous \mid MarxBrothers_0(X),\ |MarxBrothers_0|=1,\ e \in E \rightarrow theme(e,X)\ ]$

Reading b:

QuantML annotation:

```
<entity xml:id="x1" target="#m2" domain="#x2" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m3" individuation="count"
        pred="Marx_Brothers"/>
<event xml:id="e1" target="#m1" pred="famous"/>
<participation event="#e1" participant="#x1" semRole="theme" distr="individual"
        evScope="narrow"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\} \rangle$

$\varepsilon_E = \langle m1, famous \rangle$,

$\varepsilon_{P1} = \langle m2, \langle\langle m3, \langle MarxBrothers,count \rangle\rangle, all, det \rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Theme, individual, narrow \rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \leftrightarrow MarxBrother_0(x)\ ]$

$I_Q(L_{P1}) = [\ X \mid x \in X \leftrightarrow MarxBrother_0(x),\ x \in X \rightarrow [\ E \subseteq famous \mid e \in E \rightarrow theme(e,x)\ ]\ ]$

$I_Q(A) = I_Q(L_{P1})$

Q.4 a. Have you [sing] finished the assignment?

Markables: m1=Have finished, m2=you, m3=the assignment, m4=assignment

b. Have you [plur] finished the assignments?

Markables: m1=Have finished, m2=you, m3=the assignments, m4=assignments

a. *QuantML annotation (represented using XML-based concrete syntax):* (singular "you")

```
<entity xml:id="x1" target="#m2" domain="#x2" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="addressee"/>
<event xml:id="e1" target="#m1" pred="finish"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="single" evScope="free"/>
<entity xml:id="x3" target="#m3" domain="#x4" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="assignment"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="free"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>
```

b. Annotation for plural "you": *ceteris paribus:*

```
<entity xml:id="x1" target="#m2" domain="#x2" involvement="all" definiteness="det"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m1, finish\rangle$

$\varepsilon_{P1} = \langle m2, \langle\langle m2, \langle you,count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle\langle m4, \langle assignment,count\rangle\rangle, single, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, free\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, free\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$

The semantic interpretation is computed according to (B42d).

$I_Q(\varepsilon_{P1}) = [\ x \mid addressee_0(x),\ |addressee_0| = 1\ ]$

$I_Q(\varepsilon_{P2}) = [\ y \mid assignment_0(y),\ |assignment_0| = 1\ ]$

$I_Q(L_{P1}) = [\ x, E \subseteq finish \mid |addressee_0| = 1, addressee_0(x), e \in E \rightarrow [\ agent(e,x)\ ]]$

$I_Q(L_{P2}) = [\ y, E \subseteq finish \mid |assignment_0| = 1, assignment_0(y), e \in E \rightarrow [\ theme(e,y)\ ]]$

$I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle = I_Q(L_{P1}) \cup' I_Q(L_{P2})$

$= [\ x, y, E \subseteq finish \mid addressee_0(x),\ |addressee_0|=1, assignment_0(y),$
$|assignment_0|=1, e \in E \rightarrow [\ agent(e,x), theme(e,y\ ]\ ]$

Plural "you":

$\varepsilon_{P1} = \langle m2, \langle\langle m2, \langle you,count\rangle\rangle, all, det\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle\langle m4, \langle assignment,count\rangle\rangle, all, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle,$

$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics, computed according to (B42a):

$I_Q(\varepsilon_{P1}) = [\ X \supseteq \text{addressee}_0 \mid x \in X \rightarrow \text{addressee}_0(x)\ ]$
$I_Q(\varepsilon_{P2}) = [\ Y \supseteq \text{assignment}_0 \mid y \in Y \rightarrow \text{assignment}_0(y)\ ]$
$I_Q(L_{P1}) = [\ X \supseteq \text{addressee}_0 \mid x \in X \rightarrow [\ E \subseteq \text{finish} \mid \text{addressee}_0(x), e \in E \rightarrow [\text{agent}(e,x)\ ]]$
$I_Q(L_{P2}) = [\ Y \supseteq \text{assignment}_0 \mid y \in Y \rightarrow [\ E \subseteq \text{finish} \mid \text{assignment}_0(y), e \in E \rightarrow [\text{theme}(e,y)\ ]]$

$I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle = I_Q(L_{P1}) \cup^* I_Q(L_{P2})$
$= [\ X \supseteq \text{addressee}_0 \mid x \in X \rightarrow [\ Y \supseteq \text{assignment}_0 \mid y \in Y \rightarrow [\ E \subseteq \text{finish} \mid \text{addressee}_0(x),$
$\text{assignment}_0(y), e \in E \rightarrow [\text{agent}(e,x), \text{theme}(e,y)\ ]]$

QC.5 The editors didn't see a misprint.

Markables: m1=The editors, m2=editors, m3=see, m4=a misprint, m5=misprint

Readings:

a. every one of the editors didn't see some misprint(s)
b. every one of the editors didn't see any misprint
c. it is not the case that every one of the editors saw a misprint
d. a misprint was missed by all the editors

Reading a:

QuantML annotation (represented using XML-based concrete syntax):

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="editor"/>
<event xml:id="e1" target="#m3" pred="see"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow" polarity="neg-narrow"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="a" definiteness="indet"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="misprint"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow" polarity="neg-narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, see\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle editor,count\rangle\rangle, all, det\rangle\rangle$, $\varepsilon_{P2} = \langle m4, \langle\langle m5, \langle misprint,count\rangle\rangle, a, indet\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, narrow\text{-}negative\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow, narrow\text{-}negative\rangle$,

$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics, computed according to (B31) and (B32):

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow see(e)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \supseteq editor_0 \mid x \in X \rightarrow editor_0(x)\ ]$, $I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \rightarrow misprint(y)\ ]$

$I_Q(L_{P1}) = I_Q(\varepsilon_{P1}) \cup (I_Q(Agent, individual, narrow, positive) \oplus^n I_Q(\varepsilon_E))$

$= [\ X \supseteq editor_0 \mid x \in X \rightarrow editor_0(x)\ ] \cup$

$([\ Y \mid \mid y \in Y \rightarrow [\ E \mid e \in E \rightarrow agent(e,y)\ ]] \oplus^n [\ E \mid e \in E \rightarrow see(e)\ ])$

$= [\ X \supseteq editor_0 \mid x \in X \rightarrow editor_0(x)\ ] \cup$

$([\ Y \mid \mid y \in Y \rightarrow \neg ([\ E \mid e \in E \rightarrow agent(e,y)\ ] \cup [\ E \mid e \in E \rightarrow see(e)\ ])\ ]\ )$

$= [\ X \supseteq editor_0 \mid x \in X \rightarrow editor_0(x)\ ] \cup$

$([\ Y \mid \mid y \in Y \rightarrow \neg [\ E \subseteq see \mid e \in E \rightarrow agent(e,y)\ ]\ ])$

$= [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x), \neg [\ E \subseteq see \mid e \in E \rightarrow agent(e,y)\ ]\ ]\ ]$

$I_Q(L_{P2}) = [\ Y \mid y \in Y \rightarrow [\ misprint(y), \neg [\ E \subseteq see \mid e \in E \rightarrow theme(e,y)\ ]\ ]\ ]$

$I_Q(A) = I_Q(L_{P1}) \cup * I_Q(L_{P2})$

$= [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x), [\ Y \mid y \in Y \rightarrow [\ misprint(y),$

$\neg [\ E \subseteq see \mid e \in E \rightarrow [\ agent(e,x), theme(e,y)\ ]\ ]\ ]\ ]\ ]\ ]$

Reading b:

QuantML annotation:

<entity xml:id="x1" target="#m1" domain="#x2" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="editor"/>
<event xml:id="e1" target="#m3" pred="see"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
evScope="narrow" polarity="neg-narrow"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="a" definiteness="indet"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="misprint"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
evScope="narrow" polarity="neg-wide"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, see\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle editor,count\rangle\rangle, all, det\rangle\rangle$

$\varepsilon_{P2} = \langle m4, \langle\langle m5, \langle misprint,count\rangle\rangle, a, indet\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, narrow\text{-}negative\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow, narrow\text{-}wide\rangle$,

$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics, computed according to (B30):

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow see(e)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \supseteq editor_0 \mid x \in X \rightarrow editor_0(x)\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \rightarrow misprint(y)\ ]$

$I_Q(L_{P1}) = I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, narrow\text{-}negative\rangle)$
$= [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x), \neg [\ E \subseteq see \mid e \in E \rightarrow agent(e,y)\ ]\ ]\ ]$

$I_Q(L_{P2}) = I_Q(\langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow, neg\text{-}wide\ \rangle)$
$= \sim [\ Y \mid y \in Y \rightarrow [\ misprint(y), [\ E \subseteq see \mid e \in E \rightarrow theme(e,y)\ ]\ ]\ ]$

$I_Q(A) = I_Q(L_{P1}) \cup * I_Q(L_{P2})$

➔ *Extension needed for 'unifying' top-level negation and ordinary DRS-negation!*

$= [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x), \neg [\ Y \mid y \in Y \rightarrow [\ misprint(y),$
$[\ E \subseteq see \mid e \in E \rightarrow [agent(e,x), theme(e,y)\ ]\ ]\ ]\ ]\ ]\ ]$

Reading c:

QuantML annotation:

<entity xml:id="x1" target="#m1" domain="#x2" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="editor"/>
<event xml:id="e1" target="#m3" pred="see"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
evScope="narrow" polarity="neg-wide"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="a" definiteness="indet"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="misprint"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
evScope="narrow" polarity="neg-wide"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, see\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle editor,count\rangle\rangle, all, det\rangle\rangle$

$\varepsilon_{P2} = \langle m4, \langle\langle m5, \langle misprint,count\rangle\rangle, a, indet\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, narrow\text{-}negative\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow, narrow\text{-}wide\rangle$,

$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics, computed according to (B30):

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow see(e)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \supseteq editor_0 \mid x \in X \rightarrow editor_0(x)\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \rightarrow misprint(y)\ ]$

$I_Q(L_{P1}) = I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, narrow\text{-}negative\rangle)$

$= \sim [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x), [\ E \subseteq see \mid e \in E \rightarrow agent(e,y)\ ]\ ]\ ]$

$I_Q(L_{P2}) = I_Q(\langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow, neg\text{-}wide\ \rangle)$

$= \sim [\ Y \mid y \in Y \rightarrow [\ misprint_(y), [\ E \subseteq see \mid e \in E \rightarrow theme(e,y)\ ]\ ]\ ]$

$I_Q(A) = I_Q(L_{P1}) \cup * I_Q(L_{P2})$

➔ *Extension needed for combining two top-level negated DRSs!*

$= \sim [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x), \neg [\ Y \mid y \in Y \rightarrow [\ misprint(y),$
$[\ E \subseteq see \mid e \in E \rightarrow [agent(e,x), theme(e,y)\ ]\ ]\ ]\ ]\ ]\ ]$

Reading d:

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="editor"/>
<event xml:id="e1" target="#m3" pred="see"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow" polarity="neg-narrow"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="a" definiteness="indet"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="misprint"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow" polarity="neg-narrow"/>
<scoping arg1="#x3" arg2="x1" scopeRel="wider"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, see\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle editor,count\rangle\rangle, all, det\rangle\rangle$

$\varepsilon_{P2} = \langle m4, \langle\langle m5, \langle misprint,count\rangle\rangle, a, indet\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, narrow\text{-}negative\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow, narrow\text{-}negative\rangle$

$sc_1 = \langle L_{P2}, L_{P1}, wider\rangle$

Semantics, computed according to (B31) and (B32):

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow see(e)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \supseteq editor_0 \mid x \in X \rightarrow editor_0(x)\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \rightarrow misprint(y)\ ]$

$I_Q(L_{P1}) = I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, narrow\text{-}negative\rangle)$

$= [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x), \neg [\ E \subseteq see \mid e \in E \rightarrow agent(e,y)\ ]\ ]\ ]$

$I_Q(L_{P2}) = I_Q(\langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow, neg\text{-}narrow\ \rangle)$

$= [\ Y \mid y \in Y \rightarrow [\ misprint(y), \neg [\ E \subseteq see \mid e \in E \rightarrow theme(e,y)\ ]\ ]\ ]$

$I_Q(A) = I_Q(L_{P2}) \cup * I_Q(L_{P1})$

$= [\ Y \mid y \in Y \rightarrow [\ misprint(y), [\ X \supseteq editor_0 \mid x \in X \rightarrow [\ editor_0(x),$

$\neg [\ E \subseteq see \mid e \in E \rightarrow [\ agent(e,x), theme(e,y)\ ]\ ]\ ]\ ]\ ]\ ]$

QC.6 Bert and Alice own an apartment in Acapulco.

Markables:

m1=Bert, m2=Bert and Alice, m3=Alice, m4=own, m5=an apartment in Acapulco, m6=apartment, m7=apartment in Acapulco, m8=in Acapulco, m9=Acapulco

Readings:

a. Bert and Alice own an apartment in Acapulco together
b. Bert and Alice each own an apartment in Acapulco

Reading a:

QuantML annotation (represented using XML-based concrete syntax):

```
<entity xml:id="x1" target="#m2" domain="#x2" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1 #m3" individuation="count" pred="Bert Alice"/>
<event xml:id="e1" target="#m4" pred="own"/>
<participation event="#e1" participant="#x1" semRole="pivot" distr="collective" evScope="free />
<entity xml:id="x3" target="#m5" domain="#x4" involvement="a" definiteness="indet"/>
<qDomain xml:id="x4" target="m87 source="#x5" restrictions'#r1"\>
<sourceDomain xml:id="x5" target="#m6" individuation="count" pred="apartment"/>
<ppMod xml:id="r1" target="#m8" prel="in" pEntity="#x6" distr="individual" linking="linear"/>
<entity xml:id="x6" target="#m10" domain="#x7" involvement="single" definiteness="det"/>
<sourceDomain xml:if="x7" target="#m9" pred="Acapulco"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/> ???
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m4, own\rangle$

$\varepsilon_{P1} = \langle m2, \langle \langle\langle m1, \langle Bert,count\rangle\rangle, single, det\rangle, \langle\langle m3, \langle Alice,count\rangle\rangle, single, det\rangle \rangle\rangle$

$\varepsilon_{P2} = \langle m5, \langle\langle m4, \langle apartment,count\rangle, \langle m8, \langle in, \varepsilon_{P3}\rangle \rangle, a, indet\rangle\rangle$

$\varepsilon_{P3} = \langle m9, \langle\langle m9, \langle Acapulco,count\rangle\rangle, single, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Pivot, collective, narrow\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$

Semantics, computed according to ???

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow own(e)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \leftrightarrow (Bert_0(x) \vee Alice_0(x))\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \rightarrow [apartment(y), in(y,Acapulco)\ ]]$ ***CHECK!***

$I_Q(\varepsilon_{P3}) = [\ z \mid Acapulco_0](z)\ ]$

$I_Q(L_{P1}) = [\ X, E \subseteq own \mid x \in X \leftrightarrow (Bert_0(x) \vee Alice_0(x))\ ,\ e \in E \rightarrow pivot(e,X)]$

$I_Q(L_{P2}) = [\ Y, E \subseteq own \mid y \in Y \rightarrow [apartment(y), in(y,Acapulco),\ e \in E \rightarrow theme(e,y)]\ ]$

$I_Q(A) = I_Q(L_{P1}) \cup' I_Q(L_{P2})$

$= [\ X, Y, E \subseteq own \mid x \in X \leftrightarrow [Bert_0(x) \vee Alice_0(x)], [\ y \in Y \rightarrow [apartment(y), in(y,Acapulco),\ e \in E \rightarrow [agent(e,X), theme(e,y)]]]]$

QC.7 A man who walks in the park whistles.

Markables:

m1=A man who walks in the park, m2=man who walks in the park, m3=man, m4=who walks in the park, m5=walks, m6=the park, m7=park, m8=whistles

QuantML annotation (represented using XML-based concrete syntax)n:

```
<entity xml:id=”x1” target=”#m2” domain=”#x2” involvement=”a” definiteness=”indet”/>
<qDomain xml:id=”x2” target=”m8 source=”#x3” restrictions’#r1”\>
<sourceDomain xml:id=”x3” target=”#m3” individuation=”count” pred=”man”/>
<relClause xml:id=”r1” target=”#m4” semRole=”agent” clause=”#e1” distr=”individual”
        linking=”linear”/>
<event xml:id=”e1” target=”#m5” pred=”walk”/>
<participation event=”#e1” participant=”#x1” semRole=”agent” distr=”individual”
        evScope=”narrow />
<entity xml:id=”x4” target=”#m6” domain=”#x5” involvement=”a” definiteness=”det”/>
<sourceDomain xml:id=”x5” target=”#m7” individuation=”count” pred=”park”/>
<participation event=”#e1” participant=”#x4” semRole=”location” distr=”individual”
        evtScope=”narrow />
<event xml:id=”e2” target=”#m6” pred=”whistle”/>
```

QC.8 Mary visits a museum every day.

Markables:

m1=Mary, m2-visits, m3-a museum, m4=museum, m5=every day, m6=day

Reading A: Every day Mary visits a (possibly different) museum.

QuantML annotation (represented using XML-based concrete syntax):

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1" individuation="single" pred="Mary"/>
<event xml:id="e1" target="#m2" pred="visit"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="single"
        evScope="free"/>
<entity xml:id="x3" target="#m3" domain="#x4" involvement="a" definiteness="indet"/>
<sourceDomain xml:id="x4" target="#m4" individuation="count" pred="museum"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow"/>
<entity xml:id="x5" target="#m5" domain="#x6" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x5" target="#m6" individuation="count" pred="day"/>
<participation event="#e1" participant="#x5" semRole="time" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>
<scoping arg1="#x1" arg2="x5" scopeRel="unscoped"/>
<scoping arg1="#x5" arg2="x3" scopeRel="wider"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}, \varepsilon_{P3}\}, \{L_{P1}, L_{P2}, L_{P3}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m2, visit\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m1, \langle Mary,count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle\langle m4, \langle museum,count\rangle\rangle, a, indet\rangle\rangle$

$\varepsilon_{P3} = \langle m5, \langle\langle m6, \langle day, count\rangle\rangle, all, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, free\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$,

$L_{P3} = \langle \varepsilon_E, \varepsilon_{P3}, Time, individual, narrow\rangle$,

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$, $sc_2 = \langle L_{P1}, L_{P3}, unscoped\rangle$, $sc_3 = \langle L_{P3}, L_{P2}, wider\rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ x \mid Mary_0(x),\ |Mary_0| = 1\ ]$

$I_Q(\varepsilon_{P4}) = [\ Y \mid y \in Y \rightarrow museum(y)\ ]$

$I_Q(\varepsilon_{P3}) = [\ D \subseteq day_0 \mid day_0(d) \rightarrow d \in D\ ]$

$I_Q(L_{P1}) = [\ x, E \subseteq visit \mid Mary_0(x),\ |Mary_0| = 1,\ e \in E \rightarrow agent(e,x)\ ]$

$I_Q(L_{P2}) = [\ Y \subseteq museum \mid y \in Y \rightarrow [\ E \subseteq visit \mid e \in E \rightarrow theme(e,y)\ ]]$

$I_Q(L_{P3}) = [\ D \subseteq day_0 \mid day_0(d) \rightarrow d \in D,\ d \in D \rightarrow [\ E \subseteq visit \mid e \in E \rightarrow time(e,d)\ ]]$

$I_Q(A) = I_Q(L_{P3}) \cup^* I_Q(L_{P1}) \cup' I_Q(L_{P2}) =$

$= [\ D = day_0 \mid d \in D \rightarrow [\ x, Y \subseteq museum \mid Mary_0(x),\ |Mary_0| = 1,\ y \in Y \rightarrow$

$[\ E \subseteq visit \mid agent(e,x), theme(e,y), time(e,d)\ ]]]$

Q.9 Some people visited the museum in Amsterdam two or three times.

Better to simplify to: Some people visited the museum twice.
(There's currently no obvious QuantML treatment for "two or three times", but see below.)

Markables:

m1=Some people, m2=people, m3=visited, m4= the museum in Amsterdam, m5=museum,
m6=museum in Amsterdam, m7= in Amsterdam, m8=Amsterdam,
m9=two or three times

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="some" definiteness="indet"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="people"/>
<event xml:id="e1" target="#m3" pred="visit"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow" rep="2"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="museum"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="free"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, visit\rangle$,
$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle people,count\rangle\rangle, some, det\rangle\rangle$
$\varepsilon_{P2} = \langle m4, \langle\langle m5, \langle museum,count\rangle\rangle, single, det\rangle\rangle$
$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, 2\rangle$
$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, free\rangle$,
$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$

The semantic interpretation is computed according to (B35).

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \rightarrow people(x)]$
$I_Q(\varepsilon_{P2}) = [\ y \mid museum_0(y), |museum_0| = 1\ ]$
$I_Q(L_{P1}) = [\ X \subseteq people \mid x \in X \rightarrow [\ E \subseteq visit \mid |E| = 2, e \in E \rightarrow [agent(e,x)\ ]]$
$I_Q(L_{P2}) = [\ y, E \subseteq visit \mid museum_0(y), |museum_0| = 1, e \in E \rightarrow [\ theme(e,y)\ ]]$

$I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle = I_Q(L_{P1}) \cup' I_Q(L_{P2})$
$= [\ X \subseteq people, y \mid museum_0(y), |museum_0| = 1, x \in X \rightarrow$
$[\ E \subseteq visit \mid |E| = 2, e \in E \rightarrow [agent(e,x), theme(e,y)\ ]]]$

Note:
Possible QuantML treatment of "two or three times":

<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
evScope="narrow" rep="#n1"/>
<numericalPred xml:id="n1" target="#m9" numRel="or" num1="2" num2="3"/>

This presupposes the availability of ternary relations, which would also be needed for dealing with "between twenty and twenty-five", or "10-12", or "7 a 8". These are also needed for numerical domain involvement specification.

The corresponding structure in the abstract syntax would be a `numerical size specification'
⟨m3, ⟨r, n1, n2⟩⟩, with the semantics λz. r'(z, n1', n2').

QC.10 Anne needed to sneeze twice.

Markables: m1=Anne, m2=needed, m3=sneeze, m4=twice

Readings a: What Anne needed was sneezing twice.
b: Twice, Anne needed to sneeze.

QuantML annotation for reading b:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1" individuation="single" pred="Anne"/>
<event xml:id="e1" target="#m2" pred="need"/>
<participation event="#e1" participant="#x1" semRole="experiencer" distr="single"
        evScope="free"/>
<event xml:id="e2" target="#m3" pred="sneeze"/>
<participation event="#e2" participant="#x1" semRole="agent" distr="single"
        rep="2" evScope="free"/>
<participation event="#e1" participant="#e2" semRole="theme" distr="individual"
        evScope="free"/>
<scoping arg1="#x1" arg2="e2" scopeRel="unscoped"/>
```

(*For reading a: the same, except:*

```
<participation event="#e2" participant="#x1" semRole="agent" distr="single"
        evScope="free"/>
<participation event="#e1" participant="#e2" semRole="theme" distr="individual"
        rep="2" evScope="free"/>)
```

Abstract syntax: $A = \langle \varepsilon_{E1}, \{\varepsilon_{P1}, \varepsilon_{E2}\} \{L_{P1}, L_{P2}, L_{P3}\}, \{\}\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle m1, \langle Anne, count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{E1} = \langle m2, need\rangle$

$\varepsilon_{E2} = \langle m3, sneeze\ \rangle$

$L_{P1} = \langle \varepsilon_{E1}, \varepsilon_{P1}, Experiencer, individual, free\rangle$

$L_{P2} = \langle \varepsilon_{E1}, \varepsilon_{E2}, Theme, individual, free\rangle,$

$L_{P3} = \langle \varepsilon_{E2}, \varepsilon_{P1}, Agent, individual, free\rangle$

$sc_1 = \langle L_{P1}, L_{E2}, unscoped\rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ x \mid Anne_0(x),\ |Anne_0| = 1\ ]$

$I_Q(\varepsilon_{E1}) = [\ E \mid e \in E \rightarrow need(e)\ ]$

$I_Q(\varepsilon_{E2}) = [\ E' \mid e' \in E' \rightarrow sneeze(e')\ ]$

$I_Q(L_{P1}) = [\ x, E \subseteq need \mid Anne_0(x),\ |Anne_0| = 1,\ e \in E \rightarrow experiencer(e,x)\ ]$

$I_Q(L_{P2}) = [\ E \subseteq need \mid e \in E \rightarrow [\ E' \subseteq sneeze \mid e' \in E' \rightarrow theme(e,e')\ ]$

$I_Q(L_{P3}) = [\ x, E' \subseteq sneeze \mid Anne_0(x),\ |Anne_0| = 1,\ e' \in E' \rightarrow agent(e,x)\ ]$

$I_Q(A) = (I_Q(L_{P1}) \cup' I_Q(L_{P2})) \cup' I_Q(L_{P3}) =$

$[\ x, E \subseteq need \mid Anne_0(x),\ |Anne_0| = 1,\ e \in E \rightarrow [\ E' \subseteq sneeze \mid e' \in E' \rightarrow$
$[\ agent(e,x),\ agent(e',x)\ ]]]$

QC.11 Not all the students passed the exam.

The semantic interpretation is computed according to (B42d).

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \rightarrow \text{student}_0(x)]$

$I_Q(\varepsilon_{P2}) = [\ y \mid \text{exam}_0(y),\ |\text{exam}_0| = 1\ ]$

$I_Q(L_{P1}) = [\ X \mid x \in X \rightarrow [\ E \subseteq \text{fail} \mid \text{student}_0(x),\ e \in E \rightarrow [\text{agent}(e,x)\ ]]$

$I_Q(L_{P2}) = [\ y, E \subseteq \text{fail} \mid |\text{exam}_0| = 1,\ \text{exam}_0(y),\ e \in E \rightarrow [\ \text{theme}(e,y)\ ]]$

$I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle = I_Q(L_{P1}) \cup' I_Q(L_{P2})$

$= [\ X, y \mid x \in X \rightarrow [\ E \subseteq \text{fail} \mid \text{student}_0(x),\ e \in E \rightarrow [\text{agent}(e,x),\ \text{theme}(e,y)\ ]]]$

QC.12 Most of the students passed the exam.

Markables:

m1=Most of the students, m2=most, m3=students, m4=passed, m5=the exam, m6=exam

QC.13 Two of the five judges checked all the evidence three times.

Markables:

m1= Two of the five judges, m2=judges, m3=checked,
m4=all the evidence, m5=evidence

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="two"
definiteness="indet" size="5"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="judge"/>
<event xml:id="e1" target="#m3" pred="check"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow" rep="3"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="all"
        definiteness="det"/>
<sourceDomain xml:id="x4" target="#m5" individuation="mass" pred="evidence"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="parts"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, check\rangle$,
$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle judge,count\rangle\rangle, 2, indet, 5\rangle\rangle$
$\varepsilon_{P2} = \langle m4, \langle\langle m5, \langle evidence,mass\ \rangle\rangle, all, det\rangle\rangle$
$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, 3\rangle$
$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$
$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

The semantic interpretation is computed according to (B5), (B2) + (B4):

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow check(e)\ ]$
$I_Q(\varepsilon_{P1}) = [\ X \subseteq judge_0 \mid |X|=2,\ |judge_0|=5,\ x \in X \rightarrow judge_0(x)\ ]$
$I_Q(\varepsilon_{P2}) = [\ Y \subseteq evidence_0 \mid evidence_0(y) \rightarrow y \in Y]$
$I_Q(L_{P1}) = I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, 3\rangle)$
$= I_Q(\varepsilon_{P1}) \cup (I_Q(Agent, individual, narrow) \cup I_Q(\varepsilon_E))$
$= [\ X \subseteq judge_0 \mid |X|=2,\ |judge_0|=5,\ x \in X \rightarrow [\ E \subseteq check \mid |E|=3,\ e \in E \rightarrow agent(e,x)\ ]]$
$I_Q(L_{P2}) = I_Q(\langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle)$
$= [\ Y = evidence_0 \mid y \in Y \rightarrow [\ E \subseteq check \mid e \in E \rightarrow theme(e,y)\ ]]$
$I_Q(A) = I_Q(L_{P1}) \cup * I_Q(L_{P2})$
$= [\ X \subseteq judge_0 \mid |X|=2,\ |judge_0|=5,\ x \in X \rightarrow$
$[\ Y = evidence_0 \mid y \in Y \rightarrow$
$[\ E \subseteq check \mid |E|=3,\ e \in E \rightarrow [agent(e,x),\ theme(e,y)]\ ]]]$

QC.14. Only elderly men and women participate in these exercises.

14a. Elderly men and women participate in these exercises.

Markables for 13a:

a) m1=Elderly, m2=elderly men and women, m3=men, m4=men and women, m5=women, m6=participate in, m7=these exercises, m8=exercises

b) m1=Elderly, m2=elderly men, m3= elderly men and women, m4=men, m5=women, m6=participate in, m7=these exercises, m8=exercises

QuantML annotation, reading a:

```
<entity xml:id="x1" target="#m2" domain="#x2" involvement="some" definiteness="indet"/>
<qDomain xml:id="x2" target="#m4" source="#x3 #x4" restrictions="#r1"/>
<sourceDomain xml:id="x3" target="#m3" individuation="count" pred="man"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="woman"/>
<adjMod xml:id="r1" target="#m1" distr="individual" pred="elderly"/>
<event xml:id="e1" target="#m6" pred="participate"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow"/>
<entity xml:id="x5" target="#m7" domain="#x5" involvement="some" definiteness="det"/>
<sourceDomain xml:id="x5" target="#m8" individuation="count" pred="exercise"/>
<participation event="#e1" participant="#x4" semRole="theme" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x5" scopeRel="wider"/>
```

Reading b:

```
<qDomain xml:id="x2" target="#m3" source="#x3 #x5">
<qDomain xml:id="x3" target="#m2" source="#x4 restrictions="#r1"/>
<sourceDomain xml:id="x4" target="#m4" individuation="count" pred="man"/>
<adjMod xml:id="r1" target="#m1" distr="individual" pred="elderly"/>
<sourceDomain xml:id="x5" target="#m5" individuation="count" pred="woman"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle$m6, participate$\rangle$

$\varepsilon_{P1} = \langle$m2, $\langle\langle$m4, $\langle \langle$man,count$\rangle$, $\langle$woman,count$\rangle\rangle$, $\langle$m1,elderly$\rangle \rangle$, all, indet$\rangle\rangle$

$\varepsilon_{P2} = \langle$m7, $\langle\langle$m8, $\langle$exercise,count$\rangle\rangle$, some, det$\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}$, Agent, individual, narrow$\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}$, Theme, individual, narrow$\rangle$

$sc_1 = \langle L_{P1}, L_{P2}$, wider$\rangle$

Semantics, computed according to (B9a), (B6) and (B42a)

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow \text{participate}(e)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \rightarrow [\ (\text{man}(x) \vee \text{woman}(x)), \text{elderly}(x)]\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \leftrightarrow \text{exercise}_0\ (y)\ ]$

$I_Q(A) = I_Q(L_{P1}) \cup * I_Q(L_{P2})$

$= [\ X \mid x \in X \rightarrow\ [\ Y \mid ((\text{man}(x) \vee \text{woman}(x), \text{elderly}(x), y \in Y \leftrightarrow \text{exercise}_0(y),$

$y \in Y \rightarrow [\ E \mid e \in E \rightarrow [\ \text{participate}(e), \text{agent}(e,x), \text{theme}(e,y)\ ]\ ]\ ]\ ]$

14b: addition of “Only” makes the quantification over the agents exhaustive:

QuantML annotation:

```
<entity xml:id=”x1” target=”#m2” domain=”#x2” involvement=”some” definiteness=”indet”/>
<qDomain xml:id=”x2” target=”#m4” source=”#x3 #x4” restrictions=”#r1”/>
<sourceDomain xml:id=”x3” target=”#m3” individuation=”count” pred=”man”/>
<sourceDomain xml:id=”x4” target=”#m5” individuation=”count” pred=”woman”/>
<adjMod xml:id=”r1” target=”#m1” distr=”individual” pred=”elderly”/>
<event xml:id=”e1” target=”#m6” pred=”participate”/>
<participation event=”#e1” participant=”#x1” semRole=”agent” distr=”individual”
        evScope=”narrow” exhaustiveness=”exhaustive”/>
<entity xml:id=”x5” target=”#m7” domain=”#x5” involvement=”some” definiteness=”det”/>
<sourceDomain xml:id=”x5” target=”#m8” individuation=”count” pred=”exercise”/>
<participation event=”#e1” participant=”#x4” semRole=”theme” distr=”individual”
        evScope=”narrow”/>
<scoping arg1=”#x1” arg2=”x5” scopeRel=”wider”/>
```

QC.15 = TiCC report (B64)

Alex donated two of his books.

Markables: m1=Alex, m2=donated, m3=two of his books, m4=his, m5=his books, m6=books

QC.16 I didn't know that Mary's car broke down.

16a I know that Mary's car broke down.

For 16a:

Markables:

m1=I, m2=know, m3=Mary, m4=Mary's, m5= Mary's car, m6=Mary's car broke down, m7=car, m8=broke down

QuantML annotation:

<entity xml:id="x1" target="#m1" domain="#x2" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1" individuation="count" pred="speaker"/>
<event xml:id="e1" target="#m2" pred="know"/>
<participation event="#e1" participant="#x1" semRole="pivot" distr="individual"
evScope="free" polarity="neg-narrow"/>
<entity xml:id="x3" target="#m3" domain="#x4" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m3" individuation="count" pred="Mary"/>
<entity xml:id="x5" target="#m5" domain="#x6" involvement="single" definiteness="det"/>
<qDomain xml:id="x6" target="#m5" source="#x7" restrictions="#r1"/>
<sourceDomain xml:id="x7" target="#m7" individuation="count" pred="car"/>
<possRestr xml:id="r1" target="#m4" distr="individual" possessor="#x3"
linking="linear"/>
<event xml:id="e2" target="#m6" pred="break-down"/>
<participation event="#e2" participant="#x5" semRole="theme" distr="single"
evScope="free"/>
<participation event="#e1" participant="#e2" semRole="theme" distr="individual"
evScope="wide"/>
<scoping arg1="#x1" arg2="e2" scopeRel="unscoped"/>

Abstract syntax: $A_1 = \langle \varepsilon_{E1}, \{\varepsilon_{P1}, \langle \varepsilon_{E2}, \{\varepsilon_{P2}\}, \{L_{P3}\}, \{\}\rangle, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle =$

$= \langle \varepsilon_{E1}, \{\varepsilon_{P1}, A_2\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_{E1} = \langle m2, know\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle m1, \langle speaker,count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{E2} = \langle m8, break\text{-}down\rangle$

$\varepsilon_{P2} = \langle m5, \langle\langle\langle m6, \langle car,count\rangle\rangle, \langle m4, \langle Poss,\varepsilon_{P3},individual,linear\rangle\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{P3} = \langle m3, \langle\langle m3, \langle Mary,count\rangle\rangle, single, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_{E1}, \varepsilon_{P1}, Pivot, individual, free\rangle$

$L_{P2} = \langle \varepsilon_{E1}, A_2, Theme, individual, narrow\rangle$

$L_{P3} = \langle \varepsilon_{E2}, \varepsilon_{P2}, Theme, single, free\rangle$

$sc_1 = \langle \varepsilon_{P1}, \varepsilon_{E2}, wider\rangle$

Semantic interpretation:

$I_Q(\varepsilon_{P1}) = [\ x \mid |speaker_0(x)|=1, speaker_0(x)\ ]$

$I_Q(\varepsilon_{P3}) = [\ z \mid Mary_0(z), |Mary_0|=1\ ]$

$I_Q(\varepsilon_{P2}) = [\ y \mid car_0(y), |car_0|=1, I_Q(Poss, I_Q(\varepsilon_{P3}))(y)\ ]$

$I_Q(Poss, I_Q(\varepsilon_{P3})) = INA_0((I_Q(\varepsilon_{P3},), \lambda u.\lambda v.Poss(v,u)) = = \lambda z.\ [\ x \mid Mary_0(x), |Mary_0|=1, Poss(x,z)\ ]$

$= [\ y \mid car_0(y),\ |car_0|=1,\ \lambda z.\ [\ x \mid Mary_0(x),\ |Mary_0|=1,\ Poss(x,z)](y)\ ]$
$= [\ y \mid car_0(y),\ |car_0|=1,\ [\ x \mid Mary_0(x),\ |Mary_0|=1,\ Poss(x,y)]\ ]$

$I_Q(A_1) = I_Q(L_{P1}) \cup' I_Q(L_{P2})$

$I_Q(L_{P1}) = [\ x, E \subseteq know \mid |speaker_0(x)|=1,\ speaker_0(x),\ e \in E \rightarrow pivot(e,x)\ ]$

$I_Q(L_{P2}) = I_Q(\varepsilon_{E1}) \cup^* I_Q(A_2)$

$I_Q(A_2) = I_Q(L_{P3})$
$= [\ y, z, E' \subseteq break\text{-}down \mid car_0(y),\ |car_0|=1,\ Mary_0(z),\ |Mary_0|=1,\ Poss(z,y),$
$e \in E' \rightarrow theme(e,y)\ ]$
so
$I_Q(L_{P2}) = [\ E \subseteq know \mid e \in E \rightarrow [\ y, z, E' \subseteq break\text{-}down \mid car_0(y),\ |car_0|=1,\ Mary_0(z),$
$|Mary_0|=1,\ Poss(z,y),\ e \in E' \rightarrow theme(e,y)\ ]]$

and so:
$I_Q(A_1) = [\ x, E \subseteq know \mid |speaker_0(x)|=1,\ speaker_0(x),\ e \in E \rightarrow$
$[\ y, z, E' \subseteq break\text{-}down \mid car_0(y),\ |car_0|=1,\ Mary_0(z),$
$|Mary_0|=1,\ Poss(z,y),\ e' \in E' \rightarrow theme(e,y)\ ]]$

16b. I believe that every man loves a woman.

Markables:

m1=I, m2=believe, m3=that every man loves a woman, m4=every man, m5=man, m6=loves m7=a woman, m8=woman

Abstract syntax: $A_1 = \langle \varepsilon_{E1}, \{\varepsilon_{P1}, A_2\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$, $A_2 = \langle \varepsilon_{E2}, \{\varepsilon_{P2}, \varepsilon_{P3}\}, \{L_{P3}, L_{P4}\}, \{sc_2\}\rangle$

$\varepsilon_{E1} = \langle$m2, believe$\rangle$

$\varepsilon_{P1} = \langle$m1, $\langle\langle$m1, $\langle$speaker,count$\rangle\rangle$, single, det$\rangle\rangle$

$\varepsilon_{E2} = \langle$m6, love$\rangle$

$\varepsilon_{P2} = \langle$m4, $\langle\langle\langle$m5, $\langle$man,count$\rangle\rangle$, all, det$\rangle\rangle$

$\varepsilon_{P3} = \langle$m7, $\langle\langle$m8, $\langle$woman,count$\rangle\rangle$, some, indet$\rangle\rangle$

$L_{P1} = \langle \varepsilon_{E1}, \varepsilon_{P1}$, Pivot, individual, free$\rangle$

$L_{P2} = \langle \varepsilon_{E1}, A_2$, Theme, individual, narrow$\rangle$

$L_{P3} = \langle \varepsilon_{E2}, \varepsilon_{P2}$, Pivot, all, narrow$\rangle$

$L_{P4} = \langle \varepsilon_{E2}, \varepsilon_{P3}$, Theme, some, narrow$\rangle$

$sc_1 = \langle L_{P1}, L_{E2}$, wider$\rangle$, $sc_2 = \langle L_{P3}, L_{P4}$, wider$\rangle$

Semantic interpretation:

$I_Q(A_1) = I_Q(L_{P1}) \cup' I_Q(L_{P2})$

$I_Q(L_{P1}) = [\ x, E \subseteq \text{believe} |\ |\text{speaker}_0(x)|=1, \text{speaker}_0(x), e \in E \rightarrow \text{pivot}(e,x)\ ]$

$I_Q(L_{P2}) = I_Q(\varepsilon_{E1}) \cup^* I_Q(A_2)$

$I_Q(A_2) = I_Q(L_{P3}) \cup^* I_Q(L_{P4})$

$= [\ Y = \text{man}_0 \mid y \in Y \rightarrow [\ Z \subseteq \text{woman} \mid z \in Z \rightarrow [\ E' \subseteq \text{love} \mid e' \in E' \rightarrow \text{pivot}(e',y), \text{theme}(e',z)\ ]]]$

etcetera.

QC.17 The headmaster's childrens' toys have disappeared.

Markables:

m1=The headmaster, m2=The headmaster's, m3- The headmaster's children, m4=The headmaster's childrens', m5=The headmaster's childrens' toys, m6=headmaster, m7=headmaster's, m8='s, m9=(the) children, m10= childrens', m11=(the) childrens' toys, m12=s', m13=toys, m14=disappear

17a. The childrens' toys have disappeared.

QuantML annotation:

```
<entity xml:id="x3" target="#m3" domain="#x4" involvement="all"
        definiteness="det"/>
<sourceDomain xml:id="x4" target="#m9" individuation="count" pred="child"/>
<entity xml:id="x5" target="#m11" domain="#x6" involvement="all"
        definiteness="det"/>
<qDomain xml:id="x6" target="#m5" source="#x7" restrictions="#r1"/>
<sourceDomain xml:id="x7" target="#m13" individuation="count" pred="toy"/>
<possRestr xml:id="r1" target="#m10" distr="individual" possessor="#x3"
        linking="linear"/>
<event xml:id="e2" target="#m14" pred="disappear"/>
<participation event="#e1" participant="#x5" semRole="theme" distr="individual"
        evScope="narrow"/>
```

Abstract syntax: $A_1 = \langle \varepsilon_{E1}, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\}\rangle$

$\varepsilon_{E1} = \langle m14, disappear\rangle$

$\varepsilon_{P1} = \langle m11, \langle\langle\langle m13, \langle toy,count\rangle\rangle, \langle m10, \langle Poss,\varepsilon_{P2},individual,linear\rangle\rangle\rangle, det\rangle\rangle\rangle$

$\varepsilon_{P2} = \langle m9, \langle\langle m9, \langle child,count\rangle\rangle, all, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_{E1}, \varepsilon_{P1}, Theme, individual, narrow\rangle$

$sc_1 = \langle \varepsilon_{P1}, \varepsilon_{E2}, wider\rangle$

Semantic interpretation:

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \leftrightarrow child_0(y)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \leftrightarrow toy_0, x \in X \rightarrow I_Q(Poss, I_Q(\varepsilon_{P2}))(x)\ ]$

$I_Q(Poss, I_Q(\varepsilon_{P3})) = INA_1((I_Q(\varepsilon_{P2}), \lambda u.\lambda v.Poss(v,u)) =$

$= INA_1(([\ Y \mid y \in Y \leftrightarrow child_0(y)\ ], \lambda u.\lambda v.Poss(v,u)) =$

$= \lambda z.[\ Y \mid y \in Y \leftrightarrow child_0(y), y \in Y \rightarrow Poss(y,z)\ ]$

$= [\ X \mid x \in X \leftrightarrow toy_0, x \in X \rightarrow \lambda z.[\ Y \mid y \in Y \leftrightarrow child_0(y), y \in Y \rightarrow Poss(y,z)\ ](x)]$

$= [\ X \mid x \in X \leftrightarrow toy_0, x \in X \rightarrow [\ Y \mid y \in Y \leftrightarrow child_0(y), y \in Y \rightarrow Poss(y,x)\ ]]$

$I_Q(A_1) = I_Q(L_{P1}) = I_Q(\varepsilon_{P1}) \cup^* I_Q(\varepsilon_{E1})$

$= [\ X \mid x \in X \leftrightarrow toy_0, x \in X \rightarrow [\ Y, E \subseteq disappear \mid y \in Y \leftrightarrow child_0(y),$

$y \in Y \rightarrow Poss(y,x), e \in E \rightarrow theme(e,x)\ ]]$

QC.18 These machines combine 12 parts.

Markables: m1=These machines, m2=machines, m3=combine, m4=12 parts, m5=parts

QuantML annotation:

```
<entity xml:id=”x1” target=”#m1” domain=”#x2” involvement=”all”
definiteness=”det”/>
<sourceDomain xml:id=”x2” target=”#m2” individuation=”count” pred=”machine”/>
<event xml:id=”e1” target=”#m3” pred=”combine”/>
<participation event=”#e1” participant=”#x1” semRole=”agent” distr=”individual”
        evScope=”narrow”/>
<entity xml:id=”x3” target=”#m4” domain=”#x4” involvement=”12”
        definiteness=”det”/>
<sourceDomain xml:id=”x4” target=”#m5” individuation=”count” pred=”part”/>
<participation event=”#e1” participant=”#x3” semRole=”theme” distr=”collective”
        evScope=”widee”/>
<scoping arg1=”#x1” arg2=”x3” scopeRel=”wider”/>
```

19. TWO committee members came in. [emphasis on “two”]

Markables:

m1=Two, m2= Two committee members, m3= committee members, m4=came in

QuantML/XML annotation:

<entity xml:id=”x1” target=”#m1” domain=”#x2” involvement=”two”
definiteness=”indet”/>
<sourceDomain xml:id=”x2” target=”#m1” pred=”committeemember”/>
(CAN BE ELABORATED)
<event xml:id=”e1” target=”#m2” pred=”come_in”/>
<participation event=”#e1” participant=”#x1” semRole=”agent” distr=”individual”
evScope=”narrow” exhaustivity=”exhaustive”/>

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\}\rangle$, with:

$\varepsilon_E = \langle$m3, come_in$\rangle$, $\varepsilon_{P1} = \langle$m1, $\langle\langle$m2, $\langle$committee-members,count$\rangle\rangle$, two, det$\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}$, Agent, individual, narrow, exhaustive, positive$\rangle$

Semantics:

$I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\}\rangle = I_Q(L_{P1})$

$= I_Q(\langle \varepsilon_E, \varepsilon_{P1}$, Agent, individual, narrow, exhaustive, positive$\rangle)$

$= [\ X \subseteq \text{committee-members}_0 \mid |X|=2, x \in X \leftrightarrow [E \subseteq \text{come-in} \mid e \in E \rightarrow \text{agent}(e,x)\ ]]\ ]$

QC.20 The boys carried the boxes upstairs.

Markables: m1=The boys, m2=boys, m3=carried upstairs, m4=the boxes, m5=boxes

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="all"
definiteness="det"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="boy"/>
<event xml:id="e1" target="#m3" pred="carry-up"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="unspecific"
        evScope="narrow"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="all"
        definiteness="det"/>
<sourceDomain xml:id="x4" target="#m5" individuation="count" pred="box"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="unspecific "
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="dual"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2},\}, \{L_{P1}, L_{P2}\}, \langle sc_1\}\rangle$

$\varepsilon_E = \langle m3, carry\_up\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle m2, boy \rangle, all, det\rangle\rangle$

$\varepsilon_{P2} = \langle m4, \langle\langle m5, box\rangle, all, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, unspecific, narrow\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, unspecific, narrow\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, dual\rangle$

Semantics:

$$I_Q(\langle A) = I_Q(\langle \varepsilon_E, \{\varepsilon_{P1},\varepsilon_{P2},\}, \{L_{P1}, L_{P2}\}, \langle sc_1\}\rangle) = I_Q(L_{P1}) \cup^D I_Q(L_{P2})$$

$$I_Q(L_{P1}) = [\ X = boy_0 \mid x \in X \rightarrow [E \subseteq carry\text{-}up, z \in X^* \mid x=z \vee x \in z\ e \in E \rightarrow agent(e,z)\ ]\ ]$$

$$I_Q(L_{P2}) = [\ Y = box_0 \mid y \in Y \rightarrow [E \subseteq carry\text{-}up, u \in Y^* \mid u=y \vee u \in y, e \in E \rightarrow theme(e,u)\ ]\ ]$$

$$I_Q(L_{P1}) \cup^D I_Q(L_{P2}) = [\ X = boy_0, Y = box_0 \mid z \in X^* \rightarrow [E \subseteq carry\text{-}up, u \in Y^* \mid e \in E \rightarrow agent(e,z), theme(e,u)\ ], y \in Y^* \rightarrow [E \subseteq carry\text{-}up, u \in X^* \mid e \in E \rightarrow agent(e,z), theme(e,u)\ ]]$$

QC.21 A train leaves to Boston every hour.

Markables: m1= A train, m2=train, m3=leaves, m4= Boston, m5=every hour, m6=hour

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="some" definiteness="indet"/>
<sourceDomain xml:id="x2" target="#m2" individuation="count" pred="train"/>
<event xml:id="e1" target="#m3" pred="leave"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow"/>
<entity xml:id="x3" target="#m4" domain="#x4" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m4" individuation="count" pred="Boston"/>
<participation event="#e1" participant="#x3" semRole="destination" distr="individual"
        evScope="free"/>
<entity xml:id="x5" target="#m5 domain="#x6" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x6" target="#m6" individuation="count" pred="hour"/>
<participation event="#e1" participant="#x6" semRole="time" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x3" arg2="x1" scopeRel="wider"/>
<scoping arg1="#x1" arg2="x2" scopeRel="unscoped"/>
<scoping arg1="#x2" arg2="x3" scopeRel="unscoped"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}, \varepsilon_{P3}\}, \{L_{P1}, L_{P2}, L_{P3}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, leave\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle train,count\rangle\rangle, some, indet\rangle\rangle$

$\varepsilon_{P2} = \langle m4, \langle\langle m7, \langle Boston,count\rangle\rangle, single, det\rangle\rangle$, $\varepsilon_{P3} = \langle m8, \langle\langle m9, \langle hour, count\rangle\rangle, all, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P3}, Destination, individual, free\rangle$

$L_{P3} = \langle \varepsilon_E, \varepsilon_{P2}, Time, individual, narrow\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$, $sc_2 = \langle L_{P3}, L_{P1}, wide\rangle$, $sc_3 = \langle L_{P2}, L_{P3}, unscoped\rangle$

Semantics:

$I_Q(L_{P1}) = [\ X \subseteq train \mid x \in X \rightarrow [\ E \subseteq leave \mid e \in E \rightarrow agent(e,x)\ ]\ ]$

$I_Q(L_{P2}) = [\ y, E \subseteq leave \mid Boston_0(y), |Boston_0| = 1, e \in E \rightarrow destination(e,y)\ ]$

$I_Q(L_{P3}) = [\ T = hour_0 \mid t \in T \rightarrow [\ E \subseteq leave \mid e \in E \rightarrow time(e,t)\ ]\ ]$

$I_Q(A) = I_Q(L_{P3}) \cup^* I_Q(L_{P1}) \cup' I_Q(L_{P1}) =$

$= [\ T = hour_0 \mid t \in T \rightarrow$

$[\ X \subseteq train \mid x \in X \rightarrow$

$[\ y, E \subseteq leave \mid Boston_0(y), |Boston_0| = 1, y \in E \rightarrow$

$agent(e,x), destination(e,y), time(e,t)\ ]\ ]$

QC.22 William, have you finished your assignment?

Markables: m1=William, m2=have finished, m3=you, m4=your, m5=your assignment, m6=assignment

N.B. *The use of a vocative treated semantically as the target of deictic "you" (singular). This should be annotated as a referential relation between the two NPs. This relation should be resolved as a preliminary step to the building of entity structures that denote event participants, resulting in this case to the semantic component:*

$I_Q(\varepsilon_{P1} + \varepsilon_{P2})$ = [x | $addressee_0(x)$, $|addressee_0|=1$, name(x, William)]

More focused example: William, are you coming?

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="single"
        definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1" individuation="count" pred="William"/>
<event xml:id="e1" target="#m2" pred="finish"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="free"/>
<entity xml:id="x3" target="#m5" domain="#x4" involvement="single"
        definiteness="det"/>
<qDomain xml:id="x4" target="#m5" source="#x5" restrictions="#r1"/>
<sourceDomain xml:id="x5" target="#m6" individuation="count" pred="assignment"/>
<possRestr xml:id="r1" target="#m4" distr="individual" possessor="#x1"
linking="linear"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="free"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \langle sc_1\}\rangle$

$\varepsilon_E = \langle m2, finish\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle m1, \langle William,count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle\langle m3, \langle addressee,count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{P3} = \langle m5, \langle\langle\langle m6, \langle assignment,count\rangle\rangle, \langle m4, \langle Poss,\varepsilon_{P1},individual,linear\rangle\rangle\rangle, single, det\rangle\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, free\rangle$

$L_{P3} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, free\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$

Semantics:

$I_Q(\varepsilon_{P2})$ = [y | $assignment_0(y)$, $|assignment_0|=1$, [z | Poss(z,y)]]

$I_Q(A) = I_Q(L_{P1}) \cup'^{ar} I_Q(L_{P2})$ = (unscoped merge with anaphor resolution)

= [x, $E \subseteq$ finish | $addressee_0(x)$, $|addressee_0|=1$, name(x,William), $e \in E \rightarrow$ agent(e,x)]

$\cup'^{ar}$ [y, $E \subseteq$ finish | $assignment_0(y)$, $|assignment_0|=1$, [z | Poss(z,y)]]

= [x, y, $E \subseteq$ finish | $addressee_0(x)$, $|addressee_0|=1$, name(x,William),
$assignment_0(y)$, $|assignment_0|=1$, Poss(x,y),
$e \in E \rightarrow$ [agent(e,x), theme(e,y)]]

Note:
The resolution of anaphoric possessive pronouns is in principle outside the scope of QuantML. Semantically, it can be included by assuming that anaphoric relations are additionally annotated. Anaphoric possessives (with antecedent within the same clause) are only possible if either (a) the antecedent is a quantifying NP with wider scope than the anaphoric NP, or (b) a non-quantifying NP.
In case (a) the corresponding link structure interpretations are combined with a variant $\cup^{*ar}$ of the scoped merge, which in addition to what the ordinary scoped merge does, also replace the 'uninstantiated' possessive condition of the form [z | Poss(z,y)] by the 'instantiated' condition Poss(x,y), where 'x' is the non-eventive individual discourse referent of the antecedent quantification. In case (b) the link structures are combined with the corresponding variant $\cup'^{ar}$ of the 'unscoped' merge operation. The latter case also applies if the antecedent quantifier has collective participation.

23. Have you all finished your assignments?

Markables: m1=Have finished, m2=you all, m3=your assignments, m4=assignments

QuantML annotation:

```
<entity xml:id="x1" target="#m2" domain="#x2" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1" individuation="count" pred="addressee"/>
<event xml:id="e1" target="#m1" pred="finish"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow"/>
<entity xml:id="x3" target="#m3" domain="#x4" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m4" individuation="count" pred="assignment"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \langle sc_1\}\rangle$

$\varepsilon_E = \langle m2, finish\rangle$

$\varepsilon_{P1} = \langle m2, \langle\langle m2, \langle addressee,count\rangle\rangle, all, det\rangle\rangle$

$\varepsilon_{P2} = \langle m5, \langle\langle m6, \langle assignment,count\rangle\rangle, all, det\rangle\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow\rangle$

$L_{P3} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \leftrightarrow addressee_0\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \leftrightarrow [\ assignment_0(y), [\ z \mid Poss(z,y)\ ]\ ]\ ]$

Scoped merge with anaphor resolution:

$$I_Q(A) = I_Q(L_{P1}) \cup^{*ar} I_Q(L_{P2}) =$$
$$= [\ X \mid x \in X \leftrightarrow addressee_0,\ x \in X \rightarrow$$
$$[\ Y \mid y \in Y \leftrightarrow [\ assignment_0(y), Poss(x,y)\ ],\ y \in Y \rightarrow$$
$$[\ E \subseteq finish \mid e \in E \rightarrow [\ agent(e,x), theme(e,y)\ ]\ ]\ ]\ ]$$

QC.24 The women did not smile.

Markables: m1=The women, m2=women, m3=smile

24a. Reading: Each of the women did not smile.

QuantML/XML annotation:

<entity xml:id="x1" target="#m1" domain="#x2" involvement="all" definiteness="def'"/>
<sourceDomain xml:id="x2" target="#m2" pred="woman"/>
<event xml:id="e1" target="#m3" pred="smile"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
evScope="narrow" polarity="neg-narrow"/>

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\}\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle woman,count\rangle\rangle, all, det\rangle\rangle$

$\varepsilon_E = \langle m3, smile\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, neg\text{-}narrow\rangle$

Semantics:

$I_Q(A) = I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\}\rangle) = I_Q(L_{P1}) = I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, neg\text{-}narrow\rangle) =$

$= I_Q(\langle smile\rangle, \langle\langle woman,count\rangle, all, det\rangle, Agent, individual, narrow, neg\text{-}narrow\rangle) =$

$= [\ X \mid x \in X \leftrightarrow woman_0(x)\ ] \cup (\ [\ X \mid x \in X \rightarrow \neg[\ E \mid e \in E \rightarrow agent(e,x)\ ]]\ \oplus^n\ [\ E \mid e \in E \rightarrow smile(e)\ ]\ ) =$

$= [\ X = woman_0 \mid x \in X \rightarrow \neg[\ E \subseteq smile \mid e \in E \rightarrow agent(e,x)\ ]]$

24b. It is not the case that each of the women smiled.

QuantML/XML annotation: Like reading a, except:

<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
evScope="narrow" polarity="neg-narrow"/>

Abstract syntax: Like reading a, except:

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, wide\rangle$

Semantics:

$I_Q(A) = I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}\}, \{L_{P1}\}, \{\}\rangle) = I_Q(L_{P1}) = I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, neg\text{-}wide\rangle) =$

$= \sim I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow, pos\rangle) =$

$= \sim I_Q(\langle smile\rangle, \langle\langle woman,count\rangle, all, det\rangle, Agent, individual, narrow, pos\rangle) =$

$= \sim [\ X = woman_0 \mid x \in X \rightarrow [\ E \subseteq smile \mid e \in E \rightarrow agent(e,x)\ ]]$

QC.25 Hong Kong reports twenty-three new corona virus infections.

Markables: m1=Hong Kong, m2=reports, m3= twenty-three new corona virus infections, m4=new, m5=new corona virus infections, m6=corona, m7= corona virus, m8=corona virus infections, m9=virus, m10=infections

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1" individuation="count" pred="hongkong"/>
<event xml:id="e1" target="#m2" pred="report"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="free"/>
<entity xml:id="x3" target="#m3" domain="#x4" involvement="23" definiteness="indet"/>
<qDomain xml:id="x4" target="#m6" source="#x5" restrictions="#r1 #r2"/>
<sourceDomain xml:id="x5" target="#m11" individuation="count" pred="infection"/>
<adjMod xml:id="r1" target="#m4" distr="individual" pred="new"/>
<nnRestr xml:id="r2" target="#m7" pred="virus" restrictions="#r3"/>
<nnRestr xml:id="r3" target="#m6" pred="corona"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="#x3" scopeRel="unscoped"/>
```

Abstract syntax:

$A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$, with

$\varepsilon_E = \langle m2, \langle report\rangle\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle hongkong,count\rangle, single, det\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle \langle m5, \langle\langle m10, \langle infection,count\rangle, \langle m4,new\rangle, modifying\ nominal\ structure\rangle\rangle\rangle, 23, indet\rangle\rangle$

with 'modifying nominal structure': $\langle m7, \langle \langle m9, \langle virus,count\rangle\rangle, \langle m8, \langle corona,count\rangle\rangle\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, free\rangle$, $L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$

Semantics:

$I_Q(A) = I_Q(L_{P1}) \cup' I_Q(L_{P2}) =$

$[\ x, Y \subseteq infection \mid hongkong_0(x), |hongkong_0|=1, |Y|=23, y \in Y \rightarrow$

$[E \subseteq report, v \in virus \mid corona(v), new(y), NN(y,v), e \in E \rightarrow [\ agent(e,x), theme(e,y)\ ]]]$

QC.26 One of my farmers adopted four monkeys from Senegal.

Markables:

m1=One of my farmers, m2=my, m3=my farmers, m4=farmers, m5=adopted, m6=four monkeys from Senegal, m7= monkeys from Senegal, m8=monkeys, m9=from, m10=from Senegal, m11=Senegal

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="1" definiteness="indet"/>
<qDomain xml:id="x2" target="#m3" source="#x3" restrictions="#r1"/>
<sourceDomain xml:id="x3" target="#m4" individuation="count" pred="farmer"/>
<possRestr xml:id="r1" target="#m2" possessor="#x4" distr="individual" linking="linear"/>
<entity xml:id="x4" target="#m2" domain="#x5" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x5" target="--" individuation="count" pred="speaker"/>
<event xml:id="e1" target="#m5" pred="adopt"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="narrow"/>
<entity xml:id="x6" target="#m6" domain="#x7" involvement="4" definiteness="indet"/>
<qDomain xml:id="x7" target="#m7" source="#x8" restrictions="#r2"/>
<sourceDomain xml:id="x8" target="#m8" individuation="count" pred="monkey"/>
<ppRestr xml:id="r2" target="#m10" pRel="from" pEntity="#x9" distr="individual" linking="linear"/>
<entity xml:id="x9" target="#m11" domain="#x10" involvement="single" definiteness="det"/>
<sourceDomain xml:id="10" target="#m11" individuation="count" pred="Senegal"/>
<participation event="#e1" participant="#x6" semRole="theme" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="#x6" scopeRel="wider"/>
```

Abstract syntax:

$A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$, with

$\varepsilon_E = \langle m5, \langle adopt\rangle\rangle$

$\varepsilon_{P1} = \langle m1, \langle\langle\langle farmer,count\rangle, \langle Poss, speaker_0\rangle\rangle, 1, indet\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle\langle\langle monkey,count\rangle, \langle PP\ structure, individual, linear\rangle\rangle, 4, indet\rangle\rangle$

PP structure: $PP = \langle m10, \langle\langle m9,from\rangle, \varepsilon_{P3}\rangle\rangle$ with $\varepsilon_{P3} = \langle m11, \langle\langle senegal,count\rangle, single, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow\rangle$, $L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics:

PP semantics: $I_Q(PP) = \lambda z.\ [\ s \mid senegal_0(s),\ |senegal_0|=1,\ from(s,z)\ ]$

Semantics of PP modification: $I_Q(\varepsilon_{P2}) = [\ Y \subseteq monkey \mid\ |Y|=4,\ y \in monkey \rightarrow I_Q(PP)(y)\ ] =$

$= [\ Y \subseteq monkey \mid\ |Y|=4,\ y \in monkey \rightarrow [\ s \mid senegal_0(s),\ |senegal_0|=1,\ from(s,y)\ ]]$

Semantics of participation link structures:

$I_Q(L_{P1}) = I_Q(\langle \varepsilon_E, \varepsilon_{P1}, Agent, individual, narrow\rangle) =$

$(I_Q(\varepsilon_{P1}) \cup^* (I_Q(\varepsilon_E)) \cup I_Q(Agent, individual, narrow)) =$

$= ([\ X \subseteq farmer\ ||X|=1,\ x \in X \rightarrow [\ u \mid speaker_0(u), |speaker_0|=1,\ Poss(x,u)\ ]] \cup^*$

$[\ E \mid e \in E \rightarrow adopt(e)\ ]) \cup [\ X \mid x \in X \rightarrow [\ E \mid e \in E \rightarrow [\ agent(e.x)\ ]] =$

$= ([\ X \subseteq farmer\ ||X|=1,\ x \in X \rightarrow [\ u, E \subseteq adopt \mid speaker_0(u), |speaker_0|=1,\ Poss(x,u),\ e \in E \rightarrow$

$agent(e.x)\ ]]$

$I_Q(L_{P2}) = (I_Q(\varepsilon_{P2}) \cup^* (I_Q(\varepsilon_E)) \cup I_Q(Agent, individual, narrow)) =$

$= [\ Y \subseteq monkey \mid\ |Y|=4,\ y \in Y \rightarrow [s \mid senegal_0(s),\ |senegal_0|=1,\ from(y,s)\ ]] \cup^*$

$$[\, E \mid e \in E \rightarrow \text{adopt}(e)\,]) \cup [\, X \mid x \in X \rightarrow [\, E \mid e \in E \rightarrow \text{theme}(e.x)\,] =$$

$$= [\, Y \subseteq \text{monkey} \mid |Y|=4,\ y \in Y \rightarrow [s,\ E \subseteq \text{adopt} \mid \text{senegal}_0(s),\ |\text{senegal}_0|=1,\ \text{from}(y,s),$$

$$e \in E \rightarrow \text{theme}(e,y)\,]]]$$

$I_Q(A) = I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle = I_Q(L_{P1}) \cup^* I_Q(L_{P2})$

$= [\, X \subseteq \text{farmer} \mid |X|=1,\ x \in X \rightarrow [Y \subseteq \text{monkey} \mid y \in Y \rightarrow [u \in \text{speaker}_0,\ s \in \text{senegal}_0,\ E \subseteq \text{adopt}|$

$\text{speaker}_0(u),\ \text{senegal}_0(s),|\text{speaker}_0|=1,\ \text{Poss}(x,u),\ |\text{senegal}_0|=1,\ \text{from}(y,s),\ |Y|=4,$

$e \in E \rightarrow [\text{agent}(e,x),\ \text{theme}(e,y)]\,]]]$

QC.27 Anne found an apartment with a balcony that overlooks the main square.

Markables:

m1=Anne, m2=found, m3=an apartment with a balcony that overlooks the main square, m4=apartment with a balcony that overlooks the main square, m5=apartment, m6=with a balcony, m7=a balcony that overlooks the main square, m8=balcony, m9=balcony that overlooks the main square, m10=that overlooks the main square, m11=overlooks, m12=overlooks the main square, m13=the main square, m14=main square, m15=main, m16=square

QuantML annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x2" target="#m1" individuation="count" pred="Anne"/>
<event xml:id="e1" target="#m2" pred="find"/>
<participation event="#e1" participant="#x1" semRole="agent" distr="individual"
        evScope="free />
<entity xml:id="x3" target="#m3" domain="#x4" involvement="a" definiteness="indet"/>
<qDomain xml:id="x4" target="m4" source="#x5" restrictions="#r1"/>
<sourceDomain xml:id="x5" target="#m5" individuation="count" pred="apartment"/>
<ppMod xml:id="r1" target="#m6" prel="with" pEntity="#x6" distr="individual" linking="linear"/>
<entity xml:id="x6" target="#m7" domain="#x7" involvement="a" definiteness="indet"/>
<qDomain xml:id="x7" target="m4" source="#x8" restrictions="#r2"/>
<sourceDomain xml:id="x8" target="#m8" pred="balcony"/>
<relClause xml:id="r2" target="#m10" semRole="pivot" clause="#e2" distr="individual"
            linking="linear"/>
<event xml:id="e2" target="#m11" pred="overlook"/>
<entity xml:id="x9" target="#m13" domain="#x10" involvement="single" definiteness="det"/>
<qDomain xml:id="x10" target="m14" source="#x11" restrictions="#r3"/>
<sourceDomain xml:id="x13" target="#m16" individuation="count" pred="square"/>
<adjMod xml:id="r3" target="#m15" distr="individual" pred="main"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m4, find\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m1, \langle Anne,count\rangle\rangle, single, det\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle\langle m4, \langle\langle apartment,count\rangle, \langle m8, \langle with, \varepsilon_{P3}\rangle\rangle\rangle\rangle, a, indet\rangle\rangle$

$\varepsilon_{P3} = \langle m9, \langle\langle m9, \langle balcony,count\rangle, RC\rangle, a, indet\rangle\rangle$

Relative clause: $RC = \langle m10, \langle Pivot, \langle m12, A_2\rangle\rangle\rangle$ with $A_2 = \langle \varepsilon_{E2}, \{\varepsilon_{P4}\}, \{L_{P3}\}, \{\}\rangle$, where

$\varepsilon_{E2} = \langle m11, \langle overlook\rangle\rangle$

$\varepsilon_{P4} = \langle m13, \langle\langle\langle square,count\rangle,\langle main,individual\rangle\rangle, single, det\rangle\rangle$

$L_{P3} = \langle \varepsilon_{E2}, \varepsilon_{P4}, Theme, individual, narrow\rangle$

$\varepsilon_{P3} = \langle m9, \langle\langle m9, \langle balcony,count\rangle, \langle m10, \langle Pivot, \langle m12, A_2\rangle\rangle\rangle\rangle, single, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Agent, collective, narrow\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$

$sc_1 = \langle L_{P1}, L_{P2}, unscoped\rangle$

Semantics:

$I_Q(\varepsilon_E)$ = [E | e ∈ E → find(e)]

$I_Q(\varepsilon_{P1})$ = [a | $Anne_0$(a)), |$Anne_0$|=1]

$I_Q(\varepsilon_{P2})$ = [X ⊆ apartment | x ∈ X → [B ⊆ balcony | b ∈ B → [y, E' ⊆ overlook | square(y), main(y), e ∈ E' → [pivot(e,y), theme(e,b)], with(y,b)]]]

$I_Q(L_{P1})$ = [a, E ⊆ find | $Anne_0$(a), |$Anne_0$|=1, e ∈ E → agent(e,a)]

$I_Q(L_{P2})$ = [X ⊆ apartment | x ∈ X → [B ⊆ balcony | b ∈ B →
[y, E' ⊆ overlook | square(y), main(y), e ∈ E' → [pivot(e,y), theme(e,b)], with(y,b)],
[E ⊆ find | e ∈ E → theme(e,x)]]]

$I_Q(A) = I_Q(L_{P1}) \cup' I_Q(L_{P2})$
= [a, X ⊆ apartment | $Anne_0$(a)), |$Anne_0$|=1, x ∈ X → [B ⊆ balcony | b ∈ B →
[y, E' ⊆ overlook | with(a,b), square(y), main(y), e' ∈ E' → [pivot(e',b), theme(e',y)]],
[E ⊆ find | e ∈ E → [pivot(e,a), theme(e,x)]]]]

"the main square"…: $I_Q(\varepsilon_{P4})$ = [s | $square_0$(s), |$square_0$|=1, main(s)] …. ???

The specification of QuantML in the ISO WD and in the TiCC report only mentions the proposed treatment of definite singular (count) NPs with a bare head noun, like "the chef", "the president", and so on. In such cases it would indeed seem reasonable to assume that there is exactly one contextually distinguished entity with the property denoted by the head noun. But if the NP head contains modifiers, it is unclear how this this approach would work (see above), and it seems to go wrong, as in the case of "the main square": it is not that there is (necessarily) exactly one contextually distinguished square, which is the main square, but rather that among the contextually distinguished square there is exactly one which has the property "main". This suggest a quantification over a singleton domain as follows:

$I_Q(\varepsilon_{P4})$ = [S | |S|=1, s ∈ S ↔ $square_0$(s), main(s)]

For the analysis of sentence QC.27 this has the following consequence:

$I_Q(A) = I_Q(L_{P1}) \cup' I_Q(L_{P2})$
= [a, X ⊆ apartment | $Anne_0$(a)), |$Anne_0$|=1, x ∈ X → [B ⊆ balcony | b ∈ B →
[S | with(a,b), |S|=1, s ∈ S ↔ $square_0$(s), main(s), s ∈ S →
[E' ⊆ overlook | e' ∈ E' → [pivot(e',b), theme(e',s)]],
[E ⊆ find | e ∈ E → [pivot(e,a), theme(e,x)]]]]]

This is a satisfactory solution.

QC.28 There's debris everywhere.

Markables: m1=There's, m2=debris, m3=everywhere

QuantML annotation:

```
<event xml:id="e1" target="#m1" pred="exist"/>
<entity xml:id="x1" target="#m2" domain="#x2" involvement="some" definiteness="indet"/>
<sourceDomain xml:id="x2" target="#m2" individuation="mass" pred="debris"/>
<participation event="#e1" participant="#x1" semRole="theme" distr="parts"
        evScope="narrow"/>
<entity xml:id="x3" target="#m3" domain="#x4" involvement="all" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m3" individuation="count" pred="place"/>
<participation event="#e1" participant="#x3" semRole="location" distr="parts"
        evScope="narrow"/>
<scoping arg1=''#x3'' arg2=''#x1'' scopeRel=''wider''/>
```

Abstract syntax: $A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m1, exist\rangle$,

$\varepsilon_{P1} = \langle m2, \langle\langle m2, \langle debris,mass \rangle\rangle, some, indet\rangle\rangle$

$\varepsilon_{P2} = \langle m3, \langle\langle m3, \langle\langle place,count\rangle, all, det\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Theme, individual, narrow\rangle$

$L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Location, individual, narrow\rangle$

$sc_1 = \langle L_{P2}, L_{P1}, wider\rangle$

Semantics:

$I_Q(\varepsilon_E) = [\ E \mid e \in E \rightarrow exist(e)\ ]$

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \rightarrow debris(x)\ ]$

$I_Q(\varepsilon_{P2}) = [\ Y \mid y \in Y \leftrightarrow place_0(y)\ ]$

$I_Q(L_{P1}) = [\ X \mid x \in X \rightarrow [\ E \mid e \in E \rightarrow [\ exist(e), debris(x), theme(e,x)\ ]\ ]\ ]$

$I_Q(L_{P2}) = [\ Y \mid y \in Y \rightarrow [\ E \mid e \in E \rightarrow [\ exist(e), place_0(y), location(e,y)\ ]\ ]\ ]$

$I_Q(A) = I_Q(L_{P2}) \cup^* I_Q(L_{P1})$

$= [\ Y \mid y \in Y \leftrightarrow place_0(y), y \in Y \rightarrow$

$[\ X \mid x \in X \rightarrow [\ E \mid e \in E \rightarrow [\ exist(e), place_0(y), debris(x), theme(e,x), location(e,y)]\ ]\ ]\ ]$

QC.29 Every man loves his brothers

Markables:

m1=every men, m2=men, m3=loves, m4=his, m5=his brothers, m7=brothers

Annotation:

```
<entity xml:id="x1" target="#m1" domain="#x2" involvement="all" definiteness="indet"/>
<sourceDomain xml:id="x2" target="#m1" individuation="count" pred="man"/>
<event xml:id="e1" target="#m2" pred="love"/>
<participation event="#e1" participant="#x1" semRole="pivot" distr="individual"
        evScope="narrow"/>
<entity xml:id="x3" target="#m5" domain="#x4" involvement="all" definiteness="indet"/>
<qDomain xml:id="x4" target="#m5" source="#x5" restrictions="#r1"/>
<sourceDomain xml:id="x5" target="#m6" individuation="count" pred="brother"/>
<possRestr xml:id="r1" target="#m4" distr="individual" possessor="#x1" linking="linear"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
        evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>
```

Abstract syntax:

$A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}\}, \{sc_1\}\rangle$

$\varepsilon_E = \langle m3, love\rangle$,

$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle man,count\rangle\rangle, all, indet\rangle\rangle$

$\varepsilon_{P2} = \langle m5, \langle\langle\langle m6, \langle brother,count\rangle\rangle, \langle m4, \langle Poss,\varepsilon_{P1},individual,linear\rangle\rangle\rangle, all, indef\rangle\rangle\rangle$

$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Pivot, individual, narrow\rangle$, $L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$,

$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \leftrightarrow\ man(x)\ ]$,

$I_Q(\varepsilon_{P2}) = [\ Y \subseteq brother \mid y \in Y \leftrightarrow I_Q(Poss, I_Q(\varepsilon_{P1}))(y)\ ]$

$= [\ Y \subseteq brother \mid y \in Y \leftrightarrow [\ z \mid Poss(z,y)\ ]\ ]$

$I_Q(L_{P1}) = [\ X \mid x \in X \leftrightarrow\ man(x),\ x \in X \rightarrow\ [E \subseteq love\ \mid e \in E \rightarrow pivot(e,x)\ ]]$,

$I_Q(L_{P2}) = [\ Y \subseteq brother \mid y \in Y \leftrightarrow [\ z \mid Poss(z,y)\ ],\ y \in Y \rightarrow\ [E \subseteq love\ \mid e \in E \rightarrow theme(e,x)]]$

$I_Q(\langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_1\}\rangle = I_Q(L_{P2})\ \cup^{*ar}\ I_Q(L_{P1})$

$= [\ X \mid x \in X \leftrightarrow\ man(x),\ x \in X \rightarrow\ [\ Y \subseteq brother \mid y \in Y \leftrightarrow Poss(x,y),$

$y \in Y \rightarrow\ [E \subseteq love\ \mid e \in E \rightarrow [\ pivot(e,x), theme(e,x)\ ]\ ]]$

QC.30 Every man loves his mother.

Markables: m1=every men, m2=men, m3=loves, m4=his, m5=his mother, m7=mother

Similar to QC.29, but with the difference that the singular "his mother" should be treated as a definite singular NP with modified head noun. So:

Annotation:

<entity xml:id="x1" target="#m1" domain="#x2" involvement="all" definiteness="indet"/> (!!)
<sourceDomain xml:id="x2" target="#m1" individuation="count" pred="man"/>
<event xml:id="e1" target="#m2" pred="love"/>
<participation event="#e1" participant="#x1" semRole="pivot" distr="individual"
evScope="narrow"/>
<entity xml:id="x3" target="#m5" domain="#x4" involvement="single" definiteness="det"/>
<qDomain xml:id="x4" target="#m5" source="#x5" restrictions="#r1"/>
<sourceDomain xml:id="x5" target="#m6" individuation="count" pred="mother"/>
<possRestr xml:id="r1" target="#m4" distr="individual" possessor="#x1" linking="linear"/>
<participation event="#e1" participant="#x3" semRole="theme" distr="individual"
evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="wider"/>

Abstract syntax:

$A = \langle \varepsilon_E, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}\}, \{sc_1\}\rangle$
$\varepsilon_E = \langle m3, love\rangle$,
$\varepsilon_{P1} = \langle m1, \langle\langle m2, \langle man,count\rangle\rangle, all, indet\rangle\rangle$
$\varepsilon_{P2} = \langle m5, \langle\langle\langle m6, \langle mother,count\rangle\rangle, \langle m4, \langle Poss,\varepsilon_{P1},individual,linear\rangle\rangle\rangle, single, det\rangle\rangle\rangle$
$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Pivot, individual, narrow\rangle$, $L_{P2} = \langle \varepsilon_E, \varepsilon_{P2}, Theme, individual, narrow\rangle$,
$sc_1 = \langle L_{P1}, L_{P2}, wider\rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ X \mid x \in X \leftrightarrow\ man(x)\ ]$,
$I_Q(\varepsilon_{P2}) = [\ Y \mid\ |Y|=1, y \in Y \leftrightarrow [\ z \mid mother(y), Poss(z,y)\ ]\ ]$

$I_Q(L_{P1}) = [\ X \mid x \in X \leftrightarrow\ man(x),\ x \in X \rightarrow\ [E \subseteq love\ \mid e \in E \rightarrow pivot(e,x)\ ]]$,
$I_Q(L_{P2}) = [\ Y \mid\ |Y|=1, y \in Y \leftrightarrow [\ z \mid mother(y), Poss(z,y)\ ], y \in Y \rightarrow\ [E \subseteq love\ \mid e \in E \rightarrow theme(e,x)]]$

$I_Q(A) = I_Q(L_{P1})\ \cup^{*ar} I_Q(L_{P2})$
$= [\ X \mid x \in X \leftrightarrow\ man(x), x \in X \rightarrow\ [\ Y \mid\ |Y|=1, y \in Y \leftrightarrow [\ mother\ (y), Poss(x,y)\ ],$
$y \in Y \rightarrow\ [E \subseteq love\ \mid e \in E \rightarrow [\ pivot(e,x), theme(e,x)\ ]\ ]]]$

QC.31 More than four hundred ships are waiting to pass through the Suez Canal.

Markables:

m1=more than four hundred, m2= more than four hundred ships, m3=ships, m4=are waiting, m5=to pass through, m6=to pass through the Suez Canal, m7=the Suez Canal, m8=Suez Canal

Annotation:

<entity xml:id="x1" target="#m2" domain="#x2" involvement="#n1" definiteness="indet"/>
<sourceDomain xml:id="x2" target="#m3" individuation="count" pred="ship"/>
<numericalPred xml:id="n1" target="#m1" numRel="greaterthan" num="400"/>
<event xml:id="e1" target="#m4" pred="wait"/>
<participation event="#e1" participant="#x1" semRole="pivot" distr="individual"
evScope="narrow"/>
<clause xml:id="c2" target="#m6" event="#e2"/> ??
<event xml:id="e2" target="#m5" pred="pass"/>
<participation event="#e2" participant="#x1" semRole="agent" distr="individual"
evScope="narrow"/>
<entity xml:id="x3" target="#m7" domain="#x4" involvement="single" definiteness="det"/>
<sourceDomain xml:id="x4" target="#m8" individuation="count" pred="SuezCanal"/>
<participation event="#e2" participant="#x3" semRole="trajectory" distr="individual"
evScope="free"/>
<participation event="#e1" participant="#e2" semRole="theme" distr="individual"
evScope="narrow"/>
<scoping arg1="#x1" arg2="x3" scopeRel="unscoped"/>

Note: semantic role of event participant is conceptually unclear.

Abstract syntax:

$A1 = \langle \varepsilon_{E1}, \{\varepsilon_{P1}, \varepsilon_{E2}\}, \{L_{P1}, L_{E2}\}, \{sc_1\}\rangle$
$\varepsilon_{E1} = \langle m4, wait\rangle$
$\varepsilon_{P1} = \langle m2, \langle\langle m3, \langle ship,count\rangle\rangle, \langle m1, \langle morethan,400\rangle\rangle, indet\rangle\rangle$
$L_{P1} = \langle \varepsilon_E, \varepsilon_{P1}, Pivot, individual, narrow\rangle$
$\varepsilon_{P2} = \langle m7, \langle\langle m8, \langle SuezCanal,count\rangle\rangle, single, det\rangle\rangle$
$A2 = \langle \varepsilon_{E2}, \{\varepsilon_{P1}, \varepsilon_{P2}\}, \{L_{P1}, L_{P2}\}, \{sc_2\}\rangle$
$\varepsilon_{E2} = \langle m6, pass\rangle$
$L_{P1} = \langle \varepsilon_{E2}, \varepsilon_{P1}, Agent, individual, narrow\rangle$
$L_{P2} = \langle \varepsilon_{E2}, \varepsilon_{P2}, Trajectory, individual, narrow\rangle$
$L_{E2} = \langle \varepsilon_{E1}, \varepsilon_{E2}, Theme, individual, free\rangle$
$sc_1 = \langle L_{P1}, L_{E2}, wider\rangle$
$sc_2 = \langle L_{P1}, L_{P2}, unscoped\rangle$

Semantics:

$I_Q(\varepsilon_{P1}) = [\ X \subseteq ship \mid |X|>400\ ]$
$I_Q(\varepsilon_{P2}) = [\ y \mid SuezCanal_0(y), |SuezCanal_0|=1\ ]$
$I_Q(L_{P1}) = [\ X \subseteq ship \mid |X|>400,\ x \in X \rightarrow [E \subseteq wait \mid e \in E \rightarrow pivot(e,x)\ ]],$
$I_Q(L_{P2}) = [\ y, E' \subseteq pass \mid SuezCanal_0(y), |SuezCanal_0|=1, e' \in E' \rightarrow trajectory(e',y)]]$

$I_Q(A2) = I_Q(L_{P1}) \cup^{*ar} I_Q(L_{P2})$

$I_Q(A1) = I_Q(L_{P1}) \cup^{*ar} I_Q(L_{E2})$