The Color of Semantic Opposition in WordNet

Sandiway Fong
NEC Research Institute
Princeton NJ
sandiway@research.nj.nec.com

Persistence and Change of State Verbs

Event-based Models of Change and Persistence in Language (Pustejovsky, 2000):

John mended the ***torn*** dress
John mended the **red** dress

Persistence and Change of State Verbs

Event-based Models of Change and Persistence in Language (Pustejovsky, 2000):

John mended the ***torn*** dress
John mended the **red** dress

Mary cleaned the *dirty* table
The waiter filled every *empty* glass
Mary fixed the *flat* tire
Bill swept the *dirty* floor
Bill swept the *dirty* floor clean
Nero built the *gleaming* temple
Nero ruined the *splendid* temple

Persistence and Change of State Verbs

Event-based Models of Change and Persistence in Language (Pustejovsky, 2000):

John mended the ***torn*** dress
John mended the **red** dress

Mary cleaned the *dirty* table	Change of State
The waiter filled every *empty* glass	
Mary fixed the *flat* tire	
Bill swept the *dirty* floor	Activity
Bill swept the *dirty* floor clean	Accomplishment
Nero built the *gleaming* temple	Creation
Nero ruined the *splendid* temple	Destruction

Event Template Representation

Change of State Verbs:

John mended the ***torn***/***red*** dress

mend: x CAUS y BECOME <STATE(*mended*)>

Event Template Representation

Change of State Verbs:

John mended the ***torn***/***red*** dress

mend: x CAUS y BECOME <STATE(*mended*)>

John CAUS the ***torn***/***red*** dress BECOME STATE(*mended*)> r

- Antonym relation between adjective and end state

System Description

- Antonym relation between adjective and end state

  Use WORDNET 1.6, PROLOG version

  (Adj/Verb system 174K nodes, 600K links)

  PROLOG/C Breadth-first search: shortest path first

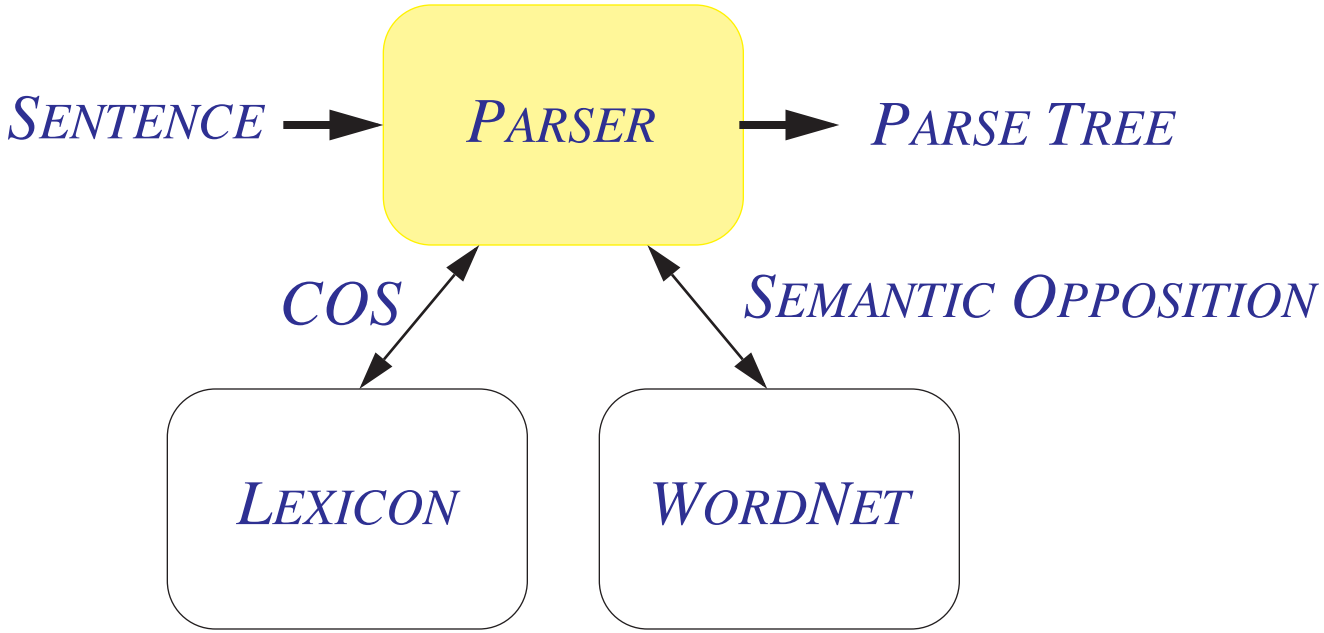
System Description

- Antonym relation between adjective and end state

  Use WORDNET 1.6, PROLOG version

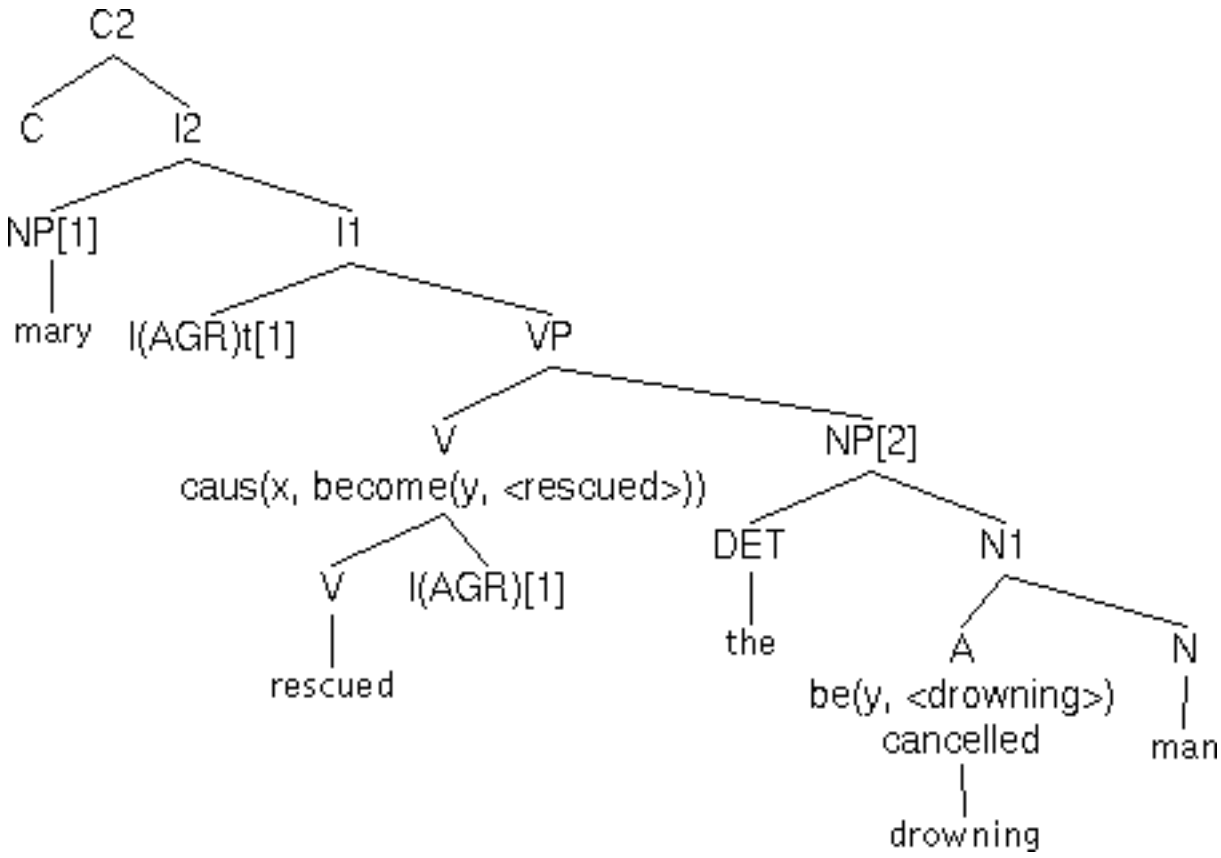
  (Adj/Verb system 174K nodes, 600K links)

  PROLOG/C Breadth-first search: shortest path first



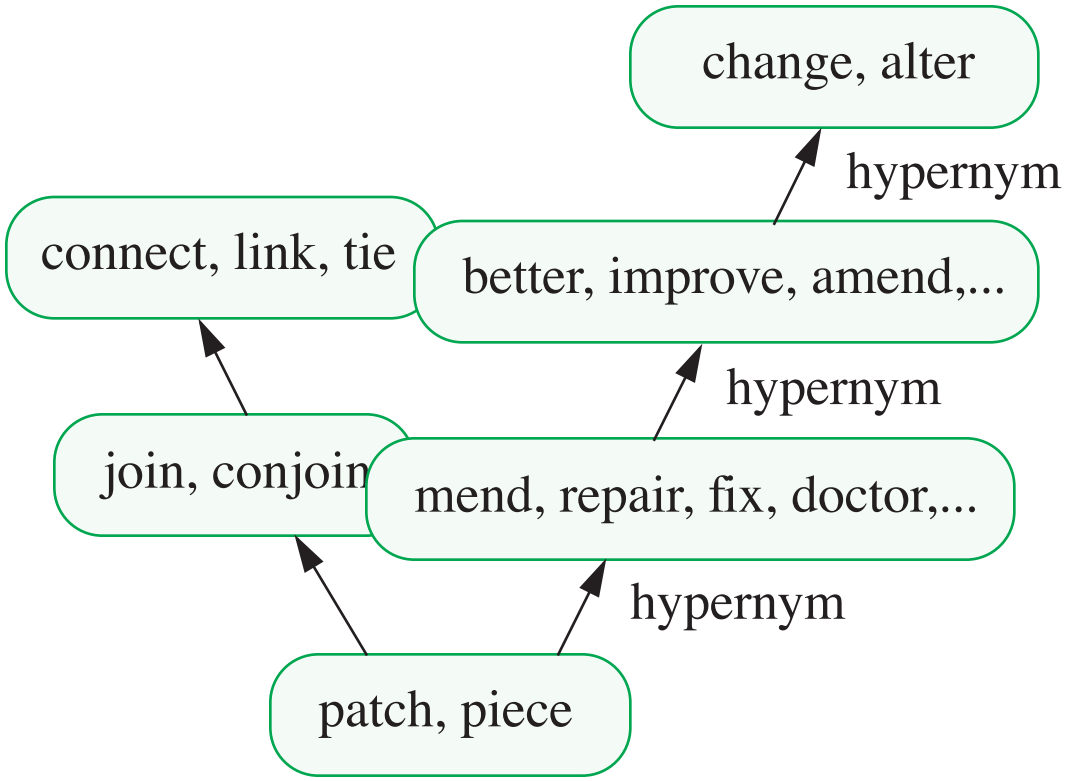
Example Output

Mary rescued the drowning man



WordNet

- Synonym set (synset) network for nouns, verbs, adjectives and adverbs
- Synsets connected by semantic relations (isa, antonymy, etc.)
- Size: 10K verbs (polysemy 2), 20K adjectives (polysemy 1.5)



WordNet Relations

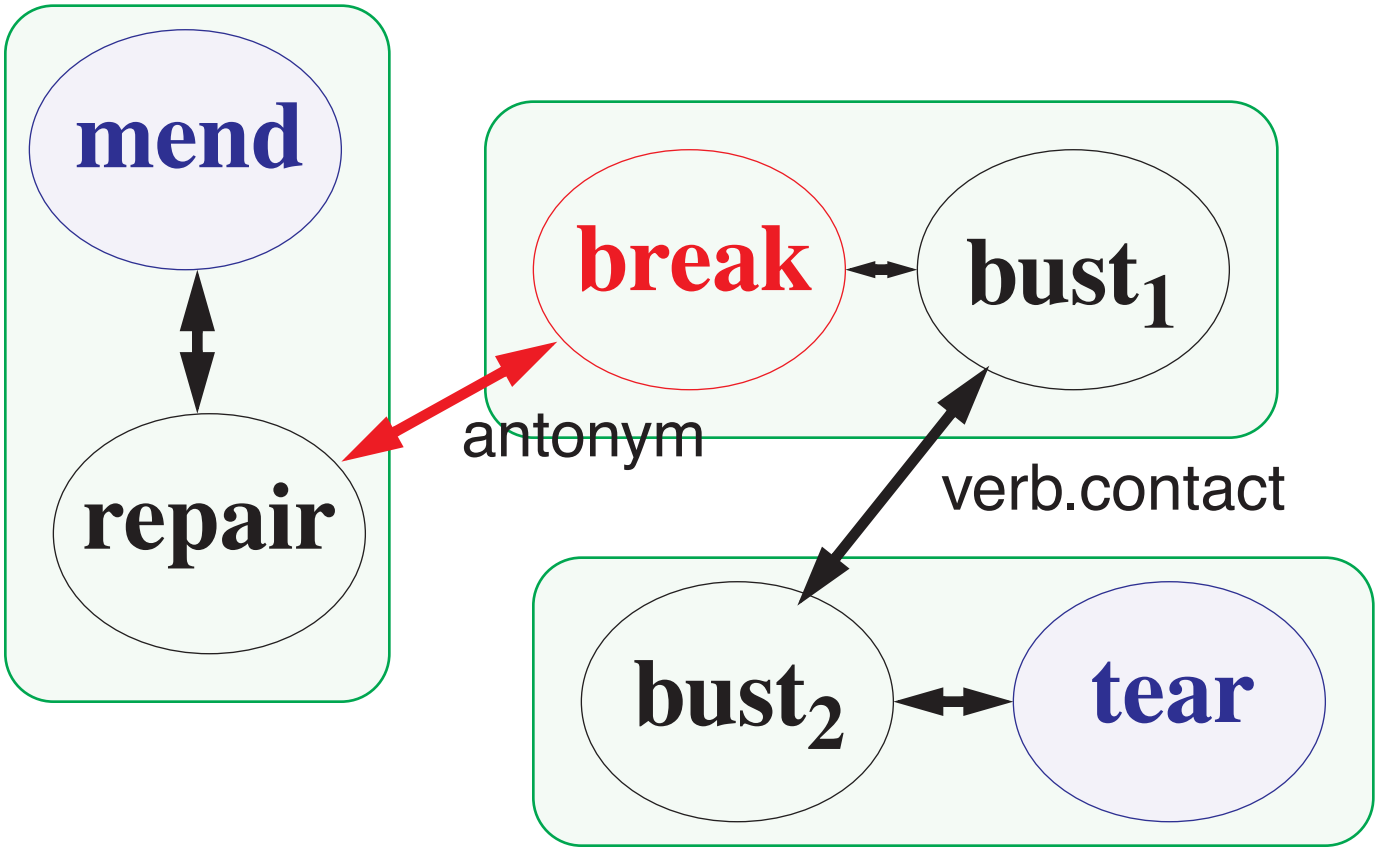
Relation	Description	Example
x HYP y	y is a hypernym of x	x: *repair*, y: *improve*
x ENT y	x entails y	x: *breathe*, y: *inhale*
x SIM y	y is similar to x (A)	x: *achromatic*, y: *white*
x CS y	y is a cause of x	x: *anesthetize*, y: *sleep*
x VGP y	y is similar to x (V)	x: *behave*, y: *pretend*
x ANT y	x and y are antonyms	x: *present*, y: *absent*
x SA y	x, see also y	x: *breathe*, y: *breathe out*
x PPL y	x participle of y	x: *applied*, y: *apply*
x PER y	x pertains to y	x: *abaxial*, y: *axial*

WordNet Relations

Relation	Description	Example
x HYP y	y is a hypernym of x	x: *repair*, y: *improve*
x ENT y	x entails y	x: *breathe*, y: *inhale*
x SIM y	y is similar to x (A)	x: *achromatic*, y: *white*
x CS y	y is a cause of x	x: *anesthetize*, y: *sleep*
x VGP y	y is similar to x (V)	x: *behave*, y: *pretend*
x ANT y	**x and y are antonyms**	**x: *present*, y: *absent***
x SA y	x, see also y	x: *breathe*, y: *breathe out*
x PPL y	x participle of y	x: *applied*, y: *apply*
x PER y	x pertains to y	x: *abaxial*, y: *axial*

Using WordNet

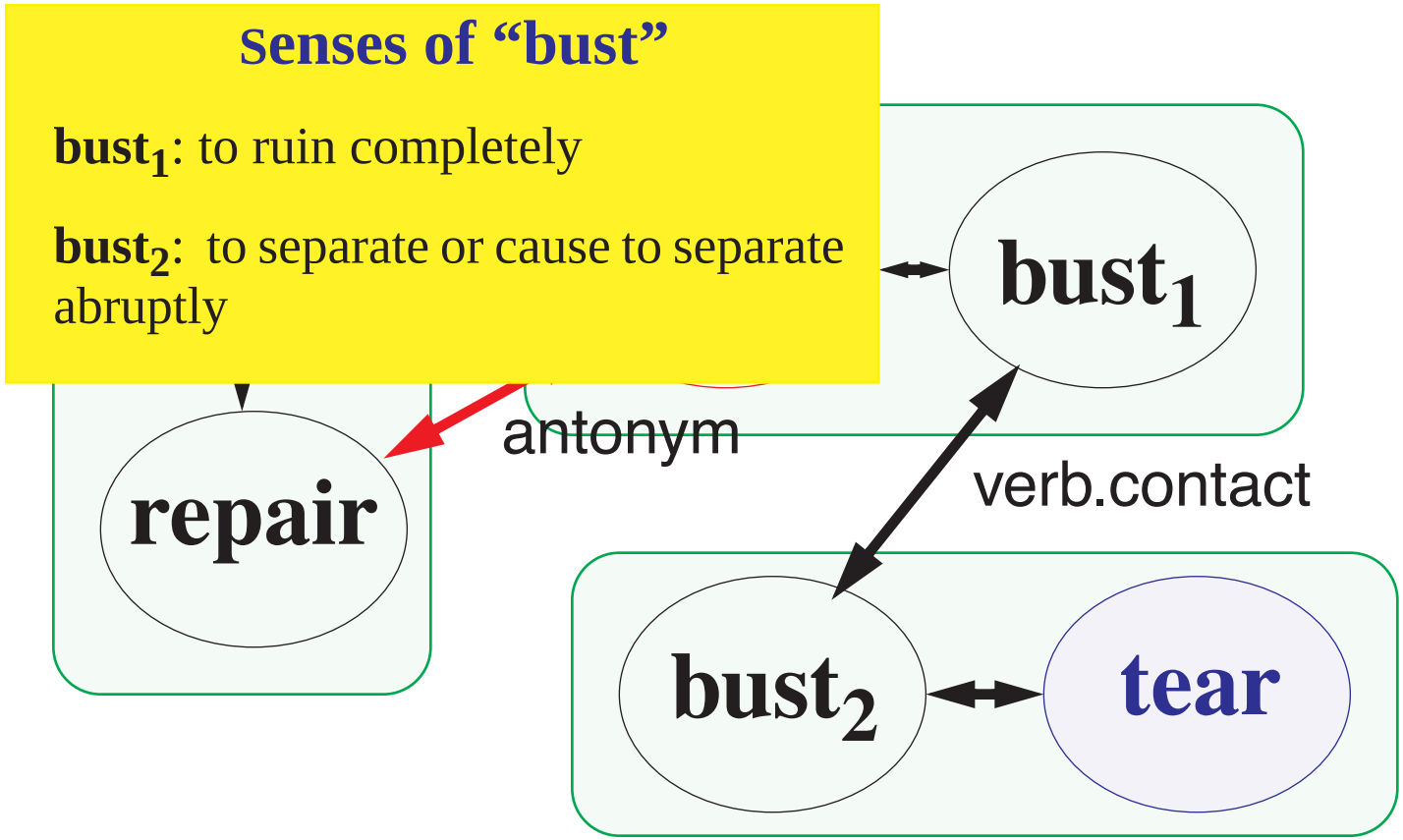
- Find shortest link with antonym relation in derivation chain:



- *mend* -> *tear*: reachable in 6 ways.

Using WordNet

- Find shortest link with antonym relation in derivation chain:



- *mend* -> *tear*: reachable in 6 ways.

Results

Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
mend-torn	5	Yes	1261
mend-red	-	No	11974
fix-leaky	5	Yes	12167
fix-blue	11	No	14553
fix-flat	-	No*	12286
mix-powdered	6	Yes	11931
comfort-crying	9	Yes	11359
blue-white	-	No*	24431
rescue-drowning	13	Yes	9142
clean-dirty	1	Yes	61
fill-empty	1	Yes	48

1. Thresholding

No upper limit on the length of the shortest chain.

1. Thresholding

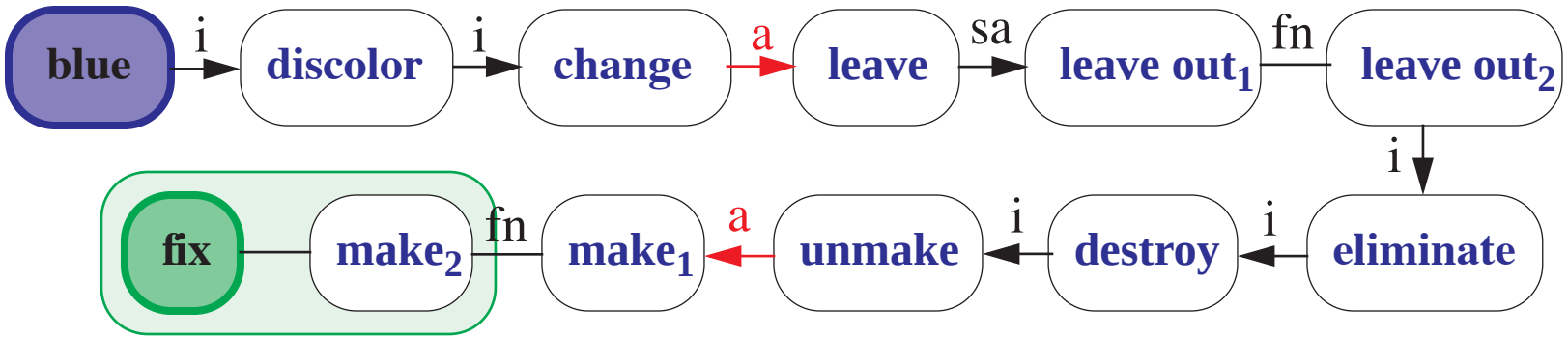
No upper limit on the length of the shortest chain.

Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
fix-blue	11	No	14553
rescue-drowning	13	Yes	9142

1. Thresholding

No upper limit on the length of the shortest chain.

Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
fix-blue	11	No	14553



2. Shortest Path Criterion

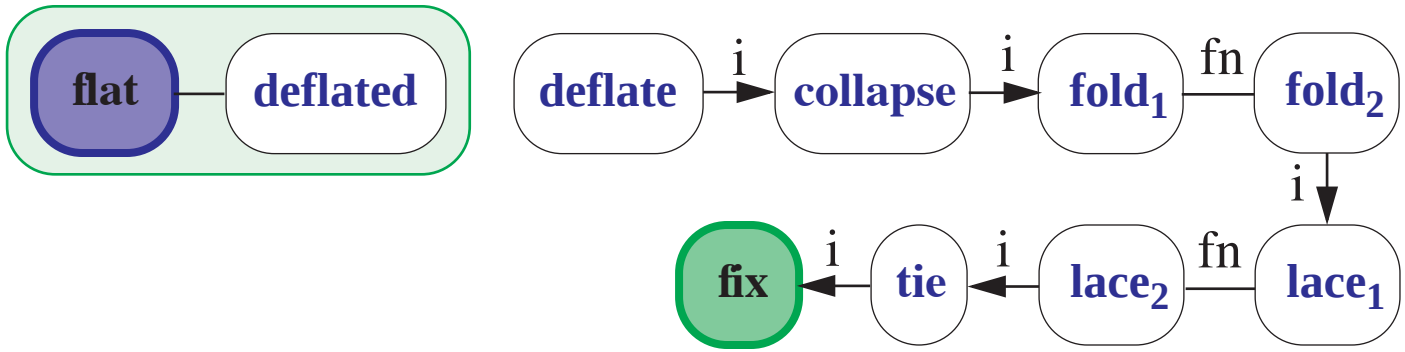
Take the shortest chain.

Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
fix-flat	-	No*	12286

2. Shortest Path Criterion

Take the shortest chain.

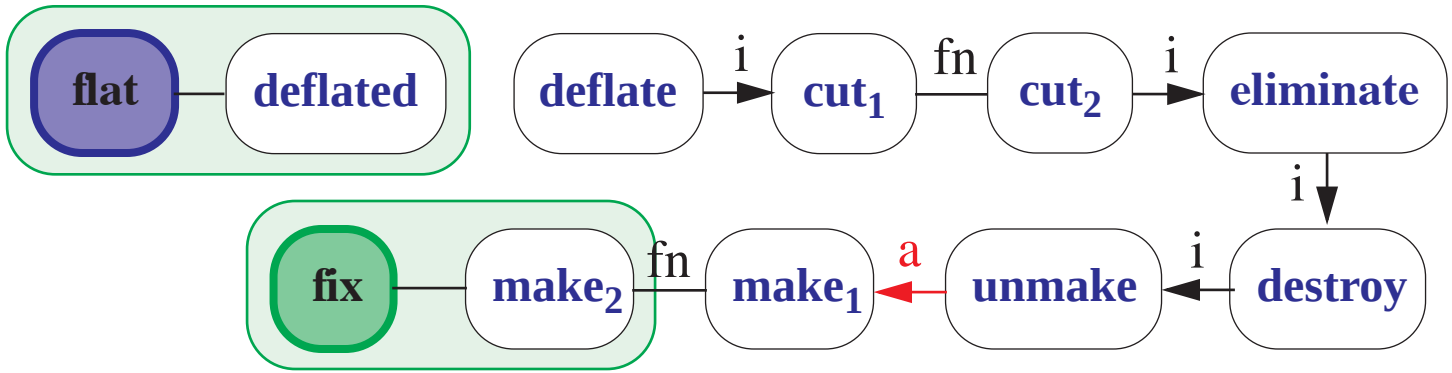
Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
fix-flat	-	No*	12286



2. Shortest Path Criterion

Take the shortest chain.

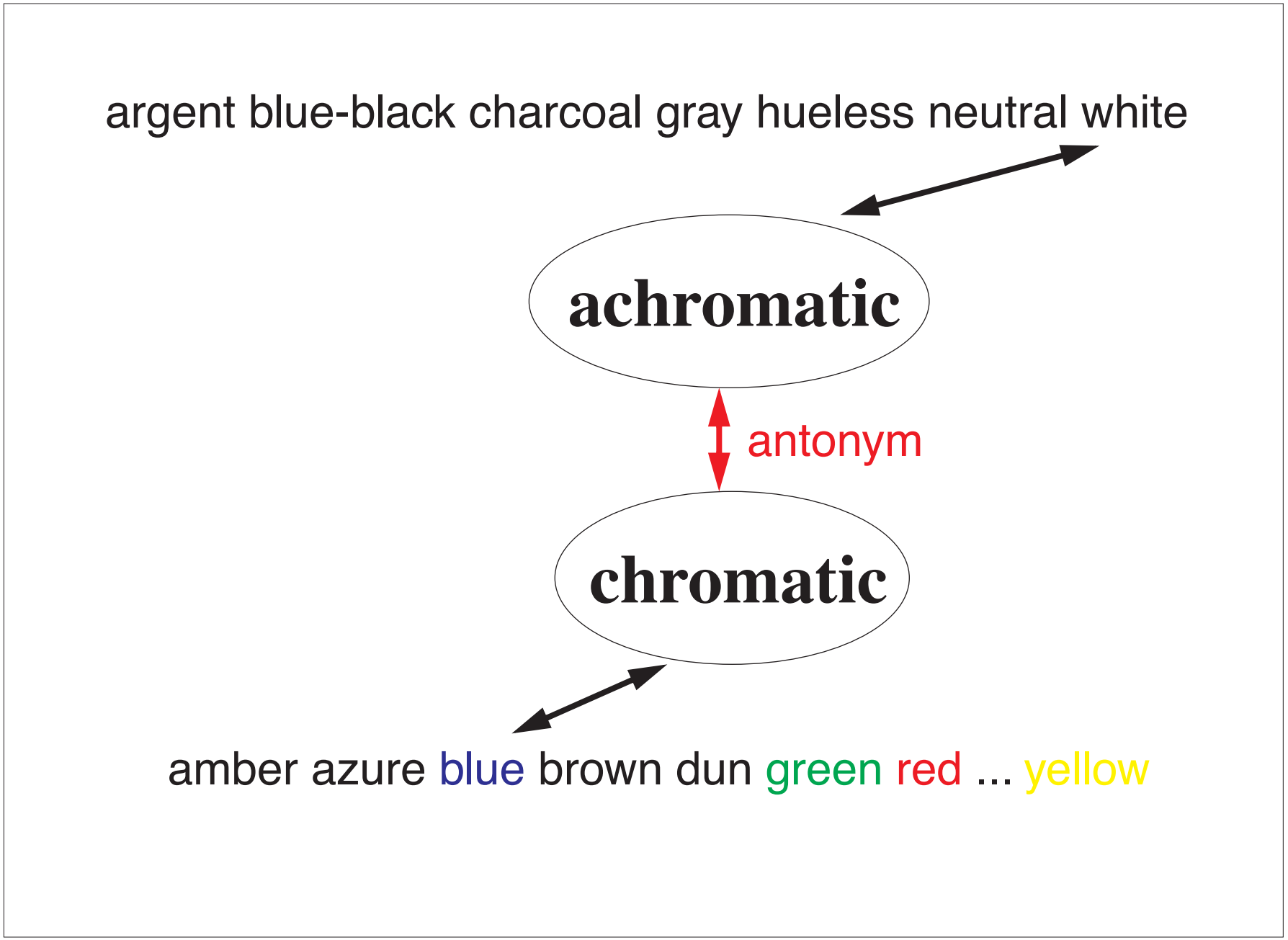
Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
fix-flat	-	No*	12286



3. Color and Opposition

WORDNET organizes color by chromaticity.

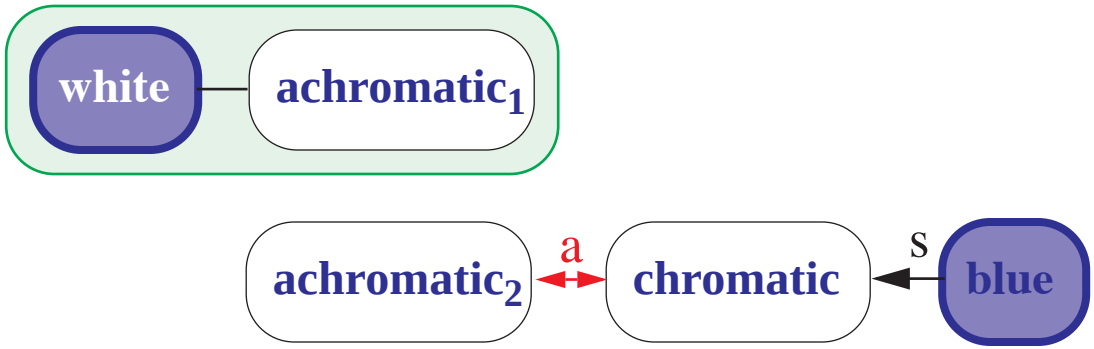
Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
blue-white	-	No*	24431


argent blue-black charcoal gray hueless neutral white
achromatic
antonym
chromatic
amber azure blue brown dun green red ... yellow

3. Color and Opposition

WORDNET organizes color by chromaticity.

Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
blue-white	-	No*	24431



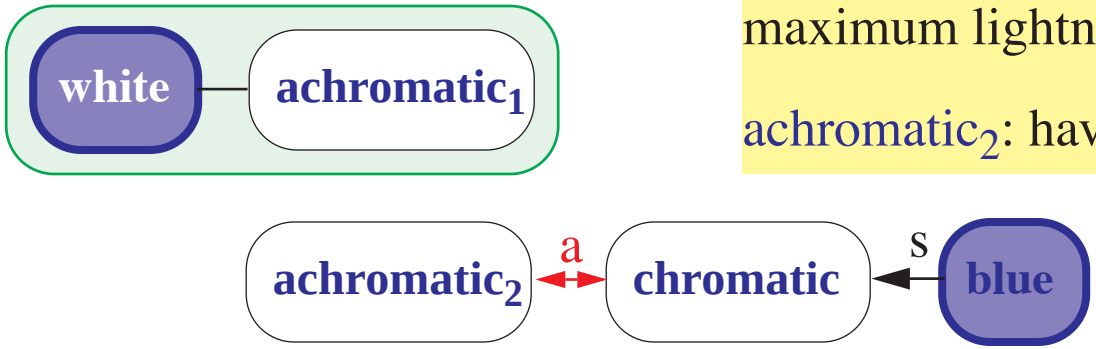
3. Color and Opposition

WORDNET organizes color by chromaticity.

Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
blue-white	-	No*	24431

achromatic$_1$: being of the achromatic color of maximum lightness

achromatic$_2$: having no hue



3. Color and Opposition

WORDNET organizes color by chromaticity.

Candidate Pair	Shortest Chain	Semantic Opposition	Search Space
blue-white	-	No*	24431

John painted the ***red*** door ***blue***

Mary painted the white tiles grey