

A distributional study of negated adjectives and antonyms

Supplementary materials

1 Annotation of lexical antonyms: contraries vs. contradictory

Data Each annotator is given a list of 148 adjectives pairs with opposite meanings (antonyms). The list is obtained according to the following criteria:

- The adjectives are tagged as regular antonyms in the Lexical Negation dictionary (van Son et al., 2016);
- Both the adjectives occur more than 100 times in the training corpus of the distributional model (UkWac + Wacky);
- The negated adjective of at least one of the members of the pair occurs more than 100 times in the training corpus of the distributional model (UkWac + Wacky).

Annotation guidelines Given a pair of words a_1 and a_2 , the annotator considers the following sentence pattern:

(a) *X is neither a_1 nor a_2*

- The annotator tags the pair as x if she does not know the meaning of the word, or does not interpret the two words as having opposite meanings.
- The annotator tags the pair as 1 (contrary) if (a) is acceptable under a default context.
- The annotator tags the pair as 0 (contradictory) if (a) is not acceptable under a default context.

The annotator is asked to carry out the task following for each case her first intuitive judgement.

Agreement Interraters agreement is computed using Fleiss' k , which generalizes Cohen's k to cases with more than two coders.

- Agreement on the three categories (1, 0, x): Fleiss' $k = 0.38$;
- Agreement on two categories (1, 0): : Fleiss' $k = 0.37$.

Dataset For the purpose of the final categorization used in the analyses, only pairs that have been categorized as either 1 or 0 are considered, hence discarding those for which at least one annotator tagged them as x, or for which there was not full agreement.

Examples of adjective pairs and their annotation	<i>beautiful, ugly</i>	contraries
	<i>alive, dead</i>	contradictory
	<i>free, bound</i>	neither
	<i>actual, potential</i>	neither

2 Antonyms and negated adjective triples

2.1 Lexical antonyms

Triple			Class	Frequency of negated adjective
negligent	diligent	not negligent	—	104
fair	foul	not fair	—	1597
present	absent	not present	contradictory	6621
present	absent	not absent	contradictory	112
hot	cold	not hot	contraries	305
hot	cold	not cold	contraries	265
active	extinct	not active	—	773
warm	cool	not warm	contraries	106
warm	cool	not cool	contraries	217
smooth	rough	not smooth	—	163
sharp	flat	not sharp	contraries	142
sharp	flat	not flat	contraries	225
natural	flat	not natural	—	590
natural	flat	not flat	—	225
straight	crooked	not straight	—	222
hard	soft	not hard	—	2539
hard	soft	not soft	—	120
long	short	not long	contraries	4211
long	short	not short	contraries	664
close	distant	not close	—	516
national	international	not national	—	207
national	international	not international	—	145
prescriptive	descriptive	not prescriptive	—	217
fast	slow	not fast	—	123
fast	slow	not slow	—	461
full	empty	not full	contraries	943
full	empty	not empty	contraries	419
military	civilian	not military	—	177
civil	sidereal	not civil	—	174
loud	soft	not loud	contraries	101
loud	soft	not soft	contraries	120
uniform	multiform	not uniform	contradictory	499
present	past	not present	contraries	6621
present	future	not present	contraries	6621
sharp	dull	not sharp	—	142
early	late	not early	contraries	268
early	late	not late	contraries	321
hungry	thirsty	not hungry	—	196
linear	planar	not linear	—	250
offensive	defensive	not offensive	contraries	209
active	passive	not active	—	773
active	passive	not passive	—	217
simple	compound	not simple	contradictory	625
single	multiple	not single	contradictory	280
linear	cubic	not linear	—	250
functional	organic	not functional	—	121
dominant	recessive	not dominant	—	107
foreign	native	not foreign	contradictory	153
foreign	native	not native	contradictory	664

extensive	intensive	not extensive	—	200
plain	fancy	not plain	contraries	119
plain	fancy	not fancy	contraries	236
top	side	not top	contraries	252
common	individual	not common	—	1858
common	individual	not individual	—	497
wise	foolish	not wise	contraries	373
soft	hardened	not soft	contraries	120
flat	contrasty	not flat	—	225
found	lost	not found	—	366
exclusive	inclusive	not exclusive	—	1089
hostile	amicable	not hostile	contraries	162
ripe	green	not ripe	contraries	127
ripe	green	not green	contraries	154
local	general	not local	—	500
local	general	not general	—	216
primary	secondary	not primary	—	123
new	worn	not new	—	2965
safe	dangerous	not safe	—	1741
safe	dangerous	not dangerous	—	521
robust	frail	not robust	—	239
right	center	not right	contraries	1620
compliant	defiant	not compliant	—	173
first	last	not first	contraries	380
first	last	not last	contraries	2668
heavy	light	not heavy	—	255
heavy	light	not light	—	206
central	peripheral	not central	contraries	340
sad	glad	not sad	contraries	147
early	middle	not early	—	268
homogeneous	heterogeneous	not homogeneous	—	125
actual	potential	not actual	—	528
optional	obligatory	not optional	contradictory	162
optional	obligatory	not obligatory	contradictory	417
full	thin	not full	contraries	943
old	young	not old	—	818
old	young	not young	—	209
physical	mental	not physical	—	353
simple	complex	not simple	—	625
simple	complex	not complex	—	137
thick	thin	not thick	—	109
live	recorded	not live	contradictory	214
positive	neutral	not positive	contraries	232
positive	neutral	not neutral	contraries	250
attractive	repulsive	not attractive	contraries	223
major	minor	not major	—	229
direct	retrograde	not direct	—	397
parallel	perpendicular	not parallel	contraries	163
large	small	not large	contraries	1764
large	small	not small	contraries	486
most	least	not most	contraries	996
most	least	not least	contraries	15197
identical	fraternal	not identical	—	1766
active	quiet	not active	contraries	773
positive	negative	not positive	—	232

positive	negative	not negative	—	178
first	second	not first	contraries	380
first	second	not second	contraries	127
natural	sharp	not natural	—	590
natural	sharp	not sharp	—	142
solid	liquid	not solid	contraries	159
free	bound	not free	—	2270
absolute	relative	not absolute	—	758
open	closed	not open	—	3802
separate	joint	not separate	contradictory	636
meaningful	meaningless	not meaningful	—	154
proud	humble	not proud	contraries	334
serious	frivolous	not serious	contraries	854
wide	narrow	not wide	contraries	266
religious	secular	not religious	contradictory	568
genuine	counterfeit	not genuine	—	383
strange	familiar	not strange	—	251
strange	familiar	not familiar	—	2970
native	adopted	not native	contradictory	664
objective	subjective	not objective	contradictory	144
natural	artificial	not natural	contradictory	590
automatic	manual	not automatic	contradictory	363
nuclear	conventional	not nuclear	—	108
nuclear	conventional	not conventional	—	131
strong	weak	not strong	—	1860
strong	weak	not weak	—	129
single	double	not single	—	280
active	stative	not active	—	773
square	round	not square	contraries	173
external	internal	not external	—	109
old	new	not old	contraries	818
old	new	not new	contraries	2965
more	less	not more	—	10527
more	less	not less	—	10235
real	nominal	not real	—	1434
dominant	subordinate	not dominant	contraries	107
tall	short	not tall	contraries	142
tall	short	not short	contraries	664
busy	idle	not busy	—	333
busy	idle	not idle	—	144
direct	inverse	not direct	—	397
big	little	not big	contraries	1349
big	little	not little	contraries	136
brave	cowardly	not brave	contraries	125
negative	neutral	not negative	contraries	178
negative	neutral	not neutral	contraries	250
active	dormant	not active	—	773
foreign	domestic	not foreign	—	153
solid	gaseous	not solid	—	159
deep	shallow	not deep	—	273
bright	dull	not bright	contraries	169
private	public	not private	contradictory	417
private	public	not public	contradictory	533
true	false	not true	contradictory	6524
true	false	not false	contradictory	226

much	little	not much	contraries	10706
much	little	not little	contraries	136
abstract	concrete	not abstract	—	144
rich	lean	not rich	—	430
nice	nasty	not nice	contraries	553
late	middle	not late	—	321
live	dead	not live	contradictory	214
live	dead	not dead	contradictory	1244
beautiful	ugly	not beautiful	contraries	200
wild	tame	not wild	—	105
clear	opaque	not clear	—	15096
tough	tender	not tough	—	119
national	local	not national	contraries	207
national	local	not local	contraries	500
straight	curly	not straight	—	222
blind	sighted	not blind	contradictory	395
different	same	not different	—	584
expensive	cheap	not expensive	—	438
expensive	cheap	not cheap	—	1238
innocent	guilty	not innocent	contradictory	120
innocent	guilty	not guilty	contradictory	4152
smart	stupid	not smart	contraries	167
smart	stupid	not stupid	contraries	439
fat	thin	not fat	contraries	149
safe	out	not safe	—	1741
difficult	easy	not difficult	—	3480
difficult	easy	not easy	—	9747
near	far	not near	—	154
dry	sweet	not dry	—	128
other	same	not other	contradictory	905
solid	hollow	not solid	—	159
parallel	oblique	not parallel	—	163
alive	dead	not alive	contradictory	209
alive	dead	not dead	contradictory	1244
optimistic	pessimistic	not optimistic	contraries	154
clear	cloudy	not clear	—	15096
many	few	not many	—	9337
many	few	not few	—	322

2.2 Morphological antonyms

Triple			Class	Frequency of negated adjective
typical	atypical	not typical	simple negation	668
confident	diffident	not confident	simple negation	817
similar	dissimilar	not similar	simple negation	314
similar	dissimilar	not dissimilar	double negation	1448
legitimate	illegitimate	not legitimate	simple negation	182
material	immaterial	not material	simple negation	219
permanent	impermanent	not permanent	simple negation	374
practical	impractical	not practical	simple negation	1512
probable	improbable	not probable	simple negation	139
probable	improbable	not improbable	double negation	199
proper	improper	not proper	simple negation	374

active	inactive	not active	simple negation	773
comparable	incomparable	not comparable	simple negation	478
correct	incorrect	not correct	simple negation	1008
corrupt	incorrupt	not corrupt	simple negation	133
credible	incredible	not credible	simple negation	294
definite	indefinite	not definite	simple negation	109
direct	indirect	not direct	simple negation	397
efficient	inefficient	not efficient	simple negation	185
flexible	inflexible	not flexible	simple negation	199
offensive	inoffensive	not offensive	simple negation	209
sensible	insensible	not sensible	simple negation	246
substantial	insubstantial	not substantial	simple negation	128
sufficient	insufficient	not sufficient	simple negation	6102
valid	invalid	not valid	simple negation	1856
visible	invisible	not visible	simple negation	2238
responsible	irresponsible	not responsible	simple negation	11454
political	nonpolitical	not political	simple negation	490
traditional	nontraditional	not traditional	simple negation	250
violent	nonviolent	not violent	simple negation	144
able	unable	not able	simple negation	18816
afraid	unafraid	not afraid	simple negation	4345
ashamed	unashamed	not ashamed	simple negation	986
attractive	unattractive	not attractive	simple negation	223
available	unavailable	not available	simple negation	32704
christian	unchristian	not christian	simple negation	252
civil	uncivil	not civil	simple negation	174
common	uncommon	not common	simple negation	1858
common	uncommon	not uncommon	double negation	7282
democratic	undemocratic	not democratic	simple negation	127
desirable	undesirable	not desirable	simple negation	481
due	undue	not due	simple negation	3543
familiar	unfamiliar	not familiar	simple negation	2970
familiar	unfamiliar	not unfamiliar	double negation	130
fashionable	unfashionable	not fashionable	simple negation	108
fit	unfit	not fit	simple negation	1222
happy	unhappy	not happy	simple negation	6683
happy	unhappy	not unhappy	double negation	119
helpful	unhelpful	not helpful	simple negation	835
identifiable	unidentifiable	not identifiable	simple negation	136
impressive	unimpressive	not impressive	simple negation	115
just	unjust	not just	simple negation	114
kind	unkind	not kind	simple negation	119
like	unlike	not like	simple negation	370
limited	unlimited	not limited	simple negation	7159
limited	unlimited	not unlimited	double negation	117
loving	unloving	not loving	simple negation	112
lucky	unlucky	not lucky	simple negation	199
married	unmarried	not married	simple negation	147
necessary	unnecessary	not necessary	simple negation	11293
popular	unpopular	not popular	simple negation	1210
profitable	unprofitable	not profitable	simple negation	281
ready	unready	not ready	simple negation	4060
realistic	unrealistic	not realistic	simple negation	455
responsive	unresponsive	not responsive	simple negation	148
satisfactory	unsatisfactory	not satisfactory	simple negation	566

scientific	unscientific	not scientific	simple negation	271
skilled	unskilled	not skilled	simple negation	105
social	unsocial	not social	simple negation	248
willing	unwilling	not willing	simple negation	3098
worthy	unworthy	not worthy	simple negation	1229
historical	ahistorical	not historical	simple negation	256
continuous	discontinuous	not continuous	simple negation	280
honest	dishonest	not honest	simple negation	142
legal	illegal	not legal	simple negation	896
legal	illegal	not illegal	double negation	1001
logical	illogical	not logical	simple negation	178
mature	immature	not mature	simple negation	128
moral	immoral	not moral	simple negation	137
perfect	imperfect	not perfect	simple negation	2072
permissible	impermissible	not permissible	simple negation	495
personal	impersonal	not personal	simple negation	404
explicit	implicit	not explicit	simple negation	271
possible	impossible	not possible	simple negation	27653
possible	impossible	not impossible	double negation	2668
precise	imprecise	not precise	simple negation	246
pure	impure	not pure	simple negation	369
accessible	inaccessible	not accessible	simple negation	1795
accurate	inaccurate	not accurate	simple negation	624
adequate	inadequate	not adequate	simple negation	927
admissible	inadmissible	not admissible	simple negation	164
advisable	inadvisable	not advisable	simple negation	919
appropriate	inappropriate	not appropriate	simple negation	3944
appropriate	inappropriate	not inappropriate	double negation	135
capable	incapable	not capable	simple negation	2320
compatible	incompatible	not compatible	simple negation	2204
compatible	incompatible	not incompatible	double negation	334
competent	incompetent	not competent	simple negation	429
complete	incomplete	not complete	simple negation	2019
conclusive	inconclusive	not conclusive	simple negation	528
consistent	inconsistent	not consistent	simple negation	1511
consistent	inconsistent	not inconsistent	double negation	710
constant	inconstant	not constant	simple negation	396
convenient	inconvenient	not convenient	simple negation	371
decisive	indecisive	not decisive	simple negation	119
dependent	independent	not dependent	simple negation	1650
dependent	independent	not independent	double negation	678
discriminate	indiscriminate	not discriminate	simple negation	1669
distinct	indistinct	not distinct	simple negation	191
divisible	indivisible	not divisible	simple negation	176
effective	ineffective	not effective	simple negation	1218
eligible	ineligible	not eligible	simple negation	4253
exact	inexact	not exact	simple negation	323
formal	informal	not formal	simple negation	192
frequent	infrequent	not frequent	simple negation	156
frequent	infrequent	not infrequent	double negation	177
secure	insecure	not secure	simple negation	452
sensitive	insensitive	not sensitive	simple negation	435
significant	insignificant	not significant	simple negation	990
significant	insignificant	not insignificant	double negation	430
vulnerable	invulnerable	not vulnerable	simple negation	185

rational	irrational	not rational	simple negation	152
reducible	irreducible	not reducible	simple negation	146
regular	irregular	not regular	simple negation	315
acceptable	unacceptable	not acceptable	simple negation	3487
attributable	unattributable	not attributable	simple negation	235
aware	unaware	not aware	simple negation	7791
aware	unaware	not unaware	double negation	128
certain	uncertain	not certain	simple negation	2893
characteristic	uncharacteristic	not characteristic	simple negation	115
clean	unclean	not clean	simple negation	227
clear	unclear	not clear	simple negation	15096
comfortable	uncomfortable	not comfortable	simple negation	755
conscious	unconscious	not conscious	simple negation	297
conventional	unconventional	not conventional	simple negation	131
critical	uncritical	not critical	simple negation	406
easy	uneasy	not easy	simple negation	9747
enforceable	unenforceable	not enforceable	simple negation	170
enthusiastic	unenthusiastic	not enthusiastic	simple negation	199
equal	unequal	not equal	simple negation	1496
fair	unfair	not fair	simple negation	1597
fair	unfair	not unfair	double negation	122
favorable	unfavorable	not favorable	simple negation	108
free	unfree	not free	simple negation	2270
friendly	unfriendly	not friendly	simple negation	109
healthy	unhealthy	not healthy	simple negation	264
important	unimportant	not important	simple negation	1941
important	unimportant	not unimportant	double negation	111
intelligent	unintelligent	not intelligent	simple negation	165
interested	uninterested	not interested	simple negation	5241
interesting	uninteresting	not interesting	simple negation	172
lawful	unlawful	not lawful	simple negation	347
lawful	unlawful	not unlawful	double negation	162
likely	unlikely	not likely	simple negation	6134
likely	unlikely	not unlikely	double negation	318
natural	unnatural	not natural	simple negation	590
noticeable	unnoticeable	not noticeable	simple negation	162
official	unofficial	not official	simple negation	463
original	unoriginal	not original	simple negation	518
pleasant	unpleasant	not pleasant	simple negation	296
pleasant	unpleasant	not unpleasant	double negation	146
predictable	unpredictable	not predictable	simple negation	132
productive	unproductive	not productive	simple negation	117
professional	unprofessional	not professional	simple negation	307
real	unreal	not real	simple negation	1434
reasonable	unreasonable	not reasonable	simple negation	664
reasonable	unreasonable	not unreasonable	double negation	1057
recoverable	unrecoverable	not recoverable	simple negation	181
reliable	unreliable	not reliable	simple negation	438
restricted	unrestricted	not restricted	simple negation	294
sound	unsound	not sound	simple negation	146
stable	unstable	not stable	simple negation	343
successful	unsuccessful	not successful	simple negation	2361
supportive	unsupportive	not supportive	simple negation	205
sure	unsure	not sure	simple negation	40753
sympathetic	unsympathetic	not sympathetic	simple negation	146

usual	unusual	not usual	simple negation	366
usual	unusual	not unusual	double negation	4317
welcome	unwelcome	not welcome	simple negation	654
considerable	inconsiderable	not inconsiderable	double negation	593
related	unrelated	not unrelated	double negation	173
fallible	infallible	not infallible	double negation	214
finite	infinite	not infinite	double negation	127
expected	unexpected	not unexpected	double negation	384
known	unknown	not unknown	double negation	1124

References

Chantal van Son, Emiel van Miltenburg, and Roser Morante Vallejo. 2016. Building a dictionary of affixal negations. In *Proceedings of the Workshop on Extra-Propositional Aspects of Meaning in Computational Linguistics*.