Picasso

Semantic Mirrors

Thesaurus derivation from parallel corpora

Helge Dyvik
University of Bergen

Overview

1. *Meaning, semantic representations and translation*
2. *Sense individuation based on a parallel corpus*
3. *Deriving semantic wordnets from a parallel corpus*
4. *A toy semantic field*
5. *Evaluating the results; future perspectives*

Princeton WordNet online:

Results for "Synonyms, ordered by estimated frequency" search of noun "society"

4 senses of *society*

Sense 1
society -- (an extended social group having a distinctive cultural and economic organization)
=> social group -- (people sharing some social relation)

Sense 2
club, society, guild, gild, lodge, order -- (a formal association of people with similar interests; "he joined a golf club"; "they formed a small lunch society"; "men from the fraternal order will staff the soup kitchen today")
=> association -- (a formal organization of people or groups of people; "he joined the Modern Language Association")

Sense 3
company, companionship, fellowship, society -- (the state of being with someone; "he missed their company"; "he enjoyed the society of his friends")
=> friendship, friendly relationship -- (the state of being friends)

Sense 4
society, high society, beau monde, smart set, bon ton -- (the fashionable elite)
=> elite -- (a group or class of persons enjoying superior intellectual or social or economic status)

Princeton WordNet online:

Results for "Hypernyms (this is a kind of...)" search of noun "society"

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society -- (an extended social group having a distinctive cultural and economic organization)
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=> association -- (a formal organization of people or groups of people; "he joined the Modern Language Association")
=> organization, organisation -- (a group of people who work together)
=> social group -- (people sharing some social relation)
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Sense 3
company, companionship, fellowship, society -- (the state of being with someone; "he missed their company"; "he enjoyed the society of his friends")
=> friendship, friendly relationship -- (the state of being friends)
=> relationship -- (a state involving mutual dealings between people or parties or countries)
=> state -- (the way something is with respect to its main attributes; "the current state of knowledge"; "his state of health"; "in a weak financial state")

Princeton WordNet online:

Sense 4
society, high society, beau monde, smart set, bon ton -- (the fashionable elite)
=> elite -- (a group or class of persons enjoying superior intellectual or social or economic status)
=> upper class, upper crust -- (the class occupying the highest position in the social hierarchy)
=> class, social class, socio-economic class -- (people having the same social or economic status; "the working class"; "an emerging professional class")
=> people -- ((plural) any group of human beings (men or women or children) collectively; "old people"; "there were at least 200 people in the audience")
=> group, grouping -- (any number of entities (members) considered as a unit)

Semantic field

A “meaning continuum” which the words in a language carve up in their own particular way.

(Examples: colour terms, emotional terms)

Concepts in a semantic field

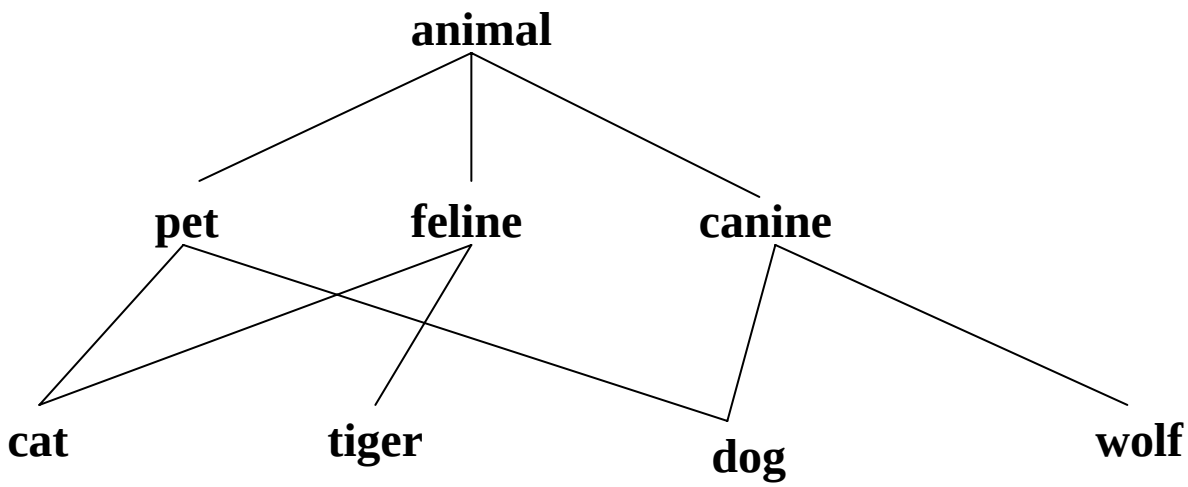
animal

pet **feline** **canine**

cat **tiger** **dog** **wolf**

Concepts in a semantic field

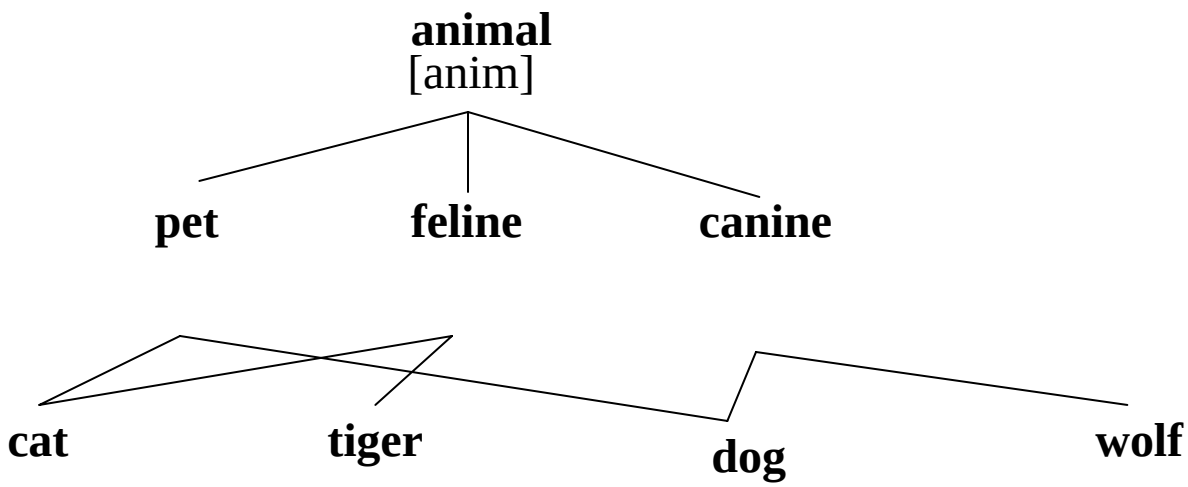
Lattice structure



Concepts in a semantic field

Lattice structure

Feature analysis



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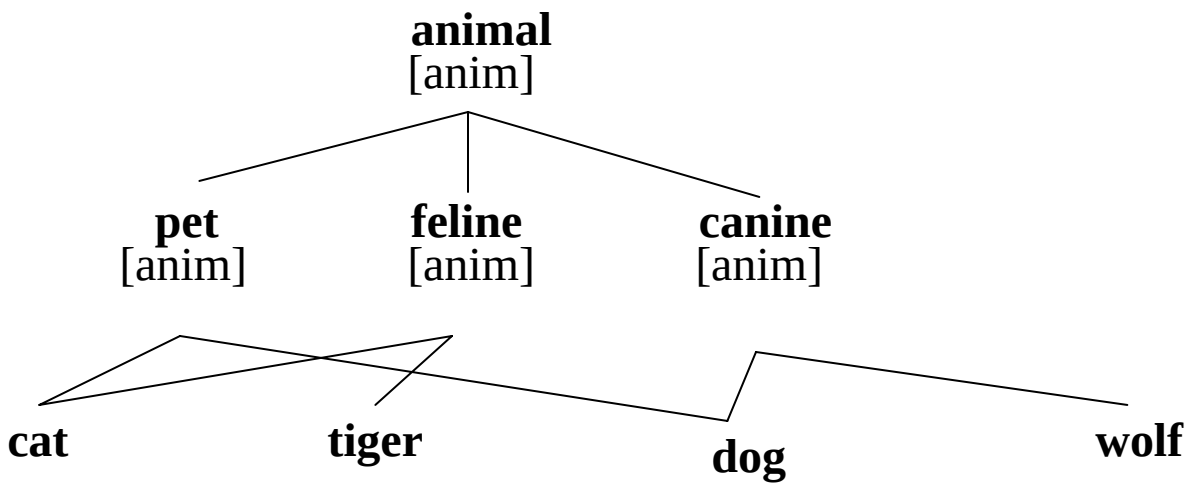

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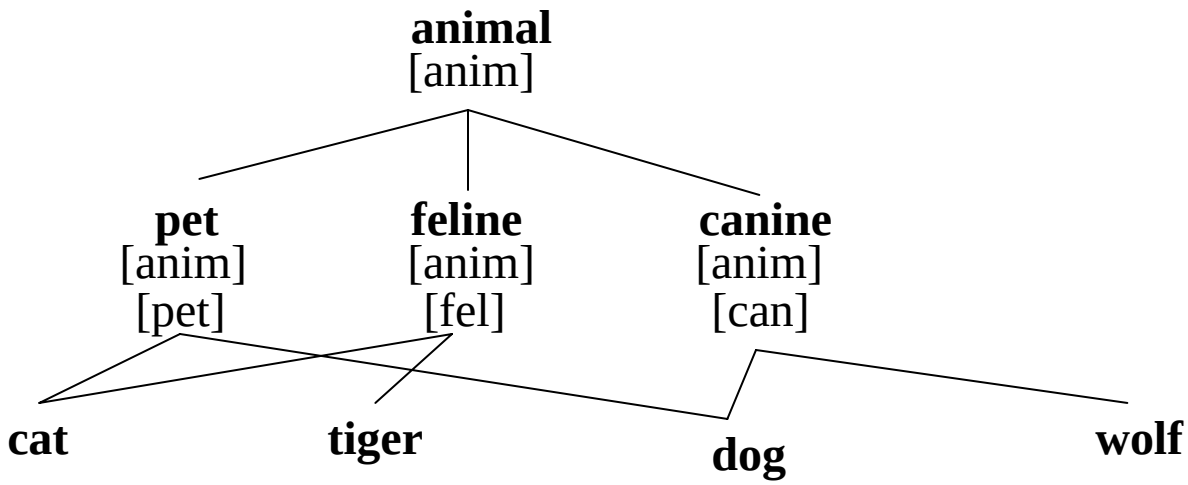

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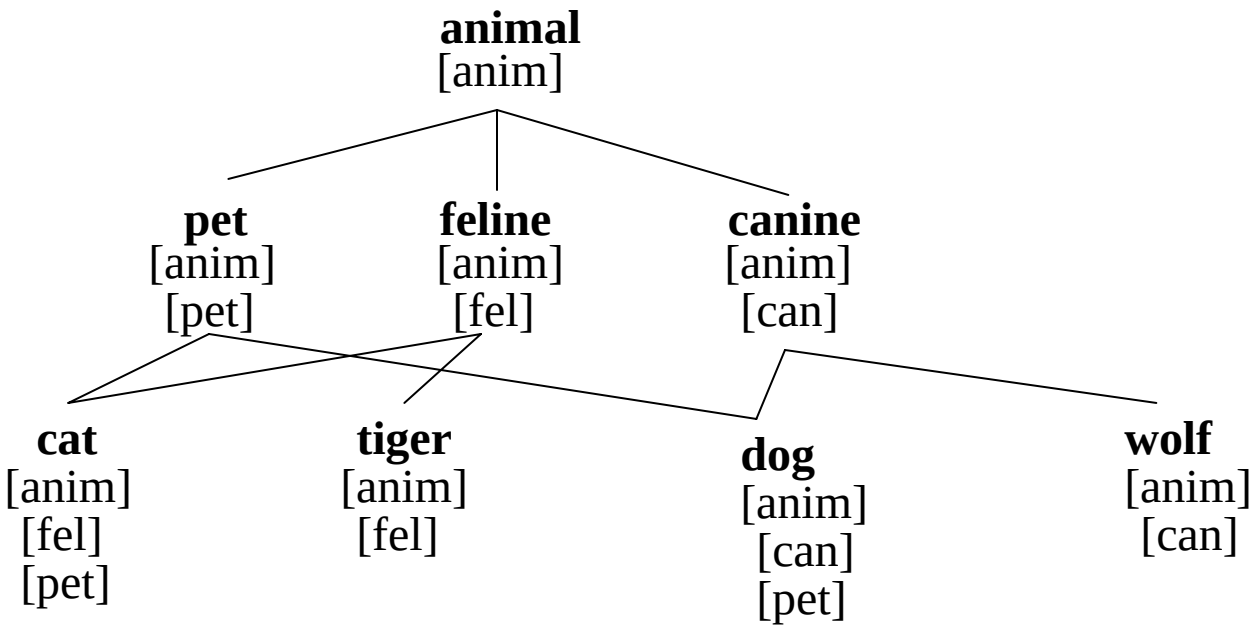

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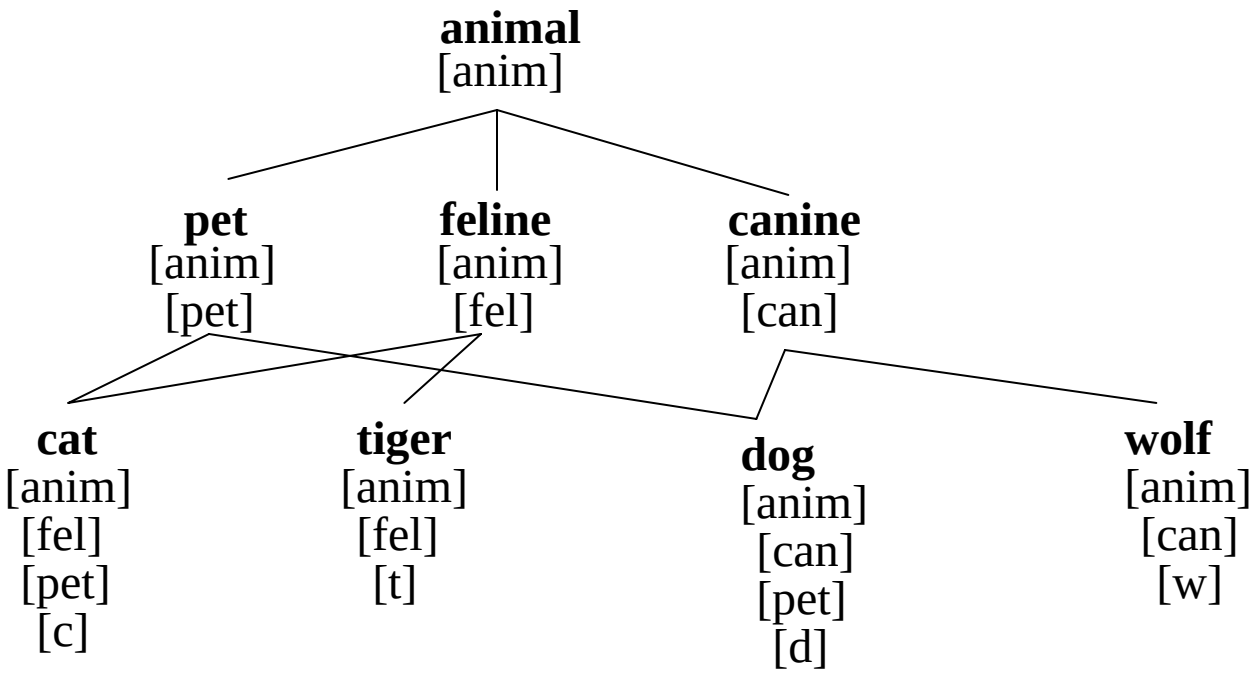
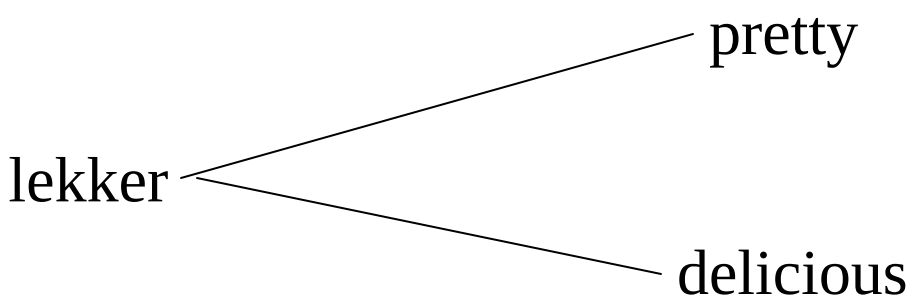


Norw *Eng*



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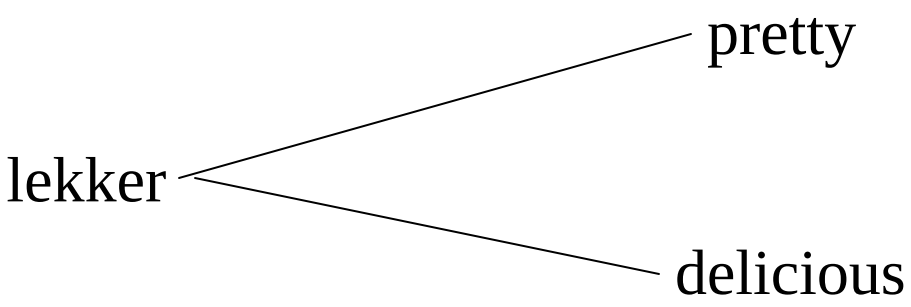

[lekker|pretty]

[lekker|delicious]

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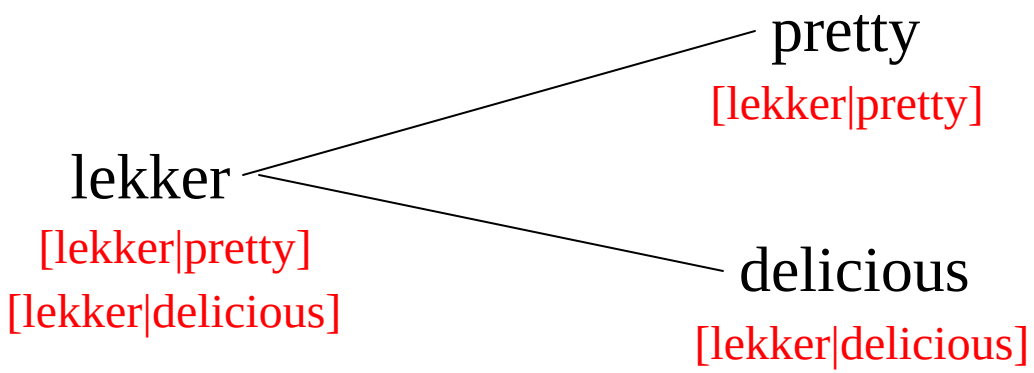

[lekker|pretty]

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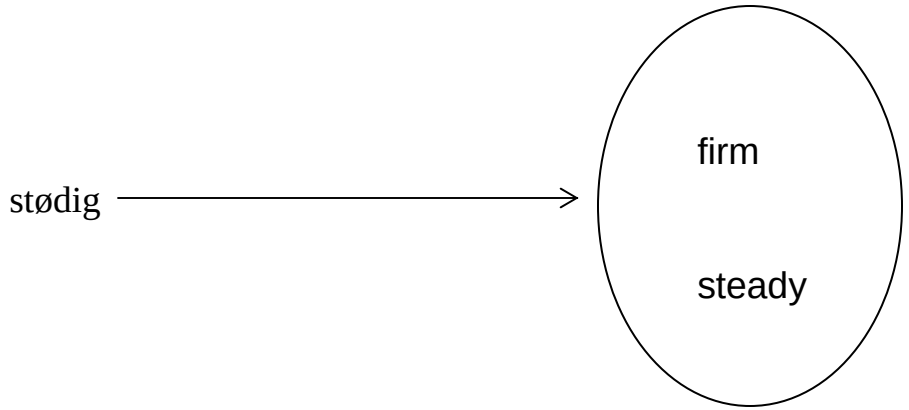
Literal or non-literal translation?

(from the EEA-agreement / EØS-avtalen)

carriers ——————— utøvere av transportvirksomhet
(performers of transport activities)

Filling accidental gaps in the corpus:



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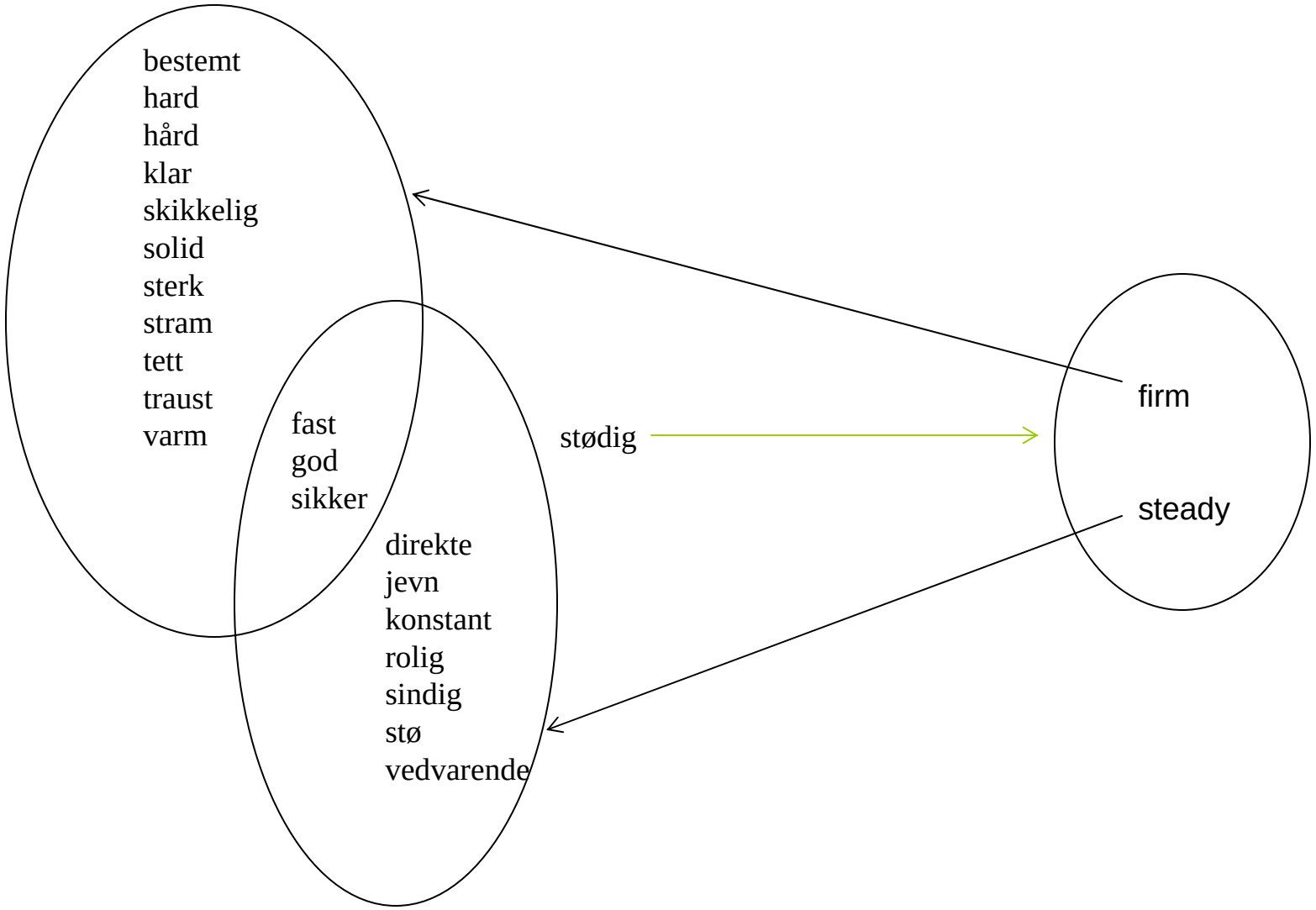

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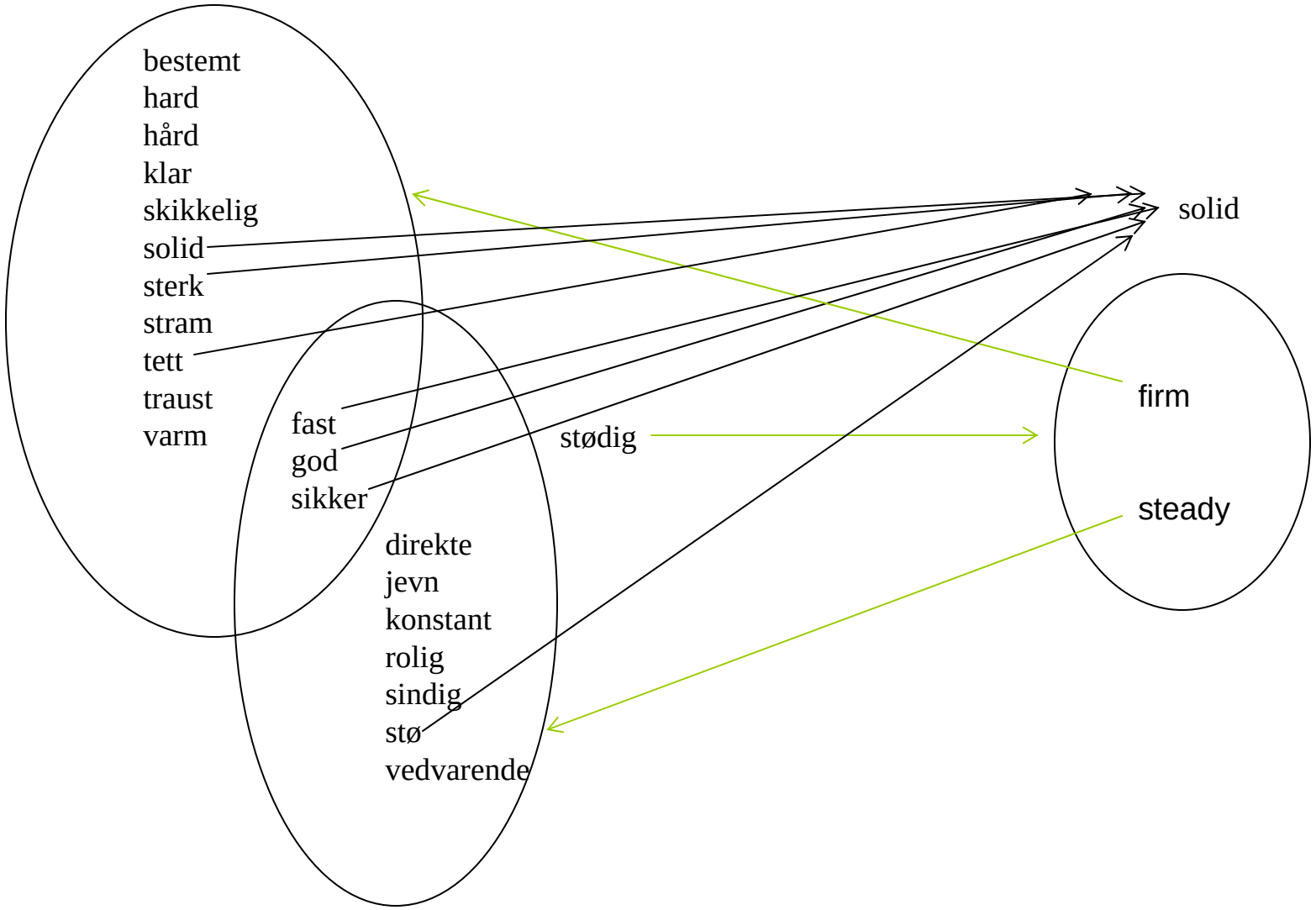

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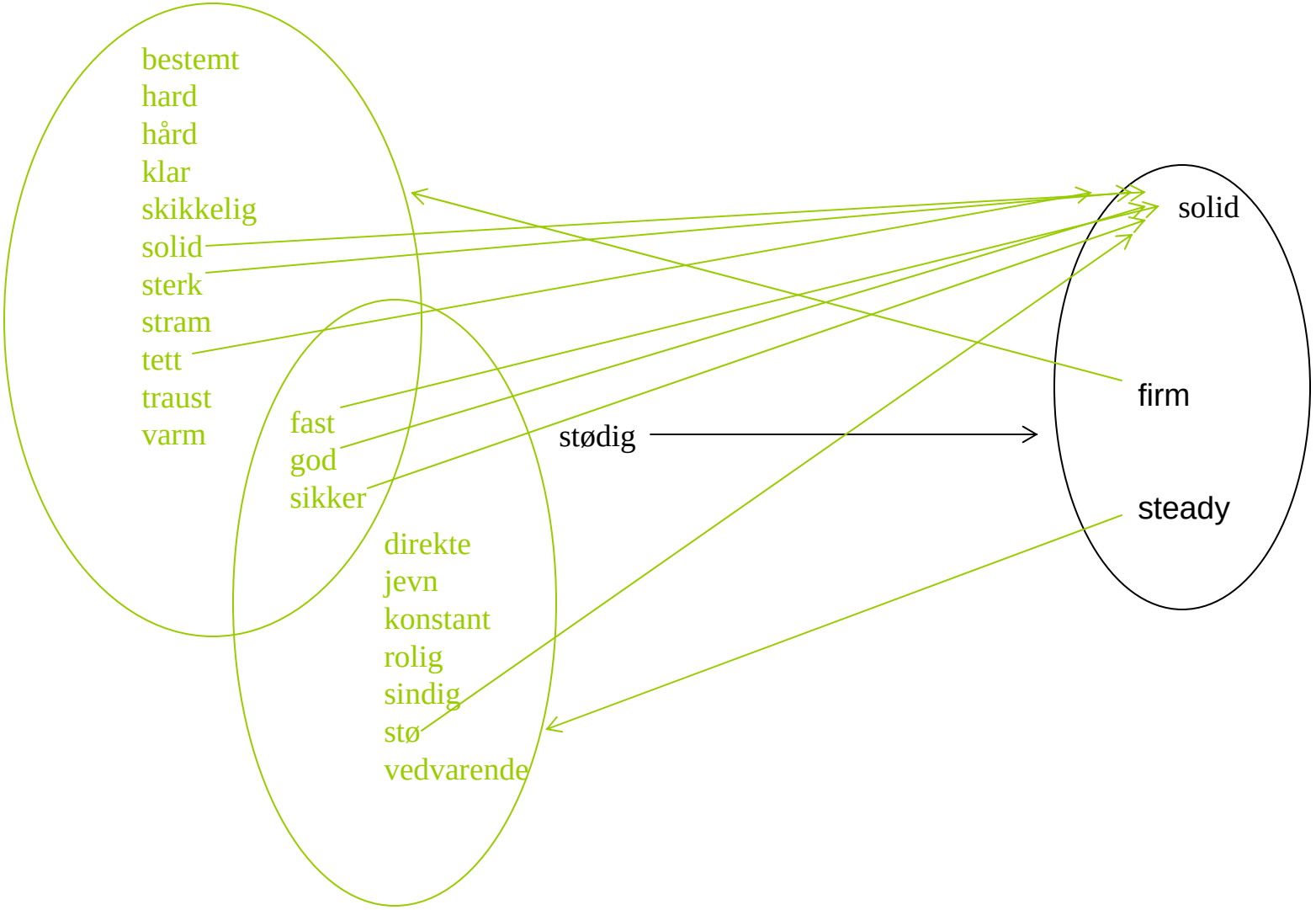

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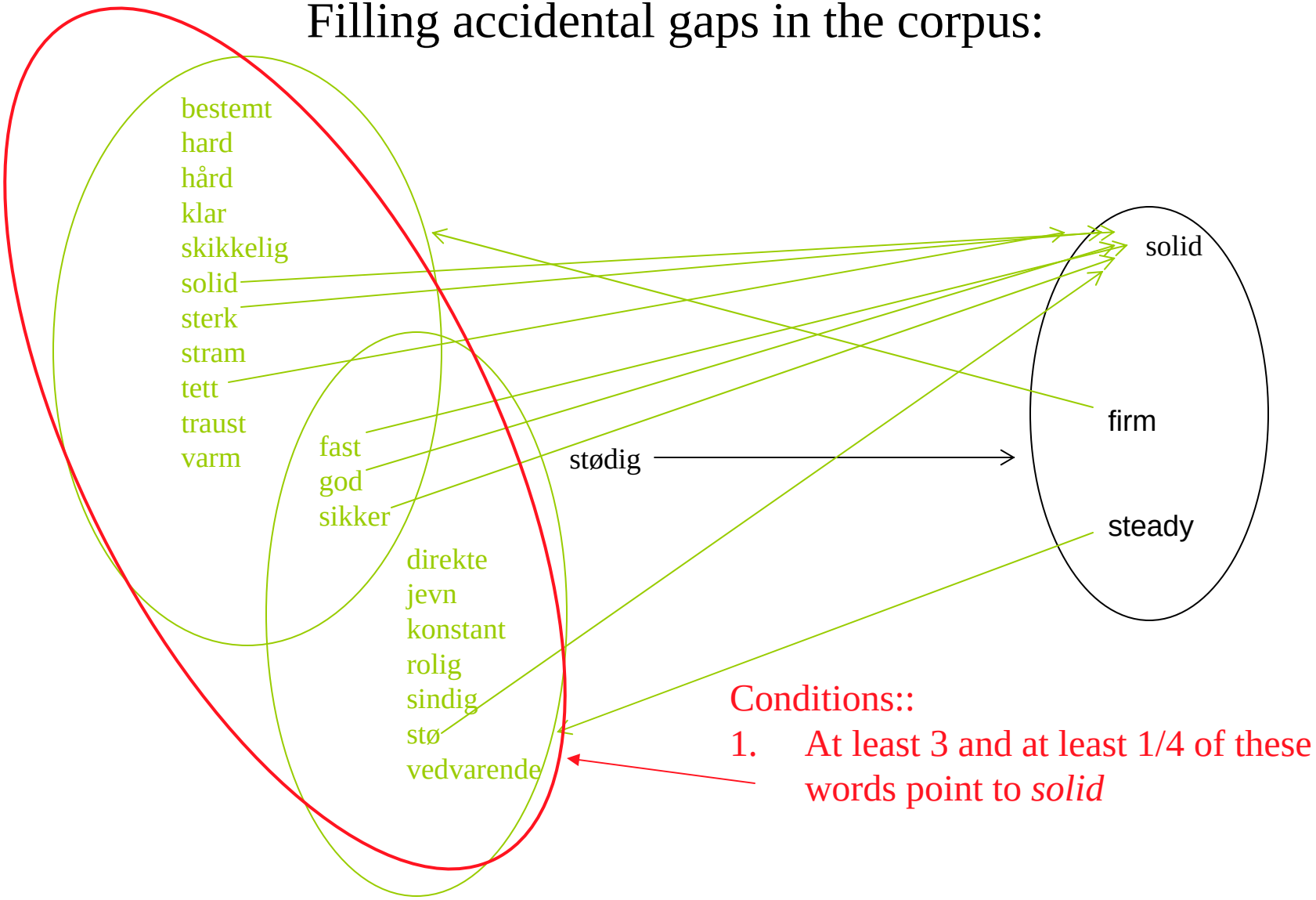

Conditions::

1. At least 3 and at least 1/4 of these words point to *solid*

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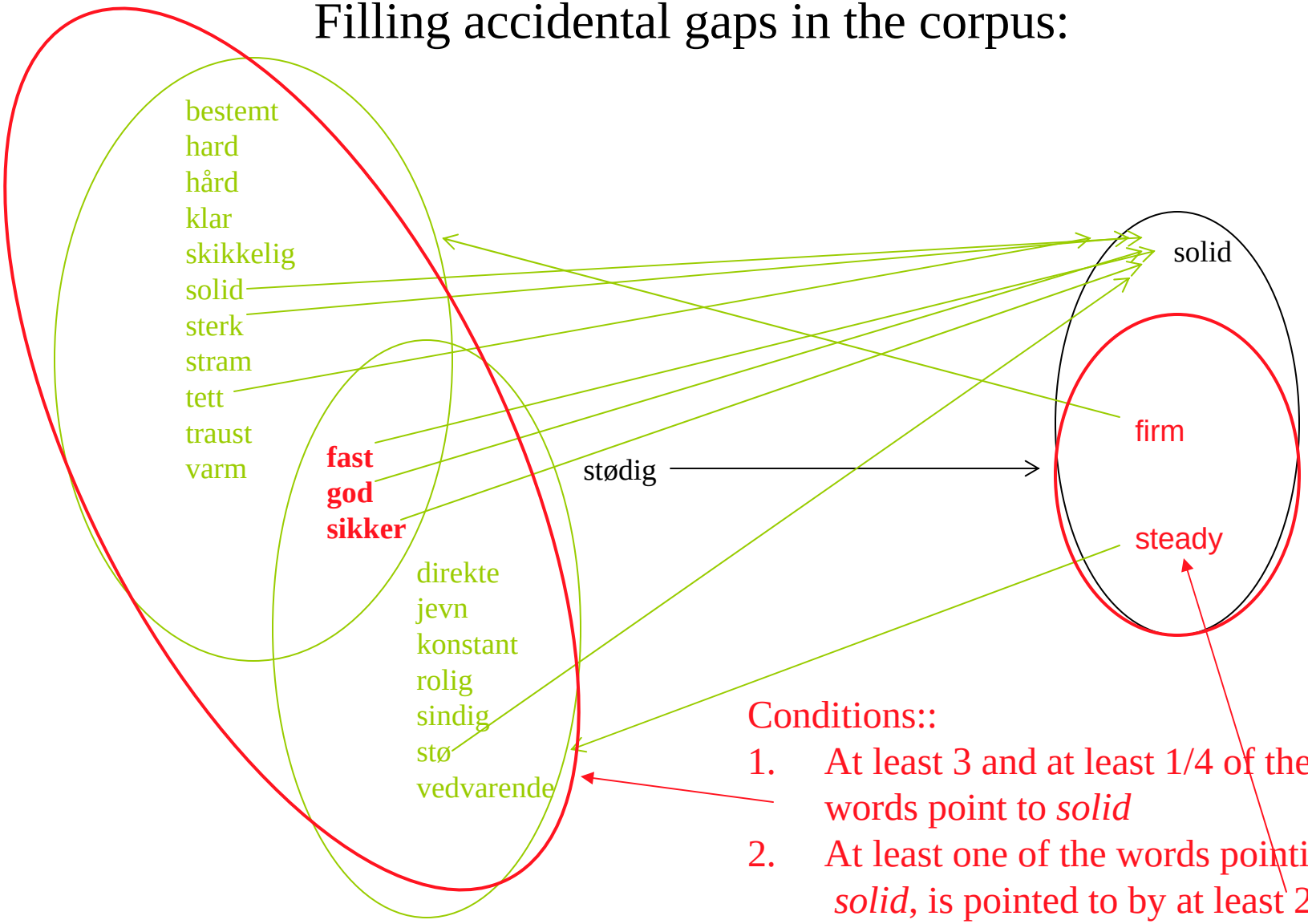
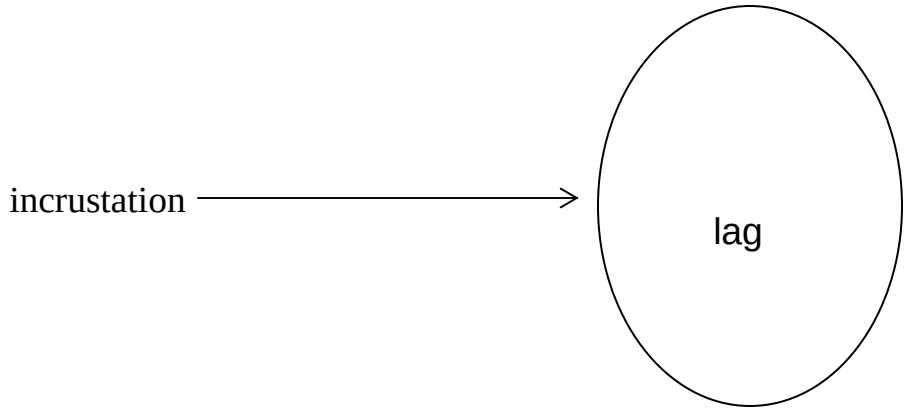


Conditions::

1. At least 3 and at least 1/4 of these words point to *solid*
2. At least one of the words pointing to *solid*, is pointed to by at least 2 words in the original *t*-image.

The reason why at least 2 words in the first *t*-image must take part in pointing out the new word:



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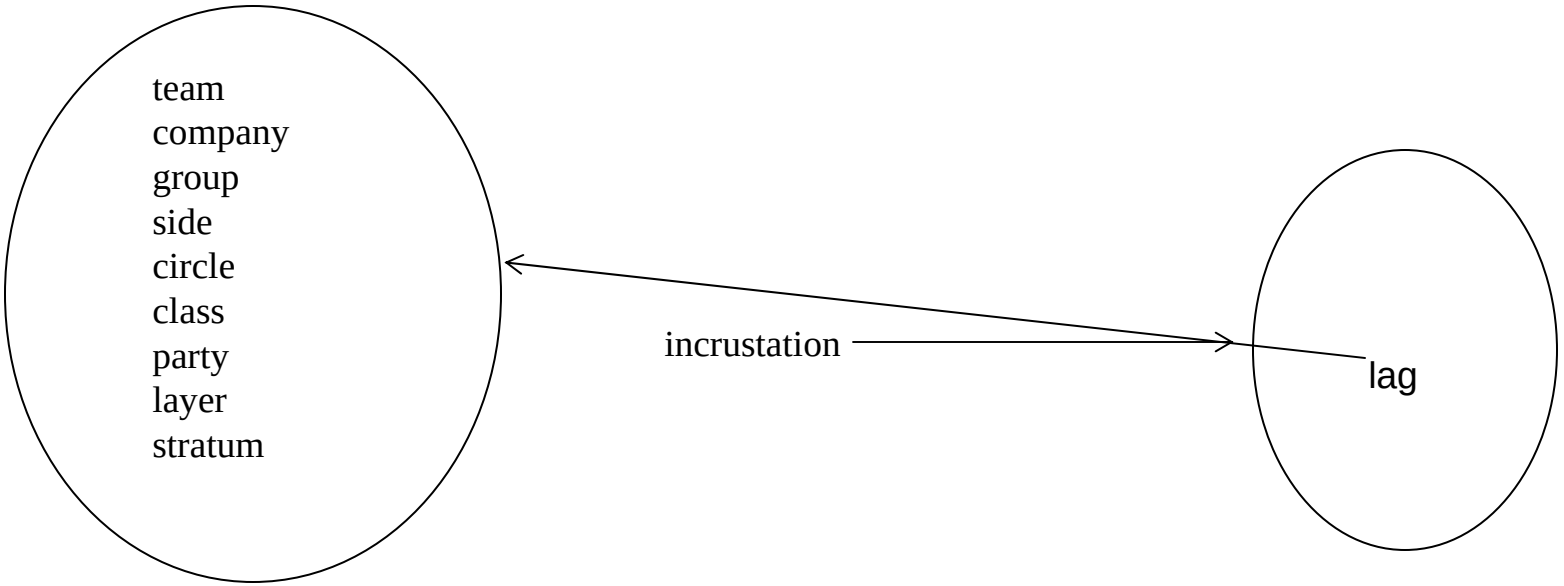

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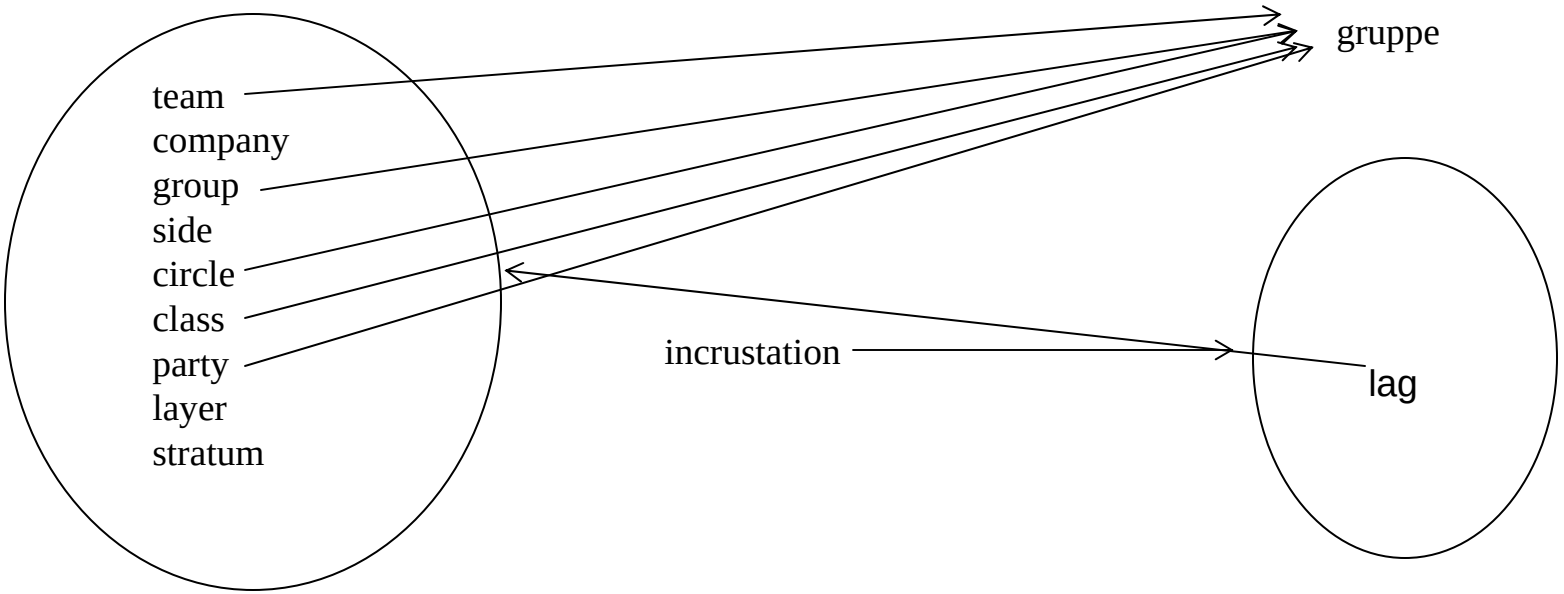

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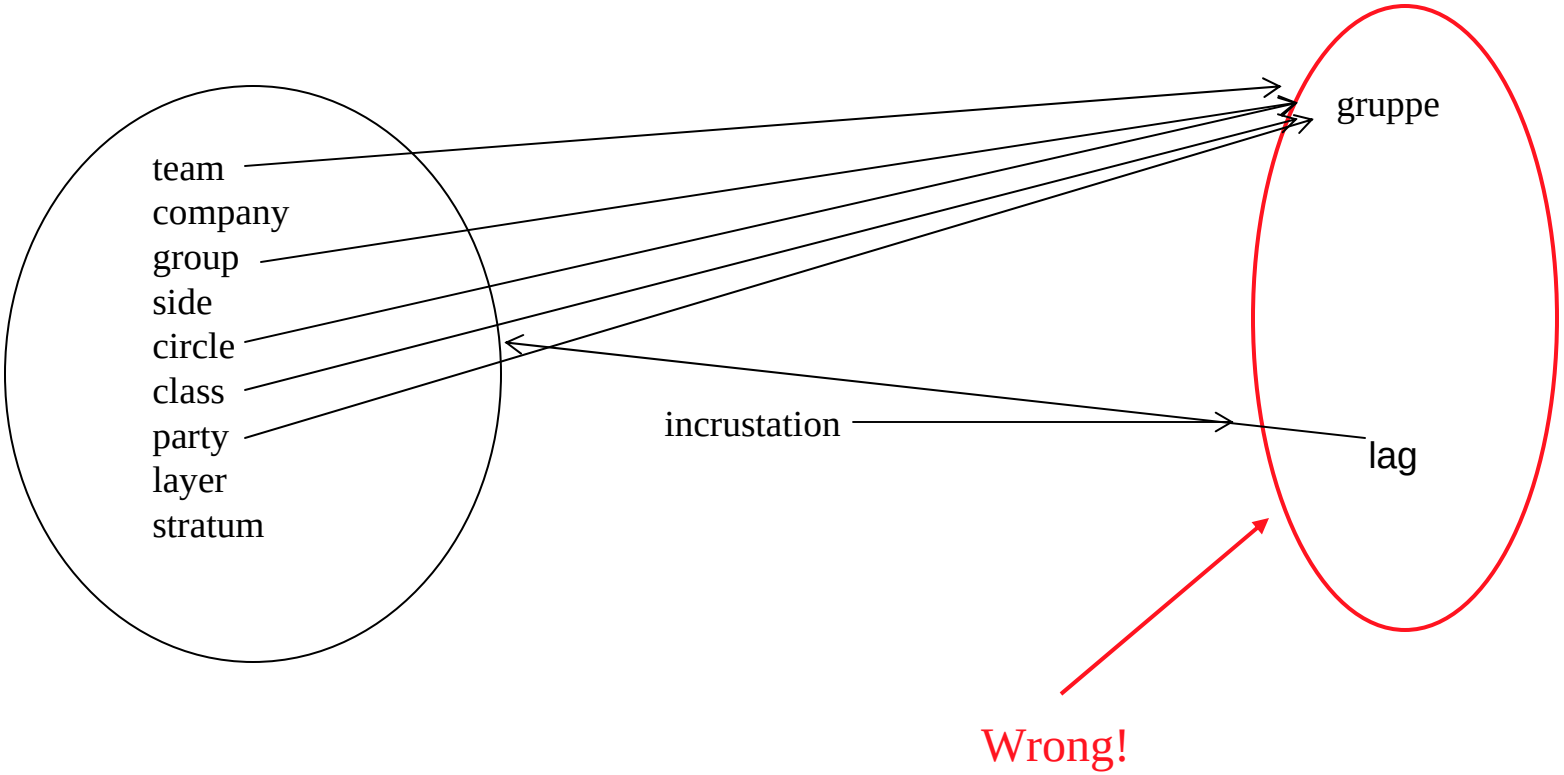

Some heuristically extended *t*-images:

fantastisk: {amazing, brilliant, enormous, extraordinary, fantastic, glorious, great, magnificent, marvellous, remarkable, spectacular, splendid, wonderful} **Added:** {exceptional, startling, surprising, unusual}

firma: {business, company, establishment, firmN, place} **Added:** {factory}

full: {absolute, alive, bright, busy, complete, covered, crammed, crowded, drunk, full, full-time, great, grown, heavy, high, immediate, laden, loaded, packed, perfect, rich, teeming, total} **Added:** {entire, unified, whole}

lysende: {bright, brilliant, festive, glittering, glowing, illuminated, intense, luminous, shining} **Added:** {shiny}

pen: {attractive, beautiful, clean, elegant, fine, formal, gentle, good, handsome, lovely, neat, nice, pleasant, pretty, soft, sweet, tidy} **Added:** {charming, cute, dishy, enchanting, fancy, first-class, graceful, picturesque, polite}

selskap: {business, circle, class, companionship, company, firmN, gathering, party, society} **Added:** {cell, community, crowd, group, team}

skikkelig: {adequate, bad, competent, decent, effective, fair, firmA, genuine, good, nice, proper, real, regular, respectable, satisfactory, smart, sure, true} **Added:** {accurate, honest, legitimate, sincere}

Extended *t*-images (cont.):

stødig: {firm, steady} **Added:** {solid, strong}

strålende: {beautiful, bright, brilliant, excellent, fine, gleaming, glistening, glorious, glowing, great, magnificent, radiant, sparkling, splendid, sumptuous, warm} **Added:** {fantastic, glittering, shining, shiny}

vedvarende: {abiding, constant, continuous, persistent, steady, unresolved} **Added:** {perpetual}

vennlig: {amiable, benign, bland, cheerful, friendly, gentle, kind, kindly, nice, pleasant, pleasing, sympathetic} **Added:** {good-humoured, good-natured, polite, smiling}

viktig: {all-important, basic, big, central, considerable, critical, crucial, essential, great, helpful, high, important, key, large, lively, major, massive, momentous, notable, pompous, significant, urgent, vital, worthy} **Added:** {decisive, outstanding, primary, supreme}

virkelig: {actual, biological, confident, even, genuine, habitual, physical, proper, real, regular, right, serious, true} **Added:** {accurate, authentic, truthful}

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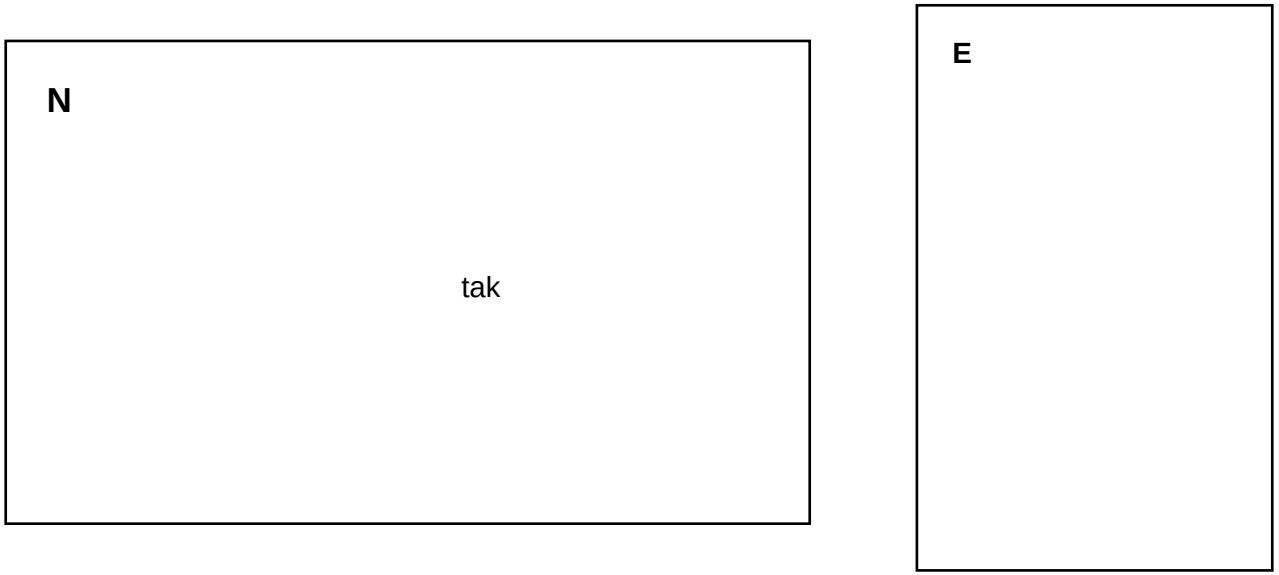
5. Words with unrelated meanings will not share translations into another language, except in cases where the shared word is contrastively ambiguous between the two unrelated meanings. By assumption 4 there should then be at most one such shared word.

First example: ’tak’



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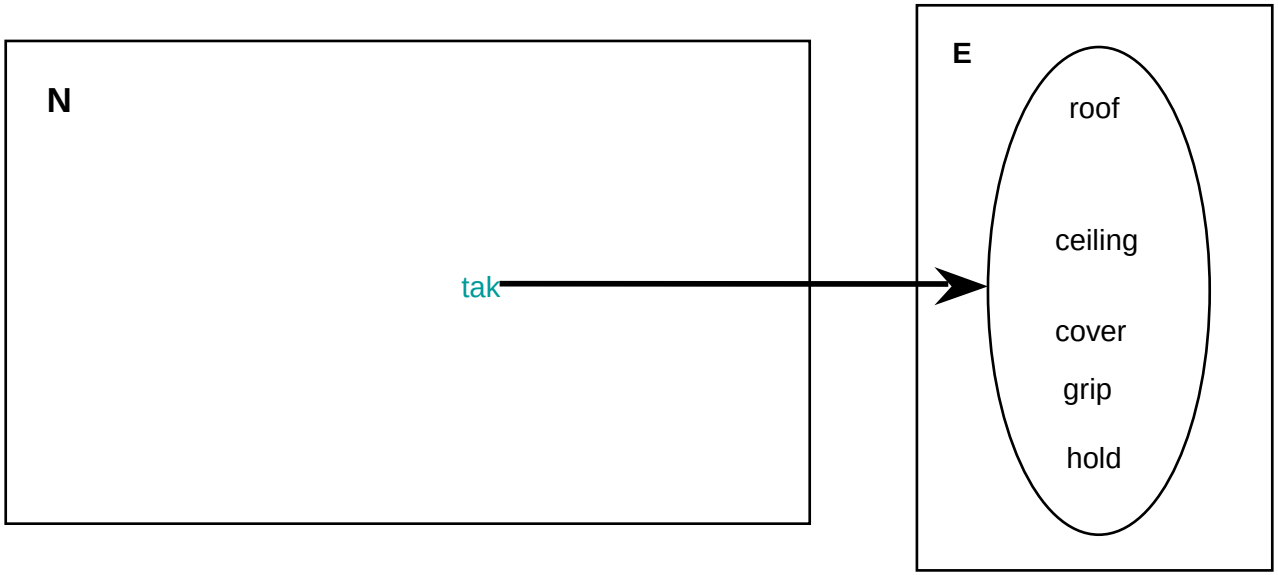
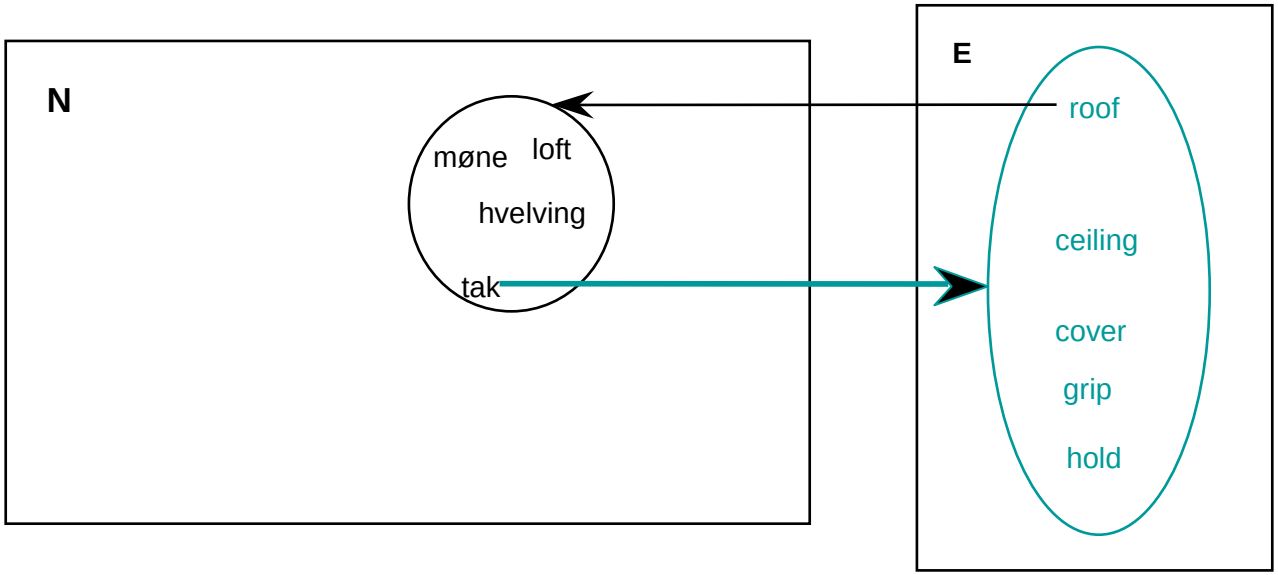


Inverse *t*-image



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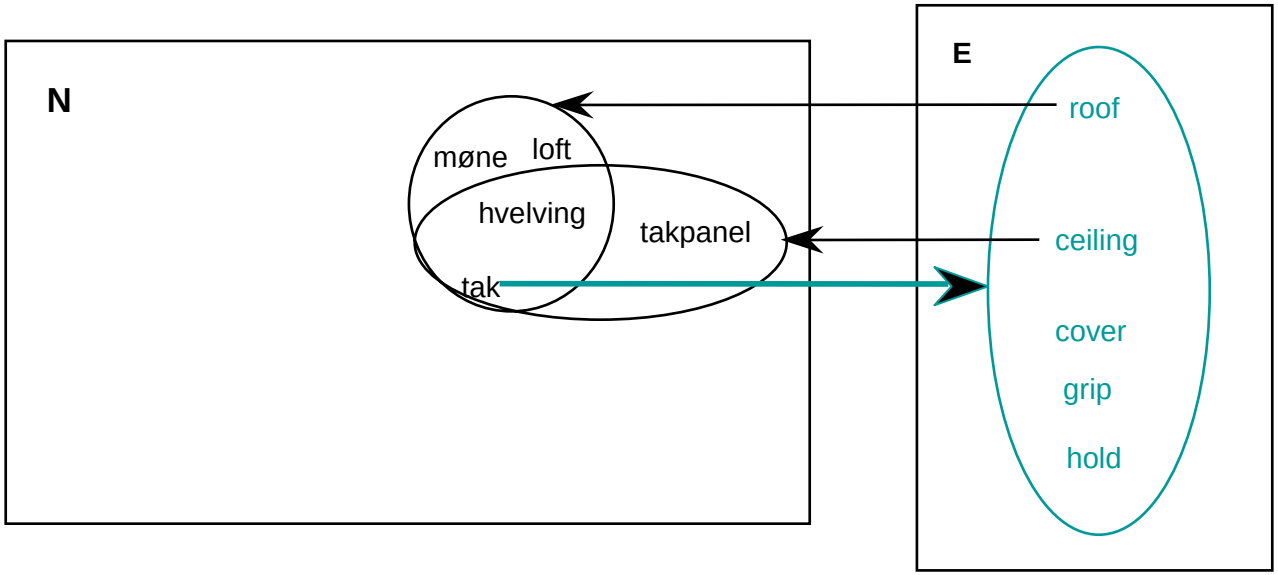

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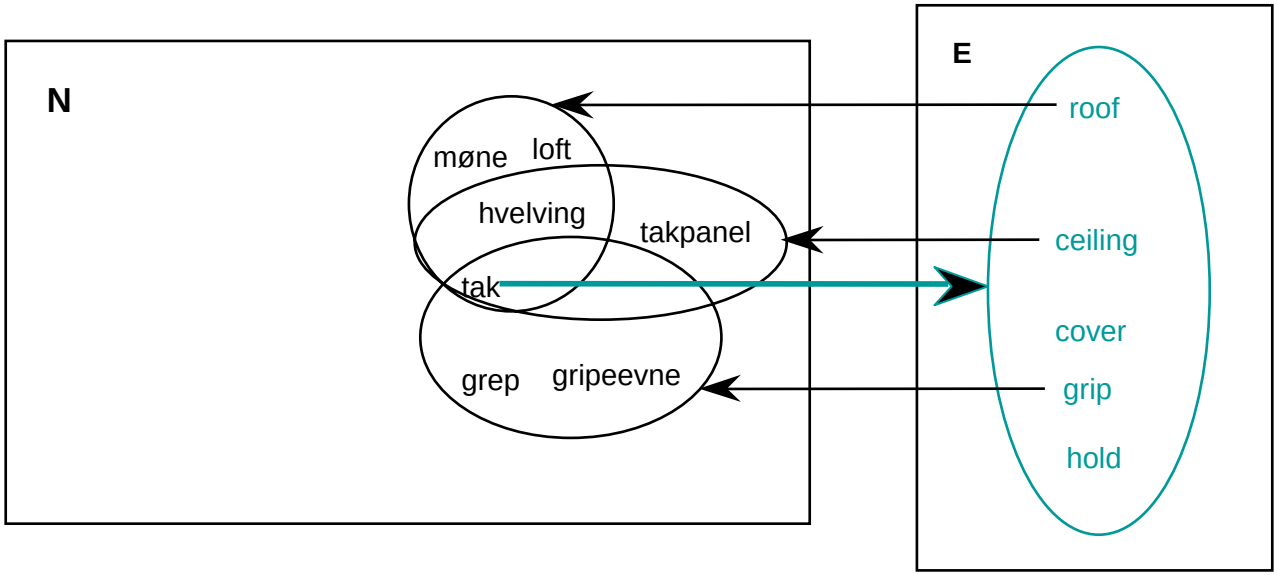

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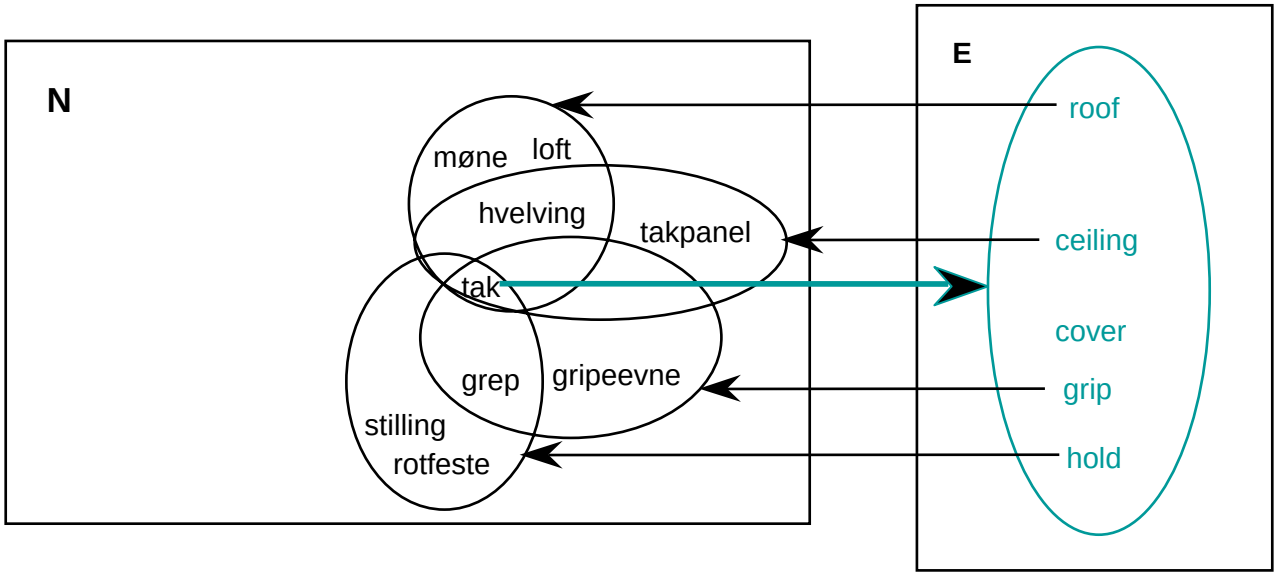

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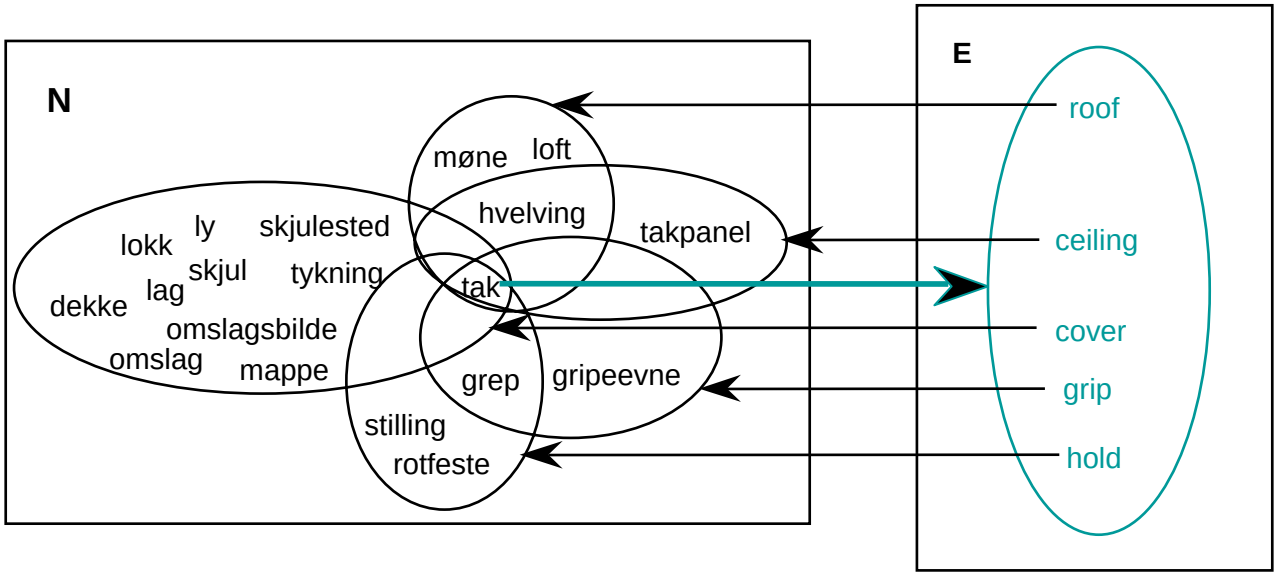
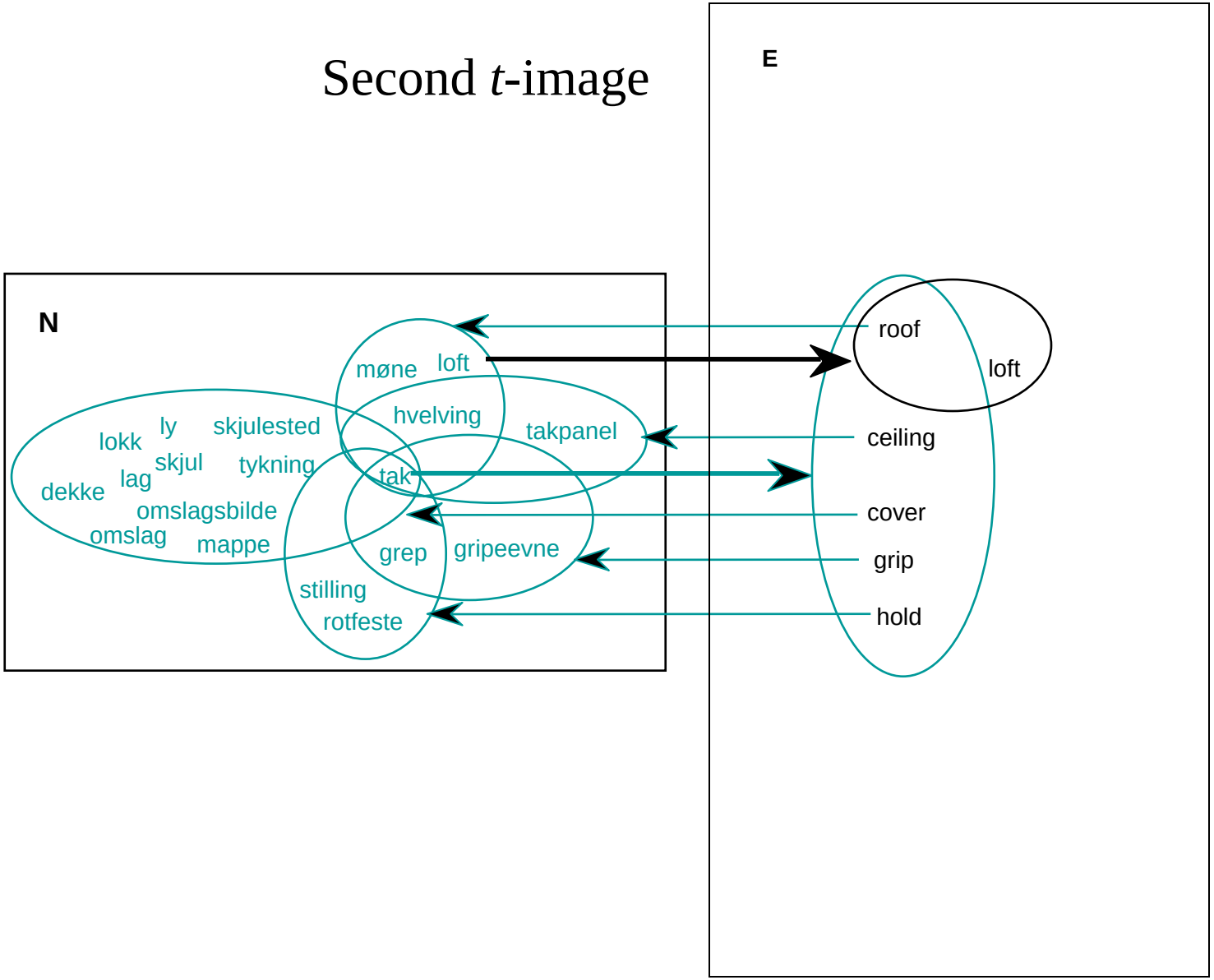


Second *t*-image



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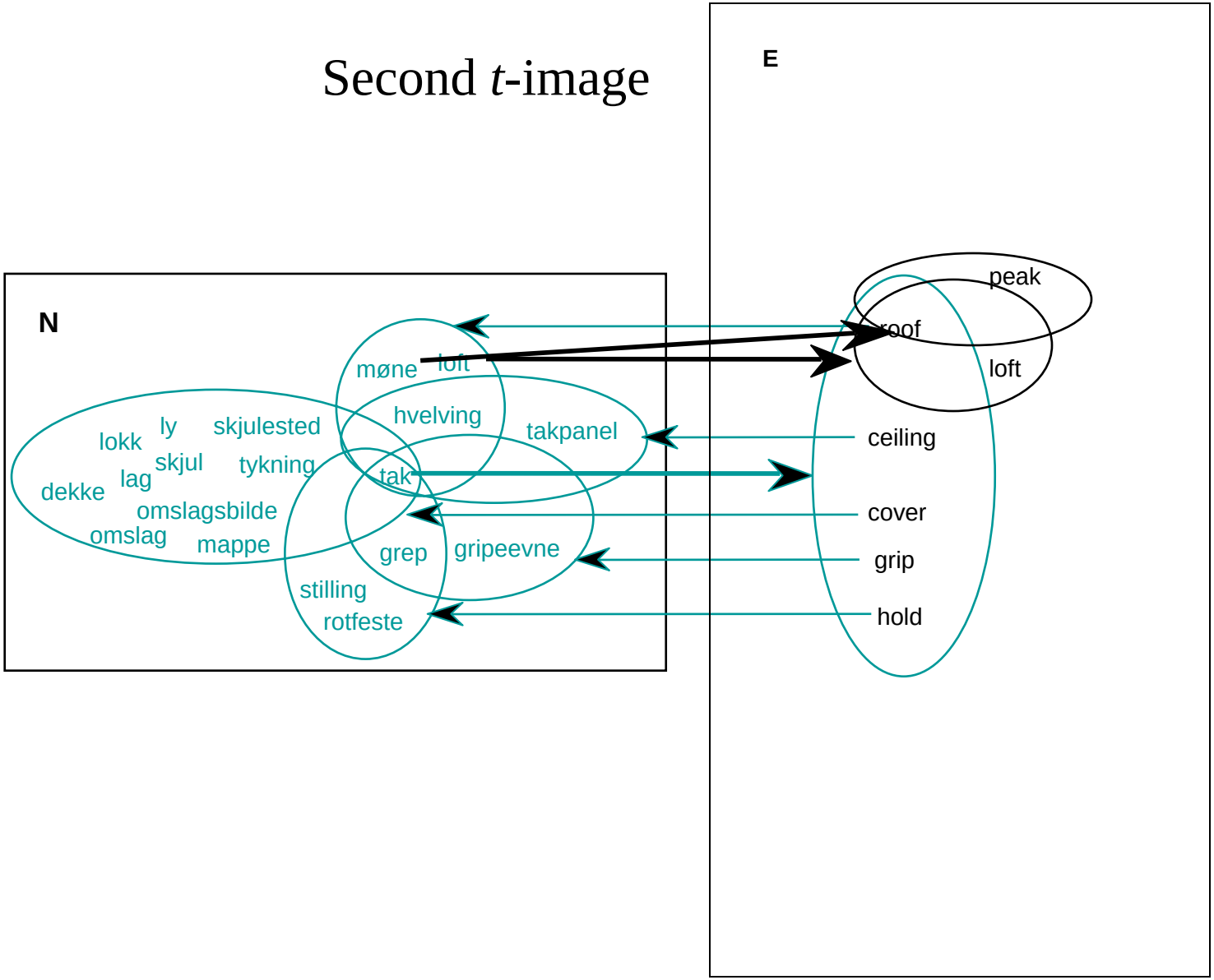

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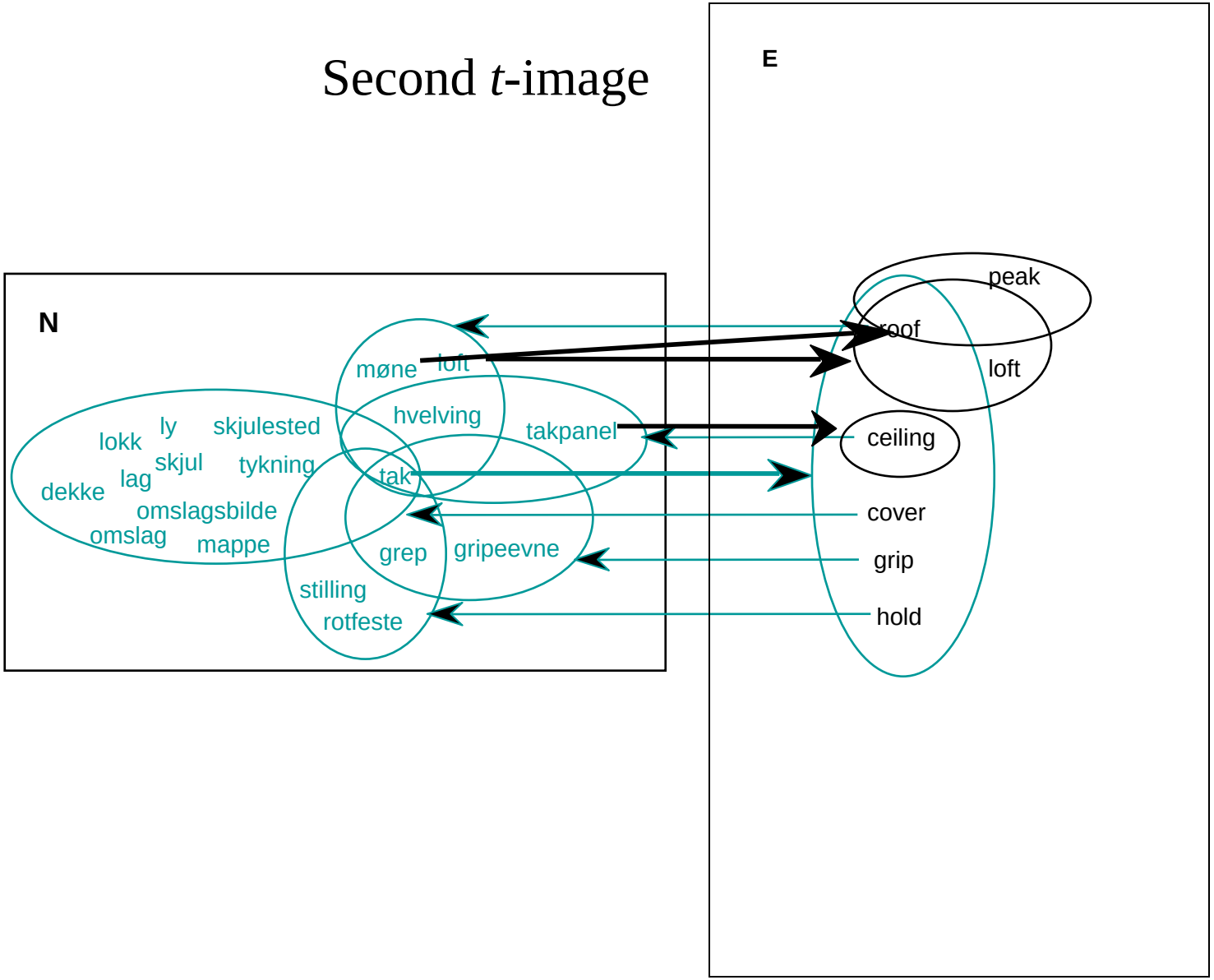

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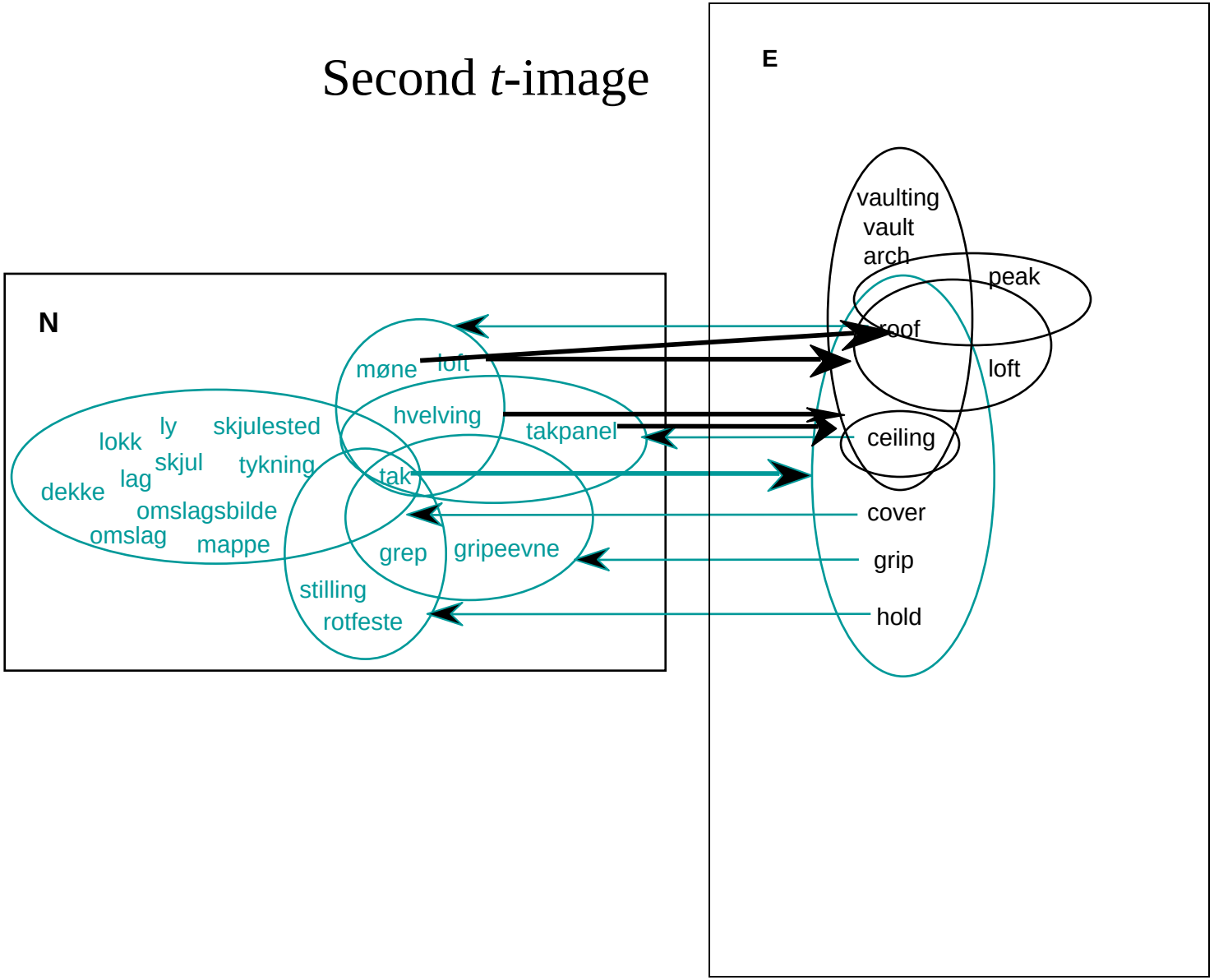

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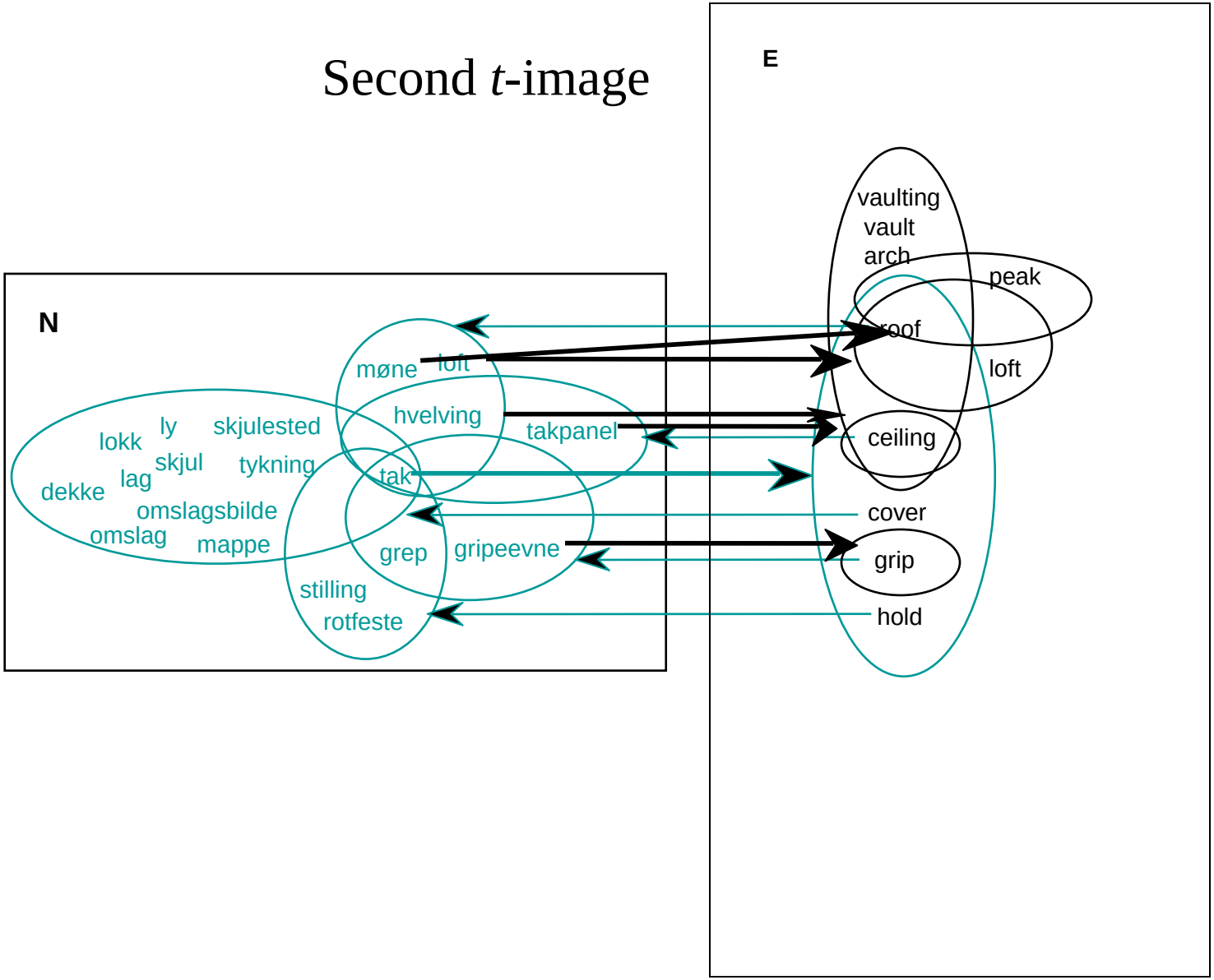

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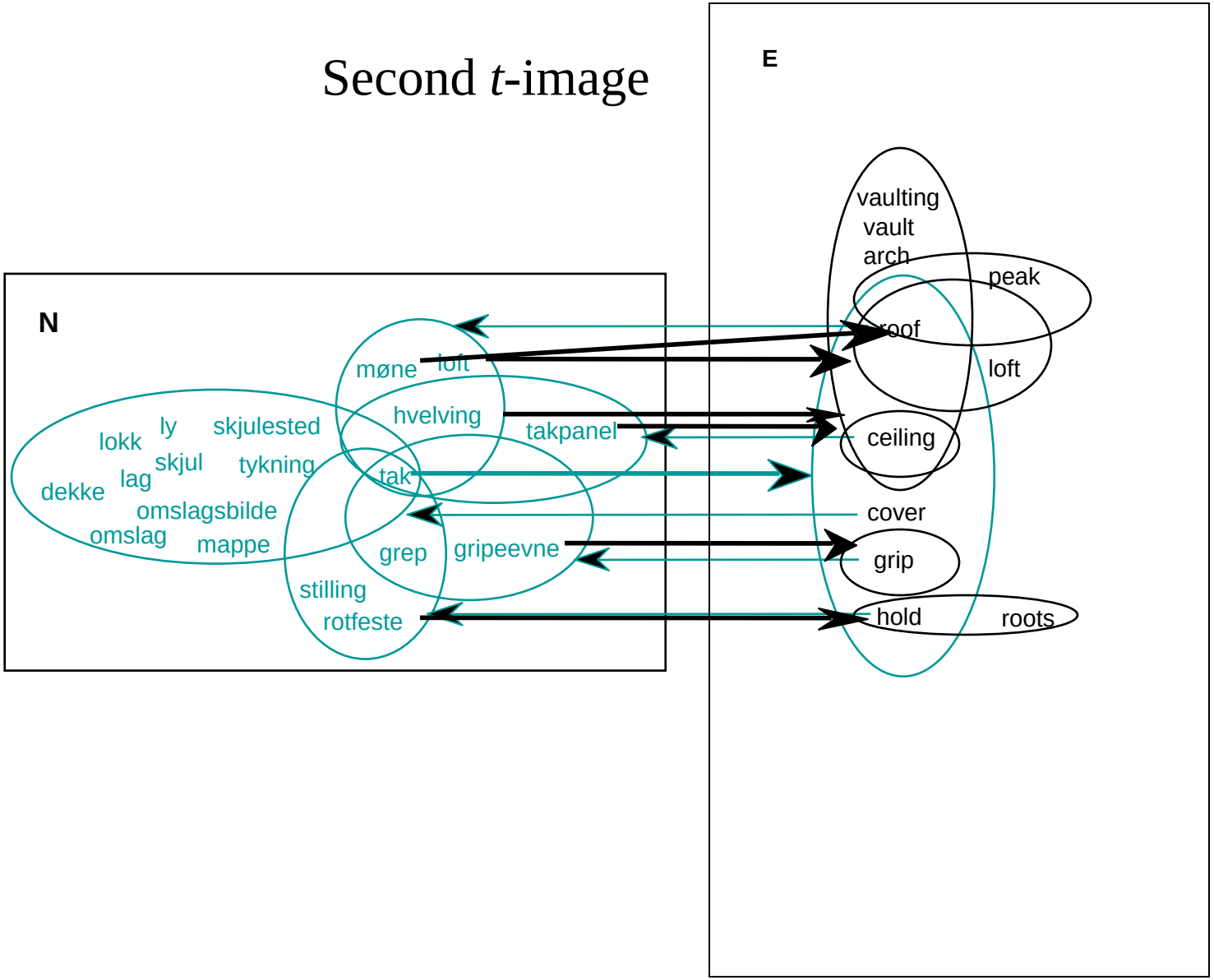

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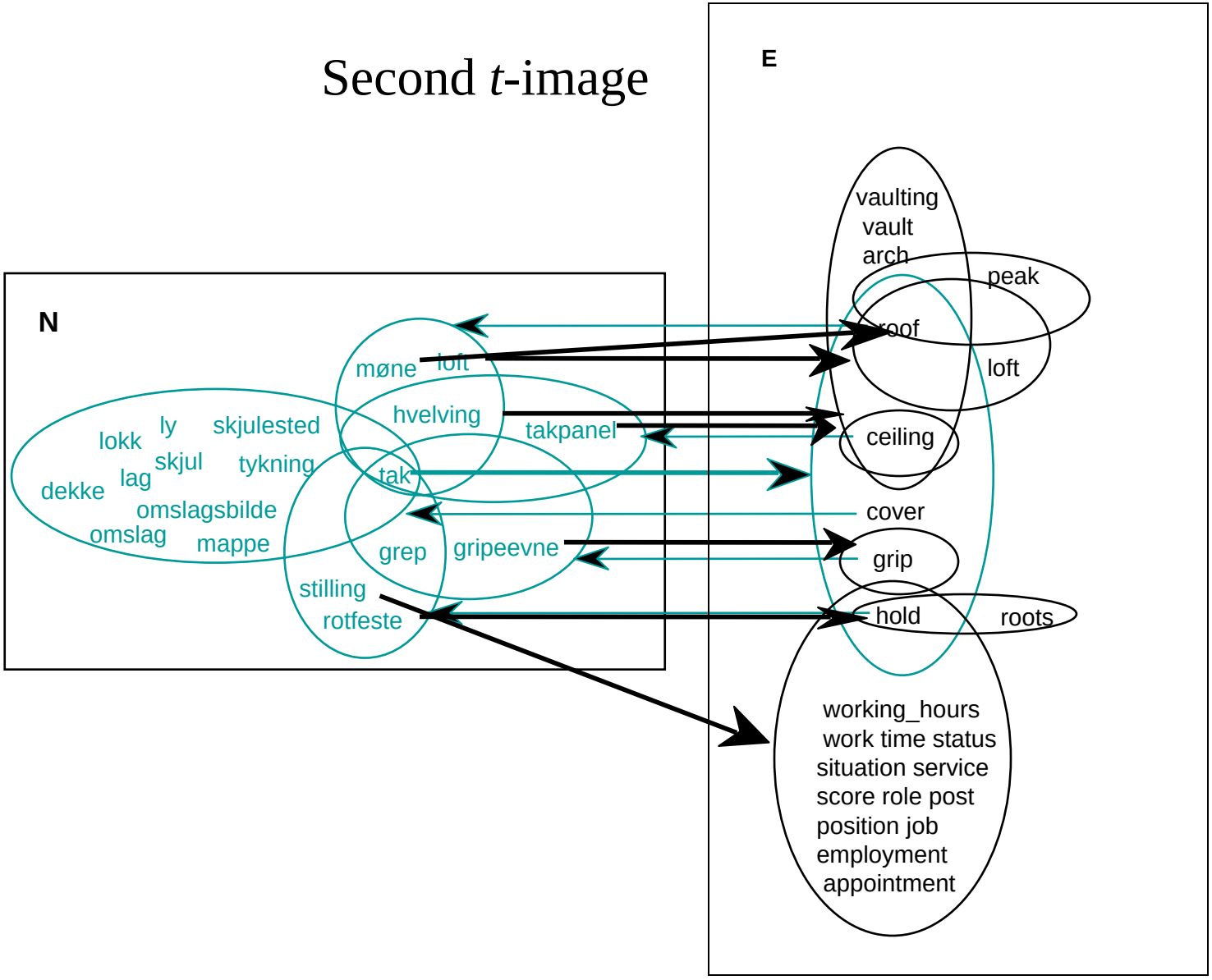

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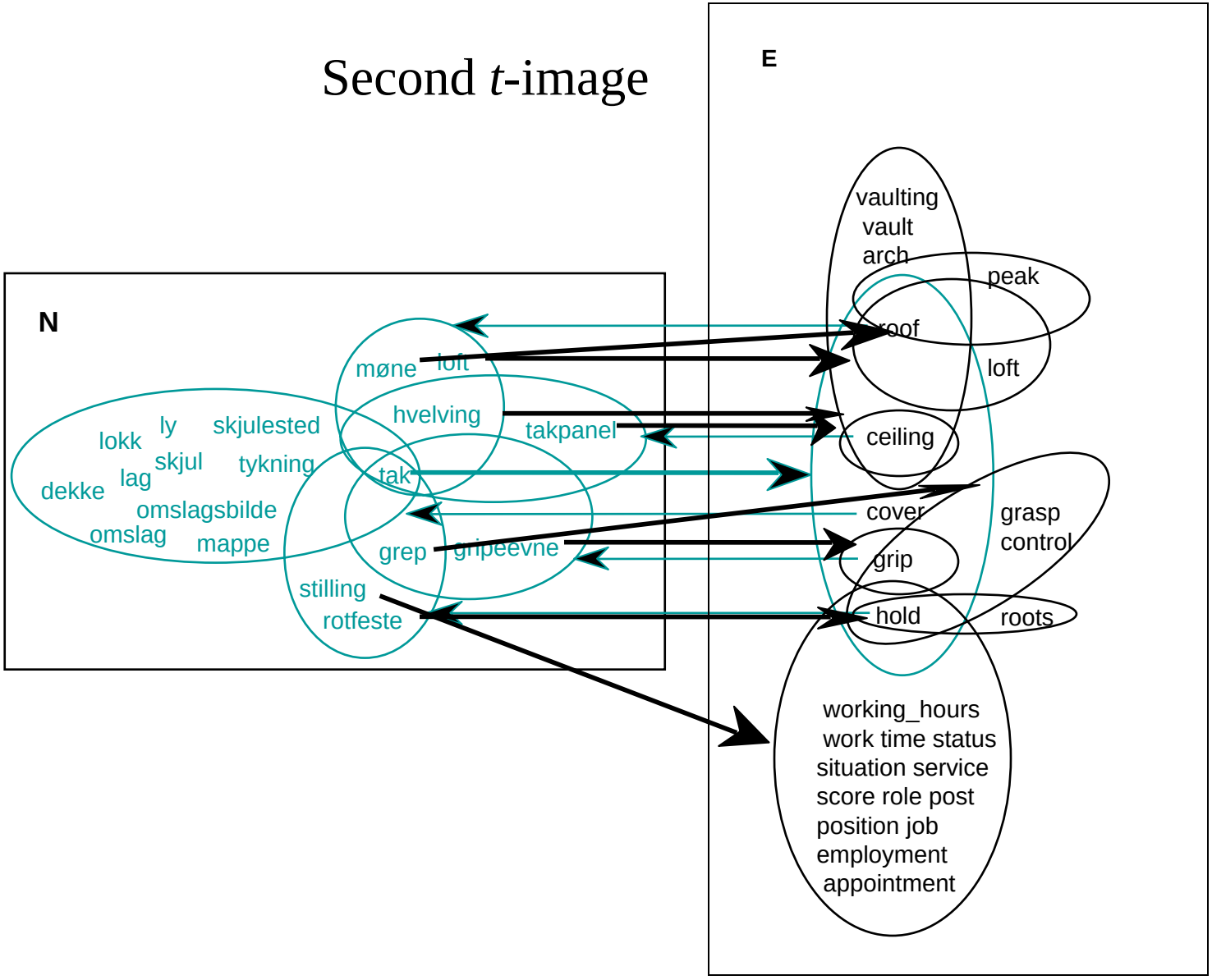

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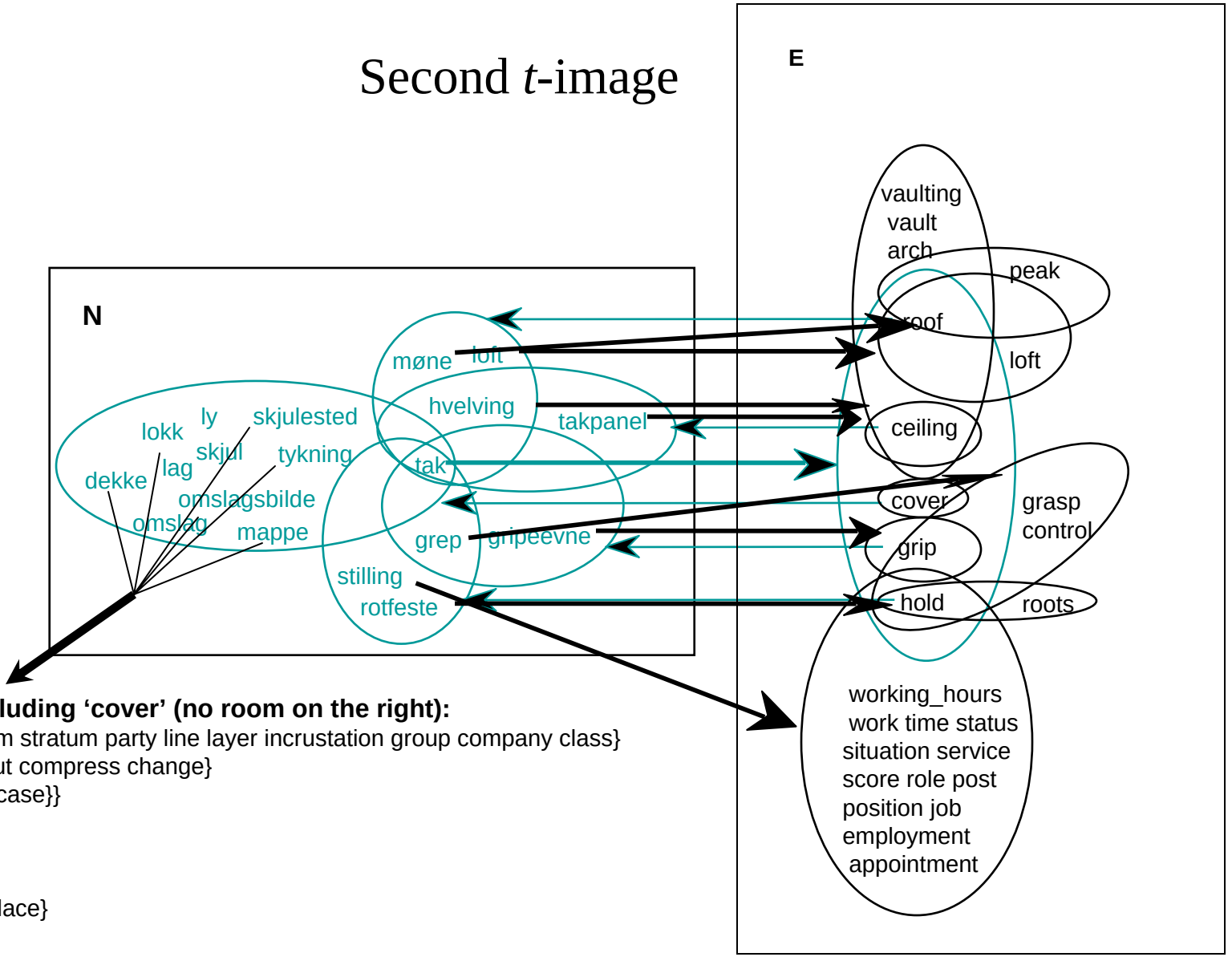
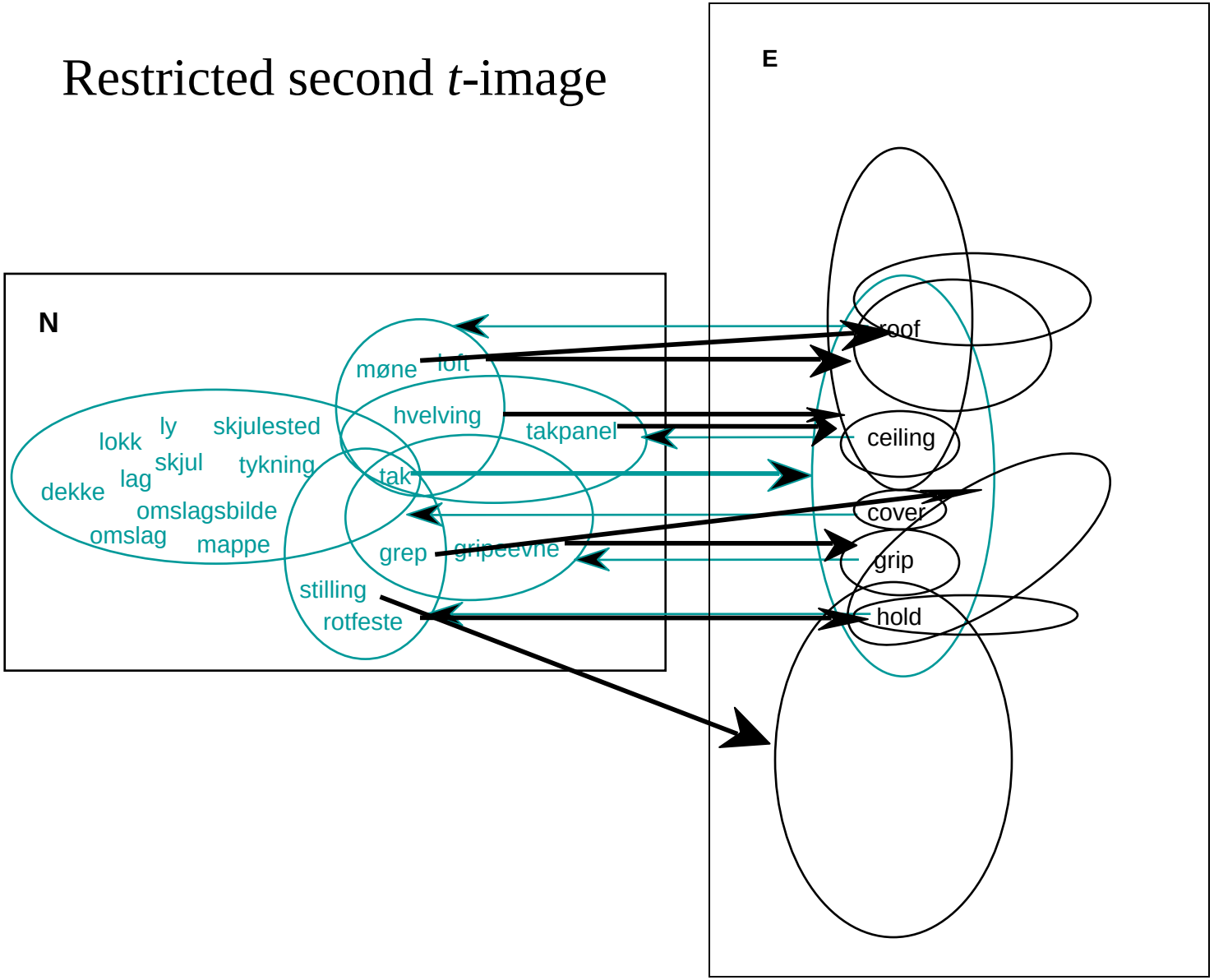


Plus sets including ‘cover’ (no room on the right):

{cover way team stratum party line layer incrustation group company class}
{cover turnabout compress change}
{cover file briefcase}}
{cover lid}
{cover shelter}
{cover shed}
{cover hiding-place}
{cover thicket}
{cover}}

Restricted second *t*-image



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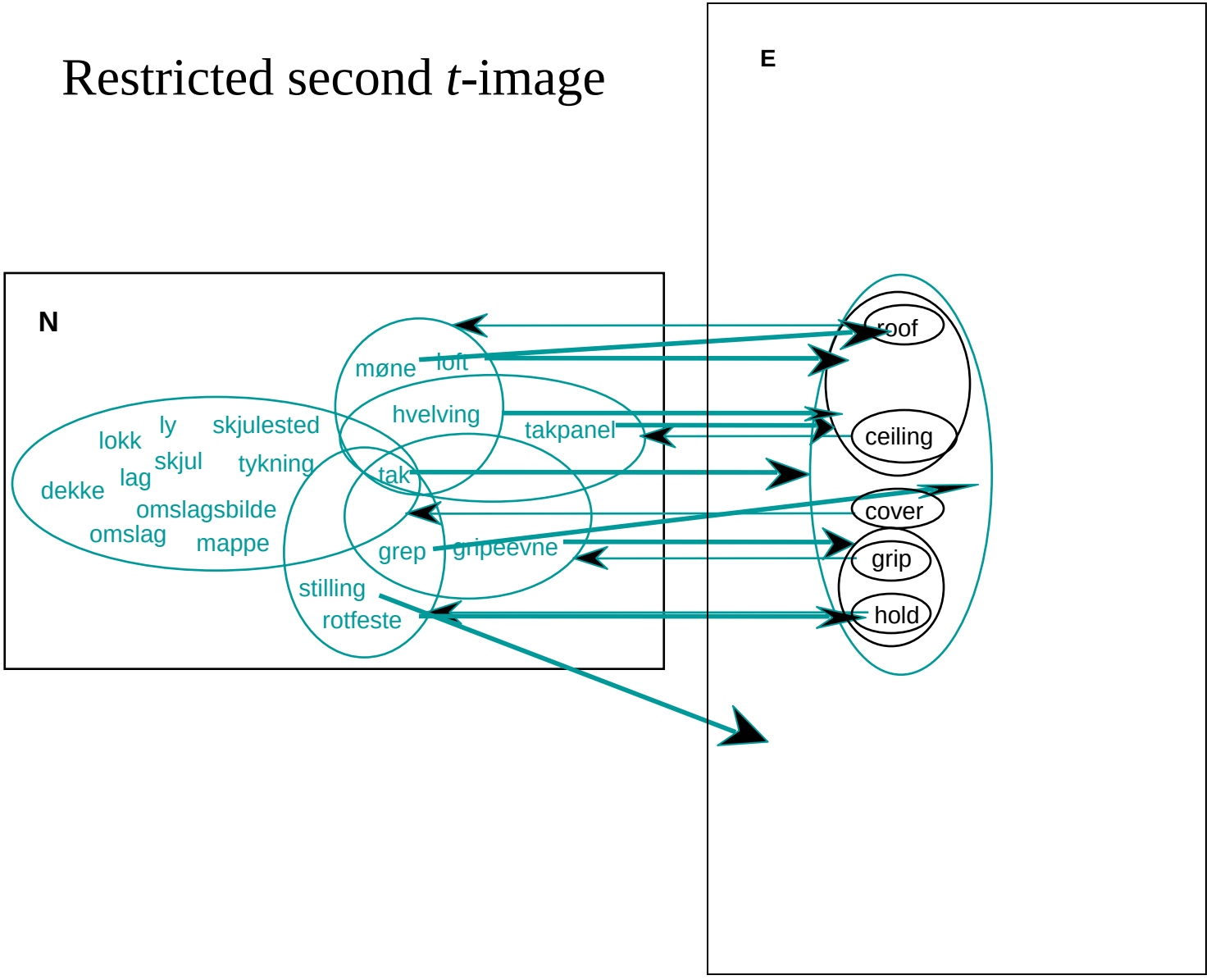
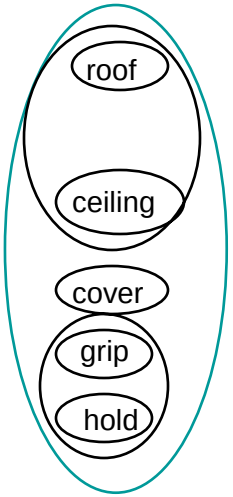
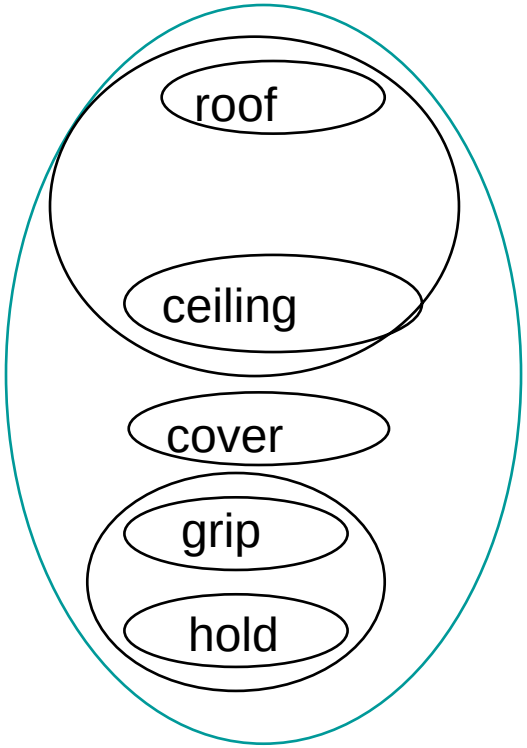


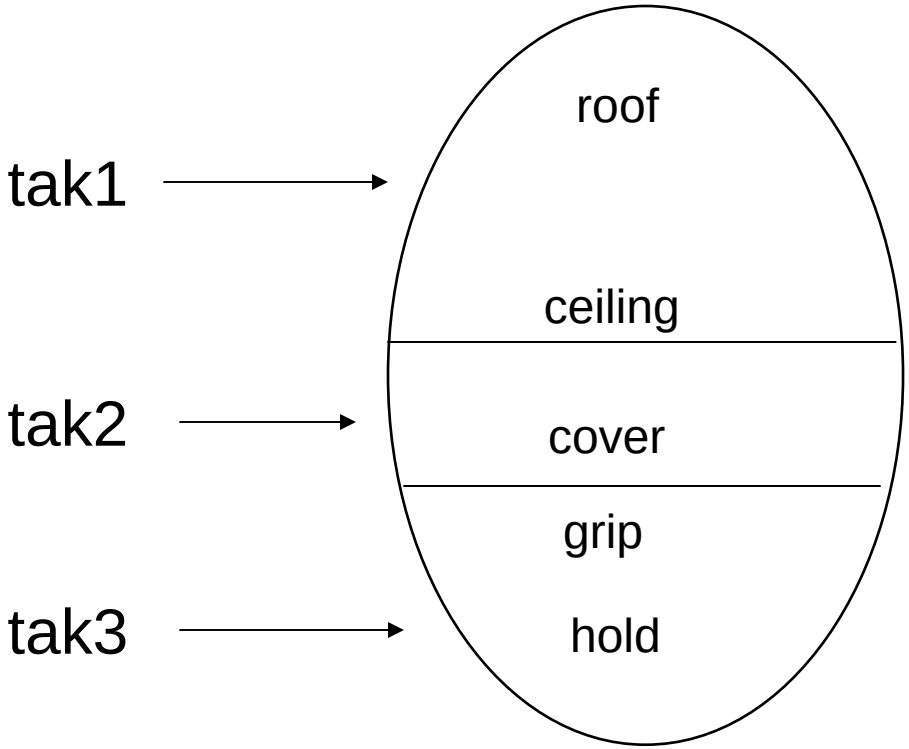
Three «sense groups» for ‘tak’
(groups of intersecting sets):



Three «sense groups» for ‘tak’
(groups of intersecting sets):



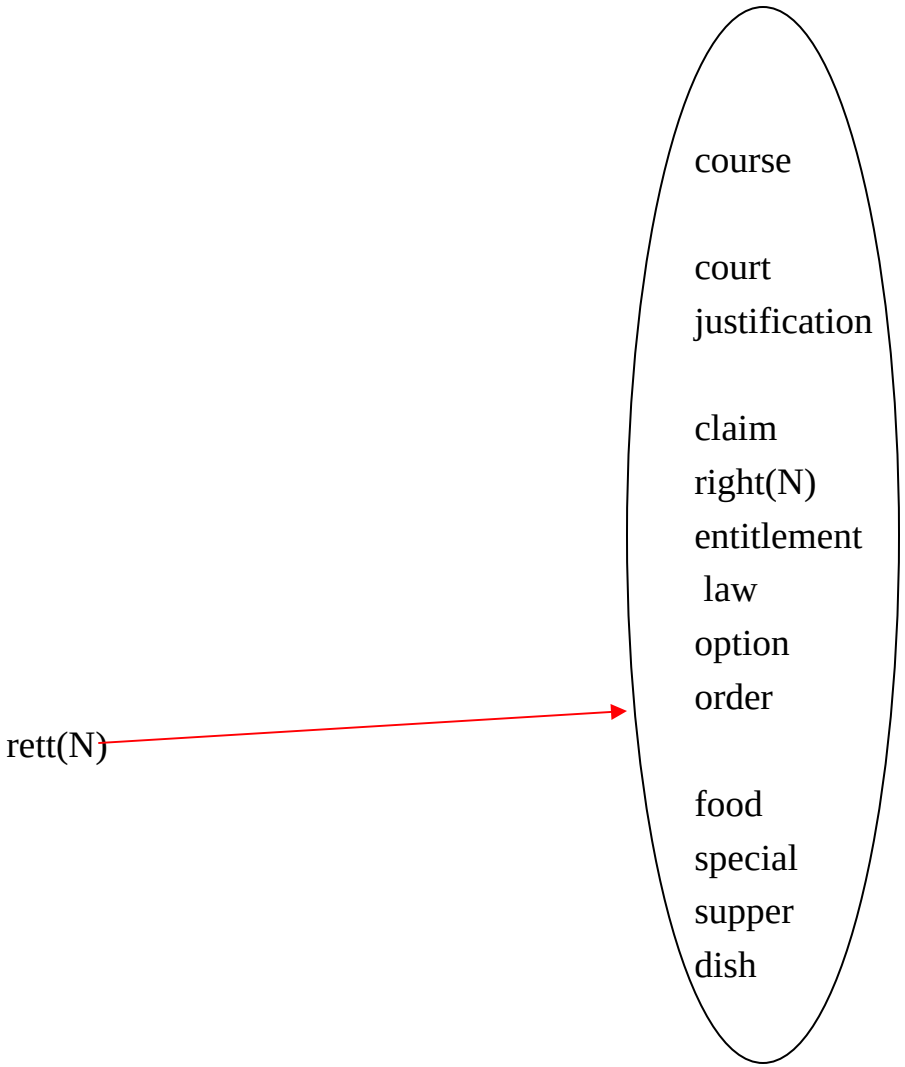
Three «sense partitions» of ‘tak’s first *t*-image:



Second example: ’rett’

(Thanks to Gunn Inger Lyse)

rett(N)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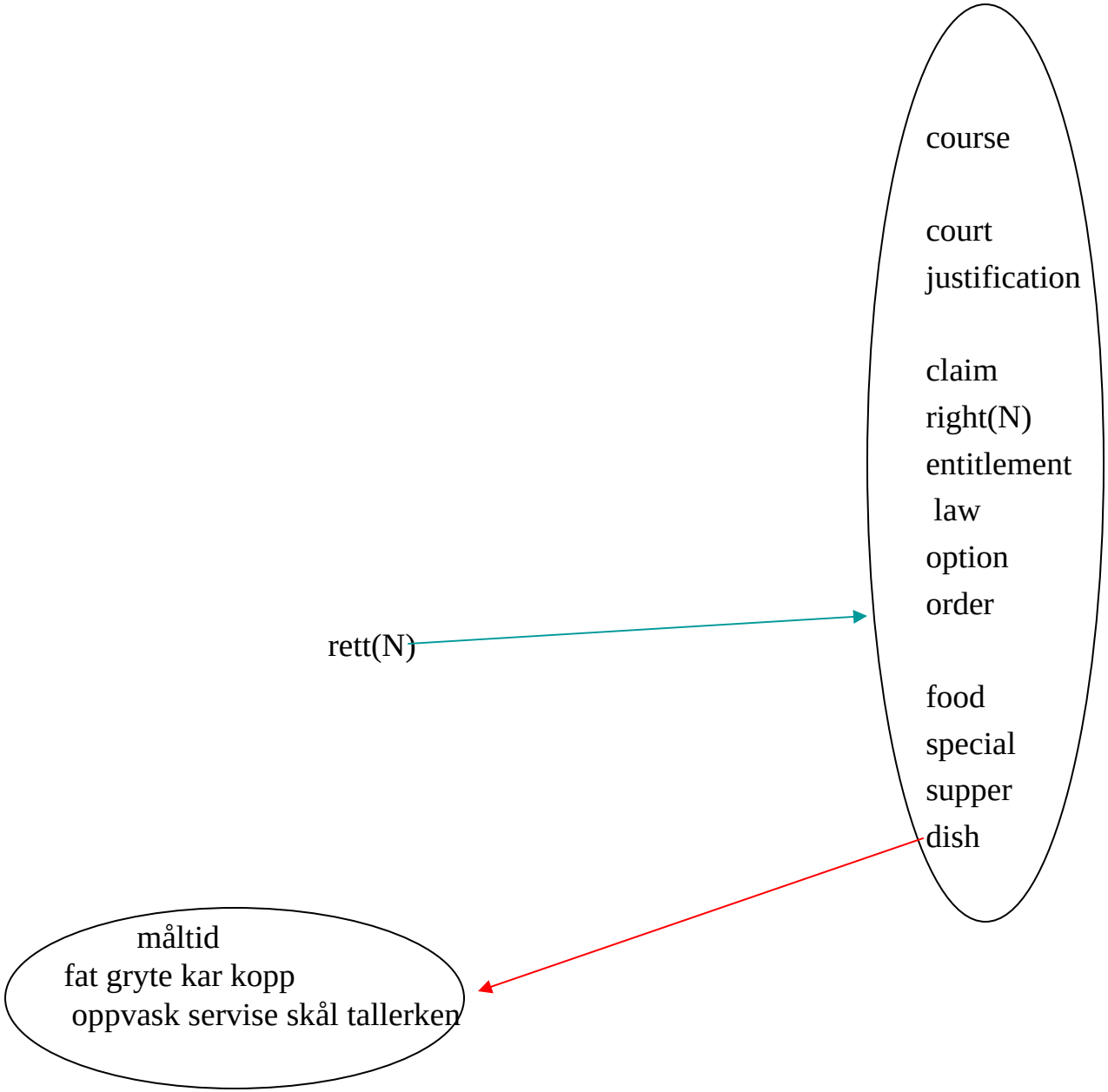
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fat gryte kar kopp
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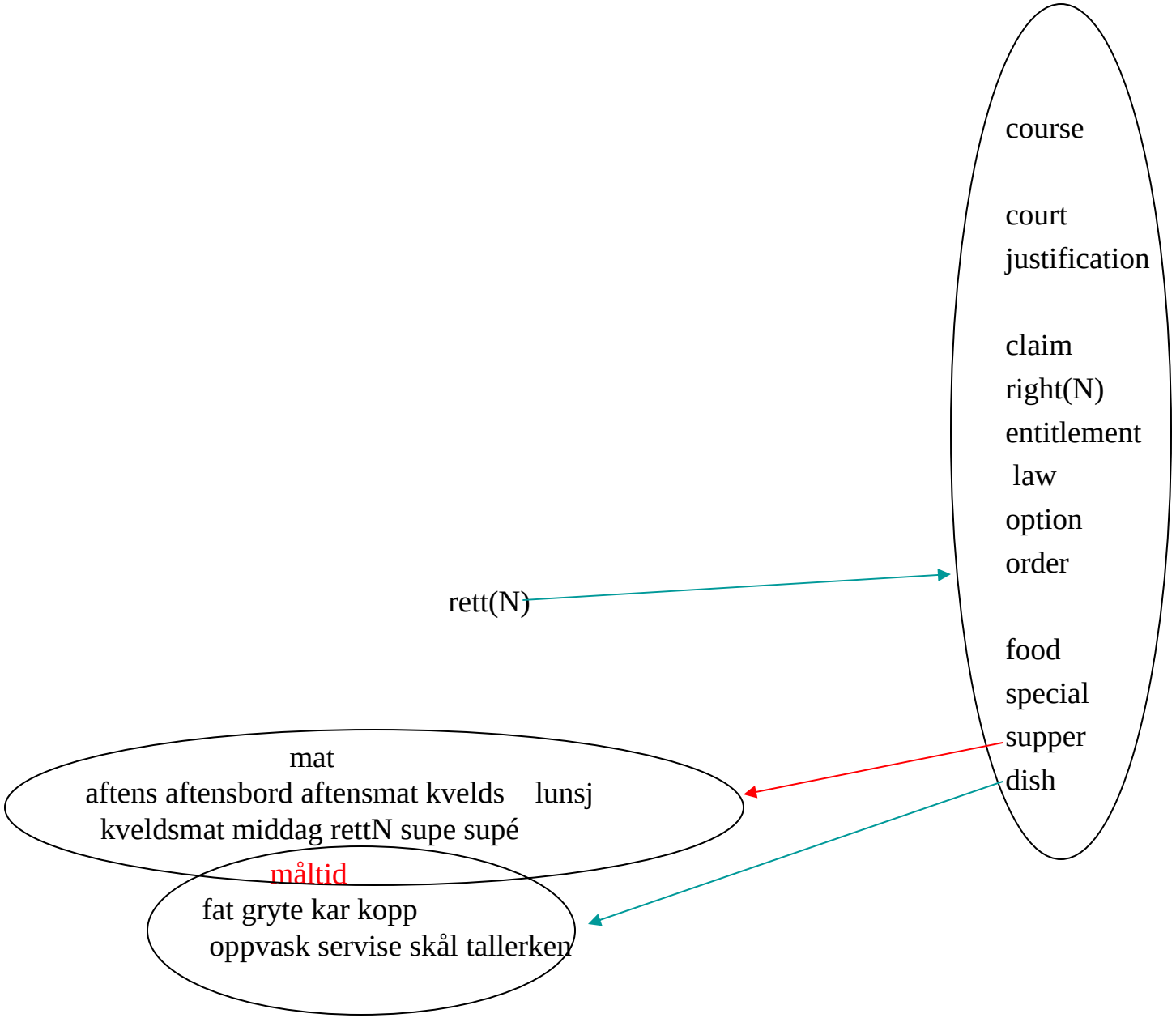
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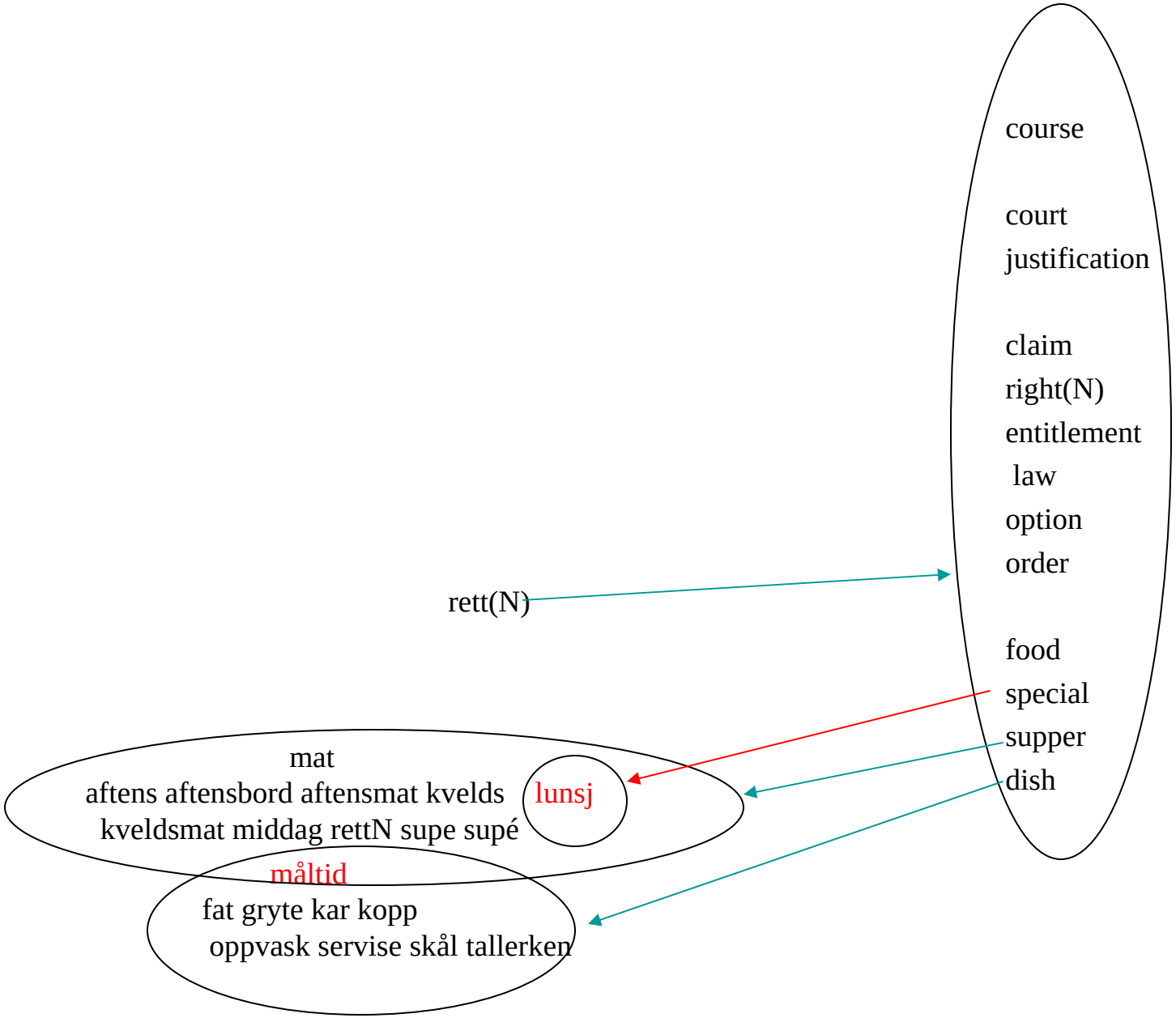
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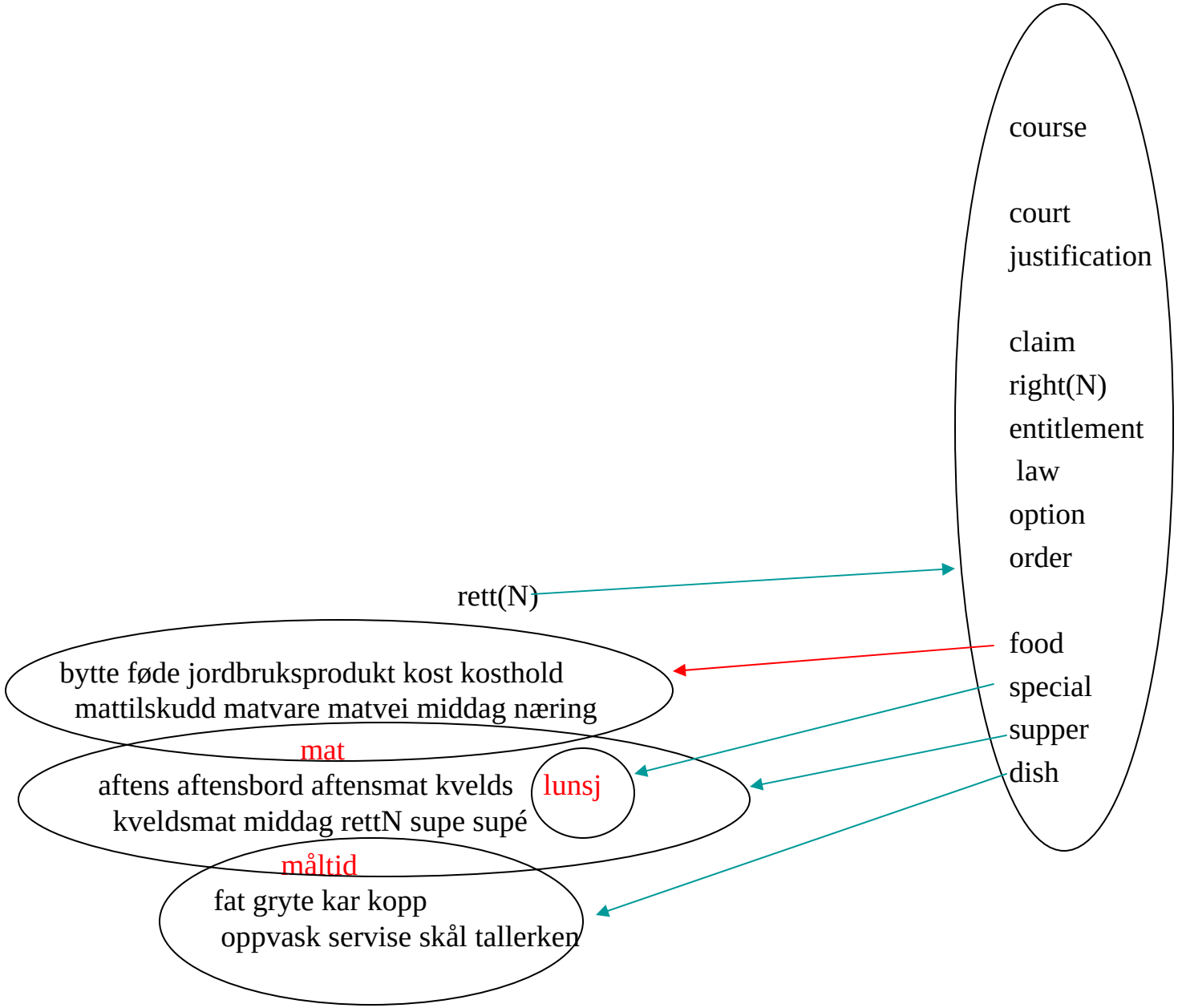
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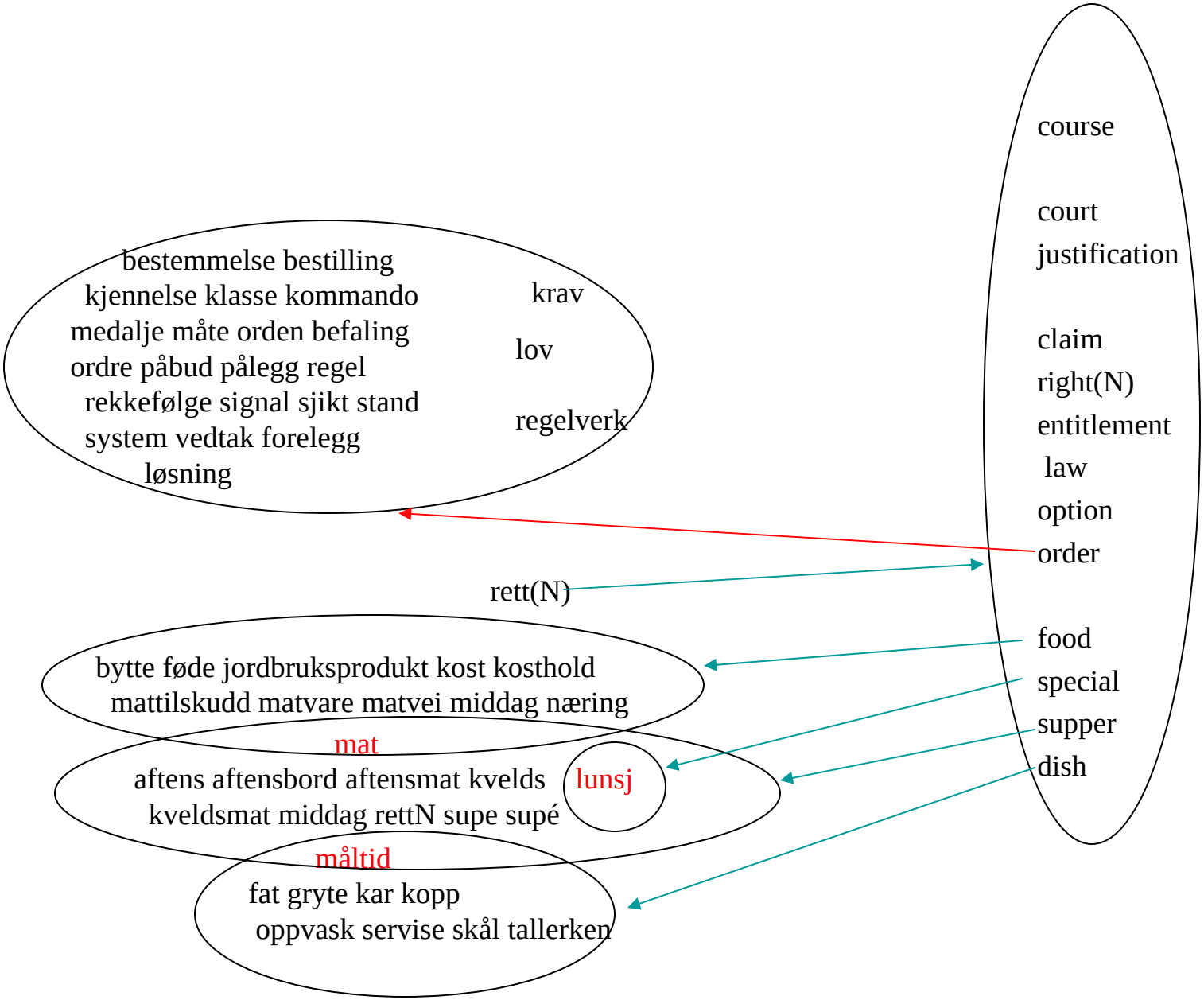
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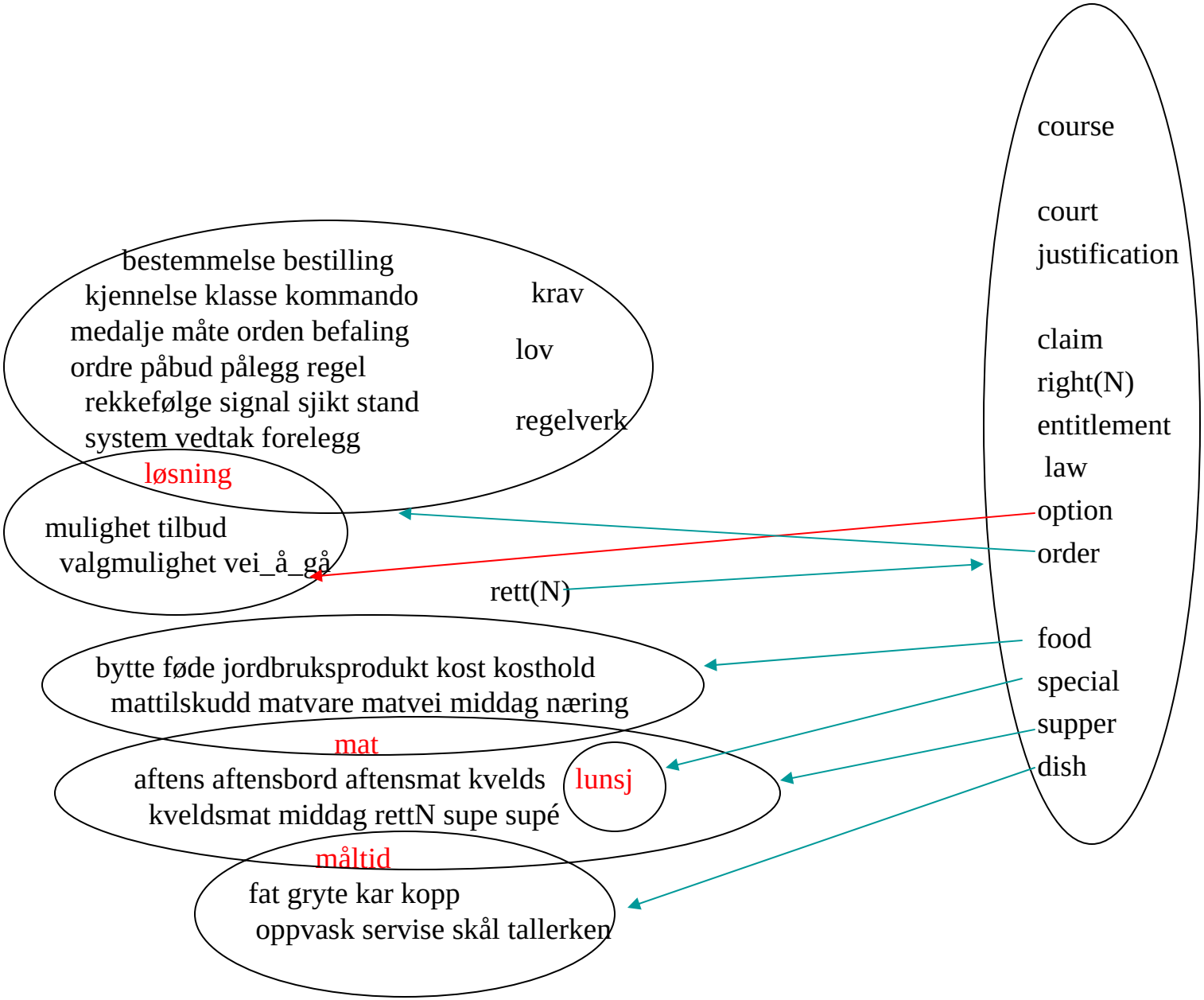
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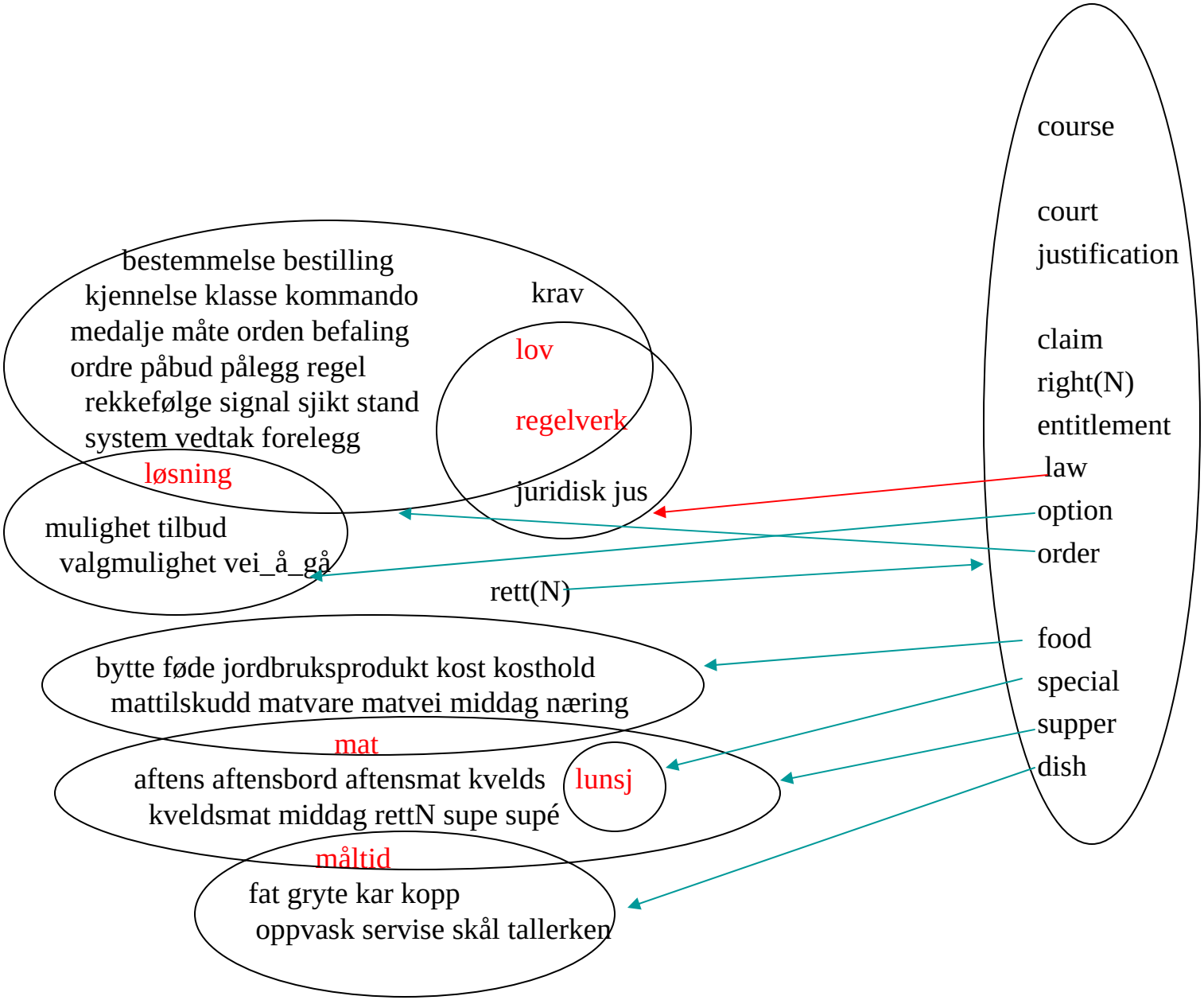
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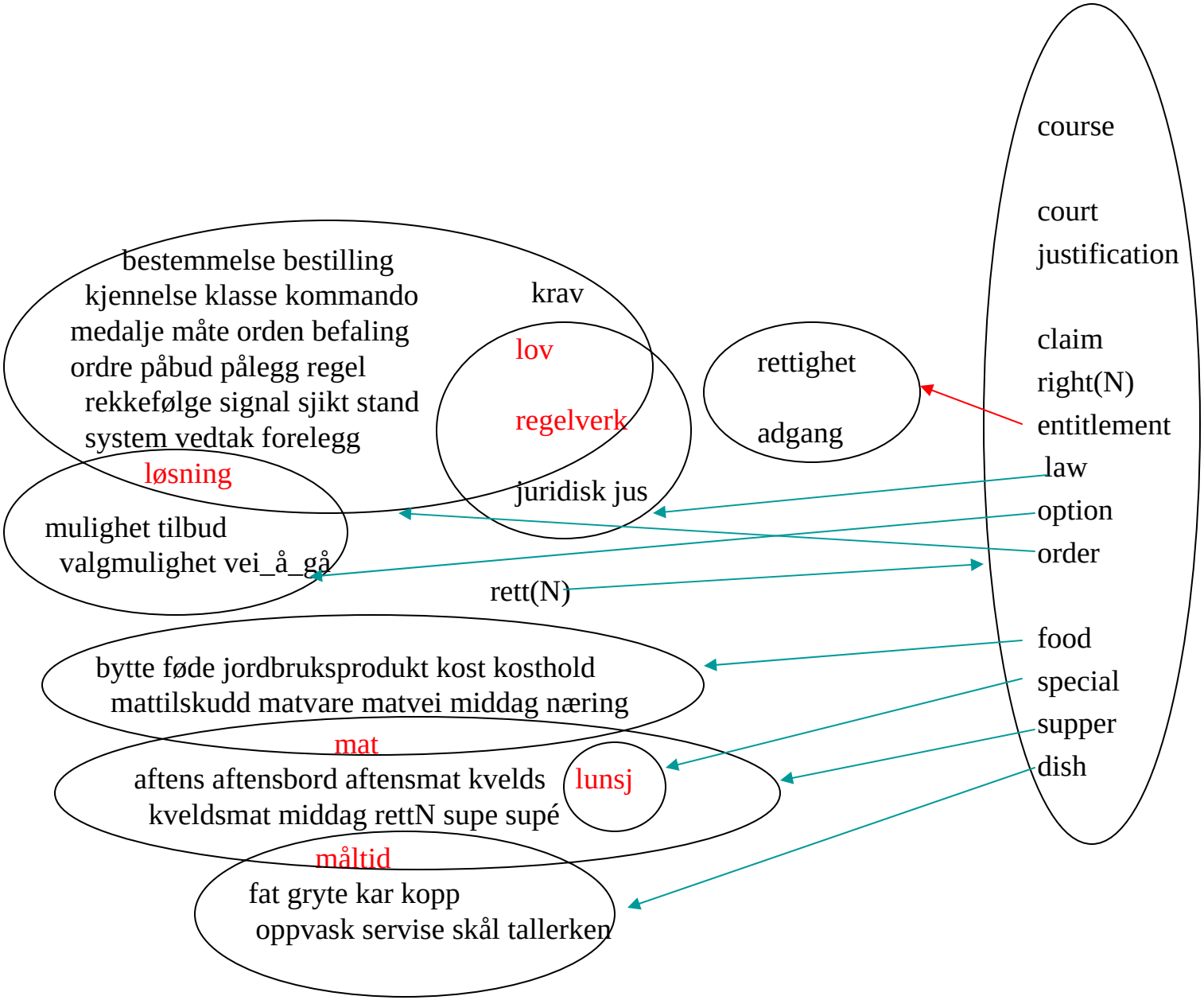
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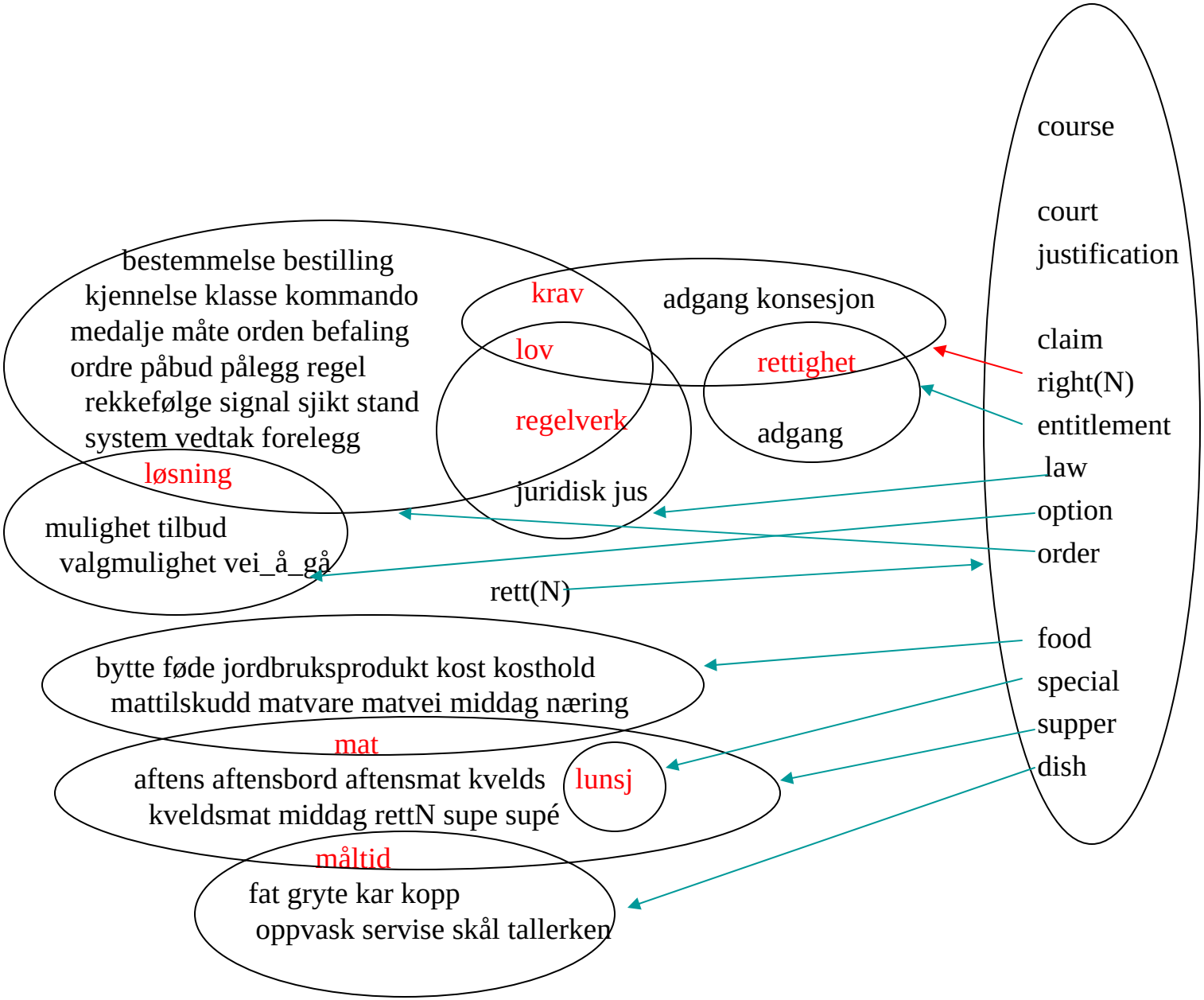
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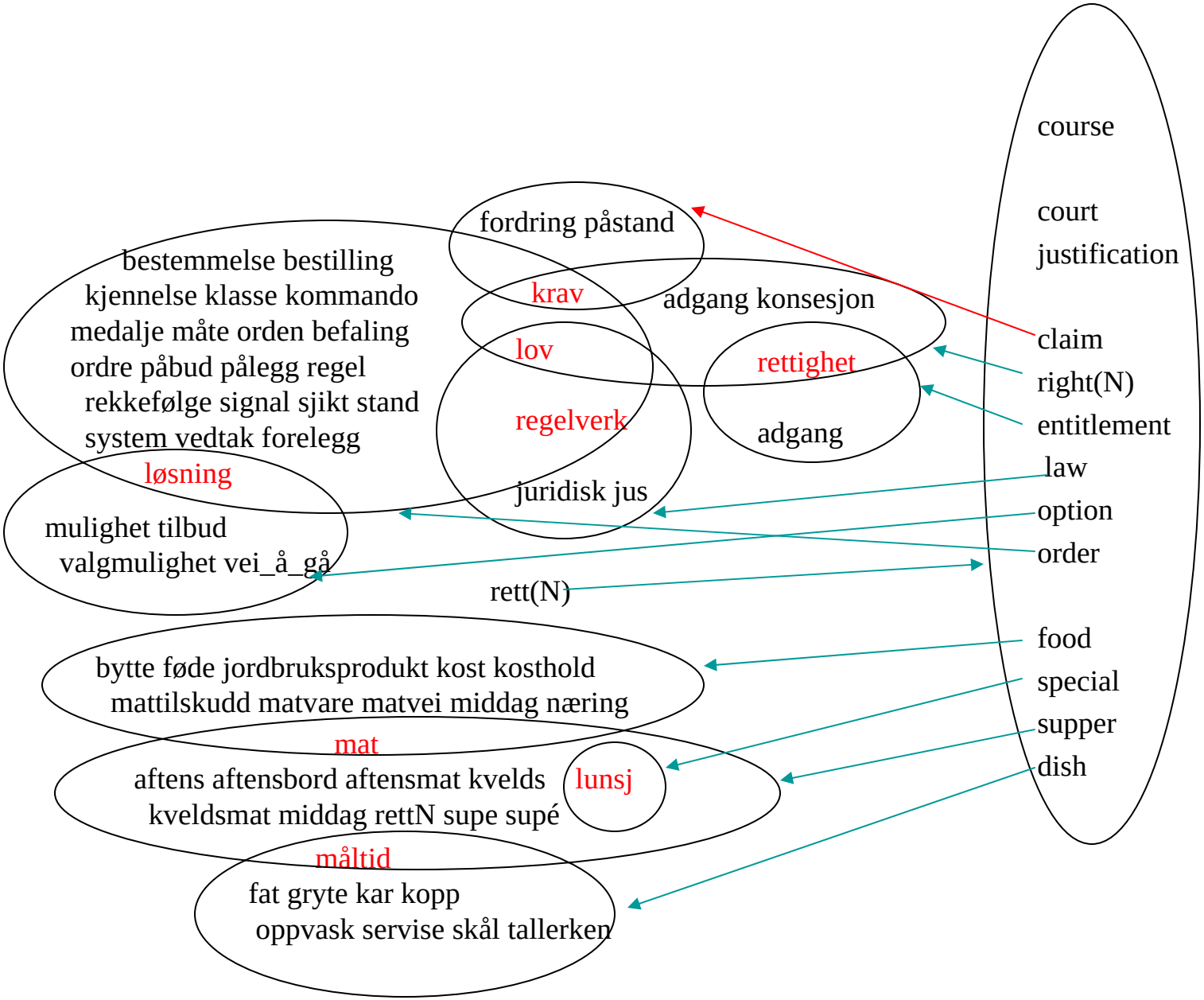
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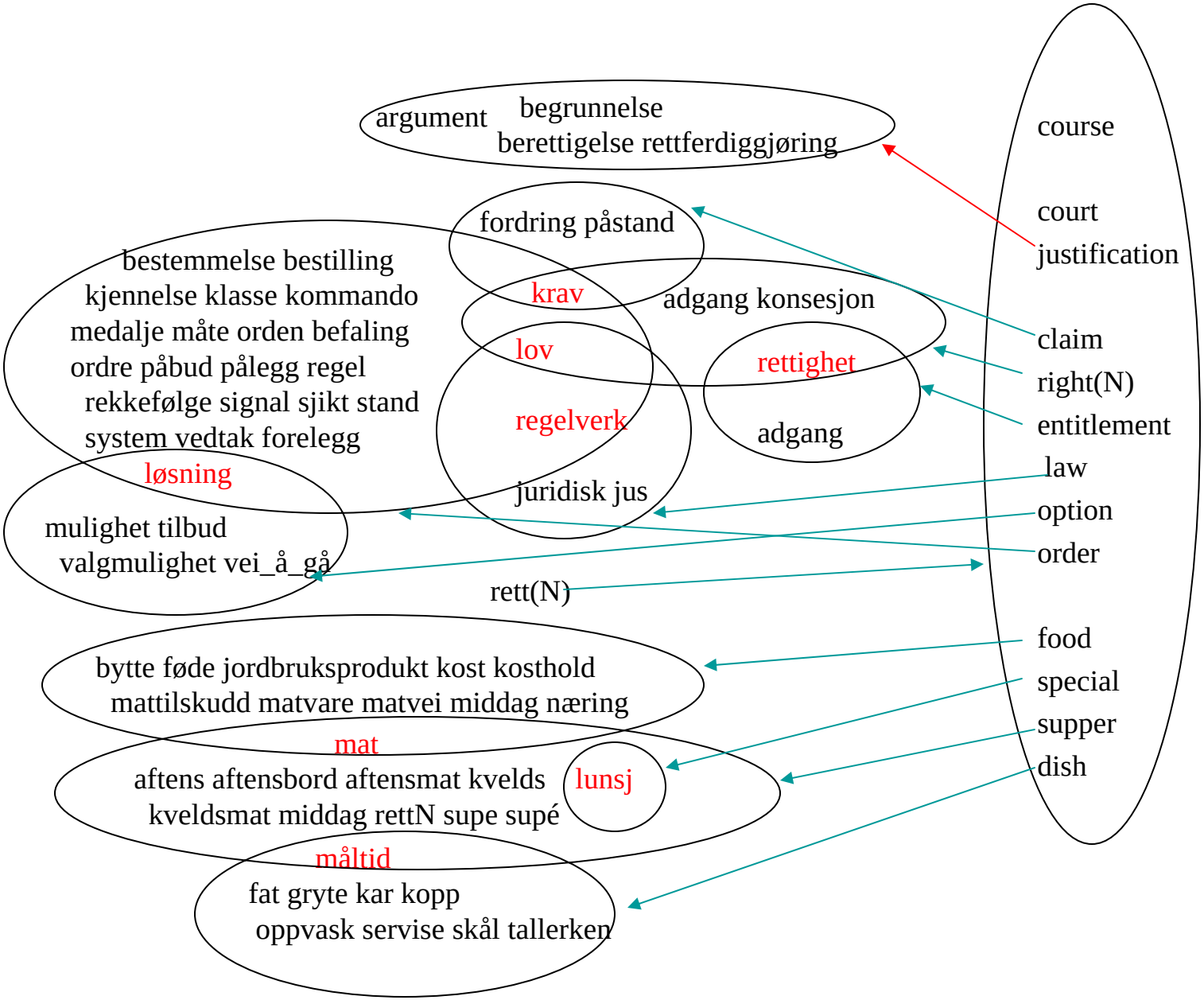
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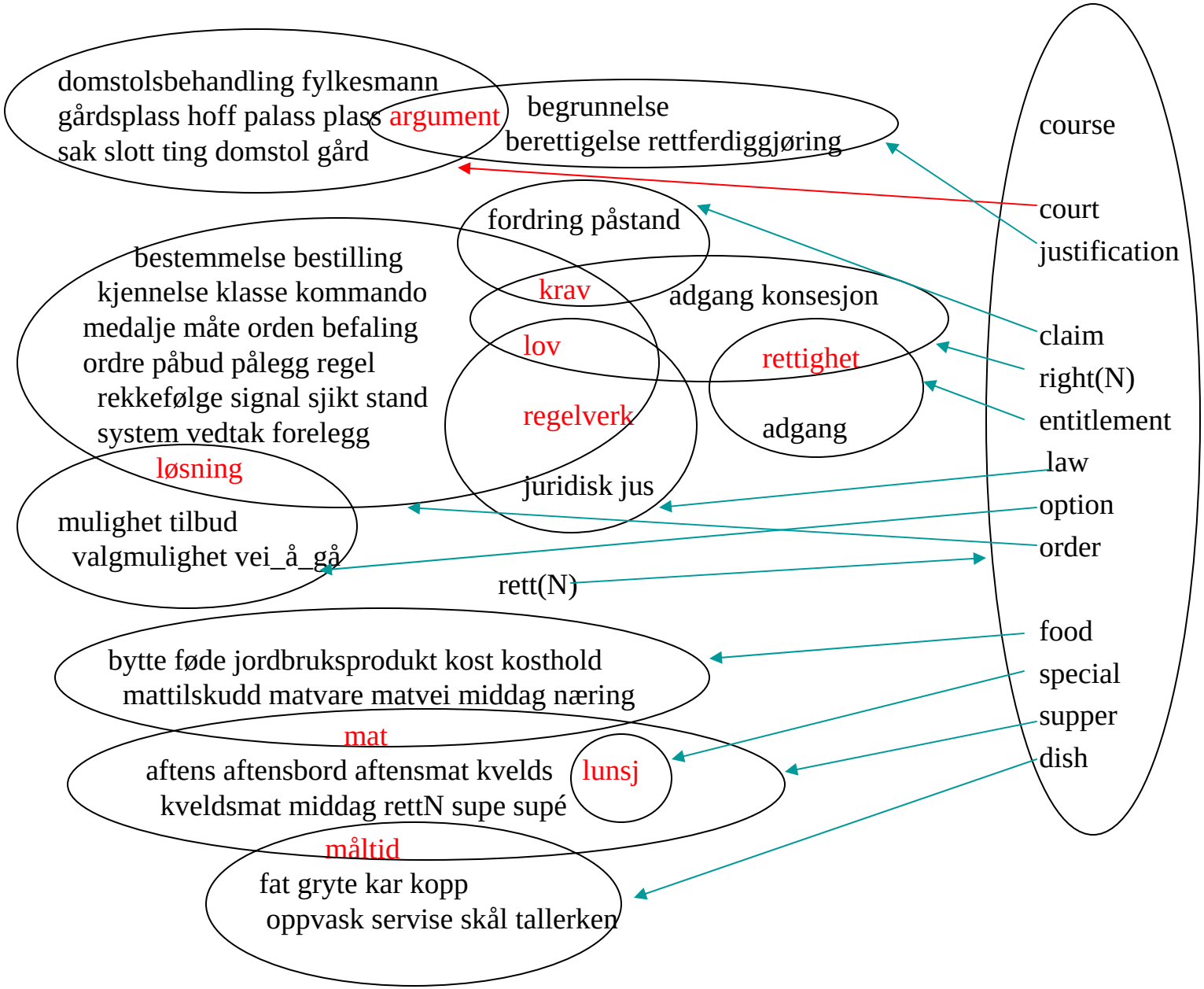
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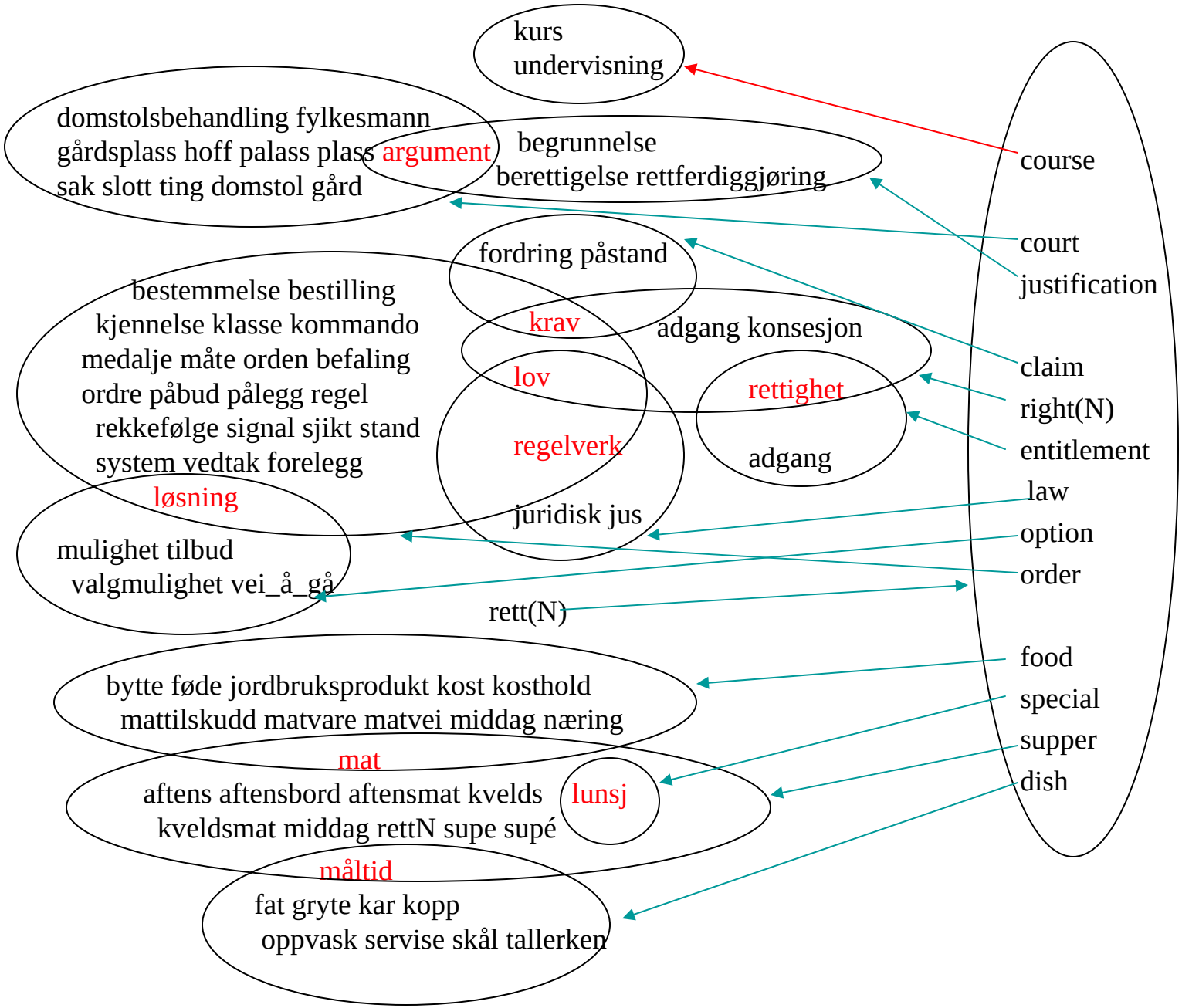
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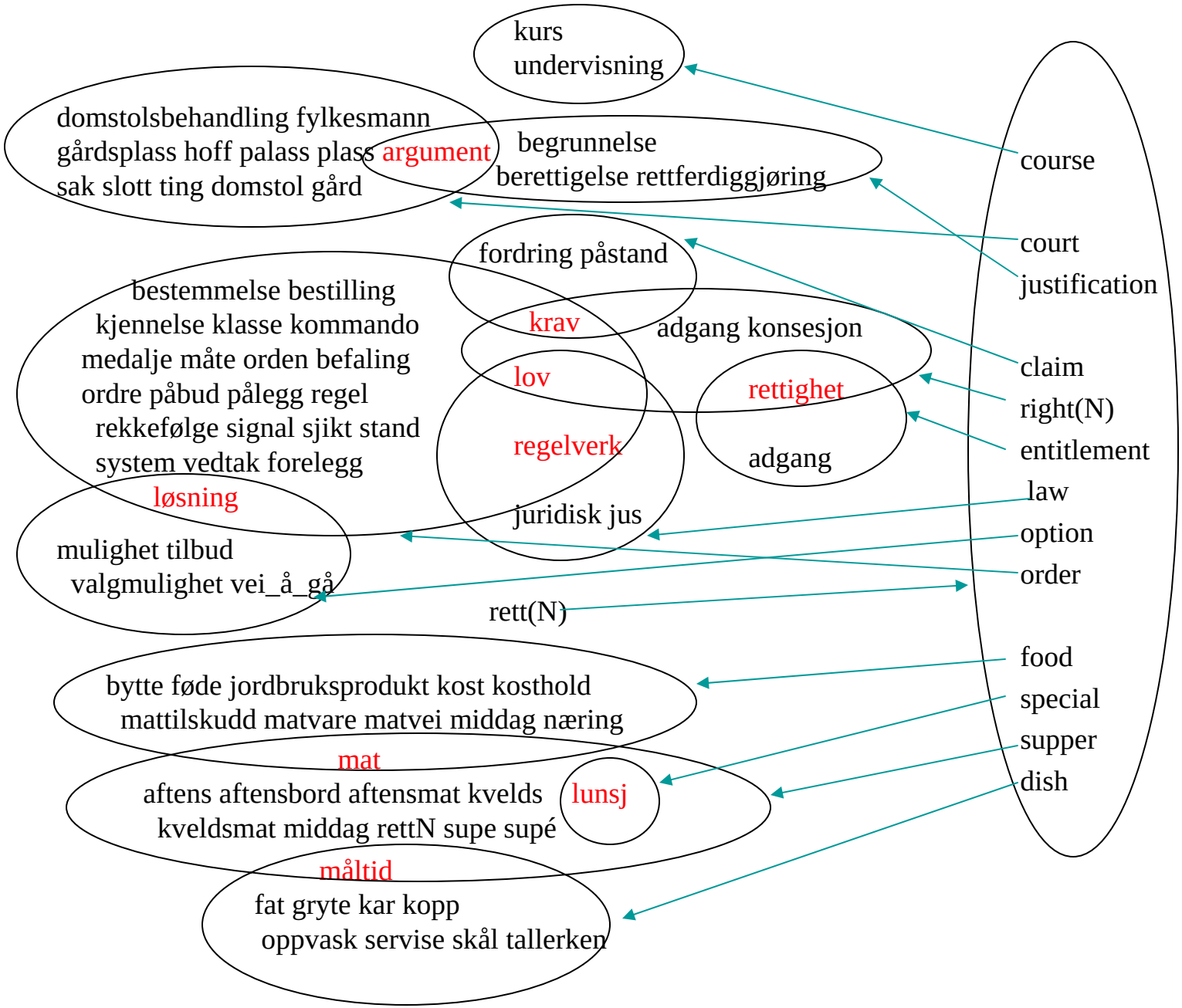
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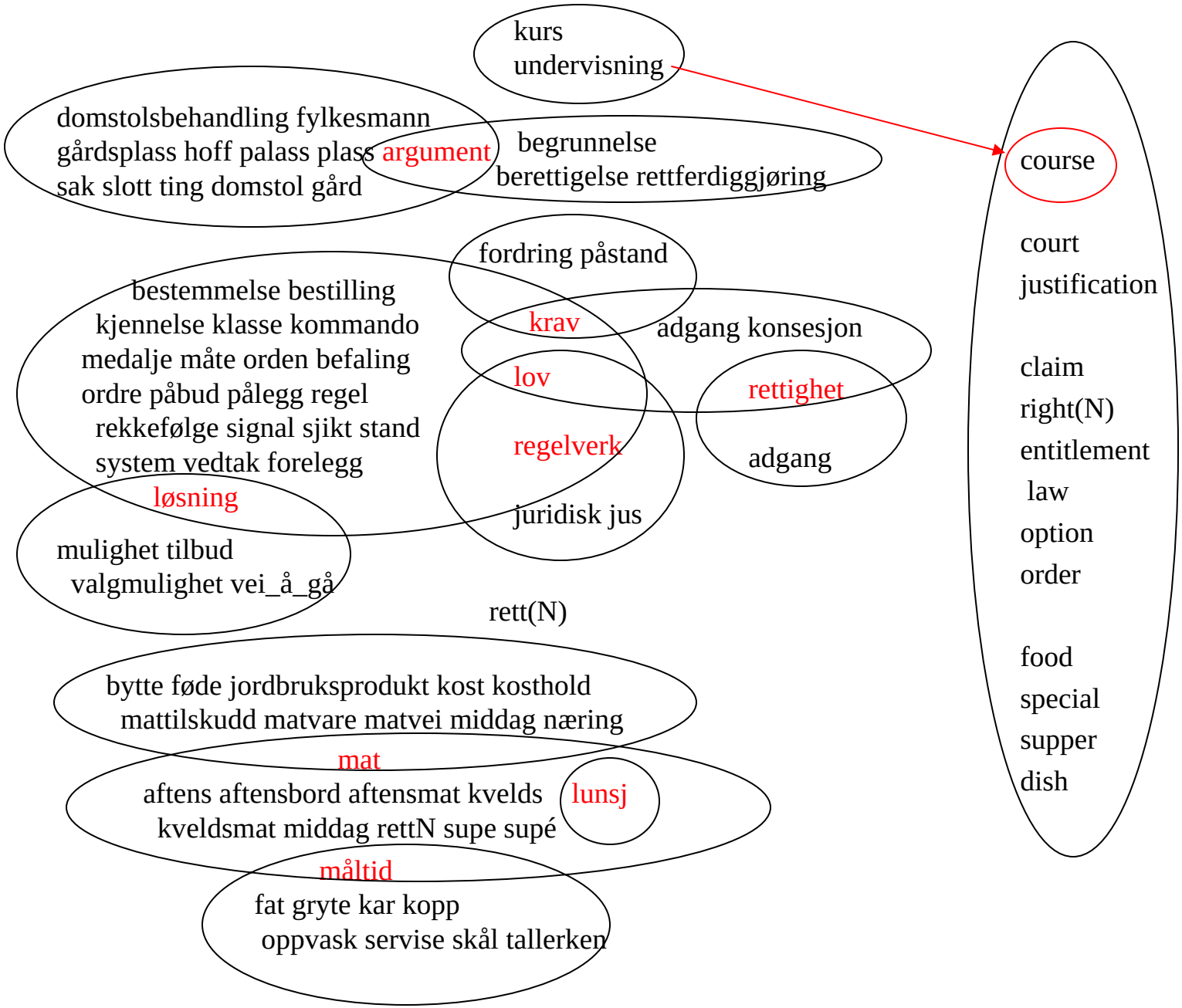
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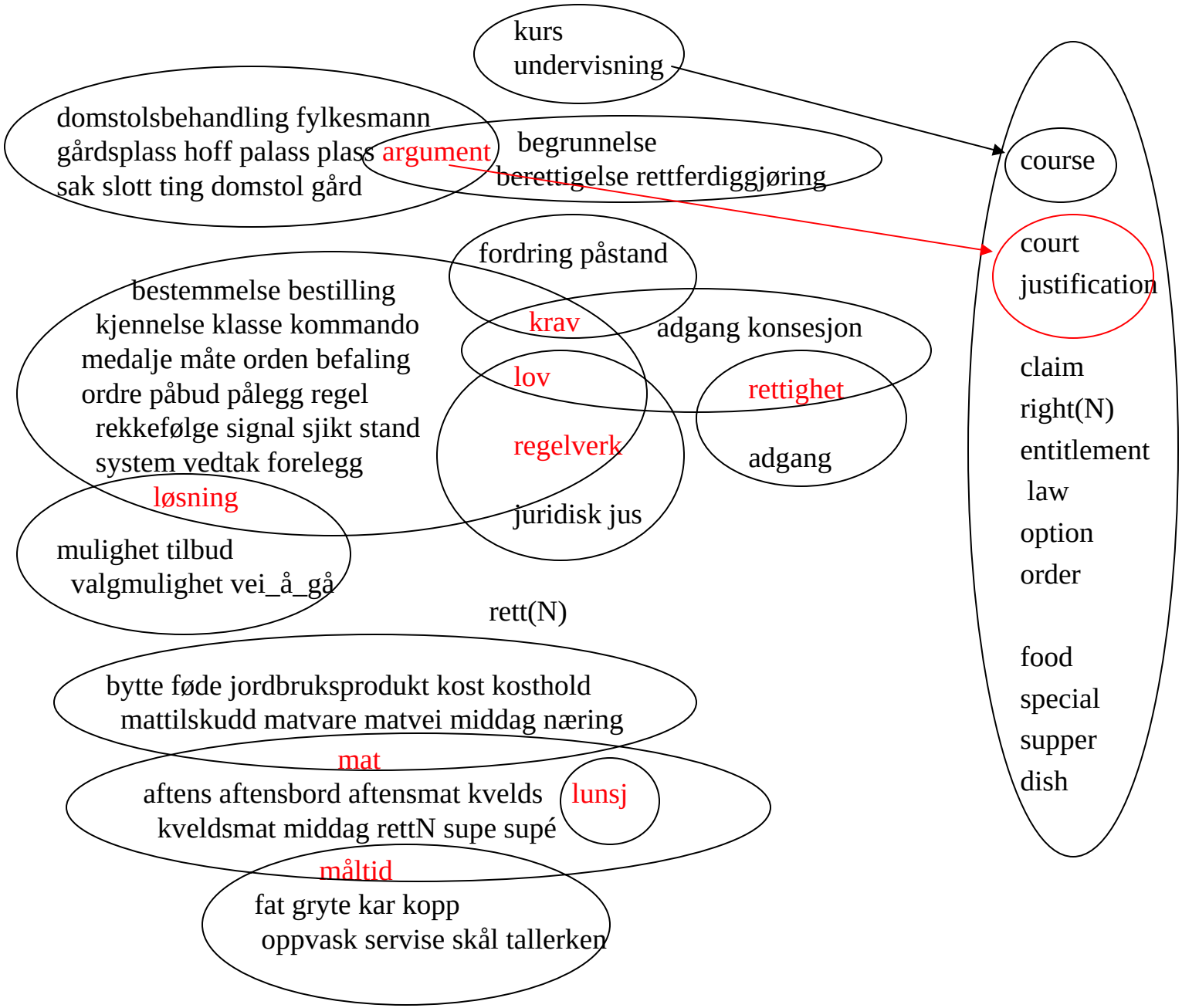
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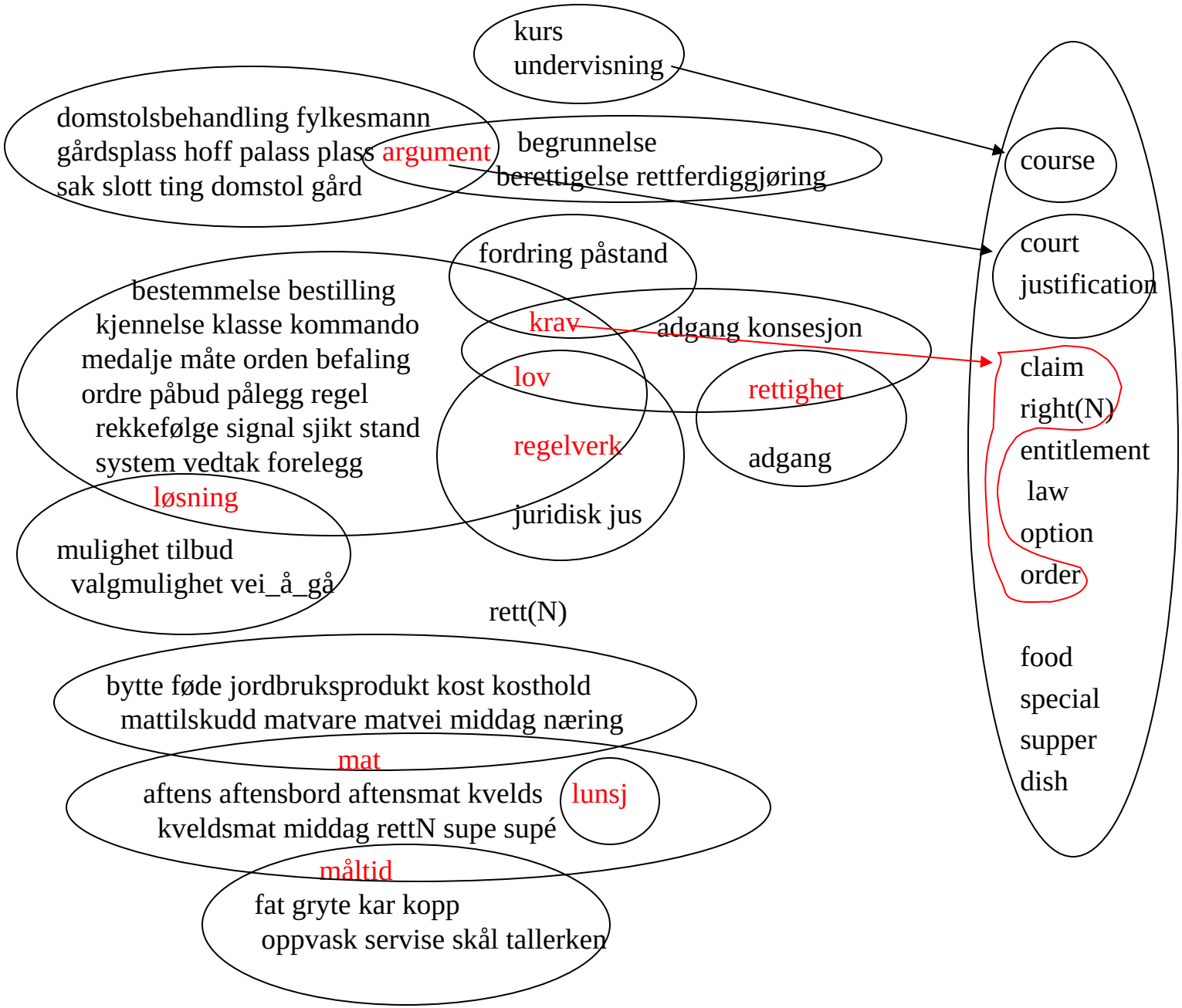
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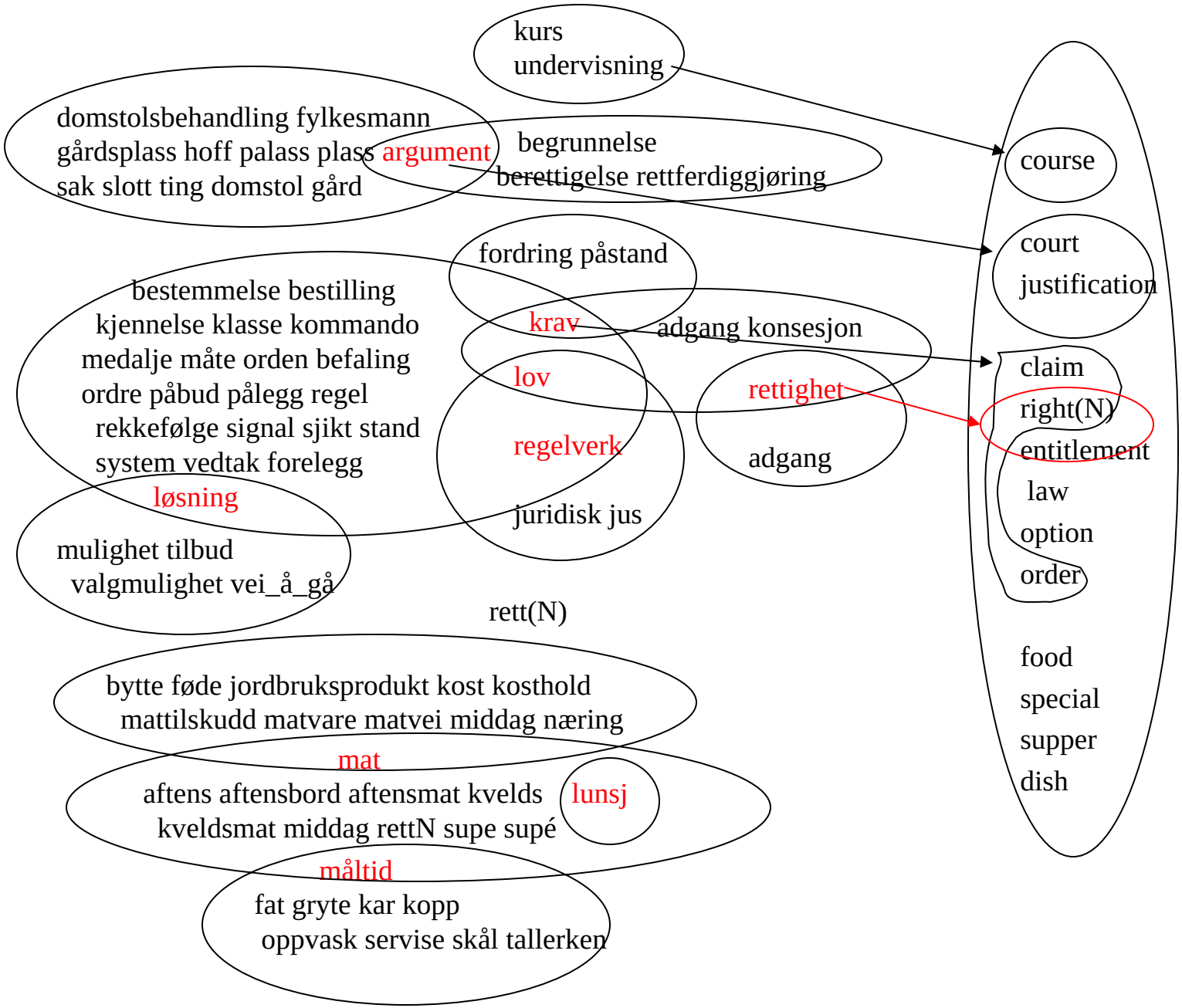
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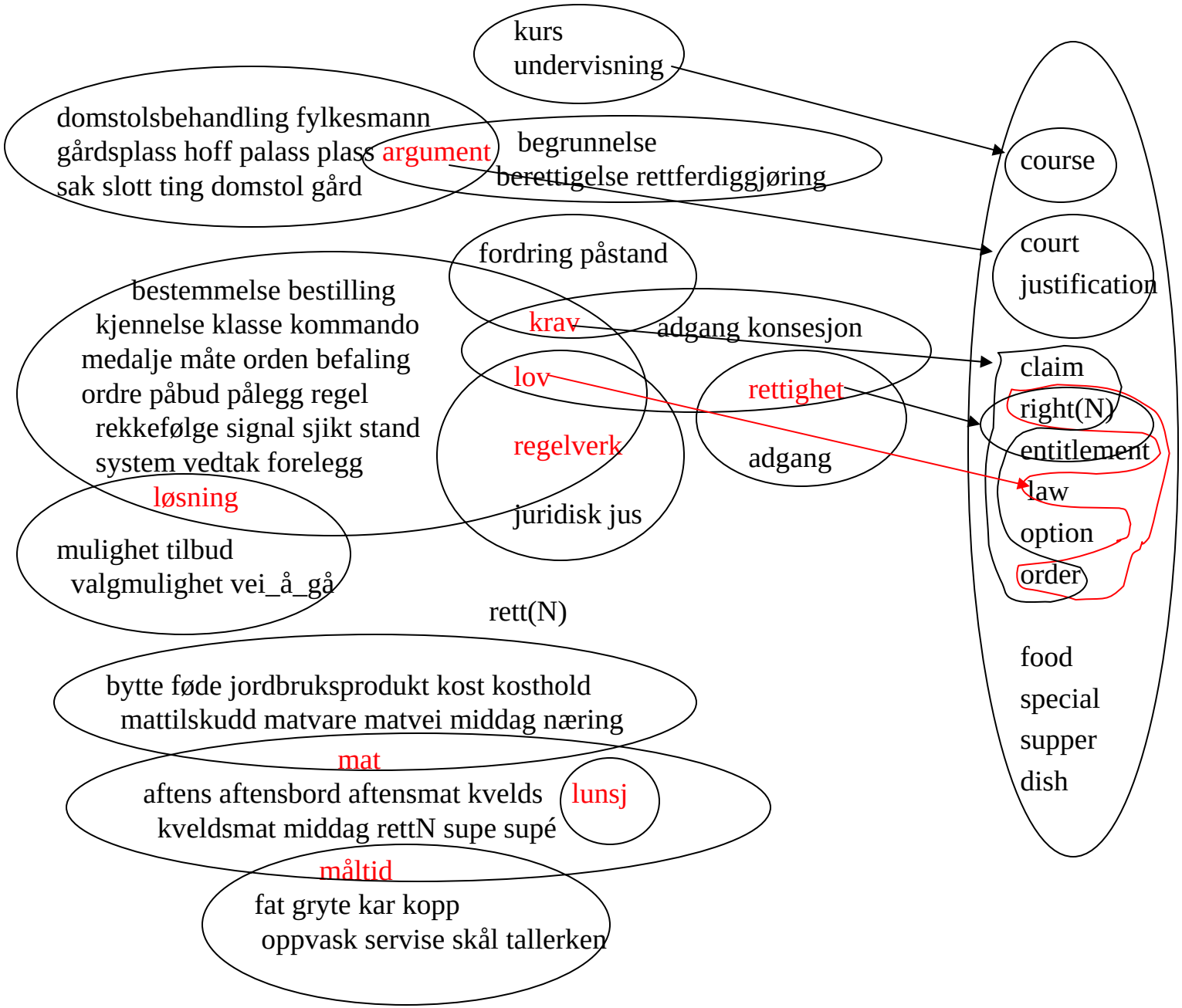
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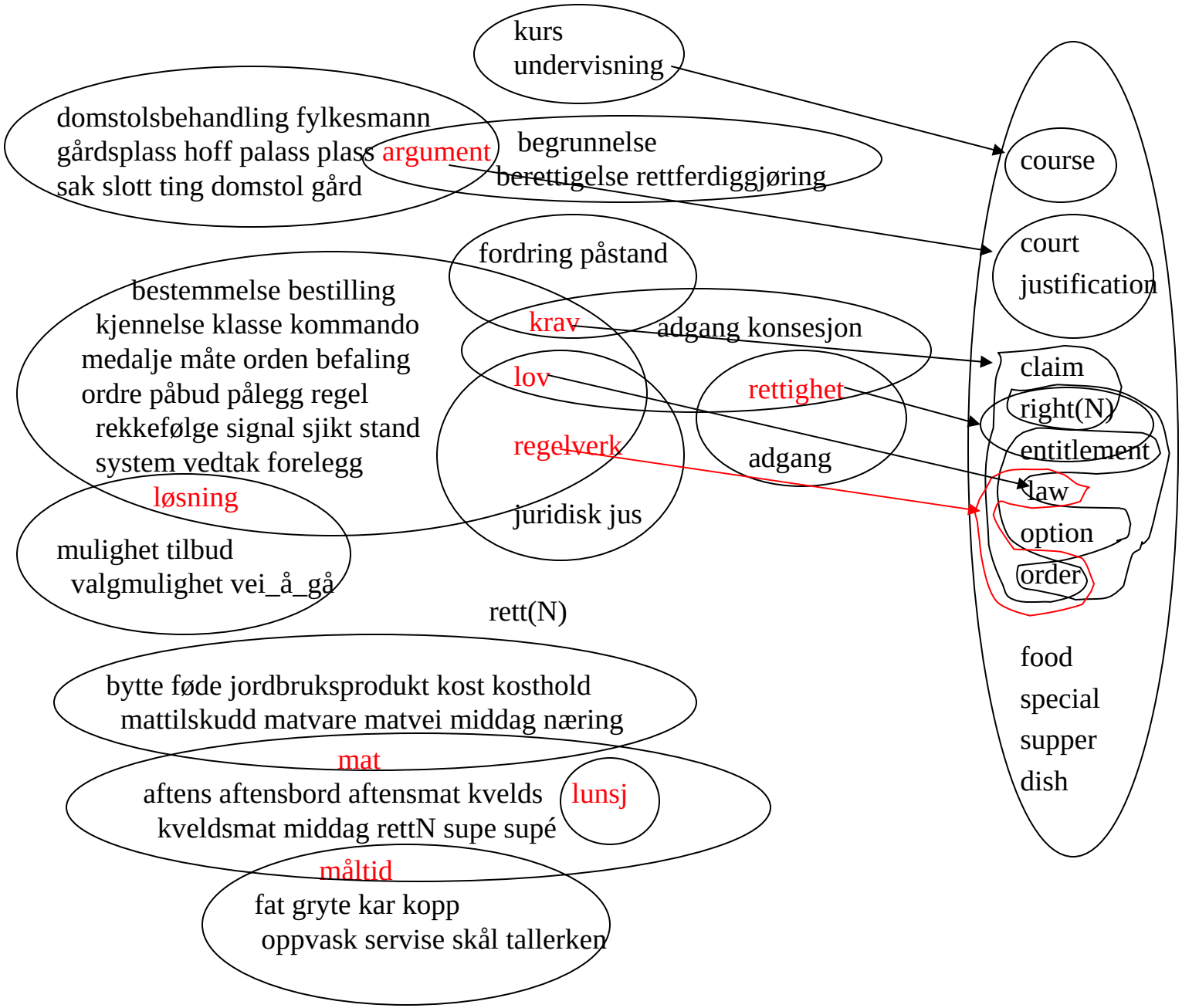
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course
court
justification
fordring påstand
bestemmelse bestilling
kjennelse klasse kommando
medalje måte orden befaling
ordre påbud pålegg regel
rekkefølge signal sjikt stand
system vedtak forelegg
krav
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lov
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mulighet tilbud
valgmulighet vei_å_gå
rett(N)
bytte føde jordbruksprodukt kost kosthold
mattilskudd matvare matvei middag næring
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kveldsmat middag rettN supe supé
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måltid
fat gryte kar kopp
oppvask servise skål tallerken
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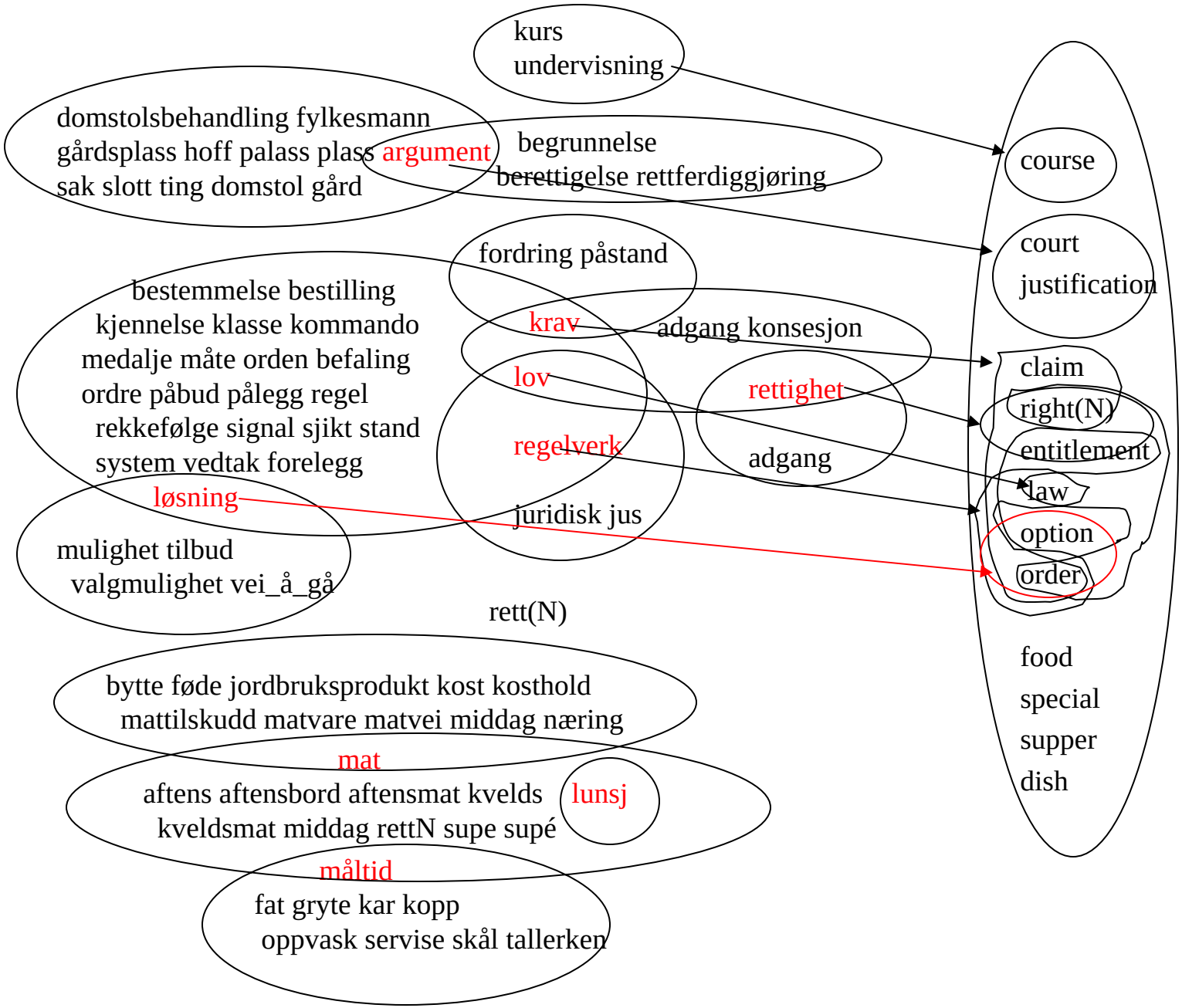
supper
dish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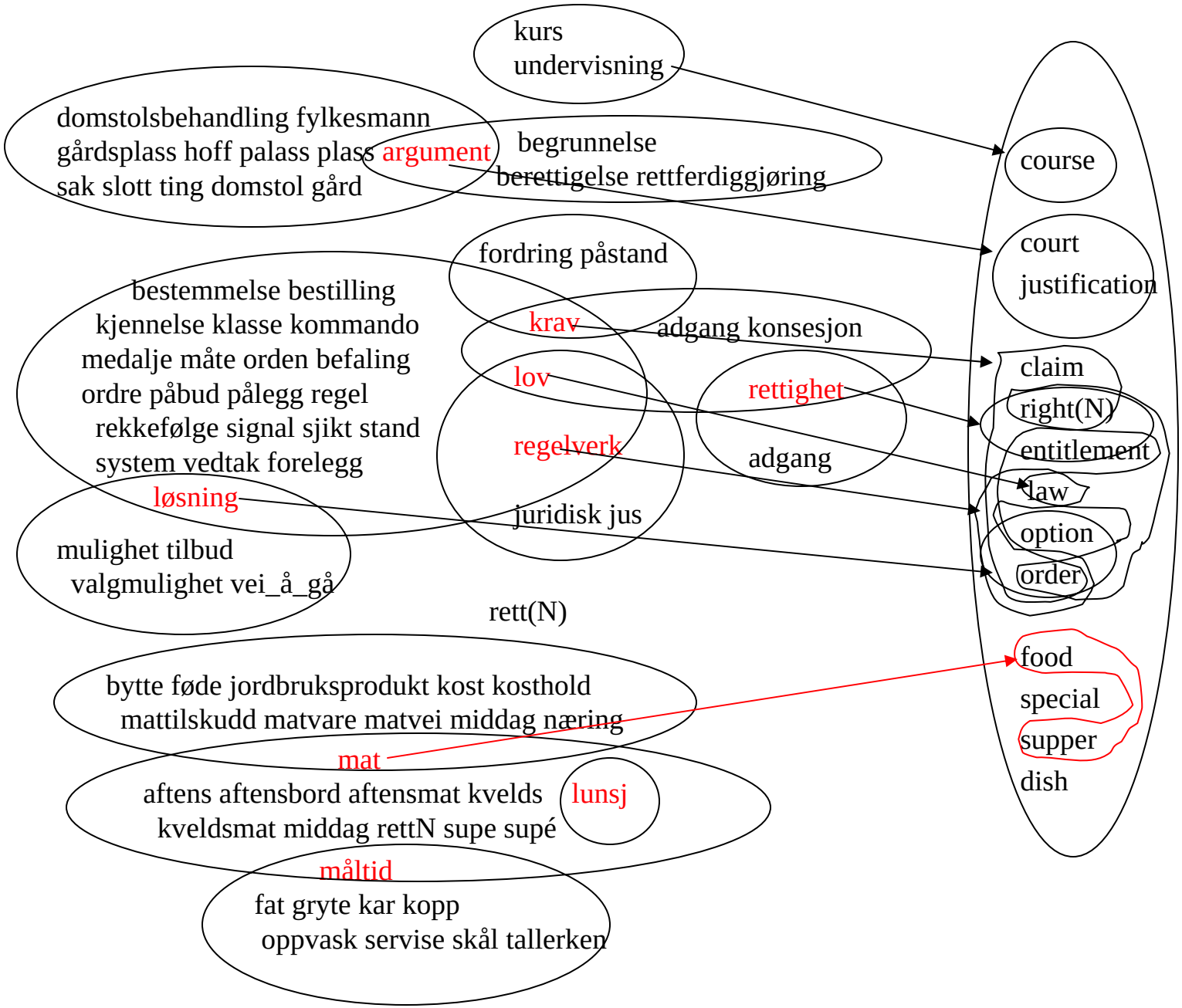
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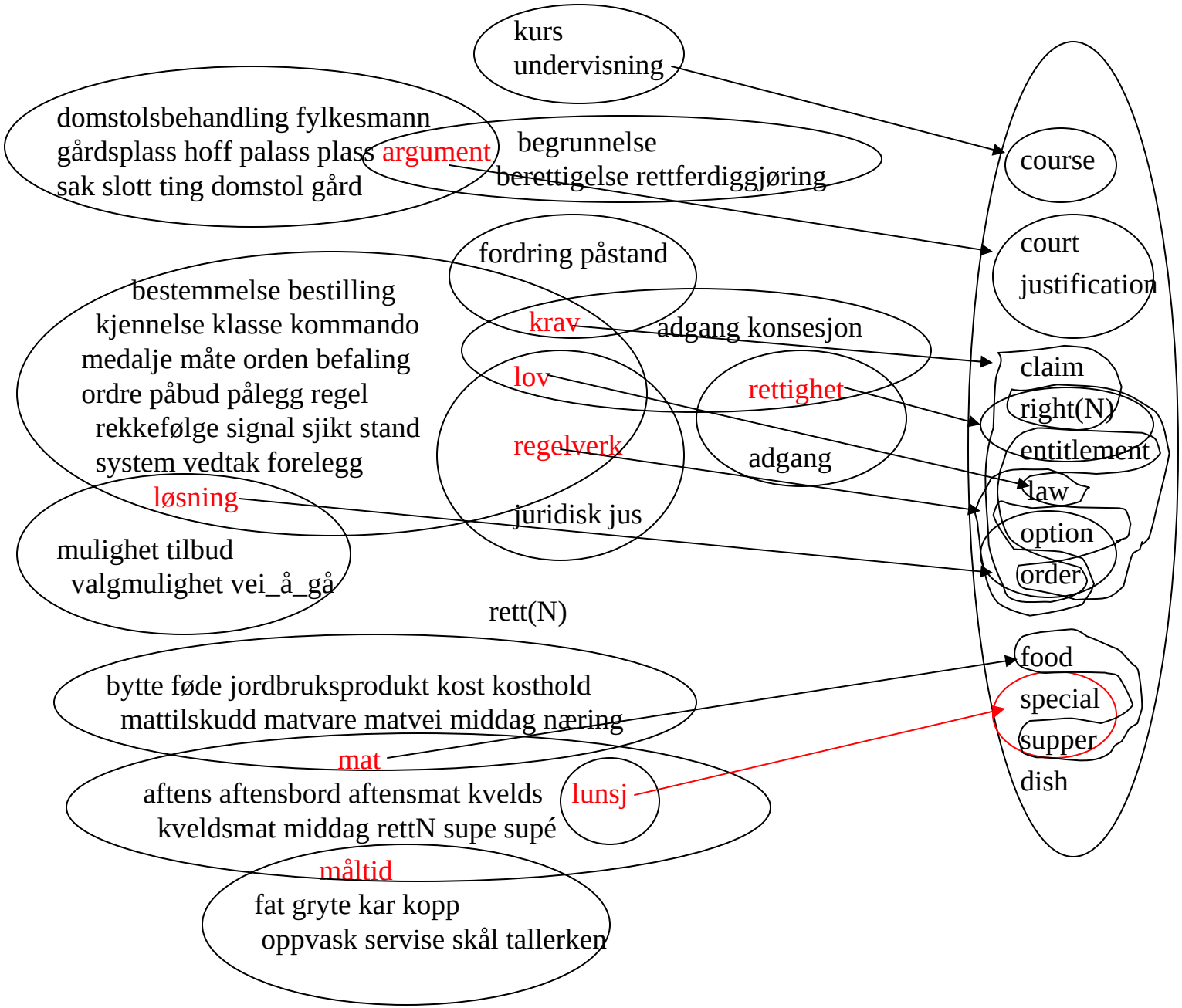
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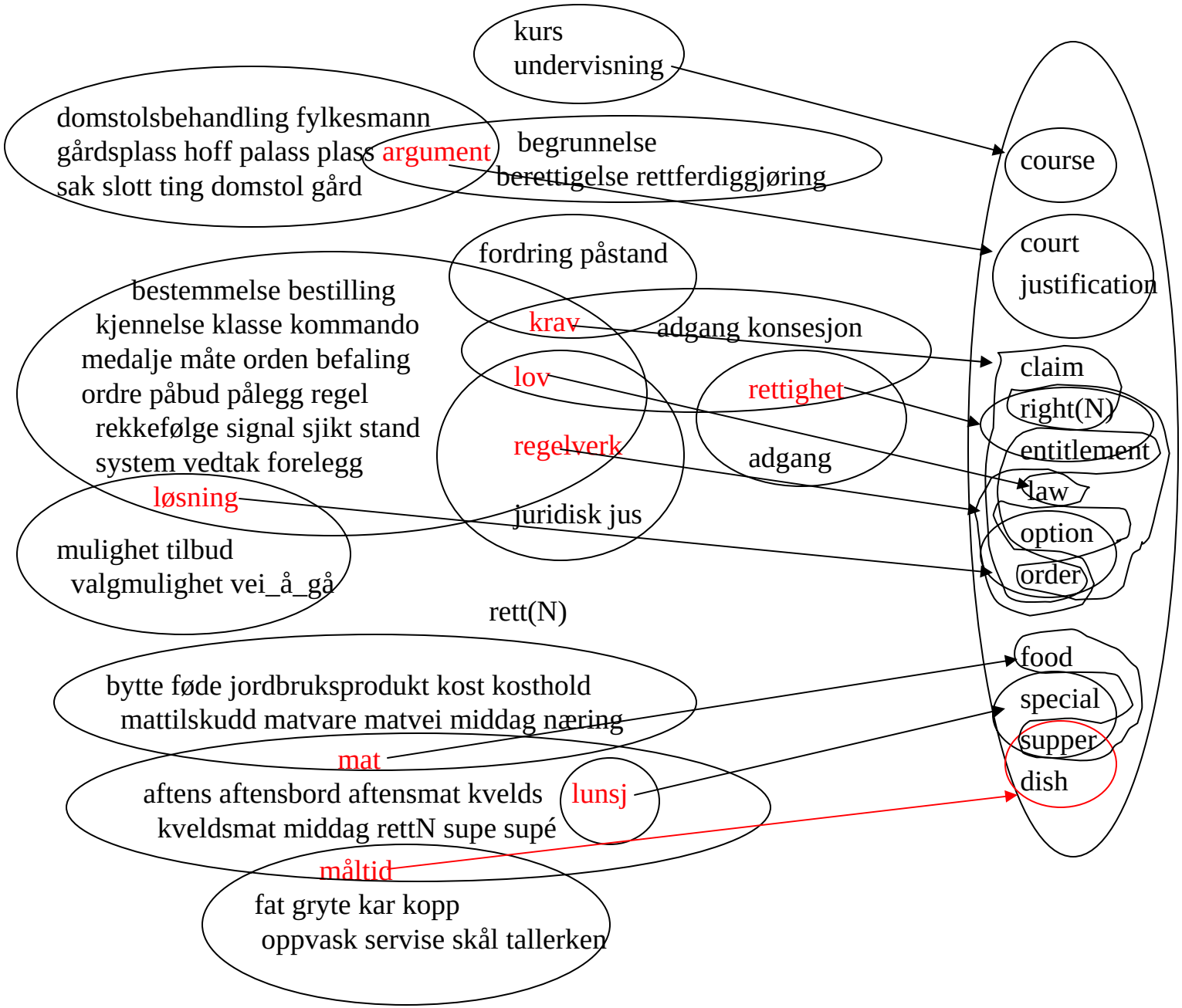
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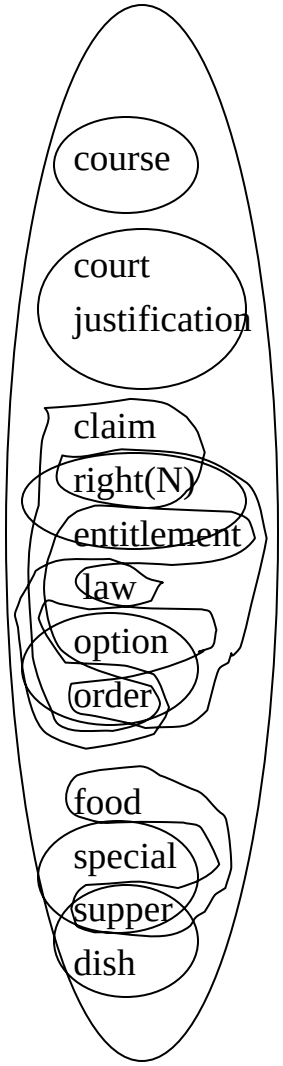
rett(N)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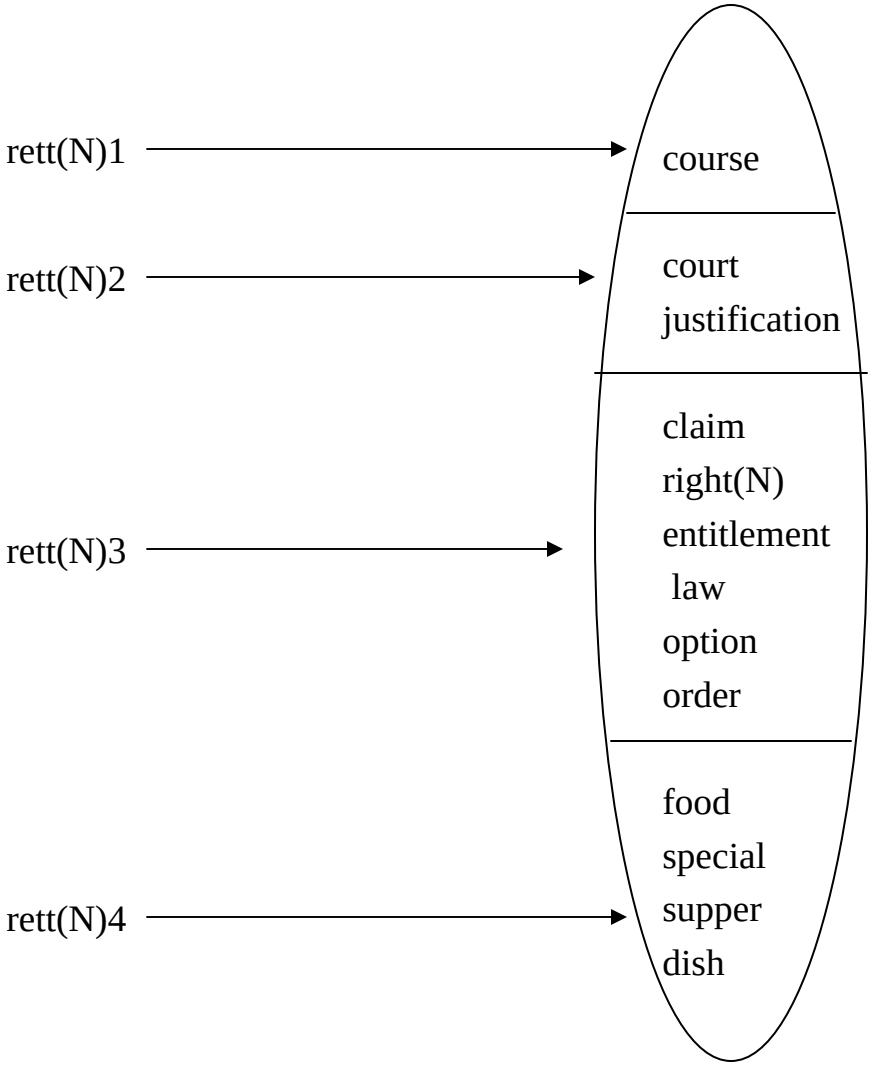
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rett(N)4
course
court
justification
claim
right(N)
entitlement
law
option
order
food
special
supper
dish

Semantic fields

Semantic fields

When sense individuation has been performed
across the vocabulary in both languages,
each sense has a *t*-image consisting of senses
in the other language.

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On this basis senses can be collected in
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A *semantic field*:

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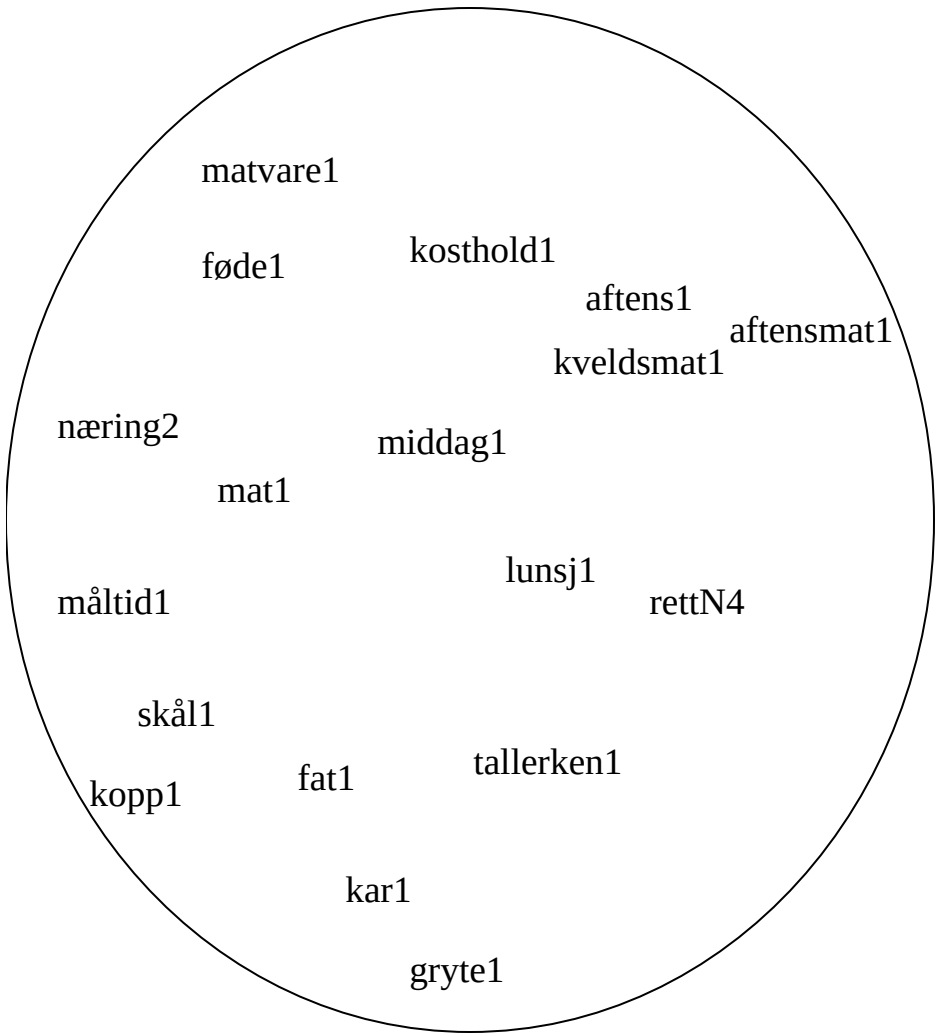
A *semantic field*:

A set of word senses with directly or indirectly intersecting *t*-images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aftensmat1
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næring2
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rettN4
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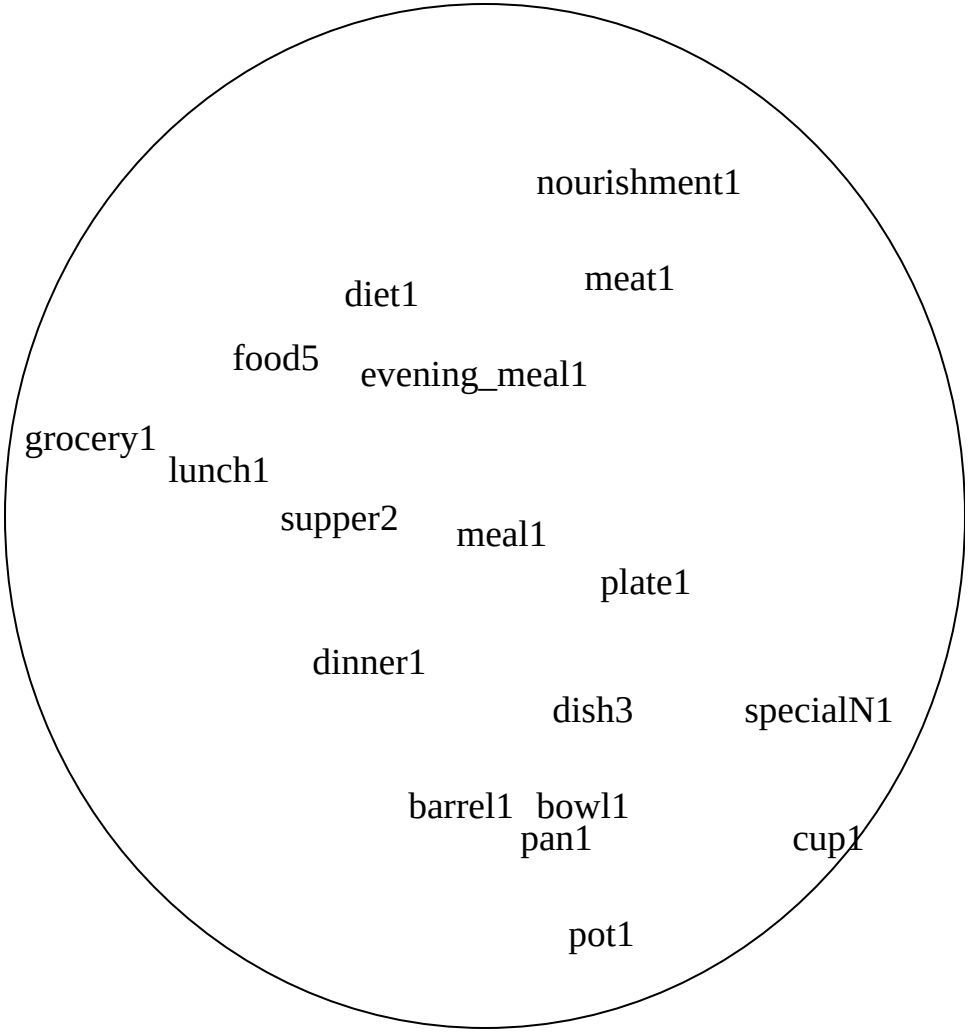
fat1
kopp1
kar1
gryte1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food5
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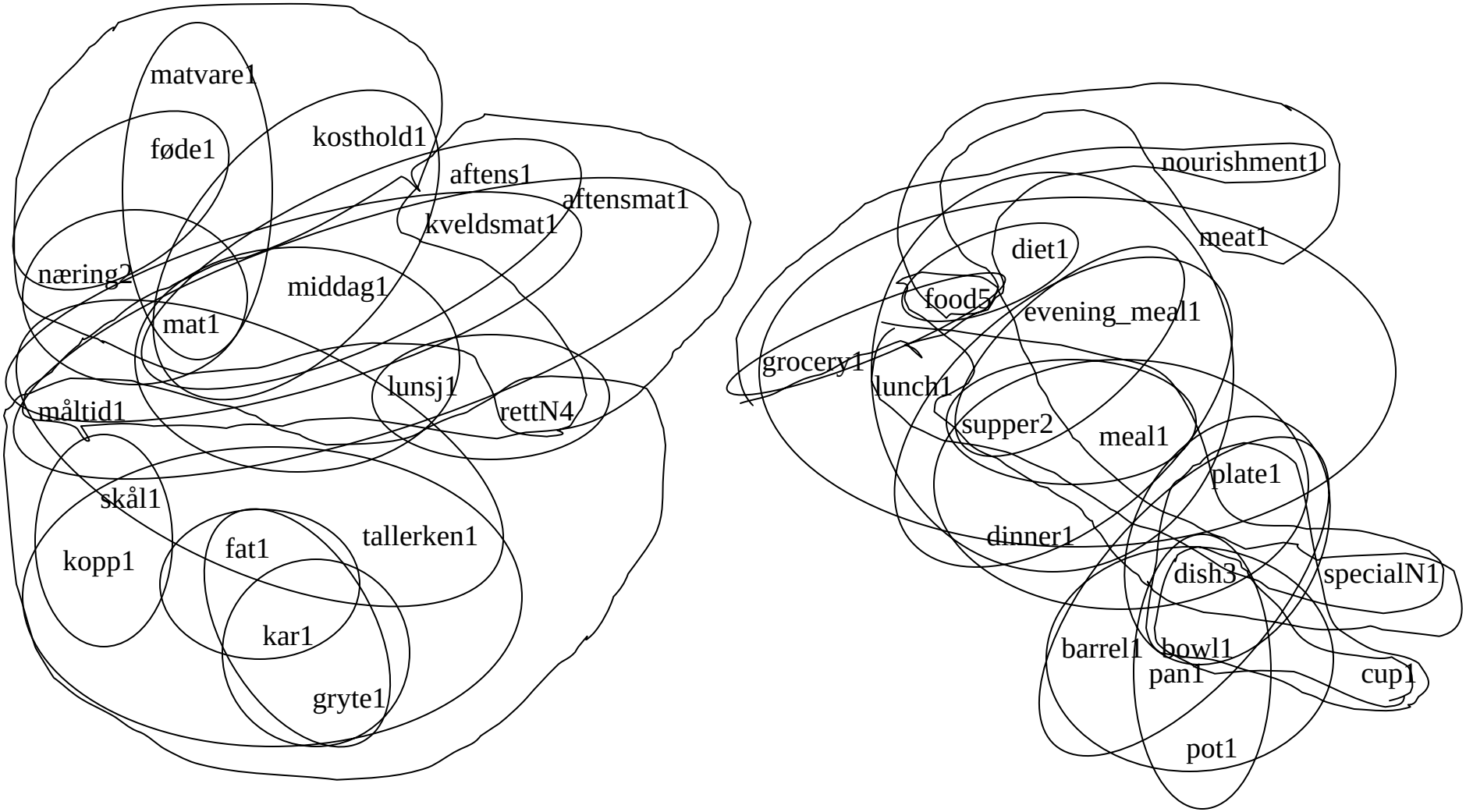
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cup1
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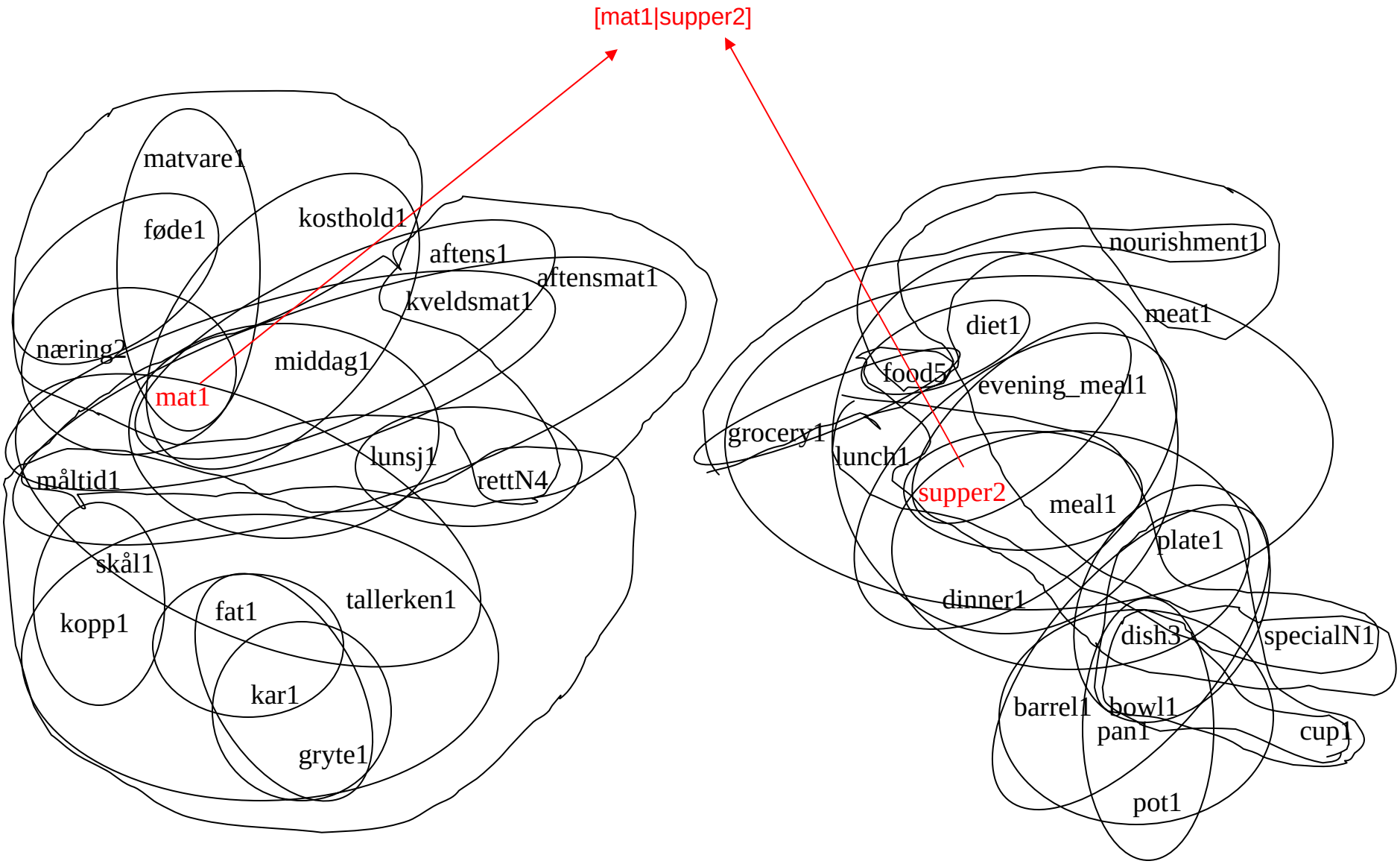
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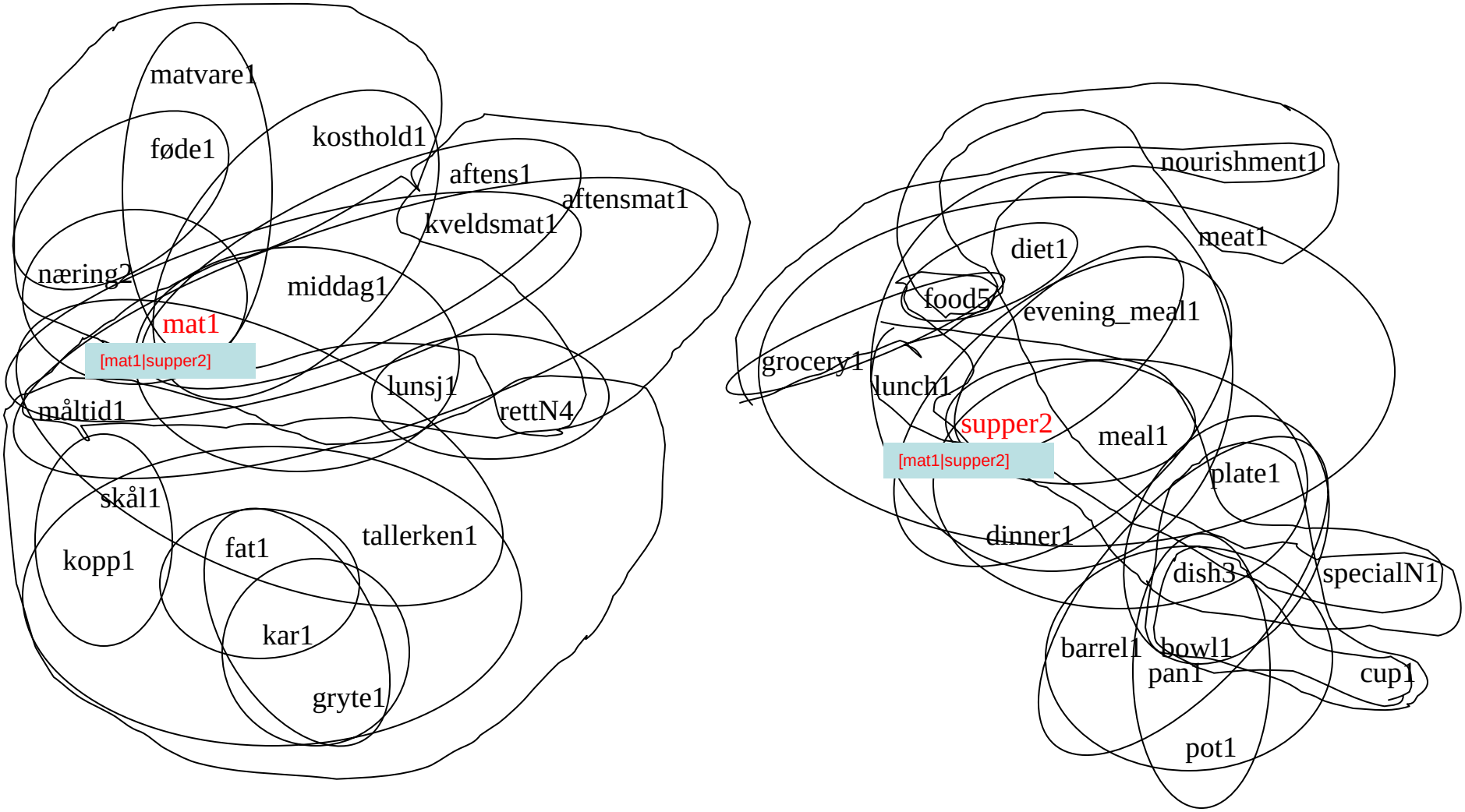
middag1
mat1
lunsj1
rettN4
måltid1
skål1
kopp1
fat1
tallerken1
kar1
gryte1
nourishment1
meat1
diet1
food5
evening_meal1
grocery1
lunch1
supper2
meal1
plate1
dinner1
dish3
specialN1
barrel1
bowl1
pan1
cup1
pot1

[mat1|supper2]



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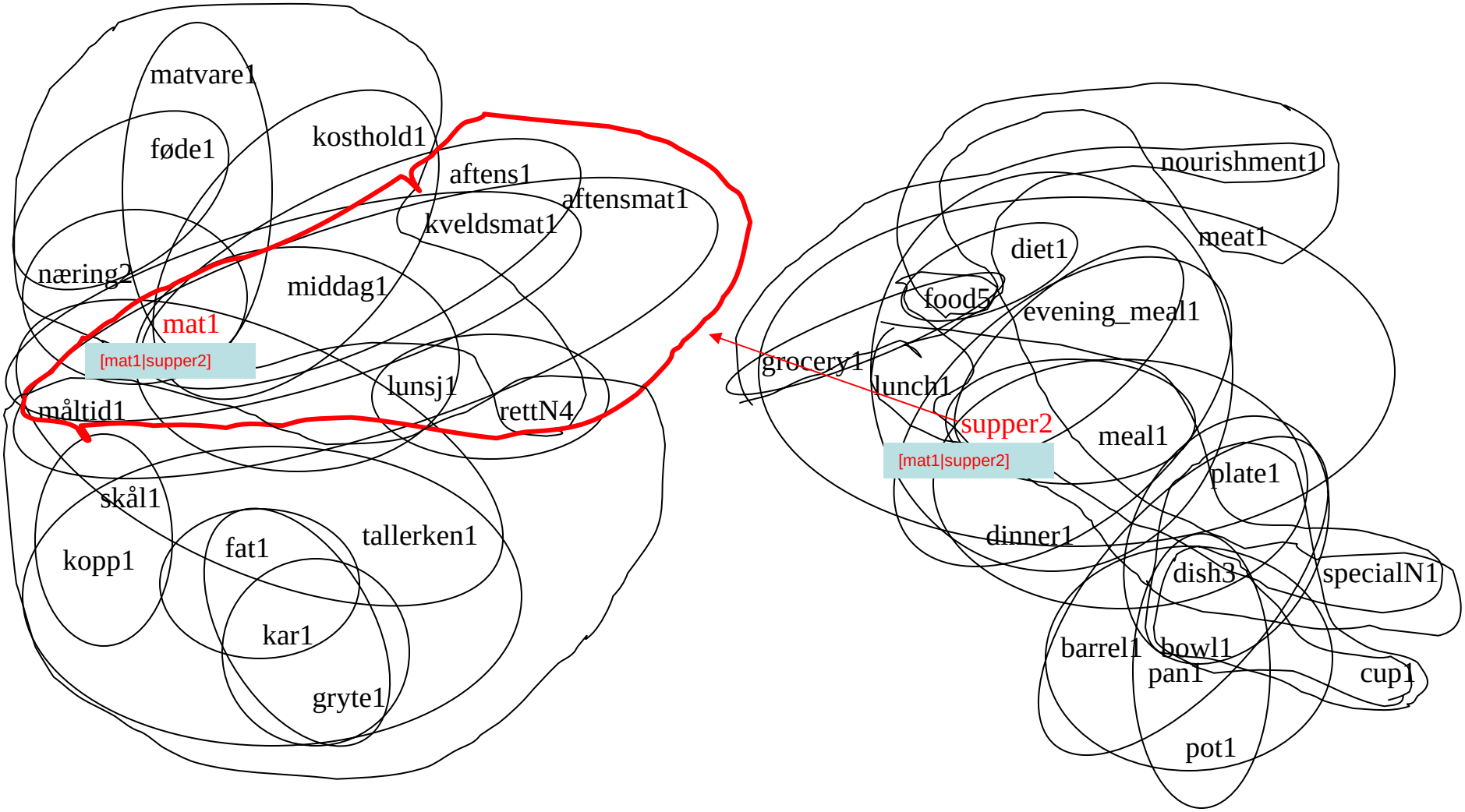

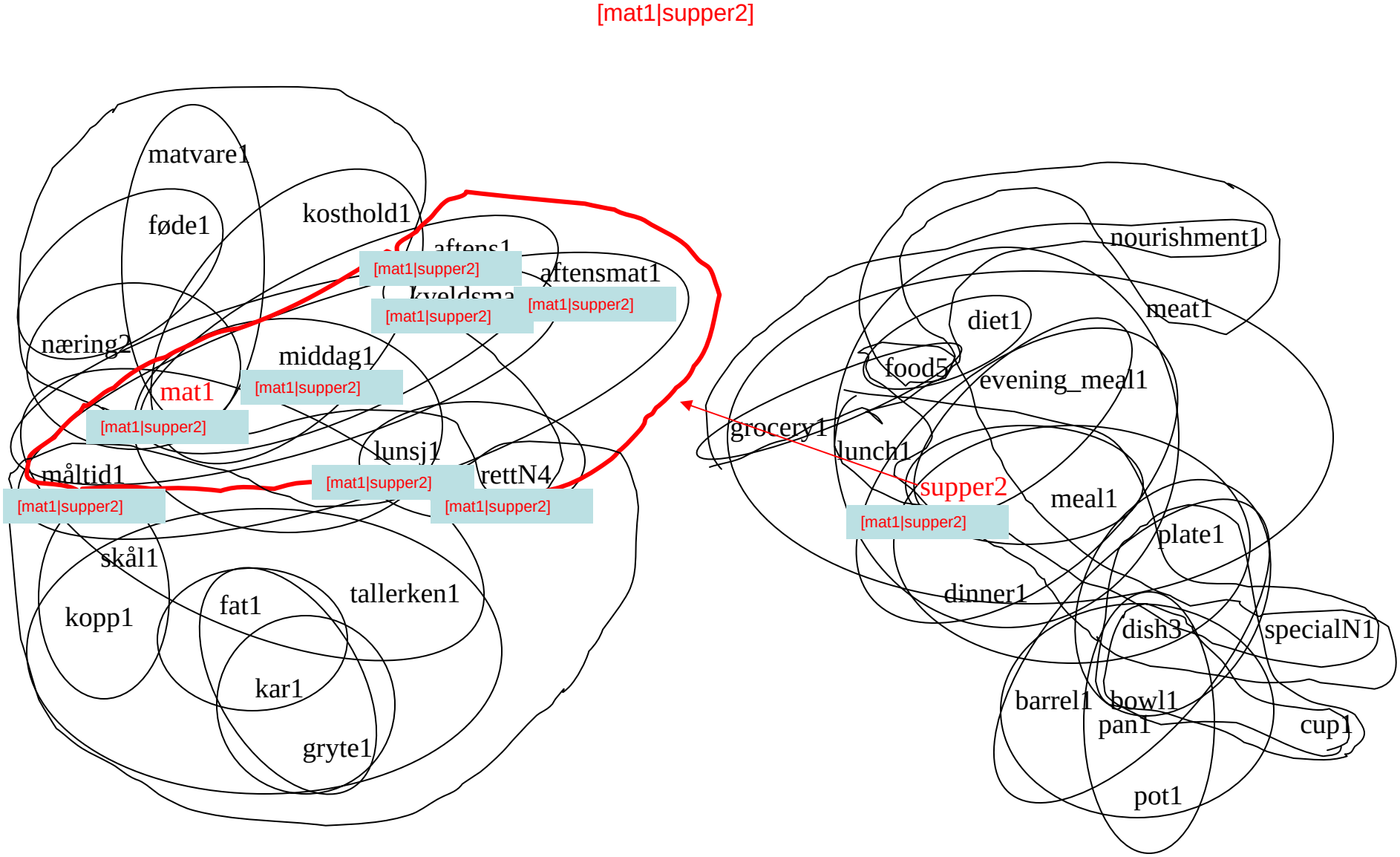
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næring2
middag1
mat1
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lunsj1
måltid1
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rettN4
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kar1
gryte1
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meat1
diet1
food5
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grocery1
lunch1
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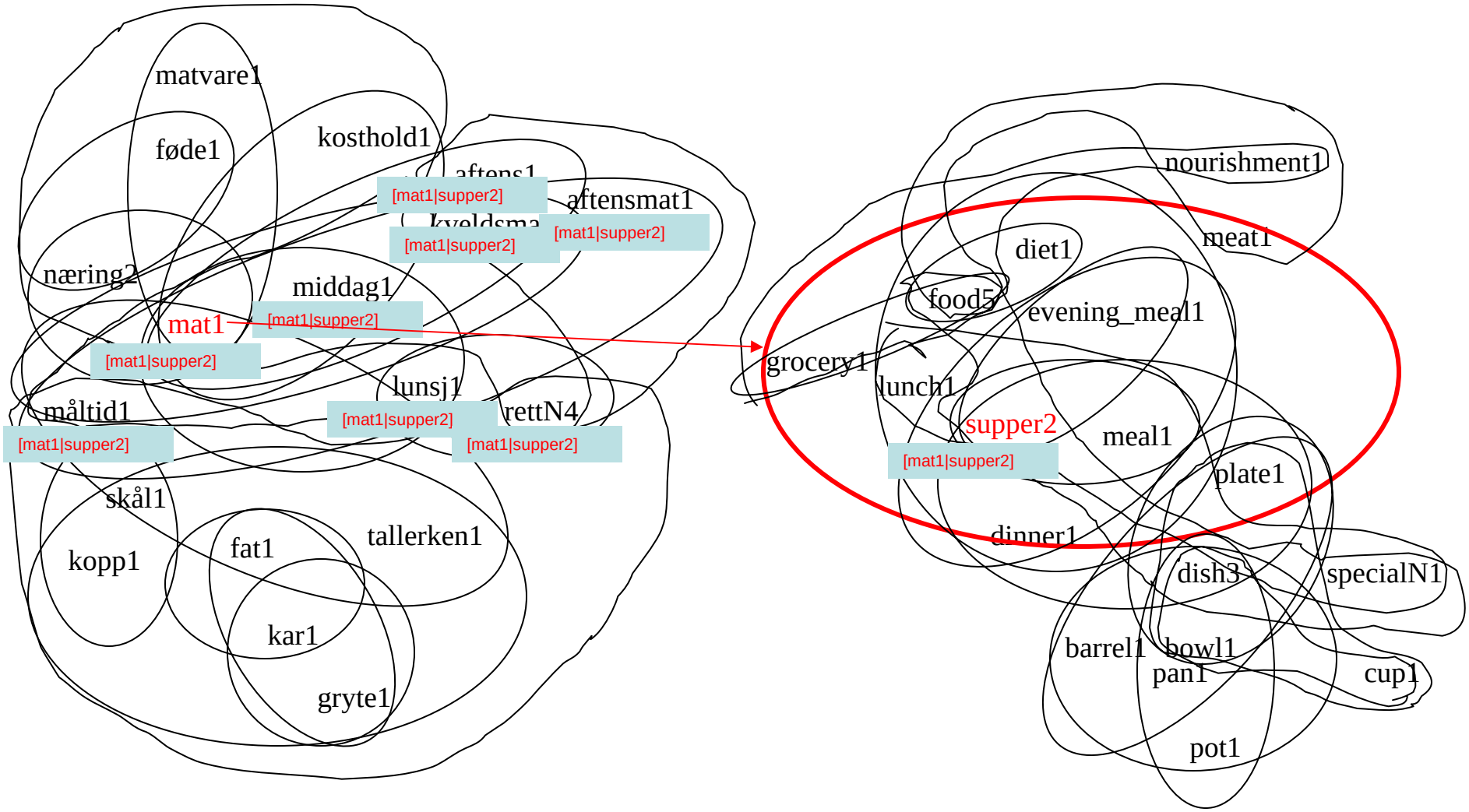
bowl1
pan1
cup1
pot1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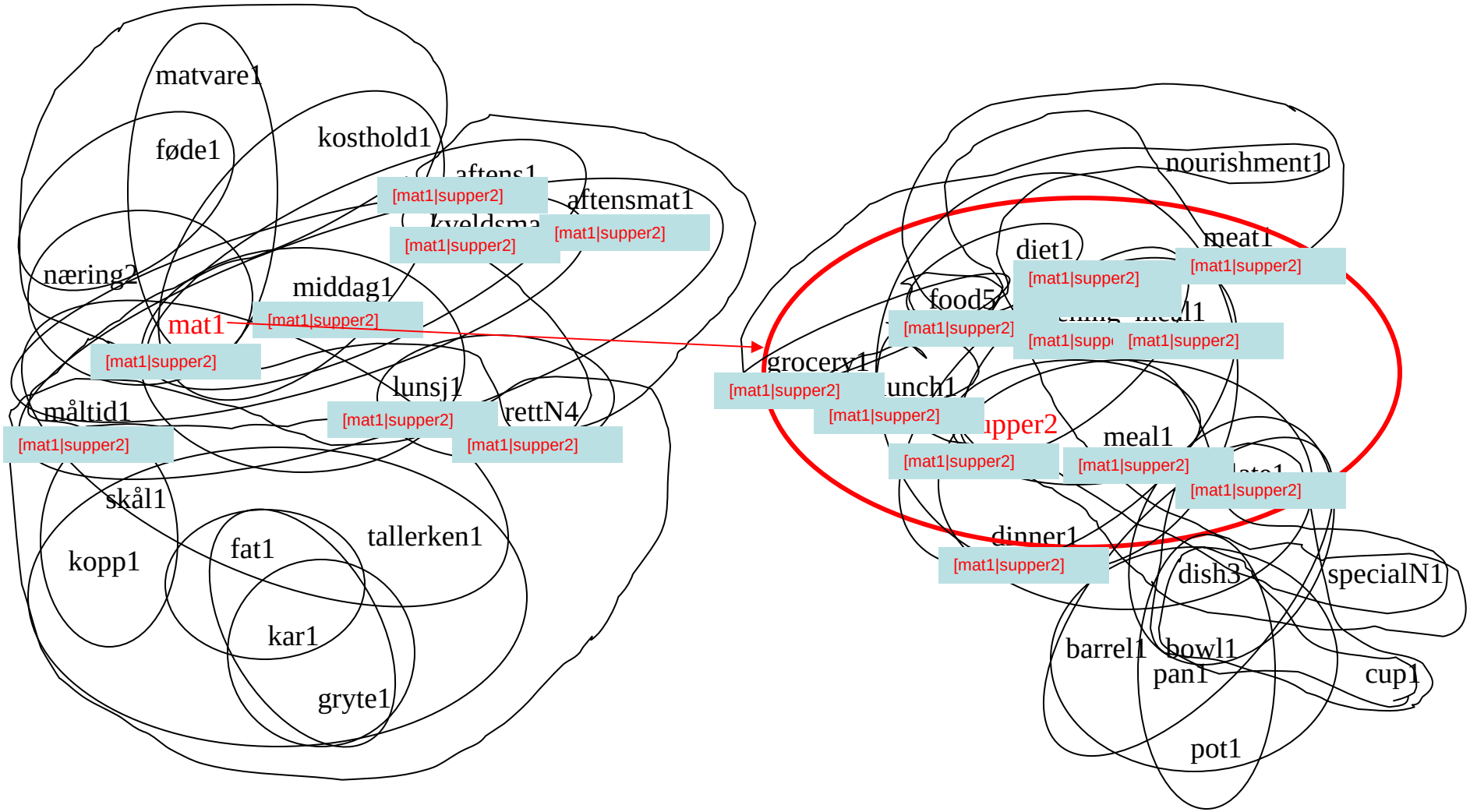
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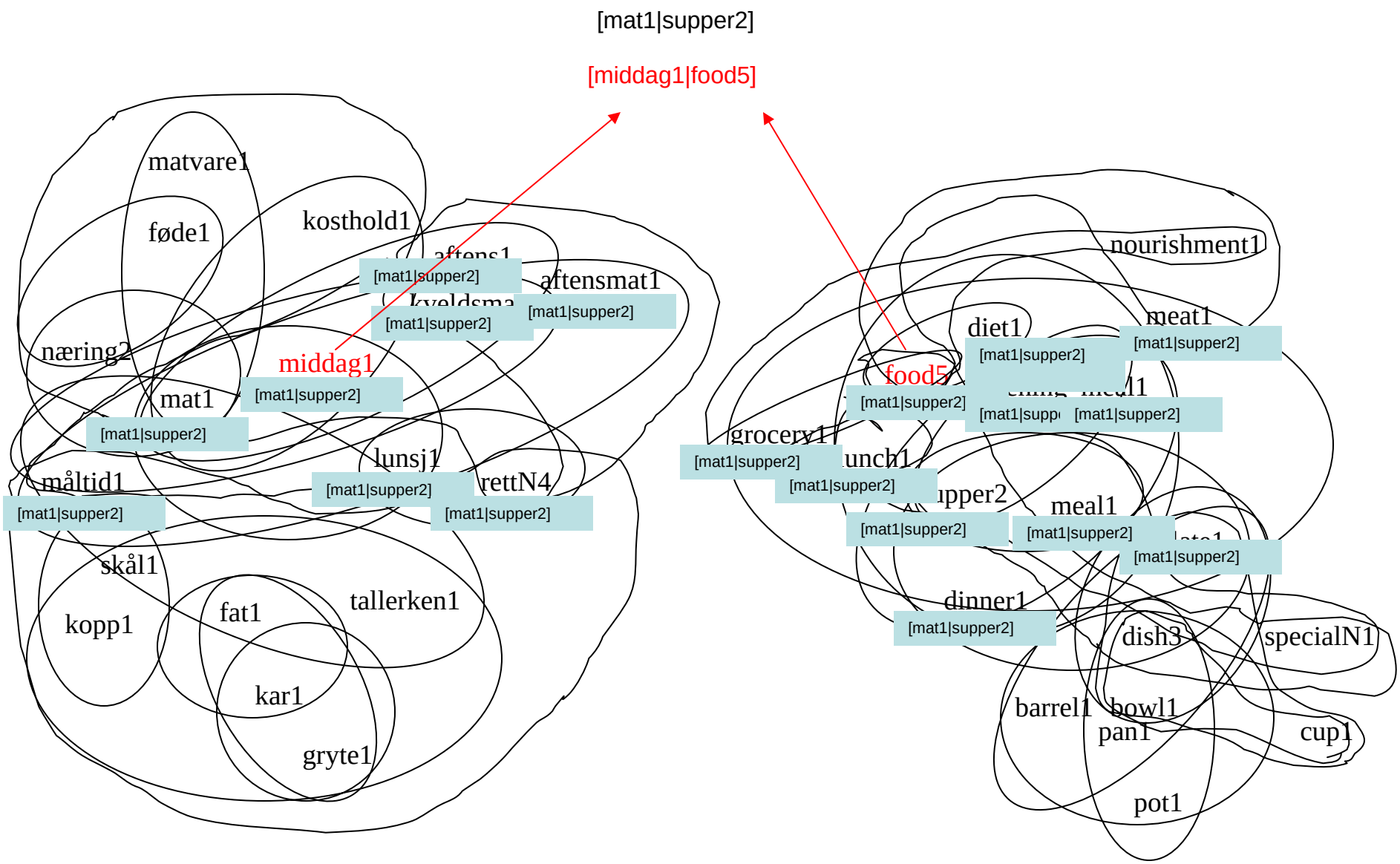
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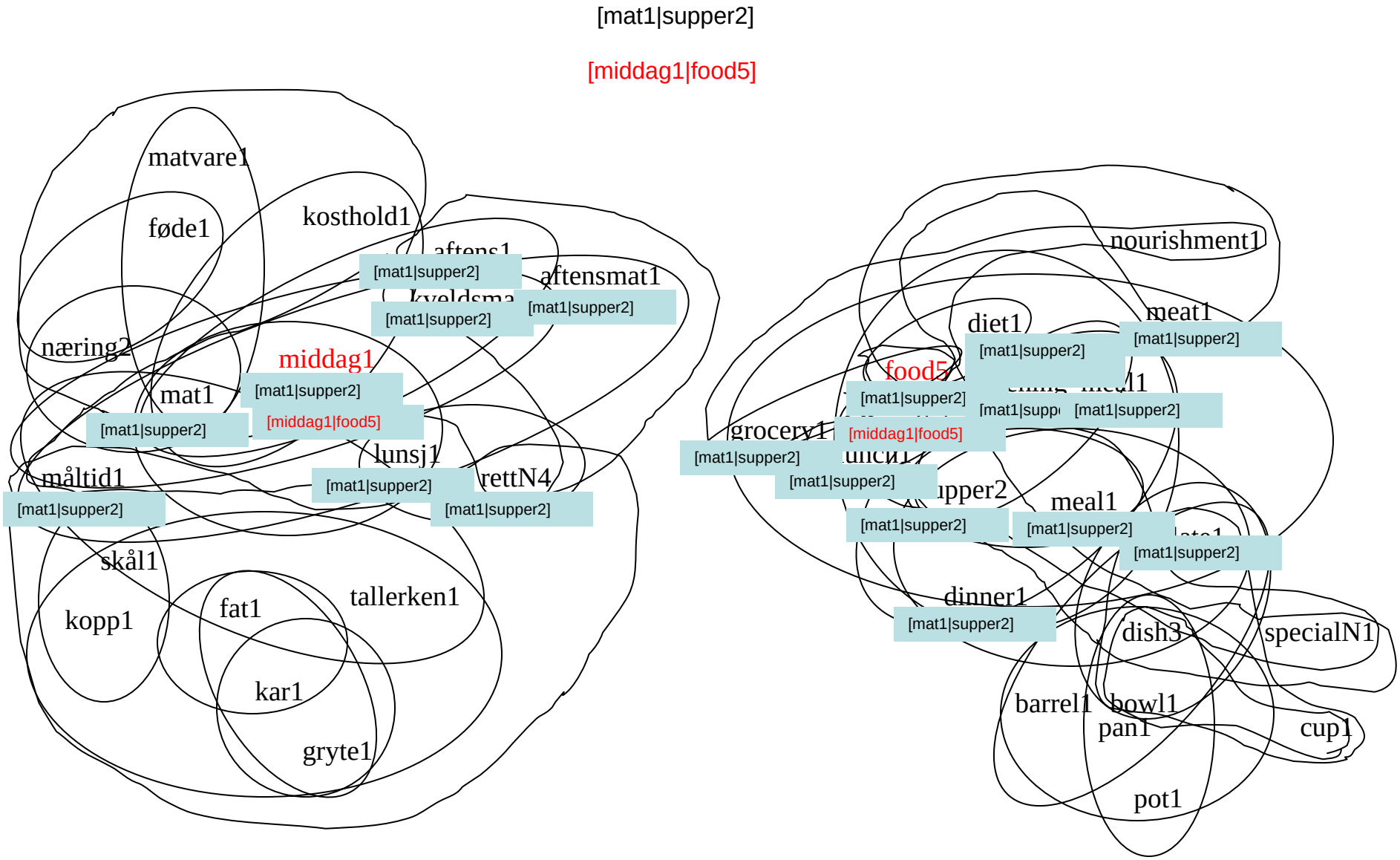
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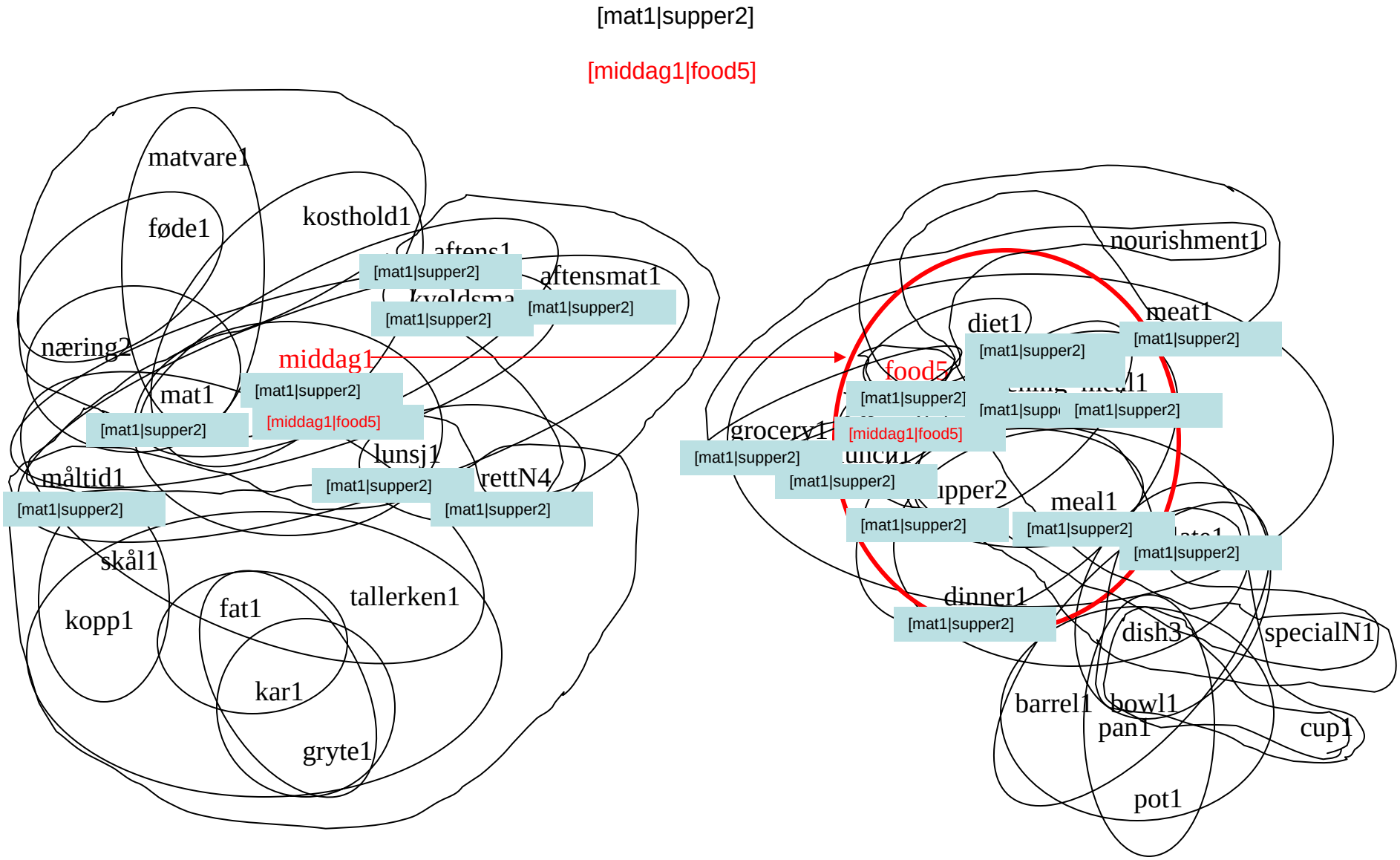
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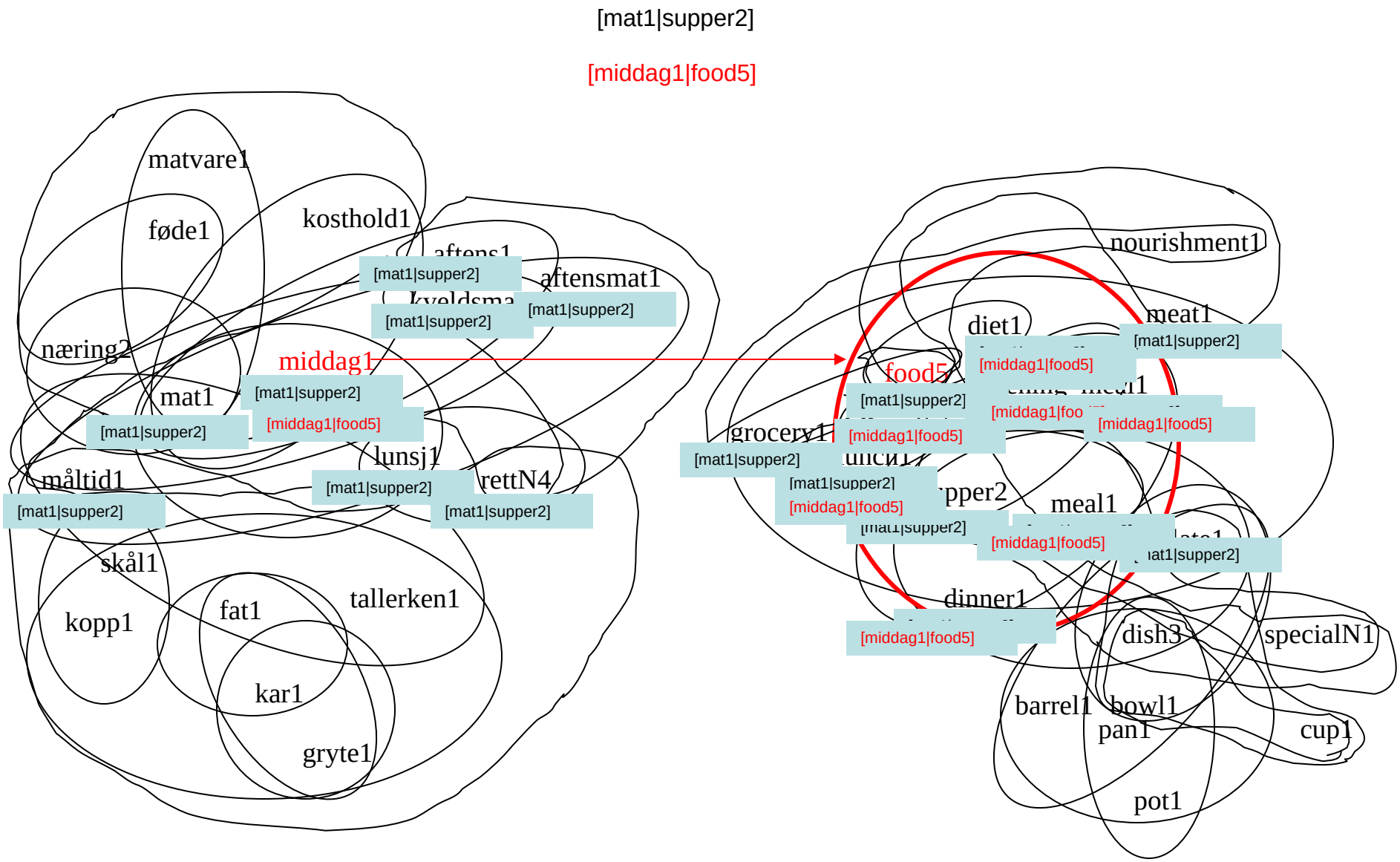
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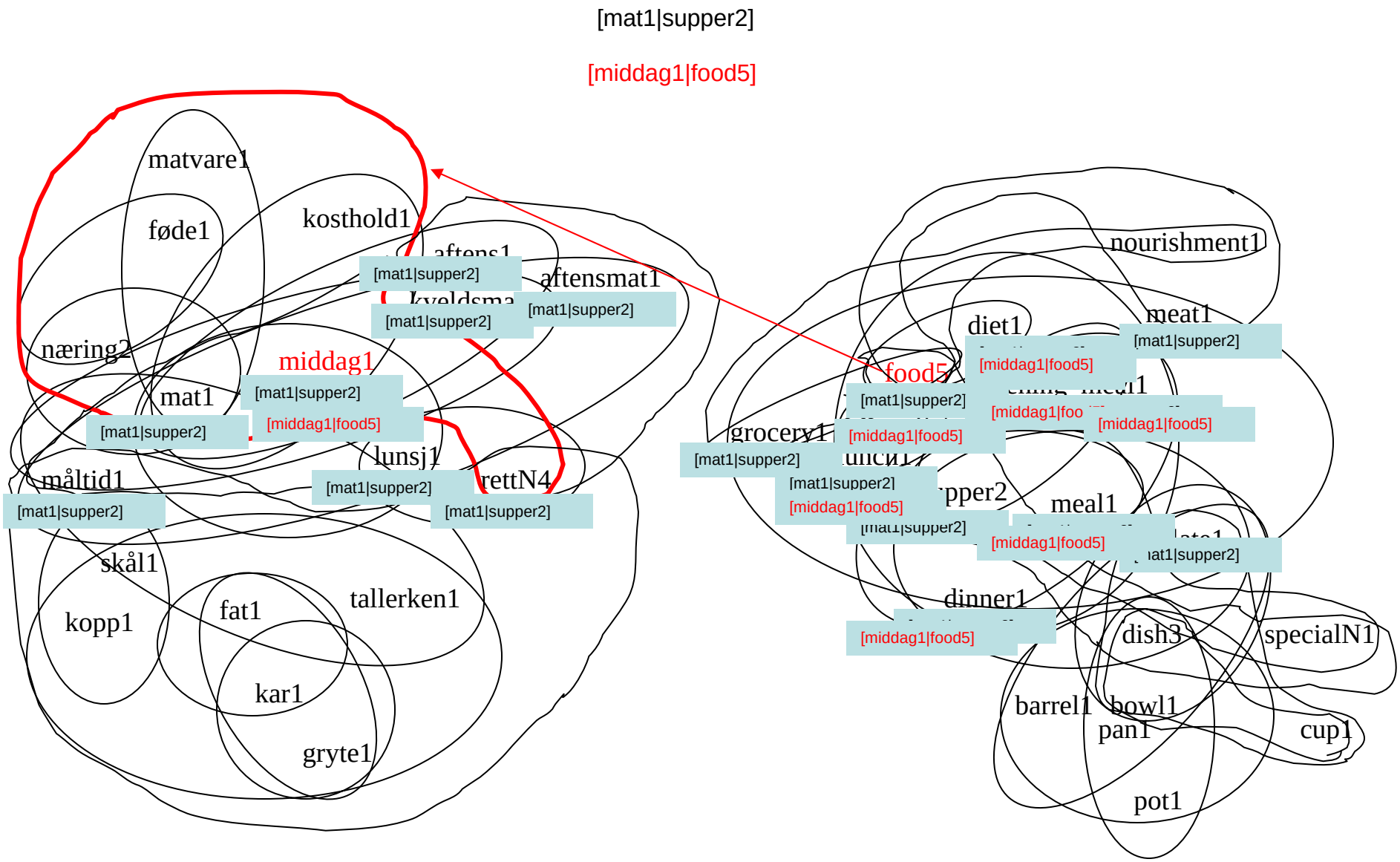
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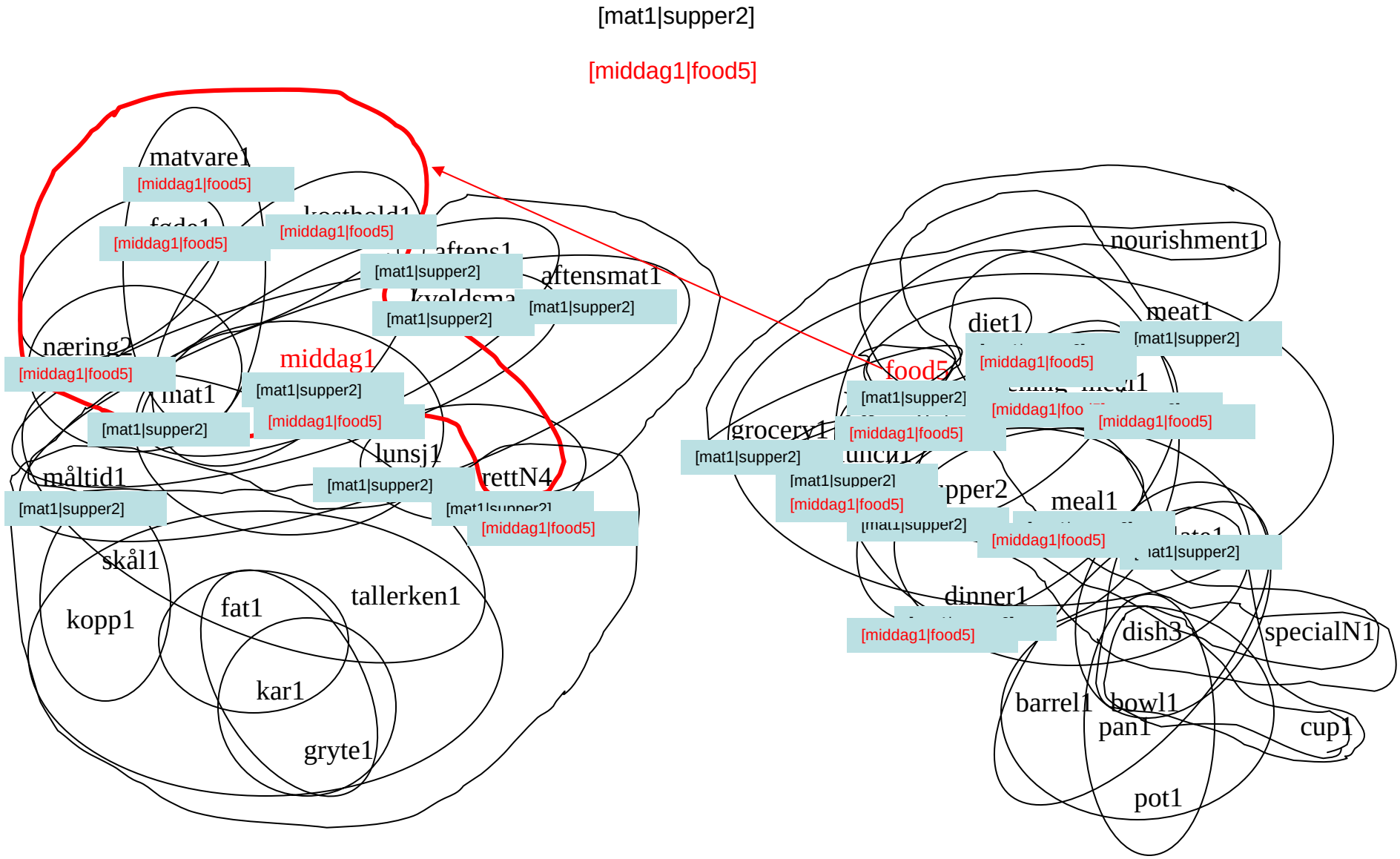
food5
[middag1|food5]
[mat1|supper2]
[middag1|foo
[middag1|food5]
grocery1
[middag1|food5]
[mat1|supper2]
[mat1|supper2]
[middag1|food5]
meal1
[middag1|food5]
[mat1|supper2]
dinner1
[middag1|food5]
dish3
specialN1
barrel1
bowl1
pan1
cup1
pot1


[mat1|supper2]
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[middag1|food5]
[middag1|food5]
[mat1|supper2]
aftensmat1
[mat1|supper2]
[mat1|supper2]
næring2
middag1
[middag1|food5]
mat1
[mat1|supper2]
[middag1|food5]
[mat1|supper2]
lunsj1
måltid1
[mat1|supper2]
rettN4
[mat1|supper2]
[middag1|food5]
skål1
kopp1
fat1
tallerken1
kar1
gryte1
nourishment1
meat1
diet1
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[middag1|food5]
food5
[mat1|supper2]
[middag1|food5]
[middag1|food5]
grocery1
[middag1|food5]
[mat1|supper2]
[mat1|supper2]
[middag1|food5]
meal1
[middag1|food5]
[mat1|supper2]
dinner1
[middag1|food5]
dish3
specialN1
barrel1
bowl1
pan1
cup1
pot1

aftens1
[mat1|supper2]
[aftens1|evening_meal1]

aftensmat1
[mat1|supper2]
[lunsj1|meal1]
[kveldsmat1|meal1]
[aftensmat1]

fat1
[fat1|dish3]

føde1
[middag1|food5]
[føde1|grocery1]

gryte1
[måltid1|dish3]
[fat1|dish3]
[kar1|dish3]
[gryte1|bowl1]

kar1
[kar1|dish3]

kopp1
[måltid1|dish3]
[fat1|dish3]
[kar1|dish3]
[skål1|bowl1]
[gryte1|bowl1]
[kopp1|cup1]

kosthold1
[middag1|food5]
[kosthold1|diet1]

kveldsmat1
[mat1|supper2]
[kveldsmat1|meal1]

lunsj1
[mat1|supper2]
[lunsj1|meal1]

mat1
[mat1|supper2]

matvare1
[middag1|food5]
[føde1|grocery1]
[matvare1]

middag1
[mat1|supper2]
[middag1|food5]

måltid1
[mat1|supper2]
[måltid1|dish3]

næring2
[middag1|food5]
[næring2|nourishment1]
[næring2|meat1]

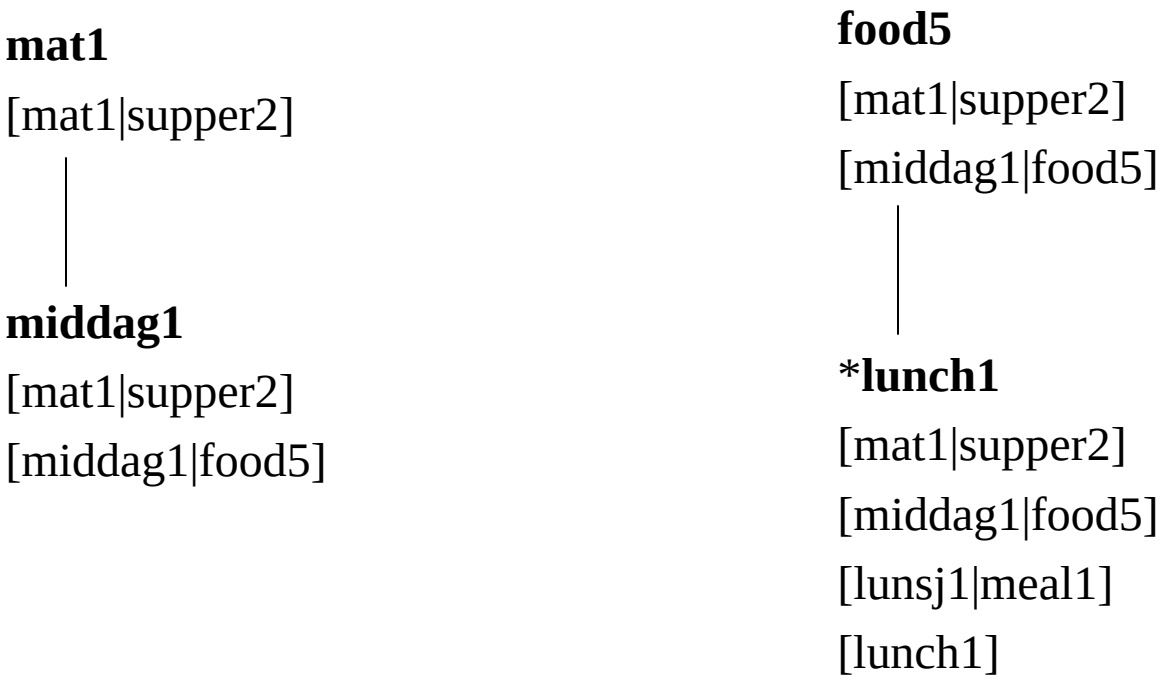
rettN4
[mat1|supper2]
[middag1|food5]
[måltid1|dish3]
[fat1|dish3]
[kar1|dish3]
[rettN4|specialN1]

skål1
[måltid1|dish3]
[fat1|dish3]
[kar1|dish3]
[skål1|bowl1]

tallerken1
[måltid1|dish3]
[fat1|dish3]
[kar1|dish3]
[skål1|bowl1]
[gryte1|bowl1]
[tallerken1|plate1]

***barrel1** [fat1|dish3] [kar1|dish3] [barrel1] ***bowl1** [fat1|dish3] [kar1|dish3] [gryte1|bowl1] [skål1|bowl1] ***cup1** [skål1|bowl1] [kopp1|cup1] ***diet1** [mat1|supper2] [middag1|food5] [kosthold1|diet1]	***dinner1** [mat1|supper2] [middag1|food5] [måltid1|dish3] [kveldsmat1|meal1] [dinner1] **dish3** [kar1|dish3] [fat1|dish3] [måltid1|dish3] ***evening_meal1** [mat1|supper2] [middag1|food5] [kveldsmat1|meal1] [aftens1|evening_meal1] **food5** [mat1|supper2] [middag1|food5] ***grocery1** [mat1|supper2] [føde1|grocery1]	***lunch1** [mat1|supper2] [middag1|food5] [lunsj1|meal1] [lunch1] ***meal1** [mat1|supper2] [middag1|food5] [måltid1|dish3] [kveldsmat1|meal1] [lunsj1|meal1] ***meat1** [mat1|supper2] [næring2|meat1] ***nourishment1** [føde1|grocery1] [næring2|nourishment1]	***pan1** [fat1|dish3] [kar1|dish3] [gryte1|bowl1] [pan1] ***plate1** [mat1|supper2] [måltid1|dish3] [fat1|dish3] [skål1|bowl1] [tallerken1|plate1] ***pot1** [kar1|dish3] [gryte1|bowl1] [pot1] **specialN1** [lunsj1|meal1] [rettN4|specialN1] **supper2** [mat1|supper2]

Assumption:
Feature set inclusion expresses hyperonymy/hyponymy



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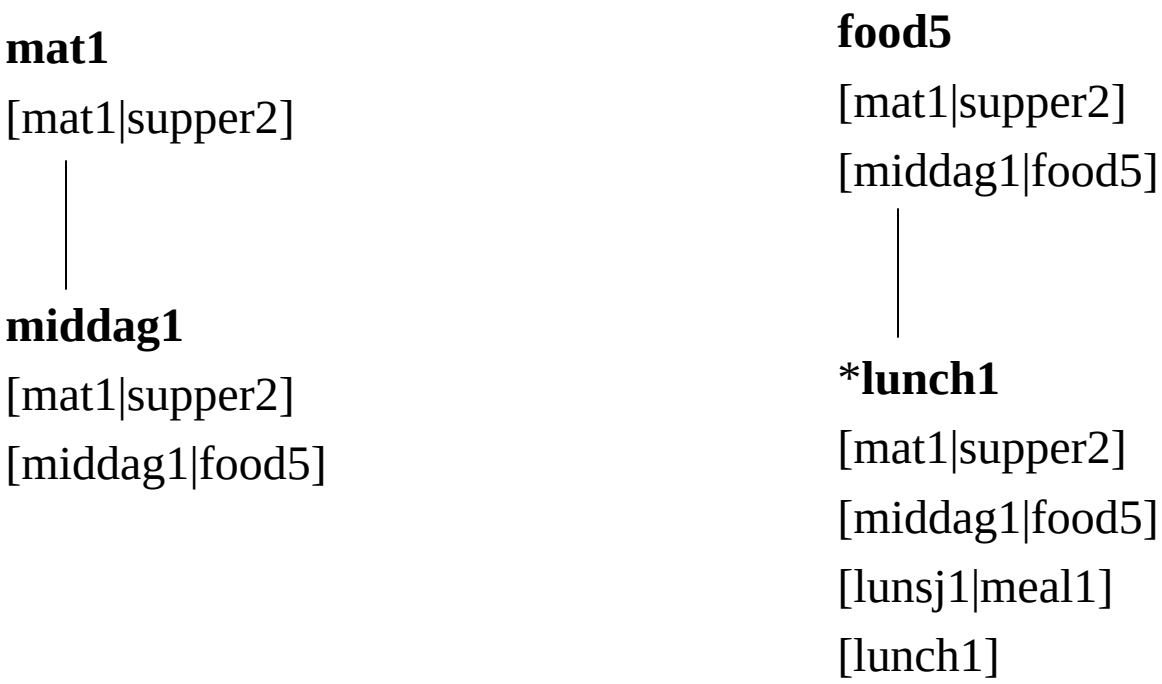

The set of senses in a field can be seen as a *partially ordered set*, ordered by set inclusion.

A *semilattice* (upper):
A partially ordered set in which each pair of elements has a *least upper bound*.

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A partially ordered set in which each pair of elements has a *least upper bound*.

Applied to our case:
For each pair of feature sets,

- either one set includes the other,
- or there is a third element consisting of the intersection of the two sets.

A *semilattice* (upper):
A partially ordered set in which each pair of elements has a *least upper bound*.

Applied to our case:
For each pair of feature sets,

- either one set includes the other,
- or there is a third element consisting of the intersection of the two sets.

Constructing a semilattice allows us to compare the distances between all senses

Constructing a semilattice:

If two feature sets intersect without inclusion,

busy2

[full5|bright2]
[effektiv2|excellent1]
[livlig1|brisk2]
[opptatt1|busy2]

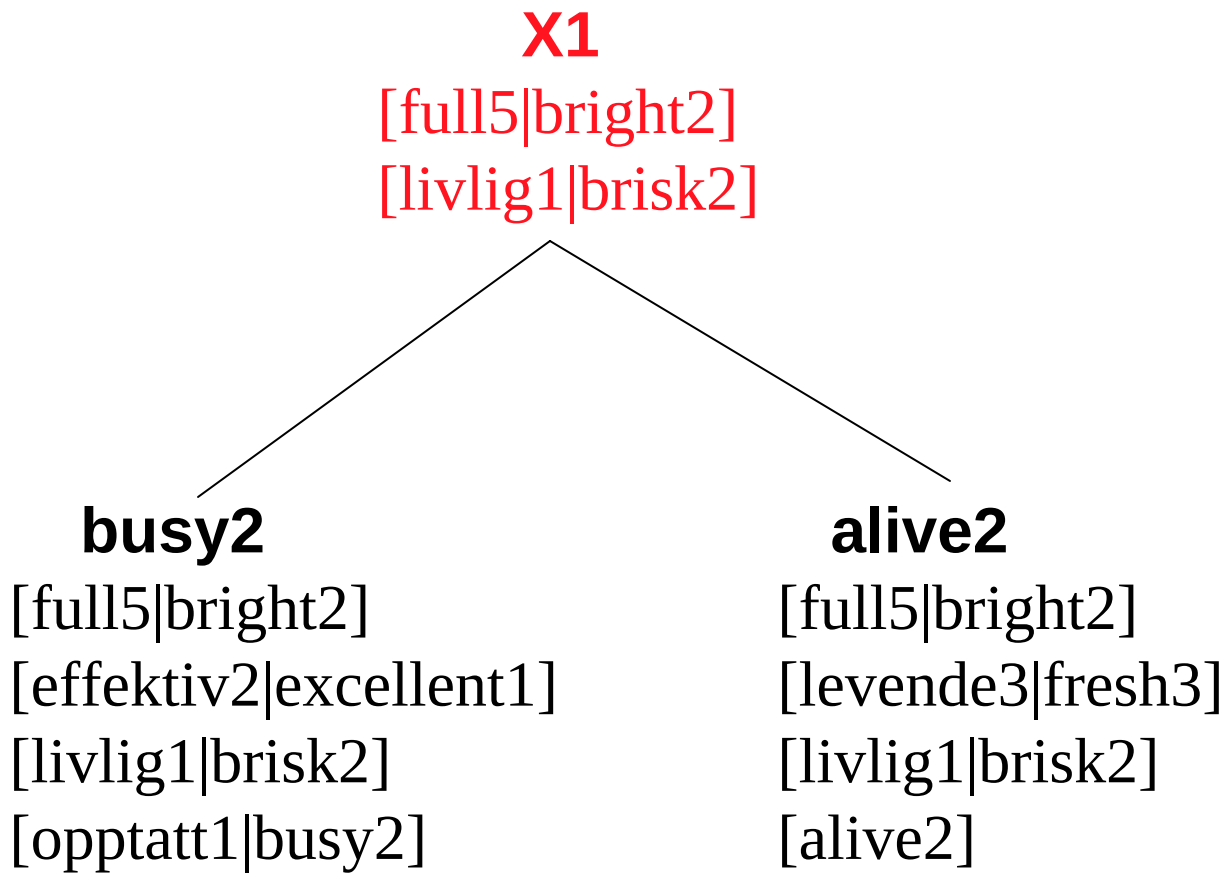
alive2

[full5|bright2]
[levende3|fresh3]
[livlig1|brisk2]
[alive2]

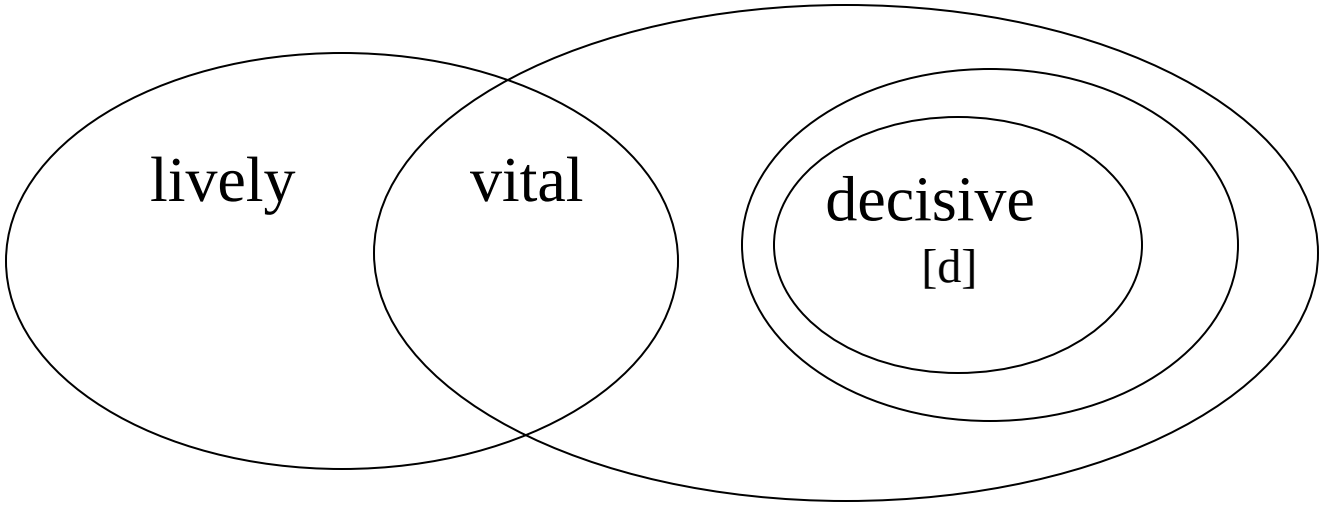
Constructing a semilattice:

If two feature sets intersect without inclusion,

a «virtual» mother node with the intersection of the two feature sets is constructed:



A sense only transfers its *own* features downwards, not its *inherited* features:



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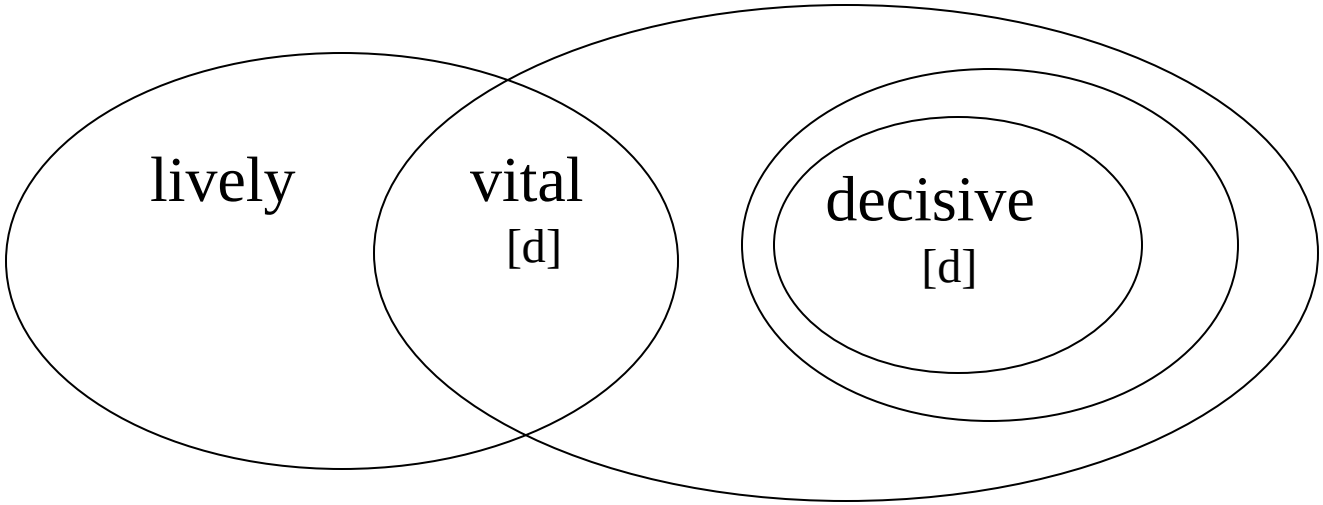

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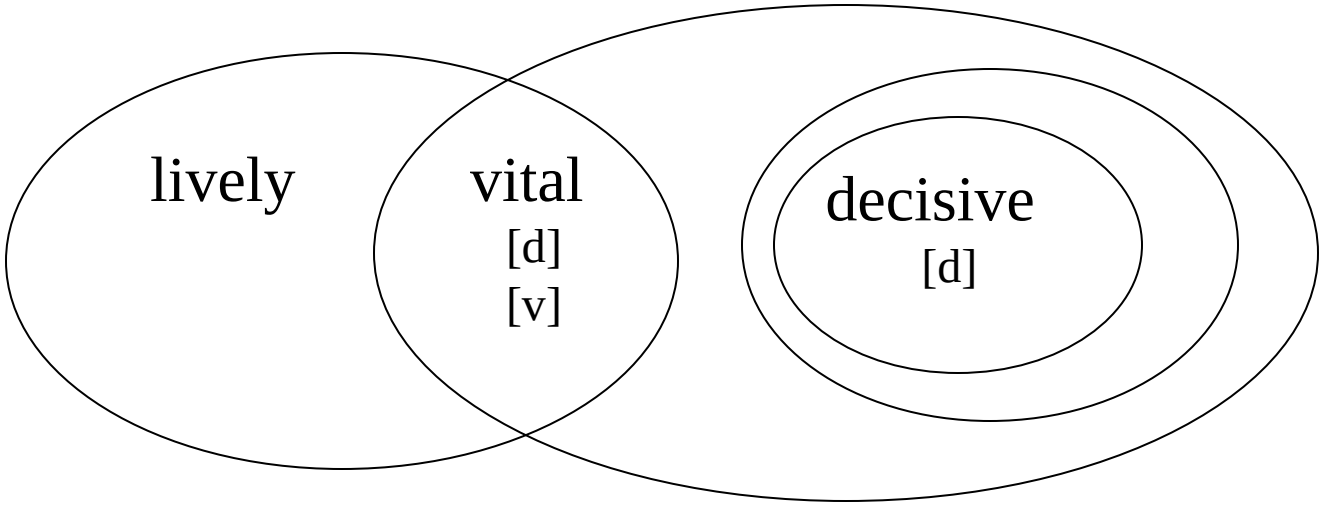

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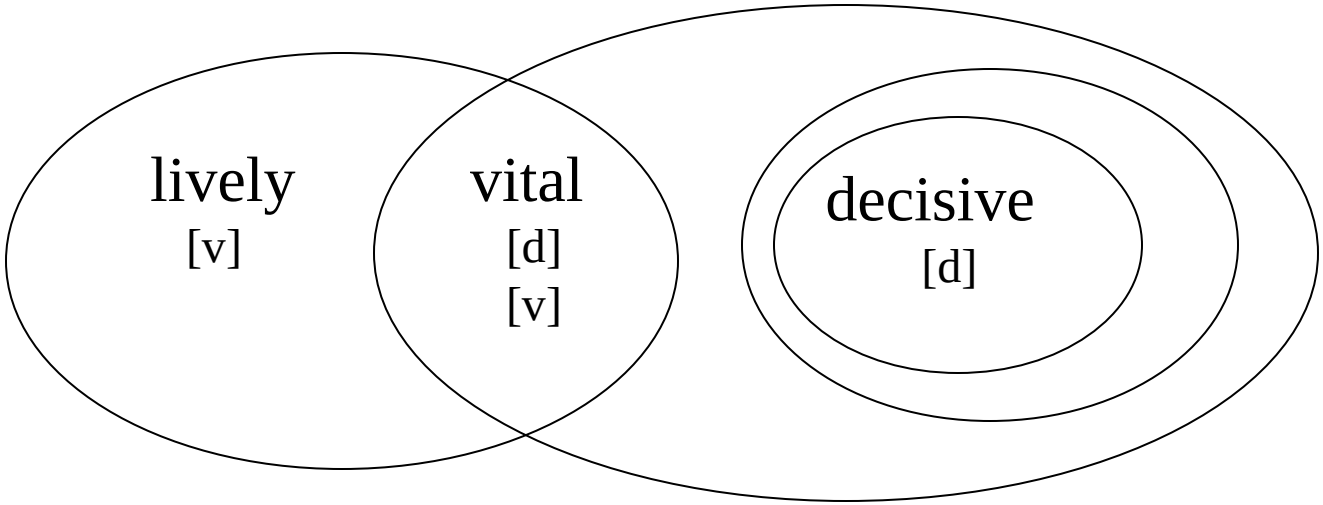

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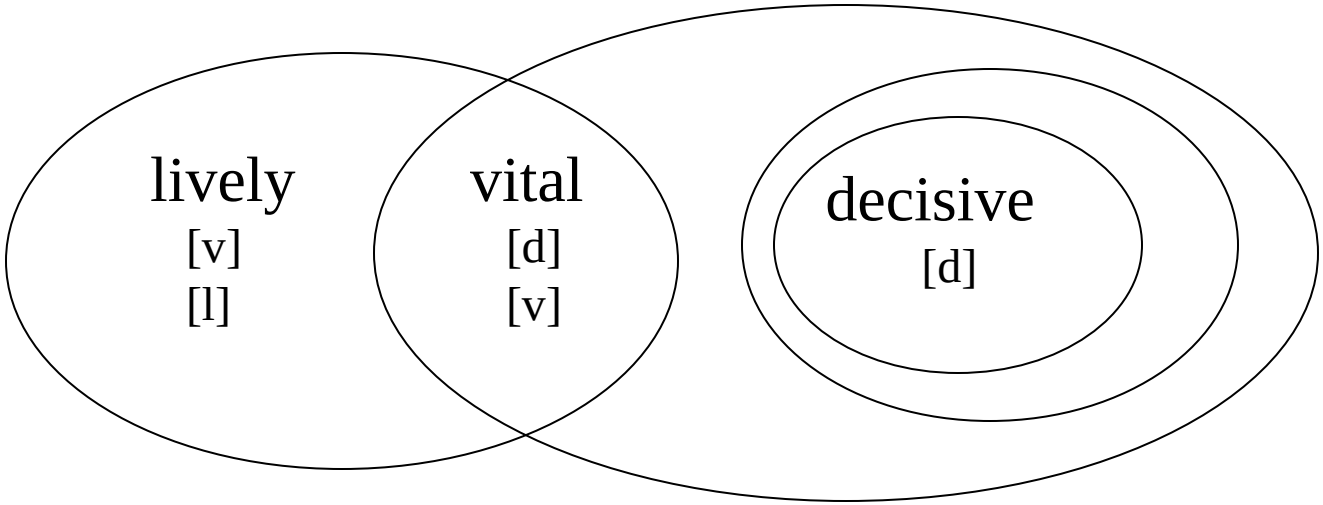

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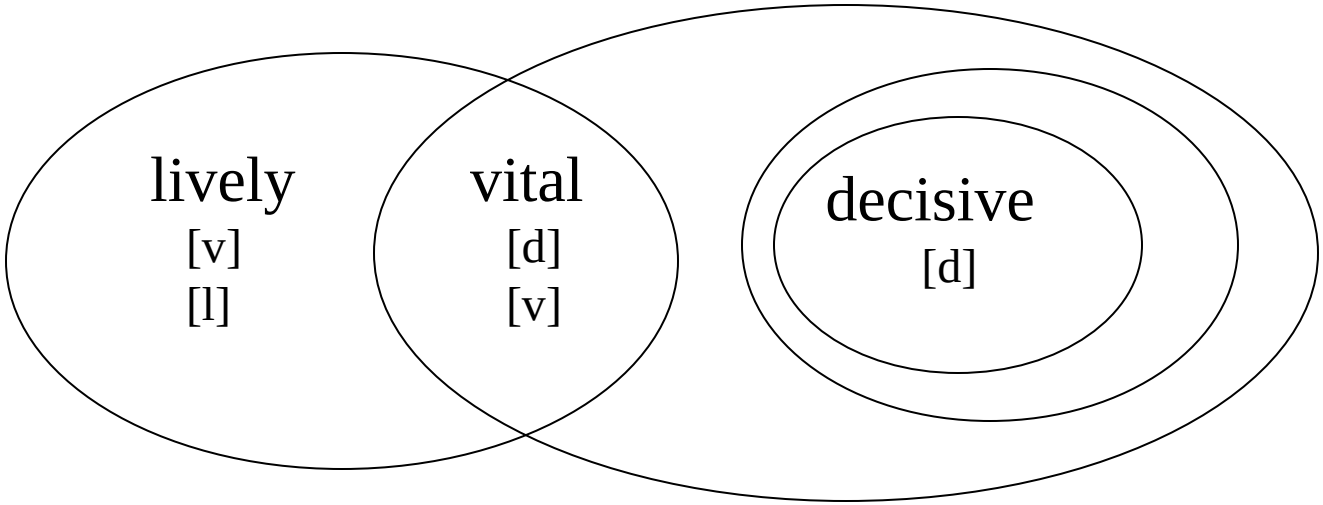
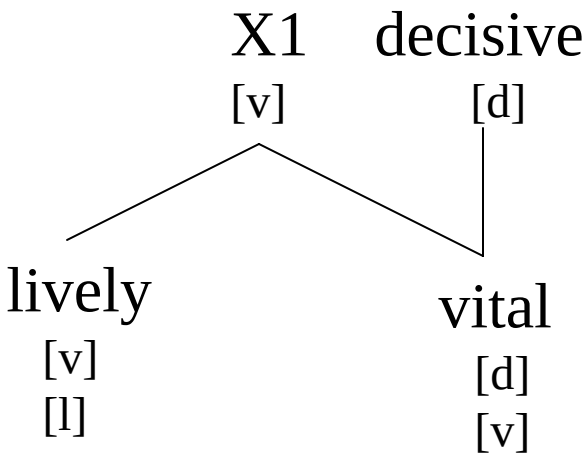
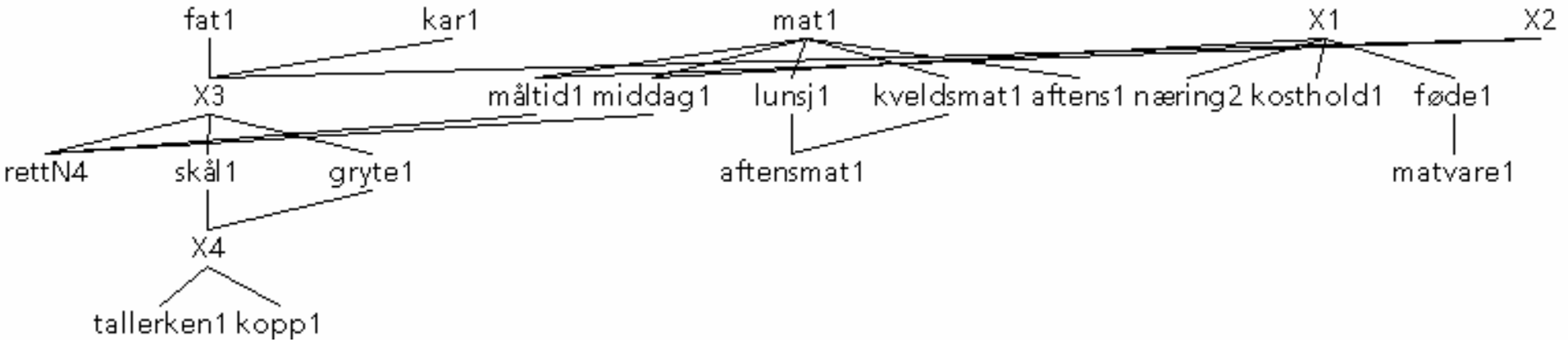


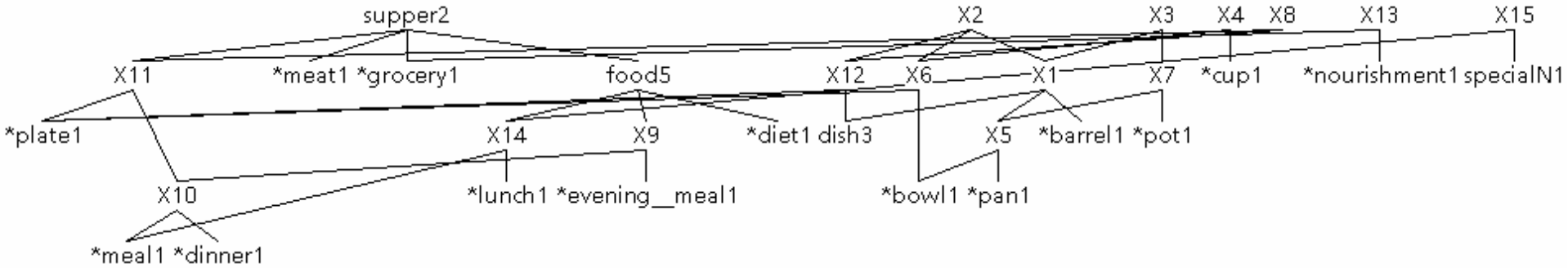
Resulting lattice:



Norwegian semantic field as lattice graph



Corresponding English semantic field



Features assigned to *sweet1*:

sweet1
[god3|good1]
[fin2|nice2]
[pen1|gentle3]
[vakker1|soft2]
[snill1|pleasant1]
[deilig1|splendid3]
[frisk4|sweet1]
[blid3|sweet1]

The feature denotations:

[god3|good1]:
(able1 accurate1 adept1 adequate2 affectionate1 all_right2 amiable2 appropriate5 attractive4 beautiful2 beneficial1 benign3 bright2 burning3 charming2 clean1 clear1 close3 comfortable2 comforting3 competent2 confident2 correct1 cozy2 cute1 decent2 delicious1 delightful2 detailed3 dishy1 easy1 efficient2 elegant3 excellent2 fair2 fancy1 favourable1 fine1 firmA1 first-class3 first-rate2 fit3 fortunate1 fresh3 friendly2 full2 genuine2 good1 handsome2 happy3 healthy2 high3 hot2 joyful2 kind1 kindly1 long3 lovely2 lucky2 magnificent3 marvellous1 neat2 nice2 okay1 peaceful1 perfect3 placid2 pleasant1 pleased2 pleasing1 pleasurable1 plentiful1 plenty1 polite2 positive1 pretty2 proficient1 quite_certain1 real2 reassuring2 respectable3 right2 ripe1 safe2 satisfactory1 satisfying1 secure2 sizeable1 smart2 smooth3 soft2 solid2 sound2 spectacular2 steady1 strong3 successful2 suited1 superb2 superior5 sure1 sweet1 talented2 thorough1 tidy1 well2 whole2 wholesome1 wonderful3 worthy2)

[fin2|nice2]:
(attractive4 beautiful2 breathtaking2 charming2 comfortable2 cute1 delicate3 dishy1 easy1 elegant3 enchanting1 excellent2 fancy1 fine1 first-class3 gentle3 glorious4 graceful2 handsome2 impressive2 lovely2 magnificent3 marvellous1 neat2 nice2 okay1 perfect3 pleasurable1 polite2 pretty2 pure2 slight3 smart2 soft2 splendid3 sweet1 thin2 wonderful3)

[pen1|gentle3]:
(attractive4 beautiful2 charming2 clean1 cute1 dishy1 elegant3 enchanting1 fancy1 fine1 first-class3 formal1 gentle3 graceful2 handsome2 lovely2 neat2 pleasant1 polite2 pretty2 soft2 sweet1 tidy1)

[vakker1|soft2]:
(attractive4 charming2 cute1 delightful2 dishy1 enchanting1 fair2 fancy1 graceful2 handsome2 lovely2 magnificent3 mild2 ornate2 pleasant1 pleasurable1 pretty2 soft2 sweet1)

[snill1|pleasant1]:
(all_right2 amiable2 benign3 friendly2 good-humoured1 good-natured3 jolly1 kind1 kindly1 mild3 pleasant1 pleasing1 polite2 smiling2 sweet1)

[deilig1|splendid3]:
(beautiful2 charming2 cute1 enchanting1 delicious1 delightful2 pleasureable1 splendid3 sweet1)

[frisk4|sweet1]:
(all_right2 brisk5 eager2 fit3 fresh3 healthy2 new1 pert2 sweet1 well2)

[blid3|sweet1]:
(amiable2 blithe3 cheerful4 cheery1 good-humoured1 good-natured3 jolly1 kind1 kindly1 merry1 mild3 smiling2 sweet1)

SynsetLimit (integer)

Given the feature set *F* of a sense *s*:

SynsetLimit (integer)

Given the feature set F of a sense s:

For a feature $f \in F$, if the cardinality of f's denotation exceeds *SynsetLimit*, then its members are not included among possible synonyms or related words (except if denoted by other features).

SynsetLimit (integer)

Given the feature set F of a sense s:

For a feature $f \in F$, if the cardinality of f's denotation exceeds *SynsetLimit*, then its members are not included among possible synonyms or related words (except if denoted by other features).

The sense from which such a feature was constructed
is considered a *hyperonym* of s.

Synonyms (close) and *related words* (less close):

Defined in terms of feature sharing
(number and kind of shared features)

Related subsenses:

The division of a given sense into related subsenses does not have a unique solution.

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We may want to vary the granularity of such divisions according to our purposes.

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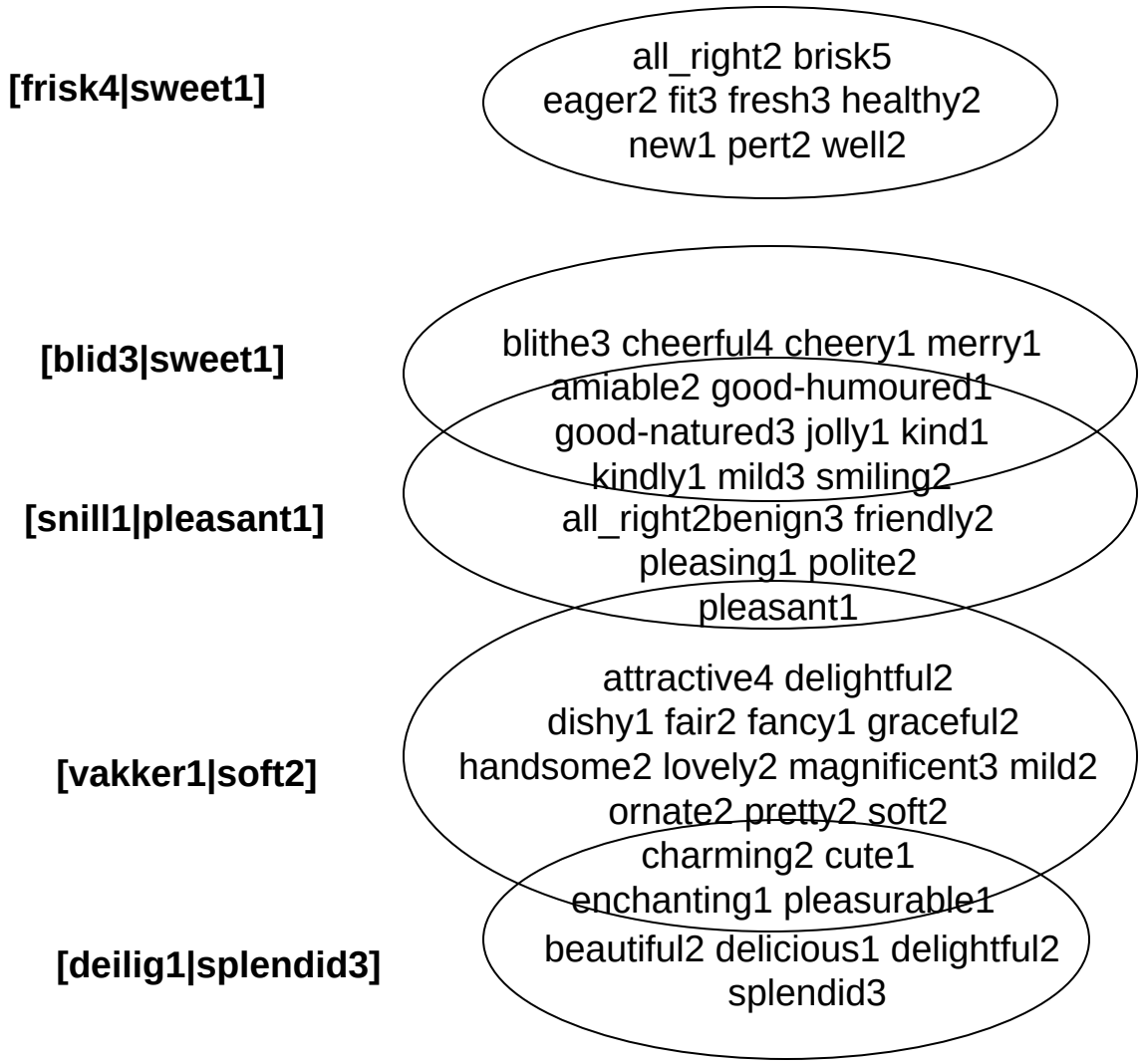
The parameter *OverlapThreshold* allows us to do this.

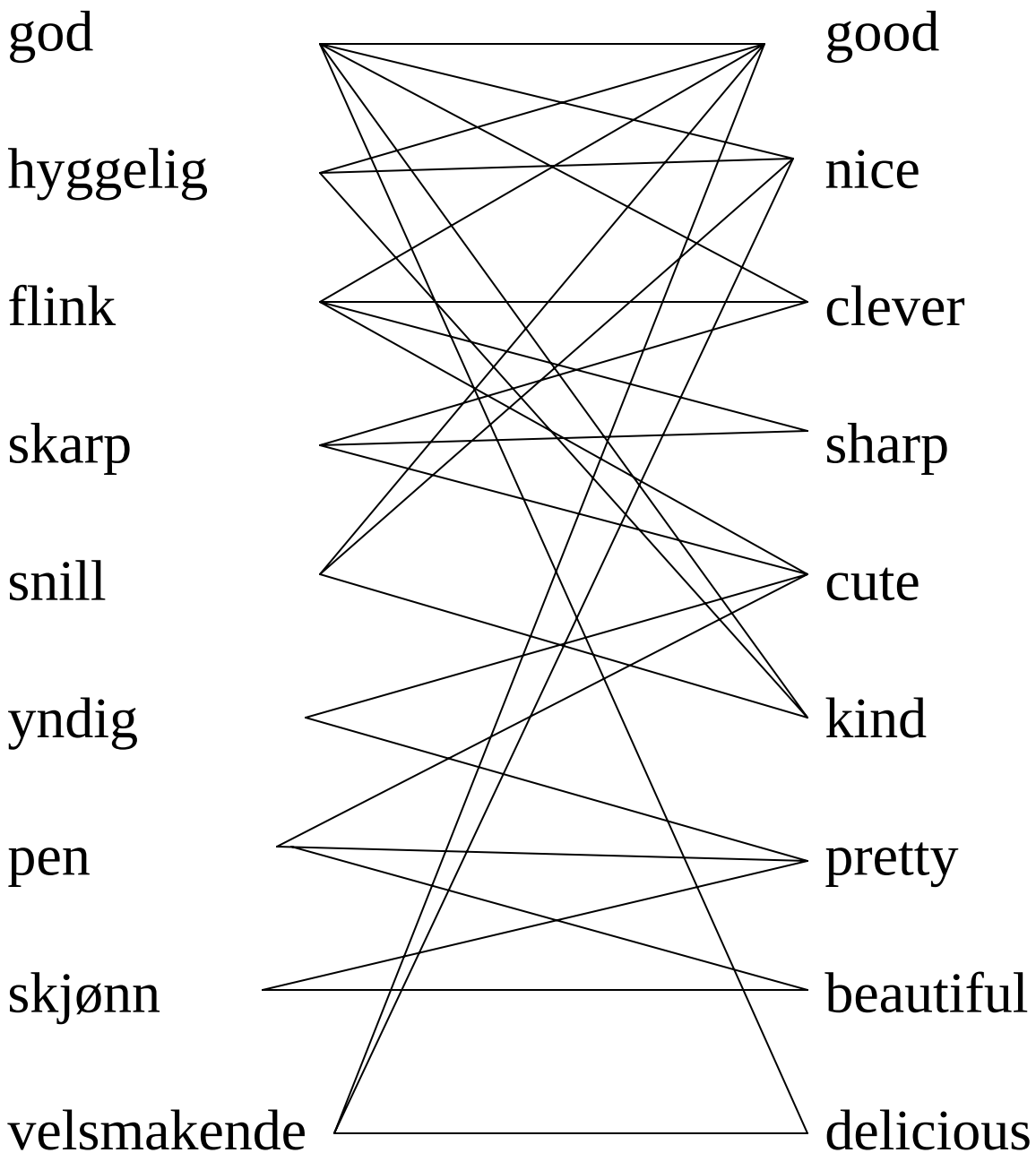
OverlapThreshold [0,1]:
Specifies the minimal *overlap degree* of two feature denotations for the features to be counted as belonging to the same subsense.

Intersecting feature denotations:



Web demo...

http://ling.uib.no/~helge/mirrwebguide.html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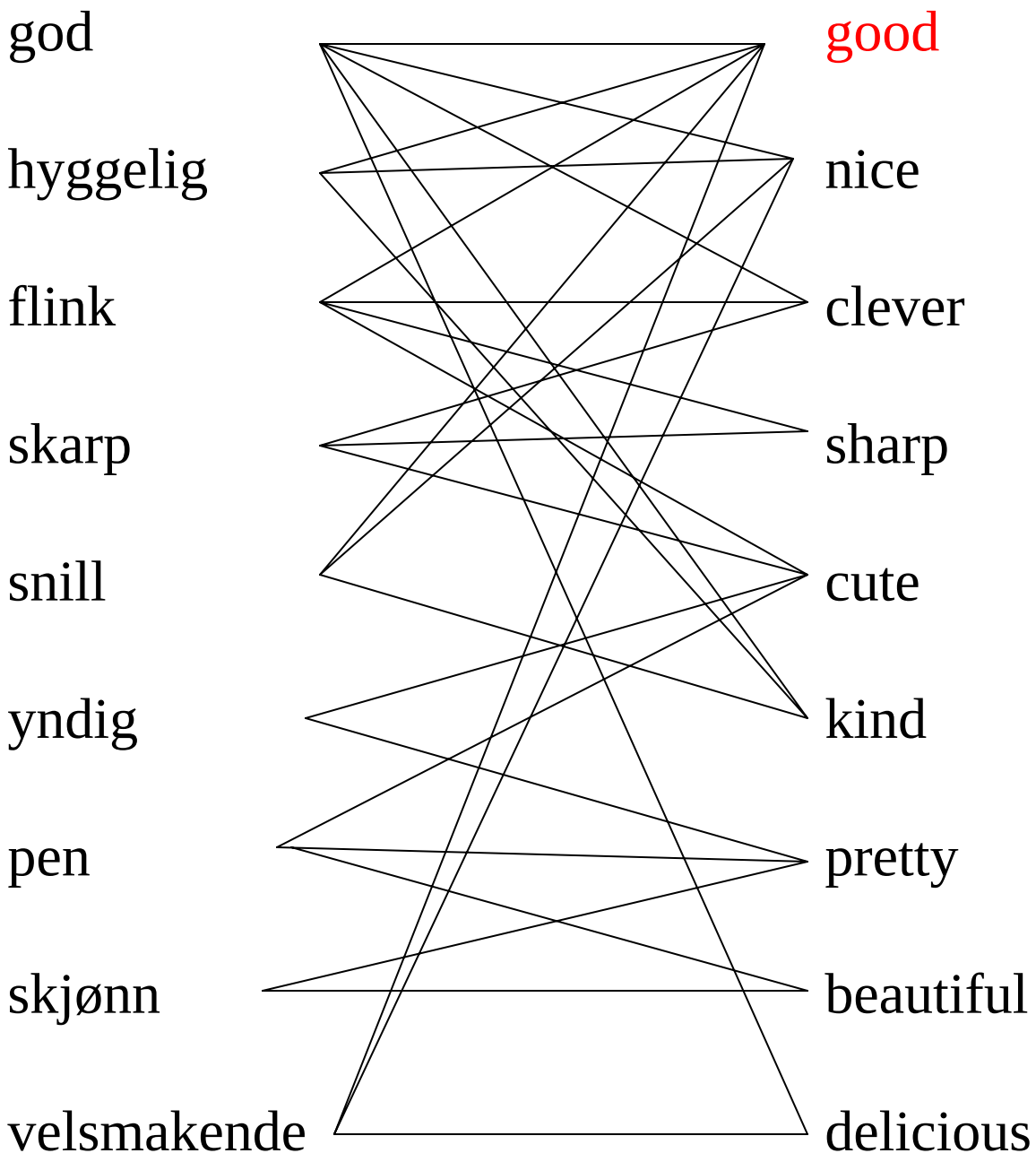
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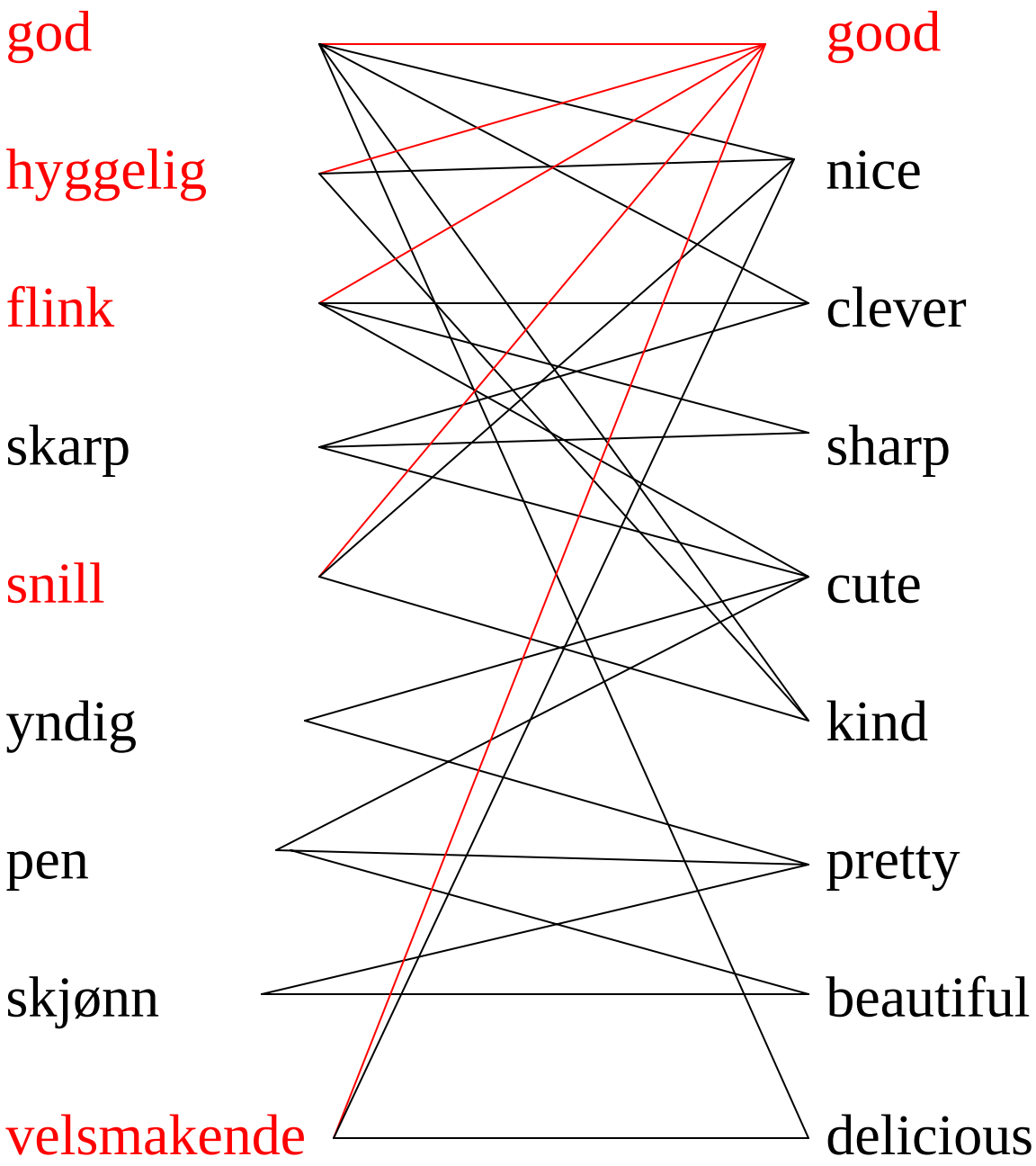
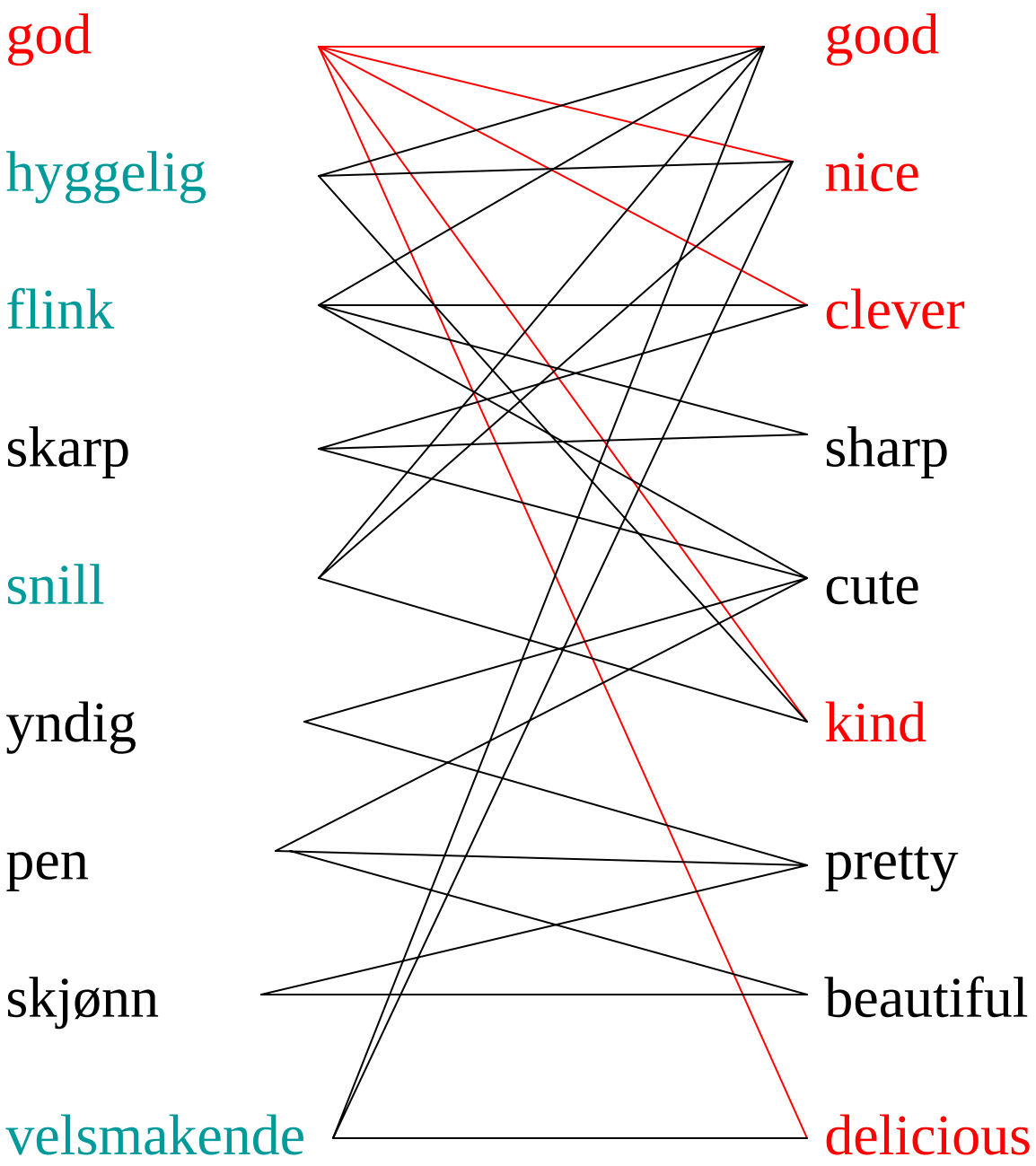
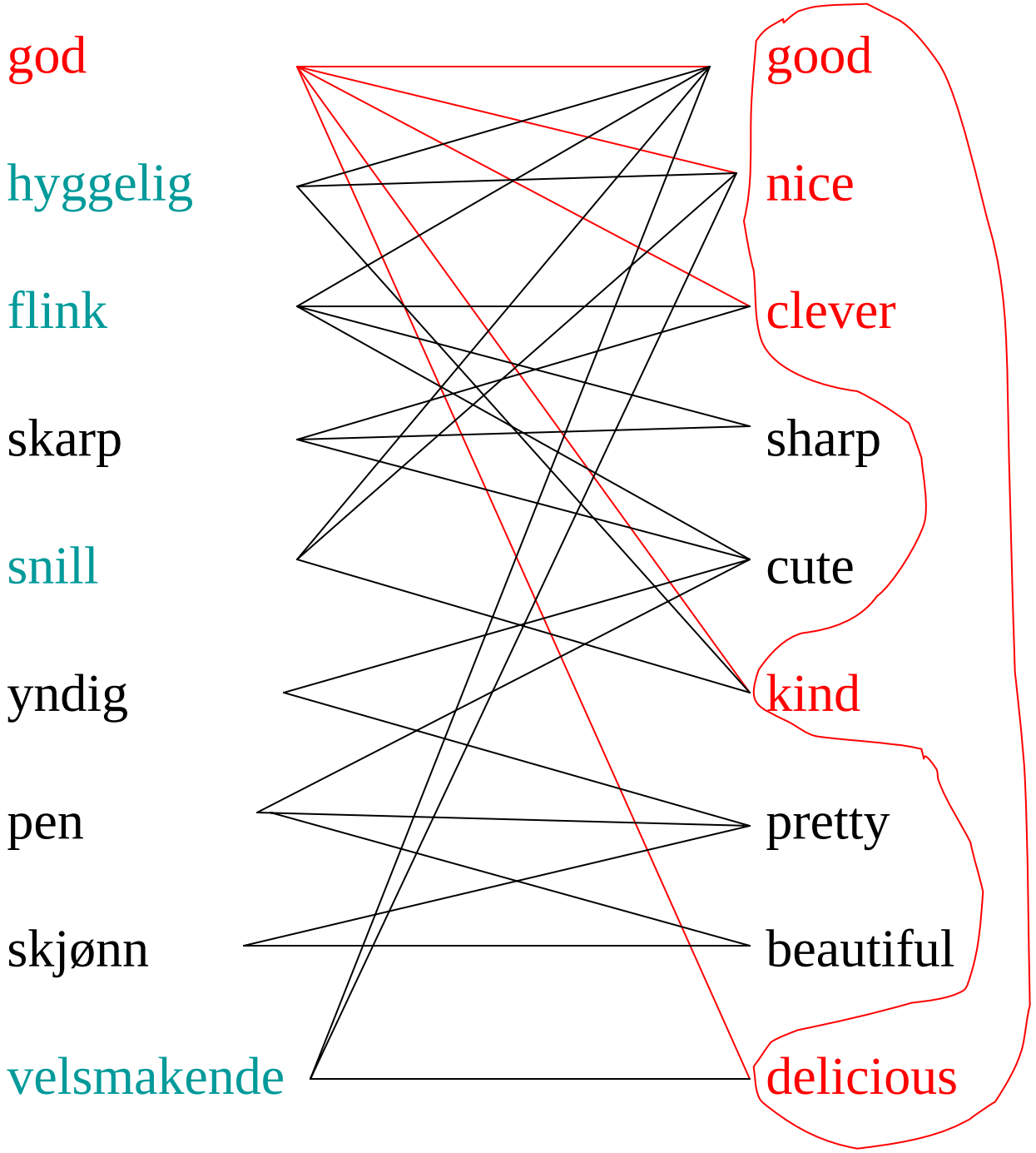
The first *t*-image of 'good'

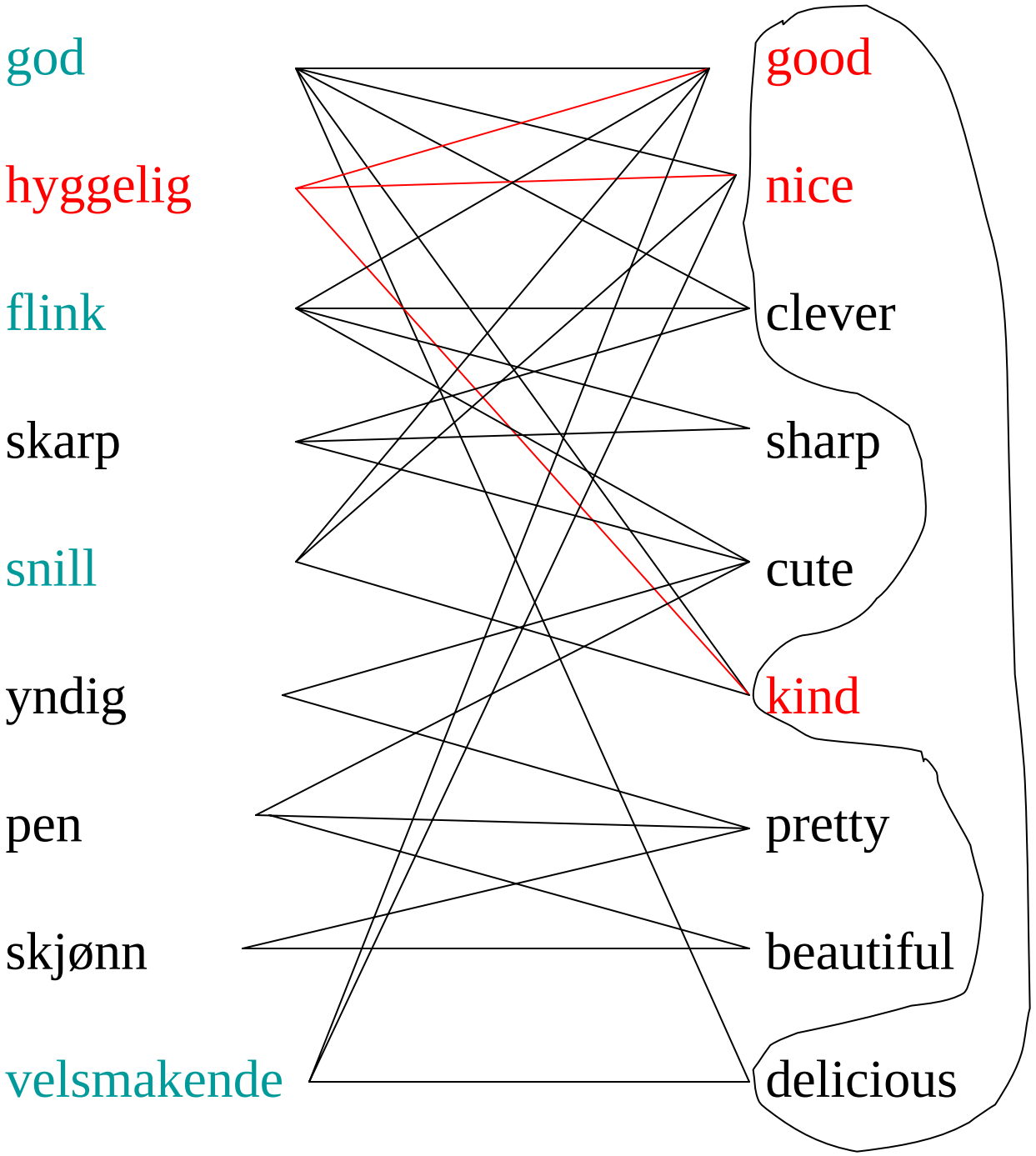




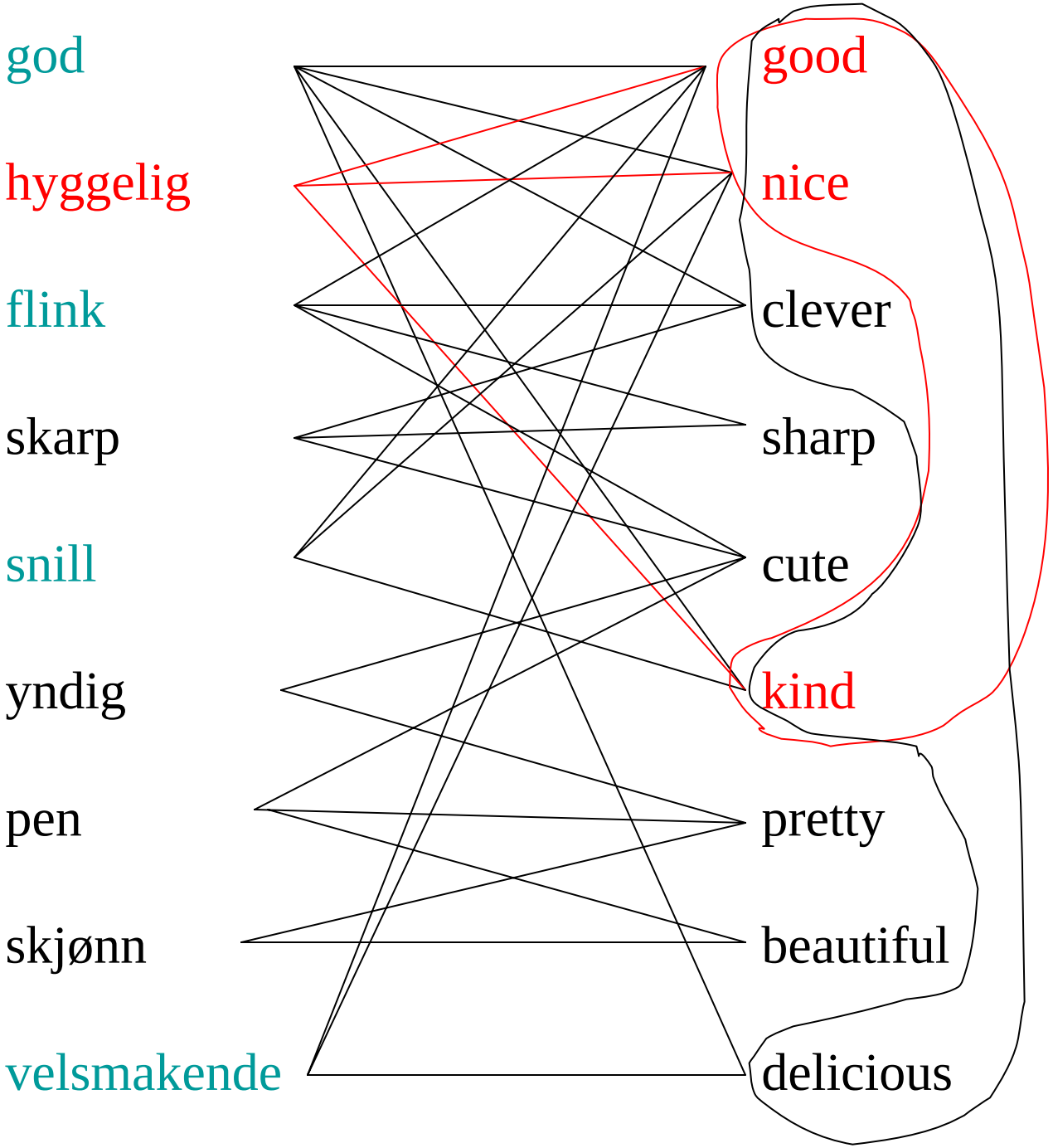
The inverse *t*-image of 'good' I



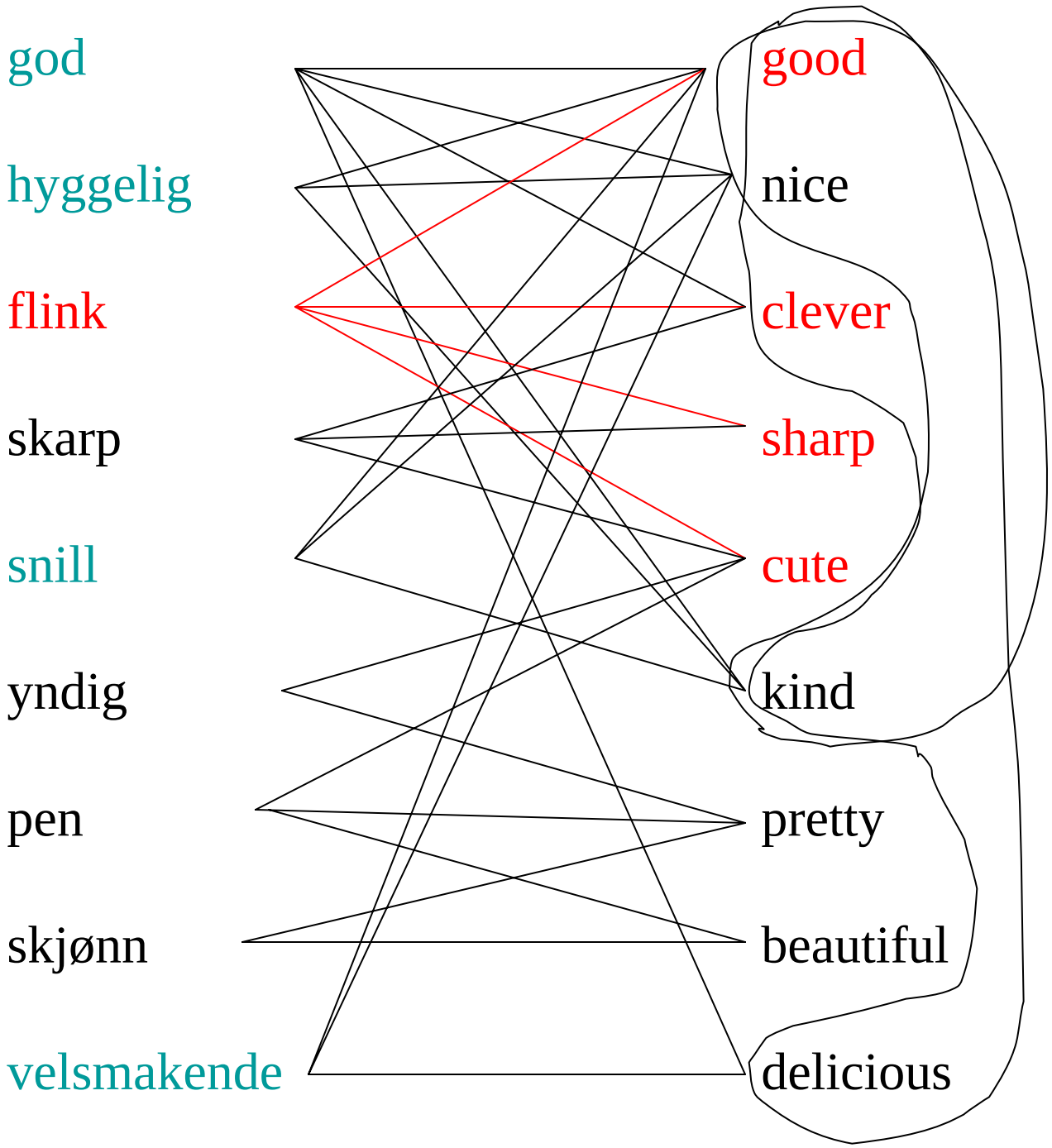
The inverse *t*-image of ‘good’ I



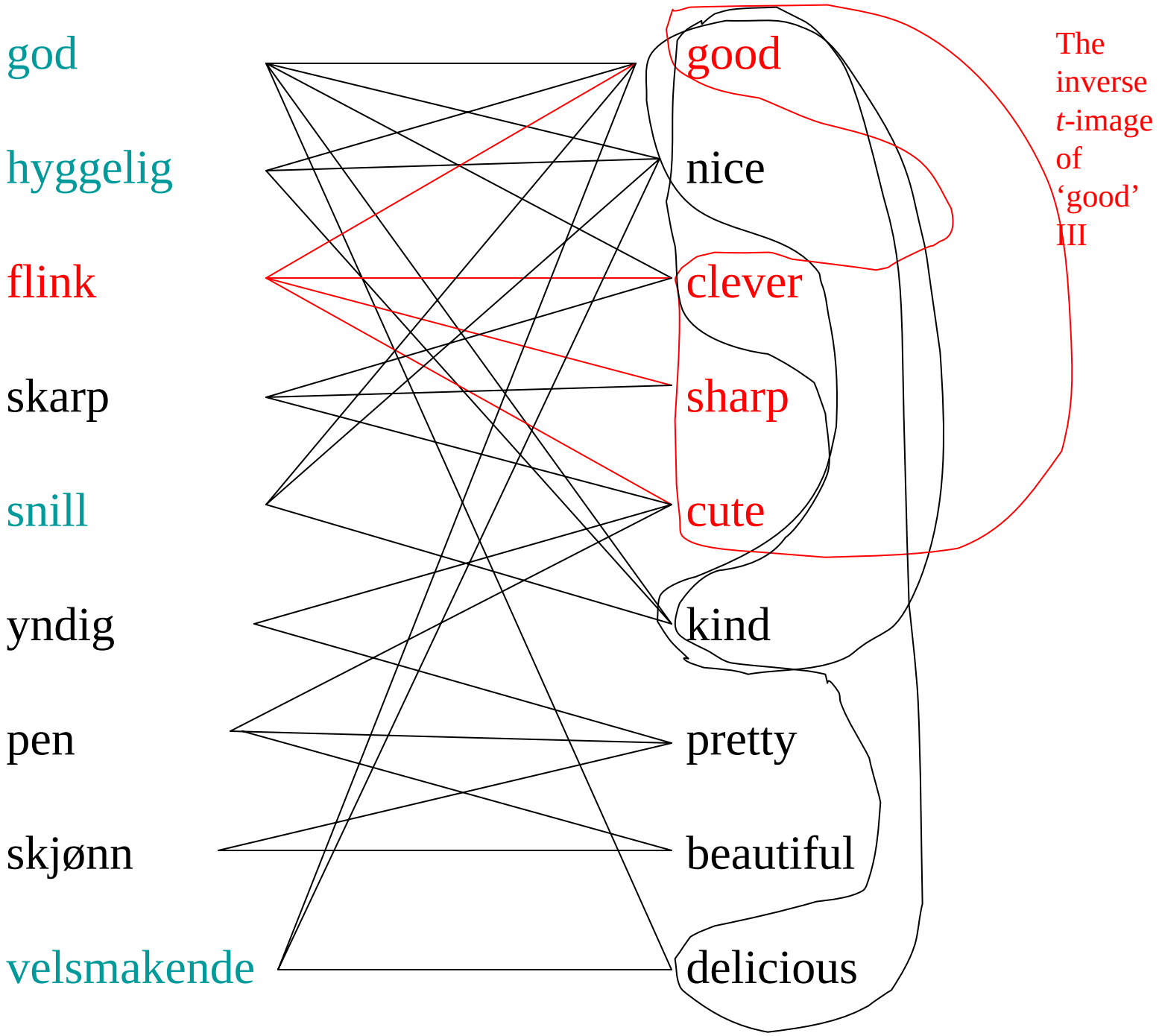
The inverse *t*-image of 'good' II



The inverse *t*-image of 'good' II



The inverse *t*-image of 'good' III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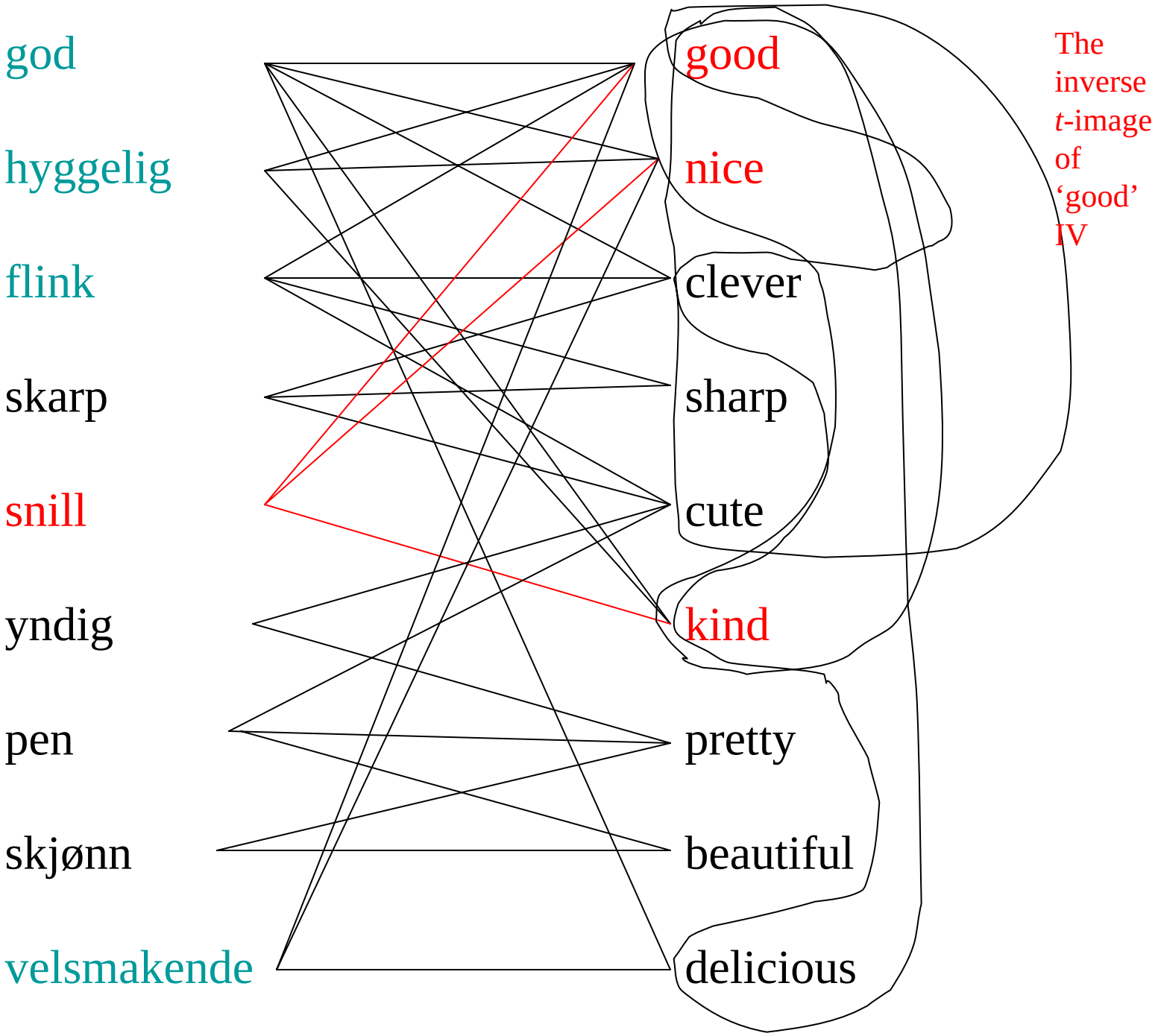
The inverse *t*-image of 'good' III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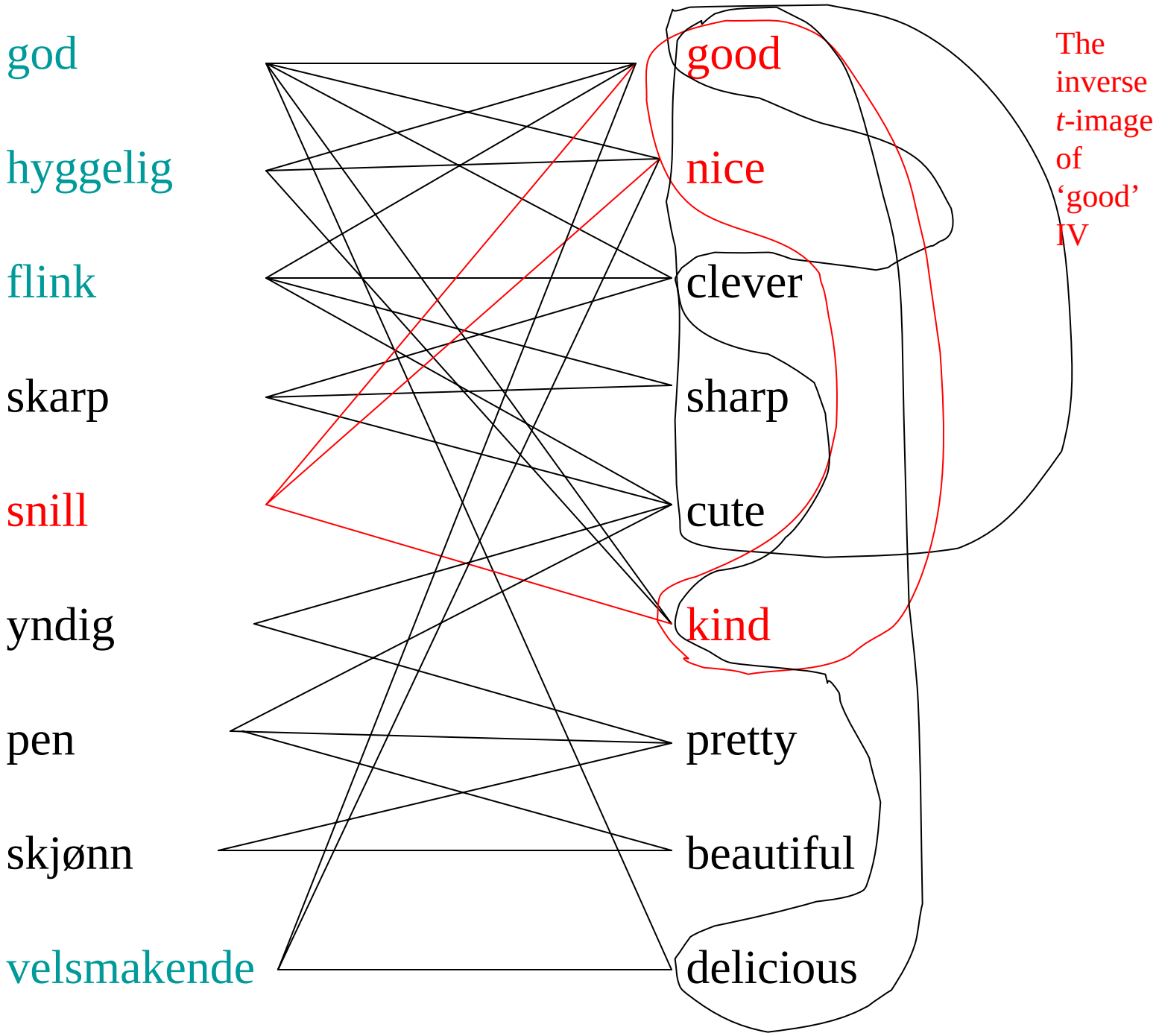
The inverse *t*-image of 'good' IV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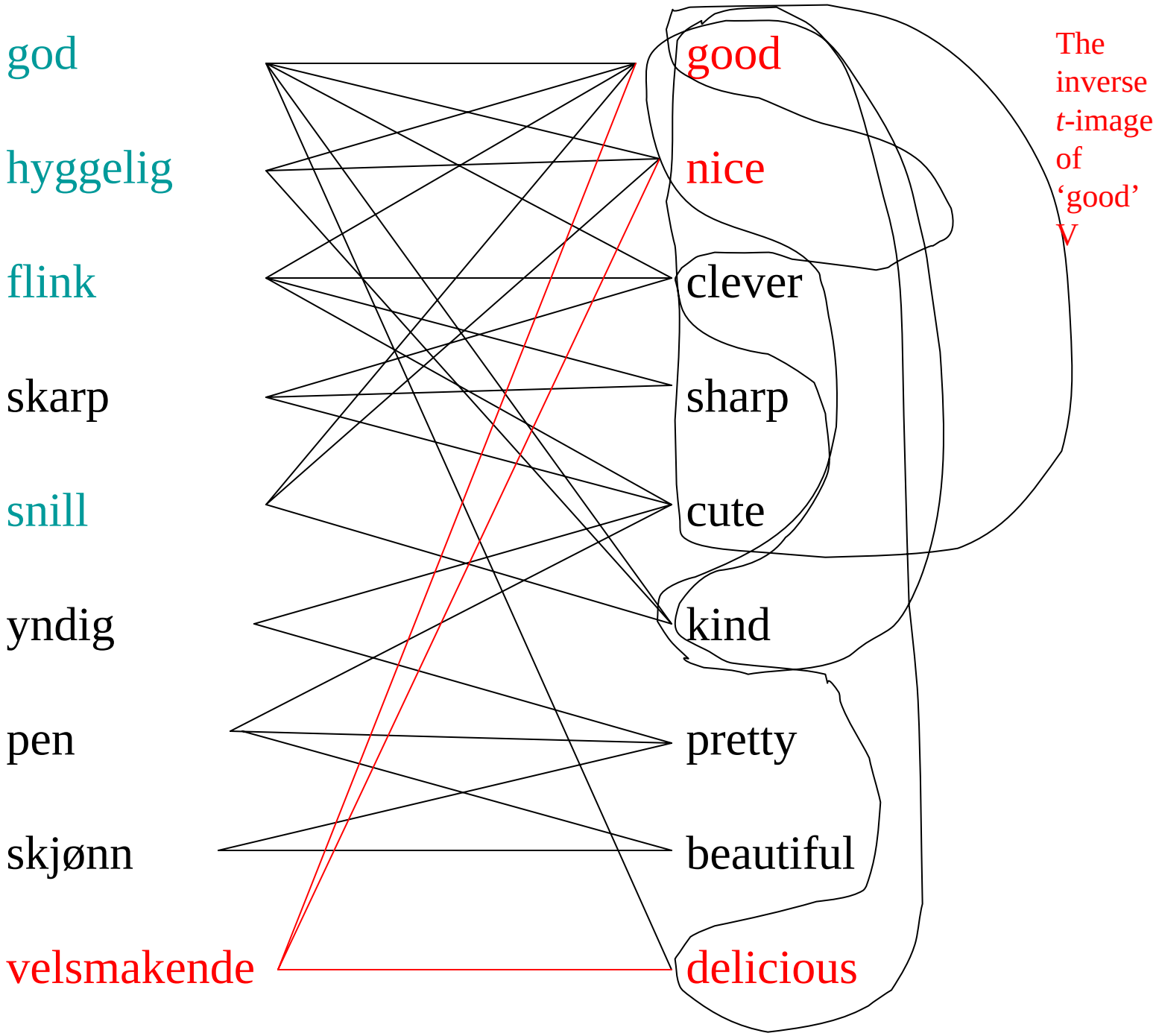
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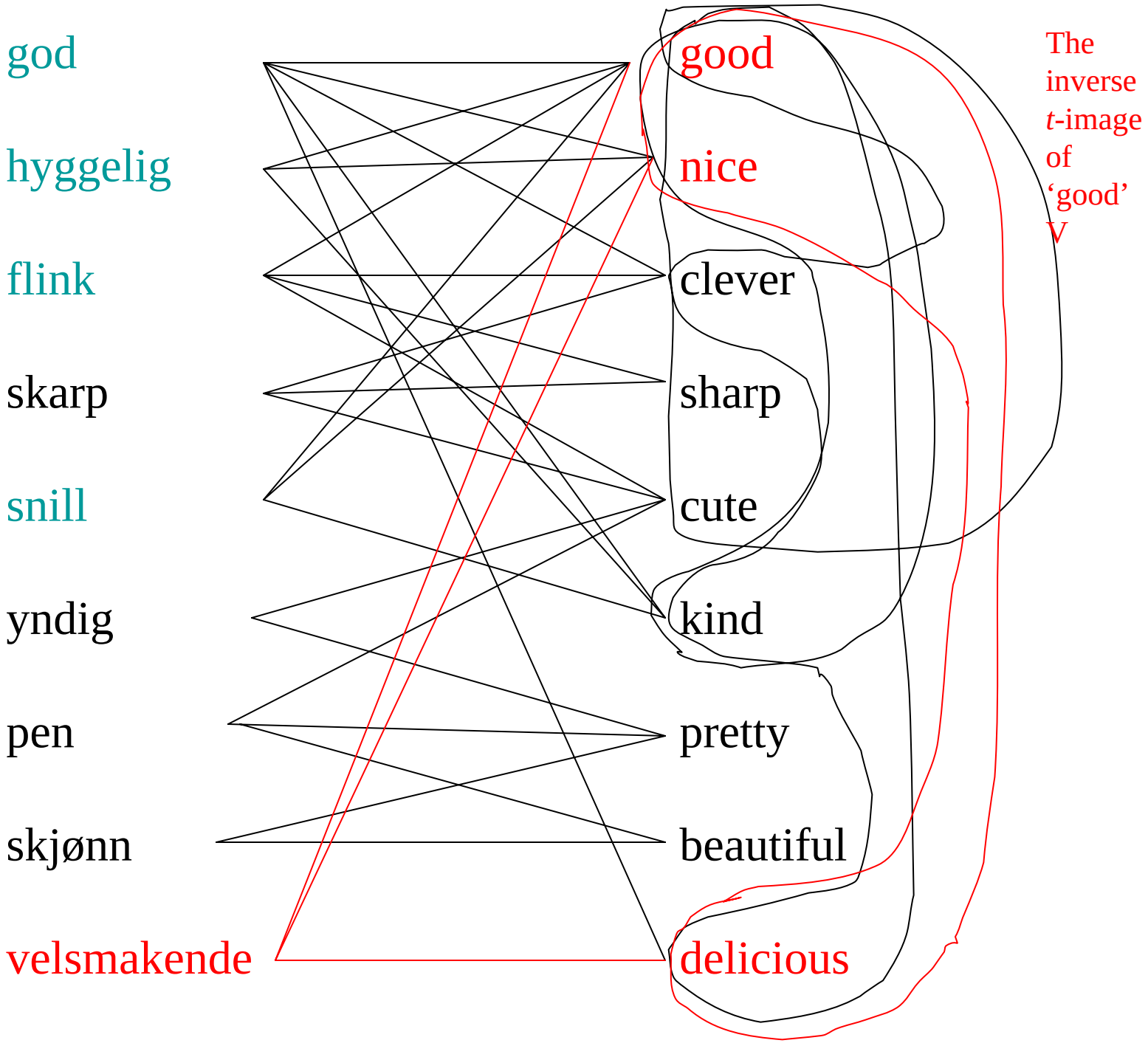
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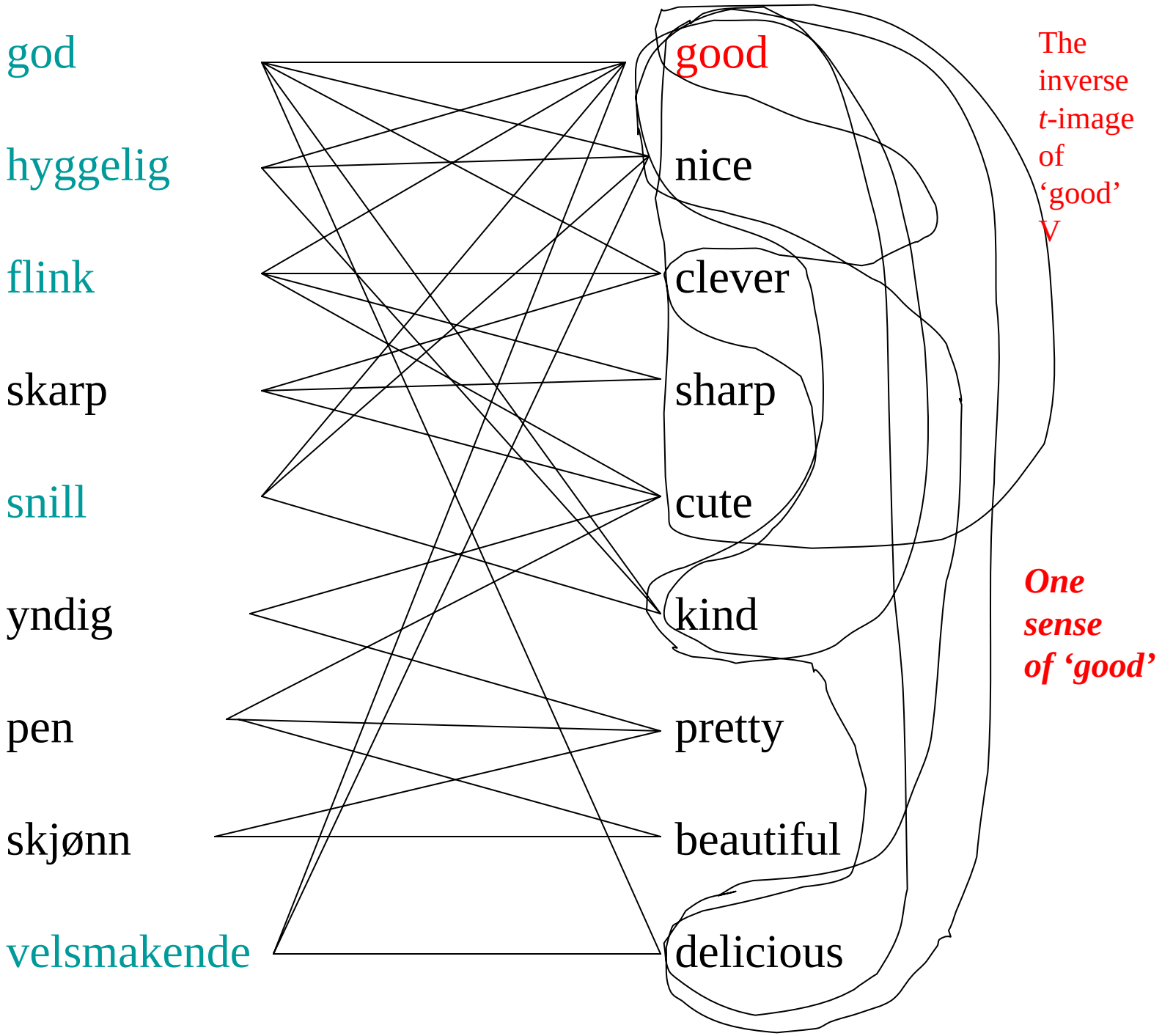
The inverse *t*-image of 'good'
V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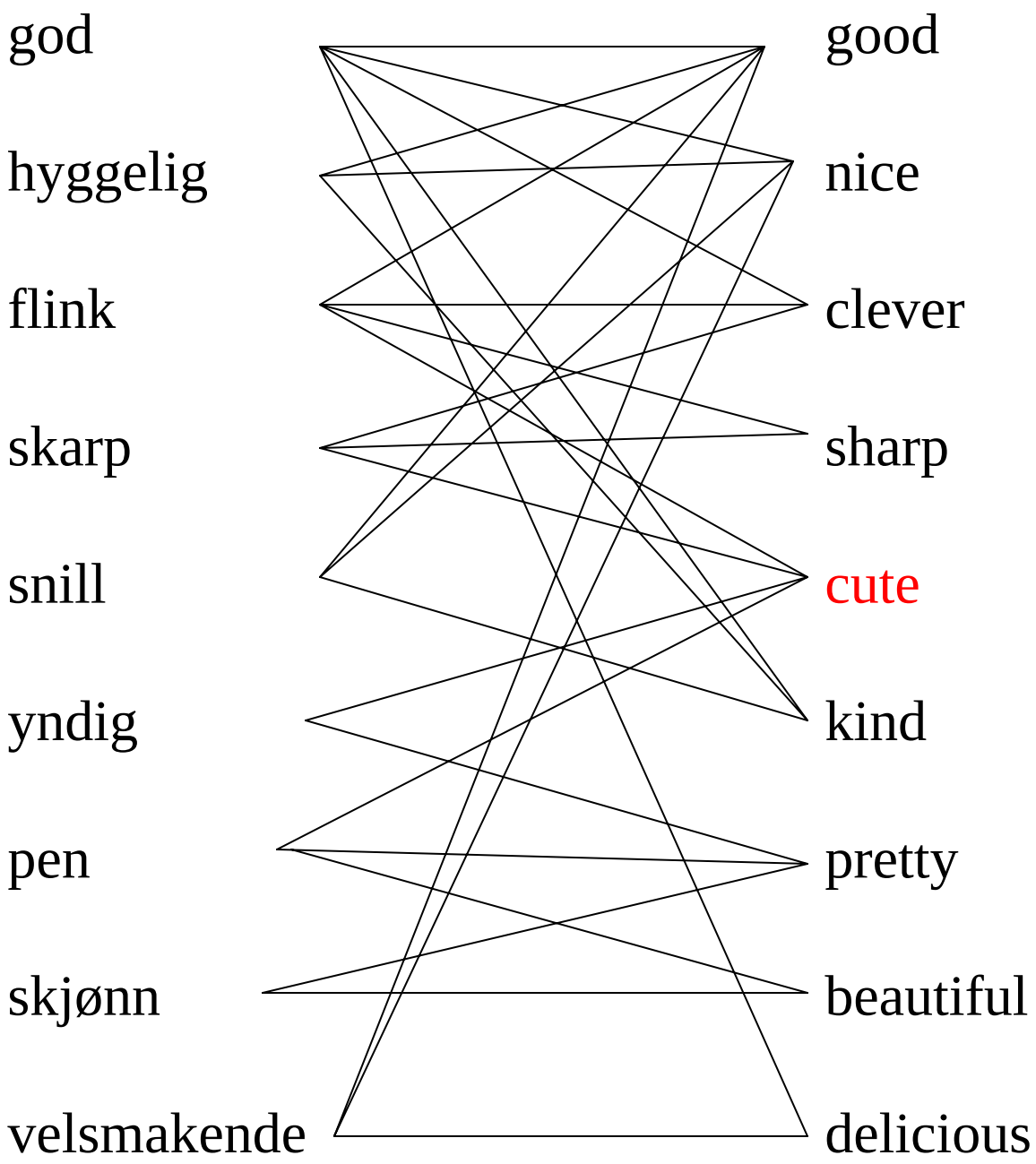
The inverse *t*-image of 'good' V
One sense of 'good'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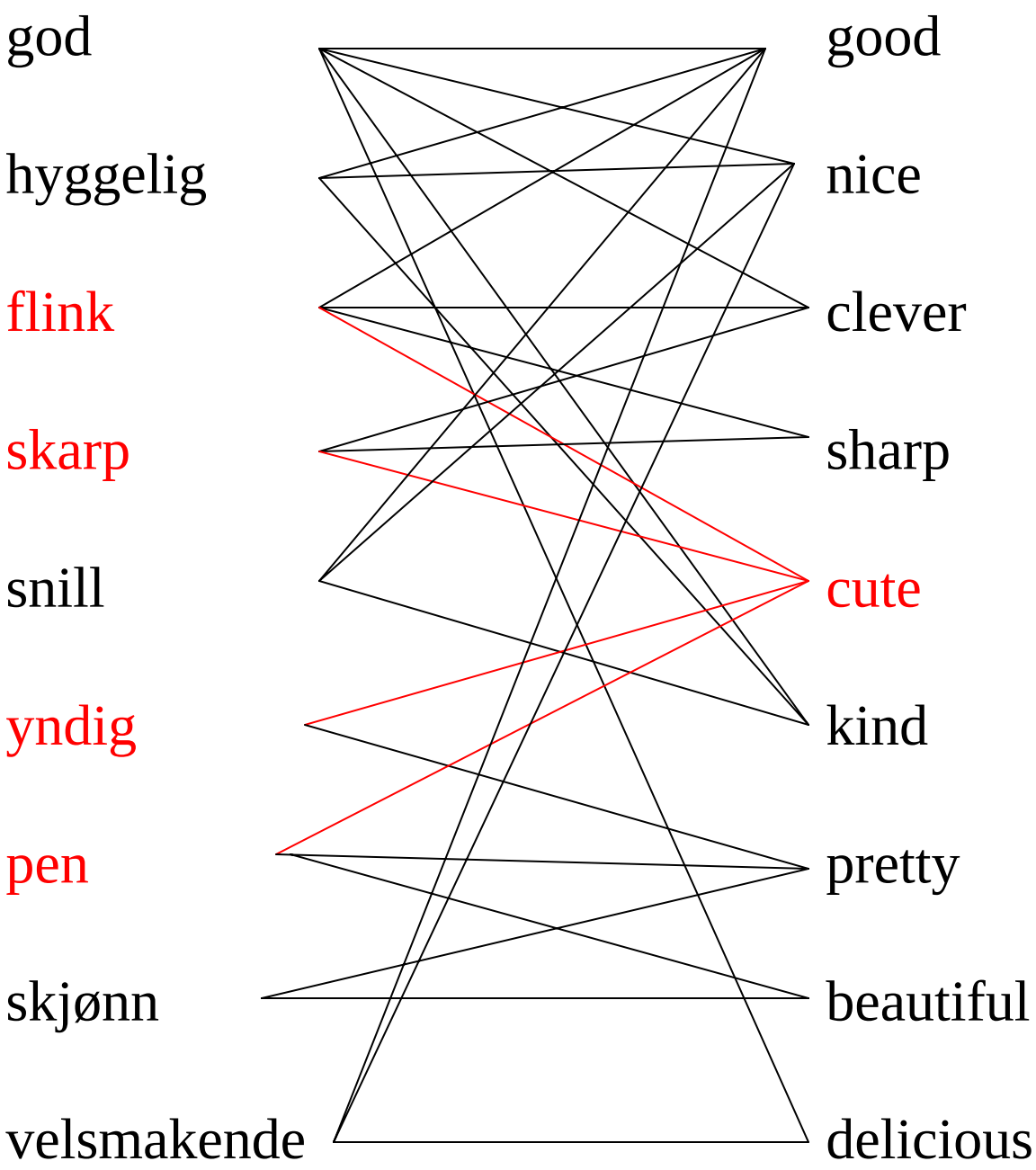
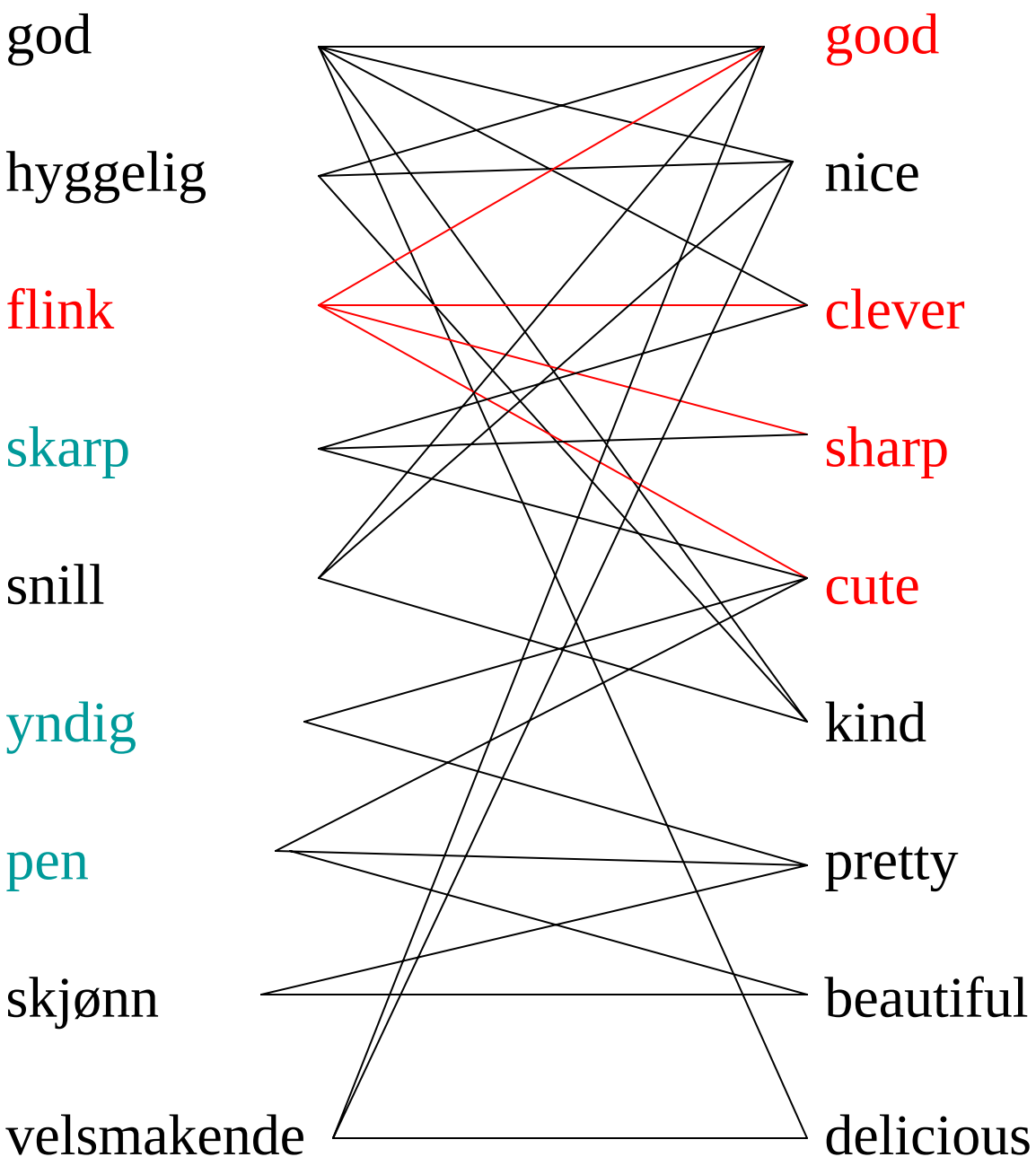
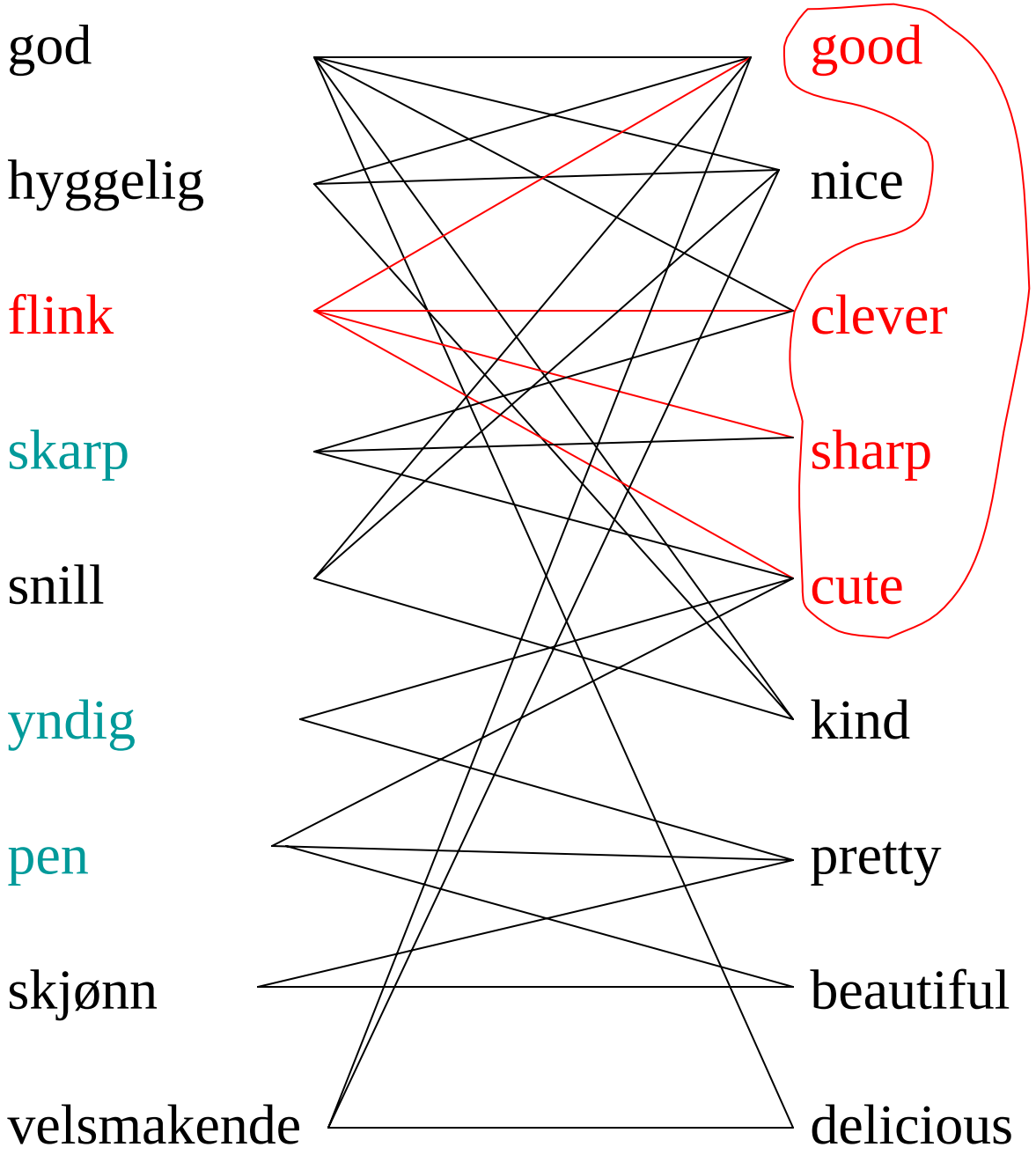
beautiful
delicious

The first *t*-image of ‘cute’

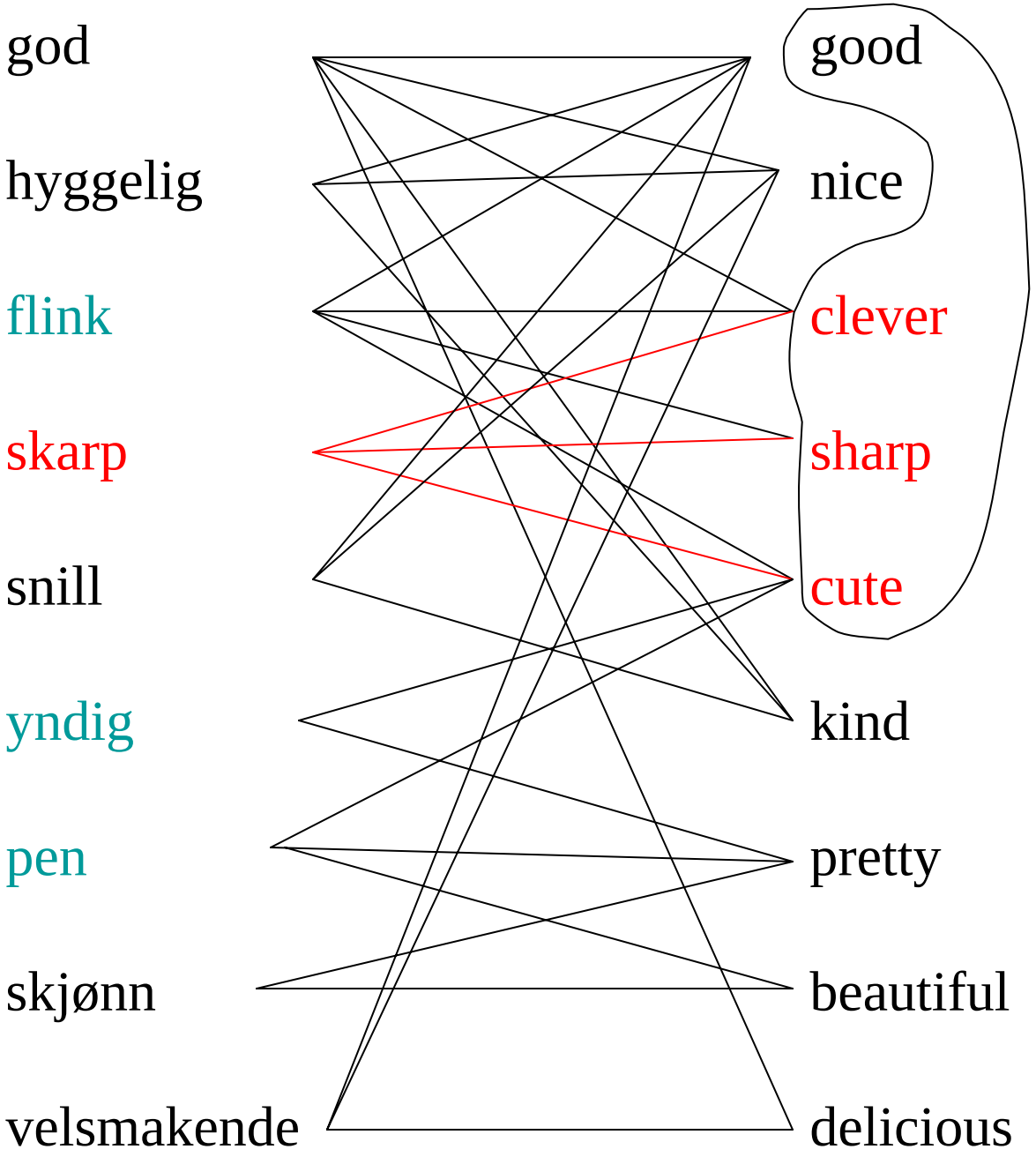




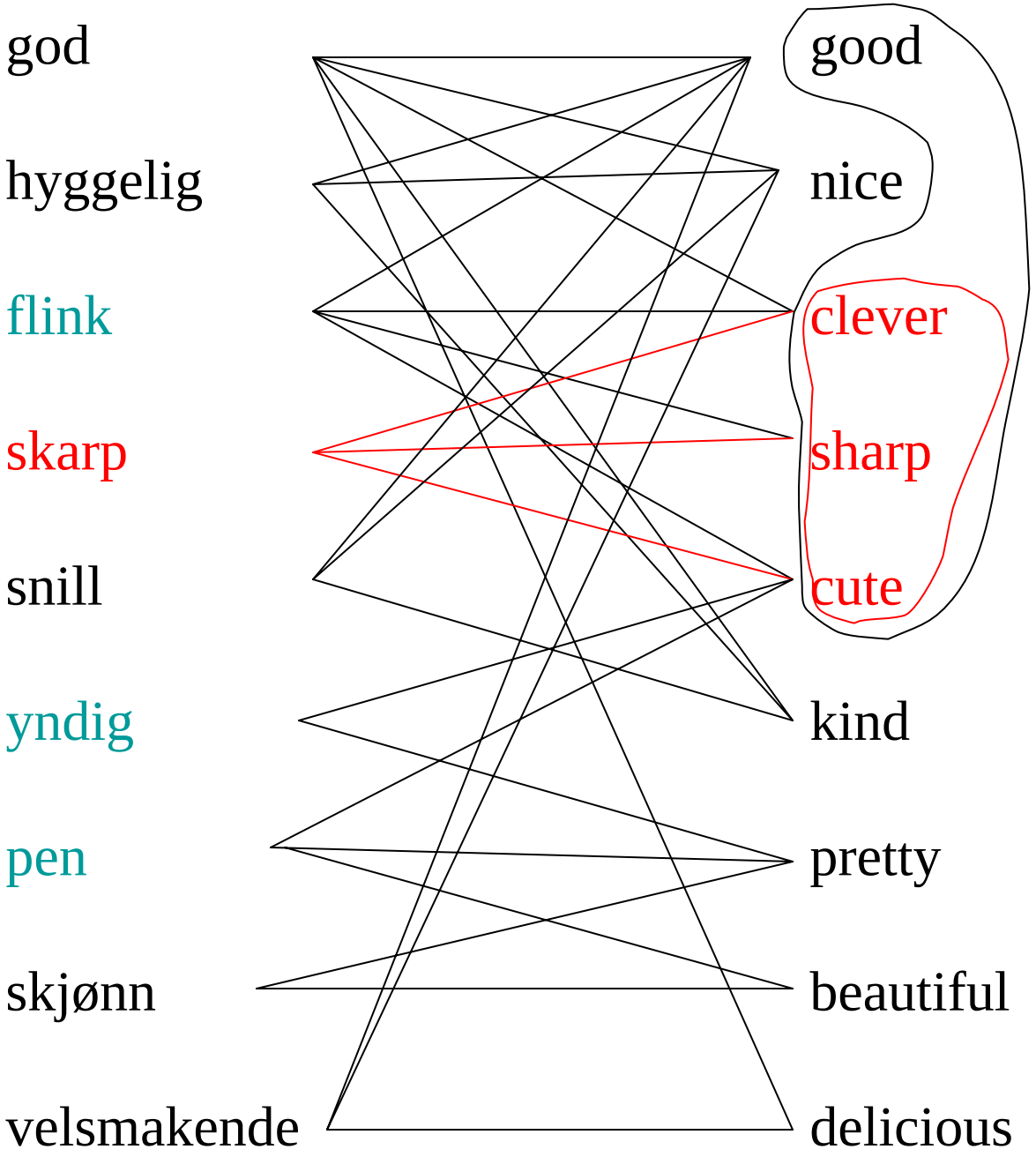
The inverse *t*-image of ‘cute’ I



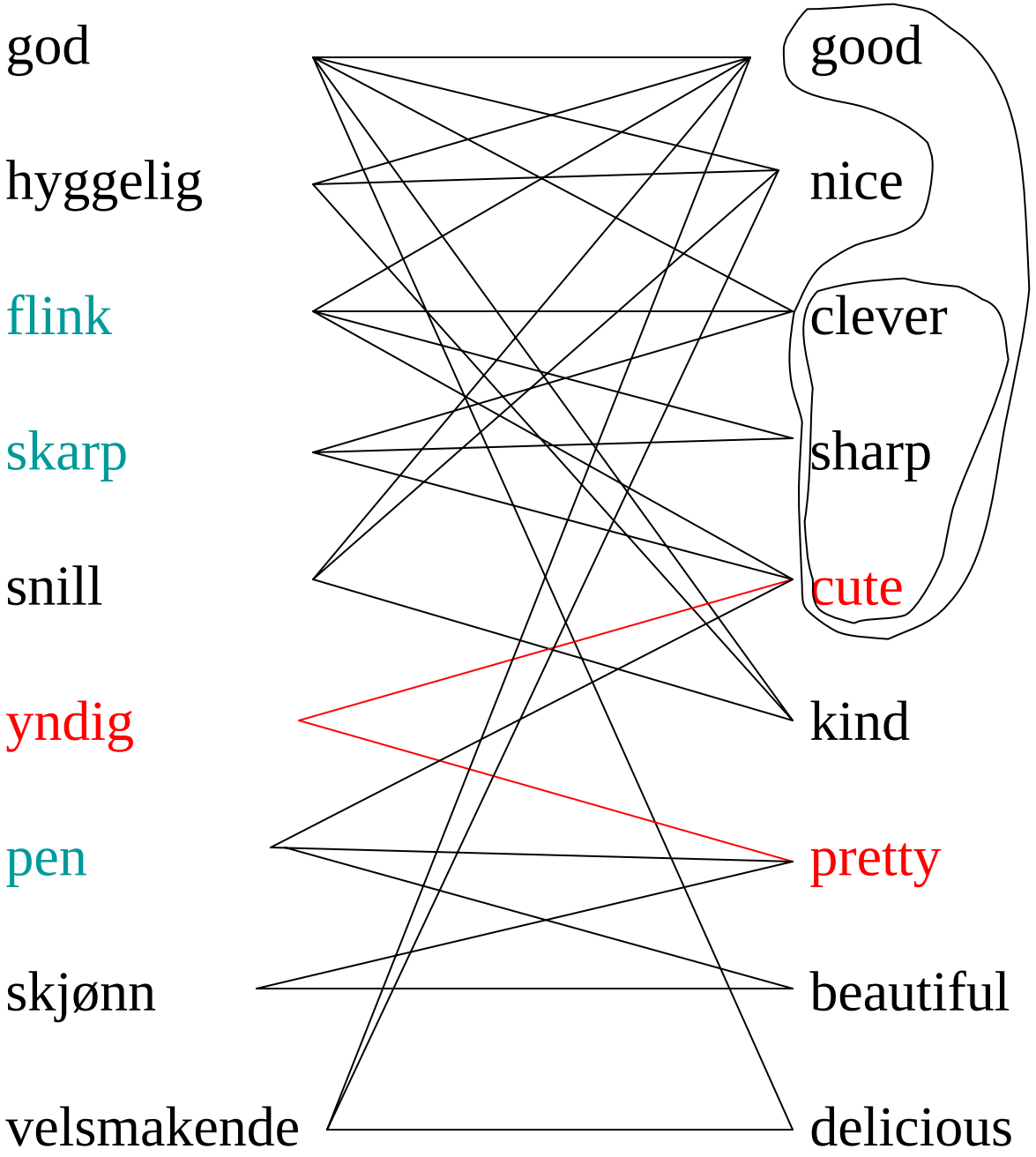
The inverse *t*-image of ‘cute’ I



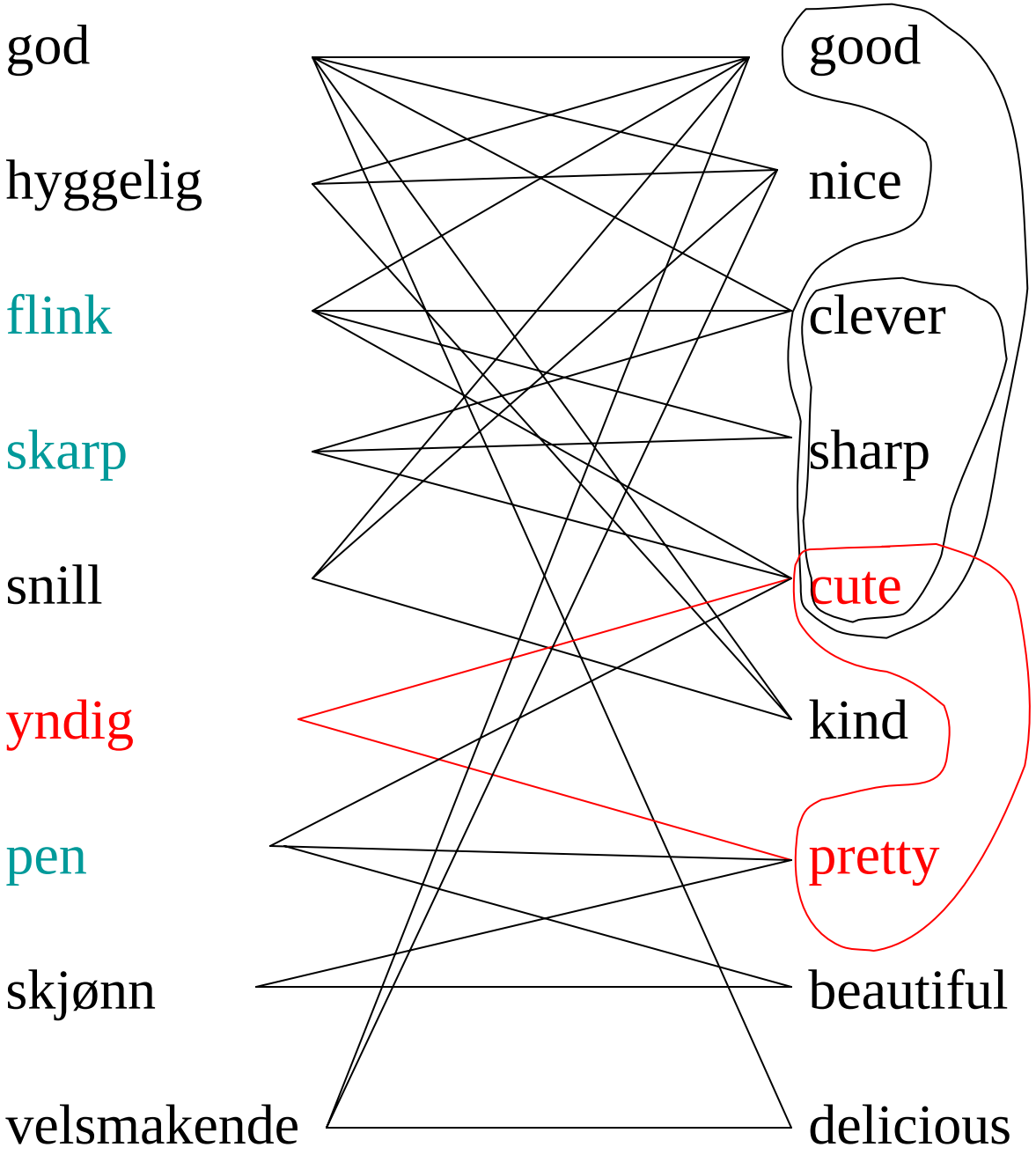
The inverse *t*-image of 'cute' II



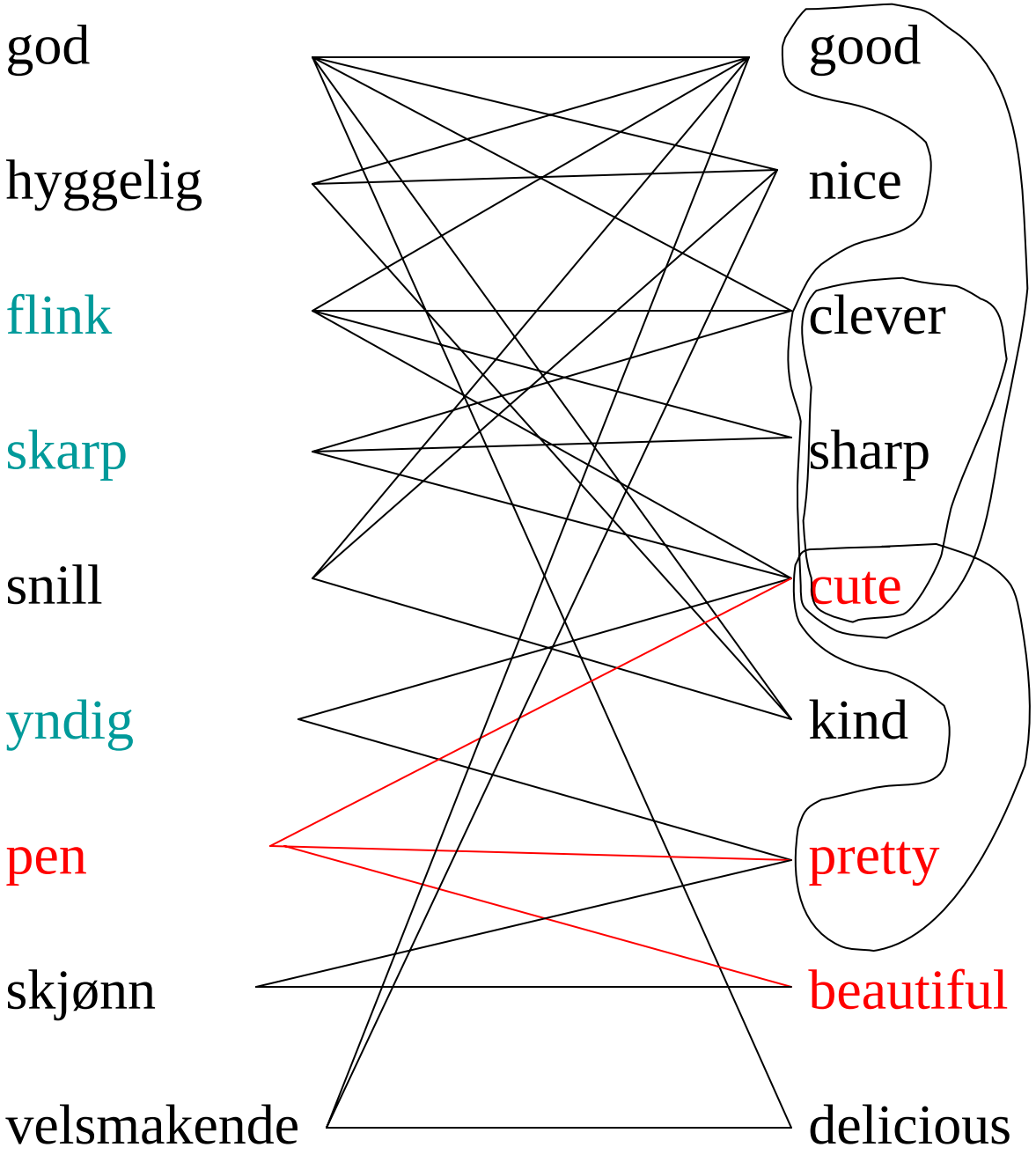
The inverse *t*-image of 'cute' II



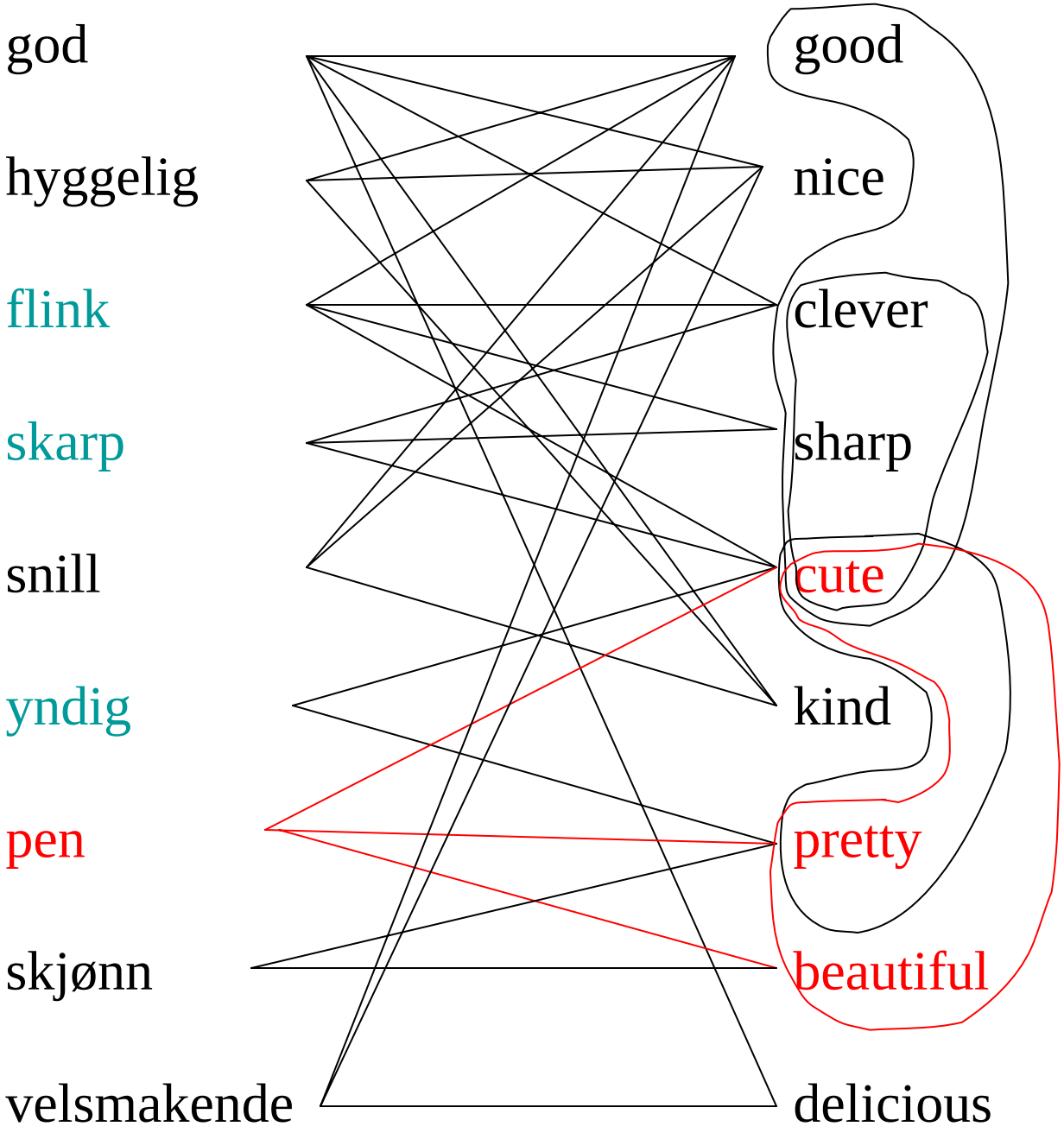
The inverse *t*-image of 'cute' III



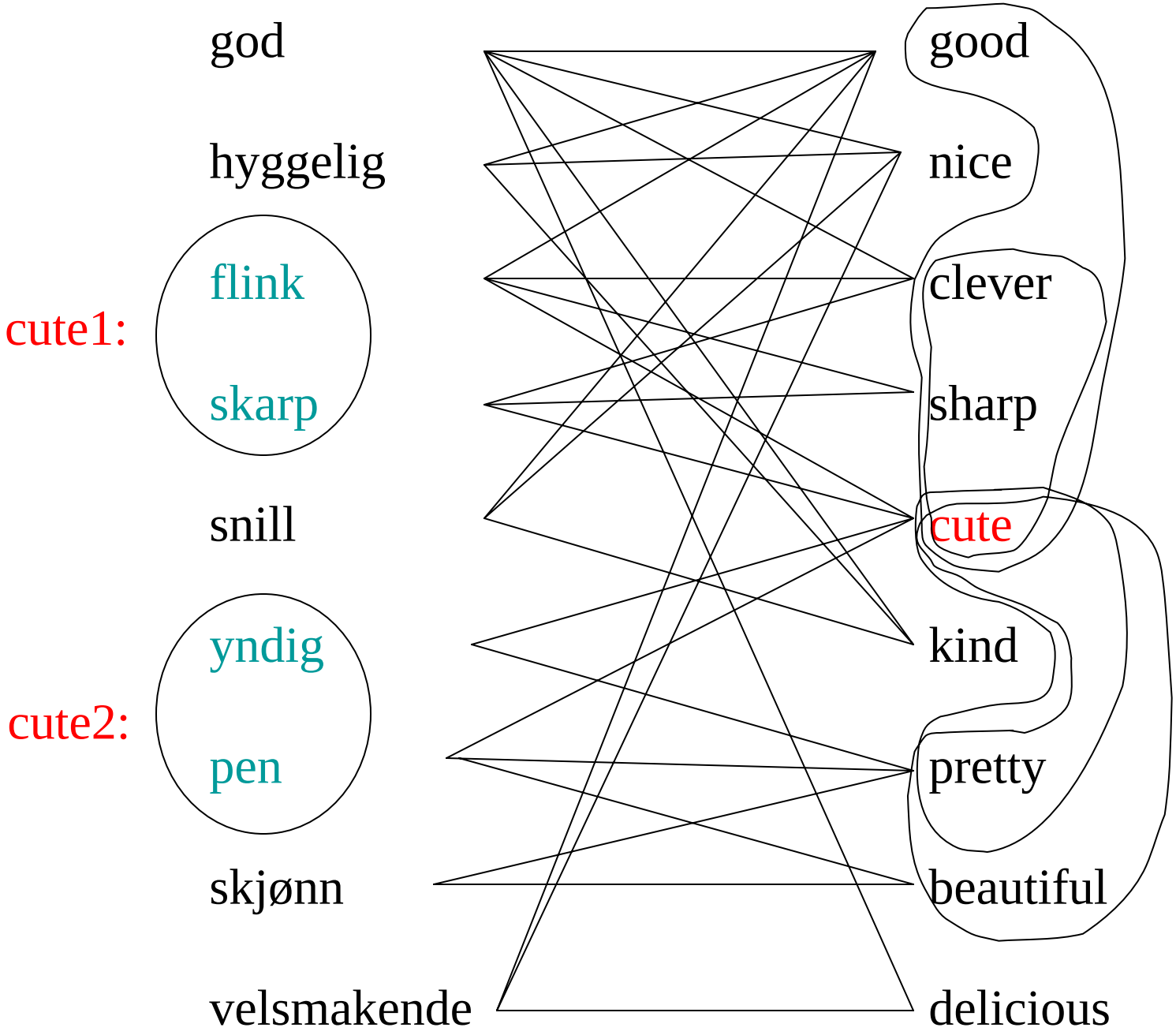
The inverse *t*-image of 'cute' III



The inverse *t*-image of 'cute' IV

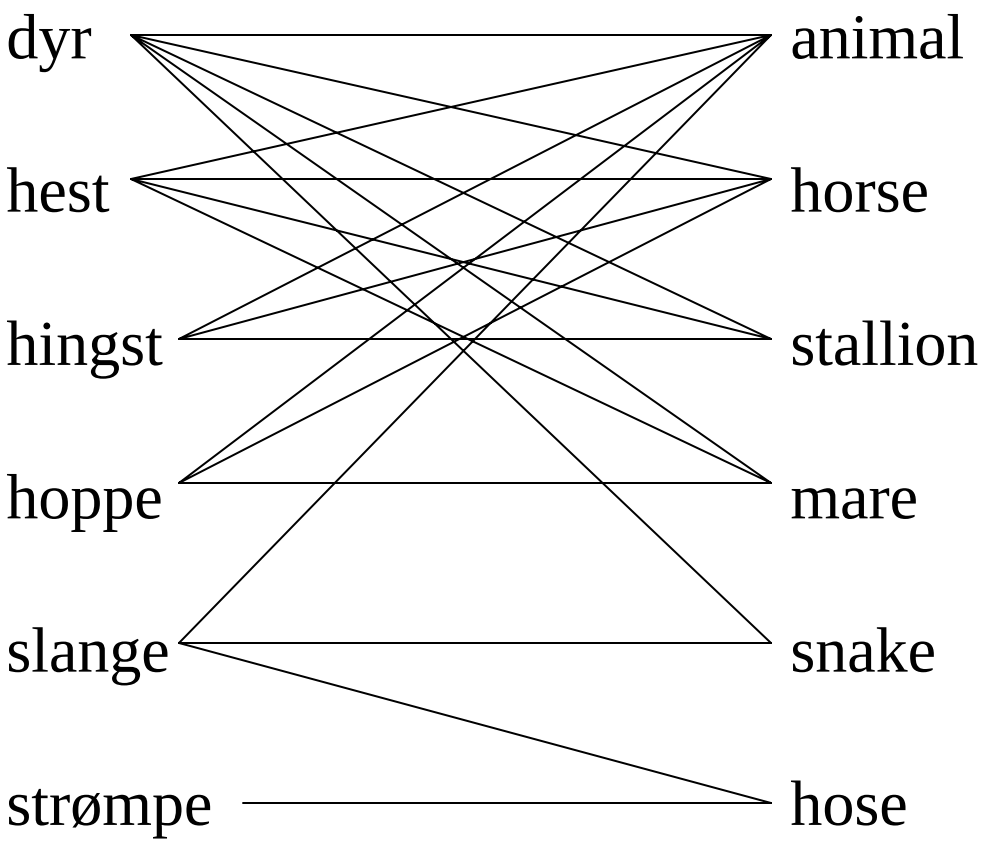


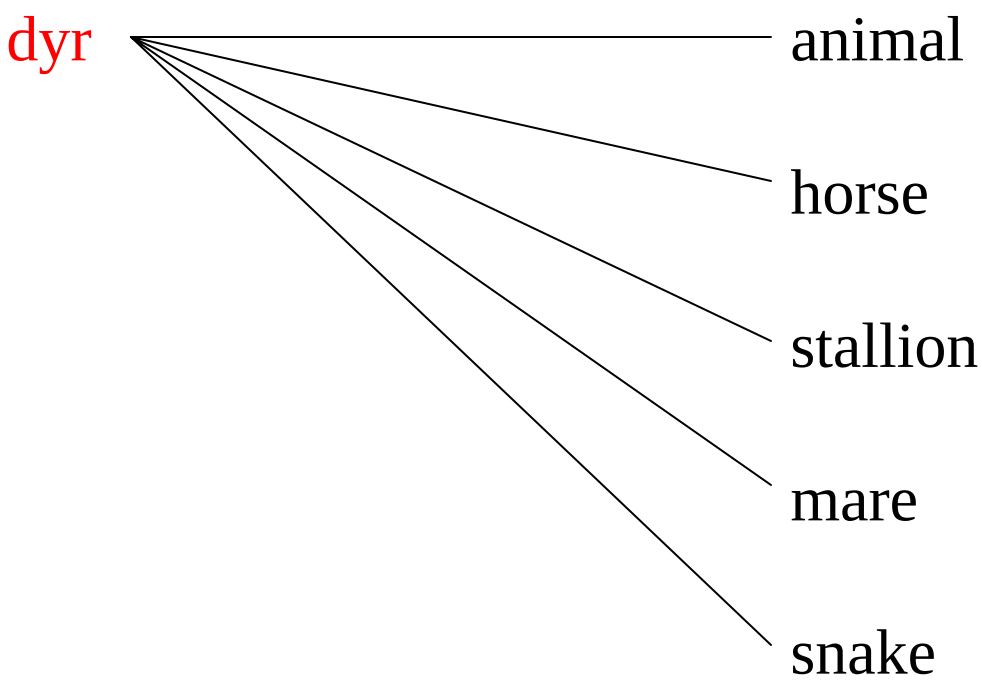
The inverse *t*-image of ‘cute’ IV

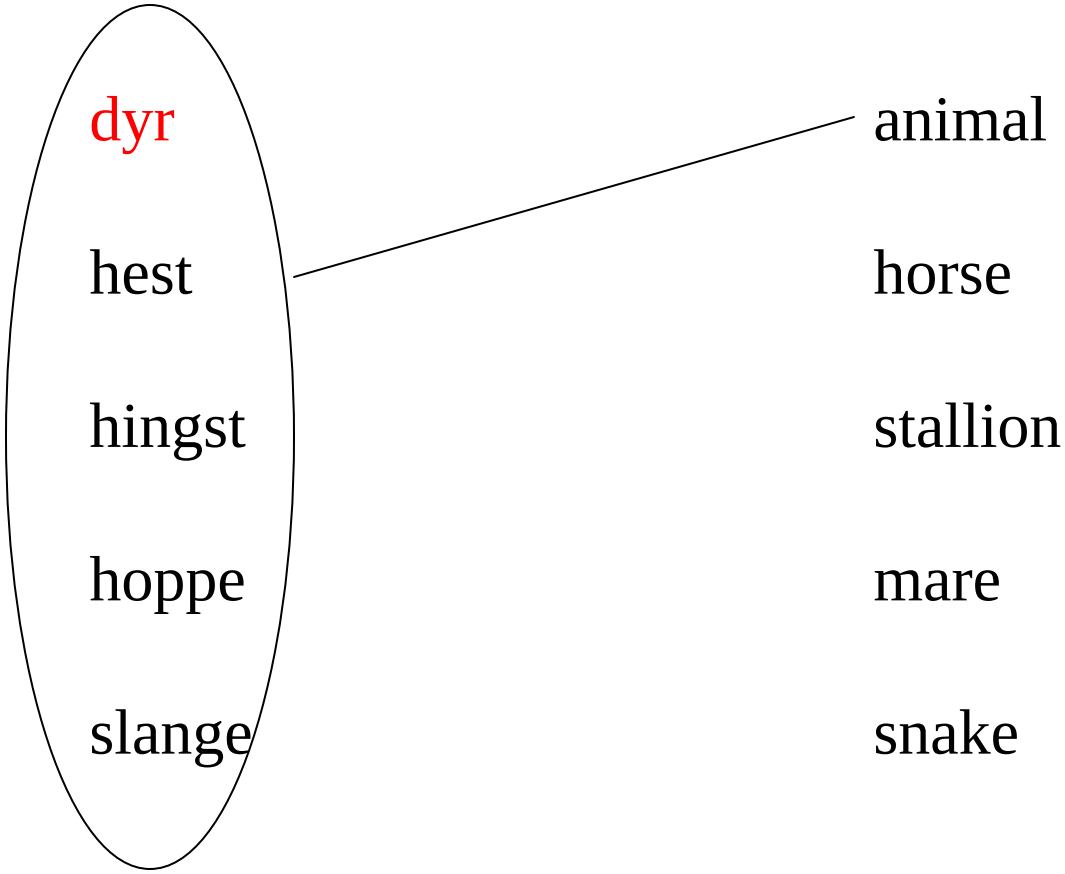


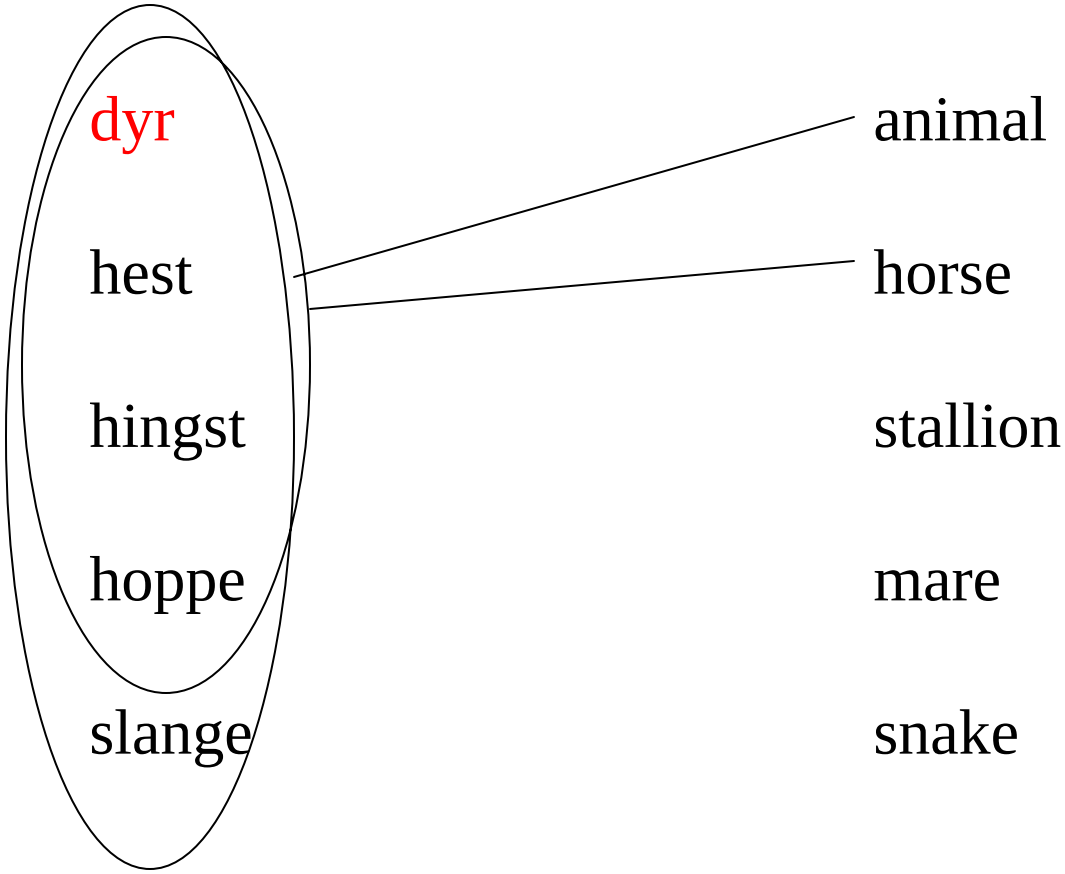
The inverse *t*-image of 'cute'

Two senses of 'cute'


dyr
hest
hingst
hoppe
slange
strømpe
animal
horse
stallion
mare
snake
hose


dyr
animal
horse
stallion
mare
snake


dyr
hest
hingst
hoppe
slange
animal
horse
stallion
mare
snake


dyr
hest
hingst
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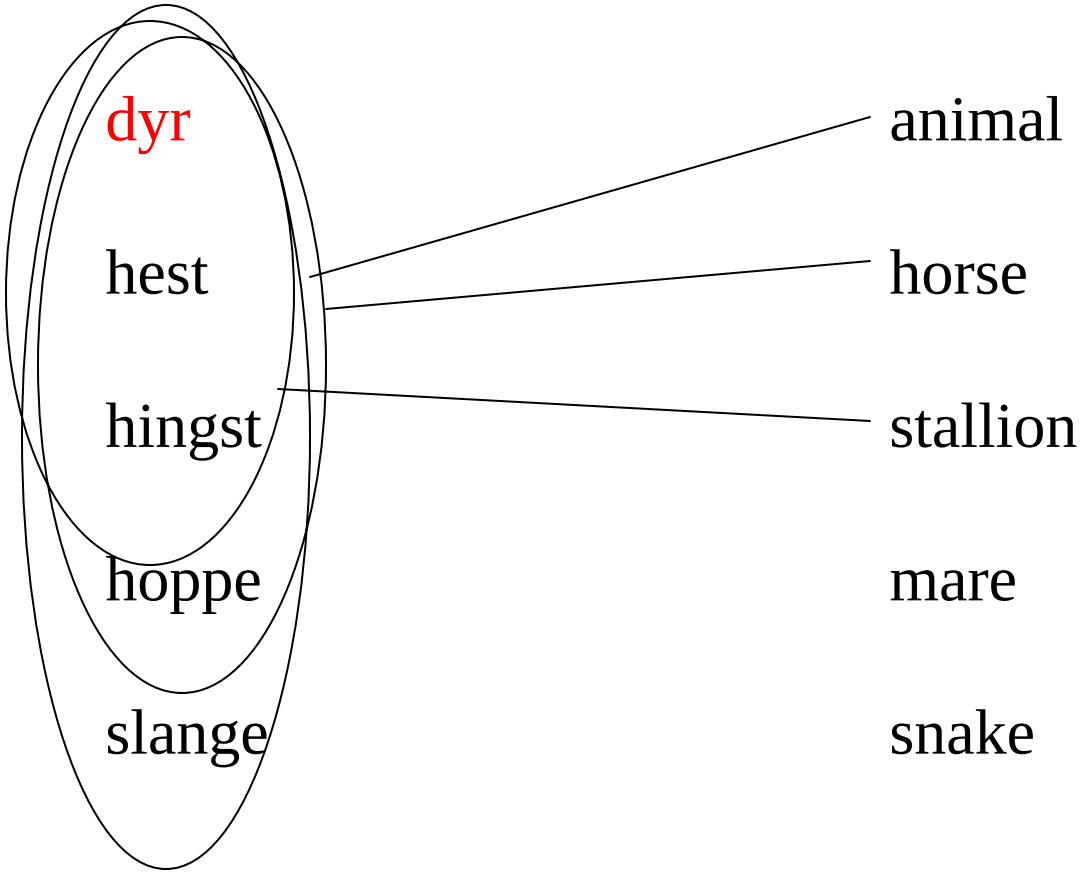
slange
animal
horse
stallion
mare
snake


dyr
hest
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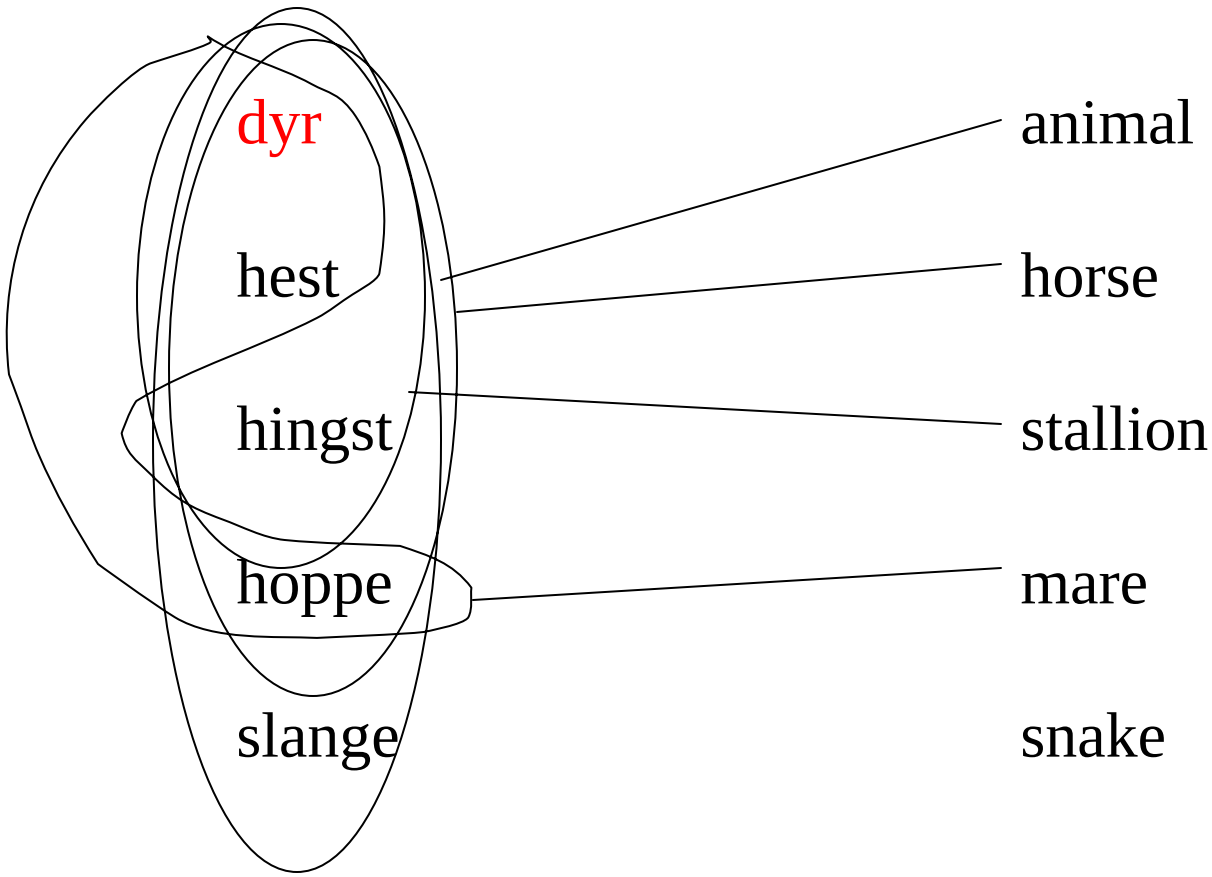
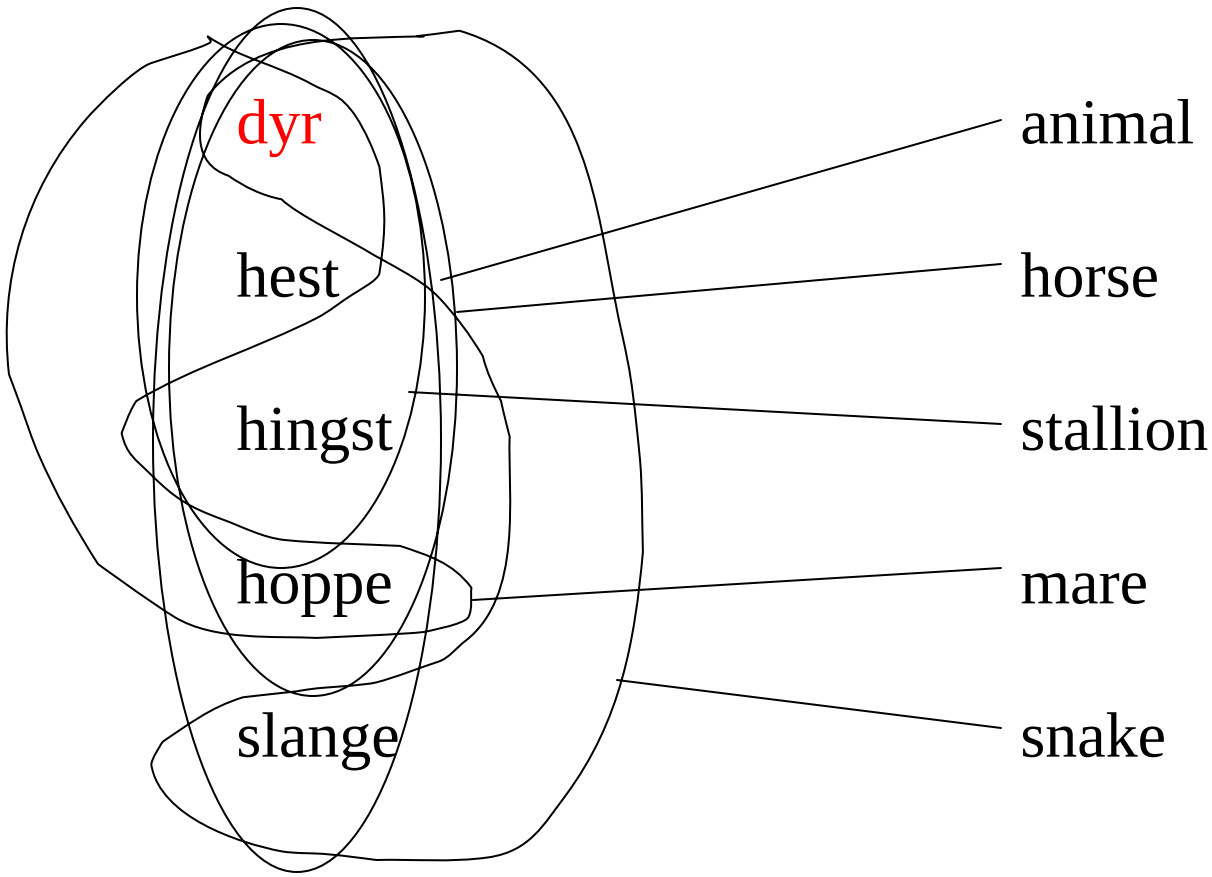
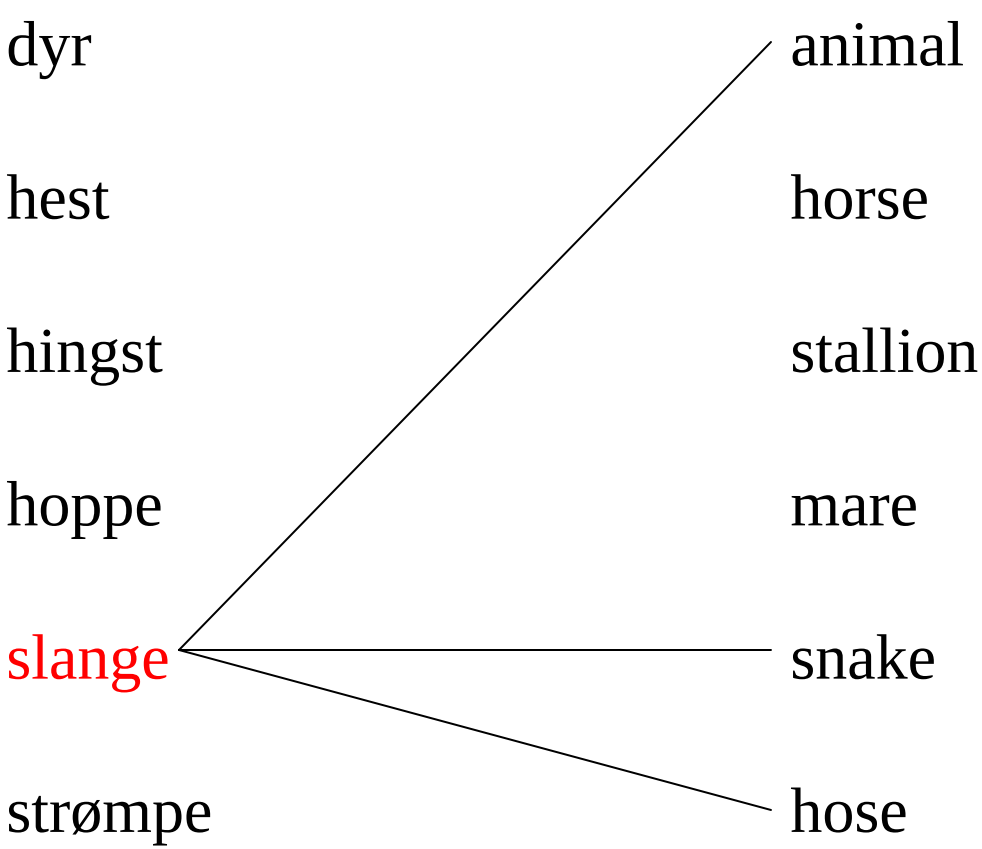
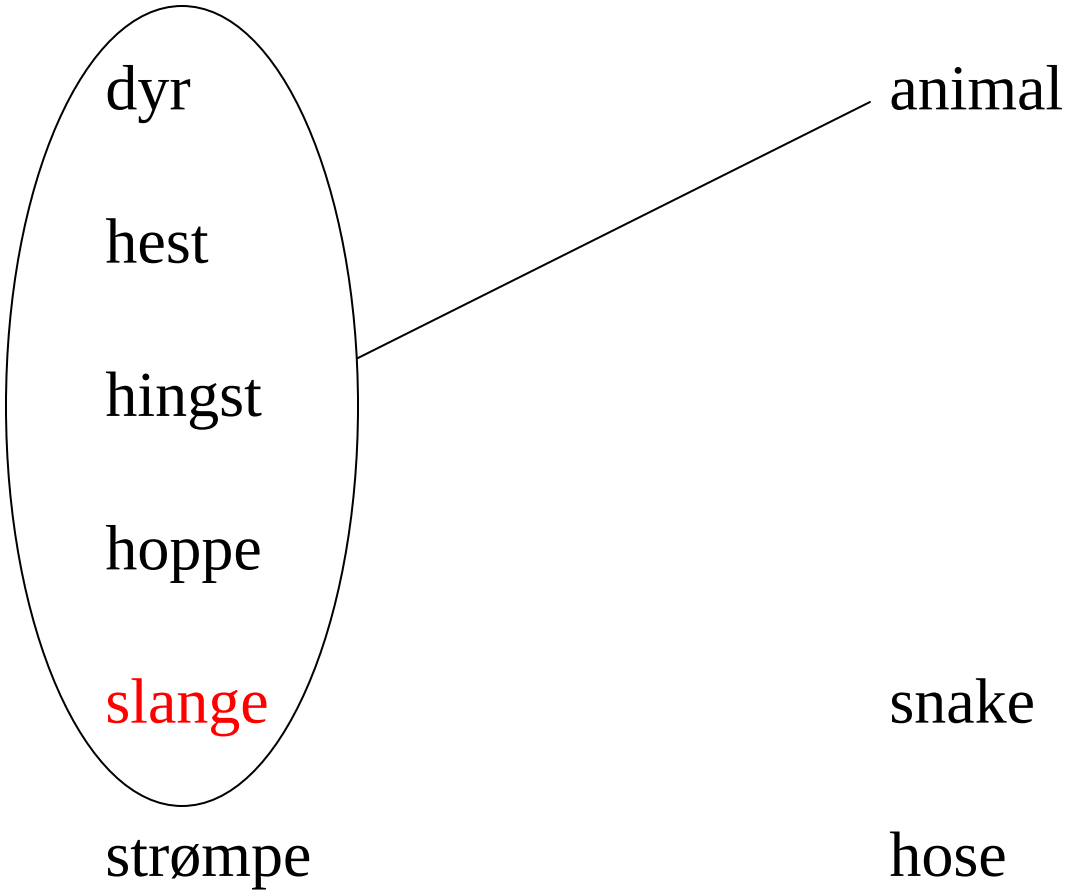
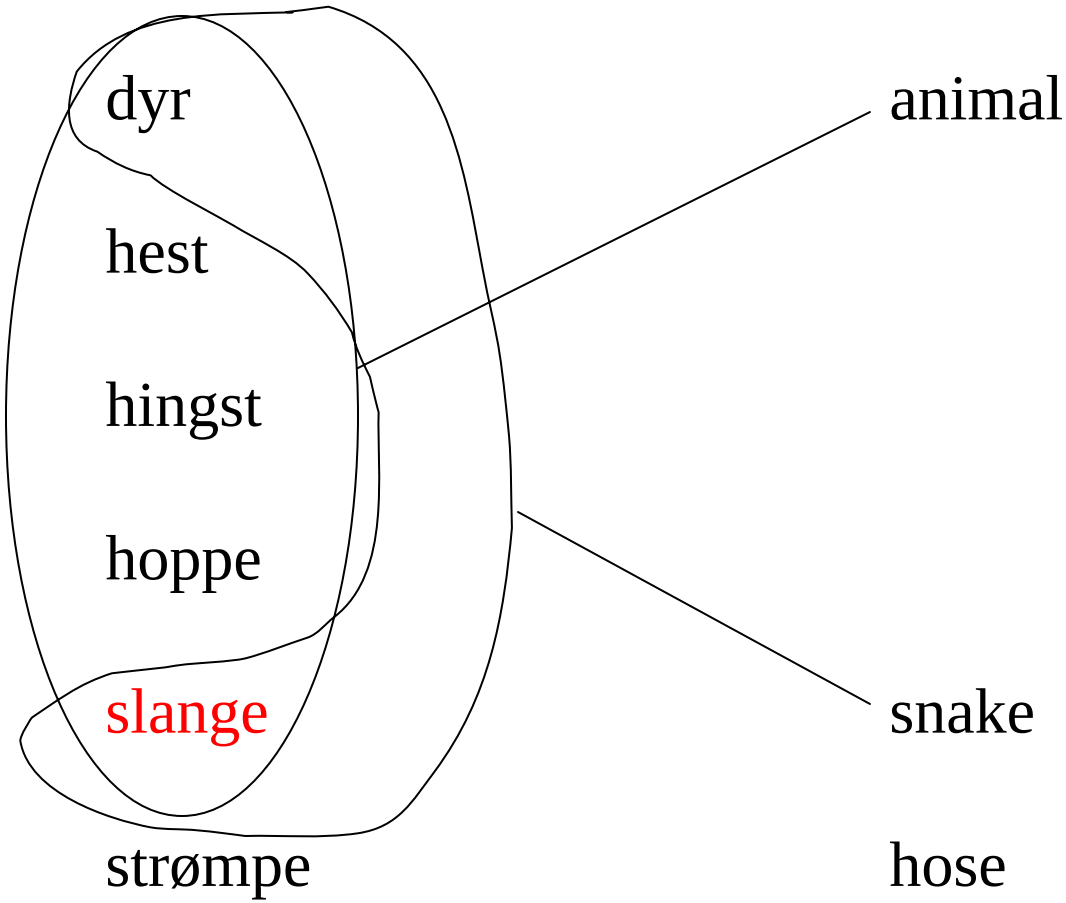
slange
animal
horse
stallion
mare
snake

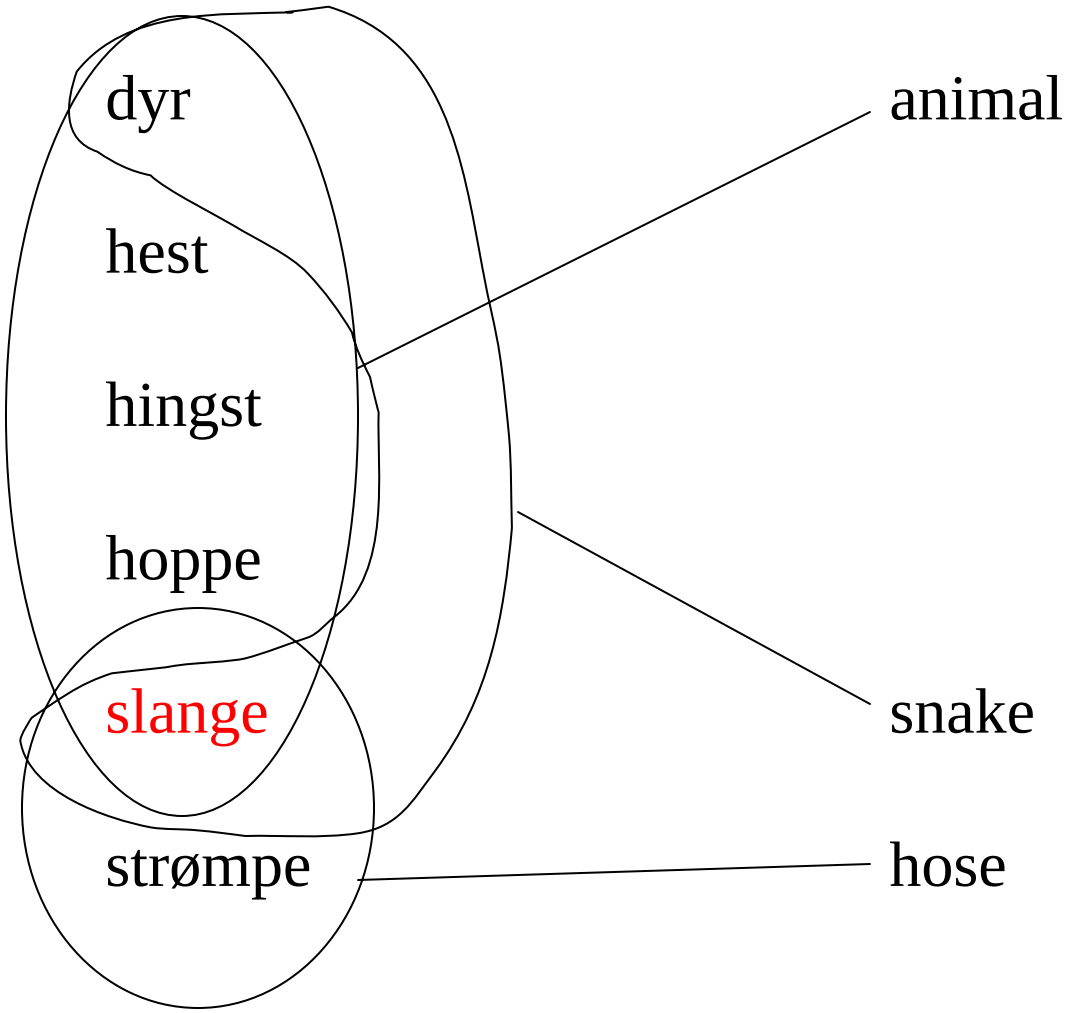

dyr
hest
hingst
hoppe
slange
animal
horse
stallion
mare
snake

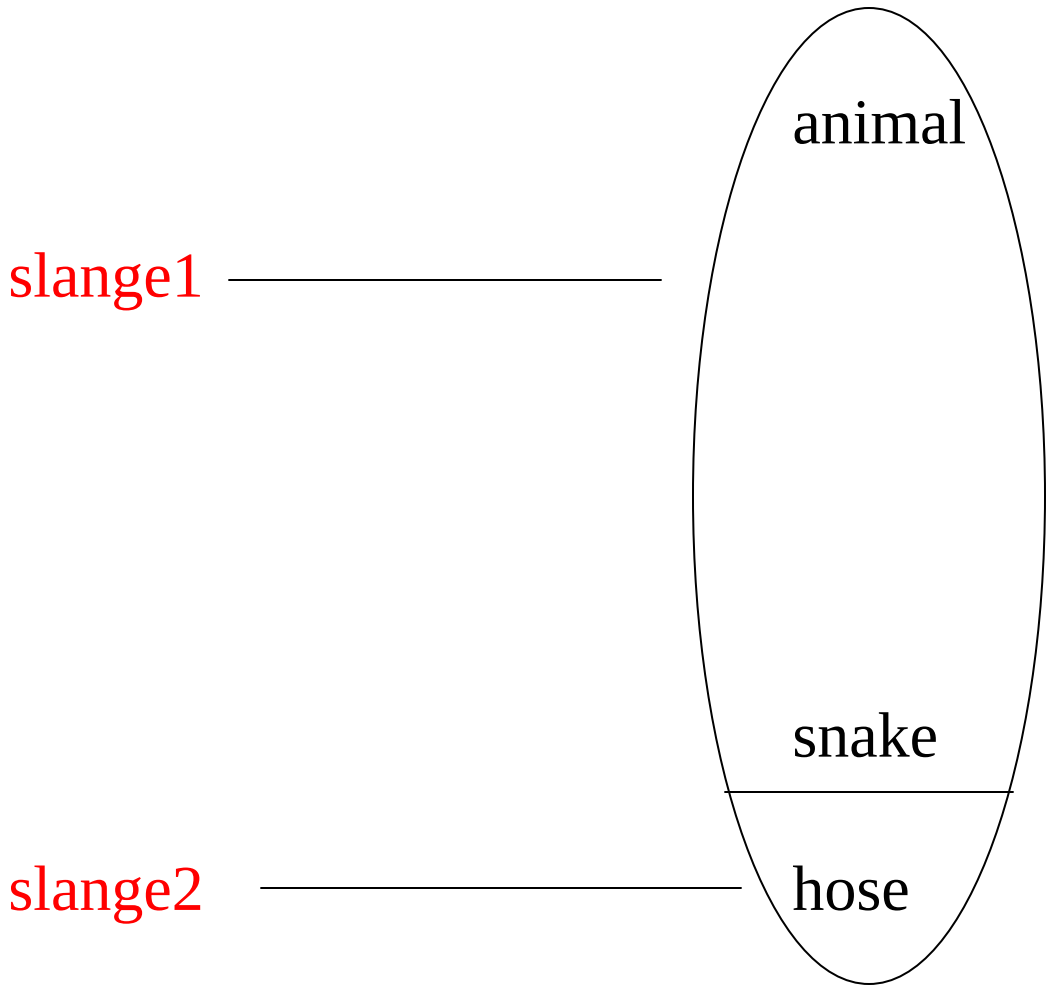

dyr
hest
hingst
hoppe
slange
animal
horse
stallion
mare
snake


dyr
hest
hingst
hoppe
slange
strømpe
animal
horse
stallion
mare
snake
hose

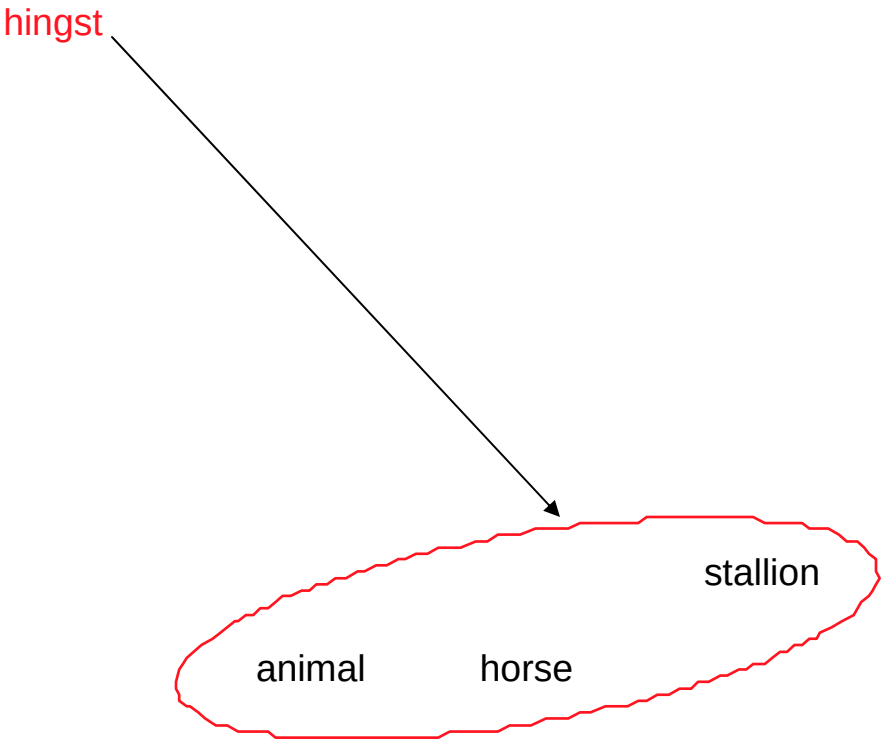

dyr
hest
hingst
hoppe
slange
strømpe
animal
snake
hose


dyr
hest
hingst
hoppe
slange
strømpe
animal
snake
hose

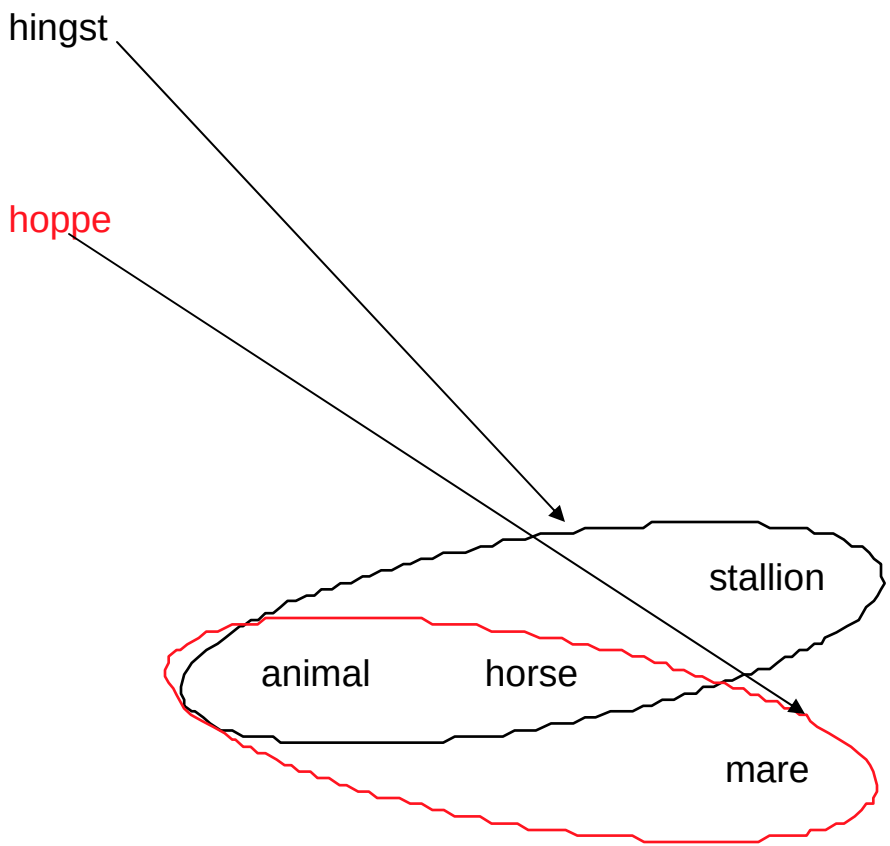

dyr
hest
hingst
hoppe
slange
strømpe
animal
snake
hose


animal
slange1
snake
slange2
hose

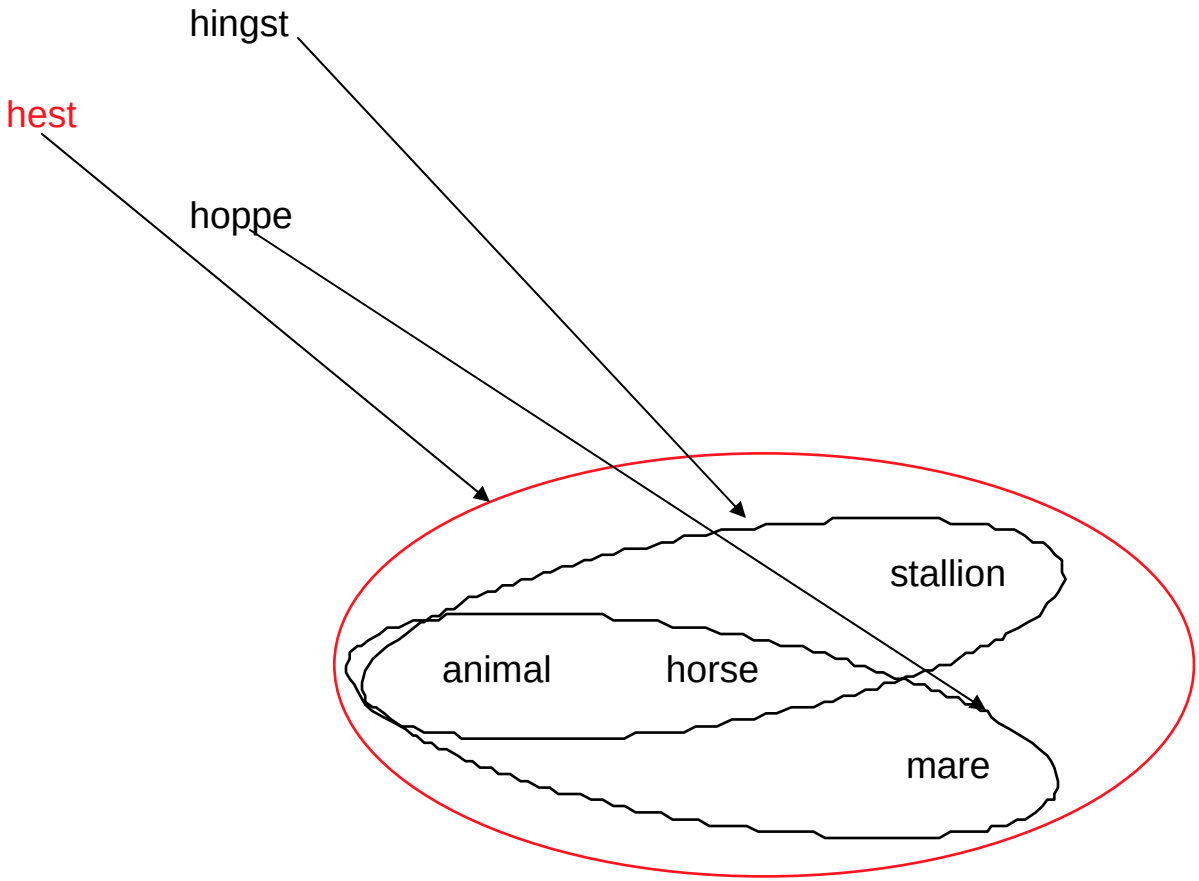
t-images within one semantic field:



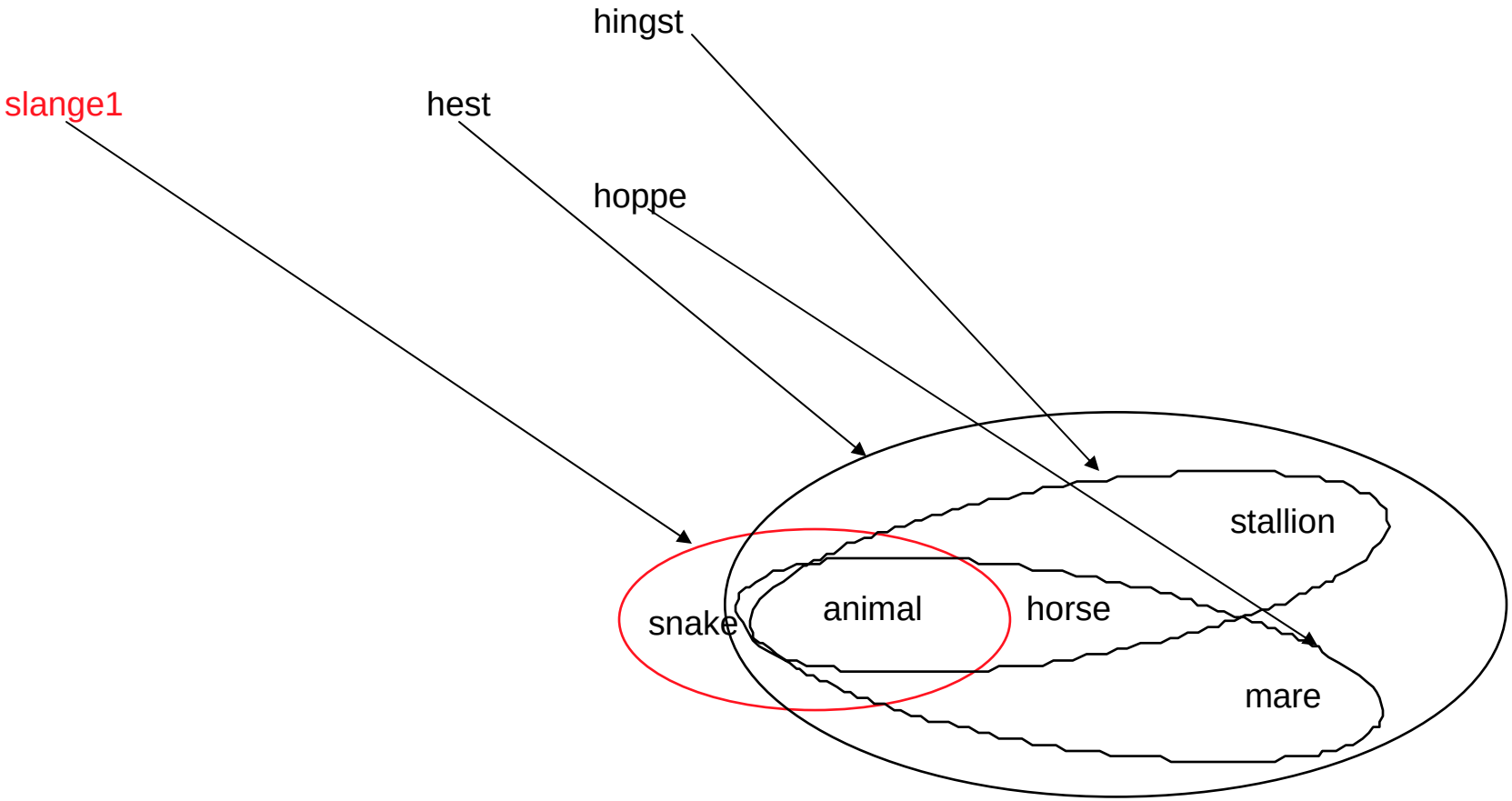
t-images within one semantic field:



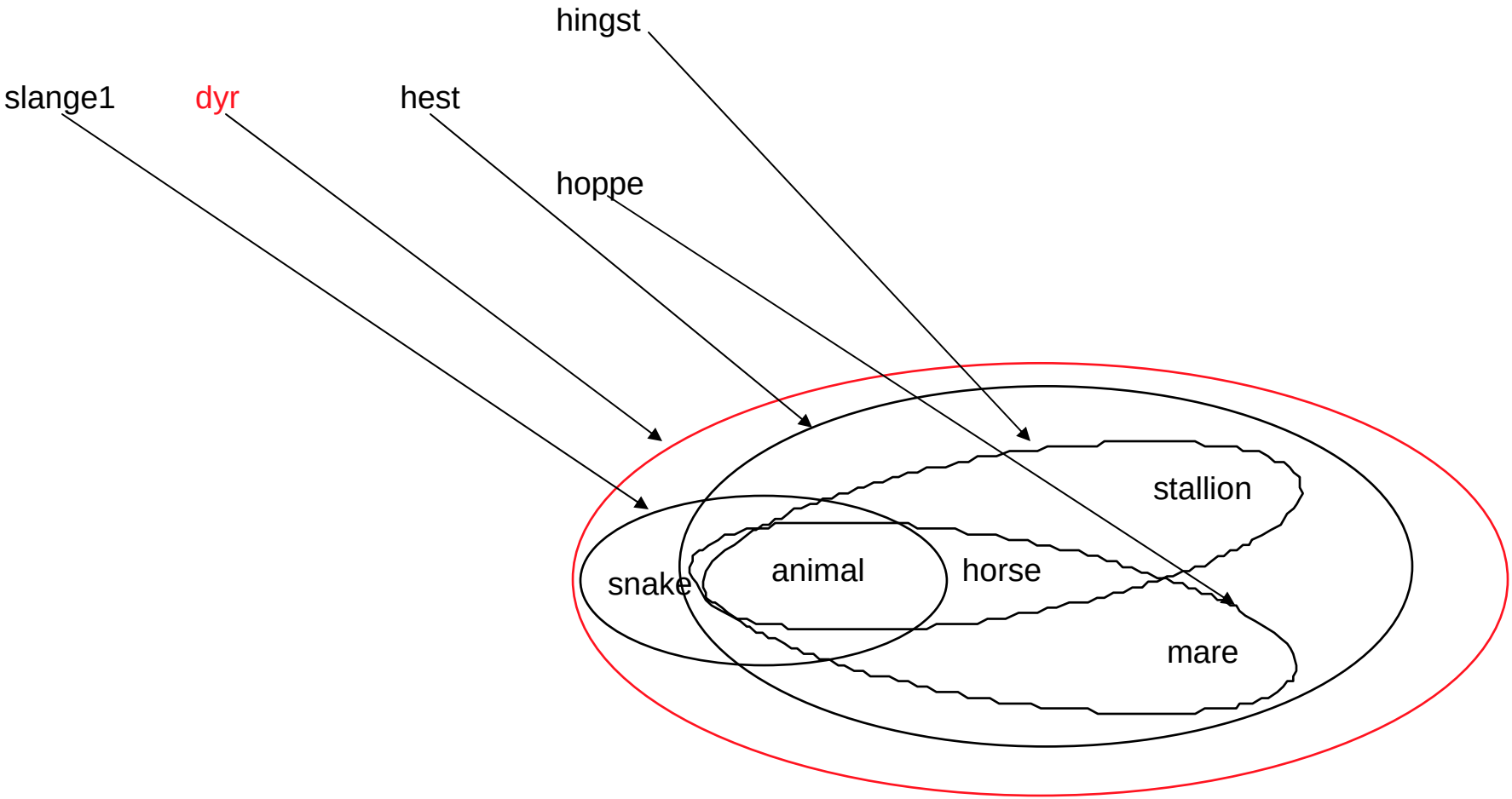
t-images within one semantic field:



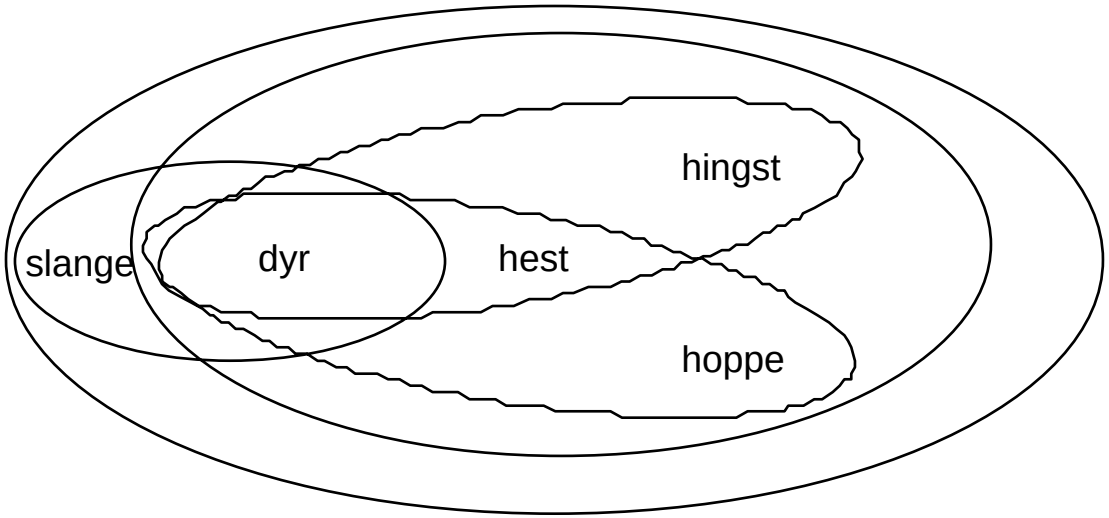
t-images within one semantic field:

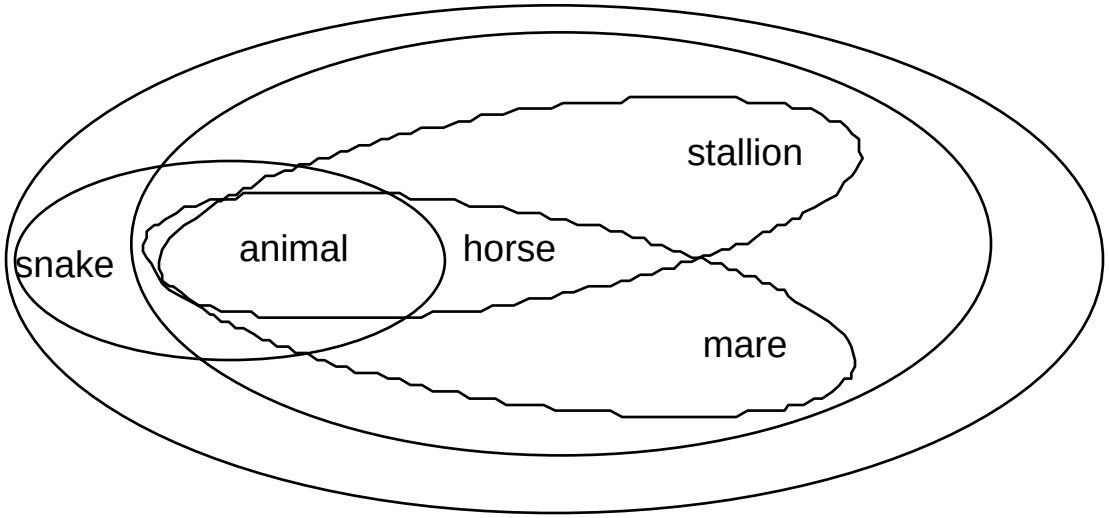


t-images within one semantic field:

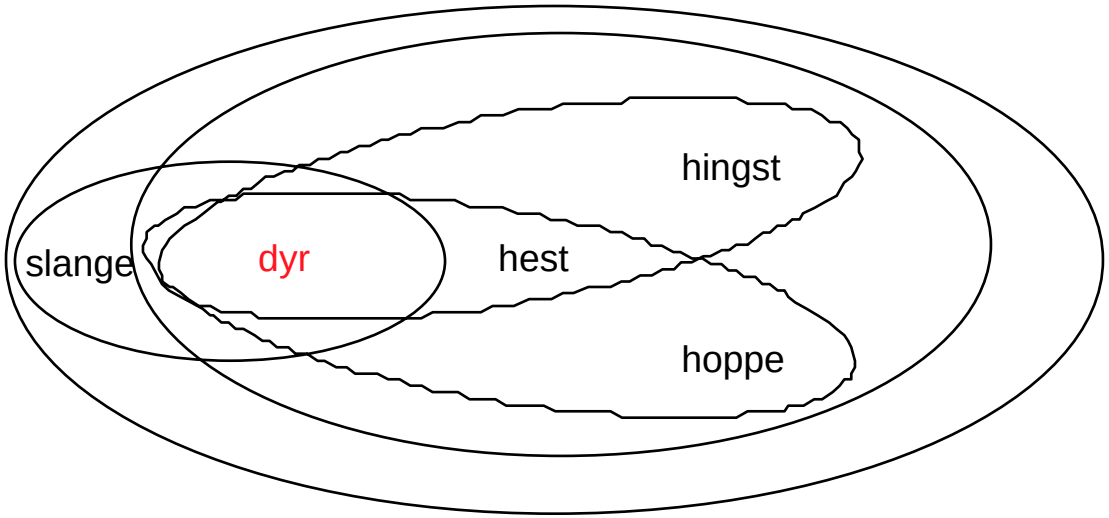


Corresponding semantic fields assign set structures to each other:

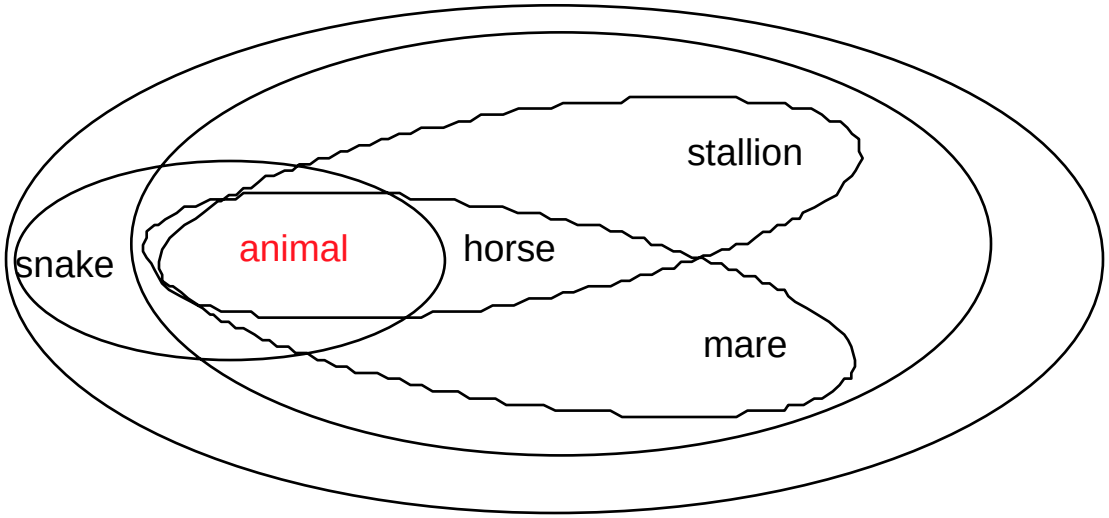




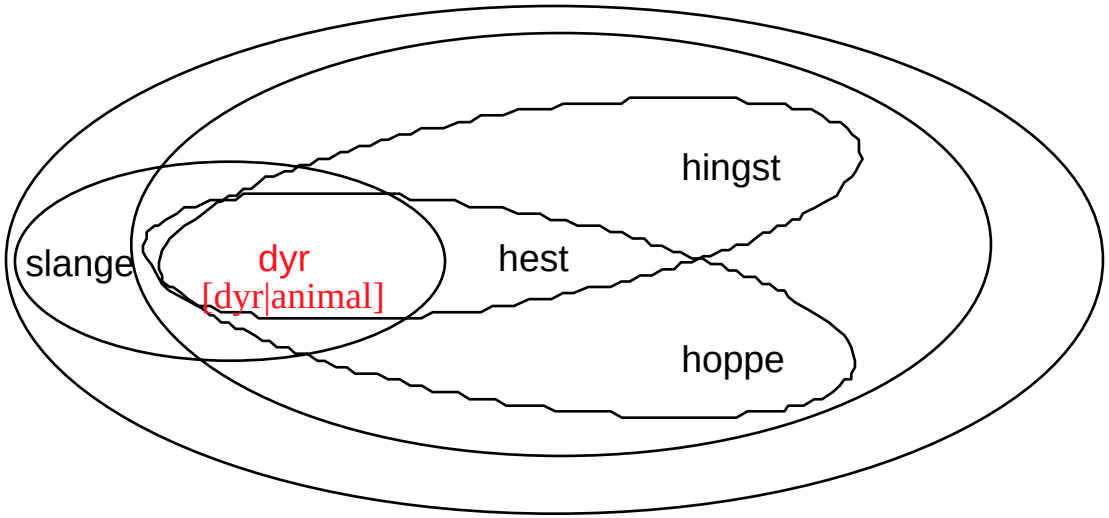
Semantic features are constructed from the peaks:



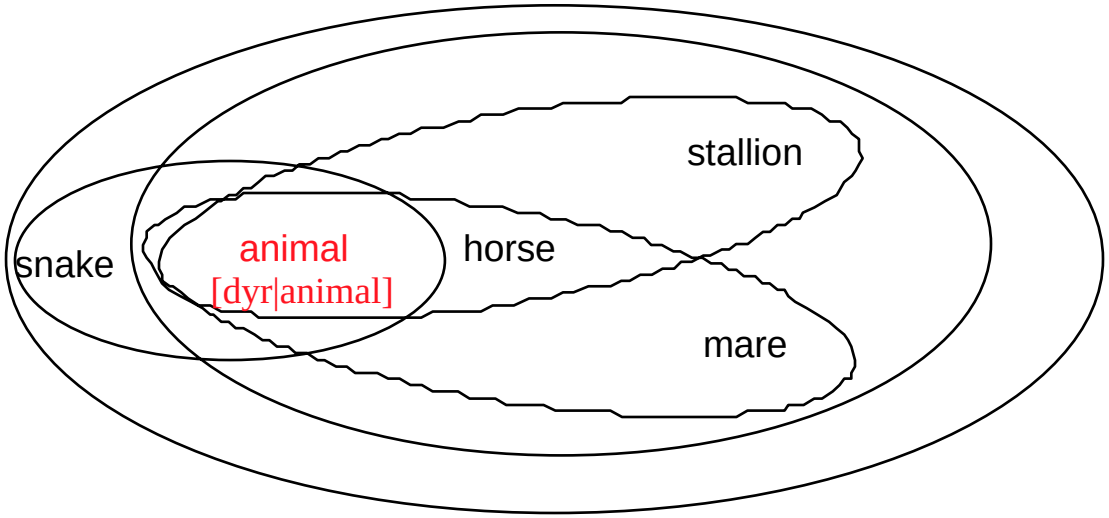
[dyr|animal]



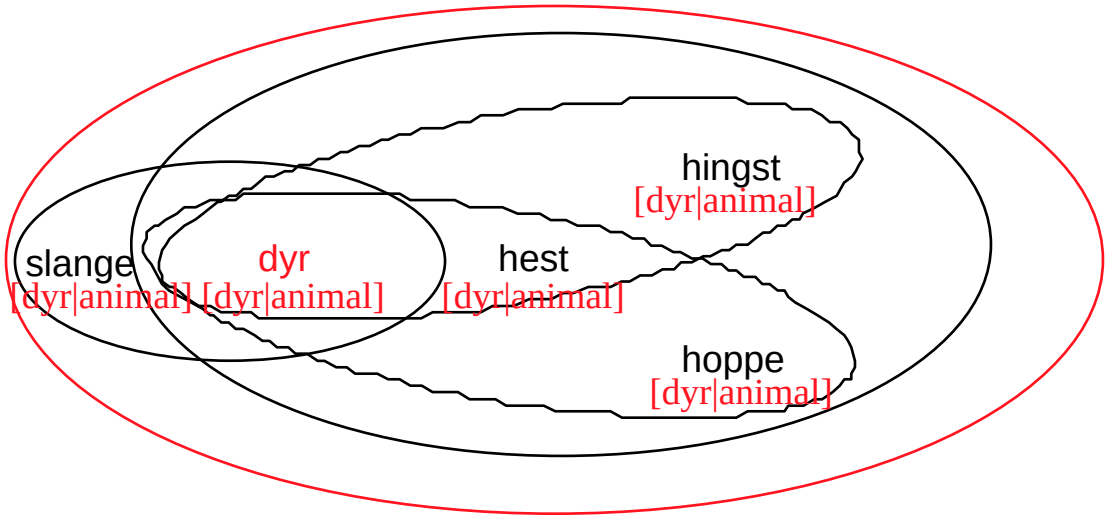
The feature is assigned to the two senses from which it is constructed...



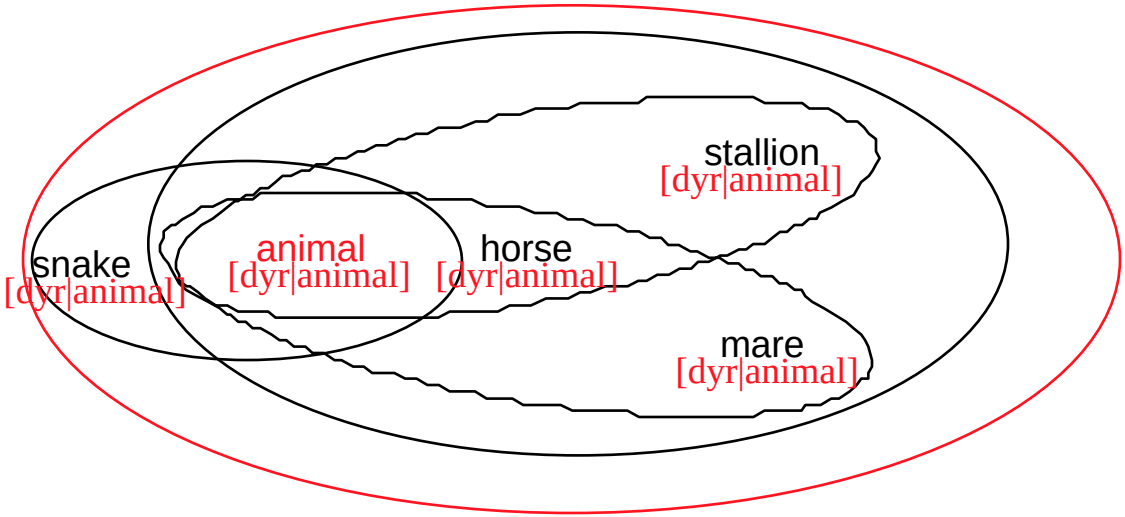
[dyr|animal]



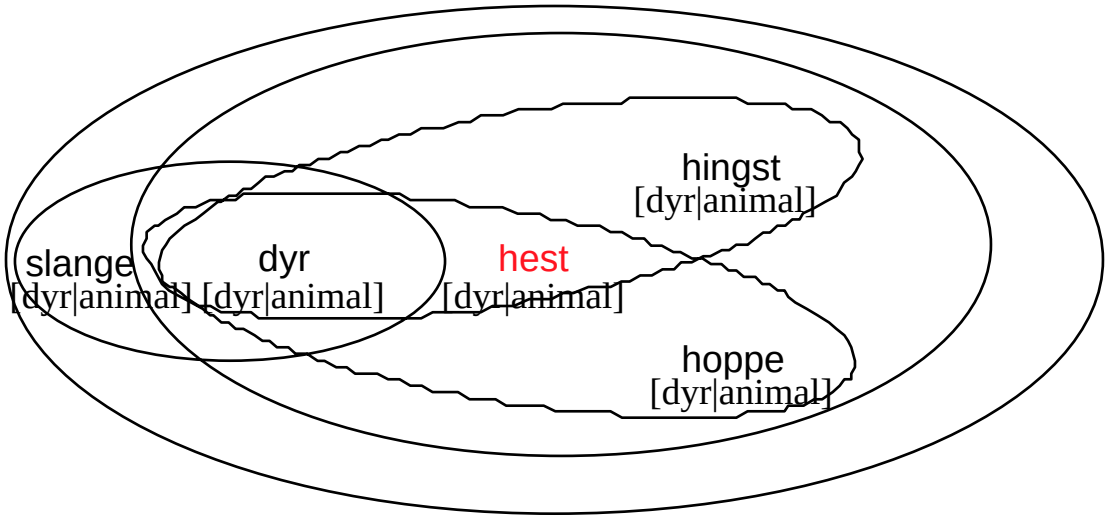
...and besides to all the lower senses in the *t*-images of ‘dyr’ and ‘animal’:



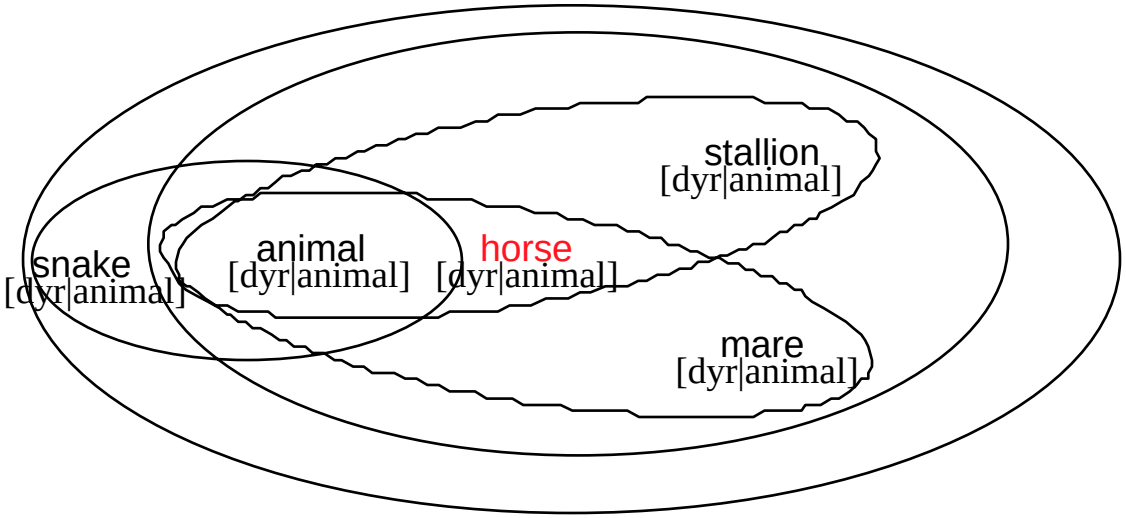
[dyr|animal]



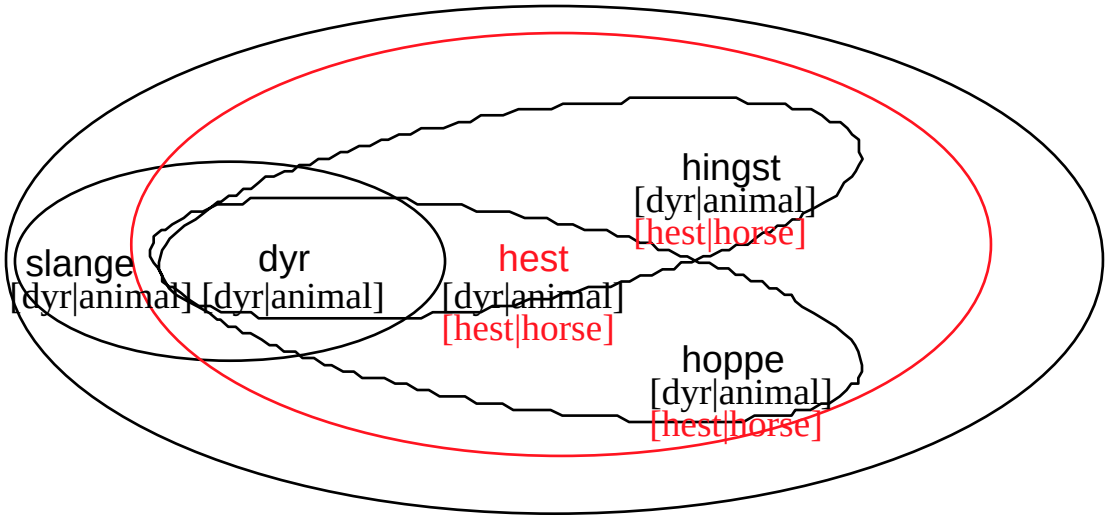
We go on to the lower peaks:



[dyr|animal]
[hest|horse]

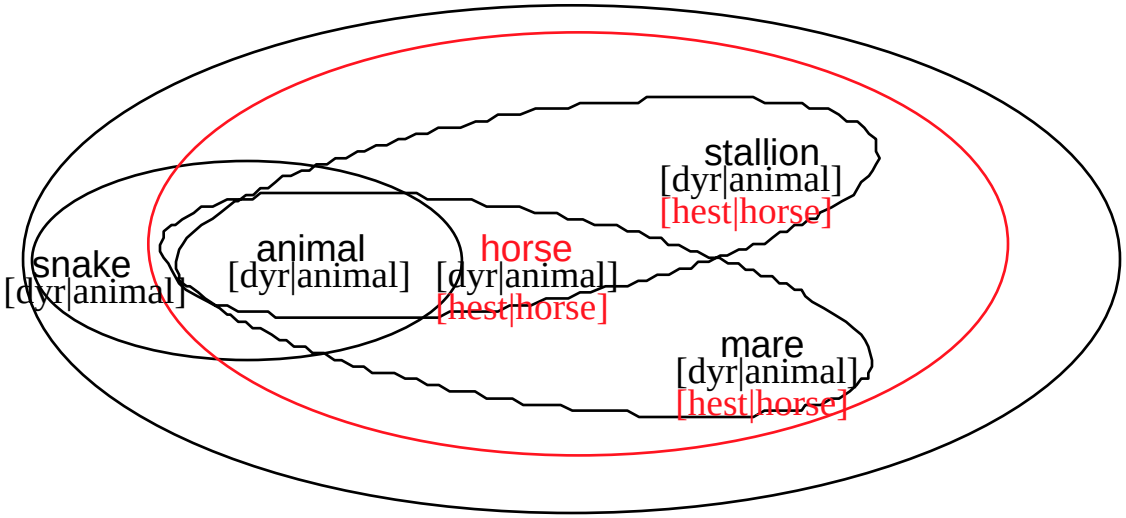


The feature is assigned to ‘hest’, ‘horse’ and lower senses in the *t*-images of ‘hest’ and ‘horse’:

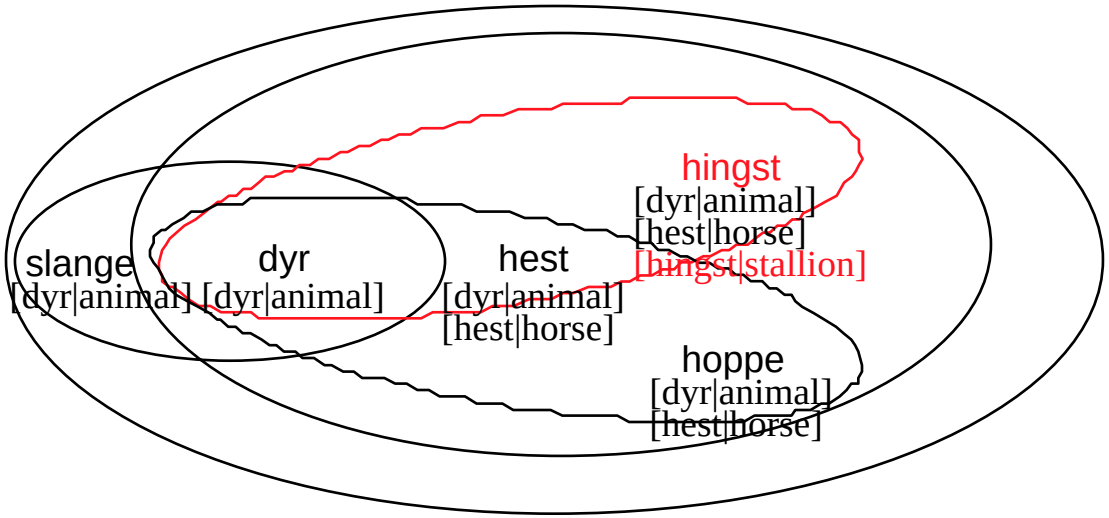


[dyr|animal]

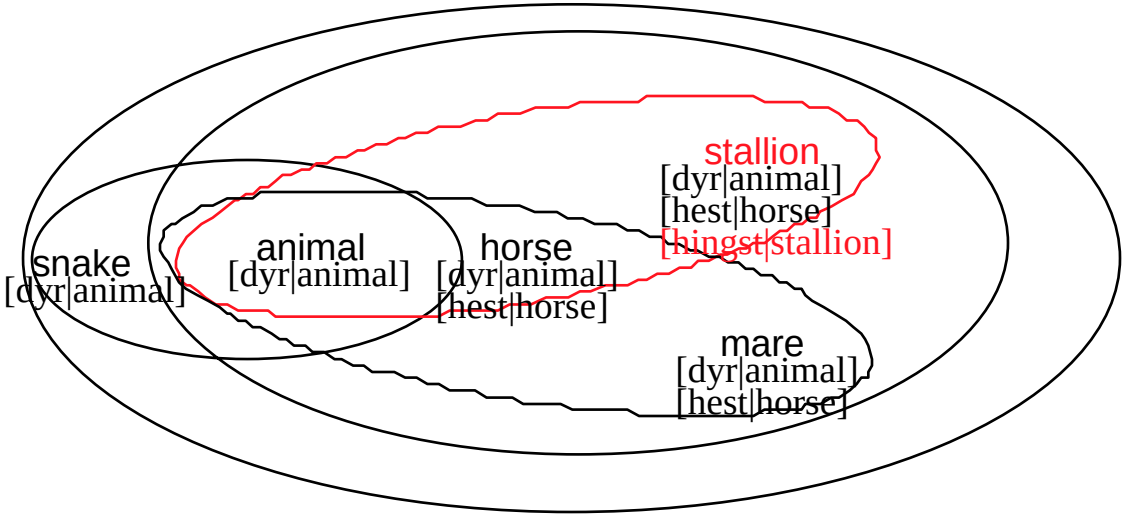
[hest|horse]



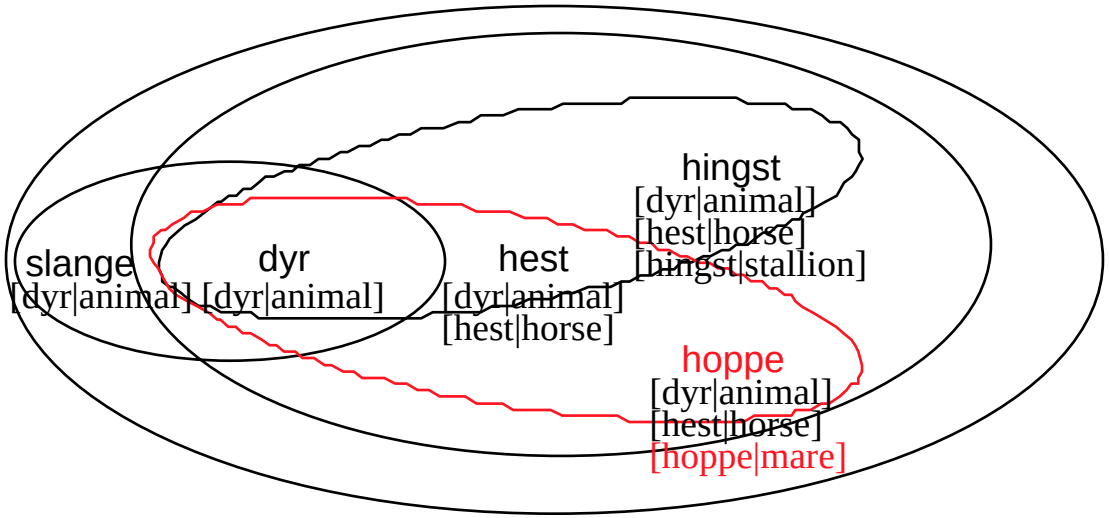
The two next peaks have the same height –
we arbitrarily choose ‘hingst’/‘stallion’:



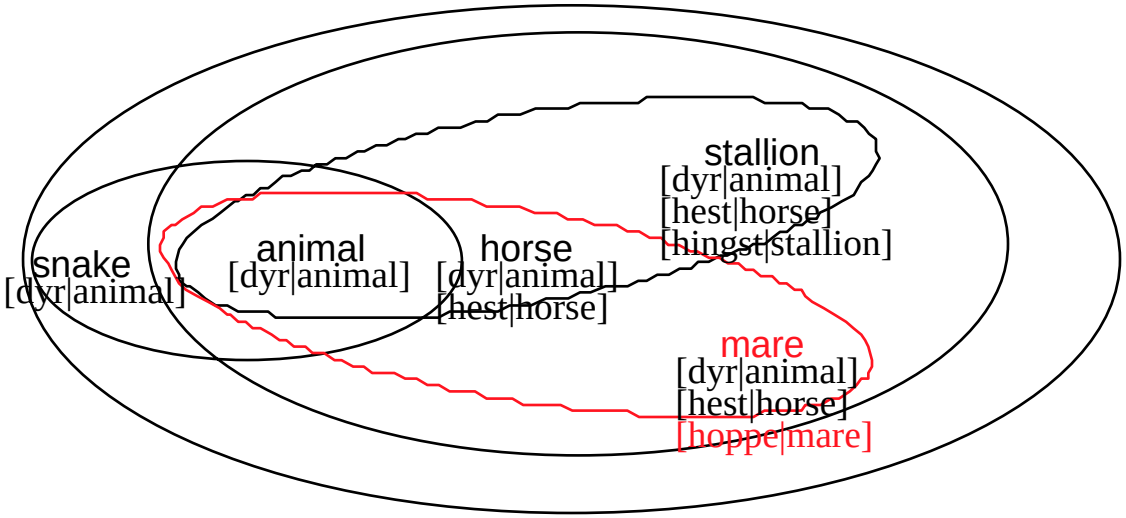
[dyr|animal]
[hest|horse]
[hingst|stallion]



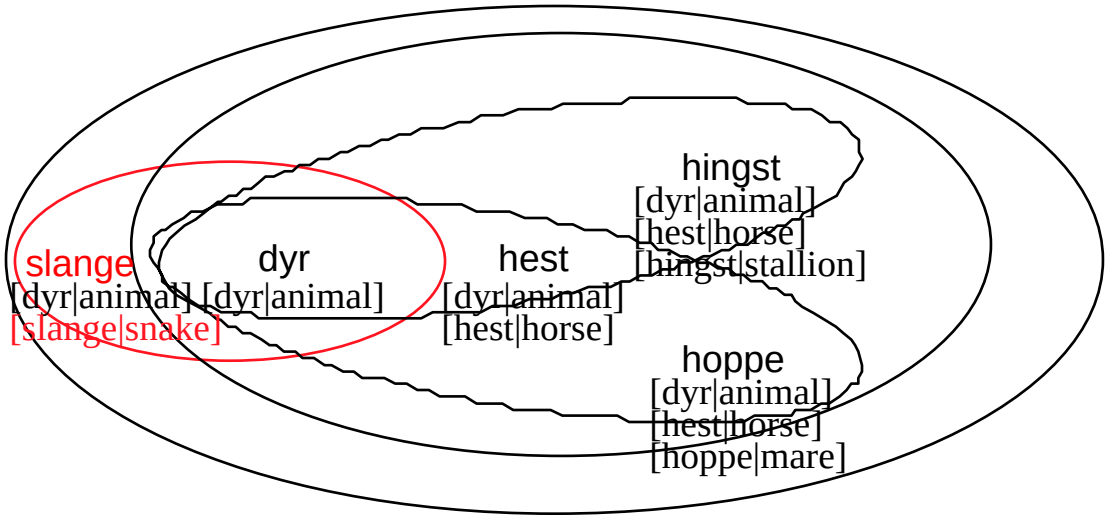
Then ‘hoppe’/‘mare’:



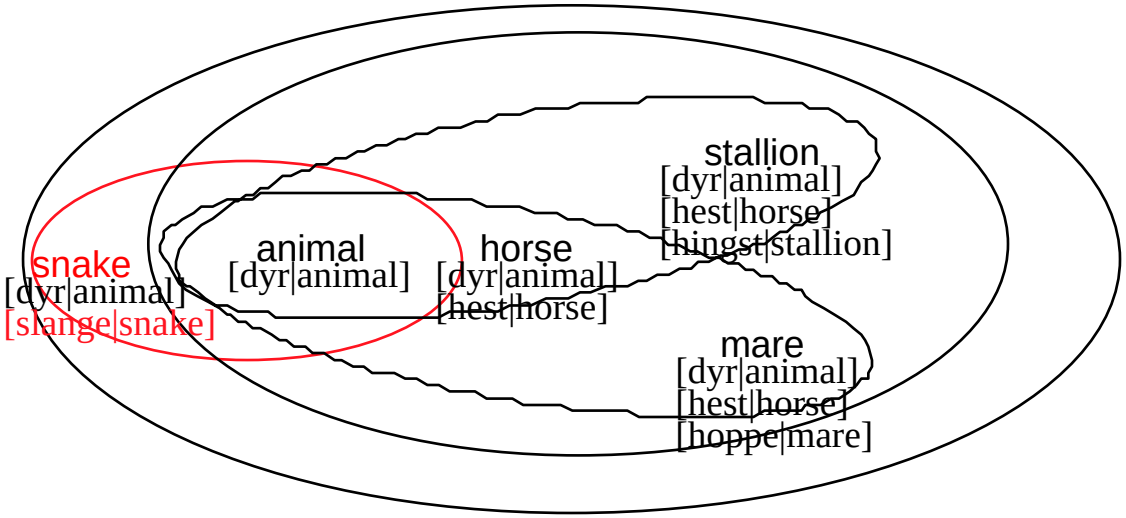
[dyr|animal]
[hest|horse]
[hingst|stallion]
[hoppe|mare]



And finally ‘slange’/‘snake’:

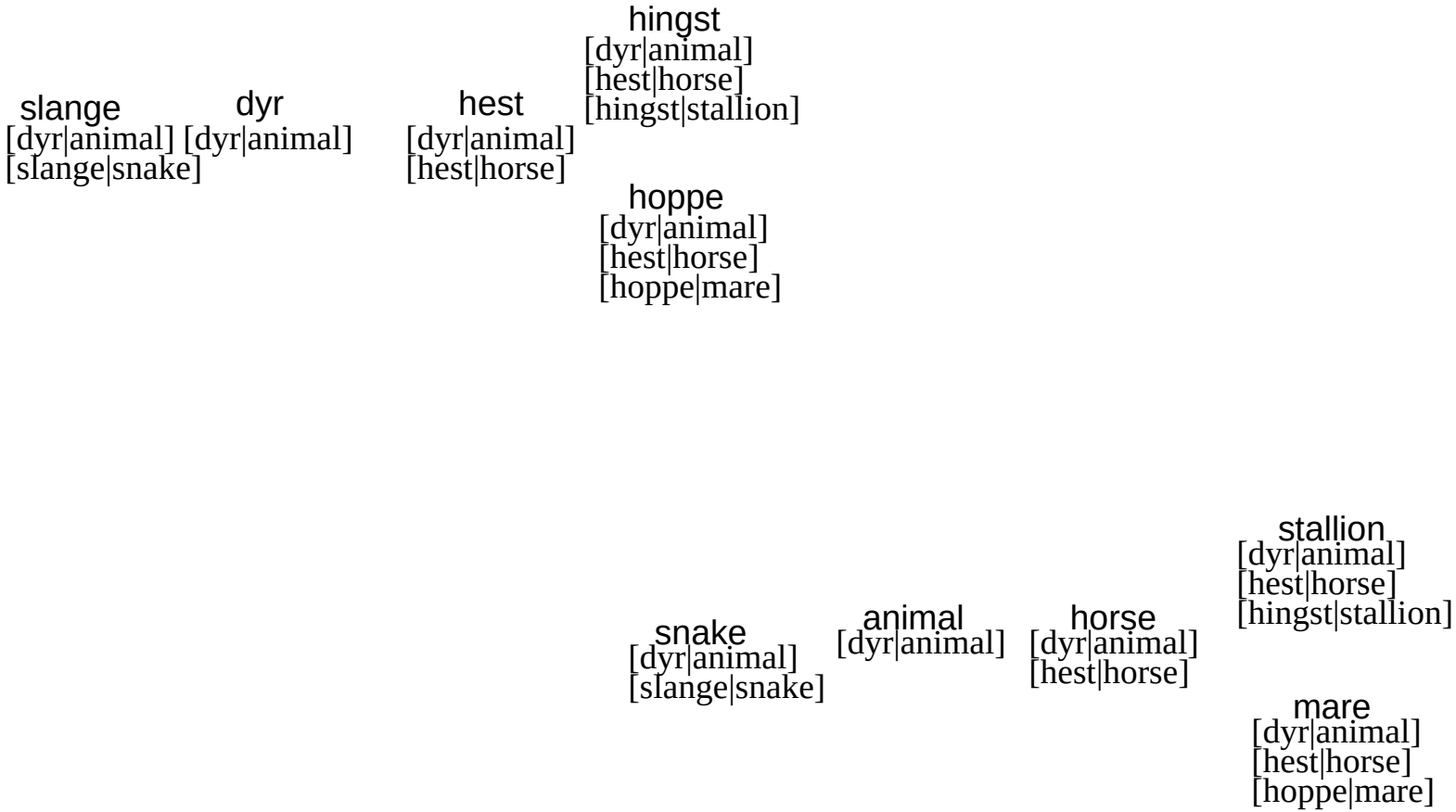


[dyr|animal]
[hest|horse]
[hingst|stallion]
[hoppe|mare]
[slange|snake]

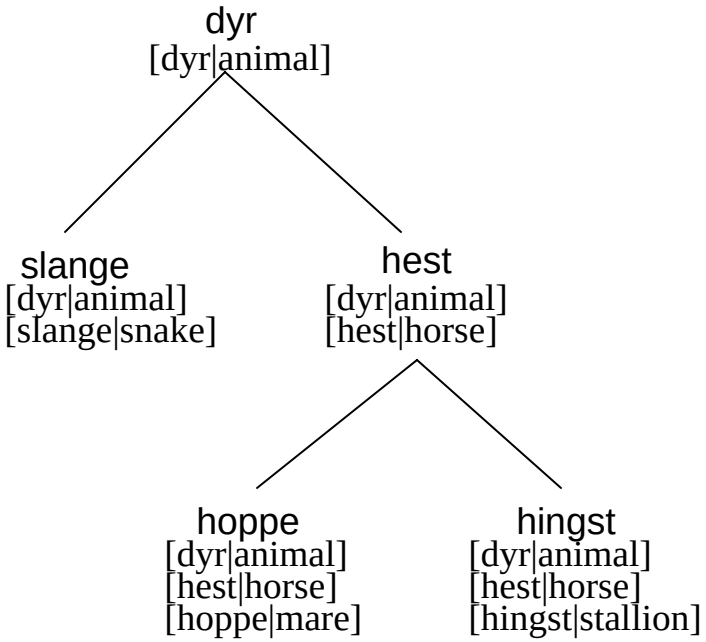


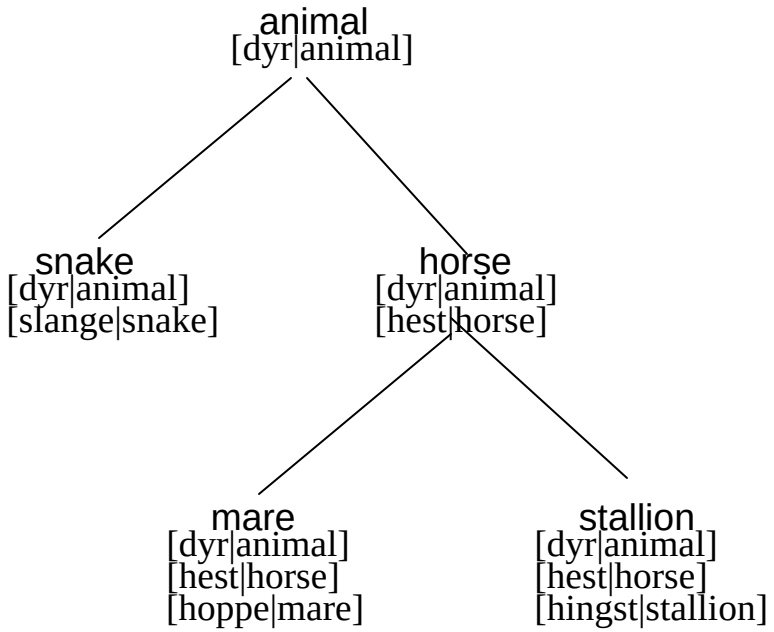
The feature sets express:

- Semantic relations among the senses
- Translational relations to the other language



Inclusion relations among the feature sets define lattices:





Automatic word alignment

Implemented by Sindre Sørensen, Aksis, Bergen

Web demo:

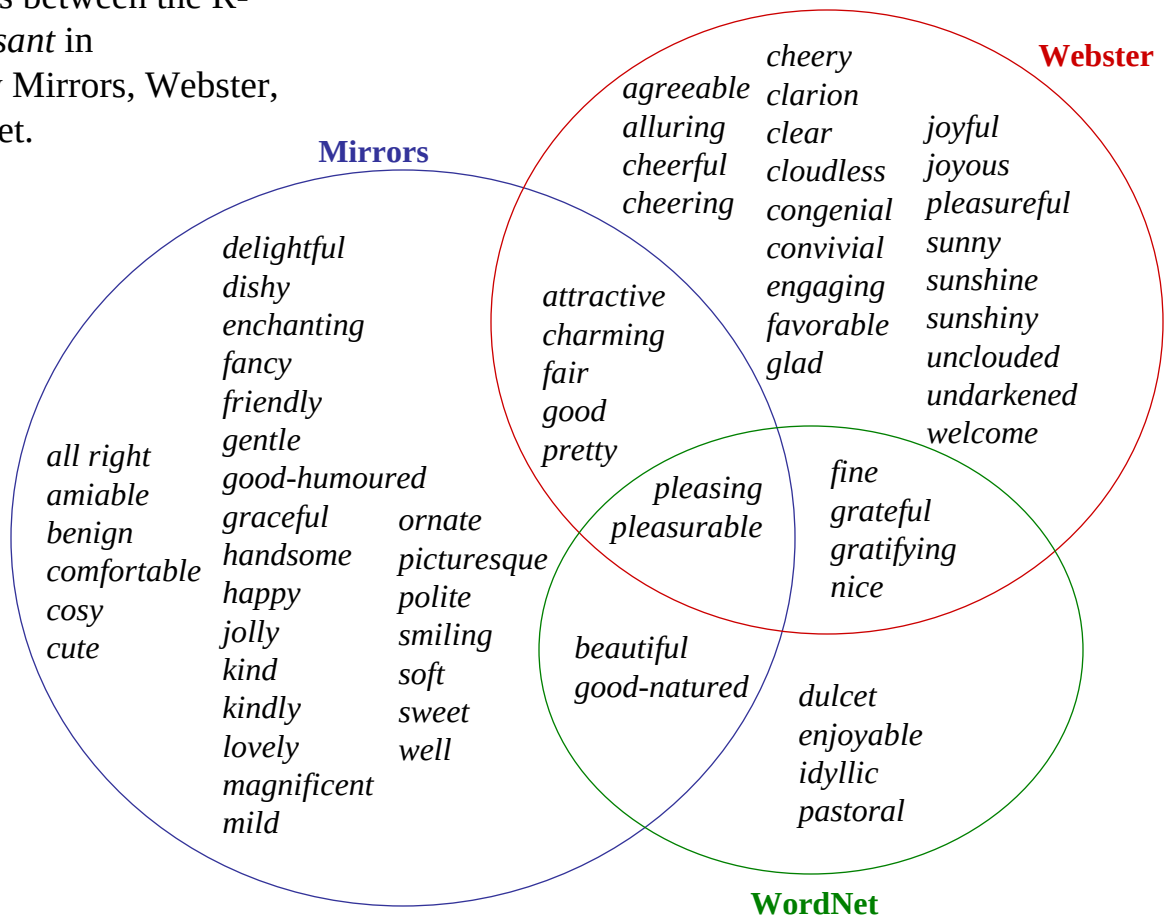
http://decentius.hit.uib.no:9000/cl/sm/documents.html

(Password protected)

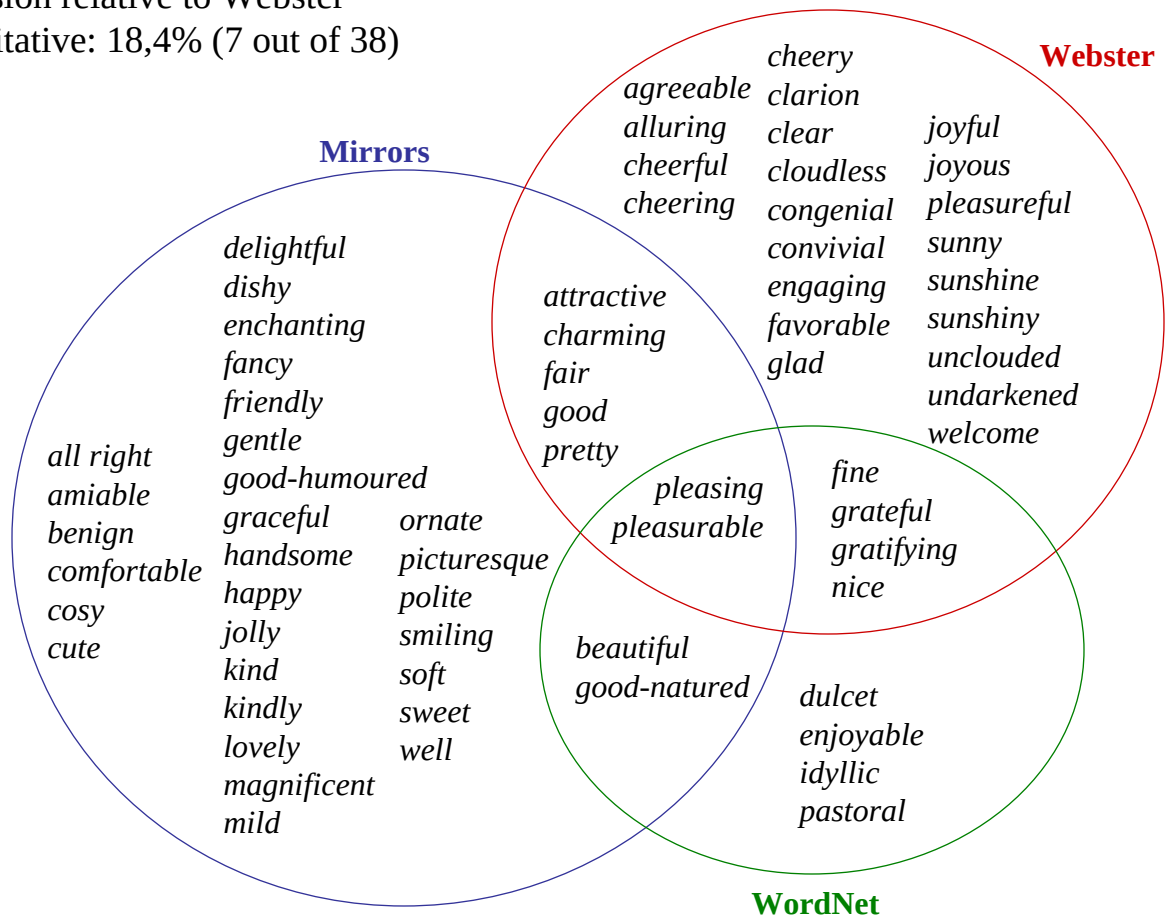
Evaluation of the Mirrors output

Work by Martha Thunes, Aksis, Bergen

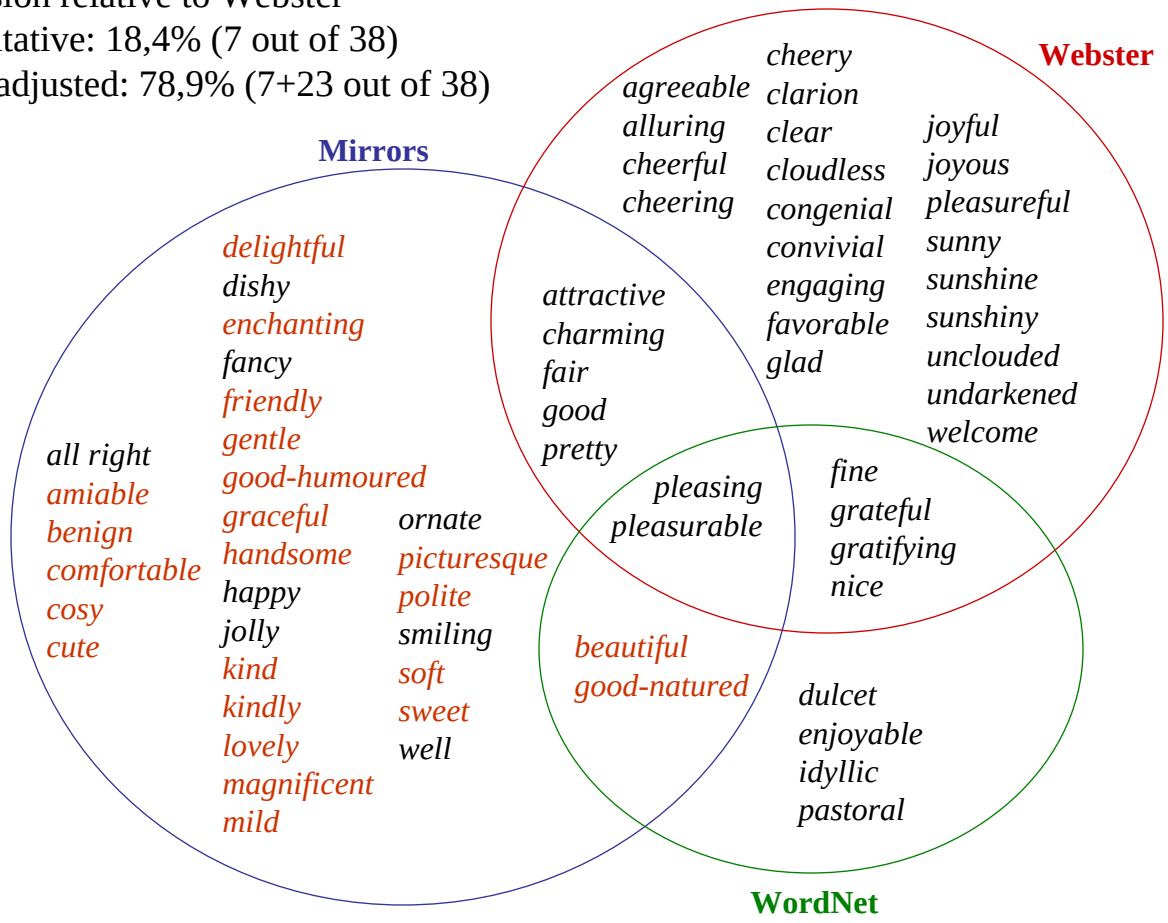
Intersections between the R-sets of *pleasant* in respectively Mirrors, Webster, and WordNet.



Mirrors precision relative to Webster
Strictly quantitative: 18,4% (7 out of 38)

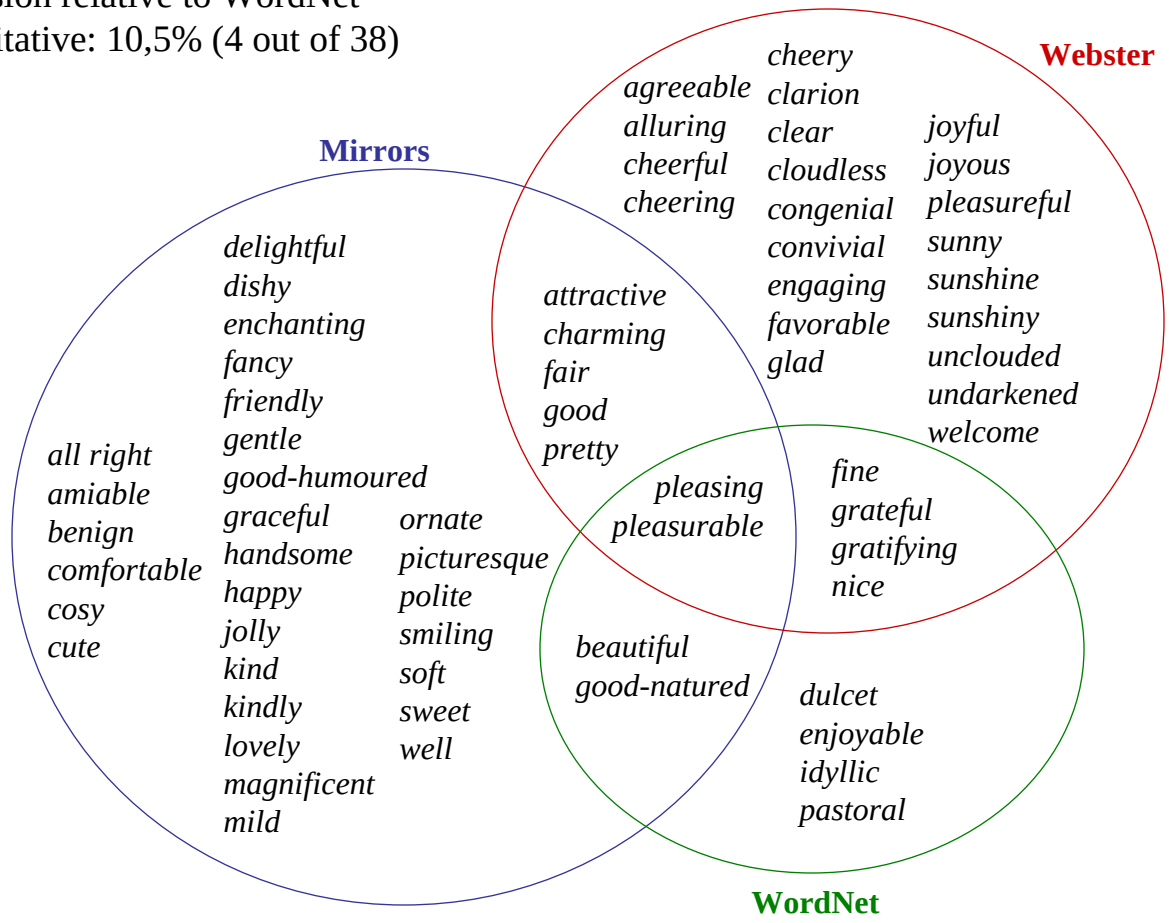


Mirrors precision relative to Webster
Strictly quantitative: 18,4% (7 out of 38)
Qualitatively adjusted: 78,9% (7+23 out of 38)

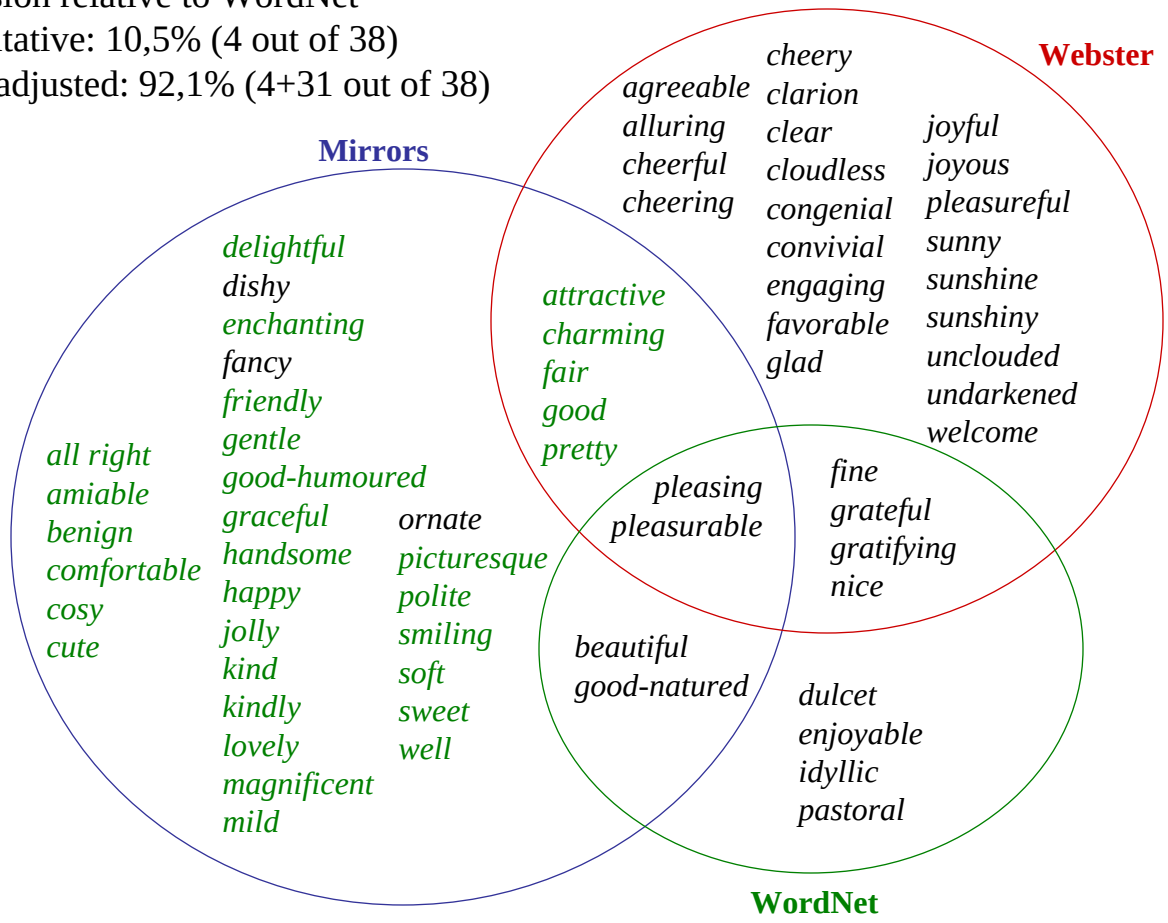


Qualitative adjustment: another 23 Mirrors R-words, in red, fall within the sense description given in the Webster entry.

Mirrors precision relative to WordNet
Strictly quantitative: 10,5% (4 out of 38)

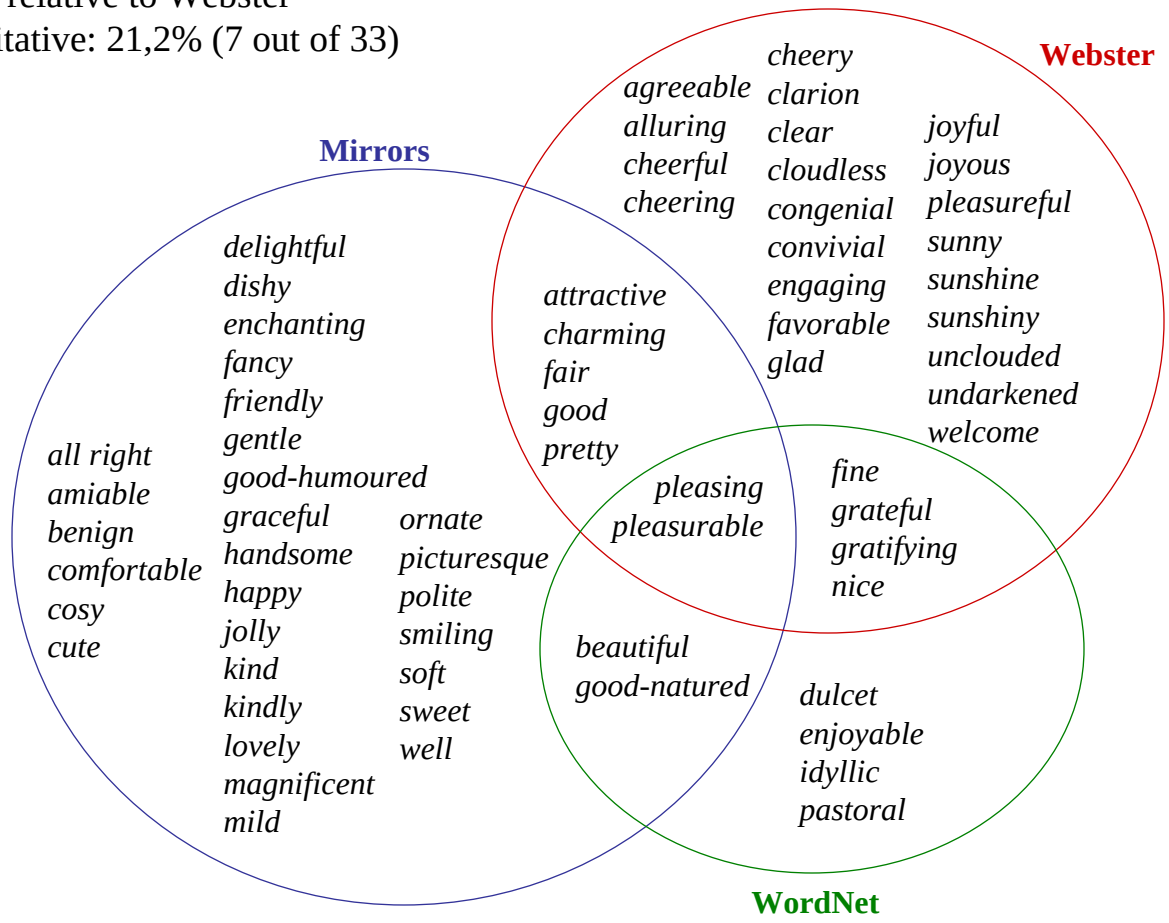


Mirrors precision relative to WordNet
Strictly quantitative: 10,5% (4 out of 38)
Qualitatively adjusted: 92,1% (4+31 out of 38)

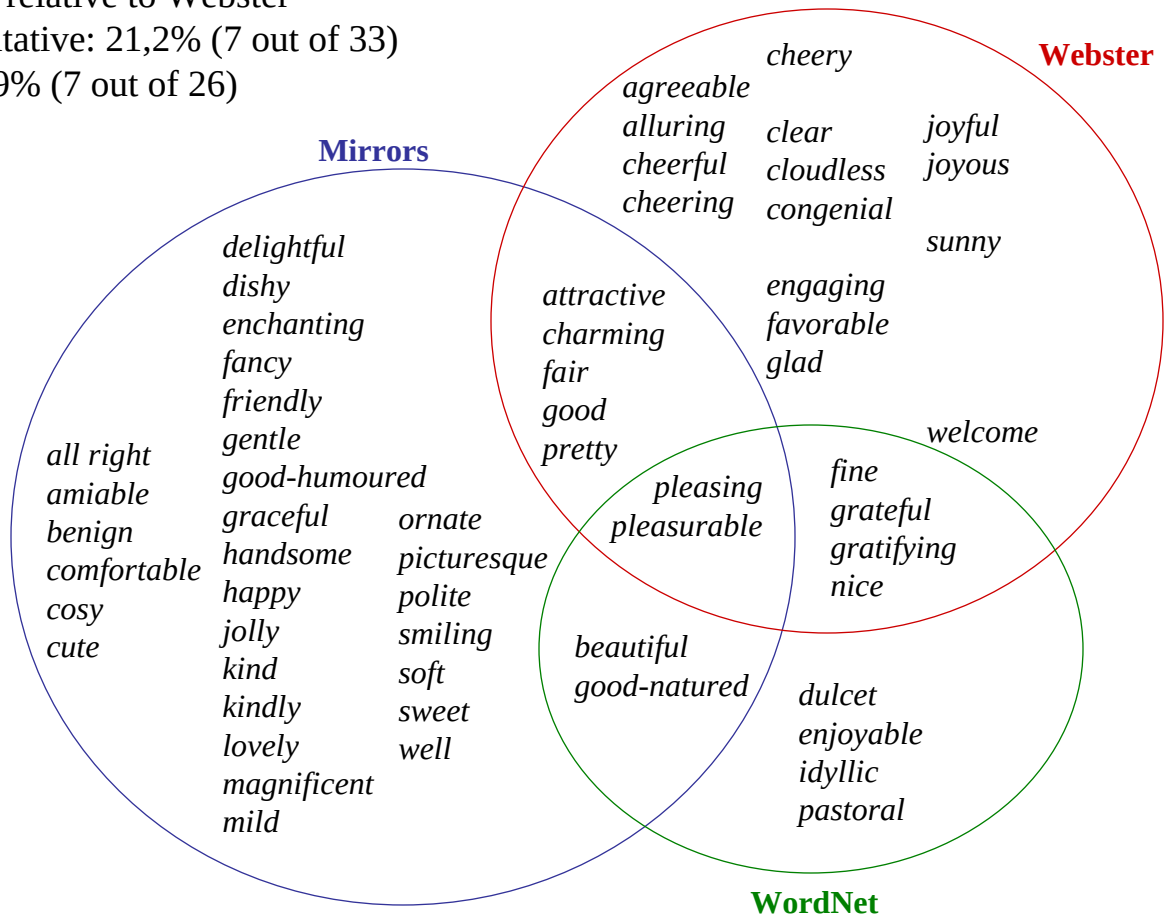


Qualitative adjustment: another 31 Mirrors R-words, in green, fall within the sense description given in the WordNet entry.

Mirrors recall relative to Webster
Strictly quantitative: 21,2% (7 out of 33)

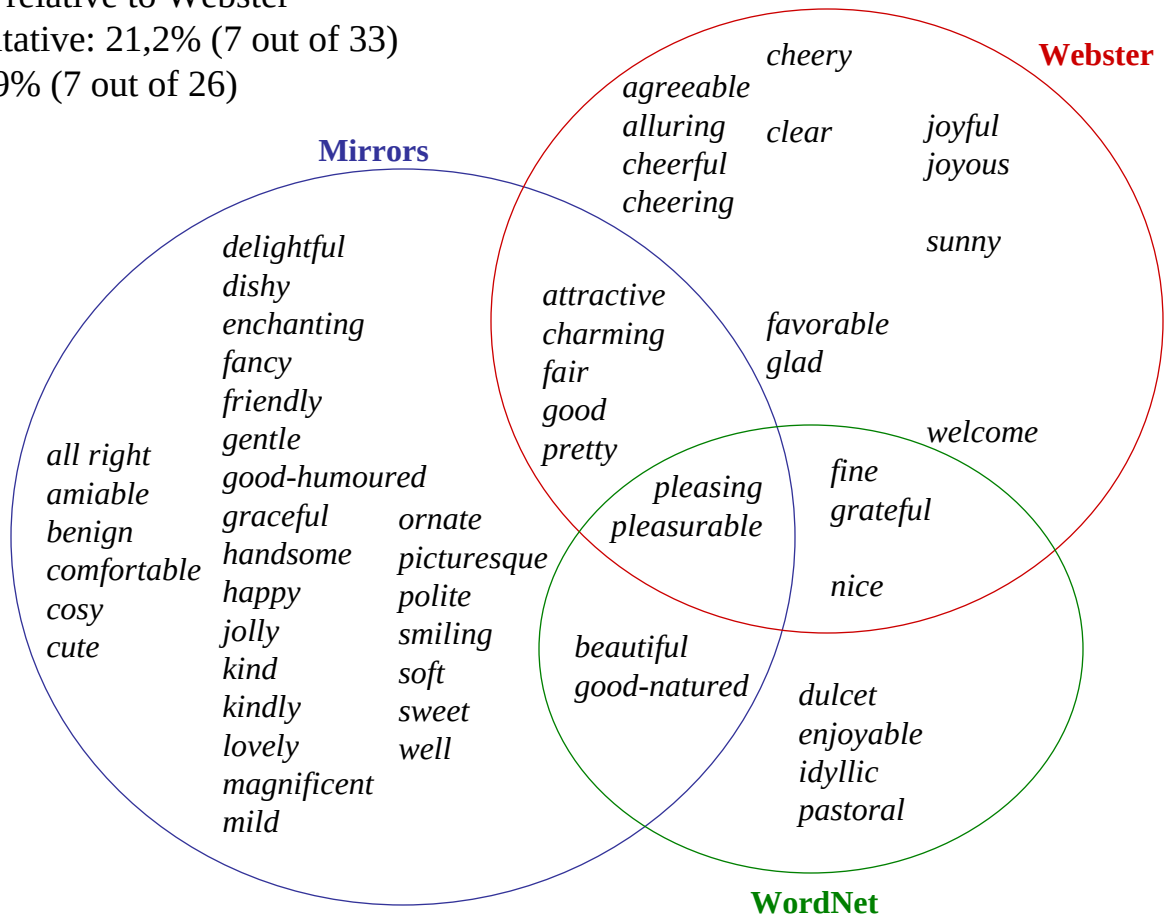


Mirrors recall relative to Webster
Strictly quantitative: 21,2% (7 out of 33)
Adjusted: 26,9% (7 out of 26)



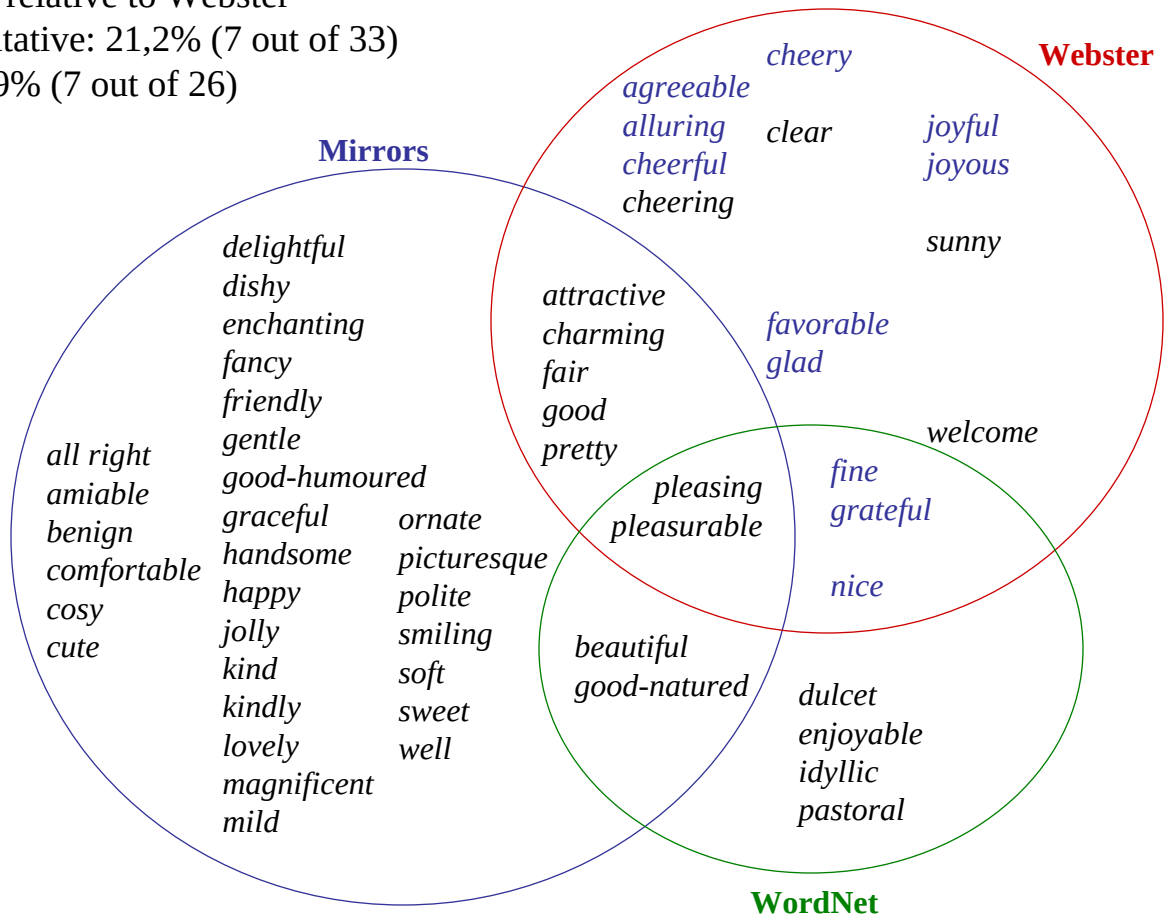
Adjusted recall: 7 Webster R-words do not occur in the corpus; hence, cannot be included in Mirrors.

Mirrors recall relative to Webster
Strictly quantitative: 21,2% (7 out of 33)
Adjusted: 26,9% (7 out of 26)



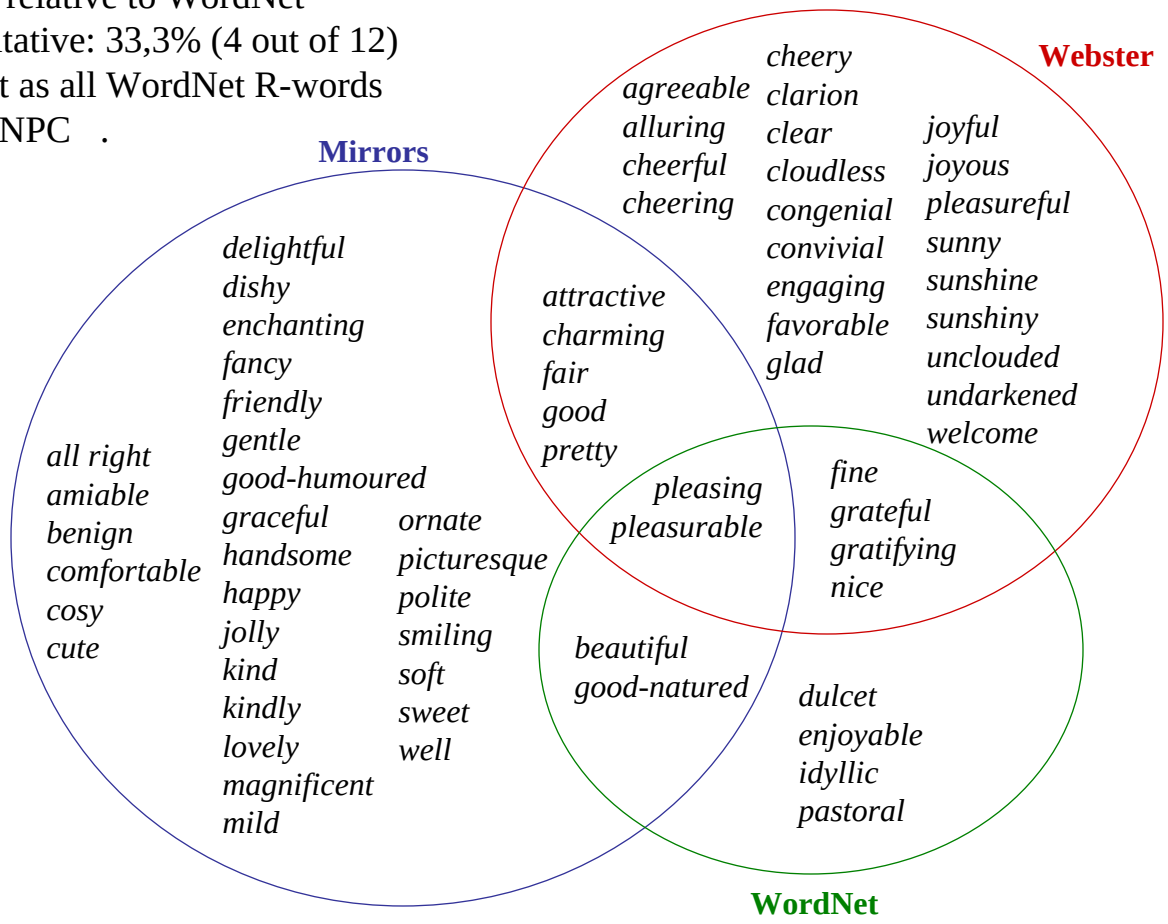
Further adjustment: disregarding another 4 Webster R-words because the Mirrors method cannot identify them as R-words due to their translational properties in the ENPC.

Mirrors recall relative to Webster
Strictly quantitative: 21,2% (7 out of 33)
Adjusted: 26,9% (7 out of 26)

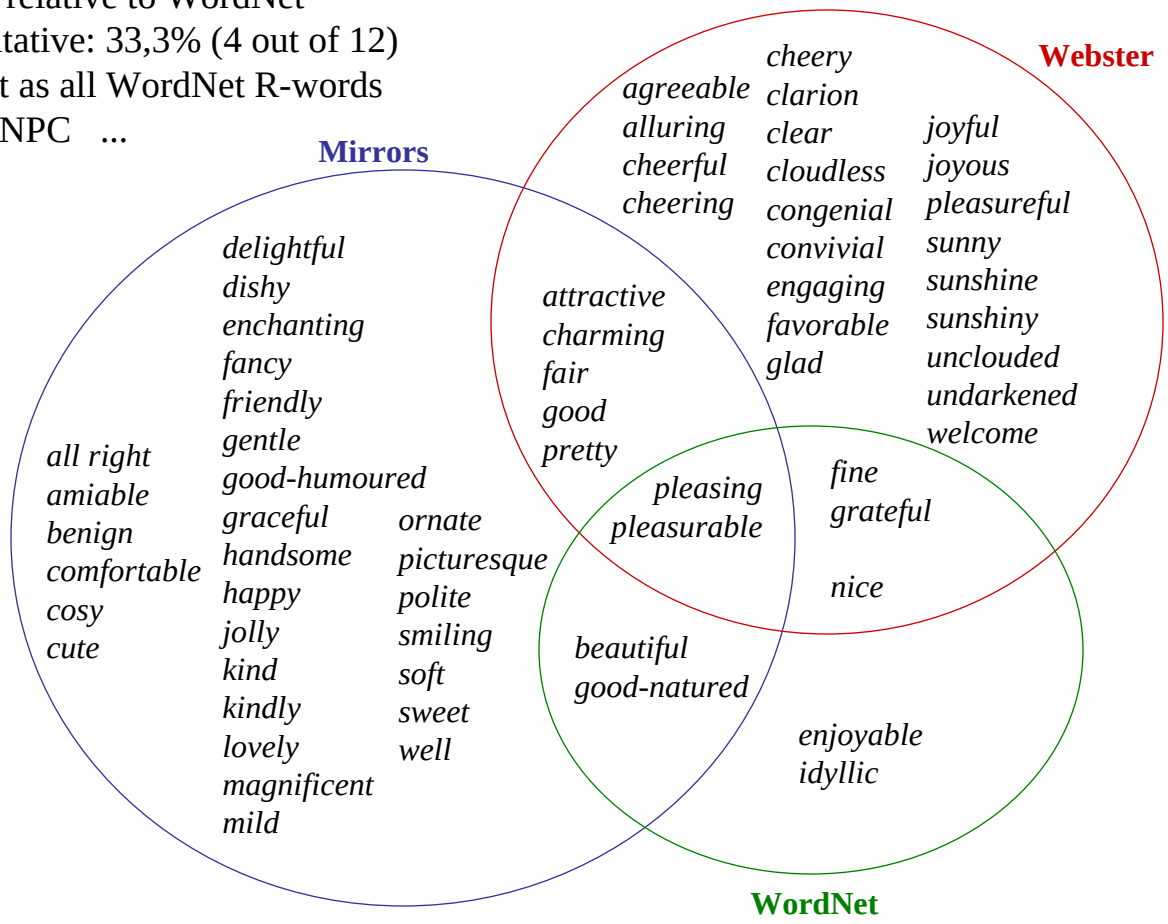


Among the remaining 15 Webster R-words missed by Mirrors, 11 words, in blue, represent meanings covered by the Mirrors R-set.

Mirrors recall relative to WordNet
Strictly quantitative: 33,3% (4 out of 12)
No adjustment as all WordNet R-words occur in the ENPC .

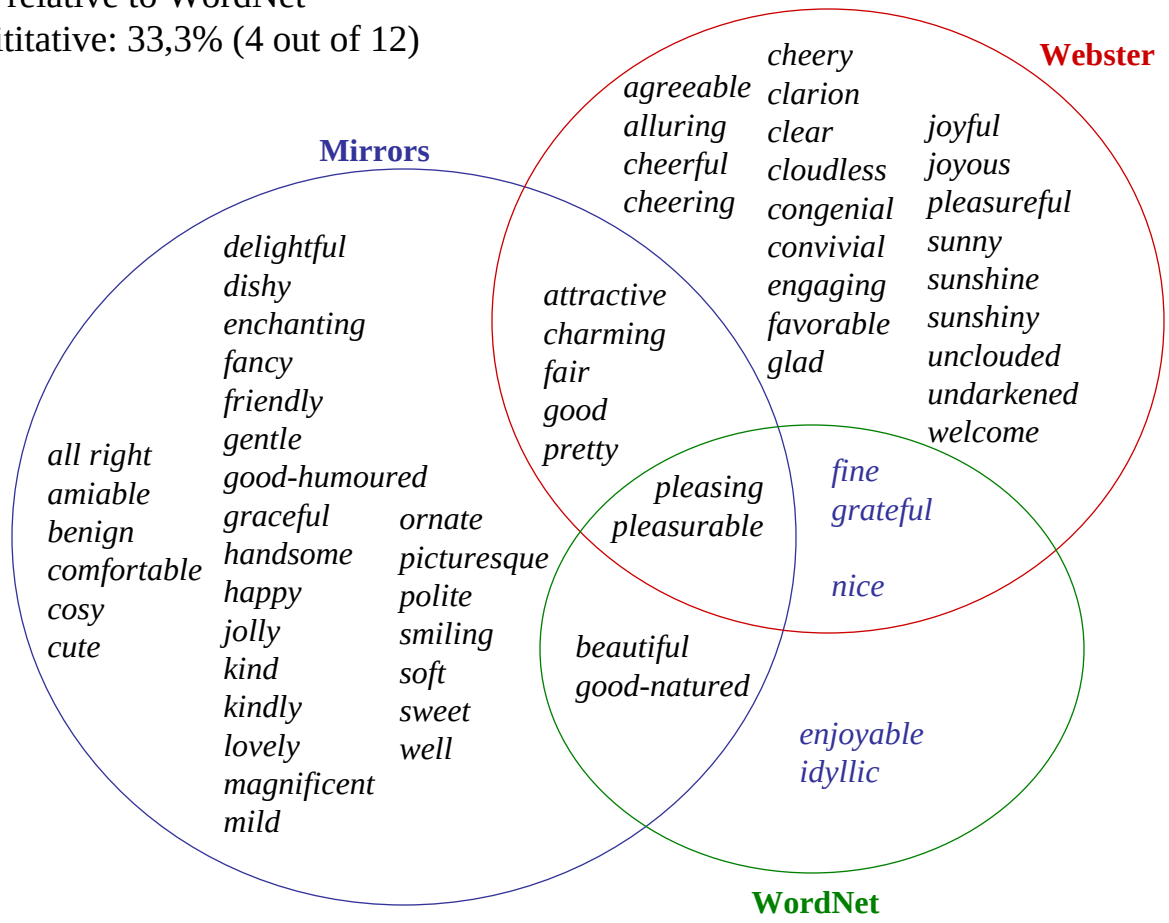


Mirrors recall relative to WordNet
Strictly quantitative: 33,3% (4 out of 12)
No adjustment as all WordNet R-words occur in the ENPC ...



...but 3 WordNet R-words may be disregarded as they are missed by Mirrors due to their translational properties in the corpus.

Mirrors recall relative to WordNet
Strictly quantititative: 33,3% (4 out of 12)



The remaining 5 WordNet R-words missed by Mirrors represent meanings covered by the Mirrors R-set, indicated with blue print.

Entry word	No. of words in Mirrors R-set	No. of words in Webster R-set	Words shared between the two R-sets		
			in numbers	% of Mirrors total (precision)	% of Webster total (recall)
able	13	25	7	53,8	28,0
adequate	31	18	3	9,7	16,7
affectionate	5	9	1	20,0	11,1
all right	38	10	2	5,3	20,0
appropriate	15	40	2	13,3	5,0
attractive	26	47	9	34,6	19,1
beneficial	9	12	2	22,2	16,7
bright	38	66	8	21,1	12,1
clear	59	73	12	20,3	16,4
comforting	15	no entry			
delicious	11	20	1	9,1	5,0
easy	49	114	15	30,6	13,2
excellent	23	56	2	8,7	3,6
fair	52	83	13	25,0	15,7
favourable	5	54	4	80,0	7,4
fine	31	42	3	9,7	7,1
firm	56	47	11	19,6	23,4
first-rate	2	10	1	50,0	10,0
fortunate	8	12	2	25,0	16,7
fresh	53	51	9	17,0	17,6
friendly	28	15	0	0,0	0,0
full	27	44	9	33,3	20,5
genuine	36	26	5	13,9	19,2
good	112	123	26	23,2	21,1

Entry word	No. of words in Mirrors R-set	No. of words in Webster R-set	Words shared between the two R-sets		
			in numbers	% of Mirrors total (precision)	% of Webster total (recall)
kind	22	38	7	31,8	18,4
nice	39	71	3	7,7	4,2
peaceful	17	13	1	5,9	7,7
pleasant	38	33	7	18,4	21,2
plentiful	6	25	4	66,7	16,0
positive	22	56	6	27,3	10,7
ripe	1	21	0	0,0	0,0
satisfactory	27	25	5	18,5	20,0
serviceable	0	10	0	0,0	0,0
siz(e)able	2	14	1	50,0	7,1
solid	51	17	5	9,8	29,4
sound	44	56	10	22,7	17,9
spectacular	19	18	2	10,5	11,1
steady	32	41	4	12,5	9,8
superb	7	35	2	28,6	5,7
sweet	51	37	8	15,7	21,6
tantalising	0	no adj. entry			
thorough	38	15	1	2,6	6,7
worthy	3	21	0	0,0	0,0
SUM (minus *comforting*)	1146	1543	212	18,5	13,7

Results for 42 adjectives,
with Merriam-Webster's Thesaurus as gold standard
(after Thunes):

Entry word	No. of words in Mirrors R-set	No. of words in Webster R-set	Words shared between the two R-sets		
			in numbers	% of Mirrors total (precision)	% of Webster total (recall)
SUM 42 adjectives	1146	1543	212	18,5	13,7

Qualitative adjustment of precision and recall for 3 adjectives (after Thunes):

Precision of the Mirrors R-set of	Strictly quantitative		Qualitatively adjusted	
	in numbers	percentage	in numbers	percentage
delicious	1 of 11	9,1	5 of 11	45,5
firm	12 of 57	21,1	38 of 57	66,7
fortunate	2 of 8	25,0	4 of 8	50,0

Recall of the Mirrors R-set of	Strictly quantitative		Adjusted w.r.t. corpus occurrences	
	in numbers	percentage	in numbers	percentage
delicious	1 of 20	5,0	1 of 12	8,3
firm	12 of 47	25,5	12 of 43	27,9
fortunate	2 of 12	16,7	2 of 9	22,2

Manual vs. automatic word alignment:
Results with Webster as gold standard
(after Thunes):

Entry word	No. of words in Mirrors R-set	No. of words in Webster R-set	Words shared between the two R-sets		
			in numbers	% of Mirrors total (precision)	% of Webster total (recall)
SUM 42 adjectives, *manual alignment*	1146	1543	212	18,5	13,7
SUM 42 adjectives, *automatic alignment*	477	1543	90	18,9	5,8