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# Understanding argument roles through the prism of BivalTyp

(a typological database of bivalent verbs and their encoding frames)

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# Introductory examples

(1) *Karl wartet auf Marie* NOM; auf+ACC
‘Karl is waiting for Marie.’

(2) *Mir fehlt ein Euro* DAT; NOM
‘I am one Euro short.’

– What semantic roles are assigned to *Marie* and *mir* in (1) and (2)?
– What other verbs have similar semantic roles?
– Do these roles trigger argument encoding?
– Are these encoding patterns typologically predictable?

# Structure of the talk

- Valency research: an overview
- The database: BivalTyp
- Discrete semantic roles: a phantom
- Results
  - transitivity prominence
  - semantic role clusters
  - predictability
- Conclusions and implications

# Valency research: an overview

Typology is mainly focused on major clause types

- monovalent: ‘sleep’, ‘run’, …
- transitive: ‘kill’, ‘break’, …
- ditransitive: ‘give’, …

# Valency research: an overview

The semantic basis of transitivity is relatively well understood

| | HIGH | LOW |
|---|---|---|
| A. PARTICIPANTS | 2 or more participants, A and O.[1] | 1 participant |
| B. KINESIS | action | non-action |
| C. ASPECT | telic | atelic |
| D. PUNCTUALITY | punctual | non-punctual |
| E. VOLITIONALITY | volitional | non-volitional |
| F. AFFIRMATION | affirmative | negative |
| G. MODE | realis | irrealis |
| H. AGENCY | A high in potency | A low in potency |
| I. AFFECTEDNESS OF O | O totally affected | O not affected |
| J. INDIVIDUATION OF O | O highly individuated | O non-individuated |

Hopper, Thompson (1980: 252), see also (Tsunoda 1985, Dowty 1991, Lehmann 1991, Lazard 1994, Malchukov 2005)

# Valency research: an overview

- All (?) languages have minor (a.k.a. non-canonical) valency patterns

- (Until recently) underrepresented in typological research

  «The selection principles apparently only govern argument selection for two-place predicates having a subject and a true direct object» (Dowty 1991: 576)

- Goal: to fill this gap for bivalent verbs

# Valency research: an overview

- Why bivalent verbs?
  - they are especially prone to show deviant valency behaviour (Bickel et al. 2014)

(3) *The boy looked* ***at the clouds***

(4) *Das Heu duftet* ***nach*** *Pferd*

Estonian

| | | | | |
|---|---|---|---|---|
| (5) | *Peetri-le* | *meeldi-b* | *see* | *särk* |
| | PN-ALL | appeal_to-PRS.3SG | this | shirt.SG.NOM |

‘Peter likes this shirt.’

  - they often form relatively large classes, unlike non-canonical trivalent verbs

# Valency research: an overview

- The valency of a verb = “the list of its arguments with their coding properties”
- Coding properties
  - flagging (cases & adpositions)
  - indexing (agreement, cross-referencing)
  - word order (rarely)

| | | | | |
|---|---|---|---|---|
| [*Den* | *Kindern*] | *gefällt* | [*der* | *Schneemann*]. |
| the.PL.DAT | child.PL.DAT | please.3SG | the.SG.NOM | snowman.SG.NOM |

‘The children like the snowman.’

Malchukov and the Leipzig Valency Classes Project team, 2015: 30

# Valency research: an overview

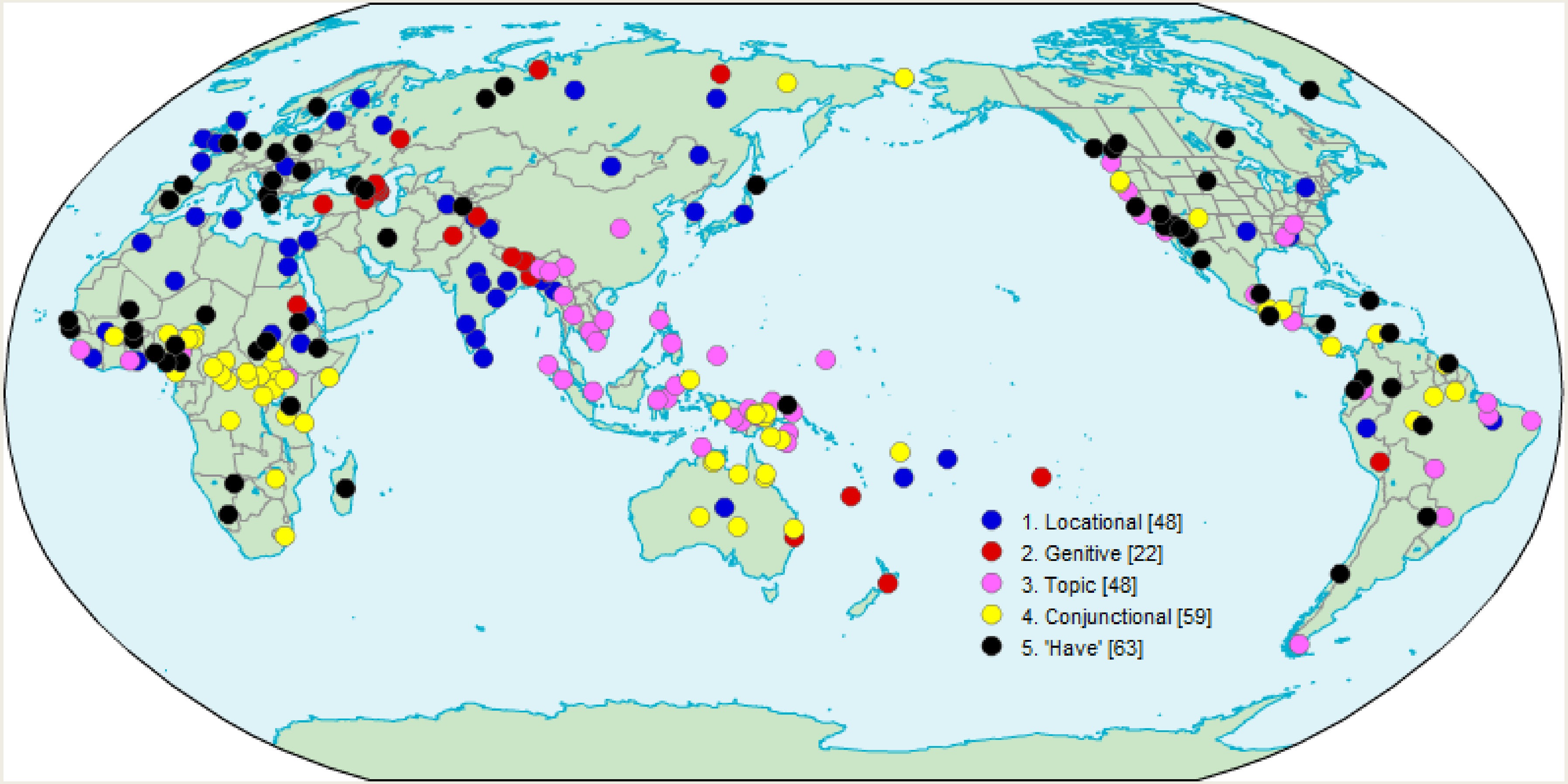
- Immediate problem for typology: coding properties are language-specific

- If notions such as “Instrumental case” or “Agreement slot #3” are language-specific, then where can we find a *tertium comparationis*?

# Valency research: an overview

- The usual answer: compare with other predicates in the same language
  - Classical alignment typology: is S aligned with (≈ encoded similarly to) A or P?
  - Ditransitive alignment: is P aligned with T (theme) or R (recipient)?
  - Predicative possession (e.g. in Stassen's work)
  - etc.
- All of these questions produce relatively simple categorical variables

# Predicative possession (Stassen, WALS)



# Valency research: an overview

- For such data, we need sets of pre-established gross values
- It mostly works for "big" construction types, such as predicative possessive constructions or ditransitive constructions with 'give'
- Not all constructions are like that =>

**wordlist-based typology**

# Valency research: an overview

- Wordlist-based typological studies into valency patterns
  - experiential predicates in European languages (Bossong 1998); 10 predicates: ‘see’, ‘forget’, ‘remember’, ‘be cold’, ‘be hungry’, ‘be thirsty’, ‘have a headache’, ‘be glad’, ‘be sorry’, ‘like’
  - Split-S: A-like vs. P-like vs. G-like (Nichols 2008)
  - Causative~Inchoative alternation and valence orientation (Nedjalkov 1969; Haspelmath 1993; Nichols et al. 2004; WATP)
  - “a posteriori” wordlist-based approach in (Bickel et al. 2014)

# Valency research: an overview

- Bivalent reflexive and passive-like emotion predicates in SAE (and related) languages:

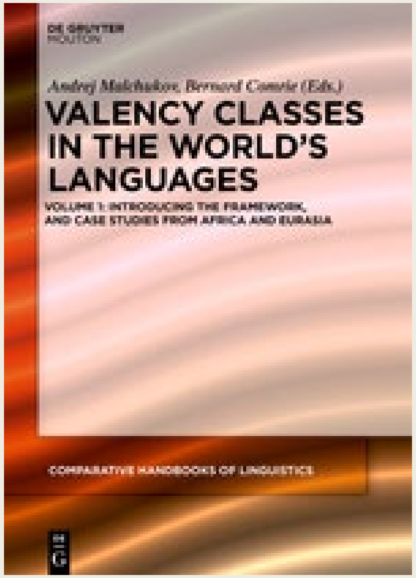
“The preposition or oblique case governed by the reflexive or resultative verb is not predictable” (Haspelmath 2001: 65)

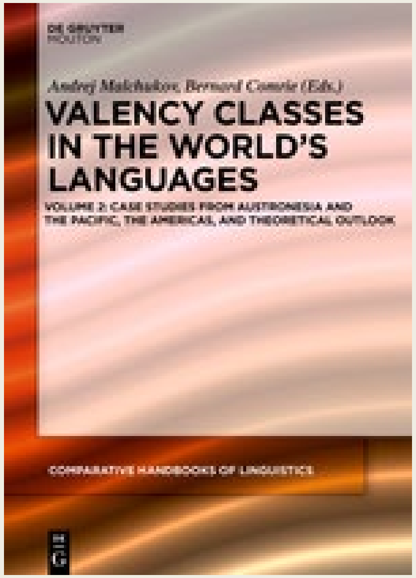
# Valency research: an overview

| | English | German | French | Polish |
|---|---|---|---|---|
| a. | *amaze* | *wundern* | *étonner* | *dziwić* |
| | *be amazed (at)* | *verwundert sein (über)* | *être étonné* | *być ździwionym* |
| | | *sich wundern (über)* | *s'étonner (de)* | *dziwić się* (DAT) |
| b. | *interest* | *interessieren* | *intéresser* | *interesować* |
| | *be interested (in)* | *interessiert sein (an)* | *être intéressé (par)* | *byćzainteresowanym* |
| | | *sich interessieren (für)* | *s'intéresser (à)* | *interesować się* (INSTR) |
| c. | *(anger)* | *ärgern* | *fâcher* | *gniewać* |
| | *(be angry)* | *verärgert sein (über)* | *être fâché* | *być rozgniewanym* |
| | *(get angry)* | *sich ärgern (über)* | *se fâcher* | *gniewać się* |
| d. | *sadden* | *betrüben* | *désoler* | *martwić* |
| | *be sad(dened)* | *betrübt sein (über)* | *être désolé* | *być zmartwionym* |
| | | *sich betrüben* | *se désoler (de)* | *martwić się* |
| e. | *worry* | *beunruhigen* | *préoccuper* | *niepokoić* |
| | *be worried (about)* | *beunruhigt sein (über)* | *être préoccupé* | *być zaniepokojonym* |
| | | *sich beunruhigen* | *se préoccuper* | *niepokoić się* |

# Valency research: an overview

- Valency Patterns Leipzig Online Database (ValPaL project) [http://www.valpal.info/]
- all numeric valency types
- 80 verb meanings
- 36 languages



# Valency research: an overview

- Typical problems in valency research
  - short wordlists (4-70 verbs) ≈ only major patterns
  - sets of values are often pre-established

# BivalTyp: goals

- Which factors determine valency class assignment in individual languages?
- To what extent are valency classes similar across languages? To what extent are they variable?
- What is the role of genealogical and areal factors?

# BivalTyp: major design features

Say, Sergey (ed.). 2020--... BivalTyp: Typological database of bivalent verbs and their encoding frames. (Available online at https://www.bivaltyp.info)*

*All credit for building the web-page goes to Dmitry Nikolaev

# BivalTyp

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Home Project ↓ How to read the data Languages ↓ Predicates Data overview ↓ Maps Download

## Welcome to BivalTyp

BivalTyp is a typological database of bivalent verbs and their encoding frames. As of 2023, the database presents data for 92 languages, mainly spoken in Northern Eurasia. The database is based on a questionnaire containing 130 predicates given in context. Language-particular encoding frames are identified based on the devices (such as cases, adpositions, and verbal indices) involved in encoding two predefined arguments of each predicate (e.g. 'Peter' and 'the dog' in 'Peter is afraid of the dog'). In each language, one class of verbs is identified as transitive. The goal of the project is to explore the ways in which bivalent verbs can be split between the transitive and different intransitive valency classes.

## How to use BivalTyp

You can browse BivalTyp by predicate (e.g., in case you are interested in how the arguments of the verb 'to fear' are encoded in different languages) or by language (e.g., in case you want to explore the behaviour of 130 predicates in a specific language). Besides, you can take an overview of the data in your browser, build customizable maps, or search the database as an extended spreadsheet form. Finally, you can download the spreadsheet with data for further use offline.

The web-site built by Dmitry Nikolaev.

# BivalTyp: major design features

- First-hand data provided by language experts
  - St. Petersburg-style typology
- Questionnaire with 130 verbs given in context

  => “probes” in the infinite semantic space

# BivalTyp: major design features

#21 (Peter was crossing the river in a boat)

| | | | |
|---|---|---|---|
| | ‘Peter | **reached** | the bank’ |
| | X | | Y |

#22 (The wall was covered with fresh paint)

| | | | |
|---|---|---|---|
| | ‘Peter | **touched** | the wall’ (and got dirty) |
| | X | | Y |

=> Two pre-defined arguments (X, Y) for each predicate

# BivalTyp: major design features

Abaza (< Northwest Caucasian)

(6) *fatíma murád jə-z-qá-l-ç̣-əj-ṭ*

PN PN [3SG.M.IO-BEN]-LOC-[3SG.F.ERG]-believe-PRS-DCL

Y X

'Fatima trusts Murad.'

Valency pattern = [ERG; BEN]

# BivalTyp: major design features

- The pattern is considered transitive iff its X and Y arguments are coded like the two arguments of the sentence with ‘kill’, see also (Haspelmath 2015: 136)

# BivalTyp: major design features

- The sample: currently 97 languages, mainly spoken in Northern Eurasia

# BivalTyp: major design features

- A big **THANK YOU** to language experts

Anna Alexandrova, Daria Alfimova, Ekaterina Aplonova, Peter Arkadiev, David Avellan-Hultman, Aleksandra Azargaeva, Mislav Benić, Sandra Birzer, Alena Blinova, Nadezhda Bulatova, Denis Creissels, Michael Daniel, Varvara Diveeva, Sergey Dmitrenko, Vladimir Fedorov, Timothy Feist, Dmitry Gerasimov, Wakweya Gobena, Elena Gorbova, Olga Gorickaja, Ingunn Hreinberg Indriðadóttir, Ildar Ibragimov, Emil Ingelsten, Vasilisa Kagirova, Maxim Kloczenko, Maria Khazhomia, Maria Kholodilova, Mikhail Knyazev, Elena Kolpachkova, Daria (Suetina) Konior, Yukari Konuma, Elena Kordi, Richard Kowalik, Kirill Kozhanov, Irina Külmoja, Olga Kuznecova, Timur Maisak, Anastasia (Borisovna) Makarova, Anastasia (Leonidovna) Makarova, Ramazan Mamedshaxov, Solmaz Merdanova, Stepan Mikhajlov, Daria Mischenko, Zarina Molochieva, George Moroz, Rasul Mutalov, Galina Nekrasova, Johanna Nichols, Dmitry Nikolaev, Ajtalina Nogovitsyna, Sofia Oskolskaya, Maria Ovsjannikova, Anastasia Panova, Elena Perekhvalskaja, Natalia Perkova, Krasimira Petrova, Inna Popova, Maria Pupynina, Tatiana Repnina, Neige Rochant, Alexander Rostovtsev-Popiel, Daria Ryzhova, Sergey Say, Ekaterina Sergeeva, Ksenia Shagal, Mayya Shlyakhter, Natalia Stoynova, Ksenia Studenikina, Evgenija Teplukhina, Mladen Uhlik, Anastasia Vasilisina, Arseniy Vydrin, Valentin Vydrin, Elizaveta Zabelina, Natalia Zaika, Andreja Žele, Ekaterina Zheltova, Vasilisa Zhigulskaja, Daria Zhornik, Anastasia Zhuk

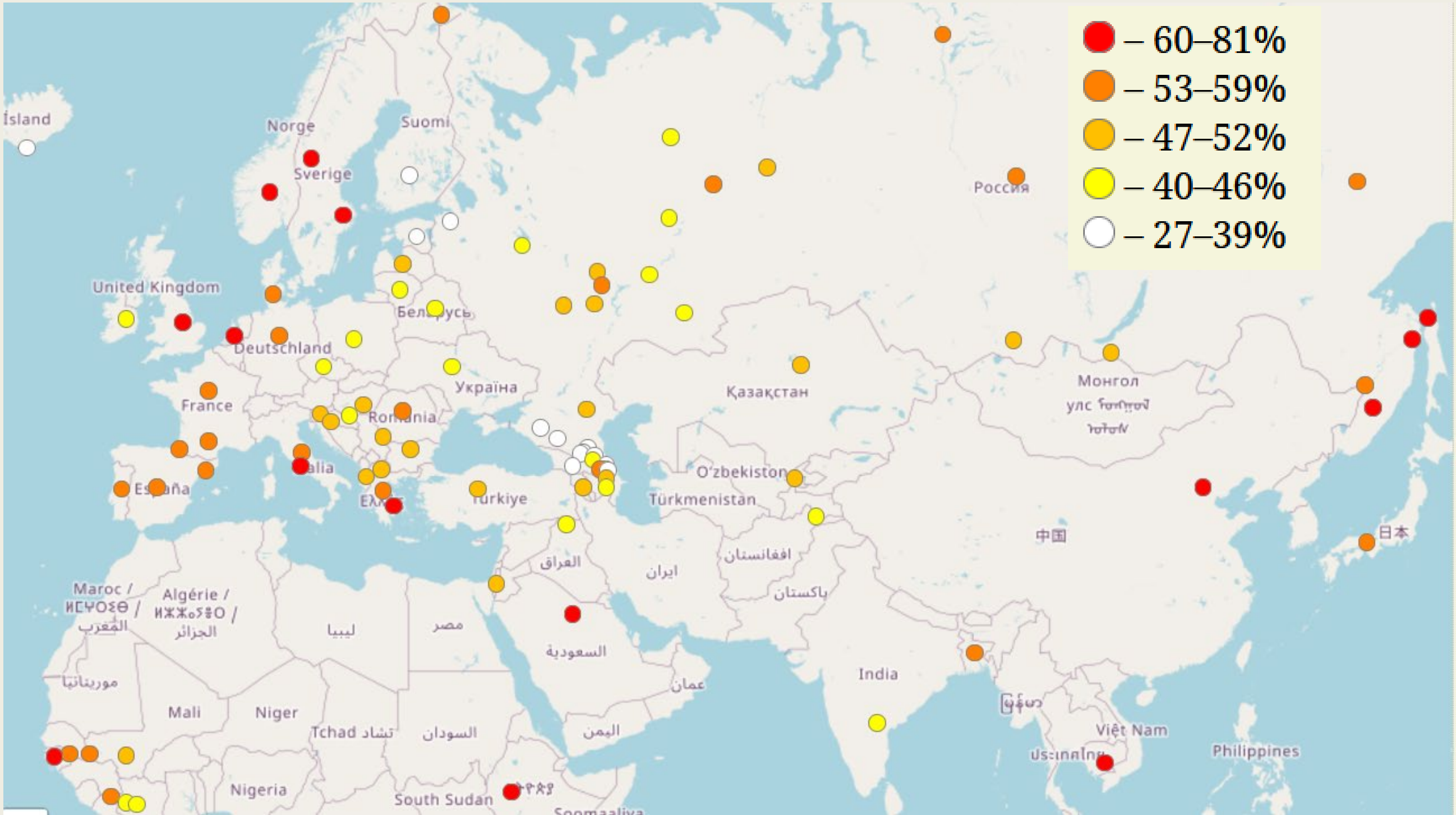
# BivalTyp: major design features

- 11402 entries (130 predicates in 97 lgs – 1208 gaps):
  - language ID
  - predicate ID
  - verb lemma
  - valency pattern: encoding of X and Y + locus of intransitivity
  - (for 40 languages: interlinearized examples)
- The database is searchable, sortable and mappable by predicates, languages, valency patterns, etc.

- **Further contributions are very welcome!**

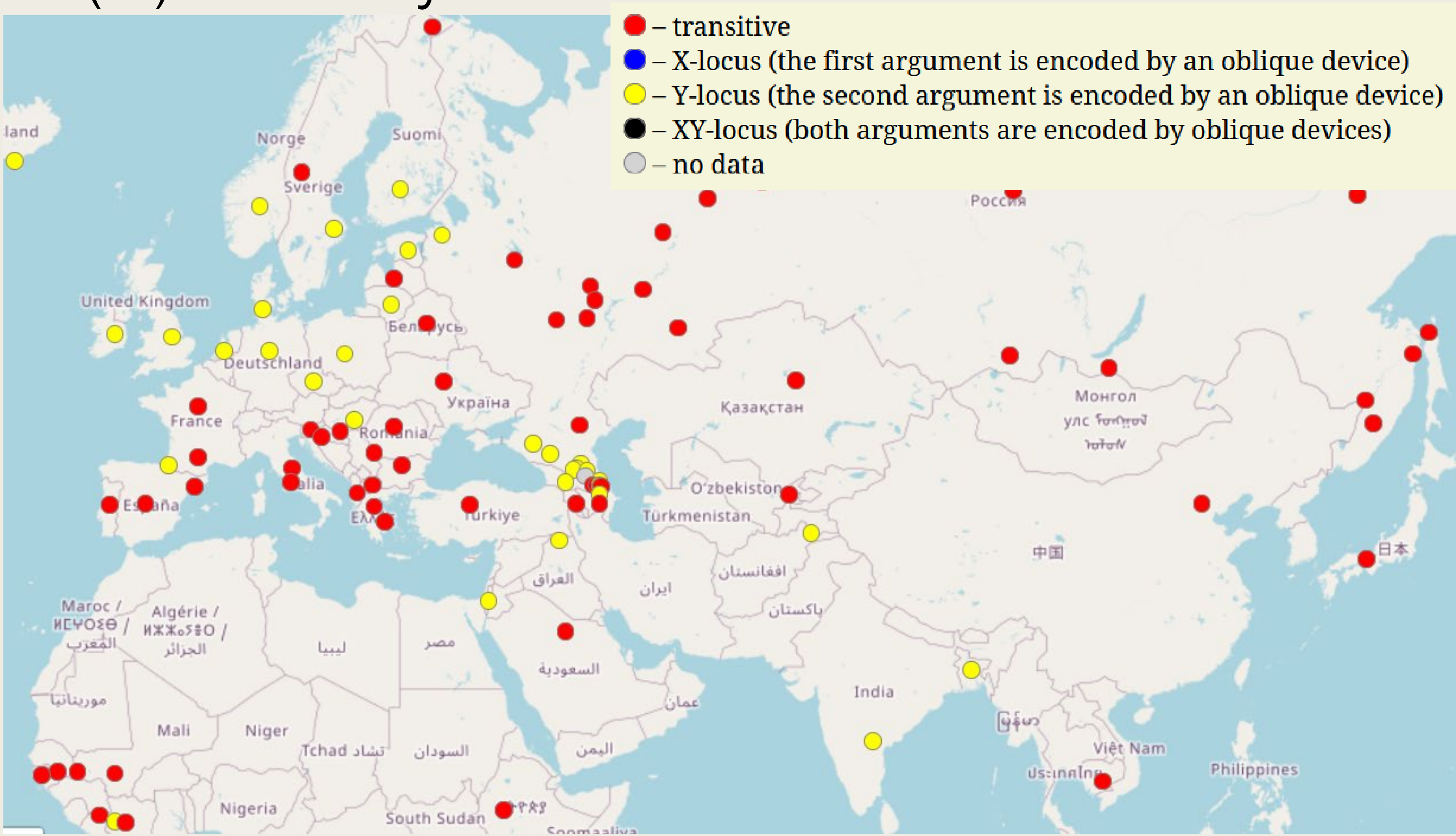
# BivalTyp: major design features

- Transitivity prominence



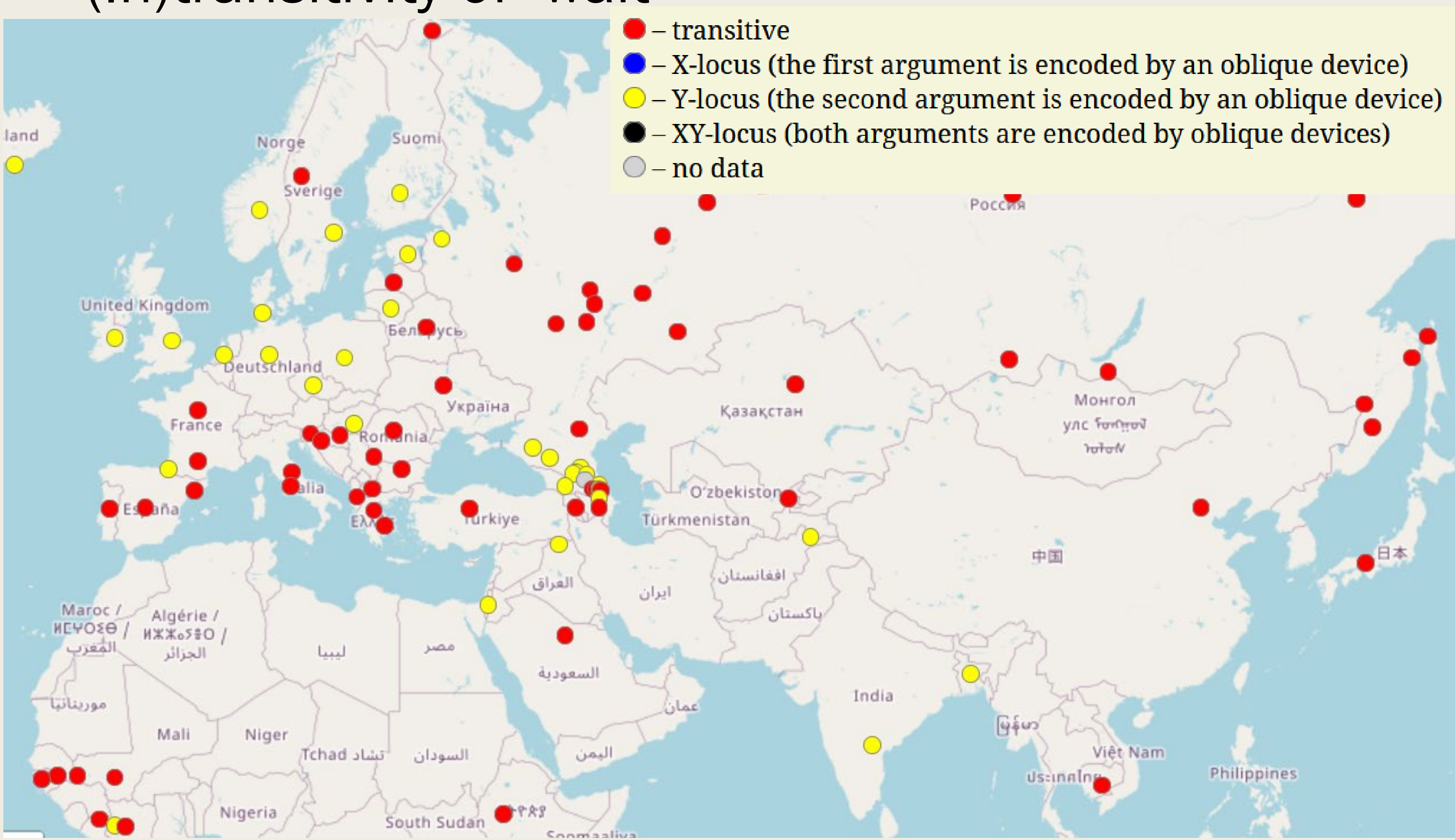
# BivalTyp: major design features

- (In)transitivity of 'wait'



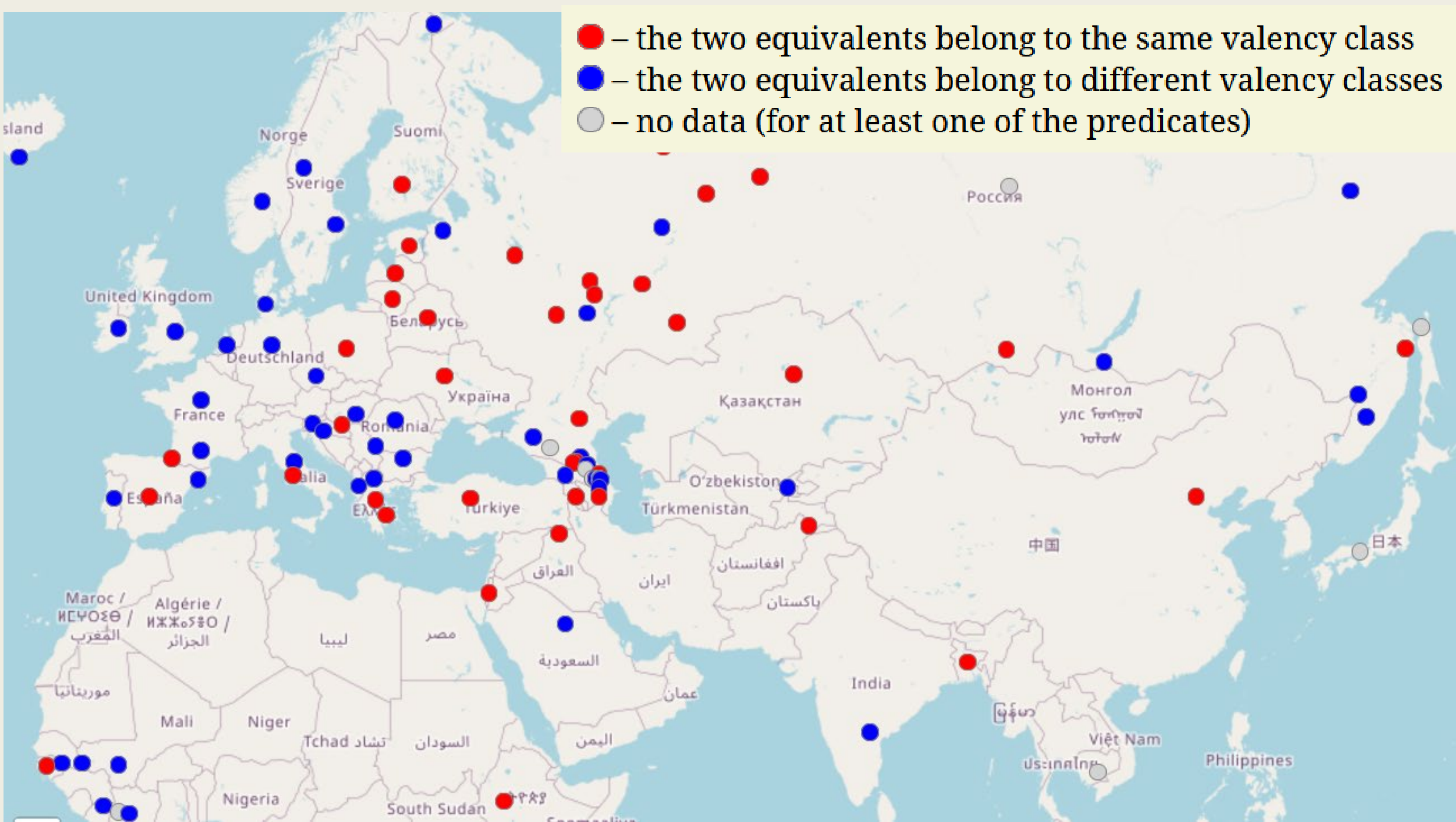
# BivalTyp: major design features

- (In)transitivity of ‘wait’



# BivalTyp: major design features

- ‘be afraid’ in the same class as ‘avoid’?



# Discrete semantic roles: a phantom

- An old idea: semantic roles are linked to argument positions
- Variations on this theme (Fillmore 1968, Dowty 1991, Levin & Rappaport Hovav 2005)
- Possible semantic (thematic) roles
  - Agent
  - Patient
  - Experiencer
  - Stimulus
  - Instrument
  - Recipient
  - …

# Discrete semantic roles: a phantom

- Possible layered classification

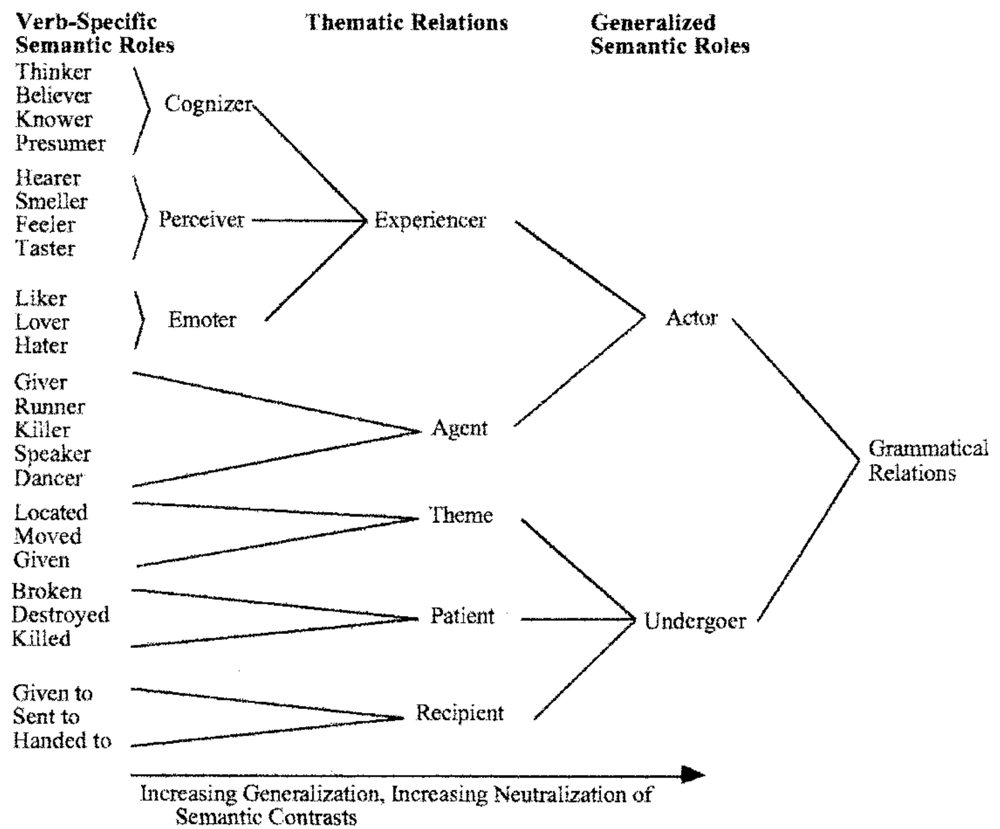



Figure 1: Relation of generalized semantic roles to thematic relations

(Van Valin 1999: 374)

# Discrete semantic roles: a phantom

- Possible linking rules:
  - Agent => Nominative
  - Patient => Accusative
  - Recipient => Dative
  - …

# Discrete semantic roles: a phantom

- Problem: can we really identify discrete semantic roles for every verb?

- Semantic roles are typically
  - abstract
  - arbitrary
  - based on cherry-picked verbs

# Discrete semantic roles: a phantom

- Theoretical studies mainly focus on salient cases, such as
  - ‘kill’: Agent & Patient
  - ‘see’: Experiencer & Stimulus
  - …
- By contrast, empirical studies based on large wordlists arrive at **fuzzy** roles (Bickel et al. 2014, Hartmann et al. 2014, Widmer et al. 2019)

# Discrete semantic roles: a phantom

- Interim summary

Discrete semantic roles defined on *a priori* grounds are not suitable for the empirical typological study of argument encoding

- An alternative:

Use empirically defined valency classes in individual languages as proxies for roles

# Results

- **Transitivity prominence**
- Semantic role clusters
- Predictability

# Transitivity prominence

= the ratio of languages where the meaning is coded by a transitive clause (among those languages for which relevant data have been obtained)

E.g. ‘be afraid’

- is transitive in 12 languages of the sample
- is intransitive in 84 languages of the sample
- (data are missing for 1 language);

=> Transitivity prominence (‘be afraid’) = 12 / (12 + 84) = 0.125

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| depend | 0 | be shy | 0.05 | influence | 0.3 | listen | 0.68 | find | 0.91 |
| be different | 0 | enter | 0.08 | get to know | 0.31 | hate | 0.7 | lose | 0.91 |
| cut oneself | 0 | tell | 0.09 | look | 0.31 | catch up | 0.71 | upset | 0.92 |
| get stuck | 0 | be called | 0.09 | encounter | 0.33 | leave | 0.72 | take off | 0.96 |
| speak | 0 | be short | 0.1 | make fun | 0.35 | want | 0.72 | plough | 0.97 |
| mix | 0 | remain | 0.1 | miss | 0.36 | remember | 0.73 | pour | 0.97 |
| have a quarrel | 0 | resemble | 0.11 | attack | 0.38 | cross | 0.74 | throw | 0.98 |
| sink | 0 | smell | 0.11 | help | 0.38 | kiss | 0.77 | drive | 0.98 |
| take offence | 0 | be surprised | 0.12 | be fond | 0.39 | respect | 0.78 | milk | 0.98 |
| get upset | 0 | marvel | 0.12 | wave | 0.4 | despise | 0.78 | try to catch | 0.98 |
| fight | 0.01 | be afraid | 0.13 | sympathise | 0.4 | call | 0.79 | put on | 0.98 |
| be glad | 0.01 | be squeamish | 0.15 | forget | 0.41 | love person | 0.79 | cover | 0.98 |
| go out | 0.02 | think | 0.16 | have | 0.41 | surround | 0.79 | read | 0.98 |
| agree | 0.02 | dream | 0.17 | dream sleeping | 0.41 | hit | 0.79 | bend | 0.99 |
| be angry | 0.02 | trust | 0.17 | touch | 0.42 | move bodypart | 0.8 | fry | 0.99 |
| have a grudge | 0.02 | answer | 0.19 | avoid | 0.44 | look for | 0.81 | break | 0.99 |
| feel pain | 0.03 | believe | 0.21 | follow | 0.44 | bite | 0.81 | open | 0.99 |
| have enough | 0.03 | hit target | 0.22 | play instrument | 0.47 | understand language | 0.84 | take | 1 |
| be friends | 0.03 | have illness | 0.23 | flatter | 0.48 | punish | 0.85 | eat | 1 |
| match | 0.03 | like | 0.23 | obey | 0.51 | drop | 0.86 | make | 1 |
| fill intr | 0.04 | need | 0.25 | forfeit | 0.52 | hold | 0.87 | wash | 1 |
| lose game | 0.04 | fall in love | 0.25 | win | 0.57 | give birth | 0.88 | sing | 1 |
| dismount | 0.04 | enjoy | 0.25 | govern | 0.6 | hear | 0.88 | write | 1 |
| be content | 0.04 | reach | 0.27 | cost | 0.62 | see | 0.89 | drink | 1 |
| get irritated | 0.04 | shoot at | 0.29 | love tea | 0.63 | know | 0.89 | melt | 1 |
| fall behind | 0.05 | envy | 0.29 | wait | 0.67 | paint | 0.9 | kill | 1 |

# Transitivity prominence

- Tsunoda's implicational hierarchy

  «1a) direct effect (*kill, break* subtype) >

  1b) direct effect (*hit, shoot* subtype) >

  2a) perception (*see* subtype) >

  2b) perception (*look* subtype) >

  3) pursuit (*search, wait*) >

  4) knowledge (*know, understand, remember, forget*) >

  5) feeling (*love, like, fant, need*) >

  6) possession (have)»

  (Tsunoda 1981, modified and shortened in 1985)

| | | |
|---|---|---|
| 1a) direct effect | break | 0.99 |
| 1b) direct effect | hit | 0.79 |
| | shoot at | 0.29 |
| 2a) perception | see | 0.89 |
| | hear | 0.88 |
| 2b) perception | look | 0.31 |
| | listen | 0.68 |
| 3) pursuit | search | 0.81 |
| | wait | 0.67 |
| 4) knowledge | know | 0.89 |
| | understand | 0.84 |
| | remember | 0.73 |
| | forget | 0.41 |
| 5) feeling | love | 0.79 |
| | like | 0.23 |
| | need | 0.25 |
| 6) possession | have | 0.41 |

# Transitivity prominence

- The data do not fully support Tsunoda's hierarchy (except for the first direct effect subtype: 'kill' & 'break')

- High intra-group heterogeneity
  => *a priori* defined groups are doubtful
  => finer distinctions are necessary (see below)

# Results

- Transitivity prominence
- **Semantic role clusters**
- Predictability

# Semantic role clusters

- **The rationale**

  argument roles associated with two notional predicates are similar iff the equivalents of these predicates often fall in the same language-specific valency classes

- Operationalized through **Hamming distance**

  = the number of languages in which the equivalents of the two predicates belong to different valency classes

# Semantic role clusters

- Toy example

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 'be_afraid` | r | l | a | g | m | a | l | f | a | t | d | g | j |
| 'avoid` | r | t | ? | g | ? | a | n | f | t | ? | d | g | f… |
| Same? | 0 | 1 | | 0 | | 0 | 1 | 0 | 1 | | 0 | 0 | 1 |

Letters are arbitrary codes for valency classes in individual languages (columns)

=> D (‘be afraid’, ‘avoid’) = 4/10 = 0.4

# Semantic role clusters

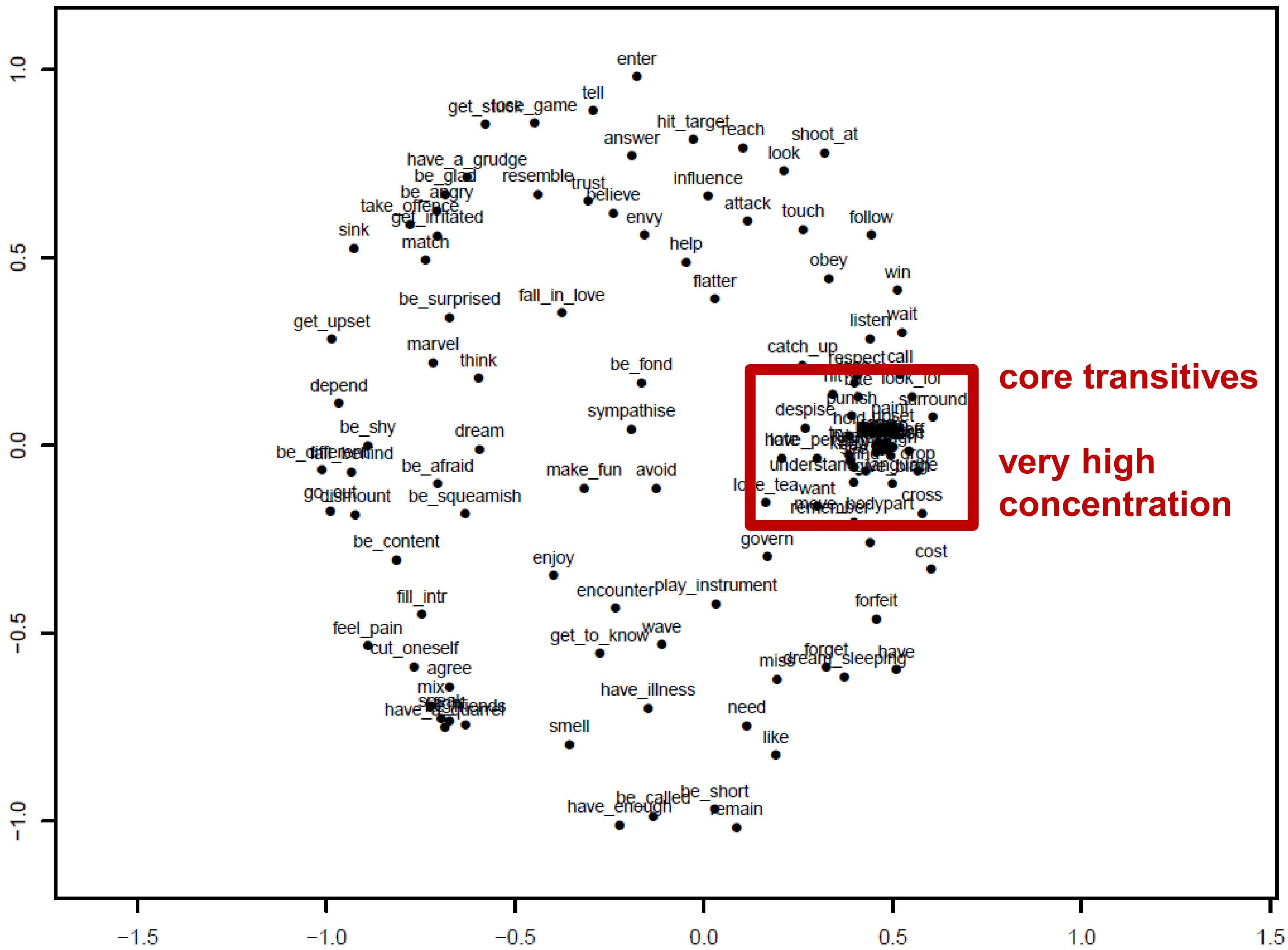
- Real data: a distance matrix (130x130)

| | be afraid | avoid | attack | look | like | … |
|---|---|---|---|---|---|---|
| be afraid | 0 | 0.55 | 0.9 | 0.89 | 0.92 | … |
| avoid | 0.55 | 0 | 0.67 | 0.74 | 0.85 | |
| attack | 0.9 | 0.67 | 0 | 0.56 | 0.86 | |
| look | 0.89 | 0.74 | 0.56 | 0 | 0.9 | |
| like | 0.92 | 0.85 | 0.86 | 0.9 | 0 | |
| … | … | | | | | |

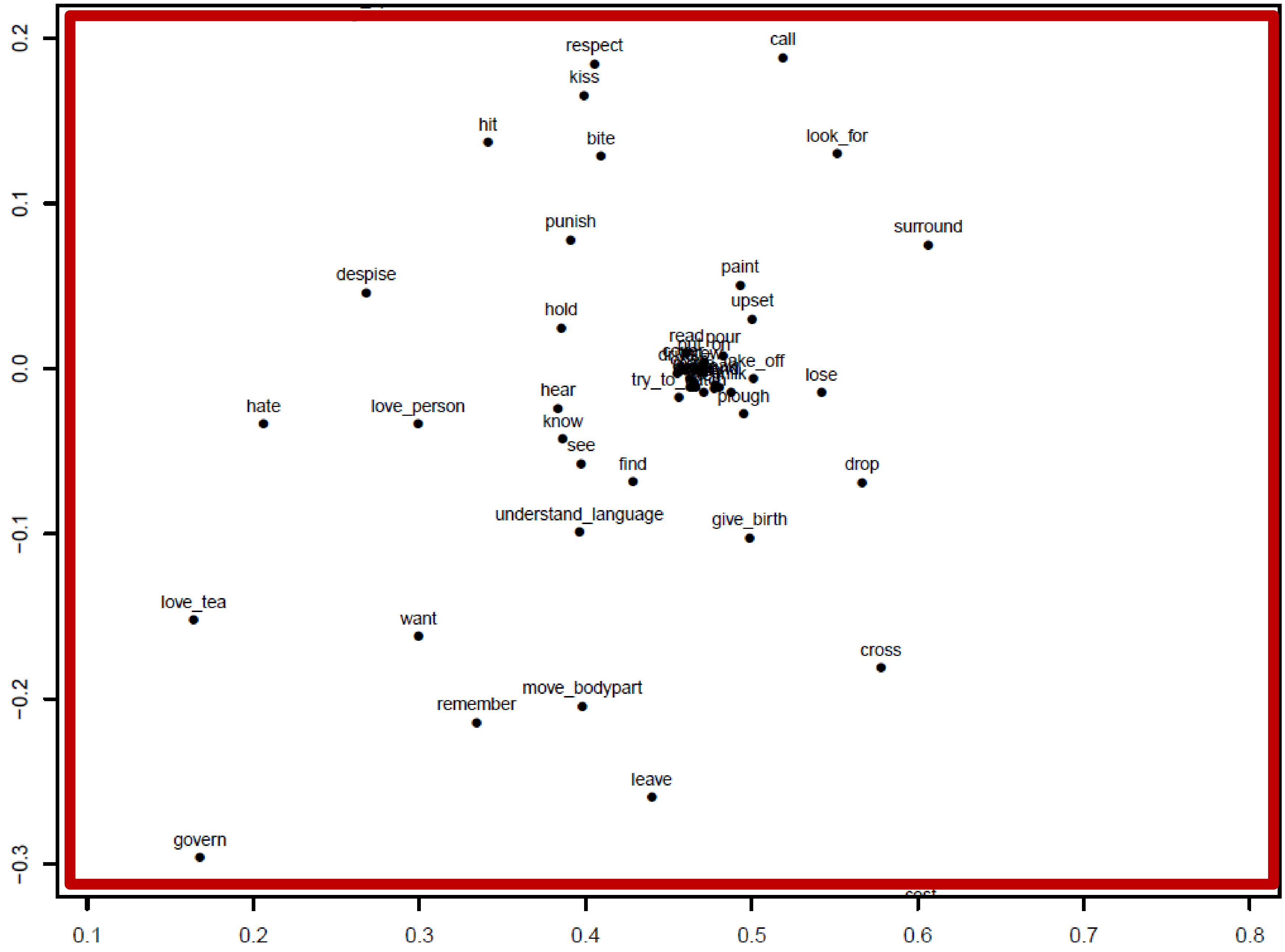
# Semantic role clusters

- Standard methods of visualization and dimensionality reduction
  - Multidimensional Scaling (MDS), implemented in R (R Core Team 2021) using `smacof` package (de Leeuw, Mair 2009 )
  - NeighborNet, implemented using SplitsTree software (Huson, Bryant 2006)

# Distances between 130 verbs



# Transitives



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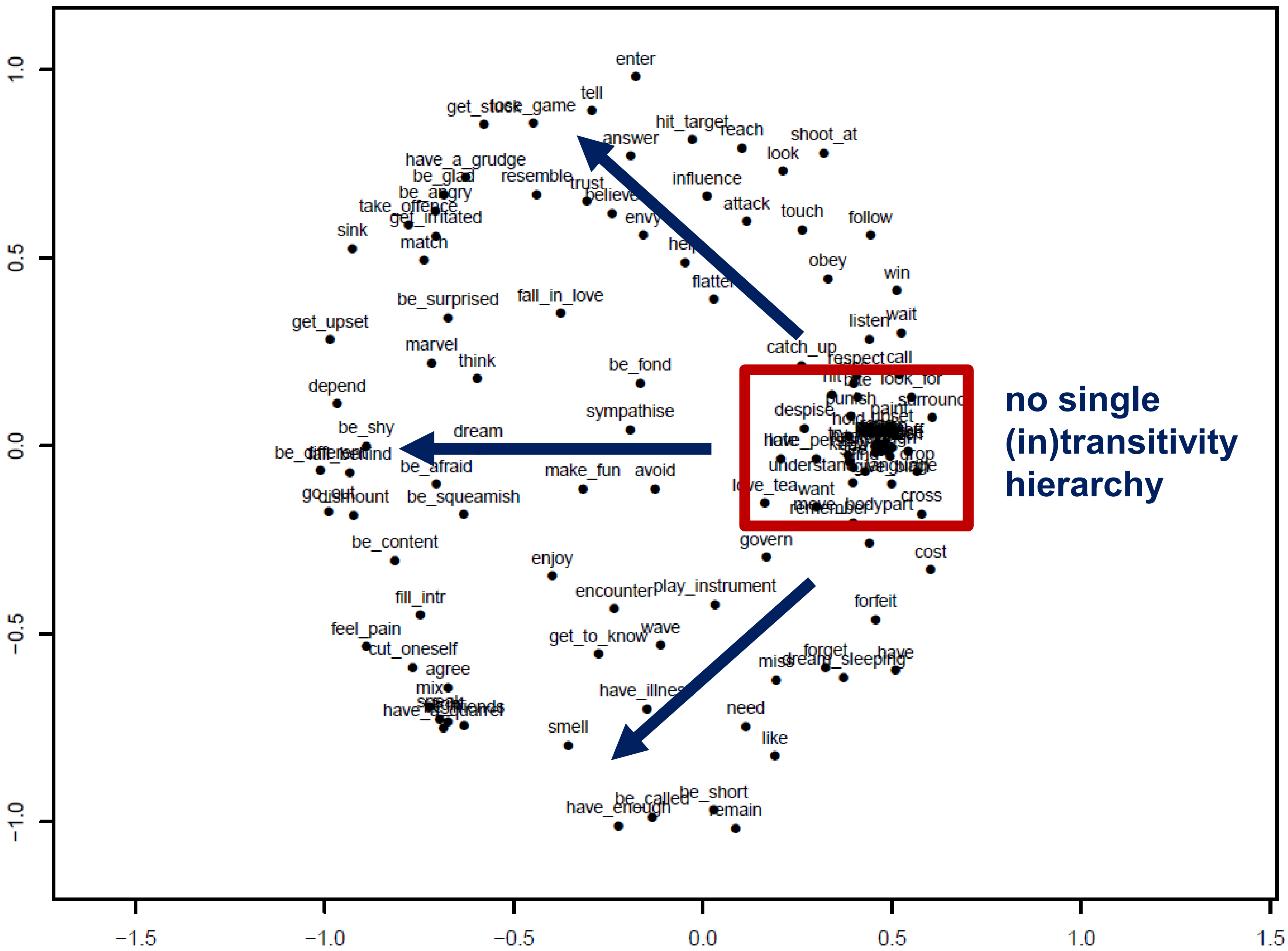
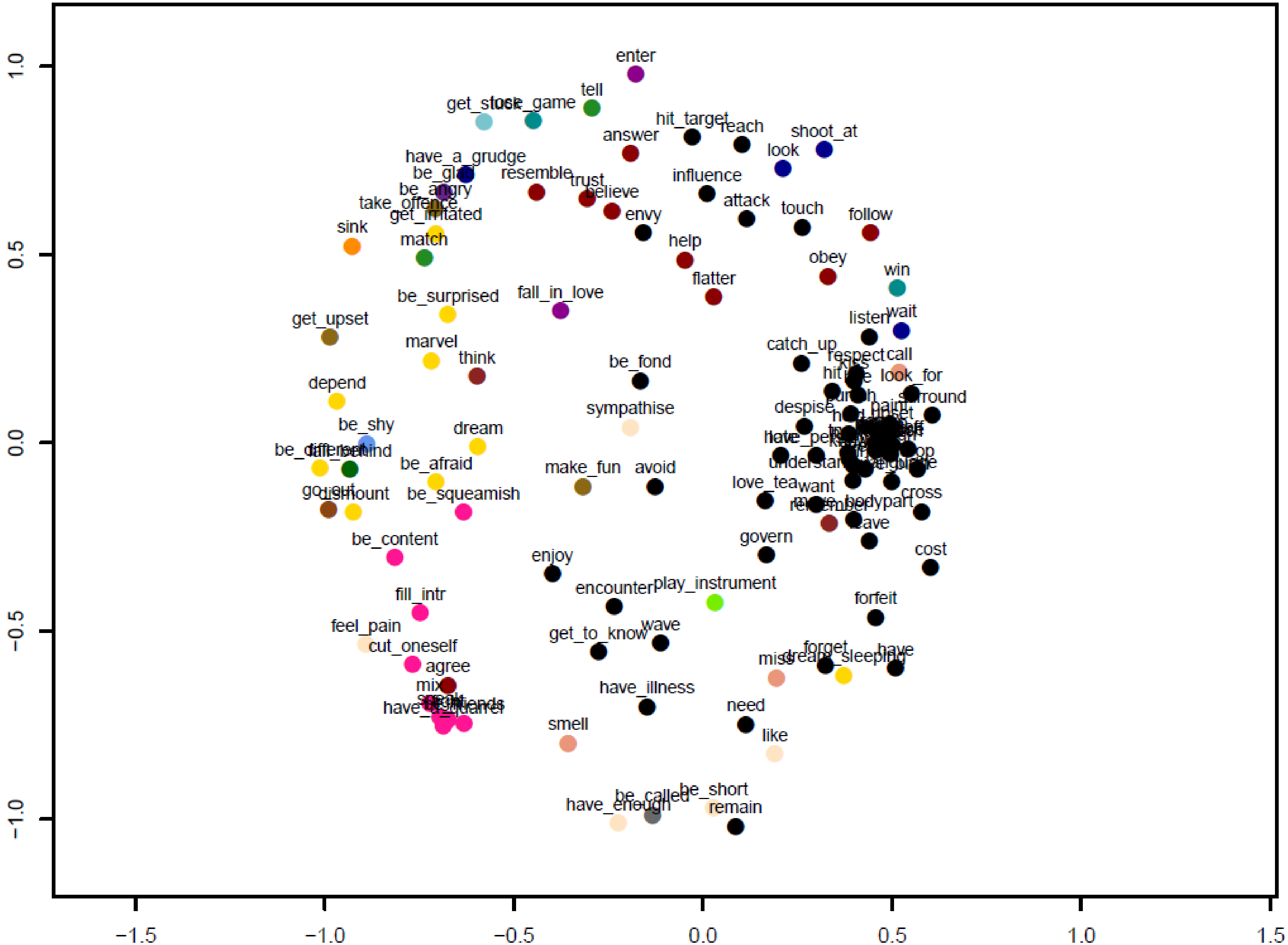
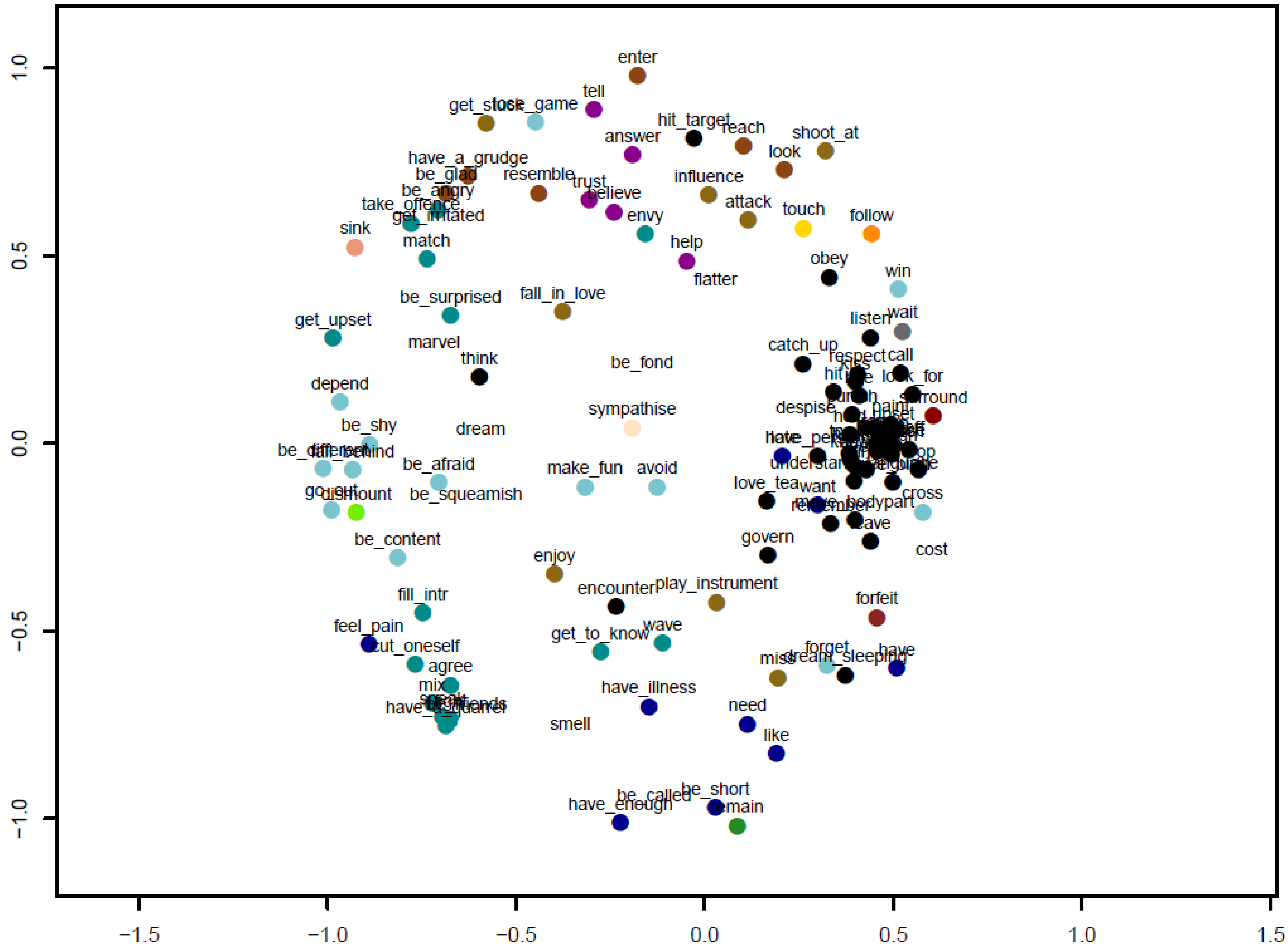



**no single (in)transitivity hierarchy**

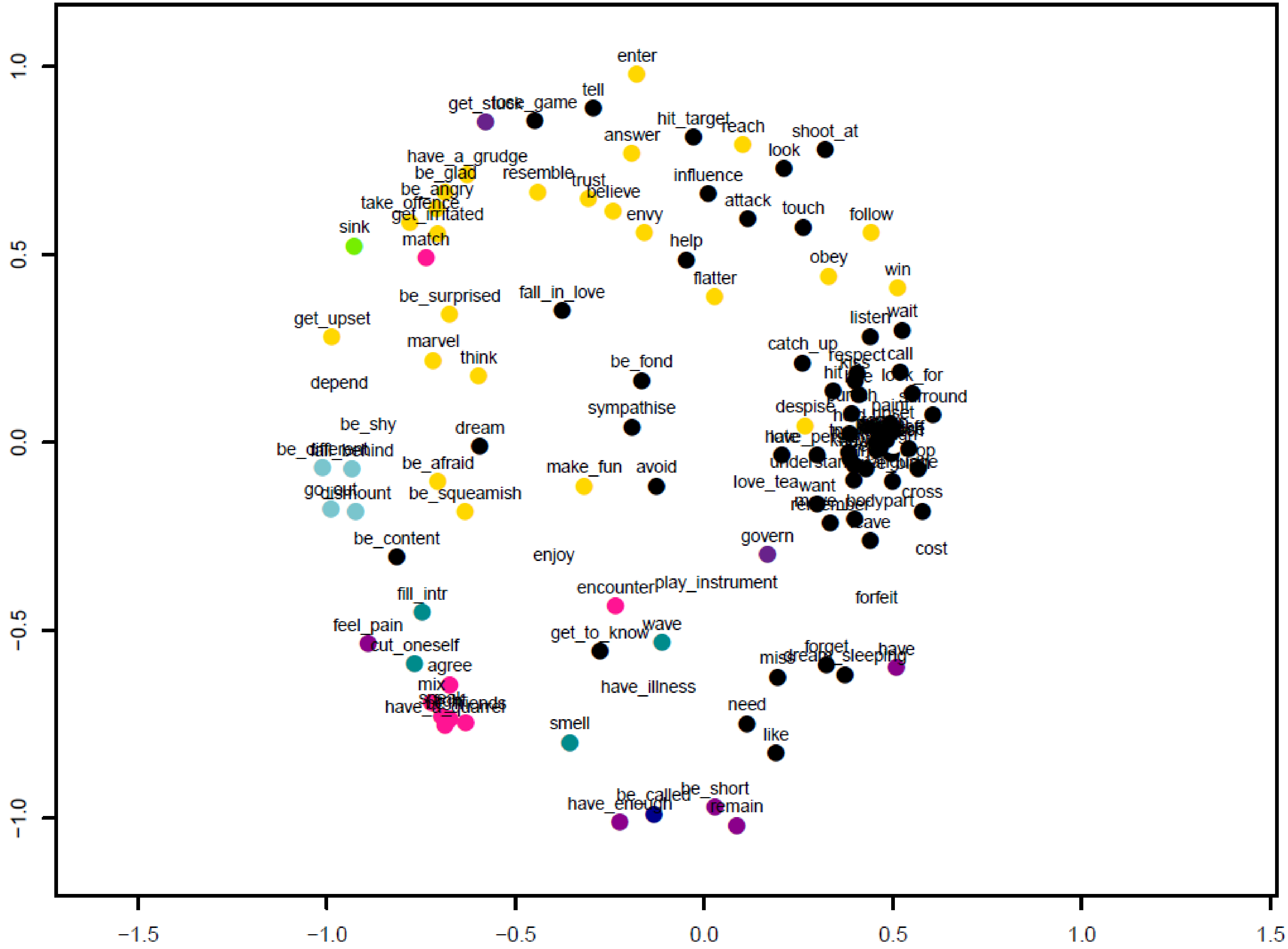
# German patterns



# Shughni patterns



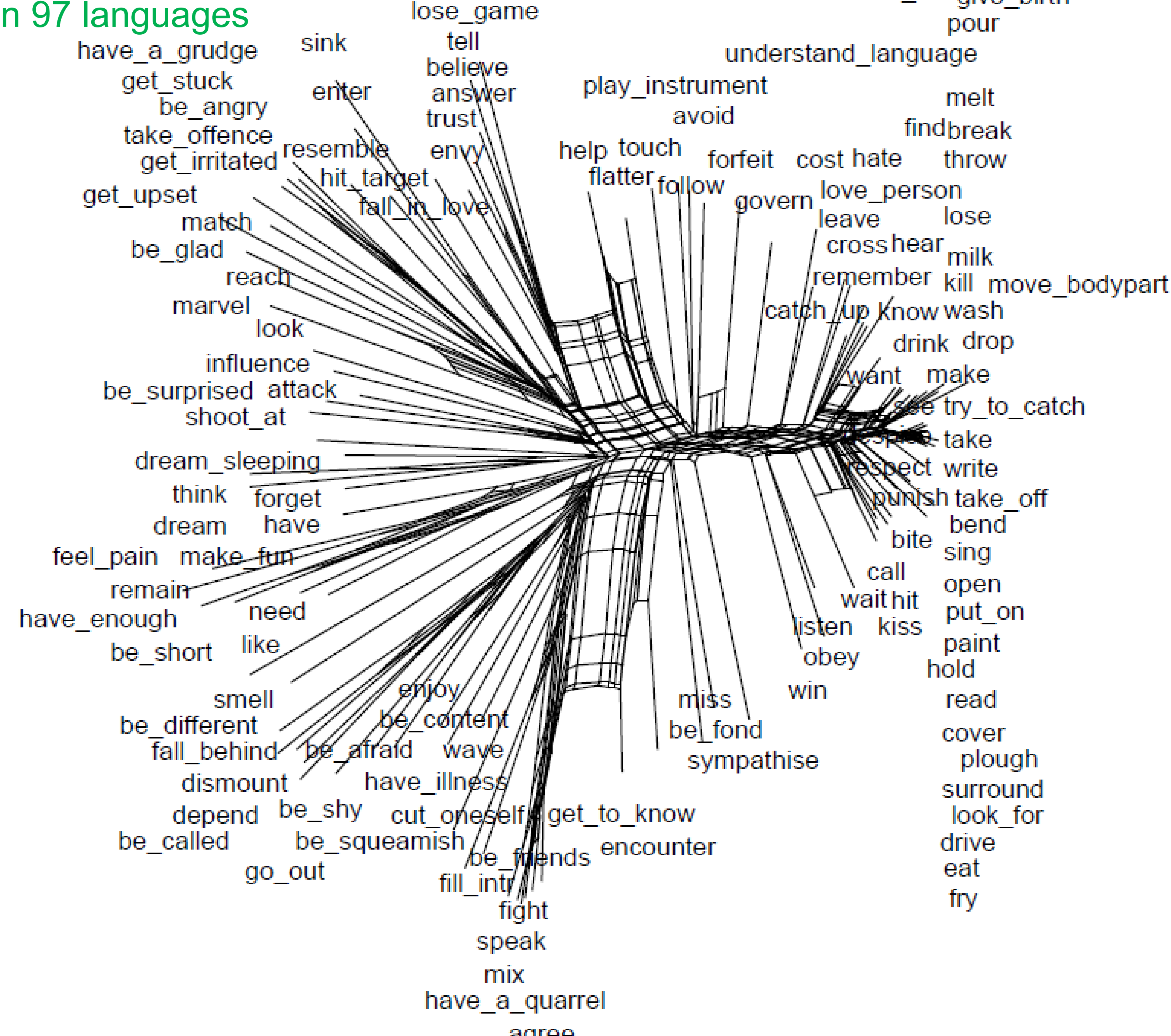
# Chukchi patterns



# Semantic role clusters

- MDS plots are great for inspecting individual languages…
- but different algorithms are needed for discerning clusters of argument roles => NeighborNet

# A NeighborNet network of 130 predicates based on their valency properties in 97 languages



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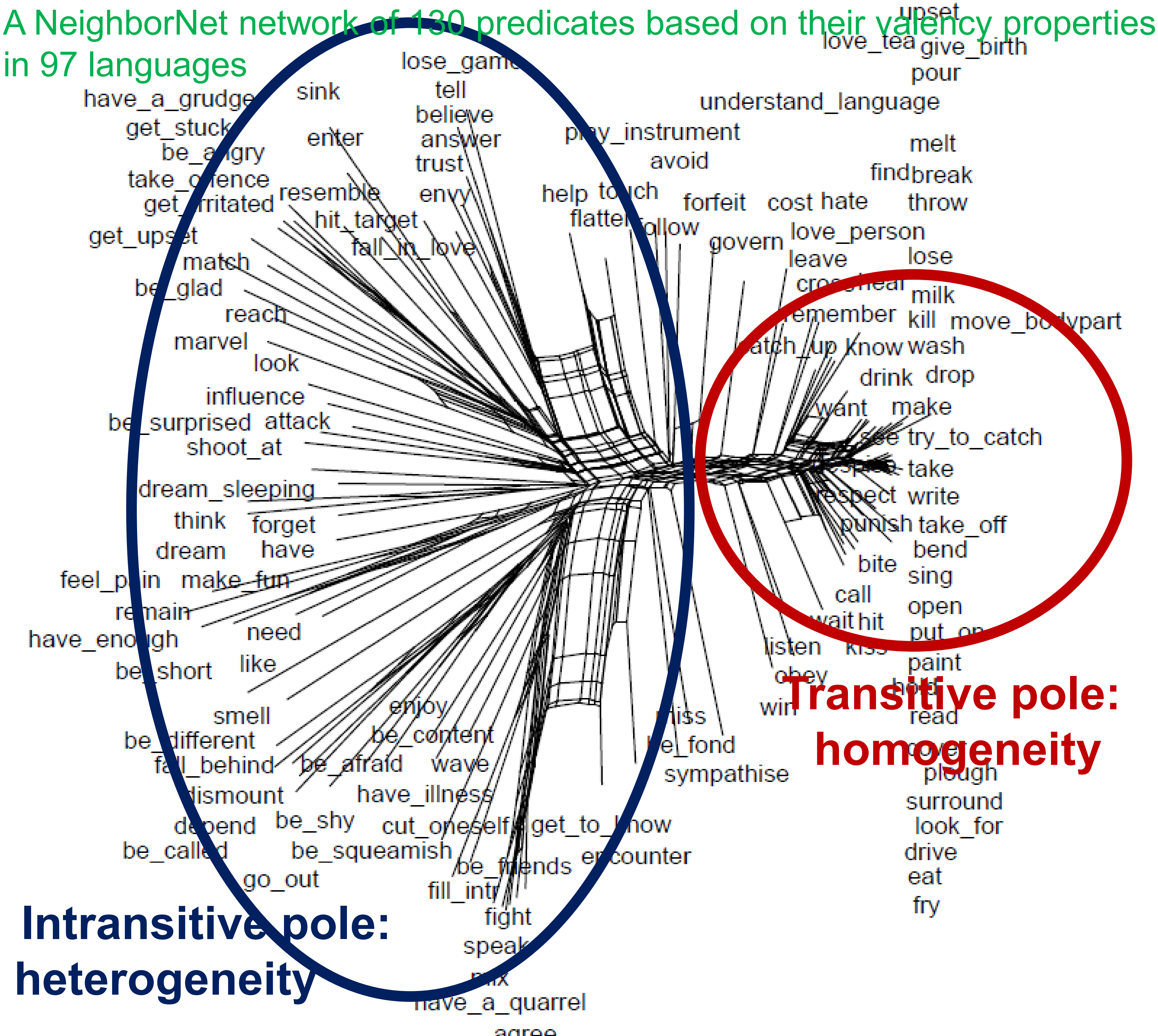
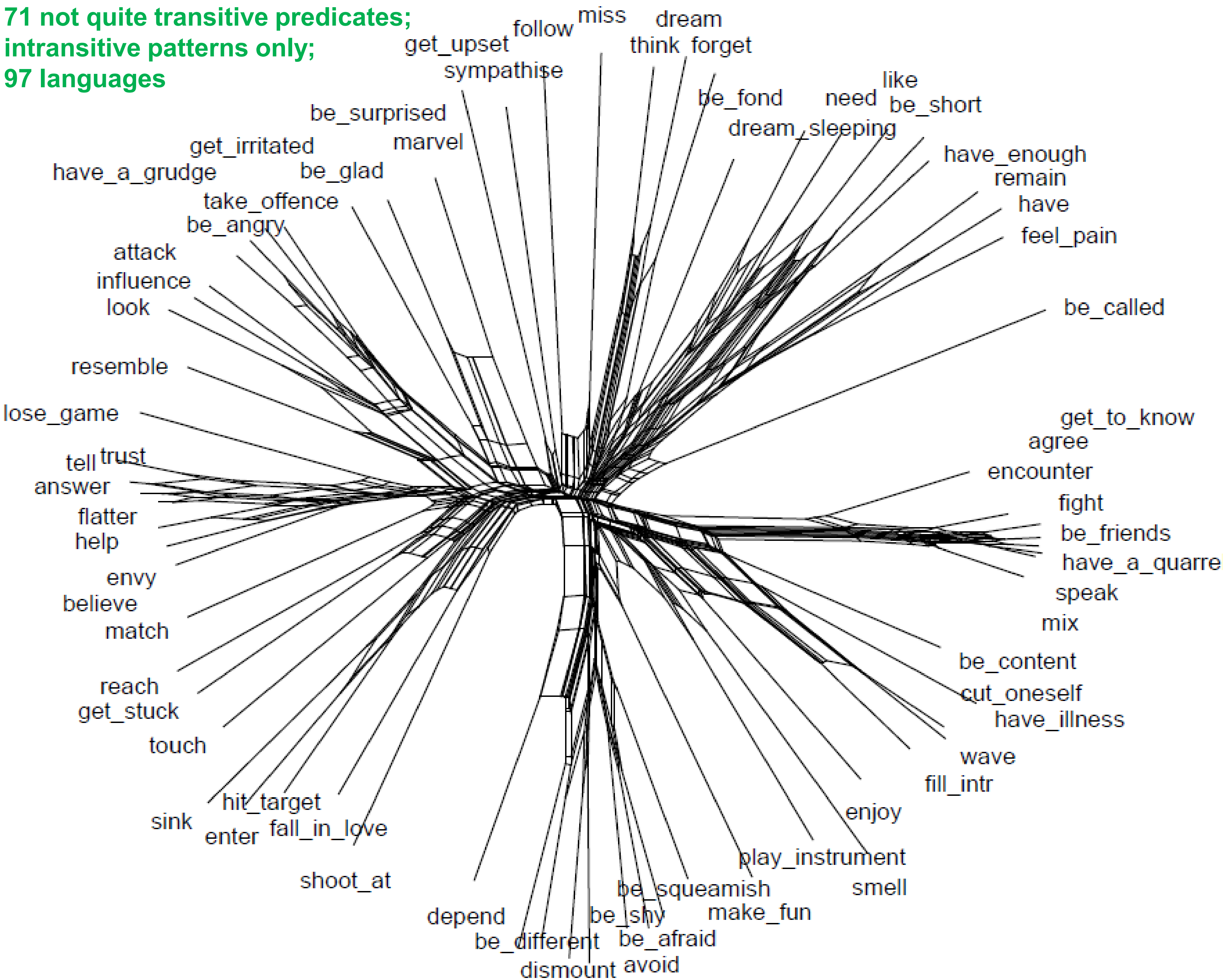


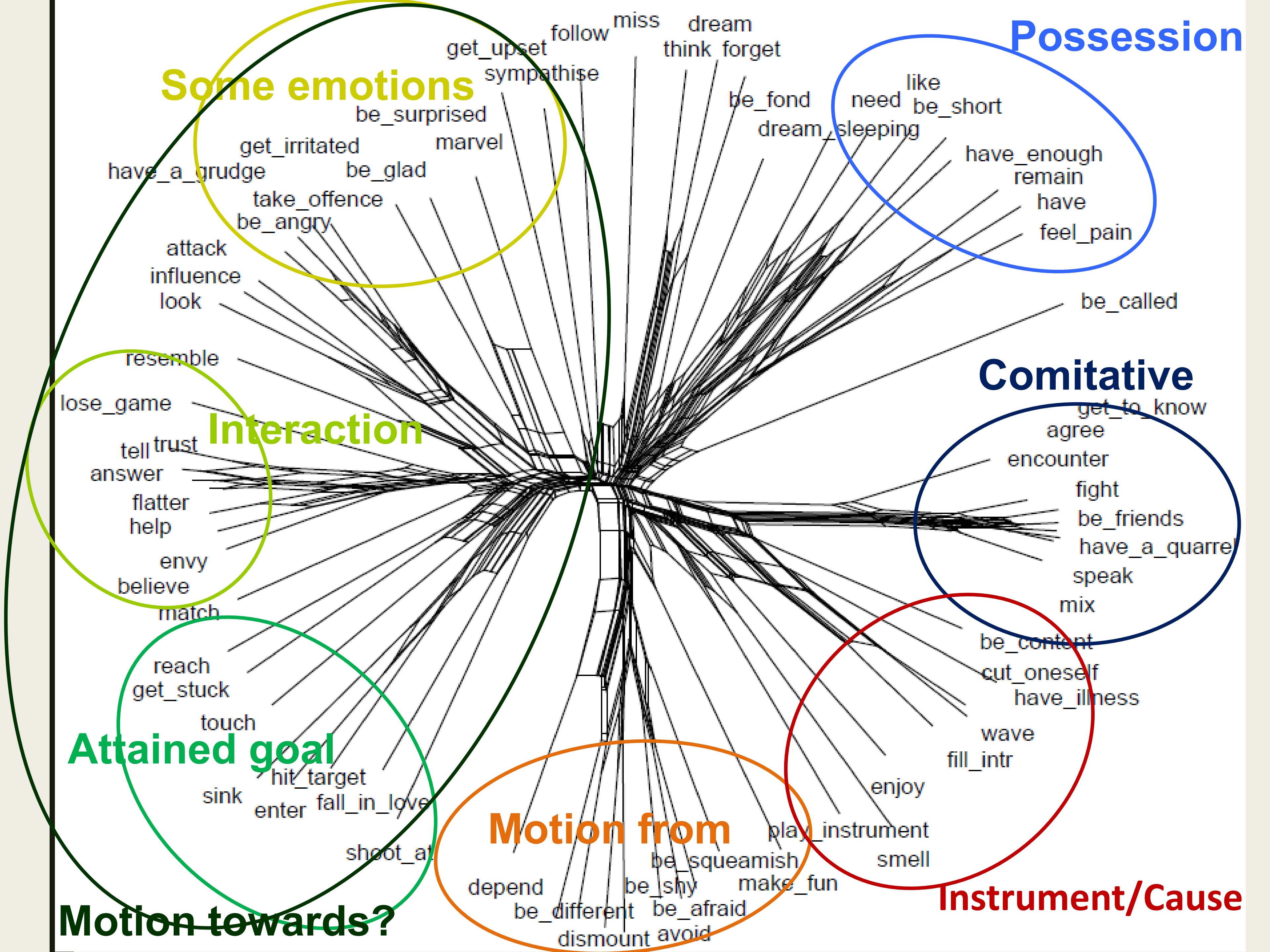
# Semantic role clusters

- Focus on intransitive patterns:
  - remove verbs with transitivity ratio > 0.5
  - consider remaining transitive patterns as NAs

    In a nutshell: verbs are considered similar iff they belong to the same **intransitive** class

**71 not quite transitive predicates; intransitive patterns only; 97 languages**

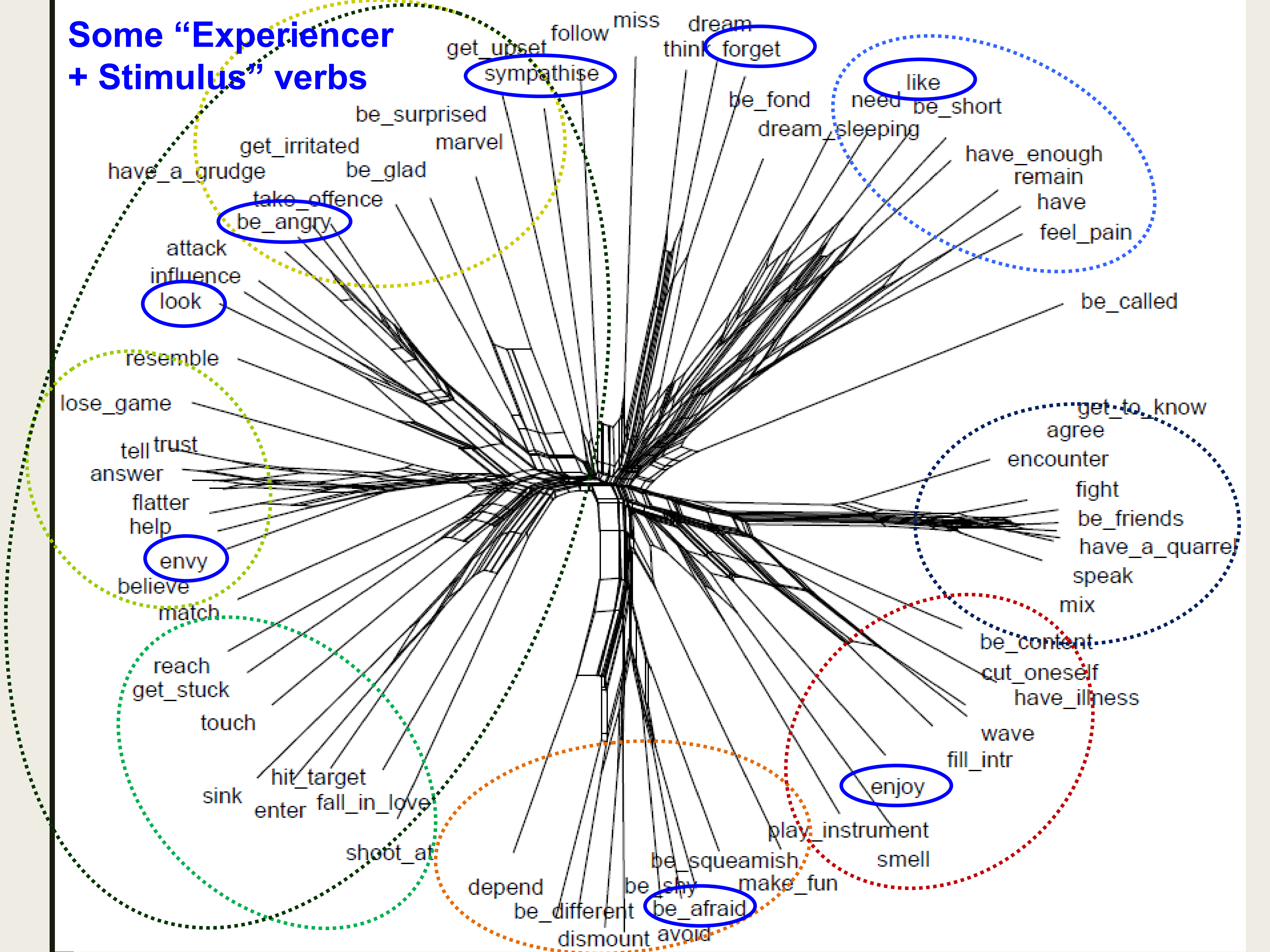



Possession
Some emotions
Interaction
Comitative
Attained goal
Motion from
Instrument/Cause
Motion towards?
miss
follow
dream
think
forget
get_upset
sympathise
be_surprised
marvel
get_irritated
have_a_grudge
be_glad
take_offence
be_angry
be_fond
need
like
be_short
dream_sleeping
have_enough
remain
have
feel_pain
be_called
attack
influence
look
resemble
lose_game
tell
trust
answer
flatter
help
envy
believe
match
get_to_know
agree
encounter
fight
be_friends
have_a_quarrel
speak
mix
be_content
cut_oneself
have_illness
wave
fill_intr
enjoy
play_instrument
smell
reach
get_stuck
touch
hit_target
sink
enter
fall_in_love
shoot_at
depend
be_different
dismount
be_shy
be_squeamish
make_fun
be_afraid
avoid

# Semantic role clusters

- Arguably, these (fuzzy) clusters are indicative of cognitive / spatial schemas rather than traditional semantic roles ("meso-roles")

# Some "Experiencer + Stimulus" verbs



# Results

- Transitivity prominence
- Semantic role clusters
- **Predictability**

# Predictability: introducing $\pi$

- How to measure predictability of argument encoding?
  - ~~In terms of semantic roles~~
  - Use other languages as predictors, that is, as proxies for the meaning of arguments

# Predictability: introducing *π*

- Assume there are only 4 verbs that belong to a certain class A in a given L1:

| | L1 |
|---|---|
| $V_i$ | A |
| $V_j$ | A |
| $V_k$ | A |
| $V_l$ | A |
| … | |

# Predictability: introducing *π*

- Explore the encoding of the corresponding verbs in L2:

| | L1 | L2 |
|---|---|---|
| $V_i$ | A | W |
| $V_j$ | A | W |
| $V_k$ | A | W |
| $V_l$ | A | W |

…

- The valency patterns of these 4 verbs in L2 seem to be predictable given the system of L1

# Predictability: introducing $\pi$

- Explore the encoding of the corresponding verbs in L2:

| | L1 | L2 |
|---|---|---|
| $V_i$ | A | X |
| $V_j$ | A | Y |
| $V_k$ | A | Z |
| $V_l$ | A | W |

...

- The valency patterns of these 4 verbs in L2 seem to be totally unpredictable given the system of L1

# Predictability: introducing π

- Real-data example

| | Russian | Kalmyk |
|---|---|---|
| ‘be afraid’ | NOM_GEN | NOM_ABL |
| ‘reach’ | NOM_GEN | NOM_DAT |
| ‘avoid’ | NOM_GEN | NOM_ACC |
| ‘forfeit’ | NOM_GEN | NOM_ABL |
| ‘be ashamed’ | NOM_GEN | NOM_ABL |

- From the perspective of Russian, the encoding of the Kalmyk equivalents of ‘be afraid’, ‘forfeit’ and ‘be ashamed’ is more predictable than that of the other two verbs (‘reach’, ‘avoid’)

# Predictability: introducing $\pi$

- Individual predicate, two languages:

$$\pi\,(V_i)(L_j \rightarrow L_k) = p\,(Class(V_i, L_k) | Class(V_i, L_j))$$

e.g.

$$\pi\,(\text{'reach'})(\text{Russian} \rightarrow \text{Kalmyk}) = 1/5 = 0.2$$

$$\pi\,(\text{'be\_afraid'})(\text{Russian} \rightarrow \text{Kalmyk}) = 3/5 = 0.6$$

# Predictability: introducing *π*

- Individual predicate, one language: explore its behaviour from the perspective of as many other languages as there are available

$$\pi(V_i)(L_k) = \frac{\sum_{j=1}^{n} \pi(V_i)\left(L_j \rightarrow L_k\right)}{n}$$

e.g. π (‘be_afraid’) (Kalmyk) = 0.53

# Predictability: introducing π

- Individual predicate, many languages: average predictability

$$\pi(V_i) = \frac{\sum_{j=1}^{n} \pi(V_i)(L_j)}{n}$$

e.g. π (‘be_afraid’) = 0.42

# Predictability: results

(1) *Karl wartet auf Marie* NOM; auf+ACC
'Karl is waiting for Marie.'
$\pi = 0.12$

(2) *Mir fehlt ein Euro* DAT; NOM
'I am one Euro short.'
$\pi = 0.46$

# Predictability: results

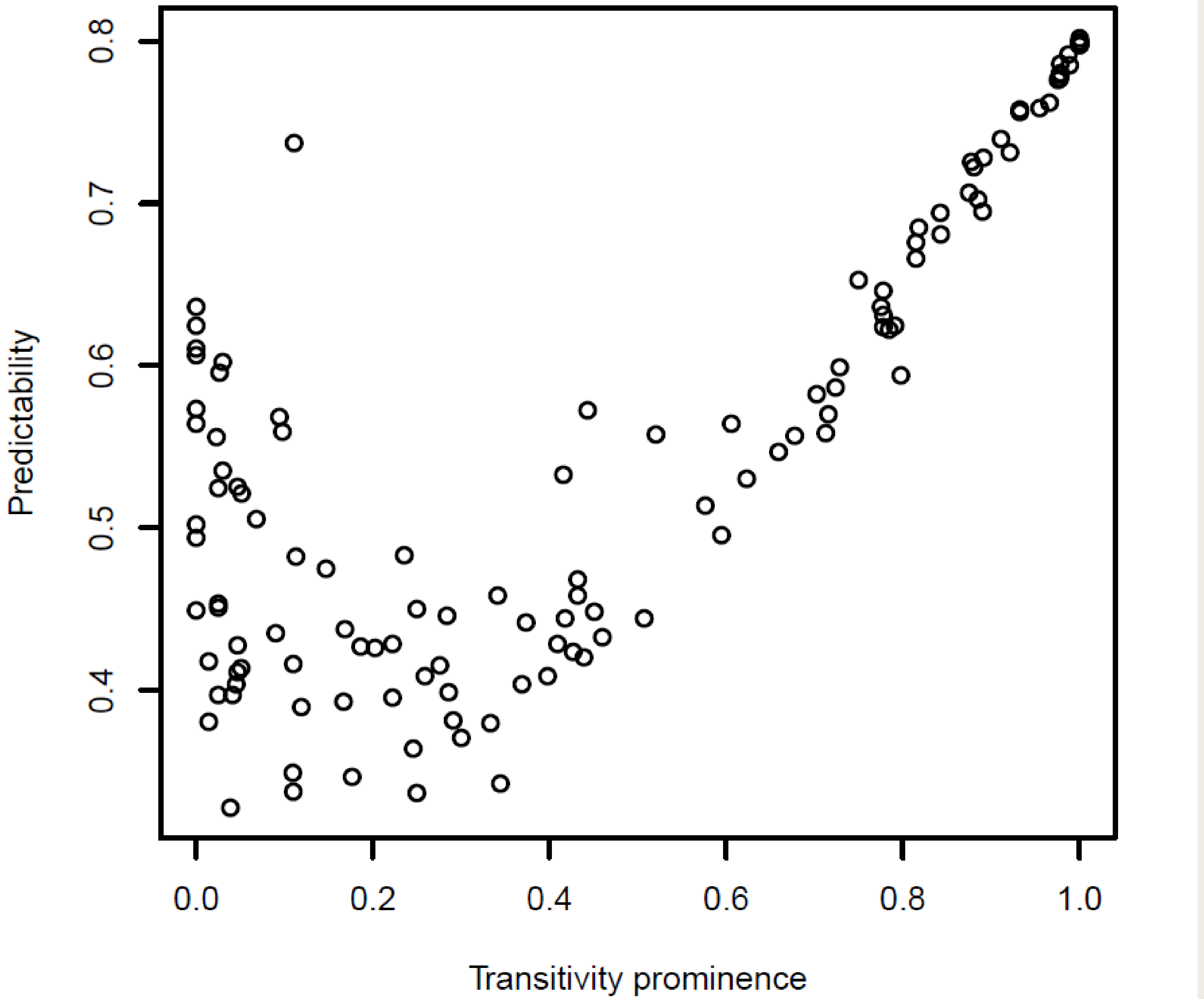
- Example: Finnish verbs with the NOM_ILL pattern

| **verb** | **meaning tag** | **predictability** |
|---|---|---|
| *upota* | sink | 0.78 |
| *astua* | enter | 0.64 |
| *juuttua* | get_stuck | 0.52 |
| *osua* | hit_target | 0.47 |
| *sopia* | match | 0.40 |
| *rakastua* | fall_in_love | 0.33 |
| *sekoittua* | mix | 0.33 |
| *koskea* | touch | 0.30 |
| *luottaa* | trust | 0.26 |
| *vaikuttaa* | influence | 0.23 |
| *tyytyväinen* + COP | be_content | 0.22 |
| *tutustua* | get_to_know | 0.21 |

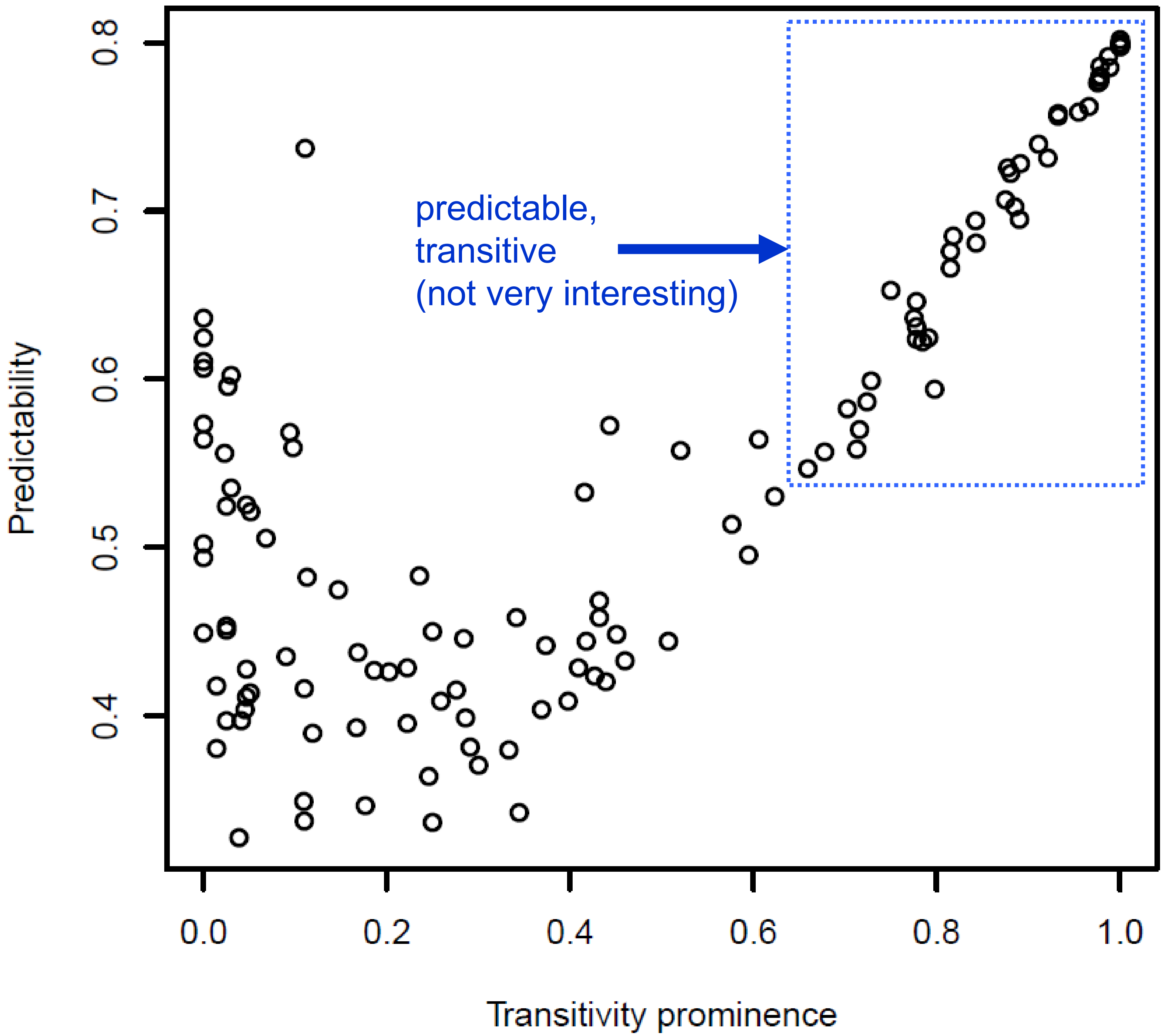
# Predictability: results

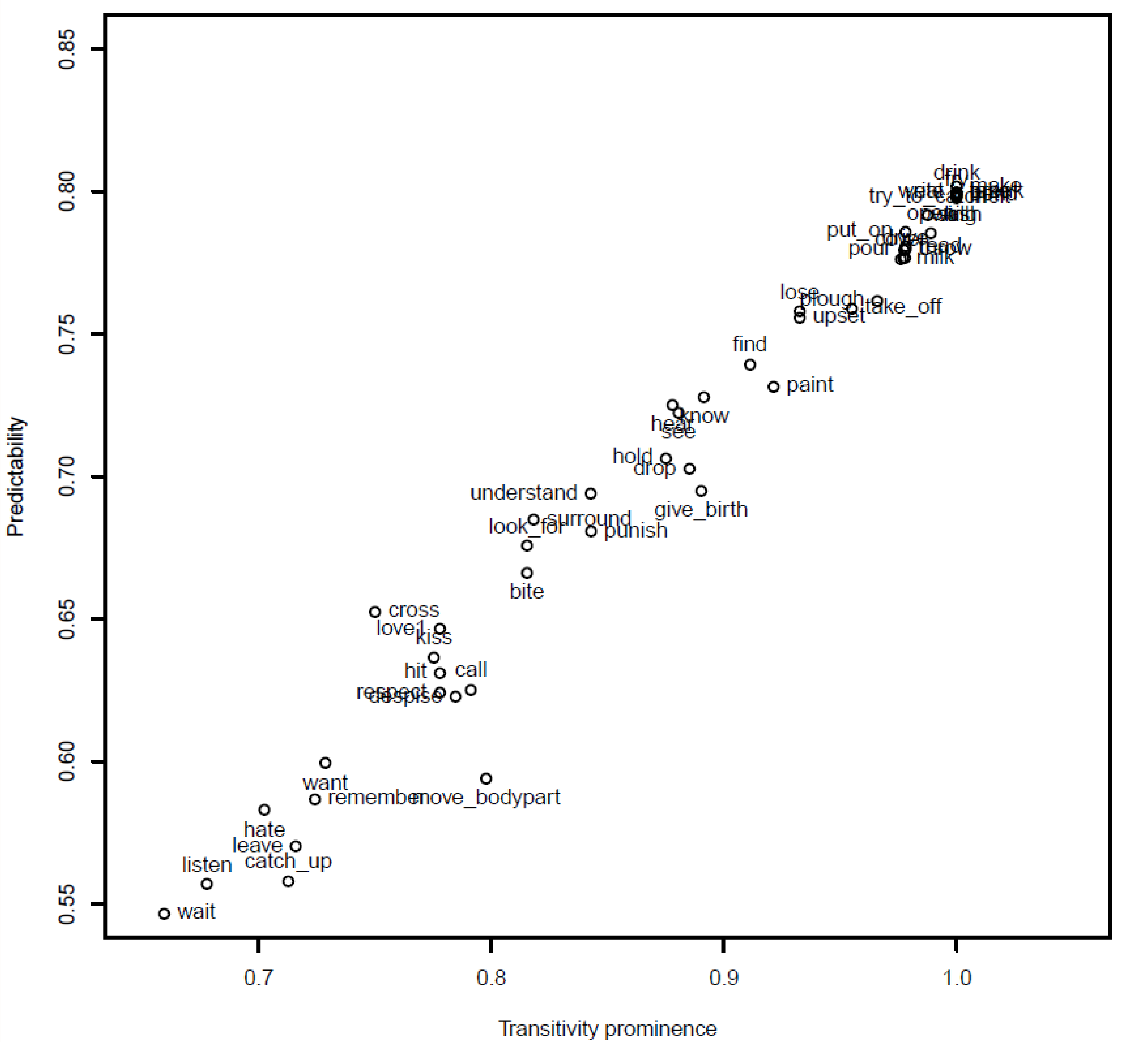
- As expected, highly transitive predicates display high predictability scores
- E.g. the list of predicates with $\pi$ > 0.80: all these verbs are invariably transitive in the data set

| | predictability | transitivity ratio | | predictability | transitivity ratio |
|---|---|---|---|---|---|
| 'make' | 0.80 | 1.00 | 'bend' | 0.80 | 1.00 |
| 'eat' | 0.80 | 1.00 | 'wash' | 0.80 | 1.00 |
| 'drink' | 0.80 | 1.00 | 'kill' | 0.80 | 1.00 |
| 'take' | 0.80 | 1.00 | 'sing' | 0.80 | 1.00 |
| 'break' | 0.80 | 1.00 | 'melt' | 0.80 | 1.00 |
| 'write' | 0.80 | 1.00 | 'fry' | 0.80 | 1.00 |

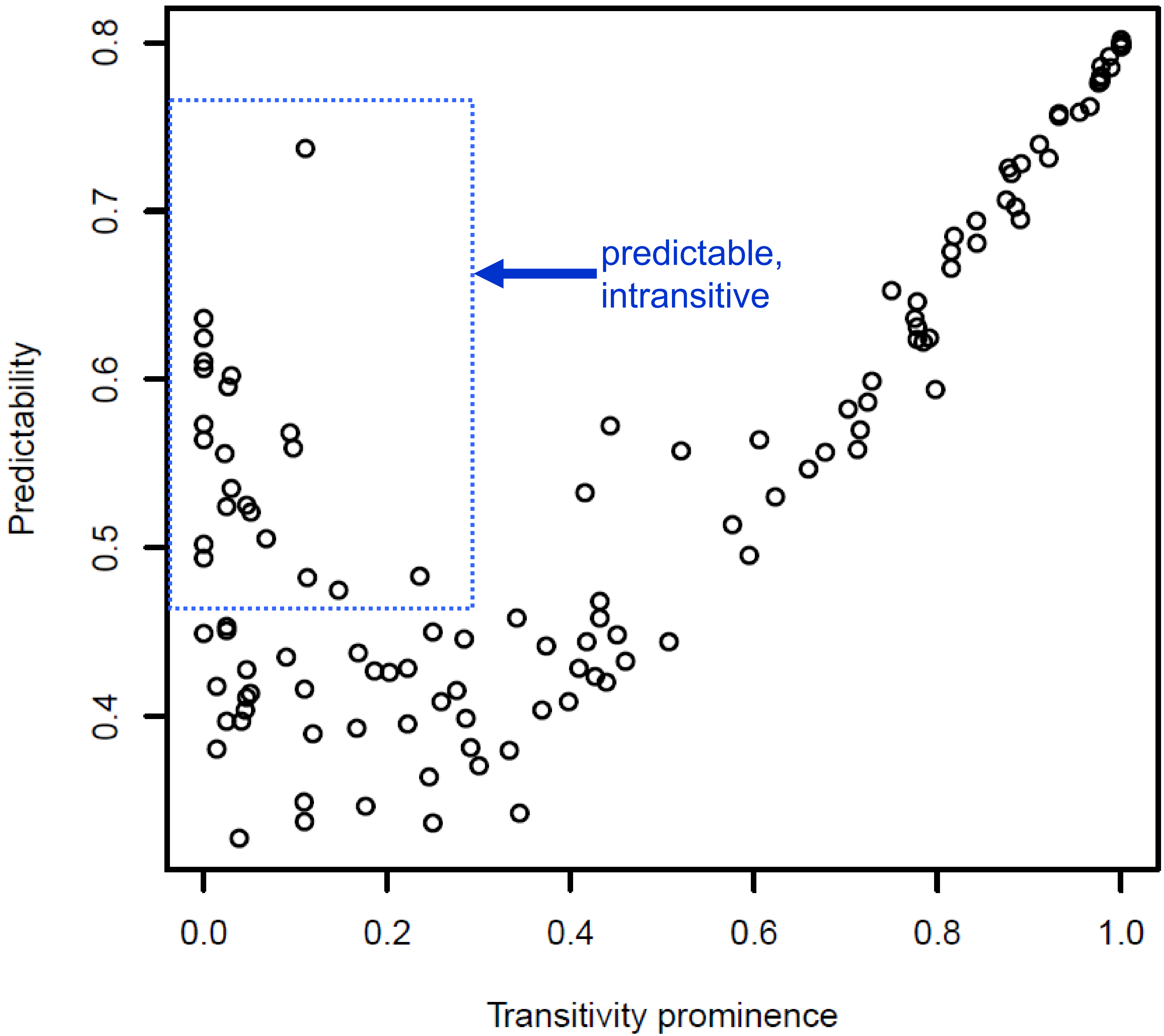


Predictability
0.4
0.5
0.6
0.7
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Transitivity prominence

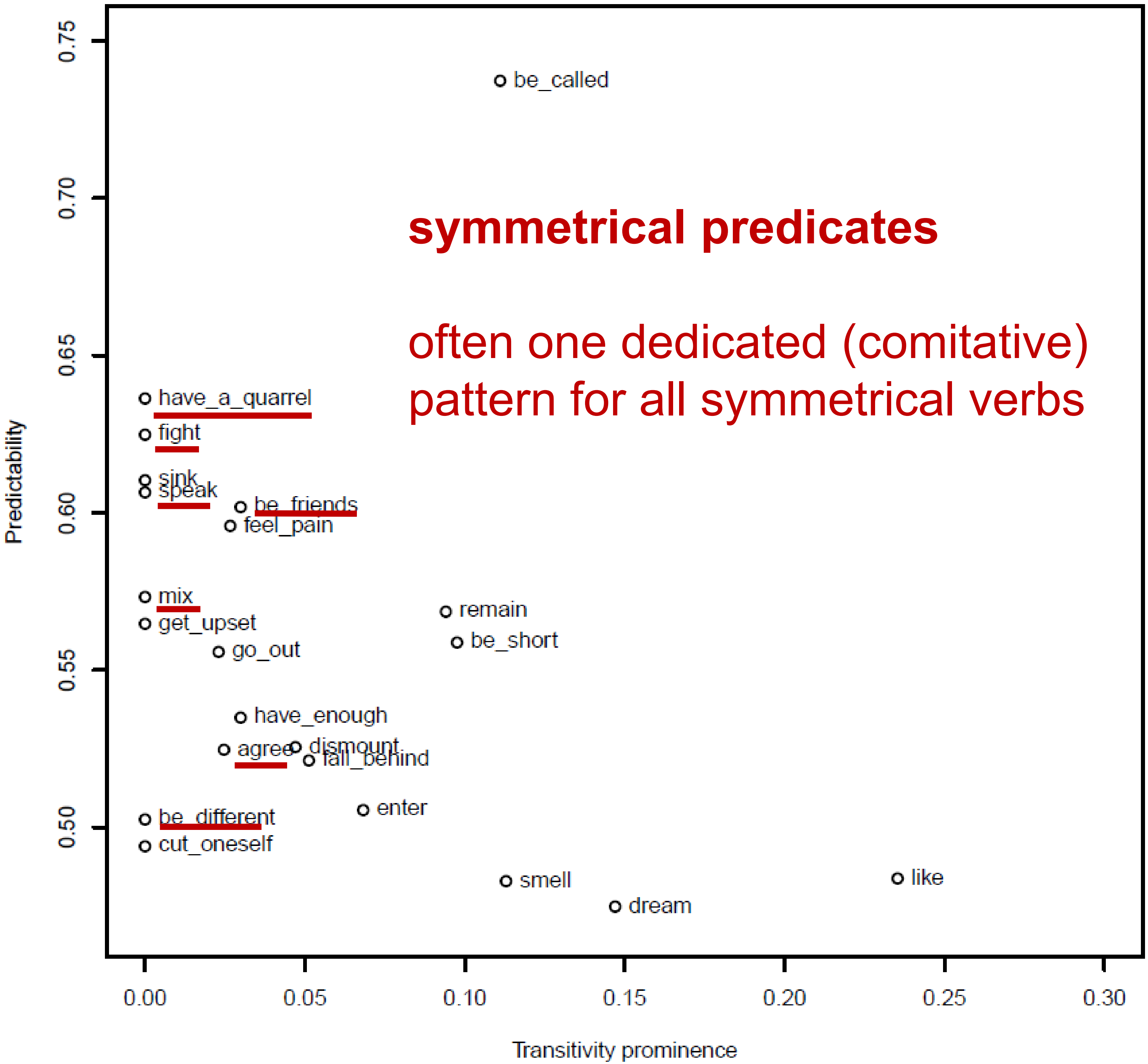

predictable,
transitive
(not very interesting)
Predictability
0.4
0.5
0.6
0.7
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Transitivity prominence



Predictability
0.85
0.80
0.75
0.70
0.65
0.60
0.55
drink
make
put_on
pour
milk
lose
plough
take_off
upset
find
paint
know
hear
see
hold
drop
understand
give_birth
surround
look_for
punish
bite
cross
love1
kiss
hit
call
respect
despise
want
remember
move_bodypart
hate
leave
catch_up
listen
wait
0.7
0.8
0.9
1.0
Transitivity prominence



predictable, intransitive
Predictability
Transitivity prominence
0.4
0.5
0.6
0.7
0.8
0.0
0.2
0.4
0.6
0.8
1.0


symmetrical predicates
often one dedicated (comitative) pattern for all symmetrical verbs
Predictability
0.75
0.70
0.65
0.60
0.55
0.50
Transitivity prominence
0.00
0.05
0.10
0.15
0.20
0.25
0.30
be_called
have_a_quarrel
fight
sink
speak
be_friends
feel_pain
mix
get_upset
go_out
remain
be_short
have_enough
agree
dismount
fall_behind
enter
be_different
cut_oneself
smell
dream
like

# Predictability: results

- Shughni (< Iranian; Tajikistan)

| | | | |
|---|---|---|---|
| *Najiba* | *Safina=qati* | *δêd* | *kix̌-t* |
| PN | PN=INS | quarrel | do-3SG |

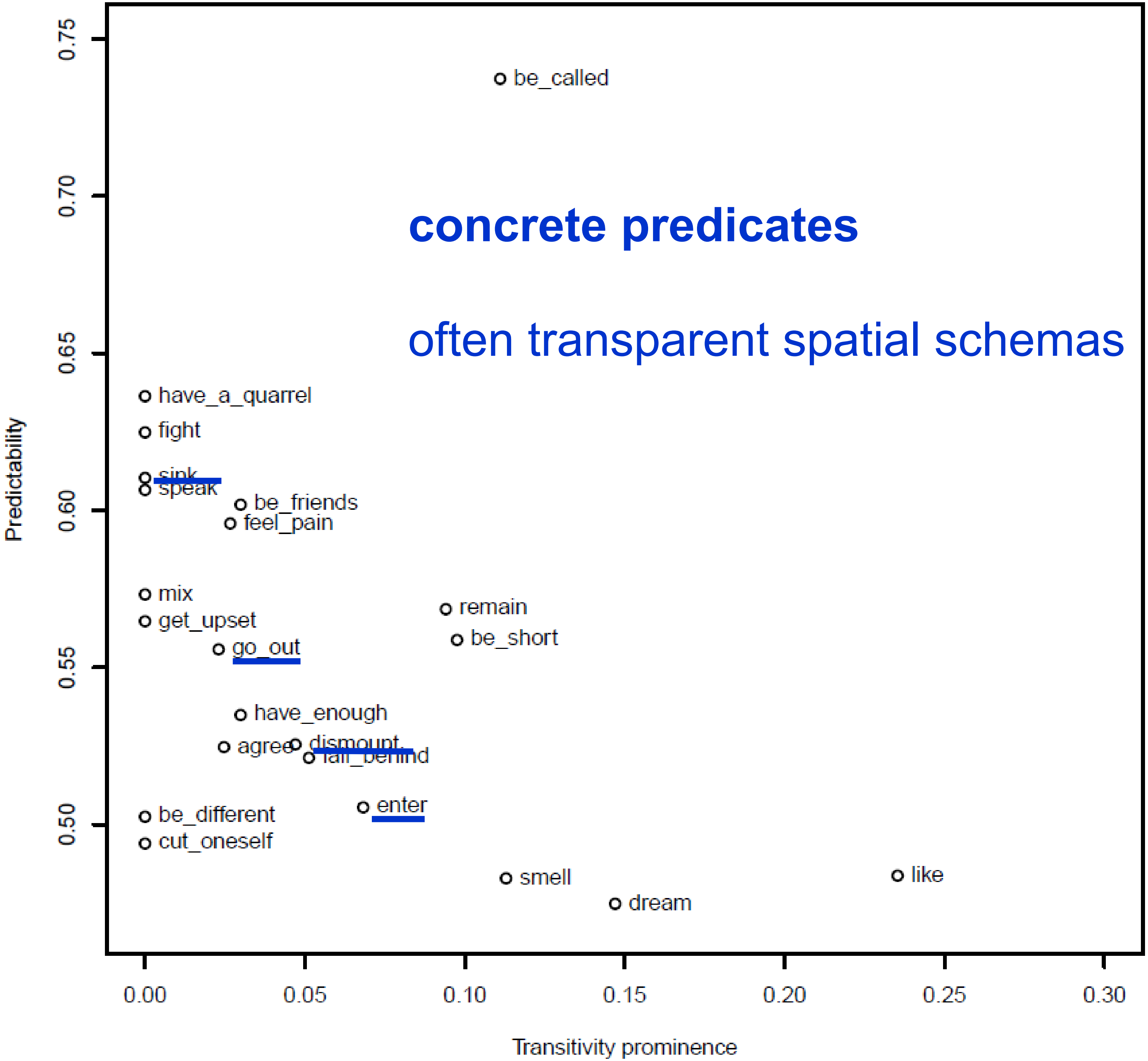
'Najiba is fighting with Safina.'

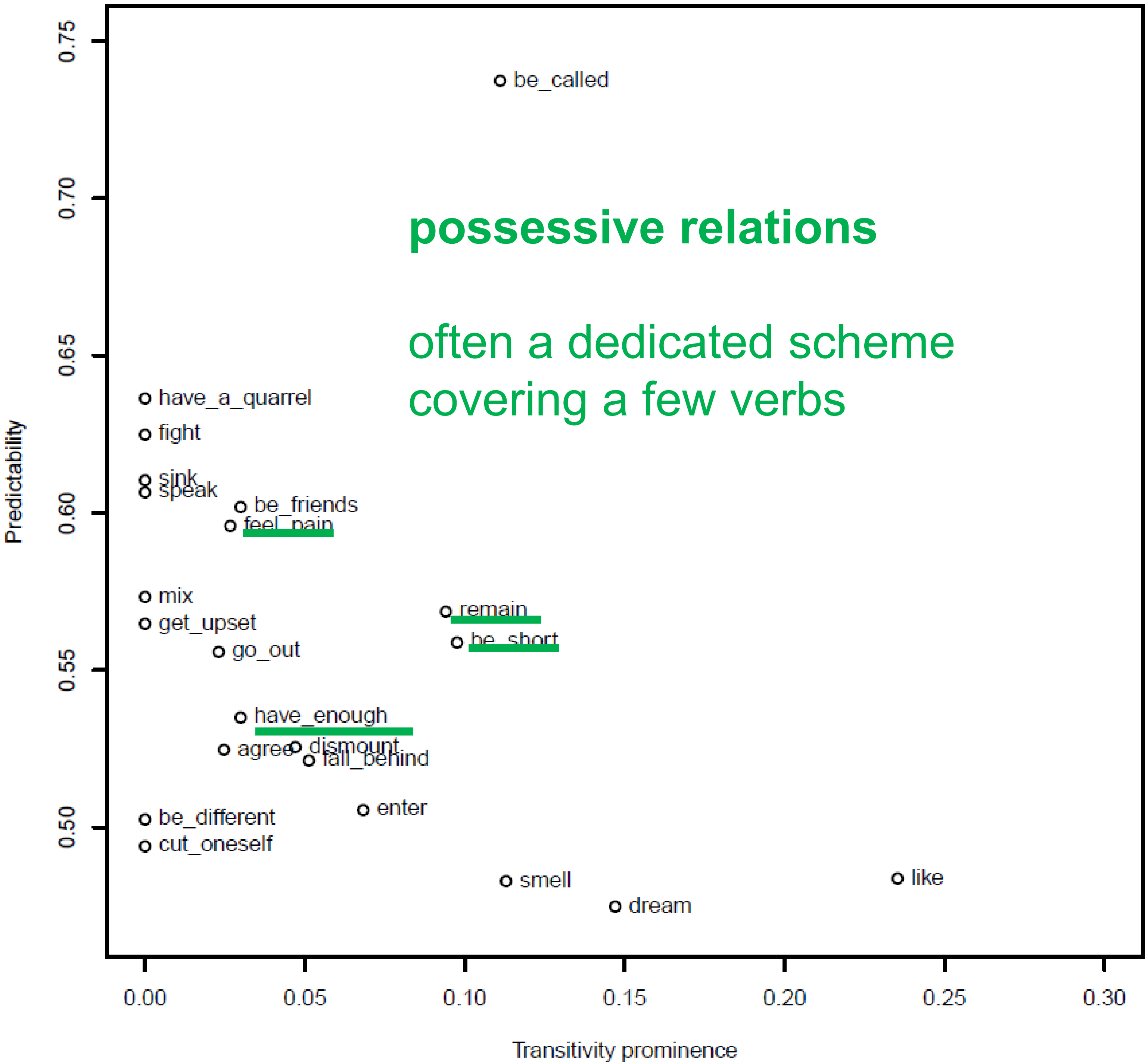
| | | | |
|---|---|---|---|
| *Asal* | *x̌uvd=qati* | *alalaš* | *sut* |
| honey | milk=INS | mix | go.M.PST |

'The honey got mixed with the milk.'

| | | | |
|---|---|---|---|
| *Ahmed* | *Saida=qati* | *rozi* | *sut* |
| PN | PN=INS | contented | go.M.PST |

'Ahmed agreed with Saida.'


concrete predicates
often transparent spatial schemas
Predictability
0.75
0.70
0.65
0.60
0.55
0.50
Transitivity prominence
0.00
0.05
0.10
0.15
0.20
0.25
0.30
be_called
have_a_quarrel
fight
sink
speak
be_friends
feel_pain
mix
get_upset
go_out
remain
be_short
have_enough
agree
dismount
fall_behind
be_different
cut_oneself
enter
smell
like
dream


possessive relations
often a dedicated scheme
covering a few verbs
be_called
have_a_quarrel
fight
sink
speak
be_friends
feel_pain
mix
get_upset
go_out
remain
be_short
have_enough
agree
dismount
fall_behind
be_different
cut_oneself
enter
smell
dream
like
Predictability
0.50
0.55
0.60
0.65
0.70
0.75
Transitivity prominence
0.00
0.05
0.10
0.15
0.20
0.25
0.30

# Predictability: results

- Turkish: the GEN_NOM pattern – 5 verbs in the data set

| | | | | |
|---|---|---|---|---|
| *Mehmed-in* | *şimdi* | *on* | *lira-sı* | *kal-dı* |
| PN-GEN | now | ten | lira-P.3 | remain-PST |

'Now Mehmet has 10 liras left.'

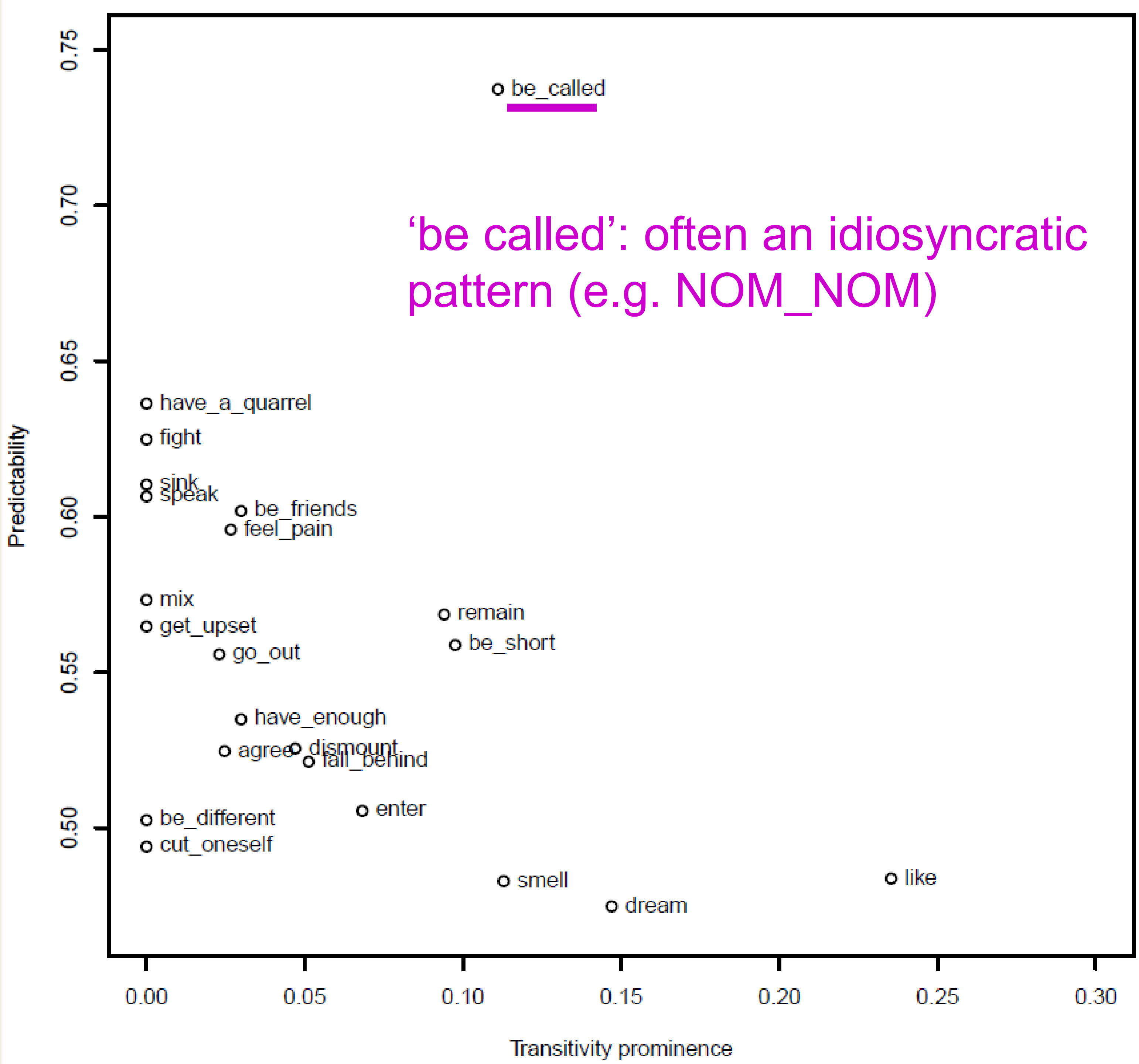
| | | |
|---|---|---|
| *Mehmed-in* | *araba-sı* | *var* |
| PN-GEN | car-P.3 | there_is |

'Mehmet has a car.'

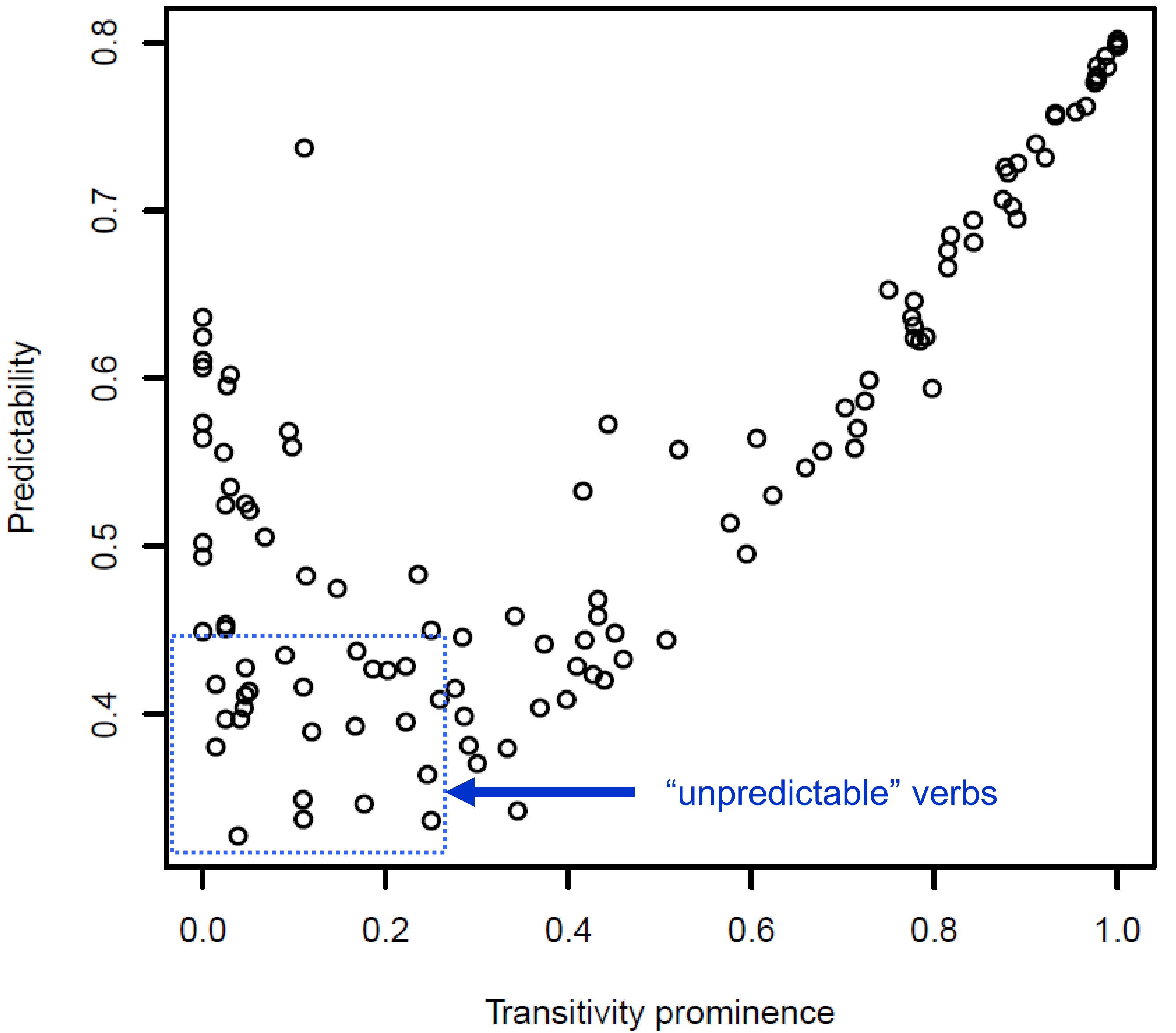
| | | |
|---|---|---|
| *Mehmed-in* | *baş-ı* | *ağrı-yor* |
| PN-GEN | head-P.3 | ache-PRS |

'Mehmet has a headache.'

+ also 'have (illness)', 'be short'



0.75
0.70
0.65
0.60
0.55
0.50
Predictability
be_called
'be called': often an idiosyncratic pattern (e.g. NOM_NOM)
have_a_quarrel
fight
sink
speak
be_friends
feel_pain
mix
get_upset
go_out
remain
be_short
have_enough
agree
dismount
fall_behind
be_different
cut_oneself
enter
smell
dream
like
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Transitivity prominence



Predictability
0.4
0.5
0.6
0.7
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Transitivity prominence
“unpredictable” verbs

# Predictability: results

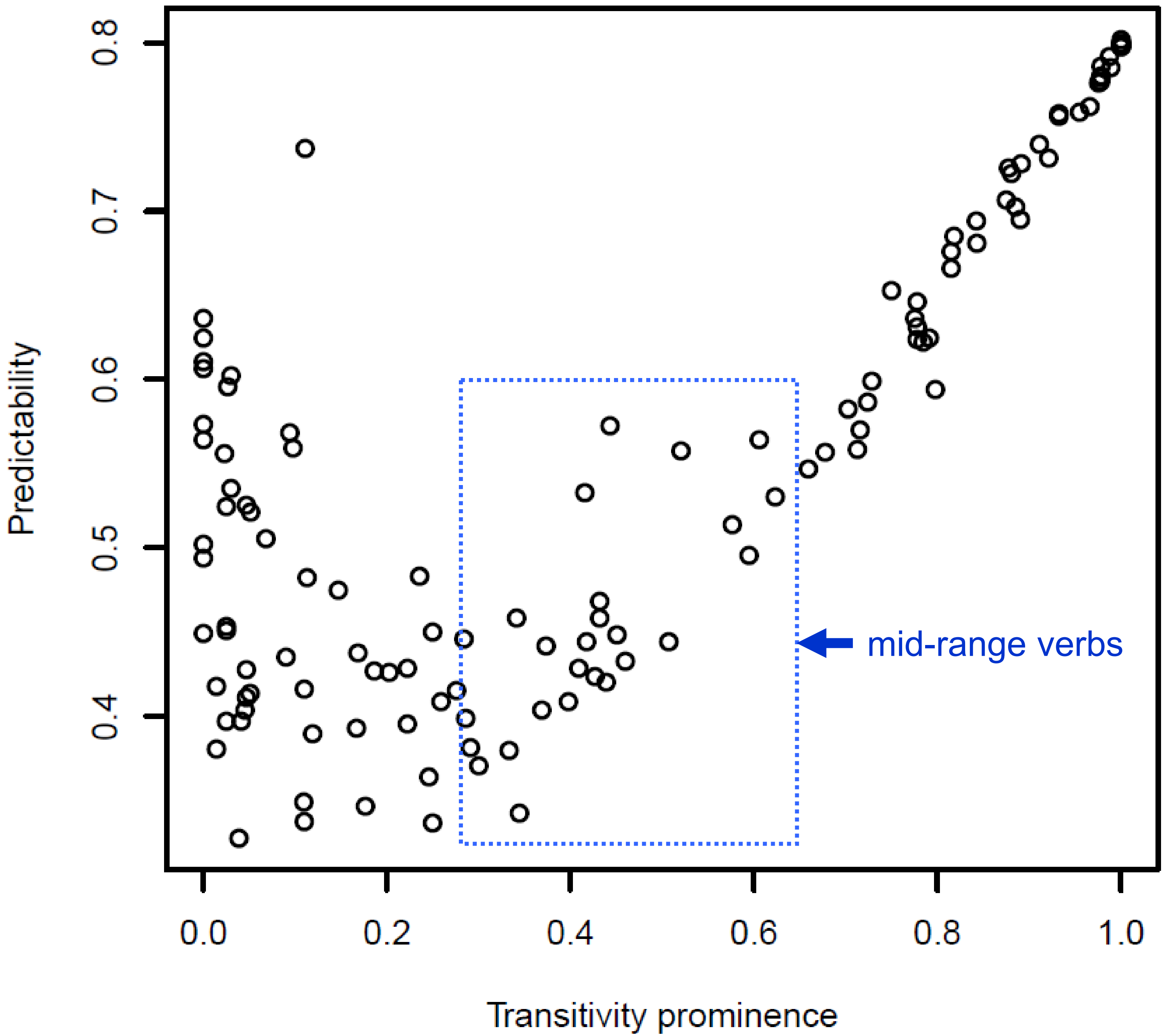
- The least predictable verbs are mainly psychological verbs
- Top 13 verbs with the lowest $\pi$-value ($< 0.395$):

| | predictability | transitivity | | predictability | transitivity |
|---|---|---|---|---|---|
| be_content | 0.33 | 0.04 | encounter | 0.37 | 0.3 |
| fall_in_love | 0.34 | 0.25 | influence | 0.38 | 0.33 |
| be_surprised | 0.34 | 0.11 | take_offence | 0.38 | 0.01 |
| be_fond | 0.34 | 0.34 | envy | 0.38 | 0.29 |
| be_squeamish | 0.35 | 0.18 | resemble | 0.39 | 0.12 |
| marvel | 0.35 | 0.11 | trust | 0.39 | 0.17 |
| enjoy | 0.36 | 0.25 | | | |

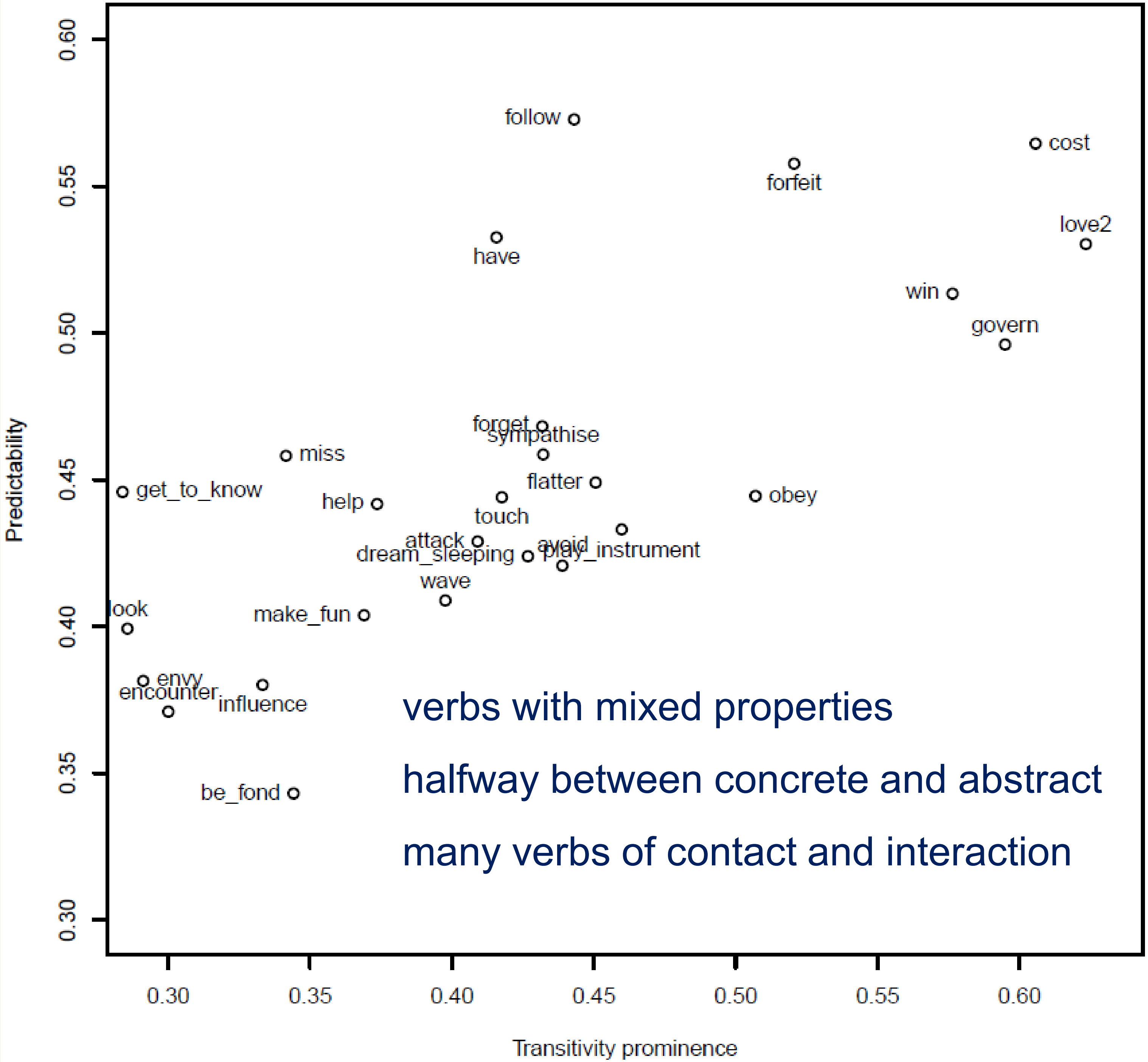
# Predictability: results

- Some psychological verbs in Aghul:
  - various patterns
  - no obvious motivation

| | verb | pattern |
|---|---|---|
| ‘be afraid’ | *guč’a-* | DAT_POST.ELAT |
| ‘be glad’ | *šad-x.u-* | ABS_DAT |
| ‘be squeamish’ | *karih-t:i* + ‘be’ | DAT_ABS |
| ‘be content’ | *rezi-di* + ‘be’ | ABS_SUPER |
| ‘fall in love’ | *k:an-x.u-* | DAT_ABS |
| ‘trust’ | *quχ.a-* | ABS_POST |
| ‘be angry’ | *qel ke-* | DAT_SUBCONT.ELAT |
| ‘be surprised’ | *ʔalamat x.u-* | ABS_SUPER |
| ‘take offence’ | *qel aq’.u-* | ERG_SUBCONT.ELAT |
| ‘despise’ | *alčaq-t:i fac.u-* | TR |
| ‘be shy’ | *neč-t:i* + ‘be’ | DAT_SUBCONT.ELAT |



Predictability
0.4
0.5
0.6
0.7
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Transitivity prominence
mid-range verbs


follow
cost
forfeit
love2
have
win
govern
forget
sympathise
miss
get_to_know
flatter
obey
help
touch
attack
avoid
dream_sleeping
play_instrument
wave
look
make_fun
envy
encounter
influence
be_fond
verbs with mixed properties
halfway between concrete and abstract
many verbs of contact and interaction
Predictability
0.30
0.35
0.40
0.45
0.50
0.55
0.60
Transitivity prominence
0.30
0.35
0.40
0.45
0.50
0.55
0.60

# Conclusions and implications

- All transitive verbs are alike, each intransitive verb is intransitive in its own way
- No empirical support for a universal transitivity hierarchy of verbs; semantic domains are not homogeneous wrt individual verbs' transitivity prominence

# Conclusions and implications

- Highly transitive verbs do form a robust cluster
- Non-transitive clusters exist, but they are fuzzy and do not always correspond to traditional semantic roles
- Rather, they are based on common patterns in metaphorization and construal, e.g. in terms of motion schemas

# Conclusions and implications

- Valency patterns are neither fully predictable, nor fully idiosyncratic
- Verbs with concrete meanings are cross-linguistically more stable than verbs with abstract meanings

# Conclusions and implications

- Low transitivity, high predictability:
  - symmetric predicates: ‘fight’, ‘speak’, ‘get mixed’, ‘agree’
  - some motion-related verbs: ‘go out’, ‘dismount’, ‘enter’, drown’
  - some verbs related to possession: ‘be short’, ‘have enough’, ‘remain’ + ‘feel pain’

- Low transitivity, low predictability:
  - most verbs of emotions and other psychological verbs: ‘rejoice’, ‘be surprised’, ‘trust’, ‘fall in love’, ‘enjoy’…

# THANK YOU!

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