# When native speakers make errors on irregular words:

## The effects of phonology

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# Ko naravni govorci naredijo napake z nepravilnimi glagoli:

## vplivi fonologije

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## Po katerem jeziku?

- Imam po angleško pisane slajde
  - malo časa za prevod…
- ∴ mešanica
  - slajdi pogosto po angelško
  - govorno besedilo pogosto po slovensko

## Vsebina

- Pregled enega dela od mojih raziskav
  - Pravilni oz. nepravilni glagoli
    - preteklega časa (angleški glagoli)
    - sedanjega časa (slovenski glagoli)
  - Splošnejša vprašanja:
    - Kaj povedo teorijam učinki tekmovanja med različnih vzorcev (morfoloških in fonoloških)?

## Morphological Regularity: English past-tense

- Regular pattern (most verbs, most tokens)
  - Add *–ed*
  - *walk-ed, slipp-ed, sneez-ed*, etc.
  - cf. base forms *walk, slip, sneeze*
- Irregular patterns (ca. 150-200 verbs)
  - many different patterns of varying size
    - » vowel changes; no change; etc.
  - *spun, broke, hurt*, etc.
    - » cf. base forms *spin, break, hurt*

## Dva vidika

- Dva mehanizma:
  - skladoščenje nepravilnih glagolov v mentalnem leksikonu
    - vsak glagol ima dve ali več različic
  - pravila ki tvorijo pravilne glagole
    - nebeno skladiščenje pravilnih glagolov
- Vse oblikoslovne oblike (nepravilne in pravilne) se najdejo v mentalnem leksikonu.
  - Tudi so splošni zvorci resnični
    - pravilni in nepravilni

## Zakaj je to pomembo?

- Generalizacija vzorcev
  - pravilnega vzorca
    - za nove besede: *google-ed*
    - kot napaka: **fall-ed, *break-ed*
      - » *fell* *broke*
  - nepravilnega vzorca
    - zgodovinsko: *snuck, pet*
      - » *sneaked* *petted*
    - kot napaka: **grun, *stook*
      - » *grinned* *staked*

## Generalizacija katerega nepravilnega vzorca?

- Fonološka podobnost
  - Družine nepravilnih glagolov se rimajo
    - *drank, sank, shrank,…*
    - *flew, grew, drew, …*
  - Velike družine
    - so bolj produktivne
    - imajo manj napak
  - Naravna morfologija: za posamezen niz
    - 5 nivojev produktivnosti, od popolno produktivnega do minimalno produktivnega

## Generalizacija brez podobnosti

- Napake z nepravilnimi vzorci, brez rimanja z znanim nepravilnim glagolom
  - *pruch* 'preached'
  - *crull* 'crawled'
  - *loost* 'lost'
    - » [ lʊst ] ne dovoljen niz po angleško!
- Statistično redke
  - Fonološka podobnost ni čisto potrebna
    - a poveča generalizacijo

## Ni samo rimanje

- Nesistematične napake odraslih
  - v katerih nadomestiti osnovno obliko
    - » nedoločnik?
    - » **flunk* 'flunked'
  - podobnost: *stunk, drunk, …*
  - več napak glede na število soglasnikov
    - 3: *flunk, thank*
    - 2: *snore*
    - 1: *glue*

## Napake dveh vrst

- Sistematične
  - naredijo otroci
    - fonologične: lahko 100%
    - oblikoslovne: najpogosteje manj kot 20% pojavnic
- Nesistematične
  - posebej odrasli
    - v pospešnih eksperimentih, najpogosteje manj kot 5% pojavnic
    - v naravi, manj kot 0,1%

## Napake iste vrste

- za oblikoslovje, sistematične = nesistematčne
  - za otroke in odrasle
  - podobne vrste napak
  - podobni vplivi fonologije & besedno pogostnost
  - statistično podobne
    - z izjemo, da otroci naredijo napake pogosteje
- Isti kognitiven mehanizem povzroča te napake
  - za vse govorce vseh starosti

## Podrobnosti: stalni učinki fonologije

- Izvira iz strukture mentalnega leksikona
  - vedno prisoten
  - merljivi učinki na
    - verjetnost generalizacije
    - hitrost
    - pogostnost napak
      - » za otroke in odrasle
- Ampak: To ni cela zgodba.

## Začasni učinki fonologije

- Izvira iz govorčevo **rabo** besed v mentalnega leksikona
- Prednostno vrednotenje (priming)
  - Ko je element aktiviran, ima vpliv na druge elemente
    - ki so aktivirani malo kasneje ali istočasno
  - Vpliv je pogosto pozitiven
    - podkrepi elemente
      - jih pospeši
      - zmanjša napake

## Nivoji prednostnega vrednotenja

- besede
- fonemi
- fonološki značilnosti
- Hipoteza:
  - Prednostno vrednotenje od fonoloških elementov na oblikoslovne oblike glagolov (nepravilnih in pravilnih)

## Integrated Multiple Competitor Approach

- Integrated (non-modular)
  - everything that impacts on the construction of phonological output form occurs at the same time
    - morphology at same time as phonology

## Multiple Competitors

- Not limited to “regular” vs. “irregular” competitors
  - also base form
  - also all other tense and aspect verb forms as well
  - and competition between words, phonemes, etc.

## Combining sources of activation

- Output elements benefit from having multiple sources of activation
  - Prediction
    - proportion of tokens that are correct or in error for morphology is influenced by factors that affect access of phonological elements
      - increase in overregularizations for phonological reasons
      - functionally no modularity

## Gradient Storage

- Some elements stored more strongly than others
  - with more activation
- frequency effect:
  - more frequent = more strongly stored
  - less frequent = less strongly stored
- Biases to output some elements rather than others

## Effects of biases in vowels

- SLIP experiments on vowel errors showed asymmetries based on vowel frequencies:
  - front vowels tend to be replaced by back
  - mid vowels tend to be replaced by high & low vowels
  - short vowels tend to be replaced by long vowels & diphthongs
    - » /ɛ/ → /ʌ, ɪ, æ, iː/
  - for other contrasts, more errors on low freq
    - » /æ, ʌ/ → /ɪ/

## Effect on overregularization

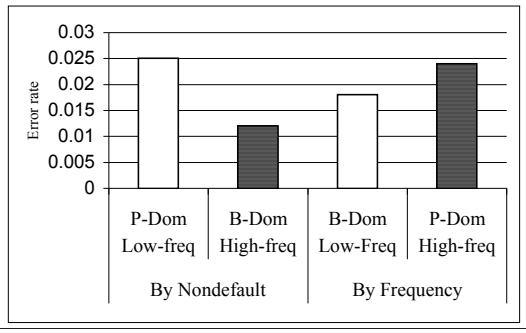
- fall - fell → *f**a**lled *common*
  - base vowel has nondefault [+back,+low]
  - item-specific outcompetes in output, **base-dominant**
  - overregularized at high rate
- break - broke → *breaked ***UN***common*
  - past vowel has nondefault [+back]
  - preferred in output, **past-dominant**
  - overregularized at low rate

## Vowel dominance in overtensing

- Preference for opposite set of verbs from overregularization
  - Base-dominant: less common
    - *didn't **fe**ll* (*didn't f**a**ll*)
  - Past-dominant: more common
    - *didn't br**o**ke* (*didn't br**ea**k*)

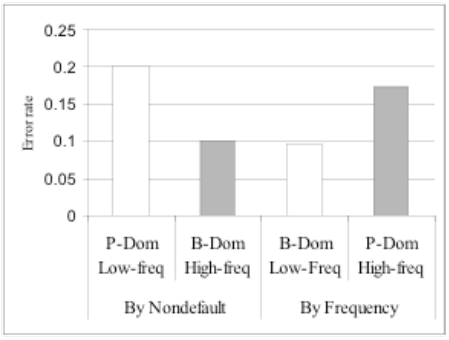
## Vowel dominance by frequency (adults)

Freq. of vowel in past-tense form



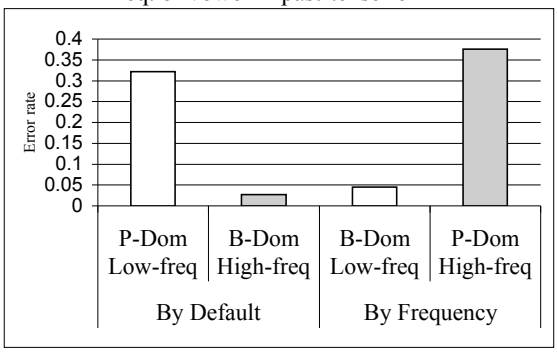

## Vowel dominance by frequency (TD children)

Freq. of vowel in past-tense form



## Vowel dominance by frequency (SLI children)

Freq. of vowel in past-tense form




## Magnitude of vowel effects

- Variation across populations
  - adults: 1.5 (but also different task)
  - TD: 2.0
  - SLI: 10.0
    - » higher error rate for past-dominant
    - » lower error rate for base-dominant

## Effects of context on phoneme processing

- Interference from other words leads to classic speech errors
  - item-specific information tends to outcompete system-general
    - » high-freq /s/ vs. low-freq /š/
- Q: do we expect such effects to influence the rate of overregularization errors?

## Sentence production: Effect of phonology of subject noun

- Task (speeded):
  - Read silently: The boat was sinking.
  - Say aloud: The boat **sank**.
- Effect of subject noun's phonology:
  - No phonemes in common: 4% error
    - » The boat *sinked*.
  - Same vowel only: 6% error
    - » The ship *sinked*.
  - Rhymes with base of verb: 12% error
    - » The mink *sinked*.

## What this means

- Vowel of subject noun primes another token of same vowel in another word
  - biases system to output the same vowel
  - Reinforces base vowel and makes a better competitor with past-tense vowel
    - so base *fall* accessed
  - System-general pattern for past-tense then leads to generalization of *-ed* pattern
    - though there is *also* a greater rate of base-form errors like *fall*

## Not just phonological vowel error

- Consequent addition of *-ed*
- Vowel errors are never that frequent
  - ca. 1% of tokens or less in SLIPs task
    - uses priming to increase likelihood of phonological errors
- An interaction of morphology and phonology
  - magnifies the effect of the phonological factor
  - summing activation from multiple sources

## Why rhyming > just shared V?

- Phonological speech errors: the Repeated Phoneme Effect
  - phoneme errors especially likely if the two words share other phonemes
    - » a similarity effect
- Greater error rate on vowels if shared VC
  - shared: Half a cent sales *tex extra*. 'tax'
  - not: Some of them *comm off* ... 'come'
  - spontaneous speech: 3 times the error rate when shared vs. when not

## Coordinated VP

- Sentences in which two verbs are produced with conjunction *and*
  - *He coughed and sneezed.*
  - *The plant wilted and died.*
  - *He came and ate.*
  - *She slipped and fell*.
- Questions:
  - Do the two conjoined verbs interact?
    - negatively: higher error rates
  - Are regulars or irregulars affected more?

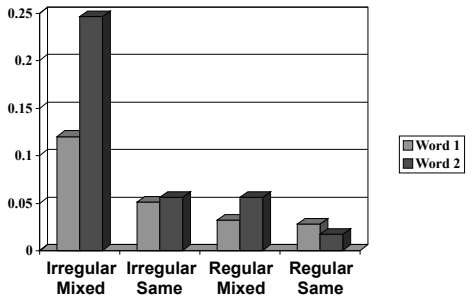
## Task (speeded)

- Read silently:
  - The clown was spinning and grinning
- Say aloud:
  - The clown **spun** and **grinned**.
- Conditions:
  - Mixed irregular and regular, always rhyming
  - Same regularity, no phonemes in common
    - two irregulars, different patterns
    - two regulars
- Subjects spontaneously reported: *very* difficult

## Primary analysis: mixed vs. same

- Full overregularization of irregular
  - The clown spinned and **grinned**.
- Targeted over-irregularization of regular
  - The clown **spun** and grun.

## Exp. 1: Overregularization of irregulars & Targeted over-irregularization of regulars




## Errors when not rhyming: Irregulars

- Overregularization of irregulars
  - 5.3% of trials
  - same on 1st vs. 2nd word
  - about the same as in previous experiments involving production of just one verb
    - about 4.0% in each of 4 experiments
    - maybe *slightly* elevated

## Errors when not rhyming: Regulars

- Over-irregularization of regulars
  - 2.2% (lower than on irregulars, as usual)
    - even though regulars were of lower mean frequency
  - slightly more on word 1 (n=13) than on word 2 (n=8)

## Errors when rhyming: Irregulars

- Dramatic increase for irregulars
  - 3.5 times the error rate!
  - Effect of position in VP
    - Smaller effect for 1st word:
      - » 5.1% vs. 12.0%
    - Huge effect for 2nd word:
      - » 5.6% vs. 24.6%
      - » 4.4 times; 19.0% of trials
  - so especially a ***perseveratory*** effect

## Errors when rhyming: Regulars

- Modest increase for regulars
  - Twice the error rate
  - Effect of position in VP
    - Minimal effect for 1st word:
      - » 2.8% vs. 3.2%
    - "Huge" effect for 2nd word:
      - » 1.7% vs. 5.6%
      - » 3.3 times; 3.9% of trials
  - so especially a ***perseveratory*** effect

## Začasni oz. stalni učinki

- Same types of errors likely
  - more on irregular than on regular
- But magnitude of effect increased
  - Začasni vplivi imajo večji učinek kot stalni?
  - Vedno začasni in stalni **skupaj**
    - Ko **dodamo** začasne, je **dodatno** učinek večji kot učinek stalnih vplivov **samih**.

## Integrated Multiple Competitor Approach

- Access of irregular involves competition between base and past
  - *spun* vs. *spin*
  - Base accessed on some trials
  - Default *–ed* usually added, to express tense
- Reinforcing phonology of base increases competitiveness of base
  - & percentage of trials where erroneously accessed
- Conjoined rhyming regular (same vowel and coda in output) reinforce base phonemes *in output*
  - Magnified rate of overregularization errors

## Not purely phonological

- Greater magnitude than purely phonological errors on vowels
  - e.g. 1% in SLIPs experiments
- Phonology-morphology interaction
  - magnified via summing activation from multiple sources

## Processing of regulars

- Output vowel in irregular primes same vowel in regular
  - vowel /ʌ/ (from *spun*) reinforces error *grun*
- Context *not* as much effect as with irregulars
  - ¿because error rate inherently lower?

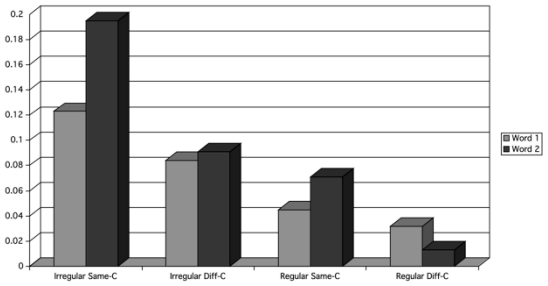
## 2. Eksperiment: Slovene

- V sodelovanju s Prof. Dr. Teodorjem Petričem
- Regular present tense forms have same theme vowel in present and infinitive
  - *kisati*; *-l* form *kisal*
    - » 3sg.pres. *kisa*; imperative *kisaj*
- Some irregulars change theme vowel and palatalize some consonants
  - *pisati* 'to write' ; *-l* form *pisal*
    - » 3sg.pres. *piše*; imperative *piši*
  - child overregularization: *pisa*

## Similar task

- Slovene does not require subject
  - » pro-drop language
  - READ: kisati in pisati
  - SAY: kisa in piše
- Fewer than 50% of stimuli rhyming
  - » too few irregulars
  - » and many variable
  - but share same last-consonant (/s, z, c/)

Exp. 2: Overregularization of irregulars & over-irregularization of regulars




## Pogostnost in rimanje

- Več napak za nepogostne glagole
- Več napak ko dva glagola se rimata
  - VK isto oz. samo K isto
    - *kisati in pisati*
    - *drsati in risati*
  - VK raziskavano za angleščino
    - » ne še V samega

## So, robust

- quite different characteristics from English
- lesser degree of similarity has effect
  - same consonant only vs. VC
- Clear effect that phonology of output form of conjoined regular verb inhibits ability of speakers to process irregular forms

## Fonološki vplivi na oblikoslovje

- Fonologija in morfologija poteka istočasno
  - stalni učinki so vedni prisotni
    - pomaga korektno obliko ali jo poškoduje
  - začasni učinki tudi jo pomaga ali poškoduje
    - dodaten učinek je večji kot izvirni stalni učinek fonologije

## Methodological note

- Many people like research on child errors
  - the errors are so frequent
  - people feel can trust
- Many people dislike research on adult errors
  - the errors are so infrequent
  - even though results are replicable
- If can investigate same errors in child & adult speech, & can replicate findings from one age with the other age
  - error research is error research