Why do languages tolerate heterography?
An experimental investigation of the cultural evolution of informative orthographies

Jon W. Carr & Kathleen Rastle
Royal Holloway, University of London
Holistic

Redundant

Expressive

Degenerate

informativeness in use

simplicity in learning

the simplicity-informativeness tradeoff
the simplicity–informativeness tradeoff
1. We test the idea that heterography emerges in response to a functional pressure to disambiguate meaning in writing.
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2. We seek to understand how the emergence of heterography plays out under the two mechanisms of differentiation and conservation.
Differentiation

Conservation

Berg & Aronoff (2021)
### Differentiation

- Time 1: /læt/ (light)  
- Time 2: /læt/ (light)

- Words: light–lite, bite–byte, check–cheque
- Examples: by–bye, for–fore, or–ore, be–bee, in–inn, to–too, but–butt
- Additional: Carr, Wilde; Blu-Tack, Wite-Out
- Notes: discreet–discrete, flower–flour, plain–plane

### Conservation

- Time 1: /niːt/ (knight)  
- Time 2: /niːt/ (knight)

- Words: heal–heel, leak–leek, meat–meet, read–reed, sea–see, team–teem, weak–week
- Examples: /kn/ → /n/: knight–night, know–no, knot–not
- Additional: /ç/ → /ʃ/: eight–ate, right–rite, sight–site
- Notes: /ʍ/ → /w/: whale–wail, which–witch, whine–wine
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Two conditions: evolution with and without communicative pressure

Experiment 1

Experiment 2
Experiment 1: Differentiation
Suffixes:

Stems:
Suffixes

Stems

/buvi-/  
<wopi-/>  
<buvi->

/zeti-/  
<wopi-/>  
<zeti->

/wopi-/  
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### Suffixes

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### Stems

<table>
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<th>/buvi-/</th>
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Kirby et al. (2015)
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Holistic  Expressive  Redundant  Degenerate

informativeness in use  simplicity in learning
Holistic
Redundant
Expressive
Degenerate

informativeness in use
simplicity in learning
Experiment 2: Conservation
Conservation

Time 1

Time 2
Suffixes

/-fəʊ/
/-ʃə/
/-sɪə/

Stems

/buvɪ-/  <buvɪ->
/zetɪ-/  <zetɪ->
/wopi-/  <wopi->

/ˈDUO/  /ˈʃə/  /ˈsɪə/
Epoch I
Generations 1–3

/-fɔu/-→/-fɛi/-→/-fə/

/-ʃə/-→/-ʃə/-→/-fə/

/-sɛɪ/-→/-fɛi/-→/-fə/

Sound change 1
/s/→/f/, /əʊ/→/ɛɪ/

Epoch II
Generations 4–6

Epoch III
Generations 7–9

Sound change 2
/s/→/f/, /ɛɪ/→/ə/
## Transmission-only

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## Transmission + Communication

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Conclusions
Hurdles in differentiation

The apprehension problem: Participants must grasp the mechanics of the game and its incentive structure.

The theory of mind problem: Participants must be able to put themselves in the shoes of their partners.

The innovation problem: Participants must be capable of devising linguistic solutions.

The alignment problem: Participants must be able to align with an interlocutor separated in time and space.

The social problem: Participants must be prepared to rebel against their input, overcoming various social stigmas in the process.
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Hurdles in conservation

The learnability problem: Participants must be able to learn the spelling system
Read more: doi.org/k3v4