What's that?

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ELALT, Novi Sad, 9/3/19
Change

- Language change tends to progress along an S-curve.
- We have a good story about why (Weinreich et al. 1968, Bailey 1973, Kroch 1989, Blythe & Croft 2012).
  - Forms compete to do the same job.
  - Something favours a particular form.
  - Gradually, that form spreads through the population.
- This story presupposes that the ‘job’ (or function) comes first, and that change involves finding a different way to do the same job (the stable functions assumption).
- If we remove that assumption, things change.
Today

- An argument that the stable functions assumption isn’t always warranted (partly joint work with Nik Gisborne).
- Plans for what to do without that assumption (joint work-in-progress with Richard Blythe, Simon Kirby).
Two types of competition

- Part of language use is selecting among alternative forms which realize a communicative intention.
- Part of language acquisition involves pairing a given form with grammatical information.
- Both of these involve competition, but in different ways.
  - Among forms paired with a given function.
  - Among specifications of the function of a given form.
The functions of functional heads

- Acquisition of content word meaning has been extensively investigated.
- But content words are the easy ones.
- Functional vocabulary is harder in many respects.
  - Ambiguity is the norm.
  - Mutual exclusivity not such a strong pressure.
  - Miscommunications less obvious and/or less serious.
  - Pairings between category and denotation more fluid.
- Learners are quick to figure out that *that* is a word.
- But it is much harder for them to answer a question like ‘What is *that*?’.
The denotation of a lexical item doesn’t directly determine what functions it can realize.

That’s determined by compositional interactions between lexical items (including an unspecified number of null lexical items), and by the many–many relationship between denotations and communicative intentions.

Moreover, among functional vocabulary, polysemy is the norm, so figuring out the denotation of any relevant item is not easy.
Change is change in associations

- Most well-studied cases of grammar change involve:
  - A stable set of forms
  - A stable set of functions
  - A dynamically changing set of alignments of forms with functions.

- *Do*-support emerged, but *gorp*-support never got off the ground: we rarely invent brand new grammatical lexemes to do extant jobs.

- And the set of jobs a grammar can do remains fairly stable (though not completely, e.g. Truswell & Gisborne 2016)

- Rather, grammars change because of novel answers to questions like ‘What does *do* do?’.
Innovations recur

▶ Innovative ‘mislearnings’ are not interesting or relevant, unless we can show that they’re not just noise.
▶ But the mislearnings aren’t random: they recur.

(1) de fout wie hun eigenlijk maken
    the mistake who they actually make
    ‘the mistake which they actually make’
    (Johan Cruyff, via Boef 2012)

(2) adnominal adjectives (those who are not modifying the noun predicatively)
    (Belk 2016: 179)
The problem with the stable functions assumption is that it doesn’t allow for the full range of ways in which associations can change.

In the general case, it’s not immediately clear that competition-based explanations for phenomena related to S-curves are valid.
Case study

- I’m going to talk about English relative clauses. Basic terms:

1. Distinction between **headed** relatives (clauses modifying some external constituent, typically NP) and **free** relatives (clauses with the function of some other constituent, typically NP).

   (3) a. I’ll have the same thing [∅ that he’s having __]  
   b. I’ll have [what ∅ he’s having __]

2. Both types of relative have dedicated **specifier** and **head** positions.
   - Possible specifiers: inflected demonstrative phrases in OE, wh-phrases, ∅.
   - Possible heads: OE þe, that, marginally as, ∅.

Each position can be filled or empty independently of the other in either type of relative, at least at some point in the last 1,000 years.
Case study

▶ We will try to understand the brief period in 13th-century English when virtually every relative clause (headed or free) was introduced by complementizer *that* with an empty specifier (*peak* *that*).
  ▶ This wasn’t true in Old or Very Early Middle English.
  ▶ It hasn’t been true since Middle Middle English.
▶ Part of this is straightforward.
  ▶ Demonstrative relatives disappeared as inflected demonstratives disappeared (slowly).
▶ Part of it can be understood in standard S-curve terms:
  ▶ Between c.1150–1250, *be*, which had been the most common complementizer in relative clauses, was replaced by *that*. *be* and *that* are forms competing to realize the same function.
▶ Part of it (*wh*-relatives) only really makes sense when you consider competition among possible denotations of otherwise stable forms.
Case study

- *Wh*-phrases in some contexts must be indefinite descriptions.
- In other contexts, they must be definite descriptions.
- The indefinite denotation is old, the definite denotation is newer.
- The change from indefinite to definite is possible because, within the scope of certain operators, it doesn’t make much interpretive difference.
- (And the denotation of *wh*-forms in interrogatives may be neither of the above).
- The peak-*that* period corresponds to a lull between the death of indefinite *wh*-phrases and spread of definite *wh*-phrases.
- None of this can be explained by competition among forms (in some cases, *wh*-phrases aren’t competing with anything) or by competition among functions (the non-isomorphism between denotations and functions is important).
Pe and þæt

- OE had two functionally specialized finite complementizers.
- *That* occurs in complement clauses, adverbial clauses (*if that*), degree clauses (*so much that*), most free relatives, most clefts.
- *Pe* occurs in *the*-comparatives (*the more pe he ate*) and most headed relatives.
- This specialization is nearly categorical.
Pe and þæt
Relatives are messier

- The ‘complementarity’ is more of a strong tendency in relatives (including clefts).
- *Pe* sometimes occurs where *þæt* is expected. I don’t know why.
- *þæt* sometimes occurs where *pe* is expected.
- In many cases, relativizer *þæt* is plausibly a demonstrative pronoun (*þæt*: dem.N.sg.nom/acc).

(4) *Pa ... næfde he scyld æt honda, þæt he þone*
When NEG.had he shield at hand that he the
*cyning [mid __] scylidan meahte*
king with shield might
‘When . . . , he did not have a shield to hand with which he could shield the king.’

(cobede,Bede_2:8.122.19.1160)
Back-of-an-envelope calculation

- *Pe* is undoubtedly a complementizer.
- It occurs in 16,846 OE relatives, of which 826 involve P-stranding (4.9%).
- There are 76 occurrences of relative *þæt* with P-stranding (out of 2,715 relative *þæt*).
- Although we can’t know the incidence of relative-complementizer *þæt* as opposed to relative-specifier *þæt*, this suggests an estimate of $\frac{76}{0.049} = 1550$ occurrences in OE.
- This estimate suggests that *þæt* in relative clauses, even in OE, is normally a complementizer, not a demonstrative pronoun.
- So *Pe* and *þæt* are in competition, and *þæt* wins.
*Pe vs. *pæt, all tokens

![Diagram showing the comparison between *Pe and *pæt over time. The graph includes data points for different years, with a focus on the proportion of occurrences of the words. There are two curves, one for *Pe and another for *pæt, along with data points representing the frequency of 'That' and 'The' words across different years.](image-url)
Pe vs. þæt: Summary

- þæt was always a complementizer.
- It was even always a relative complementizer, occurring as such with low frequency.
- Other demonstrative forms barely behaved like this (c.10x more common with þæt than other demonstratives).
- þæt killed þe within a couple of generations, following a trajectory that could be an S-curve (but so abrupt that the middle part of the trajectory is unclear).
- Compatible with classical grammar competition, though even here, distinctive transient grammars (see McIntosh 1948 on animacy effects in Peterborough Chronicle).
A four-way fight

- The competition between *be* and *bæt* overlapped with the loss of demonstrative relative specifiers, and subsequent introduction of interrogative relative specifiers.
- Neither the specifier nor the complementizer has to be present.
- So the bigger picture could be construed as:
  - a 4-way fight (*DEM, be, bæt, WH*);
  - two simultaneous 3-way fights (*DEM, WH, ∅ × be, bæt, ∅*);
  - a 9-way fight (crossing the two 3-way fights).
- For the sake of our sanity, we’ll stick with a 4-way fight and hope we’re not losing much.
The four-way fight over time
This shows us the peak-*that* window: from c.1250–1400, around 90% of relatives were formed with *that*.

This is much higher than before or since.

But it doesn’t look very interesting.

*De* was the dominant strategy, then *that* became the dominant strategy, and it was even more dominant because the demonstratives (secondary strategy) died.

However, a more interesting pattern is revealed when we factor out headed vs. free relatives.
The four-way fight in headed relatives
The four-way fight in free relatives
The N-shaped trajectory of free wh-relatives

- Free hw-relatives were well-established in OE.
- They slump appreciably in early ME.
- They rise again in late ME, and are now the only form of free relative.
- In its pomp, that not only killed be, and replaced demonstratives in [Spec,CP], but took a chunk out of wh forms too.
- This is surprising, because wh-forms were in no danger of disappearing.
Word frequencies over time
We identify three different denotations for *wh*-forms.

1. Indefinite

   (5) and *gif hwa hyt bletsað*, þonne ablinð seó dydrung.  
   and *if who it blesses then ceases the illusion*  
   ‘and if anyone blesses it, then the illusion is dispelled.’  
   (coaelhom,+AHom_30:4.4082)

2. Definite

   (6) Gemyne, [hwæt Sanctus Paulus cwæð]  
   remember *what Saint Paul said*  
   ‘Remember what Saint Paul said.’  
   (cogregdC,GDPref__and__3__[C]:15.207.28.2739)

3. Interrogative

   (7) Hwær lede ge hine?  
   where *lead you him*  
   ‘Where are you leading him?’  
   (coaelhom,+AHom_6:77.915)

We can track the diachronies of these denotations, by tracking the frequency of constructions which require one of them.
Denotations and constructions

- *Wh*-indefinites are indicative of an indefinite denotation.
- Bare free relatives and nonrestrictive headed relatives are indicative of a definite denotation.
- In other constructions, the distinction is unclear or makes less sense (other free relatives, restrictive relatives, interrogatives).
- If it’s less clear to us, it’s less clear to the learner, and so riper ground for change.
- Implication: relatively minor *wh*-constructions may be disproportionately important to a learner trying to figure out lexical meaning.
Denotations over time

Year
Proportion
Function
Bare FR
Headed rel
Indefinite
Question

Function
- Bare FR
- Headed rel
- Indefinite
- Question
Alignment with peak *that*
Summary

- As we approach peak *that*, three things happen:
  1. Inflected demonstratives mainly disappear.
  2. *pe* mainly disappears.
  3. *Wh*-forms lose their indefinite denotation.

- The spread of definite *wh*-denotations to headed relatives brings an end to peak *that*.
  - Bare (definite) free *wh*-relatives increase in frequency in the 13th century. This clear trend doesn’t much dent peak *that* because free relatives are relatively rare (headed relatives are 10x more common).
  - Headed *wh*-relatives follow 100 years later. Most early headed relatives are nonrestrictive.
Implications for models of change

- A grammar is a set of associations between a set of expressions (forms) and a set of denotations.
- Grammar change is change in the set of associations.
- The sets of expressions and denotations themselves are often stable.
- Expressions with overlapping denotations, and multiple expressions per denotation, are both common (no clear mutual exclusivity pressure).
- The relationship between denotations and communicative functions is indirect — depends on what else the grammar generates.
- Speakers can always circumlocute — no functional vocabulary is strictly necessary.
The mutant dice model

- $f$ ‘meanings’ (or functions) and $e$ expressions.
  - A meaning can be associated with 0–$e$ expressions.
  - An expression can be associated with 0–$f$ meanings.
- A grammar is a set of meaning–expression pairings.
- Flat prior over grammars.
- Meanings associated with different frequencies.
- There are $T$ trials. In each trial:
  - An agent has to communicate about a given meaning.
  - The agent selects among expressions associated with that meaning (if there is one in the agent’s grammar), with small amount of noise.
  - The learner receives the form, and the intended expression with small amount of noise.
  - The learner updates the distribution over grammars accordingly.
- Two variants:
  1. If an agent doesn’t have an expression for a given function, pick an expression at random.
  2. An agent always has the option to circumlocute.
Transition network

No circumlocution

2x2 modified T=5
Transition network

With circumlocution

2x2 circumlocution T=5
Visualization key

1. Each square represents a possible grammar, each arrow represents a change.
2. In each square, functions are columns and expressions are rows; functions ordered left-to-right by frequency.
3. lifetimes decrease from top to bottom.
4. equivalence classes on same row.
5. line thickness $\propto$ transition probability
6. die size $\propto$ stationary probability
7. colour $\propto$ 2nd eigenvector (blue = $-ve$, red = $+ve$, green $\approx 0$). I’ve forgotten what this means.
Pilot results

- In the circumlocution condition:
  - the most frequent transitions all involve changes in the expression of the less frequent function;
  - more frequent functions are more stably expressible.
- Neither applies to the model without circumlocution.
- No convergence to the prior: the prior is flat, the stationary distribution isn’t (different dice are different sizes).
- Local lifetime is not correlated with stationary probability: no relation between thickness of arrow and bigness of dice.
- Most important part of all this: predictions about language typology that don’t straightforwardly derive from the prior, or from the data, but rather from the dynamics of the system itself.
- Compare the three factors in Chomsky (2005) (innate stuff, experience, other).
Next steps

- Try to refine these models to investigate links between:
  - Microscopic irreversibility (speaker has more knowledge of communicative intentions and ‘target grammar’ than learner);
  - Macroscopic irreversibility (nonrandom patterns of change, e.g. grammaticalization patterns, change relative to Accessibility Hierarchy).

- ‘Inverse problem’:
  - ‘develop statistical inferential methods to reverse-engineer the details of the individual grammar-learning process from trajectories of grammatical change in the historical record.’
  - Particularly the relative contributions of Chomsky’s three factors.
  - Might sound a bit ambitious, but at least this class of models has the right structure to allow dissociation of the three factors.
Conclusions

- Grammar change is change in associations. The historical record says so.
- If you model grammar change in those terms, interesting emergent things start happening.
- Maybe one day we’ll know what it all means.


McIntosh, A. (1948). The relative pronouns *þe* and *þat* in Early Middle English. *English and Germanic Studies, 1*, 73–87.

