Formal Semantic Theory and Diachronic Data:
A Case Study in Grammaticalization

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What keeps synchronic and diachronic theory apart? For one, the ‘“’. In synchronic theory, ‘“’ means ‘natives ought to complain’; in diachronic theory: ‘none ever will’. If one then asks, normatively, there is an answer to supplement Saussure’s state-of-play metaphor: To none whatever. Diachronic data are crucially nonexperimental in precluding the purposive generation of natively certified counterexamples. Yet these are the staple of broadly generative syntax and semantics, i.e. of much synchronic theory.

A concomitant of this verdict is that formal semantics—the study of meaning as a subdiscipline of the mathematical social or human sciences—is not being brought to bear on diachronic data either. This is a sociological fact of the same order as the one that ‘intelligible’ has close to complementary extensions in ‘cognitive' and ‘mathematical’ linguistics.

Could anything cast doubt on the hygienic principle, outflanked as it is by actual practice? I believe; yes. Diachrony bids us ask; What is it that unites a number of seemingly disparate uses of a single word? A plea of homophony sounds feeble if diachrony militates against. An assertion of polysemy then poses a challenge to the formally committed semanticist.

To lend substance to these generalities, I offer a case study in grammaticalization. The focus is on three aspects by which grammaticalization is *inter alia* characterized:

A. change of syntactico-semantic type—often, though not invariably from a free and relatively open-class form to a less free and relatively closed-class form (even bound or zero morpheme) with matching degree of phonological attrition;

B. change of substantive meaning from ‘concrete’ to ‘abstract’, with emphasis on progress from spatial to temporal to discourse-relational and finally to attitudinal meaning;

C. partial persistence of substantive meaning (‘metaphor’).

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[A.] concerns item type, i.e. morphosyntactic combinatorial potential. I shall consider semantic combinatorial correlates within a truth-conditional framework (Montague 1970 [EFL], 1973 [PTQ]) largely shorn of intensionality.

[C.] concerns substantive intuitions of content, distinguishing within syntactic and broadly Montagovian ontological categories. [B.] engages [A.] and [C.]

Section 1 recalls type theoretic tools and calibrates them. Generalizations are not overwhelming. However, difficulties there point to the uncertain role of semantic type structure in current synchronic analysis. Some of the investment is recouped in Section 2. It applies results to the diachrony of OE be-útan > ME bute > ModE but which exhibits contraction and phonological weakening, though without loss of lexeme status. In Sections 3 - 6, but is examined regarding [B.] and [C.] with tools of elementary set, measure and probability theory. This is to explain the semantic shift from sensori-motor space to epistemic spaces of surprise and rhetorical discourse dynamics, and some properties of exception sentences. Free use is made of ModE intuitions.

1. Type change. In broadly Montague semantics the denotation $[\alpha]$ of an expression $\alpha$ (morpheme, word, phrase, sentence) is a function of the denotations of its parts, determined by syntactic composition. The ontological category (‘type’) $\tau(\alpha)$ of $[\alpha]$ is (in EFL)$^2$ either one of two primitive types

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e = \text{the type of individuals (particulars)}$$

$$t = \text{the type of propositions (truth-value bearers)}$$

or the type of a function whose arguments or values are either primitive types or, in turn, functions. Write $\tau(\alpha) = xy$ (expand mentally to notation $[x \to y]$ or Montague’s $\langle x, y \rangle$) iff $[\alpha]$ is a unary function with argument type $x$ $[\tau(\text{arg}(\alpha)) = x]$ and value type $y$ $[\tau(\text{val}(\alpha)) = y]$. For more complex types we bracket; e.g. $((et)t)(et)$ expands to $[[[e \to t] \to t] \to \langle e, t \rangle]$ or $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$.

1.1 Fr. pasAdv (coll.: ‘not’) < pasCN (‘step’). Consider Brigitte fait un pas. We have $\tau(\text{pasCN}) = et$, and hence $\tau(\text{un pasCN}) = (et)t$. Furthermore, noting that IV and TV always stand for tensed forms, $\tau(\text{fait TV}) = ((et)t)(et)$ and $\tau(\text{Brigitte PN}) = (et)t$. Thus, finally, $\tau(\text{Brigitte fait un pas}) = t$. Current colloquial usage pasAdv (coexisting with pasCN) as in Elle mange pas developed from Elle ne mange pas by elision of the negation particle ne from ne...pas. There pas occurred as a negative polarity item, designating a smallest quantity.$^3$ We can assign pasAdv various types, e.g. $\tau(\text{pasAdv}) = tt$ (‘S-negation’) or $\tau(\text{pasAdv}) = (et)(et)$ (‘VP-negation’). Given $\tau(\text{ellePN}) = (et)t$ and $\tau(\text{mangeIV}) = et$, either construal of pasAdv yields $\tau(\text{Elle mange pas}) = t$.

Either way, pasCN > pasAdv has two markworthy features. First, for the diachronic ‘source’, $\tau(\text{arg}(\text{pasCN})) = e$; for the ‘target’, $\tau(\text{arg}(\text{pasAdv})) \in$

$^2$With some abuse of PTQ notation. PTQ had $t := \text{truth values}$; and indices $s := \langle\text{possible-world, time}\rangle$ pairs, besides $e$. EFL propositions are functions from possible worlds to truth-values.

$^3$That which a journey of a thousand miles used to start with.
\{t, et\}. If e-type were to harbour all (even if not only) the ‘concrete’ elements of our ontology, we should have a formal correlate of [B.], the intuitive move from ‘concrete’ to more ‘abstract’ meanings. Secondly, \(\tau(\text{val}(\text{[pas}\_\text{CN]})) \neq \tau(\text{arg}(\text{[pas}\_\text{CN]}))\) whereas \(\tau(\text{val}(\text{[pas}\_\text{Adv]})) = \tau(\text{arg}(\text{[pas}\_\text{Adv]}))\).

An hypothesis—something to debate, confirm, improve, or discard—is now suggested, albeit anachronistically, by Humboldt, who counted prepositions and conjunctions (1825:303f.) among the products of grammaticalization:

[T]he grammatical signs must not also be words designating things, for if they were, they would stand again in isolation and require new connecting operations (Verknüpfungen). (1825:292)

Abbreviate: Args := ‘arguments’; Val := ‘value’. A function of \(n\) arguments such that \(\tau(\text{Args}) = \tau(\text{Val})\) is an \(n\)-ary operation (Ge. ‘Verknüpfung’), i.e. of type \([p \times \ldots \times p] \rightarrow p\] where \(p\) is a type. Unary operations have type \([p \rightarrow p]\) (i.e. \(pp\)). Any \(n + 1\)-ary operation can be represented as a unary operation having for value an \(n\)-ary operation (Schönfinkel 1924). The hypothesis then would be:

Grammaticalization turns lexical items into expressions that denote operations on domains of non-particulars, i.e. induces shifts

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\begin{align*}
\text{T1. } & \tau(\text{Arg}) = e > \tau(\text{Arg}) \neq e \\
\text{T2. } & \tau(\text{Arg}) \neq \tau(\text{Val}) > \tau(\text{Arg}) = \tau(\text{Val})
\end{align*}
\]

Since \(\tau(\text{CN}) = \tau(\text{IV}) = et\) and since \(\tau(\text{Adv}) = xx\) where \(x \in \{\tau(\text{IV}), \tau(\text{S})\}\) (‘flight from e’), the development of adverbs from nouns and verbs would support both counts. However, adverbs, though inflected neither for tense, case, number or gender are mostly unlike not in being open-class. And the type of \(\text{ad-VP}\) adverbs is \((et)(et)\), the same as the PTQ type of (attributively used) adjectives, which do exhibit agreement.\(^4\)

1.2 Engl. *have\_TV* > *have\_Aux*. The received view hypothesizes reanalysis \(\text{Kim}[\text{has}\_\text{TV}][\text{a cat}\_\text{NP} \text{bought}\_\text{Adj}\_\text{NP}]/\text{VP}\) to \(\text{Kim}[\text{has}\_\text{Aux} \text{bought}\_\text{TV}][\text{a cat}\_\text{NP}]/\text{VP}\) where Adj labels an ‘adjectival passive participle’ (Denison 1993:Ch.12; p.340; Jespersen 1909-1V:29f.). (OE *habban*, ‘possess’, originally meant ‘to hold’.\) In EFL \([\text{ exe} \rightarrow t] = e(et)\). ModE example: *Kim {has/holds}* Sandy.

Now consider *Kim has risen*. Since *has risen* is a VP much as *rises* or *rose\_Past*, we conclude \(\tau(\text{has risen}) = \tau(\text{rises}) = et\). Suppose next—in line with analyses that treat past participles as verbs—that \(\tau(\text{risen}_{\text{Past}}, \text{Prt}) = \tau(\text{rises}_{\text{IV}}) = et\). This would be a claim about ontological, semantic type, presumably based on notional considerations; not (a plainly false) one about syntactic

\(^4\)So Traugott’s (1988) observation that adverbs are ‘more grammatical’ than adjectives is not captured by our typing—unless we want to adduce as a case in point polymorphism (multiple typing) of the class, including type \(tt\).
combinatorial potential.\(^5\) It would imply \(\tau(\operatorname{has}_{\text{Aux}}) = (et)(et)\) and, hence, that \(\operatorname{have}_{\text{Aux}}\) is an operation taking non-’e’-type arguments.

There are objections to this story from both ends. As regards the source, \(\tau(\operatorname{have}_{\text{TV}}) = e(et)\) is problematic for \textit{Every man has a woman}. PTQ’s uniform analysis of NPs (e.g. \(\tau(\text{Kim}) = \tau(\text{a cat}) = \tau(\text{every cat}) = (et)t\) correlates \text{Kim} (intuitive type: \(e\)) uniquely with the set \(\{Q : Q(\text{Kim})\}\) of all Kim’s properties, which is of (EFL) type \((et)t\). And it would assign \(\tau(\operatorname{have}_{\text{TV}}) = ((et)t)(et)\). So we have no ‘flight from e’. Still, given the recursive nature of such type-raising we might argue in line with Partee and Rooth (1983) that lexemes \(\alpha\) are represented at (what I’ll dub) lowest instantiable type \([\text{LIT} = \text{Lit}(\alpha)]\) and then lifted as required, in accordance with a type shift calculus (Moortgat 1989). If so, \(\text{Lit}(\arg((\operatorname{have}_{\text{TV}})) = e \neq \text{Lit}(\arg((\operatorname{have}_{\text{Aux}})))\).

But there are also problems with the presumed diachronic target. Participles might be thought semantically sui generis; say of a type \(p \neq et\). Then \(\tau(\operatorname{has}_{\text{Aux}}) = p(et)\), and \([\text{has}_{\text{Aux}}]\) is not an operation. Nor will it be one if participles are typed semantically like (attributive) adjectives, of type \((et)(et)\); perhaps facilitating the presumed diachronic re-analysis.

Yet another option would then be to argue \(\tau(\operatorname{have}_{\text{Aux}}) = \tau(\operatorname{have}_{\text{TV}})\), in line with the PTQ analysis of \textit{be} as a transitive verb, i.e. of type \(((et)t)(et)\). (Taking the object NP for argument; the result being argument to the subject NP.) In the EFL framework, or at LIT, we should then treat \textit{Kim has Sandy} in analogy to \textit{Tully is Cicero}. However, \(\tau(\operatorname{have}_{\text{Aux}})\) would have to be of the raised, PTQ type of transitive verbs; as would the kind of occurrence which is transitional on the received view: \(\tau(\text{a cat bought}) = \tau(\text{every cat bought}) = (et)t = \tau(\arg(\operatorname{has}_{\text{TV}}))\). So [T1] is still a live thesis; while [T2] is not. Participles and auxiliaries also pose a general problem for all semantic analyses of grammaticalization; what place is there in our semantic typology for sentence-heads, i.e. morphemes classed under INFL in much of current syntactic theory?

1.3 Denominal and deverbal prepositions (Kortmann and König 1992) provide mixed support. We find Ger. \textit{Kraft} \(_{CN}\) (‘force’, ‘power’) > \textit{kraft} \(_{PP}\) (‘in virtue of’), governing the genitive. The resulting PP behaves as an adjunct (no verb subcategorizes for \textit{kraft} NP) and should thus have the semantic category of an adverb, i.e. conceivably \(\tau(\text{kraft seines Amtes}_{PP}) = (et)(et)\) or \((tt)\). Since \(\tau(\text{seines Amtes}_{NP}) = (et)t\), we have \(\tau(\text{kraft}_{PP}) = ((et)t)((et)(et))\) or \(((et)t)(tt)\). Since \(\tau(\text{Kraft}_{CN}) = et\), we have \(et > ((et)t)((et)(et))\) (phrasal adverb parse of PP) or \(et > ((et)t)(tt)\) (sentential adverb parse). And given *\textit{kraft} \textit{Kim}, \text{Lit}(\text{kraft}_{PP}) \neq \text{ex} \text{ for any } x\). So \textit{kraft} supports ‘flight from e’; but not operationalization.

\(^5\)Bach (1980) has a participial category ‘transitive verb phrase’, which behaves as a complex transitive verb that combines with ‘be’ and ‘get’ to yield an intransitive verb phrase. He proposed that it denote sets of entities (‘predicatives’) of type \([e \times \ldots x e \rightarrow t]\). The simplest predicative (or EFL property), though not for passives is of type \textit{et}.\(^4\)
Deverbals such as ModE \( bar_{	ext{prep}} < bar_{	ext{TV}} \) and \( save_{	ext{prep}} < save_{	ext{TV}} \) (‘preserve’, ‘keep’) offer \( \tau(save_{	ext{TV}}) = ((et)\tau)(et) \) and \( \text{Lit}(save_{	ext{TV}}) = e(et) \) on the standard PTQ analysis; as in \text{Kim saved Sandy}. But there is also \( save/bar \) \( Leepp \), semantically an adsentential adverb of type \( tt \). Thus, at LIT, \( bar_{	ext{TV}} > bar_{	ext{prep}} \) would instantiate \( e(et) > e(tt) \) and exhibit neither ‘flight from \( e \)’ nor operationalization.\(^6\)

Moreover, if we do rely on LIT, ‘flight from \( e \)’ would not help us distinguish instances of grammaticalization from other morphological processes such as conversion—e.g. \( \text{butter}_\text{CN} > \text{butter}_{	ext{TV}}, \) i.e. \( et > \text{LIT} \ e(et) \); \( \text{hoover}_{	ext{PN}} > \text{hoover}_{	ext{TV}}, \) i.e. \( e > \text{LIT} \ e(et) \)—or, \( \text{Hertz}_{	ext{PN}} > \text{Hertz}_{	ext{CN}}, \) i.e. \( e > \text{LIT} \ e; \) similarly, backformation—e.g. \( \text{burglar}_\text{CN} > \text{burgle}_{	ext{TV}}, \) i.e. \( et > \text{LIT} \ e(et) \). And going for analogy with maximal distance, i.e. LIT for the source, PTQ type for the target, would beg most of the question.\(^7\) What are we left with? A tamer thesis:

T3. Grammaticalization raises the type of an item in terms of \( \tau(\text{Arg}) \) or \( \tau(\text{Val}) \) or both; with \( t \) deemed of higher type than \( e \).\(^8\)

This will cover the development of prepositions from adverbs, and that of conjunctions from prepositions. I now turn to the main example, which instantiates hypothesis 1 in a modified way and part 2 rather nicely.

2. \textit{But} and type shift. I shall focus on the diachrony and synchrony of ModE \textit{but}, which derives from OE \textit{būtan} (variously spelt) and ultimately \textit{be-ūtan}. \textit{Utan} had the meaning ‘outside’ (cp. Ge. \textit{ausehen})\(^9\) and the morpheme \textit{be} (‘by’, ‘around’) is best seen as a classifier of location (LOC) (cp. \textit{be-innan}; \textit{be-fore}). In OE \textit{be-ūtan} was used both as an adverb and a preposition of location (cp. ModE \textit{outside}). From \textit{be-ūtan} ‘outside’ there derive \textit{būtan}, \textit{būta}. These already have a meaning ‘without’. Phonetic weakening via \textit{bute}, \textit{bute} yields \textit{but} which serves as a conjunction, yet to this day retains a prepositional use (cp. Mitchell 1985; O.E.D. 1989). Attested OE occurrences of \textit{butan} under various spellings

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\(^6\)Horne Tooke (1978) achieved notoriety propounding deverbal development, via imperative forms, of all coordinating conjunctions. But see below how his widely emulated theory of \textit{that} \(_\text{comp} \), does contribute to a more credible story for \textit{save that} and \textit{except that}.

\(^7\)Today it is no longer clear just how enlightening Montague’s virtuoso exercise in syntactico-semantic parallelism (the real artistry of which lies in the intensionality here ignored) is. It also creates theory-internal problems if both attributive and predicative uses of adjectives are considered. One response would be multiple categorization; but where do we stop this cousin of homophony? More generally, the proliferation of logics inspired by Lambek (cp. Moortgat 1989) must raise a question: Is type shifting more than a device for accommodating unruly data into the semantic framework of boolean coordination and Fregean quantification?

\(^8\)This could still suggest an answer to the question, posed by Marga Reis of Tübingen University: ‘Do grammaticalization processes \( \alpha > \beta > \ldots \) tend to reach natural stationary states \( \gamma \)?’ Namely: ‘\textit{If any}, when \([\gamma]\) is an operation.’

\(^9\)OHG \textit{uzzan} has all the meanings of \textit{butan} described below.
are cotemporaneously adverbial and prepositional, including interpretations translating ‘without’.\(^\text{10}\)

Adverbial use is exemplified by **sume binan**, **sume butan** ‘some inside, some outside’ (A.S. Chron. A, 867) or [Petrus] **eode buta** ‘Peter went outside’ (Lindisf. Gosp. Mk 14,68). Montague (EFL) types \(\tau(\text{outside}_{Adv}) = (et)(et)\). Example: \(\tau(\text{sleeps}) = et = \tau(\text{sleeps outside})\). This makes for a non-‘e’-type argument and operation status. The adverb has a hidden, deictic argument.

The preposition makes the argument syntactically explicit. Example: **butan bare wicstow** ‘outside the encampment’ [Ælfriç, Lev. 4,21]. Analogously to Geach (1972) for syntax, Montague’s EFL types \(\tau(\text{outside}_{Prp}) = e((et)(et))\). Thus if \(\tau(\text{London}) = e\) then \(\tau(\text{outside London}) = (et)(et)\), the type of the location adverb. PTQ follows the uniform generalized quantifier treatment of NPs with \(\tau(\text{outside}_{Prp}) = ((et)t)((et)(et))\). Thus, if \(\tau(\text{London}) = \tau(\text{every house}) = (et)t\), then \(\tau(\text{outside London}) = \tau(\text{outside every house}) = (et)(et)\). The EFL account yields \(\text{Lit}(\text{outside}_{Prp}) = e((et)(et))\), and thus \(\text{Lit}(\arg(\text{outside}_{Prp})) = e\). In view of the like distributional properties of \(\text{butan}_{Prp}\) one should conclude \(\text{Lit}(\arg(\text{butan}_{Prp})) = e\), as in **butan Breitone** ‘outside Britain’ (BTS A.I).

Cotemporaneous use as **except** has a correlate in Geach’s **Nobody except Raleigh smoked**, synonymous with **Nobody but Raleigh smoked**. Since \(\tau(\text{Nobody}) = (et)t\), also \(\tau(\text{Nobody but Raleigh}) = (et)t\). This yields \(\tau(\text{but Raleigh}) = ((et)t)(et)t\). And given \(\tau(\text{Raleigh}) = e\) we have \(\tau(\text{but}_{PrpEx}) = e(((et)t)(et)t)\). But considering **Nobody but Raleigh or Bacon smoked** and **None but \{two/a few\} people smoked** we ascend, with Geach, to \(\tau(\text{but}_{PrpEx}) = ((et)t)((et)t)(et)t)\) which is of form \(p(pp)\).

Examples such as **ealle buton anum** ‘all but one’ [Beowulf 705] already fit this pattern, assuming ‘one’ to be a quantifier phrase. Thus [**buton**] has become an operation—the broad type of function denoted by coordinating conjunctions. Given Schönfinkel isomorphism along with prosodic data suggesting an \([A [\text{and } B]]\) parse for binary coordinate constructions, there is now structure common to **butan_{Prp}** and **butan_{Conj}**. With subjunctive \(B\) the transition appears smooth in all respects (see 4.3).

With indicative \(B\) a pivotal stage is presumed to be **butan bæt** with \(B\) an apparent clausal complement. **Butan** occurs also with bare and to-infinitives. Consider therefore that complementizers that and to respectively turn clauses and base-forms of verbs into constituents that fill NP-type syntactic roles and, in the latter case, provide notional nominalizing strategies. If ModE **that** is regarded as a function of syntactic type \([S\rightarrow NP]\) i.e. semantically te or \(t((et)t)\) we still have **butan** as an operation on NP types.\(^\text{11}\) This explicates Varnhagen’s (1876:8) claim that **butan þam\text{Dat} anum bæt** functions as a sentential conjunc-

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\(^{10}\)O.E.D. (bout) suggests an adverbial source and construal with a genitive.

\(^{11}\) *That* has a nominalizing effect, as is suggested by its uniform analysis (Horne Tooke 1798:1,86f.; Davidson 1968) as the demonstrative pronoun even in complementizing use.
tion in & eal ḏaet de styrd & leofađ beo eow to mete ... butan ḏam anum ḏaet ge flæsc mid blode ne eoton (Ælfric, Gen. 9.3-4). Since butan_{prp} can govern the dative or, more rarely, accusative case, while butan_{conj} does not, the historically pivotal complementizer ḏaet might be seen to have at least its origin in the demonstrative with unmarked, nominative case.\footnote{Mitchell’s (1985:§3628) opinion that conj. ḏaet introduces here a ‘noun clause’ governed by butan is not at all contrary, presuming ‘noun’ means ‘nominalized’. Varnhagen’s claim is not that butan ḏaet is a coordinating conjunction. If the complementizer that (trad.: subordinating conjunction) is treated as a nominalizer, then ‘that one thing’ is an abstract individual encoding propositional information; think of gerunds. But here we exceed the bounds of simple type theories; cp. Turner (1983). And the anaphoric link suggests a move to Discourse Representation theories; cf. Kamp and Reyle (1993).} \footnote{O.E.D. suggests the synonymy of ModE Nobody (else) went but I/me (prep.) and Nobody else went, but I did (conj.) to illustrate the ambiguous categorial status of but.} 

3. Informal semantics of the diachronic target: ModE but. If translation into German or Spanish is anything to go by (cp. Anscombe and Ducot 1977; Abraham 1979), ModE but_{conj} has two main uses; label them but_{a} and but_{s}.

But_{a} coordinates full sentences, VPs, Vs, APs and some NPs. In discourse context, A but_{a} B (A, B sentences) presents A as a concession—indeed, turns it into a concessive clause (Quirk 1954:62)—and B as a claim. [A] Lee doesn’t love Kim but [B] she loves Sandy concedes A and asserts B. Thus [A] = [C] where C is a real or virtual other’s or interlocutor’s claim. (Ducot 1973).\footnote{OE use after an explicitly negative A-clause and with reduced B-clause takes NP complements, and indeed preserves a preference for NPs to this day: ??Kim didn’t walk but talk contrasts with the goodness of Kim didn’t kiss Sandy but Lee, where the verb is elided.} 

A but_{s} B, as in [A] Lee doesn’t love Kim, but [B] Sandy, requires A to have the explicitly negative form not-C and B to be an elliptic remnant whose syntactic type is equal to, and whose lexical content is different from, that of the negation particle’s focus in A. In discourse terms, [A] = [C] is a denial of another’s claim C, and is typically supported by B. ([\[\]] maps a sentence to a proposition, i.e. a set of ‘possible worlds’.) Still, it is not obvious how but_{a} and but_{s} have a unitary meaning related to the spatial one.\footnote{Nevalainen’s (1990:340f.) description of ‘expressive/interpersonal’ use fits this analysis and explains her hunch of cotemporaneous emergence with use as a ‘propositional’ conjunction.} 

4. Formal semantics of the diachronic spatial source. Spatial PPs such as on
the floor; under the canopy, in the box, outside the house designate, if anything intuitable, regions of an appropriate space (Crandle & Suppes 1989). Montagovian type structure does not engage substantive semantic intuitions about adverbs and prepositions. One response is to abandon its categorial rigours for ‘flat’ but ontologically fatter representations. Here eventualities are treated as a type of individual, of which the propositional constituents predicate certain properties (Ramsey 1927; Davidson 1967). There is no canonical analysis at present; so I’ll make up a simple common-sensical one.

Assume three types \( \eta, \epsilon, \pi \) of individuals; events (\( \eta \)), continuants (\( \epsilon \)), i.e. individuals in the ordinary sense, e.g. Kim or London, and places (\( \pi \)), intuitively regions of four-dimensional space-time or of a lower-dimensional subspace \( \Omega \). For our purposes ‘space’ will be the two-dimensional space \( \mathcal{R}^2 \) of points, naively identified with smooth terrestrial surface. Places are then subsets of \( \Omega = \mathcal{R}^2 \). Functions \( \text{Loc}_\eta; \eta \rightarrow \pi \) and \( \text{Loc}_\epsilon; \epsilon \rightarrow \pi \) map eventualities and entities to places, where \( \pi = \text{Pow}(\mathcal{R}^2) \) is the set of subsets of two-dimensional space. We represent the mereology of places in terms of the subset relation, whose transitivity licenses \( \text{Kim lives in a small room in a house in London} \models \text{Kim lives in London} \). Let then: \( [\text{Kim lives in London}] = \exists ! \epsilon [\text{Kim lives}(\epsilon) \land \text{Loc}_\epsilon(\epsilon) \subseteq \text{Loc}_\epsilon(\text{London})] \).

This says: there is an eventuality of Kim living and its location is a subset of the place occupied by London. Hence we can set \([ \text{in London}] = \lambda X. \text{Loc}_\eta(X) \subseteq \text{Loc}_\epsilon(\text{London}) \). And thus, for spatial usage, \([ \text{in}] = \lambda Y. \lambda X. \text{Loc}_\eta(X) \subseteq \text{Loc}_\epsilon(Y) \). Given our semantics for in and setting (for simplicity) \([ \text{in}] = [\text{inside}] \), there is an obvious semantics for the PP \( \text{outside (of)} \) London: \([ \text{Kim lives outside (of) London}] = \exists ! \epsilon [\text{Kim lives}(\epsilon) \land \text{Loc}_\epsilon(\epsilon) \subseteq \Omega \setminus \text{Loc}_\epsilon(\text{London})] \). Now Kim’s living takes place within the relative complement with respect to \( \Omega \) of the place of London. The ‘\( \setminus \)’-sign designates set-difference: \( A \setminus B =_d A \cap \bar{B} \); i.e. \( \Omega \setminus B = \bar{B} \), read; ‘non-\( B \)’. Thus \([ \text{outside of London}] = \lambda X. \text{Loc}_\eta(X) \subseteq \Omega \setminus \text{Loc}_\epsilon(\text{London})] \). And hence, again for spatial usage, \([ \text{outside (of)}]_{\text{prep}} = \lambda Y. \lambda X. \text{Loc}_\eta(X) \subseteq \Omega \setminus \text{Loc}_\epsilon(Y) \).

The PP, as an adjunct, is syntactically an adsentential. But where \( \text{outside (of)}_{\text{prep}} \) takes an explicit argument NP, \( \text{outside}_{\text{Adv}} \) is indexical to the context of reference (cp. Reichenbach 1947 for time). To say \( \text{Kim lives outside} \) is to assume that a point of reference is given, say a house or encampment. The range of implicit arguments is more restricted than that for the explicit arguments of the preposition. But the semantic argument structure is the same. Hence \([ \text{outside}_{\text{Adv}}] = \lambda X. \lambda Y. \text{Loc}_\eta(X) \subseteq \Omega \setminus \text{Loc}_\epsilon(Y) \) where \( Y \) is indexically instantiated from context. (\( \text{Kim went outside} \) complicates this to the change to a target state of being outside.)

To see common structure, set \( Ki = \text{Kim lives}, B = \text{London} \). Then, simplify-

\(^{17}\) As of now, symbols \( A, B, \text{London} \), etc. stand indiscriminately for expressions and their denotata; use context to interpret.
ing by dropping indices,\textsuperscript{18} $[K \text{ butan}_{\text{prep}} B]$ holds iff $\text{Loc}_\eta(K) \subseteq \Omega \setminus \text{Loc}_\epsilon(B)$.
Hence we obtain, abstractly, $[\text{butan}_{\text{prep}} B] = \lambda X_\eta[\text{Loc}_\eta(X_\eta) \subseteq \Omega \setminus \text{Loc}_\epsilon(B)]$, the functional correlate of the complement of $B$. Next we abstract away from $B$ and obtain a repeat of what we had for outside (of): $[\text{butan}_{\text{prep}}] = \lambda Y_\epsilon \lambda X_\eta[\text{Loc}_\eta(X_\eta) \subseteq \Omega \setminus \text{Loc}_\epsilon(Y_\epsilon)]$. Note that $\Omega$ is taken as given. But we can refine things by further abstraction to select instead an arbitrary subset of some set of places: $[\text{butan}] = \lambda Z_\pi \lambda Y_\epsilon \lambda X_\eta[\text{Loc}_\eta(X_\eta) \subseteq Z_\pi \setminus \text{Loc}_\epsilon(Y_\epsilon)]$.

4. Substantive abstraction. Here we leave sensori-motor space, but preserve structure in spaces (sets) of qualities or of individuals.

4.1 ‘Without’. Adverbial construction for He hylt ... heofanas and eardan and ealle gesceafa butan geswine ‘He holds ... heaven and earth and all creatures without effort’ (Ælfric, Homilies I,8) or Ealle ðing he geworhte buton ælcum antimbre ‘All things he created without any matter’ (I,14) exhibits obvious intuitive analogy. The PP induces a partition of ways of holding the world, in (call it) a ‘quality space’: with effort, and without. Similarly for creating all things: with matter, and without. Put simply: let $[[\text{with effort}]]$ stand for the set $E$ of events happening or performed with effort, and thus $[[\text{without effort}]] = \Omega \setminus E$. Therefore, $[[\text{butan geswine}]] = \lambda X_\eta[\text{Loc}_\eta(X_\eta) \subseteq \Omega \setminus E]$, hence with $\pi$, relabelled to $\gamma$ now the type of regions in a quality space, $[[\text{butan without}]] = \lambda Z_\gamma \lambda Y_\epsilon \lambda X_\eta[\text{Loc}_\eta(X_\eta) \subseteq Z_\gamma \setminus \text{Loc}_\epsilon(Y_\epsilon)]$ where index $\gamma$ is lexically conditioned by the unmodified event subtype $\gamma \subset \eta$ to select an appropriate quality space $Z_\gamma$ (i.e. an appropriate universe $\Omega$).

4.2 ‘Except’ (I). Let $W$ be the set of walking entities, and $K$ the singleton set $\{k\}$ containing Kim. Now, \textit{Everyone but Kim walks} is true, presumably, iff both (i) $\Omega \setminus K \subseteq W$ (everyone who isn’t Kim walks) and (ii) $W \subseteq \Omega \setminus K$ (Kim doesn’t walk.). Thus it is true iff $W = \Omega \setminus K$, i.e. iff $W = \bar{K}$. For subsequent comparison, note this sentence in nonce canonical form as $W(\Omega \setminus \text{but} \, K)$.

Our ‘space’ or ‘universe’ $\Omega$ now is a set of $\epsilon$-type individuals; so we can drop Loc functions and type subscripts, obtaining $[[\text{butan except}]] = \lambda Y \lambda X[Z = \Omega \setminus Y]$. Thus, modulo change of domain, $[[\text{butan except}]]$ is a special case of $[[\text{butan outside}]]$, namely with set inclusion holding both ways to yield equality.

Further abstraction is needed for ModE sentences such as \textit{All but striped cats walk} which is true iff (i) All nonstriped cats walk ($CS \subseteq W$) and (ii) No striped cats walk ($CS \subseteq \bar{W}$, i.e. $W \subseteq \overline{CS}$, i.e.$W \subseteq \Omega \setminus CS$), where $C$ and $S$ are the sets of cats and striped entities. $\Omega$ is just one possible first argument of ‘\$’—albeit a natural one as a default. Let us notate $W(\text{All} \, \text{but} \, S)$.

Here I propose a modified analogon of $\lambda Z_\pi$-abstraction: $[[\text{but ex}]] = \lambda Z \lambda X[Z \setminus YZ \subseteq X \land X \subseteq \overline{YZ}]$. (Note: $\overline{YZ} = \Omega \setminus YZ$.) If, as the paraphrase \textit{Of cats, all but striped ones walk} suggests, $\Omega = C$ in actual

\textsuperscript{18}François Recanati of the Ecole Polytechnique, Paris has offered philosophical grounds for abolishing the sortal distinction between entities and eventualities.
contexts of use (think of small Discourse Representations), we get \( W = C \setminus S \),
equivalently \( W = \Omega \setminus S \); essentially as before.\(^{19}\)

4.3 ‘Except if’ (‘unless’) (I). Simple set-theoretical tools account not only for
case-governing \( \text{butan}_{\text{prep}} \) but also for \( \text{butan}_{\text{conj}} \) coordinating full clauses \( A \) and
\( B \) (\( B \) subjunctive), attested early on; e.g. \text{butan} his lic swic ‘unless his corpse
escape’ (Beowulf, 966); \text{Ne mæg nan man ṭan wyrcau ṭe du wircst buton}
god beo mid him, ‘No man can perform those miracles that you perform unless
God be with him’ (O.E. Gospel, John 3,2).

In \( A \) unless \( B \), unlike in \( A \) if not \( B \), (i) clause \( B \) does not trigger negative
polarity items and (ii) \([B]\) is being represented as a priori less likely (sc. than
\([B]\)) (Geis 1973, McCawley 1993:554). Geis therefore proposed synonymy with
\( A \), except if \( B \). But truth conditions: ‘\( A \) will be true in all conceivable worlds
except in those where \( B \) holds’, require a semantics for \( \text{except}.\(^{20}\) Let \( A \) if
not \( B \) have the truth-conditions of \( \tilde{B} \rightarrow A \). I’ll treat those of \( A \) unless \( B \)
 provisionally as those of the special case where also \( A \rightarrow \tilde{B} \). I.e. set \([A \text{ unless } B]\) = \([A \leftrightarrow \tilde{B}]\). As in the case exemplified by \( \text{all but } X_{\text{NP}} \) we have \( B \subseteq \Omega \), i.e.
(a) \( B \subseteq \Omega \) with the extra condition (b) \( \tilde{B} \neq \phi \). Now \( \Omega \) is no longer the set of
individuals, but the set of (epistemically) possible worlds, and \( A \) and \( B \) are
propositions. Hence (b) means: \( \tilde{B} \) is a possibility. Thus, \([A \text{ unless } B]\) holds iff
\( A = \Omega \setminus B \), in analogy to \( \text{but except}.\(^{21}\)

Some informants find these truth-conditions satisfactory. Yet the \( A \rightarrow \tilde{B} \) component must be defeasible to the extent that \emph{I’ll hit you unless you
hand me 5 marbles; and even then I might still hit you} is a serious business
proposition. Linguistically acceptable it is: just substitute ‘will’ for ‘might’
and watch felicity go. And indeed, you might wish to pay 5 marbles to turn
a certainty of being hit into a mere possibility. This is the condition \( \Omega \setminus B \subseteq A \),
whence \( AB \neq \phi \), i.e. \( A \), \( B \) and \( AB \) are possible.

However, \emph{I’ll hit you {if you don’t} unless you} hand me 5 marbles; and even
then I’ll hit you suggests that \( \tilde{A}B \neq \phi \); i.e. that \( \tilde{A} \) should be a possibility,
just as \( \tilde{B} \) should be.\(^{22}\)

\(^{19}\)For more on exception-sentences cp. Moltmann (1995). But note that in ModE \text{but}
is rather less liberal than \emph{except} as regards admissible left-hand arguments: \emph{All} (?kids)
\text{but Kim stayed}, \{Everyone/?Every child\} \text{but \{two babies/Kim\} talked}. Our examples
instantiate a general schema \( F(\text{Det}A \text{ but} \text{except } B) \). What wants explaining is (a) why i.
\([\text{Det}] = [\text{All/Every}] \) or ii. \([\text{No}] \), (b) why \( B \subset A \), and (c) why \( A = \Omega \) for \text{but}. Point (a.ii)
reduces to (a.i) on realizing that \( F(\text{No } A \text{ but } B) = \tilde{F}(\text{All } A \text{ but } B) \). And (a.i) and (c)
are motivated as a package via (b): instantiating thus both \text{Det} and \( A \) guarantees \( B \subseteq A \) and,
granted \( B \neq A \) for non-vacuity, \( B \subset A \). If Discourse Representation principles urge \( \Omega = A \),
at least prior to embedding in truth-conditions (cf. Kamp and Reyle 1993), then (b) entails
(a). Below I explain (b) for \text{but} in a way that should generalize to \( F(\text{Det}A \text{ except } B) \).

\(^{20}\)McCawley (1993:554) interprets \emph{A unless B} logically as: \( A \) if either not-\( B \) or \( B \)’s truth
is indeterminate. I’ll propose a description that engages (ii) as well.

\(^{21}\)Paraphrase \emph{Everyone but Kim walks as if, and only if, someone isn’t Kim, they, walk}.

\(^{22}\)When we turn from ‘except for’ and ‘except if’ to ‘except that’, as in \emph{Kim is bright},
4.4 Butₐ (I). This OE and ModE use of butan/but yields, at least in part, to purely set-theoretic representation preserving the initial constraint. Relations among the truth-conditions of propositions expressed by full A- and B-clauses mirror those among corresponding set-theoretic NP-denotata. Let \( B = \text{‘Kim is a cat’}, \ C = \text{‘Kim is a dog’}. \) Represent \( \text{Kim isn’t a dog, but a cat} \) as \( A \subset B \), so \( A = \tilde{C}. \) Thus, \( \{k\} \subseteq B \) and \( B \subseteq \Omega \setminus C \) (i.e. \( B \subseteq A \) and hence, by contraposition, \( C \subseteq \Omega \setminus B \)).

We see that \( B \subseteq A \) is the same condition as for exception. But now, since \( B \subseteq \Omega \setminus C \) i.e. \( B \subseteq A \), there is another intuitive interpretation: \( B \), which entails \( A \) is thereby (conclusive) evidence for \( A \), i.e. for \( \tilde{C} \), i.e. against \( C \).

5. Space and measure. Let \( \Omega \) be a set of points; \( \emptyset \) the empty set; \( \text{Pow}(\Omega) \) the boolean algebra of subsets of \( \Omega \); \( \mathcal{R}^+ \) the set of non-negative real numbers. Note: \( \mathcal{R} \), the real line, is a space where, intuitively, things can be added, and subtracted in a way corresponding to intuitions of motion (forwards, backwards) or of hedonic (dis)value.

\[ \text{Definition: A (finitely additive) measure on Pow}(\Omega) \text{ is a non-negative, additive function } \mu(\cdot) : \text{Pow}(\Omega) \to \mathcal{R}^+ \text{ i.e. a function satisfying [Axiom 1] } \mu(\emptyset) = 0 \text{ and [Axiom 2] } \mu(A \cup B) = \mu(A) + \mu(B) - \mu(AB) \text{ for any subsets } A, B \text{ of } \Omega. (AB =_df A \cap B.) \]

A function yielding areas of bounded subsets of the Euclidean plane \( \mathcal{R}^2 \) or of the space \( \mathcal{R}^3 \) of sensori-motor intuition is a measure; so is the cardinality function \( \text{card}(\cdot) \) on finite domains. Both these measures are ‘uniform’. This need not be so in general by definition of \( \mu(\cdot) \). Distinct points of a finite set might be assigned different values; if we determine the mass of a body, density of parts may vary. A menu with prices indicated is a measure; it maps your meal to a real (number). The key intuition for any \( \mu(\cdot) \) is therefore: it tells you what its argument amounts to.

We shall assume all our \( \mu(\cdot) \) are ‘regular’ (Carnap), i.e. that \( \mu(X) = 0 \rightarrow X = \emptyset \), as intuitive (though ultimately incoherent) for area and as definitional for cardinality. We can now show an elementary:

\[ \text{Fact: } \mu(A \setminus B) =_df \mu(AB) = [\text{Axiom 2}] \mu(A) - \mu(AB) = \mu(A) - \mu(B) \text{ iff Reg. } B \subseteq A \text{ (and } \neq 0 \text{ iff } B \subset A) \]

5.1 ‘Except’ (II). Recall ‘outside of’/‘without’/‘except’ with \( A \) instantiating the variable \( Z \). The formal fact then implies that \( B \subseteq A \) is necessary for compositional interpretation of \( A \text{ butan } B \) to the extent of being required except that he can’t read, intuition invariably requires \( AB \neq \phi. \) And this condition (set \( A = W \) and \( B = K \) or \( B = SC \) for the ‘exception’ examples) is expressly ruled out by the spatial interpretation ‘outside’. Here set-theory on its own gives out (I shall not consider ad hoc type-assignments that might do the trick) and finer tools, to be introduced below, will be needed.
for $\mu(A \ butan \ B) = f(\mu(A), \mu(B))$, where $f$ is some arithmetical function (here: subtraction).\textsuperscript{23} Note now that $\mu(A \setminus B) = \mu(A) - \mu(B)$ means that $\mu(\cdot)$ behaves as a homomorphism with respect to set- and arithmetical subtraction. All representation lives by homomorphism; and so does compositionality. Here the representation is one of keeping accounts. If cognizers treat their onta, as it were, as pragnata, what things amount to is no less vital on-line than what they are. And so A.S. Chron. 755 A ... Cyanwulf benam Sigebyht his rices ..., buton Hamtunscire 'C. deprived S. his kingdom-[of] ... except Hampshire' would tell one right away that Sigeberht’s loss amounted to (all) his kingdom, minus Hampshire.\textsuperscript{24}

5.2 Probability measure. $\mu(\cdot)$ is a normed measure when ‘normalized’ so that $\mu(\Omega) = 1$. (Imagine a unit mass to be distributed across $\Omega$.) For finite $\Omega$, $\text{card}(\cdot)/\text{card}(\Omega)$ is a normed measure. A normed measure is also called a probability measure, written $P(\cdot)$. To see why, imagine an urn containing 100 balls of which 30 are red. If we draw a ball at random, the probability $p_R = P(\text{Red})$ of an event of drawing a red ball should be 30/100, i.e. 0.3. Clearly, $p_R$ should vary monotonically with the proportion of red balls. If the subset of red balls is empty, $p_R = 0$. If all the balls are red, $p_R = 1$.

Probability is—not least—an epistemic notion. Before the draw we can entertain as possible 100 different ‘small’ worlds, each corresponding to a (strongest non-contradictory) proposition ‘ball $k$ is drawn’ ($k = 1, \ldots, 100$). Hence, the probability of the proposition ‘a red ball is drawn’ will correspond to the measure of the set of possible worlds in which a red ball is drawn. (Again, the measure need not be uniform.) We have, as it were, ascended from the probability of a predicate (the measure of a set of individual entities) to that of a proposition (the measure of a set of possible worlds). Propositions are objects of belief; and the probability calculus embodies laws of coherent belief, conservatively extending those of classical logic (Ramsey 1926; Jeffrey 1983).\textsuperscript{25}

6. Evidential-argumentative relevance. Basic to this notion is a

**Definition:** The conditional probability $P(A|B)$ of $A$ given or assuming $B$ is $P(A|B) = P(AB)/P(B)$ (where $P(B) > 0$, else undefined).

\textsuperscript{23}It also explains the general case of constraint (a,i) in Footnote 17: If $[\text{Det}] \neq [\text{All}]$, then $\mu(\text{Det}A \ butan \ B) \neq f(\mu(A), \mu(B))$. This is not a triviality. The only constraint relating arbitrary $\mu(A)$, $\mu(B)$, and $\mu(AB)$ is $\mu(AB) \leq \min[\mu(A), \mu(B)]$. Indeed, $\mu(AB) = \min[\mu(A), \mu(B)] = \mu(B) \neq \mu(A)$ if $B \subset A$.

\textsuperscript{24}Add $B \neq A$ or rather $\mu(A) - \mu(B) \neq 0$ as a non-triviality constraint (cp. *All cats except all cats walk*), and compositionality of ‘amount’ motivates constraint (b) on exception-sentences.

\textsuperscript{25}Violate them and you can be enticed into a ‘Dutch Book’: a system of bets in which you must lose, come what may.
The epistemic, dynamic intuition is here: by ‘conditioning on’ $B$ (i.e. taking $B$ for granted) we redistribute all probability mass from from $\Omega \setminus B$ [i.e. $\bar{B}$] to $AB$. Since $P(B) \leq 1$, division by $P(B)$ renormalizes the measure.

Let relevance have the evidential sense traditional in statistics and philosophy of science (Keynes 1921; Carnap 1950). Suppose conditioning on $A$ increases our belief in $B$, i.e. $P(B|A) > P(B)$, equivalently $P(AB) > P(A)P(B)$. Then $B$ is positively relevant to $A$; and negatively so when $P(B|A) < P(B)$ (i.e. $P(AB) < P(A)P(B)$). Another intuition: in the first case, $B$ is relatively expected given $A$; in the second, relatively unexpected. If $P(B|A) = P(B)$ or when $P(A) = 0$ (i.e. $P(AB) = P(A)P(B)$) we say: $B$ is irrelevant to $A$. (Relevance and irrelevance are symmetric relations.)

Peirce (1878) suggested a measure $r_H(E) := \log[P(E|H)/P(E|\bar{H})]$ (adopted by Turing 1940 and Good 1950) of relevance of a proposition $E$ (intuition: ‘evidence’) for another $H$ (‘hypothesis’) with the following property: Let $\text{Odds}(X) := P(X)/P(\bar{X})$. Then $\log[\text{Odds}(H|E)] = \log[\text{Odds}(H)] + r_H(E)$. So $r_H(E)$ measures the epistemic impact of $E$ on $H$, with respect to the epistemic state represented by $P(\cdot)$. It is an elementary fact that

$$
\begin{align*}
r_H(E) &> 0 \text{ iff } P(H|E) > P(H) \quad (E \text{ positively relevant to } H); \\
r_H(E) &= 0 \text{ if } P(H|E) = P(H) \quad (E \text{ irrelevant to } H); \\
r_H(E) &< 0 \text{ iff } P(H|E) < P(H) \quad (E \text{ negatively relevant to } H).
\end{align*}
$$

Relevance is partisan: $E$ is ‘pro’ $H$ iff ‘con’ $\bar{H}$. Indeed: $r_{\bar{H}}(E) \equiv -r_H(E)$.

6.1 ‘Except if’ / ‘Unless’ (II). Given $A$ but unless $B$ the semantics of $A \iff \bar{B}$ requires: $P(A|\bar{B}) = 1$ (gloss: ‘$A$ is certain if $\bar{B}$ is’). I.e. $AB = \phi$, hence $P(AB) = 0$. For $0 < P(A), P(B)$ thus $P(AB) < P(A)P(B)$, i.e. $P(A|B) < P(A)$. So $B$ is negatively relevant to $A$, indeed extremely so in entailing $\bar{A}$: $r_A(B) = -\infty$. But even where $B$ merely removes the certainty of $A$, it retains negative relevance.\(^{25,27}\)

6.2 But unless (II). Recall that $B$, which entails $A$ (of form not-$C$) is thereby (conclusive) evidence for $A$, i.e. for $\bar{C}$, i.e. against $C$. As in the case of typical unless, but now taking account of the negated antecedent, $r_C(B) = -\infty < 0.\(^{28}\)

\(^{25}\)Fact: If (a) $A \cup B = \Omega$, (b) $0 < P(A), P(B) < 1$, then $P(A|B) < P(A)$. Proof: 1. $P(AB) = P(AB) = P(A) + P(B) - P(AB) = P(A) + P(B) - P(A) = P(B) - 1$. 2. Set $P(A) = 1 - \alpha$; $P(B) = 1 - \beta$ ($0 < \alpha, \beta < 1$). Then $P(AB) = 1 - \alpha - \beta$; $P(A)P(B) = 1 - \beta + \alpha \beta$. But $0 < \alpha \beta [b]$. \(\square\).

\(^{26}\)\(\textit{Unless} \ < \text{‘on less [a condition] than’ (ME 14th c.) modelled after Fr. à moins que. This makes } B \text{ even more plainly a claim (and } A \text{ a threat). Negative polarity items being restricted to denials and concessions (cf. Merin 1994) explains their absence in } B \text{ and thus Geis’ observation (i). The need for a threat explains (ii) here. The fact that outside is usually larger than inside might do like things for previous use of } \text{butan. All this is assuming preservation of original structure.}\)

\(^{27}\)This explains a puzzle about OE ac (‘but, ‘for/because’). In Beo, ac occurs almost always as butan, or as ‘for’. Heading an independent sentence (. $B$) after a negative, ac needs ModE
6.3 ‘Except that’ and *A but₃ B*. Unlike for most cases of *but₃* this is one where evidence is typically short of deductively conclusive. An OE example where one is tempted (with Mitchell) to interpolate a tacit *pæt* after *butan* is *pæt wæs wæpna cyst, buton hit wæs mare ðonne ænig mon óder to beadulace ætebæaran meahte* ‘that was of weapons [the] choicest, {but/{except/save} that} it was larger than any man other to battle carry could’ (Beo. 1559ff.). Still: *butan* stands free, and the *B*-clause detracts from—what? Most likely from this: that this is a sword *any* man should wish to use.

Let *but₃* stand for the ModE full sentential conjunction *but* trsl. *aber, pero*. A stock example is: [A] *Kim is poor but [B] (she is) honest*. Locke, Frege and others interpret: *B* is unexpected given *A*. We can explicate this as
\[ P(B|A) < P(B) \] (equivalently: \( r_A(B) < 0 \)) where *P(·)* represents general background beliefs applied to *Kim* considered as an arbitrary individual (cf. Merin 1995,1996,1997).²⁹ But this constellation is not always required for felicity of *but*. Consider  
*[A] Wilkins is a man of principle, but [B] he is now Chancellor of Crawford.*  
Aspersions need be cast on Crawford, nor Wilkins. Following Ducrot (1973), we should say that *A but B* presents *A* as an argument for some contextual proposition *H* (e.g. ‘Wilkins can stop the rot at Batbridge’) and *B against; with B ostensibly carrying the day*. Explicate: *A but₃ B* needs for felicity a contextually supplied proposition *H*, one half of an issue \{*H, ˜H*\}, such that

\[ r_H(A) > 0 \] [POS], \( r_H(B) < 0 \) [NEG], and \( r_H(AB) < 0 \) [NEG].

**Fact**: Δ does not entail \( P(B|A) < P(B) \). But whenever the issue \{*H, ˜H*\} fully accounts for any probabilistic dependence between *A* and *B* \[\{(A \perp B) \pm H\}\],³⁰ Δ entails \( P(B|A) < P(B) \) and additivity of \( r \), i.e. \( r_H(AB) = r_H(A) + r_H(B) \). The stock example (poor but honest *Kim*) is the special case of Δ where *H = ˜B*. But *H = ˜B* entails \( (A \perp B) \pm H \). Hence we have another formal

**Fact**: Δ \& \( (H = ˜B) \) entails \( P(B|A) < P(B) \), thus \( P(A|B) < P(A) \) and \( r_A(B) < 0 \).³¹ Setting now \( A = C \) (C another’s claim, *conceded by Speaker*) we have \( P(C|B) < P(C) \), just as in *A but₃ B* with respect to *A = ˜C*, (C another’s

²⁹This involves universal instantiation in a probabilistic context, with eminently predictive consequences.

³⁰\((A \perp B) \pm H\) means: *A* and *B* are conditionally independent with respect to both horns of the dichotomy, i.e. \( P(AB|H) = P(A|H)P(B|H) \) and \( P(AB|H) = P(A|H)P(B|H) \).

³¹Assuming \( 0 < P(A), P(B) < 1 \). *Proofs*: in Merin (1996) Ch. 2.
claim, denied). If a \(\text{but}_n B^2\) is considered with respect to an issue \(H\) and we set likewise \(H = \bar{B}\) then, in both uses, \(r_H(C) > 0\) and \(r_H(B) < 0\). So there is a unitary prototype semantics for ModE \(\text{but}\).

6.4 Structural persistence from \text{butan} `outside’ to \text{but}_n. Recall relations of \text{butan} `outside’ to \text{but}_n. For \text{but}_n note that truth conditions \([\text{but}_n] = \text{[and]} \cap\) and the default assumption of conditional independence, \([(A \perp B | ± H)]\) entail

\[
r_H(A \text{ but } B) = r_H(AB) = r_H(A) + r_H(B) = a - b \text{ (where } a, b > 0),
\]

For note that \(a = r_H(A) > 0\) and \(-b = r_H(B) < 0\). Since \([(A \perp B | ± H)]\) holds for the salient default use of \text{but} where \(H = \bar{B}\), so will this result. Recall now from 5.1 the structurally analogous spatial condition, given \(B \subseteq A\), namely

\[
\mu(A \text{ butan } B) = \mu(A) - \mu(B) = a - b \quad \text{(where } a, b > 0).\]

But this needs completion to take account of the third content-parameter; here, Kim’s living \((Kl)\) or an entity’s walking \((W)\).\(^{32}\) Suppose we ask: ‘Where does Kim live?’ And suppose we check points \(x \in \mathcal{R}^2\) for the place \(K \subset \mathcal{R}^2\) where Kim lives. Suppose next we also compute probabilities \(P(x \in K)\). We know Kim lives outside Boston, so \(P(K|x \in B) \neq P(K|B) = 0\). Clearly, if Kim’s place is somewhere, then \(P(K|\bar{B}) > 0\). Hence, \(r_K(B) < 0\).\(^{33}\) But where do we look? — ‘Outside \(B\)’, is the deadpan answer. But the great outside is large. Note, however, that, for any \(S\) such that \(P(S) \neq 0 \neq P(K)\) holds, \(P(K|S) = \frac{P(KS)}{P(S)}\) is maximal when \(S \subseteq K\). So we want an initial search-set \(A\) that contains \(K\), but is not too large.\(^{34}\) But we knew Kim was likely to be in America, a set \(A \subset \mathcal{R}^2\). This means: we knew we were more likely to find Kim in \(A\) than outside \(A\): \(P(K|A) > P(K|\bar{A})\), hence, \(r_K(A) > 0\). And indeed, if \(B \subseteq A\) then \(r_K(A \setminus B) > r_K(A) > 0 > r_K(AB) = r_K(B) = -\infty\). The special case \(K = \bar{B}\), where Kim is everywhere (not just anywhere) except \(B\)—say, owns everything outside \(B\)—yields: \(r_K(A \setminus B) = \infty = r_K(A) - r_K(B) = a - b\), (where \(b\) now is negative.) And in this case ‘outside’ must give way to ‘except’, the pivotal notion.

7. Conclusion. ModE \text{but}_{\text{Conj.}}, the evolutionary target, is univocal. In prototypical uses the \(B\)-clause is negatively relevant to some \(C\) which the \(A\)-clause either flatly denies (‘sondern’) or concedes (‘aber’). Diachronically, starting out with mereological, visual spatial relations we reach epistemic or discourse relations where \text{but} signals ‘unexpectedness’ or a decisive ‘counter-argument’.

The bridge is the mathematical notion of measure viz. the intuitable notion of \text{amount}. What things amount to is not just something to line the solitary cognizer’s pocket. To take ‘talk exchanges’ seriously is to see them

\(^{32}\)I omit Loos etc.

\(^{33}\)\(\log(0/b) = -\infty\).

\(^{34}\)This might help explain why spatial ‘outside \(B\)’ usually means: within some area \(A\) outside \(B\) that is a (fairly small) proper subset of the universe \(\Omega \setminus B = \mathcal{R}^2 \setminus B\).
as exchanges not least of arguments. Hence, ‘amount’ as manifest in language is inextricably linked to social acts, such as claims, concessions, denials, retractions (Merin 1994). A local payoff is that we can formally explain why a construction traditionally labelled ‘concessive’ is notionally characterized by ‘one part being surprising in view of the other’ (Quirk 1954:6). (A global prospect is that neither ‘pragmatic’ nor ‘cognitive’ need, in this light, remain the linguist’s antonyms of ‘formal’.)

Moreover, there is now a story uniting the apparent diversity of meanings of *but*, which had prompted Horne Tooke (1798:1,135ff.) to postulate two sources: be-*utan* and, fired by Fr. *mais* < *magis*, a spurious verb *botan* ‘to add’. Webster (1828) maintained a similar second line of descent with a putative nominal source *bote*, ‘addition, restitution’. 19th century diachronists were to discredit such derivations decisively; but at the price of an explanatory gap or rather a studied lack of semantic curiosity which Horne Tooke could not, it seems, bear to affect. I believe that the descriptive means employed above go some way towards remedying the situation—that is, in a manner answering both to the demands of diachronic evidence and of semantic theory.

References


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Typographical note: Read the ðs crossed.