

Light heads and predicate formation: On two scopes of discontinuity*

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September 4, 2018

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*Parts of this paper were presented at Formal Semantics Seminar (Frankfurt, 2015) *Incontro di Grammatica Generativa 42* (Lecce, 2016), Formal Semantics Seminar (Brno, 2016), *Workshop on Approaches to Coercion and Polysemy* (Oslo 2017) and Applied Logic Seminar (Poznań, 2018). Critical comments from the participants of these and other discussions, in particular Nicholas Asher, Pavel Caha, Mojmír Dočekal, Patrick D. Elliott, Matthew Gotham, Henk van Riemsdijk, Daniel Tiskin, Marcin Wągiel, Bartosz Wiland, Roberto Zamparelli and Thomas Ede Zimmermann are gratefully acknowledged. Above all, I owe very special thanks to Pavel Rudnev, numerous discussions with whom shaped almost every aspect of this work. As always, I could hardly avoid numerous traps which consume me they would without the constant flow of suggestions and friendship from Jarosław Jakielaszek. All errors and defects are solely mine.

Abstract

The present paper addresses the problem of syntax-semantics mapping of syntactically complex structures that must be computed as semantically simple terms. While that kind of morphosyntactic mechanisms have been successfully applied to roots in Marantz’s framework, more complex structures turn out to be formally and conceptually challenging. To solve these problems, I make use of Cooper’s type-theoretic framework to propose a formal account of Transfer. I apply this to verbal idioms and quotational expressions whose parts do not share the properties of the surrounding context, i.e. they are not parts of idiom/quotation *proper*. The main result is a formal account of Marantzian light heads providing a recursive operation of predicate formation within cyclic derivations.

KEYWORDS: quotation, verbal idioms, predicate formation, Transfer, phases
light heads, syntax-semantics mapping, discontinuity, cyclicity

1 Introduction

It is one of the most fundamental ideas of the generative program that grammar identifies particular parts of syntactic structures as complete chunks. These chunks provide domains for cyclic operations, so that ‘the same rules are reapplied to each constituent in a repeating cycle until the highest constituent is reached’ (Chomsky & Halle 1960:275). Moreover cycles, mostly defined in terms of barriers (cf. Chomsky 1986) or phases (Chomsky 2001 *et seq.*), mark parts of syntactic structures that are closed off as impenetrable wholes and in this sense treated as atomic.

This paper shows that the above idea is correlated with formal mechanisms building semantically simple terms from complex syntactic structures. Tellingly, it argues that the fact that these mechanisms are not exceptional in the realm of syntax sheds new light on the syntax-semantics mapping and the predicate building process. The proposed approach is supported by data from verbal idioms (VIs) and quotational expressions (QEs), both exemplified in (1):

- (1) a. Mary gave Peter the cold shoulder. \rightsquigarrow Mary was unfriendly to Peter.
- b. Peter said ‘Yesterday such-and-such man came’.

Such expressions are not new in the literature (see Wasow et al. 1980; Nunberg et al. 1994 and Sudo 2013). Nevertheless, they have not been discussed as contributing to the theory of cyclic derivations from the point of view of the common mechanism of syntax-semantics mapping. I argue that VIs and QEs show phasal properties in that they must be treated as atoms derived from syntactic complexes. Nevertheless, that kind of computation turns out to be challenging, especially due to two elements exemplified in (1) by *Peter* and *such-and-such man*. Such expressions, while occurring within the idiomatic/quotational contexts, do not share their special properties. In this sense they give rise to discontinuity, which uncovers interesting formal aspects of syntax-semantic mapping within cyclic derivations. I show that VIs and QEs as in (1) contribute to the discussion over formal type-theoretic aspects of the two basic Chomskyan phases, viz. the lower verbal phase and the higher propositional phase, respectively.

The paper is organized as follows. In section 2 I present data showing a complex behaviour of VIs and QEs. I focus on two facts: first, that they show both atomic and complex behaviour; second, that their atomic treatment must take into consideration two types of discontinuity. In section 3 I present a type-theoretic account of Transfer, focusing on the syntax-semantics mapping of category-determining light heads as proposed by Marantz. In section 4 I show how the recursive application of the offered framework accounts for the data discussed in section 2. Section 5 summarizes the discussion and suggests new paths for future research.

2 The data

To begin with, I present crucial effects observed for VIs and QEs, splitting the discussion into two subsections. First I present a conflict between their atomic and structural properties. Then I compare this with effects rooted in discontinuity. I focus, in the first place, on the conflict between atomic and complex properties of such expressions, leaving aside numerous other effects that have been discussed in the literature (see Hallman 2015; Sudo 2013).

2.1 Atomic and structural properties

Let us first have a look at data showing that VIs and QEs behave like atomic expressions, both in terms of syntactic derivation and semantic computation. Let us start from the most obvious fact: neither of the two allows an extensional interpretation. In particular, they block substitution of their parts with equivalent expressions:

- (2) a. She showed Peter the door. \nRightarrow She showed Peter the doorway.
b. He said ‘Tarski is smart’. \nRightarrow He said ‘Tajtelbaum is smart’.

Second, both VIs and QEs block *wh*-movement, regardless of the initial position (arguments or adjunct) of the moved *wh*, as well as *it*-clefting:¹

- (3) a. #What_i did Peter give her ~~what_i~~? (answer: *Peter gave her the cold shoulder*)
b. #Where_i did they keep the police ~~where_i~~? (answer: *They kept the police at bay*)
(4) a. *Who_i did he say ‘~~who_i~~ is smart’?
b. *Where_i did he say ‘I rest ~~where_i~~’?
(5) a. #It was at bay that they kept the police. (see also Adger & Ramchand 2005)
b. *It was Alfred_i that he said ‘~~Alfred_i~~ is smart’.

As for other types of movement, VIs are more permissive than QEs. The latter allow only split moving the first part to Left Periphery; still, it imposes further constraints, e.g. w.r.t. the quoting verb as in (6b). The former may allow a wider variety, including passivization and Left Periphery movement. Nevertheless, that kind of operations are much more limited than in the case of non-idiomatic phrases (cf. Hulseley & Sauerland 2006; Salzmann 2017):

- (6) a. ‘Alfred’ he said ‘is a smart guy’.
b. *‘Alfred’ he didn’t say ‘is a smart guy’.
(7) a. Some real headway was made these days.
b. #The door was shown by Mary to Peter.
(8) #Głowę Janowi Marta suszyła
head.ACC.TOP Jan.DAT Marta.NOM. dried.3RD.FEM.FOC
[lit.: As for Jan’s head, Marta did dry it.] intended: Marta did badger Jan. (Polish)

Finally, VIs and QEs pose problems for copredication. The former seems to leave no margin for that kind of effect, as in (9). QEs are more permissive if the second predicate is embedded under a verb marking the extensional, as in (10a), or a different attitude context, as in (10b):

- (9) #Mary gave Peter the cold shoulder_i, but it_i was dirty/I know it_i was dirty.
(10) a. He said ‘Alfred_i is smart’ and in fact he_i is also rich.

¹I use * for ungrammatical phrases and # for phrases where the intended idiomatic reading is lost.

- b. He said ‘Alfred_i is smart’ and I think he_i is also rich.
- c. ???He said ‘Alfred is smart’ and also rich.

So, the above data show that both VIs and QEs behave like atomic units; note that had they been treated as atomic Lexical Items (LIs), neither of the abovementioned effects would have been surprising. Nevertheless, a closer look shows that constituents of VIs and QEs enter morphosyntactic relations; thus neither of the two is atomic *simpliciter*.

One effect of that kind of morphosyntactic transparency can be already observed in (10b). Note that for coindexing and copredication to be possible, QEs cannot be atomic syntactic objects (SOs). The structure of the material flanked by quotes must be transparent for binding principles. Interestingly, it is not only SOs forming QEs but also their morphosyntactic features that must be accessible for computation, also outside quotation. To see this, let us have a look at (11) below:

- (11) a. He asked ‘Who did you meet yesterday?’.
- b. He said ‘Who did you meet yesterday?’.
- c. *He asked ‘Yesterday I met Alfred’.

On the one hand, it is widely known that QEs allow any material between quotes, including gibberish. Still, the acceptability of the whole sentence does depend on the quoting verb. QEs can be quoted as questions, as in (11a). Moreover, questions can be quoted as in (11b). This is not innocent, since in this case the QE can hardly be interpreted as a quoted question. Rather, the speaker of (11b) treats it as a purely phonological string. Still, (11b) itself is not ungrammatical. However, the converse of this situation, exemplified in (11c), is not acceptable. The reason seems to be quite simple: *ask* selects the interrogative Q feature, originally inserted with C⁰ and next valued on [Spec, CP] (cf. Chomsky 2015):

- (12) I asked ‘Who_{Q:INTERROG} did you meet yesterday?’.
- 
 select Q:INTERROG

Crucially, for any selection to be possible, features appearing on the elements of the quoting inside must be transparent for SOs outside the QE (see also Saito 2012; Saito & Haraguchi 2012 for a discussion on the C⁰-QE relation). Thus QEs cannot be simply treated as atoms.

The transparency of VIs can be inferred from at least two observations. First, as known, idioms show the same agreement/CASE distribution as their non-idiomatic counterparts, e.g.:

- (13) a. She gave him a new book.
- b. She gave him the cold shoulder.

Still, this does not prove that the verb in (13b) has the same morphosyntactic features as the one in (13a). In principle, one could think of a single LI *give the cold shoulder* whose phonological form accidentally suggests the distribution of CASE identical to that of *give*. However, this faces difficulties in defining AGREE holding between idiomatic NPs and their modifiers, as in (14):

- (14) Jan musi teraz wypić przysłowiowe piwo
 Jan.NOM must now drink.INF proverbial.SG.NEUTR piwo.SG.NEUTR
 [lit.: Now Jan must drink the proverbial beer] Now Jan must face the music. (Polish)

That kind of structures, allowing also determiners (e.g. *pull SOMEONE’S leg*), are semantically complex and I cannot discuss them in detail here. For the present sake it is sufficient to point out that for agreement of number and gender to be possible, φ -features of *piwo* ‘beer’ must

be shared with those of *przysłowiowe* ‘proverbial’. Thus [SG] and [NEUTR] of *piwo* (the part of idiom) must undergo computation.

To sum up, the data from compositionality, movement, copredication and agreement show that VIs and QEs have the conflicting properties of behaving like both atomic and complex. Nevertheless, so far I have not discussed these data in the context of SOs which, while appearing within such expressions, show apparently different properties. These effects, exemplifying a kind of discontinuity, are addressed in the next subsection.

2.2 Discontinuity

In section 1 I mentioned two types of expressions, repeated below as (15):

- (15) a. Mary gave Peter the cold shoulder.
 b. Peter said ‘Yesterday such-and-such man came’.

Such expressions are special in that they contain SOs which do not share the properties of the surrounding idiomatic/quotational context. I call this effect *discontinuity* and the elements giving rise to it *discontinuity triggers* (DTs). Let us see in what sense such expressions are discontinuous.

Take, first, extensionality. For VIs the problem is simple: contrary to the effect in (2a), DTs are interpreted as standard expressions that undergo substitution *salva veritate*:

- (16) She gave Peter the cold shoulder. \Rightarrow She gave him_{Peter} the cold shoulder.

In the case of QEs the problem is more complex. Quotational DTs have special markers, e.g. doublets as in (17a)-(17b) or an additional marker of indefiniteness as in (17c):

- (17) a. John said ‘Yesterday, such-and-such man came’.
 b. Hanako-wa ‘Kinō dare-dare-ga kita’ to itta.
 Hanako.TOP ‘Yesterday WHO-WHO.NOM came’ C⁰ said
 Hanako said ‘Yesterday, such-and-such man came’. (Japanese)
 c. On powiedział ‘Denerwuję się ilekroć ktoś tam przychodzi’.
 He said ‘feel.nervous.1ST SELF every.time someone.NOM INDEF come.3RD
 He said ‘Every time such-and-such man comes I feel nervous’. (Polish)

Such DTs are not, under the prominent reading, parts of QEs. Thus John’s utterance in (17a) is standardly not interpreted as a string ‘Yesterday[□]such[□]and[□]such[□]man[□]came[□]’. Nevertheless, DTs are not interpreted completely outside the quotational context. They seem to create variables ranging over parts of quoted expressions. Thus the QE in (17a) roughly denotes a string represented by the result of substituting \mathcal{X} by an expression $E_{[+PERSON]}$ in the string ‘Yesterday \mathcal{X} came’.

In this regard, quotational DTs show effects typical for the result of \bar{A} -movement. The difference is that while *whs* denote sets of objects represented by arguments/adjuncts (see Kotek 2014, but also Šimik 2011, a.o., for an alternative view), quotational DTs denote phonological strings. This goes in hand with the fact that such² DTs can appear in proper names, which also have been conceived of as having phonological representations encoded in their semantic representations (cf. Matushansky 2008, 2015):

²This property is not cross-linguistically universal. In Japanese, proper names involve separate DTs, like *nan to ka* (lit. wh- + C⁰ + Q), e.g. *nan to ka -ko*. Here the DT ranges over phonological strings that can form a name together with the syllable *ko*, e.g. *Haruko, Tomoko*, etc. Thanks to Satō Yorimichi for calling this point to my attention. See also Cheung (2015) for various morphological realizations of such DTs in Chinese.

- (18) a. Dostałem maila od Karoliny Ziel- jakiejś tam.
 got.1ST e-mail.ACC from Karolina.GEN Ziel- some kind of.FEM.GEN INDEF
 I have got an email from Karolina Ziel-something (Polish)

The DT ranges over adjectival endings of female surnames. Thus the name could be *Karolina Zielińska*, *Karolina Zieleniewska*, etc.

These observations unearth an important difference between idiomatic and quotational DTs. The former are interpreted completely outside the idiomatic context. It is then not surprising that, unlike idioms proper, they allow both movement and copredication, as in (19):

- (19) a. She gave Peter_i the cold shoulder, so he_i left immediately.
 b. Whom_i did she give ~~whom_i~~ the cold shoulder?

By contrast, quotational DTs are interpreted within the quotational context in the sense that they provide variables ranging over parts of quoted expressions. It is then natural to expect effects analogous to standard QEs. Indeed, (20) shows that quotational DTs allow copredication, just like QEs in (10):

- (20) He said ‘Such-and-such man_i is smart’ and I think he_i is also rich.

Moreover, the possibility of coindexing *he* and *such-and-such man* shows that φ -features undergoing agreement with *is* must be also present on the latter. Therefore, features of quotational DTs must be transparent for morphosyntactic computation, like those in (11). Finally, the same effects are observed for movement, as in (21):

- (21) *Kogoś tam_i Marta powiedziała ‘Jan spotkał
 such-and-such man.ACC.TOP Marta.NOM said ‘Jan.NOM met.3RD
 kogoś tam_i’.
 such-and-such man.ACC’
 lit. As for such-and-such man, Marta said ‘Jan met’ (Polish)

Bearing in mind the discontinuous character of such QEs and an especially flexible movement to [Spec, TopP] in Polish, DTs might be expected to allow topicalization. (21) shows that, contrary to VIs, quotational DTs are frozen, at least for overt movement.

2.3 Interim conclusion No. 1

Let us summarize data from QEs, VIs as well as their discontinuous variants discussed above:

	EXTENSIONALITY	MOVEMENT	COPREDICATION	AGREE
VI	×	constrained	×	✓
QE	×	×	✓	✓
DT _{VI}	✓	✓	✓	✓
DT _{QE}	✓	×	✓	✓

Table 1: Data summary

VIs and QEs are similar in that they behave both like atoms (blocking an extensional interpretation and movement) and complex structures (entering agreement). The crucial difference is that the latter allow copredication. The corresponding DTs differ from each other w.r.t. (overt) movement which, as the only effect, is blocked in QEs. The overall conclusion is twofold. First, the grammar must secure the morphosyntactic transparency of VIs and QEs, as well as their atomic properties. Second, it must specify in what sense DTs are not parts of the idiomatic/quotational context in terms of both syntactic derivation and semantic interpretation.

3 The framework: from syntax to predicate formation

While not identical to each other, VIs and QEs share the property of behaving like semantic atoms and morphosyntactic complexes. This is not, of course, new in the generative tradition. Perhaps the most widely used concept is that of roots treated as carriers of conceptual information (cf. Marantz 1997). Their formal interpretability is enabled by the merger of light heads, e.g.:

$$(22) \quad \lambda y_e.\lambda x_e.\lambda w_s.email(x,y,w)=1 \text{ iff } x \text{ emails } y \text{ at } w \quad ; \quad \lambda x_e.\lambda w_s.email(x,w)=1 \text{ iff } x \text{ is an email at } w$$

$$\begin{array}{c} \diagup \quad \diagdown \\ v^* \quad \sqrt{\text{email}} \end{array}$$

$$\begin{array}{c} \diagup \quad \diagdown \\ n^0 \quad \sqrt{\text{email}} \end{array}$$

Light heads provide formal features. It is after this step that the non-compositional content carried by a root is lexicalized as a predicate representing, say, a relation where x emails y or an object x which is an email.

The fact that this approach allows to derive semantically simple terms from syntactic structures makes it potentially attractive for the present discussion. Nevertheless, there are at least three problems in adopting this machinery to the discussed material. First, Marantz (2007) assumes that that kind of lexicalization is limited to the first merger of category-determining head. However, what we need is a machinery which yields morphosyntactically complete structures and then turns them into atoms. Second, light heads as in (22) mark points of lexicalization.³ While VIs fit with such mechanisms (cf. Marantz 1996), QEs do not, primarily because their meaning is not determined by encyclopaedia. Third, an operation turning syntactic structures into atoms should account for two different types of DTs, neither of which shares the properties of the surrounding context. On top of that, there is a fourth obstacle, namely the lack of formal account of operations exemplified in (22). Standardly, it is assumed that, in the context of light heads, roots undergo some sort of translation as in (23):

$$(23) \quad \text{a. } \sqrt{\text{full}} = \begin{cases} \lambda y.\lambda z.full(y,z) \\ \lambda e.full(e) \end{cases} \quad (\text{Roßdeutscher 2014, irrelevant details omitted})$$

$$\text{b. } \sqrt{\text{John}} \xrightarrow{\text{translation}} \lambda e.John'(e) \quad (\text{Kelly 2013})$$

However, neither of the two accounts provides a formal interpretation of light heads; thus the mechanism allowing to compute that kind of derivation remains undefined and thus unclear. And this is the right starting point for the discussion to follow. I am going to argue that a plausible result can be achieved under the proper type-theoretic account of Transfer. In subsection 3.1 I show how Transfer can be formalized within the framework of Type Theory with Records (TTR) proposed by Cooper (2005) *et. seq.* In subsection 3.2 I argue that this framework is in a position to account for category-determining light heads.

3.1 Transfer: preliminaries

The inverted Y model assumes that, at proper points,⁴ syntactic structures are shipped off by the operation Transfer to two interfaces: conceptual-intentional (C-I) and sensory-motor

³Since Marantz's original proposal, the range of functions assigned to light heads has increased to the extent that by now they can be hardly conceived of as a coherent category (a unified account is suggested in Harley 2017). I am interested primarily in how they assign formal features, taking other roles, e.g. of introducing external arguments (cf. Kratzer 1996), to be unrelated to the present discussion.

⁴The exact account varies across frameworks. In P&P Transfer was defined on LF, in MP on a phase complement (but see Bošković 2016). Most recently, Chomsky (2016) and Chomsky et al. (2018) seem to get back to the earlier idea taking only the final output of derivation to be transferred to the interfaces. See also Obata (2017) for a more fine-grained approach.

(SM). Leaving aside conceptual details, essentially this means that Transfer is a meta-theoretic operation mapping SOs onto objects computable by the interfaces (cf. Chomsky 2004).

In order to formalize that kind of operation, I make use of TTR as proposed by Cooper (2005, 2012, 2016). There are two crucial motivations behind this proposal. The first one is shown right below; the second, much more important one, will be explicated in subsection 3.2. Let us start from the former. In TTR variables bound by λ -operators can be typed not only by simple types, say $x : \sigma$ or $x : \langle \sigma, \tau \rangle$ (x typed as σ or as a function from σ to τ). The framework allows records, whose types are more complex than those exemplified above. Records are typed as lists of that kind of term-type pairings; these are called *fields*. To illustrate, the record *rec* in (24) is a list of fields a, b, c of type σ, τ, ρ , respectively:

$$(24) \quad rec : \left[\begin{array}{ll} a & : \sigma \\ b & : \tau \\ c & : \rho \end{array} \right]$$

For such records Cooper makes use of functions defined as λ -terms which map a record onto one of its fields. Thus the function in (25) maps the record in (24) onto its second field, viz. b :

$$(25) \quad \lambda rec : \left[\begin{array}{ll} a & : \sigma \\ b & : \tau \\ c & : \rho \end{array} \right] .rec_{ii}$$

To see how this might be useful for formalising Transfer, consider the following formula:

$$(26) \quad \lambda \gamma : \left[\begin{array}{ll} \Phi_\gamma & : phon \\ \llbracket \gamma \rrbracket & : \sigma \end{array} \right] .\gamma_k$$

According to (26), an SO γ is a term whose type is a record consisting of two fields: the SM and C-I representation. Transfer within the inverted Y model corresponds, in this view, to a function mapping a record consisting of such two fields onto one of them. To illustrate, in (27) Transfer maps a nominal *email* encoded as a record onto its C-I representation:

$$(27) \quad \lambda email : \left[\begin{array}{ll} \Phi_{email} = /email/ & : phon \\ \llbracket email \rrbracket = \lambda x_e . email(x) & : \langle e, t \rangle \end{array} \right] .email_{ii}$$

Now, as it stands, TTR does not contribute much to the current literature (cf. Collins & Stabler 2016). Note, however, that (26) works under standard assumptions only insofar as the meaning of an SO reaching Transfer can be composed from the meanings of its daughters. Still, one consequence of Marantz’s idea underlying roots is that they are bare carriers of conceptual information. Until supplemented with formal properties provided by light heads, roots are not semantically interpretable. Accordingly, the simple account as in (27) does not allow a formal computation of structures as in (23). Such structures require a more fine-grained account. In what follows I show that Cooper’s TTR framework naturally meets this demand.

3.2 Syntax-semantics mapping of light heads

A quick look at the current literature shows an interesting contrast. There is a number of approaches to the way the syntax-SM mapping delivers words understood as basic SM units (cf. Kremers 2015; Piggott & Travis 2017). However, the analogous problem of mapping syntactic

structures onto basic C-I units is less developed.⁵ This state of affairs is not limited to generative grammar. In the Tarskian tradition, defining a predicate boils down to providing a natural number standing for arity and a non-logical constant encoding the conceptual content. Nevertheless, Tarski himself took leaving predicates as undefined metalogical notions to be useful ‘[f]or some reasons of both intuitive and formal nature’ (Tarski 1964:64). The provisional conclusion, then, is that securing formal computability for structures as in (22) and not departing from Tarskian semantics requires mechanisms combining two types of information. First, strings of symbols carrying conceptual information (what in the generative tradition falls under the umbrella of Saussurean arbitrariness, cf. Bierwisch 2014; Koster 1996). Second, formal properties of predicates, in particular the argument structure.

A natural candidate for the first element are roots. According to a widely assumed (though not universally, cf. Borer 2013) view of Marantz (1996), roots are bare carriers of conceptual information; they become formally interpretable only when assigned a syntactic category. This idea can be encoded into grammar by letting roots be sets of string-world pairings $\langle \phi, w \rangle$ such that the phonological string ϕ can be meaningfully used to refer to (some aspect of) the situation w . Accordingly, a bare root $\sqrt{\gamma}$ is a record whose only field is a set of pairs as in (28) below:

$$(28) \quad \sqrt{\gamma} : [\Phi_{\sqrt{\gamma}} = \{ \langle \phi, w \rangle, \langle \phi', w' \rangle, \dots \} \quad : \text{PHON}_s \quad]$$

In this sense roots are overloaded; they carry a set of bundles of information required by SM/C-I interfaces (see Labelle 2014 for a cognate approach). In order to become interpretable, the relevant information must be selected and prepared for the interface computation. To account for this, I draw on Chomsky’s idea of syntactic labels, fully compatible with Marantz’s general idea exemplified in (22):

For a syntactic object SO to be interpreted, some information is necessary about it: what kind of object is it? Labeling is the process of providing that information.
[Chomsky 2013:43]

Focusing on the C-I interface, let us then consider labels encoding (perhaps among other things, cf. Munakata 2017) formal properties of predicates: arity, types, and category-specified truth conditions. Assume, as a first attempt, that labels of light heads correspond to functions from string-world pairings as in (28) to full-fledged predicates. To illustrate:

$$(29) \quad \begin{array}{l} \text{a. } n : \langle \phi_{email}, w \rangle \mapsto (\lambda x_e. \lambda w_s. email(x, w) = 1 \text{ iff } x \text{ is an email at } w) \\ \text{b. } v^* : \langle \phi_{email}, w \rangle \mapsto (\lambda y_e. \lambda x_e. \lambda w_s. email(x, y, w) = 1 \text{ iff } x \text{ emails } y \text{ at } w) \end{array}$$

However, that kind of mapping is too underspecified. In particular, the grammar must provide a mechanism allowing selection of the relevant pair $\langle \phi, w \rangle$ from a set Φ as in (28). That is, for (29b) to be computable, there must be an adequate selection securing that the argument of v^* picks out a world where an event denoted by a transitive verb actually takes place. Put differently, the choice of the relevant $\langle \phi, w \rangle$ pairing must depend on the properties of the particular head. And this is exactly the difficulty TTR can naturally solve thanks to dependencies that can be encoded within a single record. To illustrate, Cooper’s proposal for a record encoding the meaning of *temperature* consists of three fields, the last of which is dependent on previous ones:

$$(30) \quad rec : \left[\begin{array}{ll} x & : Real \\ loc & : Loc \\ e & : temp(loc, x) \end{array} \right]$$

where *Real* is a set of real numbers, *Loc* a set of locations, and *e* a set of situations

⁵Hirose (2003), for instance, defines predicates as sets of formal properties (arity, temporality and conceptual content) distributed over light heads and roots. Still, he does not provide a formal operation turning the three properties into predicates.

Formalizing Transfer of light heads it is possible to make use of analogous dependencies to encode a predicate formation mechanism. To see how TTR allows to encode a dependency between the choice of the carrier of conventional content and formal properties imposed by a light head h^0 , let us have a look at the following proposal:

$$(31) \quad h^0 : \left[\begin{array}{ll} \Phi_{h^0} = \{ \langle \phi, w'_h \rangle, \langle \phi, w''_h \rangle \dots \} & : \text{PHON}_s \\ h & : \text{LABEL} \\ \llbracket h^0 \rrbracket^g = \lambda \Phi_\gamma. h(\alpha \mid \alpha \in \Phi_\gamma \ \& \ w_\alpha \in \{w'_h, w''_h, \dots\}) & : \langle \text{PHON}_s, h(\text{PHON}_s) \rangle \end{array} \right]$$

where $g : \text{variables} \rightarrow \Phi_\gamma$ and w_α is a world in $g(\alpha)$

Each $\langle \phi, w_h \rangle$ pair picks out a situation denoted by an SO labeled h and represented as ϕ . Thus $\langle \phi, w_n \rangle$ and $\langle \phi, w_{v^*} \rangle$ pick out situations where ϕ is used to refer to the denotation of a nominal (at w_n) or a transitive verb (at w_{v^*}), respectively. The label h enables formal interpretability by mapping carriers of conceptual information onto predicates as exemplified in (29), in harmony with the Chomsky-Marantz approach. Still, the mapping is not arbitrary; the choice of the particular argument α depends on Φ_{h^0} , more specifically on situations it provides. Thus the particular carrier of conceptual information taken as an argument by h must belong to the set of situations denoted by an SO labeled h . Finally, the function g maps variables α, \dots onto elements of Φ_γ ; thus it stands for the choice of the particular situation w as denoted by the string ϕ . Consequently, within this account predicate formation is a process of coordinating two operations. First, the specification of formal properties encoded in labels of light heads. Second, the selection g of conventional content carried by $\langle \phi, w \rangle$ pairs and constrained by w_h .

To see how this works, let us move back to the initial examples in (22). Assuming translations in (29), the structure of the noun *email* in (22) is computed as follows:⁶

$$(32) \quad \llbracket n^* \rrbracket^g(\Phi_{\sqrt{\text{email}}}) =$$

$$\langle \lambda \Phi_{\text{PHON}_s}. n(\alpha \mid \alpha \in \Phi \ \& \ w \in \{w'_n, w''_n, \dots\}) \rangle (\Phi_{\sqrt{\text{email}}}) \triangleright_{\text{FA}} \quad (1)$$

$$n(\alpha \mid \alpha \in \Phi_{\sqrt{\text{email}}} \ \& \ w \in \{w'_n, w''_n, \dots\}) =_g \quad (2)$$

$$n(\langle / \text{email} /, w \rangle \mid \langle / \text{email} /, w \rangle \in \Phi_{\sqrt{\text{email}}} \ \& \ w \in \{w'_n, w''_n, \dots\}) = \quad (3)$$

$$\lambda x_e. \lambda w_s. \text{email}(x, w) = 1 \text{ iff } x \text{ is an email at } w \quad (4)$$

First, Transfer selects the relevant fields: the meaning of v^* and $\Phi_{\sqrt{\text{email}}}$. In step (1) the machinery applies FA. The output of this operation is a function n from a conceptual carrier included in $\Phi_{\sqrt{\text{email}}}$ to a predicate representing a denotation of a nominal *email*. Step (2) instantiates the choice g selecting the conventional content encoded as $\langle / \text{email} /, w \rangle$. This selection is constrained by the condition $w \in \{w'_n, w''_n, \dots\}$ securing that what is referred to at w is a referent of a nominal. The final result obtained in step (4) is a predicate lexicalized as *email*.

3.3 Interim No. 2

To summarize, there are two motivations behind the TTR-based account. First, it provides a convenient formalization of Transfer fitting the inverted Y model. Second, it allows to encode dependencies between formal properties and carriers of conceptual information. Such dependencies are required by light heads within the Chomsky-Marantz approach, but extend standard semantic composition. A methodologically plausible result is that it assumes no additional syntactic mechanisms, e.g. reprojection (cf. Gallego 2016). In section 4 I present a third motivation showing how its recursive character allows to account for VIs and QEs discussed in section 2.

⁶A notational comment. In general, I follow the notation used in Hindley & Seldin (2008), where \triangleright_α stands for the application of a rule α . Thus if FA marks Functional Application, then $\langle \lambda x. \text{smile}(x) \rangle (\text{John}) \triangleright_{\text{FA}} \text{smile}(\text{John})$.

4 Predicate formation and two scopes of discontinuity

For simple cases like (22), the offered account does not contribute more than lexicalist (e.g. Levin & Hovav 2005; Williams 2003) or derivational approaches as in (23). Nothing special hinges on whether we assume that *email* functions as two lexical entries, it is specified by syntactic context as in (23a), translated as in (23b), or computed as in (32). However, in this section I show that the recursive character of the proposed mechanism does open up new paths of analysing predicate formation. Tellingly, it paves the way to a type-theoretic account of expressions that are derived as semantic atoms from syntactic complexes within a syntactic cycle. Cycles deriving VIs and QEs are structurally cognate to standard Chomskyan phases, i.e. v^*P and CP, respectively. Moreover, the proposed account captures two types of discontinuity that are problematic for a lexicalist approach. In subsection 4.1 I show how discontinuous VIs can be accounted for by means of layered verbal structures. In subsection 4.2 I argue that quotational DTs involve A-dependencies within the process of predicate formation.

4.1 Double v construction: idioms

Equipped with the conceptual tools sketched in section 3, let us recall the demands posed by VIs. As summarized in Table 1, the grammar must yield semantic atoms (the lack of extensionality and copredication) and block movement, retaining in the same time morphosyntactically transparent structures (AGREE). Moreover, it must leave DTs outside the idiomatic context.

An account that provides lexicalization within derivational cycles (partially for reasons given in Marantz 2007) is the transitive verbal phase (with v^* a phase head) as defended by Chomsky (2013, 2015). The general schema is depicted in (33) below, irrelevant details omitted:

$$(33) \quad [\langle v^*, \sqrt{see} \rangle [\dots [\sqrt{see} \text{ Mary}] \dots]]$$

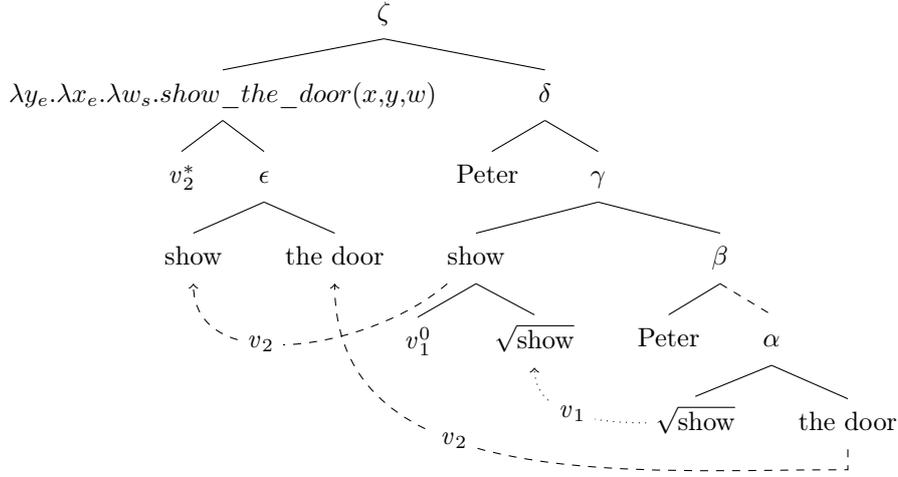

The label-less root \sqrt{see} raises to v^* via pair Merge, reaching the phase level. The obtained pair $\langle v^*, \sqrt{see} \rangle$, treated by Chomsky (2015) (see also Chomsky 1995b for similar ideas) as an amalgam, marks lexicalization yielding a transitive verb *see*. However, while that kind of lexicalization targeting a root can be computed along the lines of (32), it is less obvious how it could be applied to larger structures, as those exemplified by VIs. To solve this problem, first I draw the basic field of formal representation of complex SOs, based straightforwardly on (28) and (31). For an SO γ consisting of n terminals t_1, \dots, t_n , Transfer yields the following record:

$$(34) \quad \lambda\gamma : \left[\begin{array}{l} \Phi_\gamma = \{ \langle \langle \phi_{t_1}, w \rangle, \dots, \langle \phi_{t_n}, w \rangle \rangle, \dots, \langle \langle \phi'_{t_1}, w' \rangle, \dots, \langle \phi'_{t_n}, w' \rangle \rangle \} \quad : \text{PHON}_s \\ \dots \quad \dots \end{array} \right]$$

At the point of Transfer, γ is represented as a set of n -tuples $\langle \langle \phi_{t_1}, w \rangle, \dots, \langle \phi_{t_n}, w \rangle \rangle$. Each tuple is built from phonological strings of the terminals as defined for the particular situation w . To illustrate, assume that W is a set of situations in which John smiles. Then for each $w \in W$ there are pairs $\langle \phi_{\sqrt{John}}, w \rangle$ and $\langle \phi_{\sqrt{smiles}}, w \rangle$ carried by the roots \sqrt{John} and \sqrt{smile} , respectively. It is at the point of Transfer where the light heads n^0 and v^0 must select pairs with a situation w at which there is an individual John and at which x smiles. Therefore, for the proper interface interpretation to be possible, the Φ -representation of *John smiles* must include a set of n -tuples $\langle \langle \phi_{\sqrt{John}}, w \rangle, \langle \phi_{\sqrt{smiles}}, w \rangle \rangle$, where $w \in W$.

This approach has one important consequence. Note that according to (28) each root carries all sound-world pairings in which it can be meaningfully used. Accordingly, a root \sqrt{door} carries not only those pairings pertaining to a barrier at the entrance to buildings (door), but also to situations where x shows y the door, i.e. dismisses him. This allows to apply the Chomsky-Marantz framework sketched in (33) by providing a recursive operation of lexicalization:

(35)



The crucial difference between (33) and (35) is that in the latter raising to v applies to the whole VP, not just to the root. The problem is not new in the literature. In the pre-MP era, such operations were generally ruled out by the structure-preserving hypothesis (cf. Emonds 1976). One way to circumvent this obstacle is to treat VIs as partially similar to pseudo-incorporating structures (cf. Barrie & Li 2015; Saĝ 2016). Another is to follow Chomsky (1995a,b) in allowing XP incorporation to X^0 ‘if the LF interface permits such word structures’ (Chomsky 1995a:76).⁷ Within the present account, this condition can be reformulated in terms of semantic computability which, in turn, is secured by the proposed machinery. To see this, let us have a look at the following computation of (35), irrelevant details omitted:

- (36) i. Forming γ . Without advocating any particular account of ditransitives, I make a widely shared assumption (cf. Bruening 2010; Harley 1995; Larson 2017) that the root/verb raises to a categorizing head (perhaps via other heads). Accordingly, $\sqrt{\text{show}}$ moves to v_1^0 . Computation proceeds along the lines of (32) resulting in a standard ditransitive verb (e.g. as proposed in Bruening 2010)
- ii. IM of *Peter* and γ satisfying EPP;⁸
- iii. Forming ζ . *show* ($\sqrt{\text{show}}$ pied-piped to v_1^0) and *the door* raise to v_2^* , reaching the phase level. Since there is a convention in English that /show the door/ can be used idiomatically, this information carried by roots. Thus according to (34) there is an SO γ such that $\langle\langle\phi_{\sqrt{\text{show}}}, w'\rangle, \langle\phi_{\sqrt{\text{the}}}, w'\rangle, \langle\phi_{\sqrt{\text{door}}}, w'\rangle\rangle \in \Phi_\gamma$ and w' is a world where x shows y the door, i.e. dismisses him. Lexicalization is triggered by the merger of v^* ; it secures that w' is a situation denoted by a transitive verb:

$$\llbracket v_2^* \rrbracket^g(\Phi_\gamma) =$$

$$\langle\lambda\Phi_{\text{PHON}_s}.v_2^*(\alpha \mid \alpha \in \Phi \ \& \ w_\alpha \in \{w'_{v_2^*}, \dots\})\rangle(\Phi_\gamma) \triangleright_{\text{FA}} \quad (1)$$

$$v_2^*(\alpha \mid \alpha \in \Phi_\gamma \ \& \ w_\alpha \in \{w'_{v_2^*}, \dots\}) =_g \quad (2)$$

$$v_2^*(\langle\langle\phi_{\sqrt{\text{show}}}, w'\rangle, \langle\phi_{\sqrt{\text{the}}}, w'\rangle, \langle\phi_{\sqrt{\text{door}}}, w'\rangle\rangle \mid g(\alpha) \in \Phi_\gamma \ \& \ w' \in \{w'_{v_2^*}, \dots\}) = \quad (3)$$

$$\lambda y_e.\lambda x_e.\lambda w'_s.\text{show_the_door}(x,y,w') = 1 \text{ iff } x \text{ shows } y \text{ the door at } w' \quad (4)$$

⁷This is coherent with the framework of Chomsky (2013, 2015), where labels are the output of Labeling Algorithm defined as a part of Transfer, not inherent features of SOs. Thus Narrow Syntax cannot distinguish incorporation of Y^0 to X^0 from that of YP to X^0 .

⁸Without going into problems of linearisation (cf. Chomsky et al. 2018), I assume that SM is able to retrieve the right order from the lower copy of *Peter*.

The crucial cog of the above derivation is a recursive process of predicate formation. It consists of two verbal layers introduced by different heads. First, the derivation yields δ , which is a typical structure for the non-idiomatic reading of *show Peter the door* (see Larson 2017 and references therein). This secures retaining standard morphosyntactic relations required by the effects exemplified in (13)-(14).

The second layer captures discontinuity and the atomic character of VIs. First, raising to v_2^* and the following lexicalization allow to account for idiosyncratic properties of idioms. In particular, it overcomes the problematic issue of their composition (cf. Gehrke & McNally 2017; Mateu & Espinal 2007 both assuming non-trivial extensions of semantics). Second, incorporation to v_2^* accounts for the islandhood of VIs, as illustrated in (3), (5a), (7b) and (8). Once the whole idiom is incorporated to v_2^* , its constituents are expected to move only when pied-piping the whole incorporated material. Except highly constrained cases justifying excorporation (cf. Roberts 1991), such incorporated structures block movement. Finally, lexicalization enabled by the proper account of Transfer and light heads allows to explain the unavailability of copredication, as in (9). I follow the widely accepted assumption that copredication is possible only if the relevant LIs are logically polysemous in the sense of Asher (2011), as in (37):

(37) He wrote and then burned the book.

Then for (9) to be acceptable, there must have existed a standard and an idiomatic nominal *shoulder*, logically polysemous to each other. However, lexicalization in (35) targets the whole idiom. The derivation does not lexicalize *the door* and *shoulder* in their idiomatic meanings by means of separate light heads; hence the lack of copredication as expected.

Finally, the account specifies the type of discontinuity arising for VIs. To recall, idiomatic DTs do not receive the idiomatic reading and allow movement as well as copredication, as in (19). These effects naturally follow from the fact that such DTs do not undergo incorporation with the whole idiom, undergoing computation outside v_2^* .

To close this part of discussion, it is worth pointing out that the offered account, thanks to the recursive predicate formation, sheds new light on the idea of treating idioms as standard LIs. It implements, and formally specifies, the idea that ‘idioms are simply stored partial syntactic structures paired with some phonological content, exactly like words’ (Bruening 2015:23; see also Marantz 1996 for a cognate approach). Indeed, within the present framework it is the same mechanism, viz. raising to v , that yields both $[_V \text{ see}]$ in (33) and the idiomatic $[_V \text{ show the door}]$. Viewed from that angle, idioms are computation-wise akin to standard LIs; it is their SM computation that imposes further complexity.⁹ Nevertheless, the account does not simply overgenerate LIs. Indeed, if *show the door* undergoes incorporation to v^* and lexicalization, there must be a reason why *show the tree* does not. There are two arguments. First, had such an operation taken place, we would expect *show the tree* to behave like a head, especially with regard to movement, contrary to the facts. Second, there is no convention in English according to which *show the tree* denotes different situations than those defined for lexicalized *show*, *the* and *tree* (i.e. there is no convention such that its meaning cannot be composed from its parts). Such an additional v^* -layer and the following incorporation would not yield a new meaning. Consequently, it would be a superfluous step in derivation, automatically ruled out on economy grounds.

4.2 Creating a hole: quotation

Let us now move to QEs, relating them to VIs as discussed in subsection 4.1. As summarized in Table 1, QEs are similar to VIs in that they block extensional interpretation and movement, but

⁹The proposed account is cognate to Chomsky’s general idea according to which ‘properties of idiomatic expressions can easily be accounted for by “idiom rules” that apply at the level of D-structure and are analogous to rules of the lexicon’ (Chomsky 1980:149-150).

$$(43) \quad \llbracket q^0 \rrbracket^g(\Phi_\gamma) =$$

$$\langle \lambda \Phi_{(\text{PHON},s)}.q(\alpha \mid \alpha \in \Phi \ \& \ w_\alpha \in \{w_q, \dots\}) \rangle (\Phi_\gamma) \triangleright_{\text{FA}} \quad (1)$$

$$q(\alpha \mid \alpha \in \Phi_\gamma \ \& \ w_\alpha \in \{w_q, \dots\}) =_g \quad (2)$$

$$q(\langle \langle \phi_{\sqrt{\text{Alfred}}}, w' \rangle, \langle \phi_{\sqrt{\text{is}}}, w' \rangle, \langle \phi_{\sqrt{\text{smart}}}, w' \rangle \rangle \mid g(\alpha) \in \Phi_\gamma \ \& \ w' \in \{w_q, \dots\}) = \quad (3)$$

$$\lambda z_u. \lambda w'_s. \text{Alfred_is_smart}(z, w') = 1 \text{ iff } \ulcorner \text{Alfred is smart} \urcorner \text{ quotes } z \text{ at } w' \quad (4)$$

The final output is a set of utterances (type u) that can be quoted by the string $\ulcorner \text{Alfred is smart} \urcorner$. Each utterance of type u denotes linguistic expressions; within the present framework this means that it represents n -tuples of string-world pairings $\langle \phi, w \rangle$.

Viewed from that angle, QEs behave like VIs in that they depend on morphosyntactic relations between their constituents and sound-world pairings encoded by them, but not on their meanings. The difference is that QEs cannot be strictly conceived of as LIs. This, however, seems to be an aspect of all SOs, which is more of a philosophical than technical nature. Every SO γ universally carries string-world pairings $\langle \phi_\gamma, w \rangle$ where ϕ_γ represents its carrier, i.e. γ at w . I take this to be a formal reflex of a fundamental property of natural languages, namely of ‘the (tacit) convention that a name and its name are denoted by the same word, and so the name of a name “tells” us the name’ (Tajtelbaum 1957:53). In what follows, I show that the offered approach has significant advantages when it comes to deriving discontinuous QEs.

4.2.2 Quotation and holes

So far so good. QEs are derived by means of a general mechanism defined for light heads. However, quotational DTs give rise to a new obstacle. The problem is that they provide variables ranging over parts of strings of symbols that are encoded within quotational constants, as in (43). It is then not obvious how a grammar could yield such variables.

A natural approach is to let DTs create bound variables as a result of raising.¹⁰ This strategy was taken by Sudo (2013) (developed by Koev 2017), who proposes that DTs are indefinites; they undergo QR turning a term of type u into a predicate of type $\langle u, t \rangle$:

$$(44) \quad \left[\text{DE} \left[\alpha'_{\langle u, t \rangle} : \text{‘Yesterday } x \text{ smiled’}(x) \dots \left[\alpha_u : \text{‘Yesterday DE smiled’} \dots \right] \right] \right]$$

↑
QR

However, this solution is not costless. Sudo’s account is based on providing variants of standard composition principles defined solely for QEs. Actually, the same must be assumed about QR as in (44). Quotational DTs do not behave like typical QRed expressions. Contrary to the classical scope ambiguity as in (45), they force *de re* reading, as in (46)—the fact that, to my knowledge, has passed unnoticed in the literature:

- (45) a. John says that someone controls the media.
 b. $\rightsquigarrow (\exists x_e)(\text{person}(x) \ \& \ \text{say_that}(\text{John}, \text{control}(x, \text{media})))$
 c. $\rightsquigarrow \text{say_that}(\text{John}, (\exists x_e)(\text{person}(x) \ \& \ \text{control}(x, \text{media})))$

- (46) a. John says ‘Such-and-such man controls the media’.
 b. $\rightsquigarrow (\exists x_u)(\text{person}(\llbracket x \rrbracket) \ \& \ \text{say_quot}(\text{John}, \ulcorner x \text{ controls the media} \urcorner))$
 c. * $\rightsquigarrow \text{say_quot}(\text{John}, (\exists x_u)(\text{person}(\llbracket x \rrbracket) \ \& \ \text{control}(x, \text{media})))$

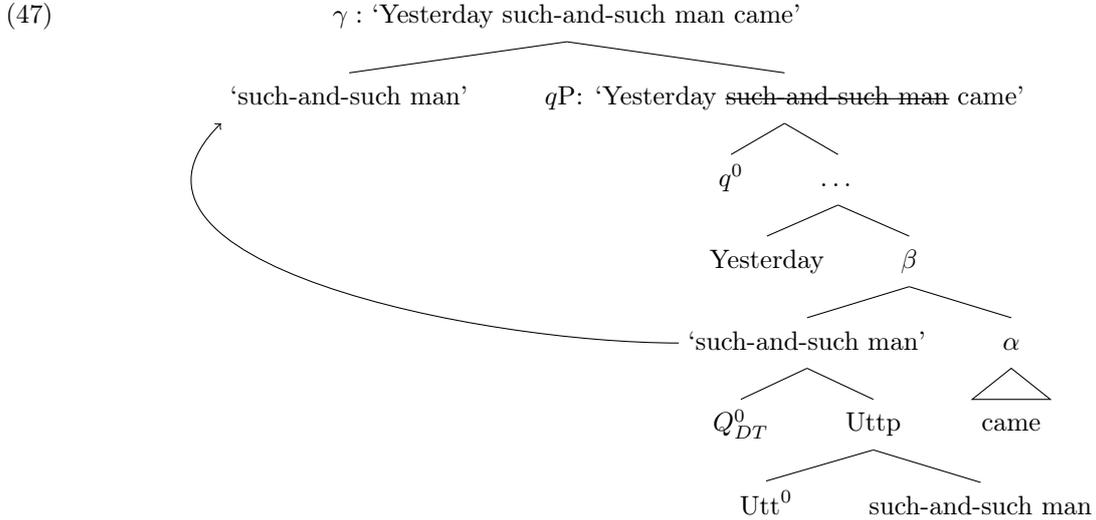
¹⁰More precisely, as a result of \bar{A} -movement. However, I do not go into detailed discussion here. For one, the A/ \bar{A} -movement distinction is less obvious on Minimalist grounds (cf. Safir 2017). For another, creating a bound variable is not necessarily limited to A-movement (cf. Chierchia 1995).

That is, while quantifying into QEs might be possible, it is nonsense to take a quantified phrase as standing for an object of a quotational report. Therefore the discrepancy between (45) and (46) seems to suggest that QR of quotational DTs has some special status.¹¹

Bearing this in mind, I propose a different approach. Leaving aside whether QR can be derived as a special type of *wh*-movement (see e.g. Johnson 2012), I let DTs undergo a kind of \bar{A} -movement, to certain extent mimicking raising to [Spec, CP]. The result of movement to [Spec, *qP*] is a bound variable \mathcal{X} , whose properties naturally follow from the proposed account. The core semantic property of light heads as in (31) is that they turn sound-world pairings into new predicates. It is then natural to expect that traces generated within complements of light heads by that kind of \bar{A} -movement are interpreted as variables of type *u* ranging over units denoting such pairings. Units of type *u* represent sound-world pairings that otherwise might be used in the predicate formation operation. Accordingly, I propose the following rule:

Definition 1 (Traces below light heads) For an \bar{A} -chain $[\alpha_i \dots [h^0 [\gamma \dots t_i \dots]] \dots]$ and a light head h^0 , the result of $[[h^0]^g(\Phi_\gamma)]$ is a term $\lambda\mathcal{X}_u.M$, where \mathcal{X}_u ranges over strings of symbols representing *n*-tuples of sound-world pairings $\langle \phi, w \rangle$ identified on t_i .

To see how this might work for QEs, consider the following structure of the QE in (1b):



Let us first have a closer look at (47). First of all, it assumes that the DT is a projection of a different (not light) head Q_{DT}^0 . This is required by the fact that DTs, e.g. *such-and-such man*, are not interpreted as QEs (sets of strings quotable by \ulcorner such-and-such man \urcorner), but variables ranging over their parts. Thus I take Q_{DT}^0 to provide the quotational feature $[iF : quot]$, but not to yield a QE as such.

This featural aspect is important in light of raising of DTs and the general islandhood of QEs. According to Labeling Algorithm (LA) proposed by Chomsky (2013, 2015), for an SO to be able to move to [Spec, XP], the two must share a common feature. Neither standard features (φ, \dots) seem to appear on *qP*, nor does $[iF : quot]$ appear on SOs c-commanded by q^0 (except the DT). Therefore, if any SO of the quoting inside raises to [Spec, *qP*], the resulting SO cannot be labeled by Chomsky’s LA. Viewed from this angle, the islandhood of QEs as in (4), (5b) can

¹¹Interestingly, the discussion in Wurmbbrand (2017) allows to suspect that QR could not explain the effect in (46) in terms of cyclicity, a natural approach to the islandhood of QEs. See also Dobrovie-Sorin & Beyssade (2012) for arguments against a QR-based approach to indefinites.

be said to follow from the labeling failure. By contrast, DTs can raise (at least covertly), leaving an open path for labeling thanks to the presence of $[iF : quot]$ on both DTs and qP s. Therefore, I assume a weaker version of LA (cf. Chomsky 2013; Takita et al. 2016) according to which γ is labeled $[iF : quot]$ by the most prominent feature shared by its daughters.¹²

Let us see how the proposed account computes the output of (47). Let β' , the highest phrase below the $[_{qP} q^0 [_{qP} Utt^0]]$ structure, be represented as in (48) below, irrelevant details omitted:

$$(48) \quad \beta' : \left[\begin{array}{l} \Phi_{\beta'} = \{ \langle \langle \phi_{\sqrt{yesterday}}, w \rangle, t_1, \langle \phi_{\sqrt{came}}, w \rangle, \dots \rangle \} \quad : \text{PHON}_s \\ \llbracket \beta' \rrbracket = \lambda x_e. \lambda w_s. \text{came}(x, w) \ \& \ \text{yesterday}(w) \quad : \langle w, et \rangle \end{array} \right]$$

The algorithm identifies the \bar{A} -chain whose head crosses the light head q^0 , triggering the trace rule of Definition 1. Accordingly, it yields a bound variable ranging over strings of symbols:

$$(49) \quad \llbracket q^0 \rrbracket^g(\Phi_{\beta'}) =$$

$$\langle \lambda \Phi_{\text{PHON}_s}. q(\alpha \mid \alpha \in \Phi \ \& \ w_\alpha \in \{w_q, \dots\}) \rangle (\Phi_{\beta'}) \triangleright_{\text{FA}} \quad (1)$$

$$q(\alpha \mid \alpha \in \Phi_{\beta'} \ \& \ w_\alpha \in \{w_q, \dots\}) =_g \quad (2)$$

$$q(\langle \langle \phi_{\sqrt{yesterday}}, w' \rangle, t_1, \langle \phi_{\sqrt{came}}, w' \rangle, \dots \rangle, \mid g(\alpha) \in \Phi_{\beta'} \ \& \ w' \in \{w_q, \dots\}) =_{\text{Def.1}} \quad (3)$$

$$\lambda \mathcal{X}_{\langle u, t \rangle}. \lambda z_u. \lambda w'_s. \text{Yesterday}_{\mathcal{X}} _ \text{came}(z, w') \quad (4)$$

Finally, the DT is remerged with the qP and interpreted as the chain head. Assuming a simplified interpretation of DTs (for details, see Koev 2017; Sudo 2013) and a general semantics of \bar{A} -chains developed by Kotek (2014), the last step of computation proceeds as follows:

$$(50) \quad \llbracket qP \rrbracket(\llbracket \text{'such-and-such man'} \rrbracket) =$$

$$\langle \lambda \mathcal{X}_u. \lambda z_u. \lambda w'_s. \text{Yesterday}_{\mathcal{X}} _ \text{came}(z, w') \rangle (\lambda \mathcal{X}_u. \mathcal{X} : [+PERSON]) \triangleright \quad (1)$$

$$\{ \lambda z_u. \lambda w'_s. \text{Yesterday}_{\mathcal{X}} _ \text{came}(z, w') \mid \mathcal{X} : [+PERSON] \} \quad (2)$$

The output is a set of strings of symbols that are quotable by the result of substituting \mathcal{X} in the string $\ulcorner \text{Yesterday } \mathcal{X} \text{ came} \urcorner$ for a string representing an expression with the feature $[+PERSON]$.

The proposed analysis accounts for the puzzling conflict between the complex and atomic behaviour of QEs. On the one hand, QEs are derived from standard expressions. Below q^0 the derivation secures the relevant morphosyntactic relations, required in (10a), (10b), (11) and (12). On the other hand, q^0 secures atomic properties. First, it yields a non-logical constant, in harmony with the rich literature on the topic. This accounts for the lack of extensional interpretation of QEs. Second, the architecture of features in (47) blocks *wh*-movement and topicalization, as in (4) and (21). Still, it allows (covert) movement of DTs to $[\text{Spec}, qP]$. This, under the assumptions naturally following from the proposed account of Transfer and light heads, yields a variable of type u ranging over units representing n -tuples of string-world pairings $\langle \phi, w \rangle$.

Finally, there are two more delicate problems. First, as shown in (9), QEs allow copredication, contrary to VIs. I take this effect to be primarily connected with the lexicon. As discussed in the context of (37) data from copredication deliver an argument against postulating anything like “idiomatic *door*” in *show someone the door*, contra Larson (2017). In the proposed account this motivates incorporation of the whole idiom to v^* , as in (35). By contrast, the abovementioned tacit convention in the sense of Tajtelbaum (1957) assumes that every expression has its quotational name. This relation can be conceived of as instantiating logical polysemy in the

¹²According to a stronger version (cf. Chomsky 2015), LA requires agreement of features. Assuming agreement between $[iF : quot]$ features might open up an interesting path for investigating why DTs can range only over parts of pure and mixed quotation, but not those of Free Indirect Discourse or DTs. I leave it for future research.

sense of Asher (2011), and thus allow copredication. The second problem concerns movement of DTs: why can they raise covertly as in (47) but not overtly, as in (21)? I take this to instantiate an LF movement yielding the operator-variable relation as in (49)–(50). On the other hand, overt movement would affect the Φ -representation of QEs which is essential for their proper interpretation.¹³ However, I leave a detailed discussion for future research.

4.3 Interim conclusion No. 3

In this final section I showed how the account proposed in section 3 deals with the data presented in section 2. The analysis unearths two issues. First, VIs and QEs have been shown to share to much extent the properties of lower (v^*P) and higher (CP) phases in the sense of Chomsky (2013, 2015). VIs can be derived as transitive verb phrases by means of incorporation; the latter as a phrase whose edge allows a kind of \bar{A} -movement. Second, both types of discontinuity involve predicate formation which, while retaining differences typical for the two phases, are driven by the formal account of light heads. In this regard the way Cooper’s TTR framework allows to formalize Transfer and light heads allows a more general, recursive application. Importantly, the offered syntax-semantics mapping does not involve additional assumptions concerning structure building mechanisms (cf. Riemsdijk 2006a,b; Svenonius 2005, 2016).

5 Summary and future prospects

In recent years, Marantz’s idea of light heads yielding basic SM/C-I units has spread across distinct accounts. Still, though much attention has been paid to word formation, the syntax-semantics mapping of such heads has hardly been specified in type-theoretic terms. This paper partially fills in this gap. It shows how Cooper’s TTR framework allows to encode dependencies extending standard semantic computation. These are required in the process of predicate formation corresponding to the syntax-semantics mapping of Marantzian light heads. The offered solution allows to formalize lexicalization and derive two kinds of non-compositional expressions, securing their morphosyntactic transparency and islandhood. Above all, it demonstrates two scopes of discontinuity rooted either in a simple merger of a light head h^0 or in an \bar{A} -chain whose head crosses h^0 . The obtained results show how the general mechanisms of two basic Chomskyan phases, assuming the proper semantic formalism, allow to derive expressions that behave like both atomic and complex. Finally, the account proposes one way of specifying the role of labels which, apart from being said to be required by C-I (cf. Chomsky 2013), has remained formally unclear.

Apart from this, the paper opens up new paths for future research on dependencies between various types of semantic atomicity and syntactic structures. First, the proper formalization allows syntax (together with Labeling Algorithm) to play a more significant role in shaping non-logical constants. This allows further development of Marantz’s idea of interface units being derived by more general syntactic mechanisms, and not automatically inserted after Transfer. Second, while both VIs and QEs require generating non-logical constants, only the former involve encyclopaedic information. To this extent different derivation patterns and the proper approach to roots suggest that the lack of one-to-one relation between semantic atomicity and lexicon might have syntactic explanation. Third, the recursive operation of predicate formation allows to pursue the problem of complexity of lexicon as dependent on syntactic architecture. In particular, it provokes questions concerning the scope and limitations of predicate formation as following from derivation and labeling, but not from lexicon/interface-internal factors.

¹³Note that according to Definition 1 the variable is generated in a slot marked by the relevant trace.

References

- Adger, David & Gillian Ramchand. 2005. Merge and Move: *Wh*-Dependencies Revisited. *Linguistic Inquiry* 36 (2):161–193.
- Asher, Nicholas. 2011. *Lexical Meaning in Context: A Web of Words*. Cambridge: Cambridge University Press.
- Barrie, Michael & Audrey Li. 2015. The Semantics of (Pseudo) Incorporation and Case. In Olga Borik & Berit Gehrke (Eds.), *The Syntax and Semantics of Pseudo-Incorporation*. 159–188. Vol. 40. Leiden: Brill.
- Bierwisch, Manfred. 2014. The role of arbitrariness from a minimalist point of view. In Susi Wurmbrand, Peter Kosta, Lilia Schürcks, Steven Franks & Teodora Radev-Bork (Eds.), *Minimalism and Beyond: Radicalizing the interfaces*. 392–415. Amsterdam: John Benjamins.
- Borer, Hagit. 2013. *Structuring Sense. Volume III. Taking Form*. Oxford: Oxford University Press.
- Bošković, Željko. 2016. What is sent to spell-out is phases, not phasal complements. *MS., University of Connecticut*.
- Bruening, Benjamin. 2010. Ditransitive Asymmetries and a Theory of Idiom Formation. *Linguistic Inquiry* 41 (4):519–562.
- 2015. Idioms, Anaphora, and Movement Diagnostics. *MS., University of Delaware*.
- Cheung, Lawrence Y-L. 2015. Uttering the unutterable with *wh*-placeholders. *Journal of East Asian Linguistics* 24 (3):271–308.
- Chierchia, Gennaro. 1995. Individual-Level Predicates as Inherent Generics. In Gregory Carlson & Francis Jeffrey Pelletier (Eds.), *The Generic Book*. 176–223. Chicago: Chicago University Press.
- Chomsky, Noam. 1980. *Rules and Representations*. New York: Columbia University Press.
- 1986. *Barriers*. Vol. 13. Cambridge, Massachusetts: MIT press.
- 1995a. Bare Phrase Structure. In Héctor Campos & Paula Kempchinsky (Eds.), *Evolution and Revolution in Linguistic Theory*. 51–109. Washington, D.C.: Georgetown University Press.
- 1995b. *The Minimalist Program*. MIT Press: Cambridge, Massachusetts.
- 2001. Derivation by phase. In M. Kenstowicz (Ed.), *Ken Hale: a life in language*. 1–52. Cambridge, MA: MIT Press.
- 2004. Beyond Explanatory Adequacy. In Adriana Belletti (Ed.), *Structures and Beyond: The Cartography of Syntactic Structures*. 104–131. Vol. 3. Oxford: Oxford University Press.
- 2013. Problems of Projection. *Lingua* 130:33–49.
- 2015. Problems of projection: extensions. In ed. by Elisa Di Domenico. Ed. by Cornelia Hamann. Ed. by Simona Matteini, *Structures, Strategies and Beyond: Studies in honour of Adriana Belletti*. 1–16. Amsterdam/Philadelphia: John Benjamins.
- 2016. A dialogue with Noam Chomsky. Talk at Universitat Àutònoma de Barcelona.
- Chomsky, Noam, Ángel J. Gallego & Dennis Ott. 2018. Generative Grammar and the Faculty of Language: Insights, Questions, and Challenges. *Catalan Journal of Linguistics*.
- Chomsky, Noam & Morris Halle. 1960. The morphophonemics of English. *MIT RLE Quarterly Progress Report* 58:275–281.
- Clark, Herbert H. & Richard J. Gerrig. 1990. Quotations as demonstrations. *Language* 66 (4):764–805.
- Collins, Chris & Edward Stabler. 2016. A formalization of minimalist syntax. *Syntax* 19 (1):43–78.
- Cooper, Robin. 2005. Records and record types in semantic theory. *Journal of Logic and Computation* 15 (2):99–112.

- Cooper, Robin. 2012. Type Theory and Semantics in Flux. In Ruth Kempson, Tim Fernando & Nicholas Asher (Eds.), *Handbook of the Philosophy of Science, Philosophy of Linguistics*. 271–323. Vol. 14. Oxford: Elsevier.
- 2016. Frames as Records. In Annie Foret, Glyn Morrill, Reinhard Muskens, Rainer Osswald & Sylvain Pogodalla (Eds.), *Formal Grammar*. 3–18.
- De Vries, Mark. 2012. Notes on the Syntax of Quotation. Conference presentation: Quotation. Perspectives from Philosophy and Linguistics. Bochum: Ruhr University.
- Dobrovie-Sorin, Carmen & Claire Beyssade. 2012. *Redefining Indefinites*. Springer.
- Emonds, Joseph E. 1976. *A Transformational Approach to English Syntax: Root, Structure-Preserving, and Local Transformations*. New York: Academic Press.
- Gallego, Ángel J. 2016. Lexical items and feature bundling. Consequences for microparametric approaches to variation. In Luis Eguren, Olga Fernández-Soriano & Amaya Mendikoetxea (Eds.), *Rethinking Parameters*. 133–169. Oxford: Oxford University Press.
- Gehrke, Berit & Louise McNally. 2017. Idioms and the syntax/semantics interface of descriptive content vs. reference. MS.
- Hallman, Peter. 2015. Syntactic Neutralization in Double Object Constructions. *Linguistic Inquiry* 46 (3):389–424.
- Harley, Heidi. 1995. Subjects, events, and licensing. PhD thesis, MIT.
- 2017. The “bundling” hypothesis and the disparate functions of little v. 64. Roberta D’Alessandro, Irene Franco & Ángel J. Gallego (Eds.):3–28.
- Hindley, Roger J. & Jonathan P. Seldin. 2008. *Lambda-Calculus and Combinators: an Introduction*. New York: Cambridge University Press.
- Hirose, Tomio. 2003. *Origins of predicates: Evidence from Plains Cree*. London: Routledge.
- Hulsey, Sarah & Uli Sauerland. 2006. Sorting out Relative Clauses. *Natural Language Semantics* 14 (2):111–137.
- Johnson, Kyle. 2012. Towards deriving differences in how Wh Movement and QR are pronounced. *Lingua* 122 (6):529–553.
- Kelly, Justin Robert. 2013. *The Syntax-Semantics Interface in Distributed Morphology*. PhD thesis, Georgetown University.
- Koev, Todor. 2017. Quotational indefinites. *Natural Language & Linguistic Theory* 35 (2):367–396.
- Koster, Jan. 1996. Saussure meets the Brain. In R. Jonkers, E. Kaan & J. K. Wiegel (Eds.), *Language and Cognition 5. Yearbook 1992 of the Research Group for Linguistic Theory and Knowledge Representation of the University of Groningen*. 115–120. Groningen.
- Kotek, Hadas. 2014. *Composing questions*. PhD Thesis. Massachusetts Institute of Technology.
- Kratzer, Angelika. 1996. Severing the External Argument from its Verb. In Johan Rooryck & Laurie Zaring (Eds.), *Phrase Structure and the Lexicon*. 109–137. Dordrecht: Springer.
- Kremers, Joost. 2015. Morphology is in the eye of the beholder. *Linguistische Berichte* 2015 (243):245–294.
- Labelle, Marie. 2014. Roots in models of grammar. *Theoretical Linguistics* 40 (3-4):401–414.
- Larson, Richard K. 2017. On Dative Idioms in English. *Linguistic Inquiry* 48 (3):389–426.
- Levin, Beth & Malka Rappaport Hovav. 2005. *Argument Realization*. Cambridge: Cambridge University Press.
- Maier, Emar. 2014. Mixed quotation: The grammar of apparently transparent opacity. *Semantics and Pragmatics* 7:7–1.
- 2017. Mixed Quotation. MS, University of Groningen.
- 2018. Quotes as complements: A Kratzerian approach. In. MS., University of Groningen.
- Marantz, Alec. 1996. “Cat” as a phrasal idiom: Consequences of late insertion in Distributed Morphology. MS. MIT.

- Marantz, Alec. 1997. No Escape from Syntax: Don't Try Morphological Analysis in the Privacy of Your Own Lexicon. *University of Pennsylvania Working Papers in Linguistics* 4 (2):201–225.
- 2007. Phases and words. In S.-H. Choe (Ed.), *Phases in the Theory of Grammar*. 191–222. Seoul: Dong In.
- Mateu, Jaume & M Teresa Espinal. 2007. Argument structure and compositionality in idiomatic constructions. *The Linguistic Review* 24 (1):33–59.
- Matushansky, Ora. 2008. On the linguistic complexity of proper names. *Linguistics and philosophy* 31 (5):573–627.
- 2015. The other Francis Bacon: On Non-Bare Proper Names. *Erkenntnis* 80 (2):335–362.
- Munakata, Takashi. 2017. Why is labeling important? MS., *Yokohama National University*.
- Nunberg, Geoffrey, Ivan A Sag & Thomas Wasow. 1994. Idioms. *Language*:491–538.
- Obata, Miki. 2017. Is Transfer strong enough to affect labels? In Leah Bauke & Andreas Blümel (Eds.), *Labels and Roots*. 117–126. Berlin: Mouton de Gruyter.
- Oshima, David Yoshikazu. 2006. *Perspectives in reported discourse*. PhD thesis, Stanford University.
- Pafel, Jürgen. 2011. Two dogmas on quotation. In ed. by E. Brendel. Ed. by J. Meibauer. Ed. by M. Steinbach, *Understanding Quotation*. 249–276. Berlin/New York: Mouton de Gruyter.
- Piggott, Glyne & Lisa deMena Travis. 2017. Wordhood and word internal domains. In Heather Newell, Marie Noonan, Glyne Piggott & Lisa Travis (Eds.), *The Structure of Words at the Interfaces*. 41–73. Oxford: Oxford University Press.
- Potts, Christopher. 2007. The dimensions of quotation. In Chris Barker & Pauline I Jacobson (Eds.), *Direct compositionality*. 405–431. Oxford: Oxford University Press.
- Riemsdijk, Henk van. 2006a. Grafts follow from Merge. Mara Frascarelli (Ed.):17–44.
- 2006b. Towards a unified theory of wh-and non-wh-amalgams. In Yubun Suzuki, Mizuho Keizo & Ken-ichi Takami (Eds.), *In search of the essence of language science: Festschrift for Professor Heizo Nakajima on the occasion of his 60th birthday*. Tokyo: Hitsuji shobo.
- Roberts, Ian. 1991. Excorporation and Minimality. *Linguistic Inquiry* 22 (1):209–218.
- Roßdeutscher, Antje. 2014. When roots license and when they respect semantico-syntactic structure in verbs. In Artemis Alexiadou, Hagit Borer & Florian Schäfer (Eds.), *The Syntax of Roots and the Roots of Syntax*. Oxford: Oxford University Press.
- Rudnev, Pavel. 2015. “Dependency and discourse-configurationality: a study of Avar”. PhD Dissertation. University of Groningen.
- Safir, Ken. 2017. The A/A'-distinction as an epiphenomenon. MS, Rutgers University.
- Sağ, Yağmur. 2016. Complex Predication via Phrasal Adjunction to a Head Category. In Aaron Kaplan, Abby Kaplan, Miranda K. McCarvel & Edward J. Rubin (Eds.), *Proceedings of the 34th West Coast Conference on Formal Linguistics*. 431–438. Somerville, MA: Cascadilla Proceedings Project.
- Saito, Mamoru. 2012. Sentence Types and the Japanese Right Periphery. In Thomas Ede Zimmermann Günther Grewendorf (Ed.), *Discourse and Grammar: From Sentence Types to Lexical Categories*. 147–175. Berlin: Walter de Gruyter.
- Saito, Mamoru & Tomoko Haraguchi. 2012. Deriving the Cartography of the Japanese Right Periphery: The Case of Sentence-Final Discourse Particles. *Iberia* 4 (2):104–123.
- Salzmann, Martin. 2017. *Reconstruction and Resumption in Indirect A'-Dependencies: On the Syntax of Prolepsis and Relativization in (Swiss) German and Beyond*. Vol. 117. Berlin: De Gruyter Mouton.
- Šimik, Radek. 2011. *Modal existential wh-constructions*. Utrecht: LOT.
- Sudo, Yasutada. 2013. Metalinguistic Quantification: Evidence from Japanese Wh-doublets. Ms., Institut Jean Nicod.

- Svenonius, Peter. 2005. Extending the extension condition to discontinuous idioms. *Linguistic Variation Yearbook* 5 (1):227–263.
- 2008. Complex Predicates and the Functional Sequence. *Nordlyd* 35 (1):47–88.
- 2016. Spans and words. In Heidi Harley & Daniel Siddiqi (Eds.), *Morphological Metatheory*. 201–222. Amsterdam: John Benjamins.
- Tajtelbaum, Al. 1957. “It is impossible to be told anyone’s name”. *Analysis* 10:52–53.
- Takita, Kensuke, Nobu Goto & Yoshiyuki Shibata. 2016. Labeling through Spell-Out. *The Linguistic Review* 33 (1):177–198.
- Tarski, Alfred. 1933/1983. The concept of truth in formalized languages. In John Corcoran (Ed.), *Logic, semantics, metamathematics: papers from 1923 to 1938*. 152–278. Indianapolis: Hackett Publishing.
- 1964. A simplified formalization of predicate logic with identity. *Archiv für mathematische Logik und Grundlagenforschung* 7 (1):61–79.
- Wasow, Thomas, Ivan Sag & Geoffrey Nunberg. 1980. Idioms: An interim report. In, *Preprints of the XIIIth International Congress of Linguistics*. 87–96. Tokyo.
- Williams, Edwin. 2003. *Representation Theory*. Cambridge, MA: MIT Press.
- Wiślicki, Jan. 2017. An Argument for Zwart’s Merge. Quotation as a Challenge for Feature-Driven Phases. MS, University of Warsaw.
- Wurmbrand, Susi. 2017. The cost of raising quantifiers. *MS, University of Connecticut*.