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

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Contents

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Abstract

The present paper addresses the problem of syntax-semantics mapping of syntactically complex structures that are interpreted 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 direct quotation, whose parts do not obtain the idiomatic/quotational reading. The main result is a formal account of light heads providing the operation of predicate formation within cyclic derivations.

KEYWORDS: quotation, verbal idioms, predicate formation, Transfer, phases, labelling, light heads, dependent types, type theory, discontinuity

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 (Chomsky 1986) or phases (Chomsky 2001), mark parts of syntactic structures that are closed off as impenetrable wholes and in this sense treated as atomic.

In this paper I argue that the above idea is correlated with formal mechanisms building basic semantic terms from complex syntactic structures. Tellingly, I show that the fact that these mechanisms are not exceptional in the realm of syntax sheds new light on the mechanism of predicate formation. The proposed approach is supported by data from verbal idioms and direct quotation exemplified in (1):

(1) a. Mary gave Peter the cold shoulder. ⇝ Mary was unfriendly to Peter.
b. Peter said 'Yesterday such-and-such man came'.

While not new in the literature (Nunberg et al. 1994; Sudo 2013; Wasow et al. 1980), such expressions have not been discussed as contributing to the discussion on predicate formation within cyclic derivations. Their special property is the presence of elements exemplified in (1) by *Peter* and *such-and-such man*. Though occurring within the idiomatic/quotational context, they do not receive its special reading and show substantially different behaviour, e.g. with respect to movement. In this sense they give rise to discontinuity, which unearths interesting formal aspects of syntax-semantic mapping. I argue that idioms and quotation show crucial properties of Chomskyan phases, i.e. the lower verbal phase and the higher propositional phase, respectively. Moreover, the two types of discontinuity they represent contribute to the discussion on formal aspects of phases in the context of non-compositional expressions.

The paper is organized as follows. In section 2 I present atomic and structural properties of idioms/quotation, together with two types of discontinuity they involve. In section 3 I propose a type-theoretic account of Transfer, focusing on the role of light heads as investigated in Distributed Morphology (DM). In section 4 I show how the offered framework accounts for the data discussed in section 2 by making use of cyclic predicate formation. Section 5 summarizes the discussion.

2 The data

To begin with, I present some effects observed for idioms and quotation, 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. Importantly, I focus on the connection between these effects and the atomic/structural properties of idioms and quotation, leaving aside numerous other problems discussed in the literature (Hallman 2015; Sudo 2013).

2.1 Atomic and structural properties

Let us start from data showing that idioms and quotation behave like atomic expressions, both in terms of syntactic derivation and semantic computation. Perhaps the most significant fact is that neither of the two is straightforwardly compositional. In particular, they block substituting equivalent expressions for their parts:

(2) a. She showed Peter the door. $\not\Rightarrow$ She showed Peter the doorway.
b. He said 'Tarski is smart'. $\not\Rightarrow$ He said 'Tajtelbaum is smart'.

Second, they block *wh*-movement, regardless of the initial position (argument or adjunct) of *wh*, as well as *it*-clefting (I leave aside echo-questions and other metalinguistic readings):[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, idioms are more permissive than quotation. The former allow a wider variety, including passivization and Left Periphery movement (Hulsey & Sauerland 2006; Salzmann 2017), albeit not without constraints, as in (7)-(8). Quotation allows only split moving the first part to Left Periphery, with certain constraints as in (6b). Importantly, these cannot be easily explained if quotation is treated as an atomic terminal node:

(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]

The third interesting problem is copredication. Idioms seem to leave no margin for this effect, as in (9). Quotation is more permissive, at least for complete sentential structures, as in (10a)-(10b):

(9) #Mary showed Peter the door$_i$, 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.
b. He said 'Alfred$_i$ is smart' and I think he$_i$ is also rich.

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

c. ???He said 'Alfred is smart' and also rich.

Examples (10a)-(10b) are important for yet another reason. Note that the formal features [PERSON] and [NUMBER] of the quoted item *Alfred* are shared with the co-indexed pronoun appearing outside quotation and undergo agreement. This shows not only that quotation cannot be treated as atomic, but also that its morphosyntactic structure must remain transparent for grammatical operations. This can be seen especially clearly in the case quoted questions, as in (11):

(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, quotation allows any material between quotes, including gibberish (see Ginzburg & Cooper 2014; Partee 1973 for a discussion on some important consequences of this fact). Still, the acceptability of the whole sentence does depend on the quoting verb. While (11a) is perfectly fine, (11b) is at least not innocent. In this case the quoted content cannot be interpreted as a question. Rather, the speaker of (11b) treats it as a purely phonological string. Still, (11b) itself is not ungrammatical. But the converse of this situation, exemplified in (11c), is not acceptable, assuming that the quoted sentence is formulated in English. The problem is that the nature of this effect goes beyond simple morphosyntactic relations. According to the standard approach assumed in the generative tradition, *ask* selects the interrogative Q feature, originally inserted with C^0 and next valued on [Spec, CP] via the AGREE operation (Chomsky 2015b):

(12) I asked 'Who$_{Q:\text{INTERROG}}$ did you meet yesterday?'.
select Q:INTERROG

Still, data from Polish show that quotation involves more complex mechanisms. Contrary to indirect discourse, quotation does not require overt *wh*s (↑ stands for rising intonation):

(13) On spytał ✓'Idziesz? ↑'/ ✓'Czy idziesz? ↑'.
He.NOM asked 'go.2ND? ↑'/ 'whether go.2ND ↑'
He asked 'You are going?/Are you going?' [Polish]

(14) On spytał *idziesz (↑)/ ✓czy idziesz.
He.NOM asked go.2ND (↑)/ 'whether go.2ND
He asked whether you were going. [Polish]

In the case of indirect speech in (14) the explanation goes along the lines of (12). If there is no overt *wh*, the verb has no host of formal features to select. But it is less obvious how to explain the odd character of (11c) and the perfectly acceptable (13) in terms of features' architecture alone. What seems to be necessary is a kind of presupposition concerning the formal properties of what is being quoted. In both cases it is presupposed that the quoted phrase is a question; hence the odd character of (11c) and the acceptability of (13). In any case, for that kind of presupposition to be definable, features appearing on the elements of quotation must be transparent for computation taking place at the higher stage of derivation (see Saito 2012; Saito & Haraguchi 2012 for further discussion).

As for idioms, in addition to movement as in (7)-(8), their transparency can be inferred from the AGREE relation holding between idiomatic NPs and their modifiers, as in (15):

(15) 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 proverbial music. [Polish]

Such expressions, 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 definable, the features [SG] and [NEUTR] of *piwo* 'beer' (the part of idiom) must be shared with those of *przysłowiowe* 'proverbial'.

Tu sum up, data from compositionality, movement, copredication and agreement show that idioms and quotation behave like both atoms and complex structures. Now I move to expressions that not only affect their atomic character, but also show apparently different properties.

2.2 Discontinuity

In section 1 I mentioned two types of expressions, repeated below as (16):

(16) a. Mary gave Peter the cold shoulder.
b. Peter said 'Yesterday such-and-such man came'.

In these examples *Peter* and *such-and-such man* do not share the reading of the surrounding idiomatic/quotational context. Accordingly, such idioms/quotational expressions are discontinuous in the sense that the non-compositional context they involve (Pagin & Westerståhl 2010) is broken. For the sake of the present discussion, I call them *context breakers* (CBs). In this subsection I discuss various types of discontinuity they give rise to.

The first problem is extensionality. Idiomatic CBs are interpreted extensionally, undergoing substitution *salva veritate* as in (17), contrary to (2a):

(17) She gave Peter the cold shoulder. ⇒ She gave him$_{Peter}$ the cold shoulder.

In the case of quotation the problem in more complex. Quotational CBs have special markers, e.g. doublets as in (18a)-(18b) or additional markers of indefiniteness as in (18c):

(18) 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' compl. 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 CBs are not, under the prominent reading, interpreted as strings. (18a) does not mean that John uttered the string ⌜Yesterday⌒such⌒and⌒such⌒man⌒came⌝. Nevertheless, CBs are not interpreted completely outside the quotational context. Rather, they seem to be interpreted as variables ranging over parts of quoted expressions. Thus (18a) roughly means that John uttered a result of substituting an expression having the feature [+PERSON] for $\mathcal{X}$ in the string ⌜Yesterday $\mathcal{X}$ came⌝.

In this regard quotational CBs show the effect typical for Ā-movement. The difference is that while *wh*s denote sets of individuals/events (see Kotek 2014, but also Šimik 2011, a.o., for an alternative view), quotational CBs denote strings. This goes in hand with the fact that such CBs

can appear in proper names,[2] which also have been conceived of as having phonological forms encoded in their semantic representations (Matushansky 2008, 2015):

(19) 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 CB 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 CBs. The former are interpreted completely outside the idiomatic context. It is then not surprising that, unlike idioms proper, they allow both copredication and movement, as in (20):

(20) 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 CBs are partially interpreted within the quotational context (they provide variables ranging over parts of quoted expressions) and thus share some of its properties. Perhaps the most significant effect is islandhood, 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 expressions and an especially flexible movement to Left Periphery in Polish (Szczegielniak 2006), CBs might be expected to undergo topicalization. (21) shows that, contrary to idioms, quotation blocks movement, also for CBs.

2.3 Interim conclusion No. 1

Let us summarize the data from idioms and quotation discussed above:

	EXTENSIONALITY	MOVEMENT	COPREDICATION	AGREE
Idioms	×	constrained	×	✓
Quotation	×	×	✓	✓
CB_{idiom}	✓	✓	✓	✓
CB_{quot}	✓	×	✓	✓

Table 1: Data summary

Idioms and quotation are similar in that they behave both like atoms (blocking the extensional interpretation and movement) and complex structures (involving agreement). They differ is that quotation allows copredication. The corresponding CBs differ from each other w.r.t. two properties. First, quotational CBs are not interpreted as quotation; instead they provide variables ranging over its parts. Second, they are blocked for overt movement. These effects are absent in

[2]Some languages provide special markers for proper names, like Japanese *nan to ka* (lit. *wh*+compl.+quest.), e.g. *nan to ka -ko*. The CB ranges over strings that form a name ending with *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 CBs in Chinese.

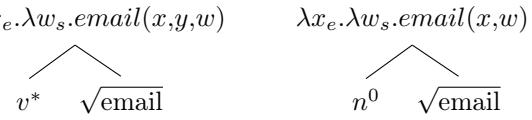
the case of idioms. The overall conclusion is twofold. First, the grammar must secure the morphosyntactic transparency of idioms and quotation, as well as their atomic properties. Second, it must specify formal mechanisms underlying the two types of discontinuity.

3 The framework: from syntax to predicate formation

The conflict between the atomic and structural properties of idioms/quotation suggests an interesting property of their formal structure. First, in order to secure the relevant morphosyntactic relations (e.g. AGREE), they must be derived as complex structures. Second, at some stage of derivation these complex structures must be marked as non-compositional atoms.

Perhaps the most closely related idea in the generative inquiry is that of roots and light heads (Marantz 1995, 1997). Roots are carriers of purely conceptual information, but they cannot be interpreted alone. Their formal interpretability is enabled by the merger of category-defining light heads. Sticking to formal representations assumed in the tradition following from Heim & Kratzer (1998), toy structures for the root $\sqrt{\text{email}}$ allowing the verbal (on the left) and the nominal (on the right) interpretation look as follows:

(22)



The non-compositional content is carried by the root. Formal features provided independently by light heads specify the interpretation. Once this structure is derived, the information carried by roots is lexicalized as a semantic term representing the relation of x emailing y in w or of x being an email in w.

In DM a non-compositional meaning is not specified pre-syntactically for terminals. Rather, insertion of such content is specified for chunks of derivation (McGinnis-Archibald 2016). This property makes it potentially attractive for the present discussion. Nevertheless, there are at least three problems in adopting this machinery to the discussed material. First, in toy examples as in (22) the non-compositional meaning is specified for the single item $\sqrt{\text{email}}$. However, what we need is a machinery yielding complex structures and then turning them into atoms. Second, light heads as in (22) mark points of lexicalization.[3] While verbal idioms fit with such mechanisms (Marantz 1996), quotation does not, primarily because its meaning is not determined by encyclopaedia. Third, an operation turning syntactic structures into atoms should account for two different types of CBs. Recall that quotational CBs provide variables ranging over units determined by the surrounding context, i.e. over parts of quotation. By contrast, idiomatic CBs do not receive the idiomatic reading in any sense. On top of that, there is an apparent lack of formal semantic accounts 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) a. $\sqrt{\text{full}} = \begin{cases} \lambda y.\lambda z.full(y,z) \\ \lambda e.full(e) \end{cases}$ [Roßdeutscher 2014, irrelevant details omitted]

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

[3] The range of functions assigned to light heads as inspired by Marantz's proposal 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 (Kratzer 1996), to be unrelated to the present discussion.

However, neither of the two accounts provides a formal mechanism showing how exactly the obtained λ-term depends on lexical properties carried by the root and on formal properties contributed by the light head. And this is the right starting point for the discussion to follow. I am going to argue that a satisfactory result can be achieved under the proper formalization of Transfer. In subsection 3.1 I provide a type-theoretic account of Transfer making use of Type Theory with Records (TTR; Cooper 2005 *et. seq*). In subsection 3.2 I show how this proposal captures predicate formation provided by light heads.

3.1 Transfer: preliminaries

One assumption lying at the heart of generative grammar is that structures derived within Narrow Syntax provide neither semantic nor phonological representations. They are sets of formal features, e.g. [CASE] or [WH]. In order to yield the relevant representation, the grammar makes use of two interfaces, i.e. the conceptual-intentional (C-I) and the sensory-motor (SM). At proper points, the operation called Transfer ships off syntactic structures to the two interfaces. These deliver the semantic and phonological representation, respectively.[4] This general model of relation holding between syntax, semantics and phonology is called the inverted Y model.

As signalised above, I argue that problems discussed in section 2 can be solved under the right formalization of Transfer. In order to do this, I make use of TTR (Cooper 2005, 2012, 2016, 2018). Let us start from its general architecture. TTR is a type-theoretic framework matched with the HPSG approach to syntax (Sag et al. 2003). Rather than assuming only simple typing, say $x : e$ or $x : \langle e, t\rangle$, i.e. x typed as e or as a function from e to t, the framework provides more complex records. Such records are sets of fields, each pairing a label with a type. To illustrate, the record rec in (24) is a set of three fields. It provides three objects a_1, a_2, a_3 labelled l_1, l_2, l_3 and typed σ, τ, ρ, respectively:

$$(24) \quad rec : \begin{bmatrix} l_1 = a_1 & : \sigma \\ l_2 = a_2 & : \tau \\ l_3 = a_3 & : \rho \end{bmatrix}$$

In order to select one field, TTR makes use of functions from records to one of their fields specified by the label. Thus the function in (25) maps the record in (24) onto the object labelled l_2:

$$(25) \quad \lambda rec : \begin{bmatrix} l_1 = a_1 & : \sigma \\ l_2 = a_2 & : \tau \\ l_3 = a_3 & : \rho \end{bmatrix} .rec.l_2$$

While in general I stick to the formal semantics framework of Heim & Kratzer (1998), I use TTR to formalize Transfer, i.e. a part of grammar that, being a meta-theoretic operation (Chomsky 2004), lies beyond the scope of formal semantics. Let γ be a set-theoretic object corresponding to a syntactic structure and consider the following formula:

$$(26) \quad \lambda\gamma : \begin{bmatrix} \text{ph} & : phon \\ \text{sem} & : \sigma \end{bmatrix} .\gamma.k \qquad \text{, where } k \in \{\text{ph}, \text{sem}\}$$

According to (26), a syntactic object (SO) γ is a term whose type is a record consisting of two fields, i.e. the SM and C-I representation. Transfer within the inverted Y model corresponds to

[4] The exact account varies across frameworks. In the P&P era Transfer was defined on LF, in MP on a phase complement (but see Bošković 2016). Most recently, Chomsky (2016a) and Chomsky et al. (2019) 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.

typing an SO as a record consisting of the above two fields and then selecting one of them. To illustrate, in (27) Transfer maps a nominal *email* typed as a record onto its C-I representation:

$$(27) \quad \lambda email : \begin{bmatrix} \text{ph} = /\text{email}/ & : phon \\ \text{sem} = \lambda x_e.email(x) & : \langle e, t \rangle \end{bmatrix} .email.\text{sem}$$

Still, as it stands TTR does not contribute much to the current literature (Collins & Stabler 2016; Gotham 2018). Note however that (26) works under standard assumptions only insofar as the meaning of an SO reaching Transfer is computable, i.e. it has a formal semantic representation. But one consequence of Marantz's approach is that roots are carriers of formally underspecified, purely conceptual information. Light heads, in turn, provide only formal properties, carrying no conceptual information. Accordingly, the simple account as in (22) does not provide a formal semantic computation of structures as in (23), where both roots and light heads lack standard C-I representations. Such structures require a more fine-grained formal account. And this is exactly the area where TTR enriches the general architecture of generative grammar and opens up a new path for solving problems discussed in section 2.

3.2 Syntax-semantics mapping of light heads

There are a number of approaches in the generative literature to word-formation understood as the syntax-phonology mapping of basic SM units (Kremers 2015; Piggott & Travis 2017). However, the problem of predicate-formation mapping syntactic structures onto atomic C-I units is much 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 took leaving predicates as undefined metalogical notions to be useful '[f]or some reasons of both intuitive and formal nature' (Tarski 1964:64). So, what seems to be necessary for securing semantic computability of structures as in (22) and not departing from Tarskian semantics is a mechanism 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.

Not accidentally, one basic goal of DM is to formulate a framework in which syntax is the proper element of grammar deriving Saussurean form-meaning pairings (McGinnis-Archibald 2016). The relevant phonological and semantic conceptual (non-compositional) information is carried by roots. However, it is provided outside Narrow Syntax by vocabulary and encyclopaedia, depending on the syntactic context of roots, in particular the surrounding light heads. Traditionally, the SM/C-I representation is provided when the relevant chunks of syntactic structures undergo Transfer to the interfaces.[6] In this sense syntax provides instructions and timing for the insertion of phonological/conceptual information to initially underspecified roots.

For that kind of framework, the grammar must encode at least two types of dependencies. First, the conventional dependency between the conceptual content and the phonological form used to express this content, i.e. the Saussurean form-meaning pairing. Second, the systematic dependency between formal features contributed by light heads and the properly selected form-meaning pairing. To use the example in (22), formal features of v^* must be combined with

[5] Hirose (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 relating the three properties with predicates.

[6] See Haugen & Siddiqi (2013) for a discussion on various approaches to the problem of insertion of phonological/conceptual information and Borer (2013) for a related yet different general picture.

the conceptual content of x emailing y, while formal features of n^0 must be combined with the conceptual content of x being an email. And encoding that kind of dependencies is exactly the difficulty that TTR can naturally solve, thanks to the system of dependent types encoded within a single record. To illustrate the TTR style of encoding such dependencies, let us have a look at the record corresponding to the meaning of *temperature* (Cooper 2016:4):

(28) $rec : \begin{bmatrix} \mathrm{c}_1 = x & : Real \\ \mathrm{c}_2 = loc & : Loc \\ \mathrm{s} = e & : temp(loc, x) \end{bmatrix}$
where *Real* is a type of real numbers, *Loc* a type of locations, and e a situation

The meaning of *temperature* is formalized as an object of type $temp(loc, x)$. The type provides a dependency between locations and real numbers, all encoded within a single record.

In this framework information carried by a single item can be selected as in (26)–(27) and encoded as dependent on other elements, as in (28). These two properties open up a path for a precise formalization of roots and light heads. Let us start from the former. As mentioned above, roots are carriers of phonological and conceptual information, whose combination corresponds to the Saussurean arbitrariness. This can be encoded into grammar by letting roots be records consisting of two types of fields. First, fields corresponding to phonological representations ϕ selected at the SM interface. Second, situations w such that phonological representations carried by the root are conventionally used to refer to w. Accordingly, a bare root $\sqrt{\gamma}$ can be formalized as carrying the following pieces of information:

(29) $\sqrt{\gamma} : \begin{bmatrix} \mathrm{ph}_1 = \phi_1 & : \textsc{phon} \\ \dots & : \textsc{phon} \\ \mathrm{s}_1 = sit_1 & : conv(\phi_1, w_1) \\ \dots & : conv(\phi_i, w_i) \end{bmatrix}$
where $conv : \{\langle \phi, w \rangle\} \rightarrow \{w\}$ and $\{w\}$ is a set of situations such that for every $w_i \in \{w\}$ there is an utterance form ϕ conventionally used to refer to w_i.

In this approach the root $\sqrt{\gamma}$ (a syntactic object) is typed as the record (a type-theoretic object). The record provides phonological representations as well as conventional links between these representations and the conceptual semantic content. The content is encoded as a set of situations the users of language refer to by means of the phonological representations at hand. This conventional pairing is a formal representation of Saussurean arbitrariness. Still, such bare pairings are not formal semantic terms.

To illustrate, take again the root $\sqrt{\text{email}}$. Assume, for the sake of simplicity, that it has exactly one phonological representation and two morphosyntactic variants, i.e. a transitive verb and a noun. Then the syntactic object $\sqrt{\text{email}}$ is typed as follows:

(30) $\sqrt{\text{email}} : \begin{bmatrix} \mathrm{ph} = /\text{email}/ & : \textsc{phon} \\ \mathrm{s}_1 = sit_1 & : conv(/\text{email}/, w_1) \\ \mathrm{s}_2 = sit_2 & : conv(/\text{email}/, w_2) \end{bmatrix}$

In this simple example $conv(/\text{email}/, w)$ delivers two kinds of situations. One where the phonological representation /email/ is used to refer to a situation in which x emails y, and another where it is used to refer to a situation in which x is an email.

In this sense roots (or, to speak more precisely, their type-theoretic representations) are overloaded. They carry all possible pieces of conceptual information (Labelle 2014). In order to become formally interpretable, the relevant information must be selected and prepared for

semantic computation. Put differently, the conceptual sound-meaning pairing must be turned into a semantic term, e.g. a predicate or an atomic constant. I let this part of computation be secured by category-defining light heads. In this regard 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? Labelling is the process of providing that information. [Chomsky 2013:43]

Following this idea, I take labelling by Marantzian light heads as corresponding in semantics to building a predicate from arbitrary sound-meaning pairings encoded in roots.

In order to account for this, first I define a type-theoretic object encoding the role of a light h^0, as in (22). Such an object must provide dependencies between formal features encoded in the head and the selected conceptual information carried by the root it is merged with. Focusing on the C-I interface, let us then consider labels encoding (perhaps among other things, cf. Kučerová 2018a,b; Munakata 2017) formal properties of predicates, i.e. arity, types and truth conditions. The relevant dependencies can be encoded within a single record standing for the type of h^0. To see this, assume a syntactic structure $[_\beta\, h^0\, \alpha]$ (i.e. an SO β with two daughters h^0 and α) and consider h^0 typed as follows:

(31) $$h^0 : \left[\begin{array}{ll} \mathrm{ph}_1 = \sigma_1 & : \textsc{phon} \\ \ldots & : \textsc{phon} \\ \mathrm{c}_1 = x & : \textsc{type} \\ \ldots & : \textsc{type} \\ \mathrm{s}_h = sit_h & : h'(x, \ldots, w_h) \\ \mathrm{cont} = \lambda r : \textsc{type}\left(\left[\begin{array}{ll} \mathrm{ph}'_1 = \Phi_1 & : \textsc{phon} \\ \ldots & : \textsc{phon} \\ \mathrm{sem} = \lambda x \ldots \lambda w_h . f(x, \ldots, w_h) & : \textsc{type} \\ \quad \text{such that } g(\Phi_k, f(x, \ldots, w_h)) & \end{array}\right]\right) & : \langle \textsc{type}, \textsc{type} \rangle \end{array}\right]$$

where:

i. the field $\mathrm{ph}'_1 = \Phi_1 : \textsc{phon}$ stands for a phonological representation of β such that Φ_1 is a concatenation of phonological representations ph of all terminals (roots or light heads) dominated by β;

ii. for every ph in i. there is a field $\mathrm{s} = sit : conv(\phi, w_i)$ within the same record where $w_i = w_h$;

iii. $g : \langle \Phi_k, f(x, \ldots, w_h) \rangle \mapsto const(x, \ldots, w_h)$ is a function from a phonological form Φ_k conventionally linked with $w_i = w_h$ and a relation $f(x, \ldots, w_h)$ of type $h'(x, \ldots, w_h)$ to the particular relation $const(x, \ldots, w_h)$ lexicalizing the meaning uttered as Φ_k.

Let us now pause and explain step-by-step all the elements of the record in (31). The syntactic object h^0 is typed as a record consisting of four kinds of fields. First, there is a set of phonological representations, each labelled ph. Standardly, they spell out functional morphemes, e.g. *-ism* in *pluralism*, *activism*, etc. Second, there is a set of variables labelled c. They are introduced on the basis of formal features of h^0 and matched with the argument structure of the final predicate created by the merger of h^0 and α. To illustrate, Transfer of the transitive verbal head v^* provides one variable for an agent and one for an object. Third, there is a field standing for the type of situations picked out by the derived item β. It involves the arguments $\mathrm{c}_1, \ldots$ and situations in which the type of relation described as the translation $h'(x, \ldots, w_h)$ holds. To use the same example, for the transitive verbal head v^*, s_h reduces the set of possible relations to

those represented by any transitive verb, i.e. $v^{*\prime}(x, y, w_{v^*})$. Finally, the fourth field is a predicate-formation function labelled cont. It is a polymorphic function from records to records. It takes as an argument a record corresponding to the output of Transfer of the sister of h^0. It returns a record with a set of phonological representations labelled ph'_1 and a full-fledged predicate labelled sem. All fields of the new record are restricted relative to all the terminals (roots and light heads; see i.) dominated by β. First, phonological representations are restricted to those for which the relevant roots provide conventional sound-meaning pairings. Situations within those pairings are compatible with situations w_h provided by the light head (see ii.). Thus the new predicate lexicalizes the conceptual content carried by roots (see iii.). Second, the relation $f(x, \ldots, w_h)$ within the new predicate $\lambda x \ldots \lambda w_h . f(x, \ldots, w_h)$ is a formal semantic term instantiating a more general type $h'(x, \ldots, w_h)$. It is uttered by a conventionally assigned utterance form Φ. The arbitrary character of the last restriction corresponds to the arbitrary character of Saussurean sound-meaning pairings.

To see how the last field in (31) works, consider the left-hand side tree in (22) and the root in (30). Assume that w_1 is a situation in which x emails y. The record specified for the transitive verbal head v^* introduces two arguments $x : e, y : e$ and the general type of relation $v^{*\prime}(x, y, w_{v^*})$. Irrelevant details aside, the computation proceeds as follows:

(32) $[\![[_\beta\, v^* \sqrt{\text{email}}]]\!]^g =$

$$\lambda r : \text{TYPE} \left(\begin{bmatrix} \text{ph}'_1 = \Phi & : \text{PHON} \\ \text{sem} = \lambda y.\lambda x.\lambda w_{v^*}.f(x, y, w_{v^*}) & : \langle e, \langle e, st\rangle\rangle \end{bmatrix} \right) \left(\begin{bmatrix} \text{ph} = /\text{email}/ & : \text{PHON} \\ \text{s}_1 = sit_1 & : conv(/\text{email}/, w_1) \\ \text{s}_2 = sit_2 & : conv(/\text{email}/, w_2) \end{bmatrix} \right) =_{\text{FA}}$$

$$\begin{bmatrix} \text{ph}'_1 = /\text{email}/ & : \text{PHON} \\ \text{sem} = \lambda y.\lambda x.\lambda w_{v^*}.f(x, y, w_{v^*}) & : \langle e, \langle e, st\rangle\rangle \\ \quad \text{s.t. } g(/\text{email}/, f(x, y, w_{v^*})) & \end{bmatrix} =_g$$

$$\begin{bmatrix} \text{ph}'_1 = /\text{email}/ & : \text{PHON} \\ \text{sem} = \lambda y.\lambda x.\lambda w_{v^*}.email(x, y, w_{v^*}) & : \langle e, \langle e, st\rangle\rangle \end{bmatrix}$$

First, the field labelled cont within the record specified for v^* is selected by the C-I interface for the sake of semantic computation. The predicate-formation function takes the whole record specified for its syntactic sister. It returns a new record consisting of two fields. First, the phonological representation of β labelled ph'_1. Second, the new predicate labelled sem. Two properties of the new predicate, i.e. the argument structure and the kind of relation it instantiates (the transitive verbal relation), are specified by the formal features of the syntactic head v^*. The output of Functional Application (FA) proceeding as defined in (31) is a new record with a single phonological representation /email/ and the semantic representation underspecified w.r.t. the predicate constant. Next, the function g delivers a new predicate by relating two pieces of information. First, as defined in (31, iii.), the phonological form conventionally used to refer to situation $w_1 = w_{v^*}$ in which x emails y. Second, the underspecified relation $f(x, y, w_{v^*})$. As a result, the whole structure β is lexicalized as a transitive verb *email* and formalized as the predicate $\lambda y.\lambda x.\lambda w_{v^*}.email(x, y, w_{v^*})$.

3.3 Interim No. 2

In this section I presented a formal account of Transfer, focusing on roots and light heads. There are two motivations behind the proposed TTR-based account. First, it provides a convenient formalization of Transfer fitting the inverted Y model. Second, it encodes dependencies between formal properties and carriers of conceptual information. Such dependencies are required by light heads within the Chomsky-Marantz approach, but go beyond standard semantic composition.

In section 4 I present a third motivation, showing how the proposed framework accounts for predicate formation defined for chunks bigger than single roots, required by idioms and quotation as discussed in section 2.

4 Predicate formation and two scopes of discontinuity

For simple cases like (22), the offered account does not contribute more than lexicalist (Levin & Hovav 2005; Williams 2003) or derivational approaches as in (23). Leaving aside purely theoretical considerations, not much hinges on whether it is assumed 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 proposed mechanism opens up new paths of deriving as well as computing idioms and quotation as structures 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 the lexicalist approach. Subsections 4.1 and 4.2 address the problem of idioms and quotation, making use of layered verbal structures and $\bar{\text{A}}$-dependencies within the process of predicate formation. In subsection 4.3 I discuss some crucial consequences of the proposed approach.

4.1 Double *v* construction: idioms

The computation in (32) shows how Transfer maps the syntactic structure $[_\beta\, h^0\, \sqrt{\text{email}}]$ onto the predicate. The next problem is how this works for lexicalization taking place in successive syntactic cycles, being applied to chunks whose parts have already been lexicalized. This puzzling problem divided also the work of Marantz. Contrary to the earlier work (Marantz 2007) arguing that lexicalization should be limited to the first merger of a category-defining head, in his latter works (Marantz 2010, 2013) he proposes that some (also phasal) heads can be semantically null. In such cases lexicalization applies to bigger chunks; operations taking place at lower cycles are somehow neglected in the computational process. The strength of the present proposal lies in that, dispensing with semantically null phasal heads, it provides a generalized lexicalization defined for successive syntactic cycles.

In the generative tradition, an account providing lexicalization within derivational cycles[7] is the transitive verbal phase, with v^* a phase head (Chomsky 2013, 2015b). The general schema is depicted in (33) below, irrelevant details omitted:

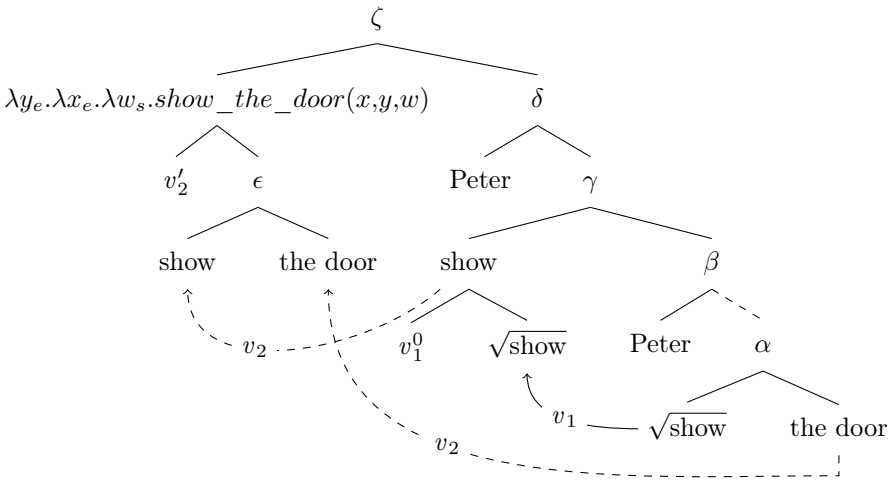
(33) $[\,\langle v^*, \sqrt{see}\rangle\,[\,\ldots[\,\sqrt{see}$ Mary$\,]\ldots]]$

The uncategorized root $\sqrt{see}$ is incorporated to the phasal head v^*. The obtained pair $\langle v^*, \sqrt{see}\rangle$, treated by Chomsky (2015b) as an amalgam (the idea already present in Chomsky 1995b), marks lexicalization and yields a transitive verb *see*.

Let us now have a look at idioms. As summarized in Table 1, the grammar should yield semantic atoms (the lack of extensionality and copredication) and block movement. In the same time it should retain morphosyntactically transparent structures, e.g. for the sake of AGREE. On top of that, it must leave CBs outside the idiomatic context. I make use of the same core mechanism as in (33), i.e. incorporation do v^0. The crucial difference is that I apply it to a more complex structure, which corresponds to the morphosyntactic complexity of idioms. To see this, consider the following derivation:

[7] See Fenger (2019) and Marantz (2007) for reasons behind matching lexicalization with syntactic cycles.

(34)



Let us now move through the derivation in (34) step-by-step. For the sake of simplicity, I assume that *the door* and *Peter* are derived as standard nominals, by mechanisms shown in (22) and (32). Then the computation proceeds as follows (irrelevant details omitted):

(35)
i. Forming γ. Without advocating any particular account of ditransitives, I make a widely shared assumption (Bruening 2010; Harley 1995; Larson 2017) that the root/verb raises to the light head (perhaps via other heads). Accordingly, $\sqrt{\text{show}}$ is incorporated to v_1^0, creating the lexicalized verbal head *show*. The result reached at the level of γ is a standard structure of the ditransitive verb *show*.

ii. *Peter* moves to [Spec,γ] satisfying the EPP feature of *show*.[8]

iii. Forming ζ. The verb *show* ($\sqrt{\text{show}}$ pied-piped to v_1^0) and *the door* are incorporated to the verbal head v_2', reaching the phase level. The new head *show the door* is formed. If no movement to the edge of v_2' takes place (Boeckx 2010), the phase is complete and Transfer ships off the phase complement *Peter* to the interfaces.[9]

The structure in (34) has two important properties. First, it divides the derivation into at least two phases. The lower one, reached at the level of ζ and containing a layered verbal structure; and the upper one, formed over ζ. Second, incorporation to v_2' of a chunk bigger than a single root. Let us have a look at some immediate consequences of these two properties.

Providing two phases secures at least three properties of idioms, i.e. (i) syntactic transparency, (ii) the special status of CBs and (iii) copredication. As for (i), the lower layer reached at the level of γ provides a typical structure for the non-idiomatic reading of *show Peter the door*, i.e. a ditransitive verb with two arguments. At the level of δ all formal features undergo computation. Thus standard morphosyntactic relations required by the effect exemplified in (15) are retained. Moving to (ii), the indirect object *Peter* becomes a phase complement. It is shipped off to the interfaces in a different phase than the idiom proper. Thus it is computed separately, exactly

[8] See Chomsky (2015b) for a detailed discussion on this step. As for the problem of linearization, without going into details (Chomsky et al. 2019), I assume that SM retrieves the right order from the lower copy of *Peter*.

[9] I do not go in this paper into the problem of Feature Inheritance required by Chomsky (2013, 2015b) to pass down all the formal features of a phasal head to the next lower head. Under this approach the domain of Transfer is shifted to the sister of the lower head. First, the mechanism itself was questioned (Carstens & Diercks 2013) and weakened also by Chomsky et al. (2019). Second, recent findings show that inheritance of formal features is much more complex (Martinović 2019), splitting only some features accross various heads. Accordingly, it cannot affect the domain of Transfer in the sense of Chomsky (2013, 2015b).

as expected. It neither receives the idiomatic reading, nor is it blocked for copredication, as in (20a). Moreover, occupying the [Spec, δ] position, it is still able to move to the phase edge over v'_2. Thus it can avoid being trapped for movement within a phase complement (Phase Impenetrability Condition; Chomsky 2000 *et seq.*), as required for some idiomatic structures, e.g. as the one in (20b). As for (iii), the phase is reached at the level of ζ. Thus the first chunk of derivation undergoing Transfer is the indirect object *Peter*, not the direct object *the door*. This explains the unavailability of copredication, as in (9). To see this, consider the widely accepted assumption that copredication is possible provided the relevant lexical items (LIs) are logically polysemous in the sense of Asher (2011), as in (36):

(36) He wrote and then burned the book.

For (9) to be acceptable, the derivation must have yielded the standard and the idiomatic nominal *door*, stored in the lexicon and logically polysemous to each other. However, lexicalization in (34) targets the whole idiom. The nominal *door* is neither lexicalized in its idiomatic meaning, nor is it (even as a DP *the door*) sent to the interfaces. Nothing like an idiomatic *door* is a candidate for insertion of non-compositional content. Thus it is not stored in the lexicon and there are no relevant objects for defining that kind of polysemy; hence the lack of copredication.

Even more important consequences follow from the second property of the structure in (34), i.e. incorporation to v'_2. First, it accounts for the islandhood of idioms, as illustrated in (3), (5a), (7b) and (8). Once the whole idiom is incorporated to the head, its constituents are expected to move only when pied-piping the whole incorporated material. Except highly constrained cases justifying excorporation (Roberts 1991), such incorporated structures block movement. Second, incorporation to v'_2 and the following lexicalization yielding the verb *show the door* account for the idiosyncratic semantics of idioms. In particular, the present proposal overcomes the problematic issue of compositionality within idioms (see Gehrke & McNally 2019; Mateu & Espinal 2007, both assuming non-trivial extensions of compositional semantics).

Putting those elements together, the derivation in (34) provides a slightly more complex structure than the one in (33), but essentially it applies the same core mechanism. By doing so it derives a lexicalized verbal head corresponding to the idiom, retaining its morphosyntactic complexity below the head. The crucial difference between (33) and (34) is that in the latter incorporation to v' applies to the whole VP, not just to the root. The problem is not new in the literature. Such operations, though recognized as necessary already in the pre-MP era (Baker 1988), were banned in various approaches (e.g. the structure-preserving hypothesis in Emonds 1976). One way to circumvent this obstacle is to treat idioms as partially similar to pseudo-incorporating structures (Barrie & Li 2015; Sağ 2016). Another is to follow Chomsky (1995a,b) in allowing YP incorporation to X^0 'if the LF interface permits such word structures' (Chomsky 1995a:76).[10] Within the present account this condition can be reformulated in terms of semantic computability which, in turn, is secured by the proposed machinery. As discussed in subsection 3.2, carriers of conceptual information in the form of roots $\sqrt{\text{show}}$ and $\sqrt{\text{door}}$ have the relevant conventional content encoded in their records, as in (29). Formalized as $conv(/show/, w^d)$ and $conv(/door/, w^d)$, they provide links between the two phonological forms and the situation w^d in which one individual dismisses another. The only assumption that must be added to this is that w^d belongs to the set $\{w_{v'}\}$ of situations where a relation $v''(x, y, w_{v'})$ opening up a slot for subject and indirect object holds. Then the predicate-formation function, based, as stated in (31), on conventions encoded in terminals, takes as an argument the record in (37). The

[10] This is coherent with the framework of Chomsky (2013, 2015b), where labels are the output of Labelling Algorithm defined as 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. Then blocking banned structures can take place only at the semantic interface.

record contains, among other things,[11] fields representing the phonological and the conceptual information carried by the terminals:

$$(37)\quad r_i : \begin{bmatrix} \text{ph} = /\text{show the door}/ & : \textsc{phon} \\ \text{s}_1 = sit_1 & : conv(/\text{show}/, w^d) \\ \text{s}_2 = sit_2 & : conv(/\text{door}/, w^d) \\ \dots & \end{bmatrix}$$

Then, leaving aside irrelevant details, the computation proceeds along the lines of (32), i.e.:

$$(38)\quad [\![[v'_2\ [\text{show the door}]]]\!]^g =$$
$$\lambda r : \textsc{type}\left(\begin{bmatrix} \text{ph}'_1 = \Phi & : \textsc{phon} \\ \text{sem} = \lambda y.\lambda x.\lambda w_{v'}.f(x,y,w_{v'}) & : \langle e,\langle e, st\rangle\rangle \end{bmatrix}\right)(r_i) =_{\text{FA}}$$
$$\begin{bmatrix} \text{ph}'_1 = /\text{show the door}/ & : \textsc{phon} \\ \text{sem} = \lambda y.\lambda x.\lambda w_{v'}.f(x,y,w_{v'}) & : \langle e,\langle e, st\rangle\rangle \\ \quad \text{s.t. } g(/\text{show the door}/, f(x,y,w_{v'})) & \end{bmatrix} =_g$$
$$\begin{bmatrix} \text{ph}'_1 = /\text{show the door}/ & : \textsc{phon} \\ \text{sem} = \lambda y.\lambda x.\lambda w_{v'}.show\_the\_door(x,y,w_{v'}) & : \langle e,\langle e, st\rangle\rangle \end{bmatrix}$$

The final output is a record whose one field is a predicate representing the meaning of the idiom *show the door*, i.e. the relation of dismissing y by x.

To close this part of discussion, note that the offered account, thanks to the cyclic 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). Within the present framework it is the same mechanism, i.e. incorporation to v^0, that yields $[_{v^*}$ see] in (33) and the idiomatic $[_{v'}$ show the door]. Idioms are derived as computation-wise akin to standard LIs; it is their SM computation that imposes further complexity.[12] The question that arises is that of overgeneration. If *show the door* undergoes incorporation to v' and lexicalization, why the same does not apply to *show the tree*. There are two reasons. First, had such an operation taken place, we would expect *show the tree* to behave like a head, e.g. with respect to movement, contrary to the facts. Second, there is no convention in English according to which *show the tree* holds in different situations than those defined for lexicalized *show* and *tree*. Put differently, there is no convention showing that this meaning cannot be composed from the meaning of the verb *show* and the nominal *tree*. Such an additional v'-layer and the following incorporation would not yield a new meaning. Consequently, it would be a superfluous part of derivation, automatically ruled out on economy grounds.

4.2 Creating a hole: quotation

Let us now move to quotation, relating it to idioms as discussed in subsection 4.1. As summarized in Table 1, the two categories are similar in that they block straightforward semantic composition and movement, but retain morphosyntactic relations. The difference lies in copredication, as in (10), and the character of CBs, which, in the case of quotation, create the operator-variable structure. I propose that quotation is a product of Merge combining any material with a light

[11] Note that the semantic information obtained by standard composition of *show* and *the door*, in general contained in the record, is irrelevant for the purpose of forming the idiomatic predicate. The only relevant information is the conventional one, carried by the terminals.

[12] This is in line with Chomsky (1980) who lets rules forming idioms be analogous to those of the lexicon.

phasal head sharing some important properties with C^0. However, since quotational phases are not standardly acknowledged in the literature, I shall first outline their general architecture.

4.2.1 Setting the stage

As discussed in Wiślicki (2019), the fact that enquotation can be applied to any material, including gibberish and another quotation, suggests that the derivation of quotation does not involve standard feature-checking. I make a very weak assumption that there is a phasal light quotational head q^0 (see De Vries 2012 for a suggestion concerning quotational heads), partially similar to C^0 (Maier 2018). The difference lies is that q^0 introduces a formal interpretable feature $[iF : quot]$ which does not undergo agreement, contrary to the *wh*-feature of C^0.[13]

Since $[iF : quot]$ is an interpretable feature, it must be somehow computed at C-I. As for the general semantics of quotation, I follow the long-standing research (at least from Tarski 1933/1983 to Maier 2017, 2018) in taking the meaning of quotation as involving strings of symbols. However, I do not, contra Potts (2007), treat quotation as expressions of a simple type u (utterance). The simplest argument is that even pure quotation, which is not as morphosyntactically transparent as mixed and direct quotation, shows typically predicative behaviour, allowing determiners, modification and pluralization:

(39) a. Gemeinsam ist das 'alle'.
common to be.3RD.SG the 'all'
Lit. They have the 'all' in common. [German; Pafel 2011]

b. His short 'hello' was all I heard.

c. I am quite fed up with his 'I hope so's. [cf. Clark & Gerrig 1990; Pafel 2011]

Had they been treated as atomic expressions of type u, their standard semantic computation would be highly problematic. Therefore, drawing on Maier (2014, 2018) and Pafel (2011), I let a quotational expression 'σ' have the general interpretation as in (40):[14]

(40) $[\![\text{`}\sigma\text{'}]\!] = \lambda z_u.\lambda w_s.\sigma(z,w) = 1$ iff $\ulcorner\sigma\urcorner$ quotes z in w

Accordingly, quotation is similar to idioms in that both of them involve operations forming a new predicate from a morphosyntactically complex input. Still, in order to formalize that kind of analogous mechanism, we need two formal objects. First, a light head forming the new predicate. Second, the relevant conventional sound-meaning pairing providing the content encoded by the new predicate. Let us shortly discuss these two objects.

First, I let any conventional exponent of quotation (quotes, intonation, etc.) be a syntactic light head q^0, typed at the point of Transfer as follows:

(41) $q^0 :$
$$\left[\begin{array}{ll} \mathrm{ph}_1 = \text{`}\ldots\text{'} & : \textsc{phon} \\ \ldots & : \textsc{phon} \\ \mathrm{c}_1 = z & : u \\ \mathrm{s}_h = sit_h & : q'(z, w_q) \\ \mathrm{cont} = \lambda r : \textsc{type} \left(\left[\begin{array}{ll} \mathrm{ph}'_1 = \Phi_1 & : \textsc{phon} \\ \ldots & : \textsc{phon} \\ \mathrm{sem} = \lambda z.\lambda w_q.f(z,w_q) & : \langle u, st\rangle \\ \quad \text{such that } g(\Phi_k, f(z,w_q)) & \end{array}\right]\right) & : \langle \textsc{type}, \textsc{type}\rangle \end{array}\right]$$

[13] Another argument, coming from covert movement of quotational CBs, is given in subsection 4.2.2.

[14] For the sake of clarity, I focus on direct quotation. Note, however, that the semantic account of mixed quotation proposed by Maier (2014), essentially cognate to (40), opens up a promising way for extensions.

The record provides one variable of type u, the type of relation labelled s_h, and the predicate-formation function. That kind of predicate formation is possible thanks to a convention which, while not different from the technical point of view from cases discussed so far, has a special mixture of properties. On the one hand, quotation is essentially driven by '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). On the other hand, while this property is a convention in the sense that it is not logically necessary, it is universal across natural languages. I let this mixture be encoded in the grammar by the fact that every terminal node for every phonological representation ϕ encoded in its record contains a field $conv(\phi, w_q)$. The convention says that the relevant phonological form can be used in the quotational context, i.e. as referring to any string of symbols quoted by ϕ in the situation w_q.

Letting r_i be the record specified at the point of Transfer for the syntactic structure of *Alfred smiled*, the quotation *'Alfred smiled'* is computed as follows:

(42) $[\![[q^0\,[\text{Alfred smiled}]]]\!]^g =$

$$\lambda r : \text{TYPE}\left(\begin{bmatrix} \text{ph}_1' = \Phi & : \text{PHON} \\ \text{sem} = \lambda z.\lambda w_q.f(z,w_q) & : \langle u, st\rangle \end{bmatrix}\right)(r_i) =_{\text{FA}}$$

$$\begin{bmatrix} \text{ph}_1' = /\text{Alfred smiled}/ & : \text{PHON} \\ \text{sem} = \lambda z.\lambda w_q.f(z,w_q) & : \langle u, st\rangle \\ \text{s.t. } g(/\text{Alfred smiled}/, f(z,w_q)) & \end{bmatrix} =_g$$

$$\begin{bmatrix} \text{ph}_1' = /\text{'Alfred smiled'}/ & : \text{PHON} \\ \text{sem} = \lambda z.\lambda w_q.Alfred\_smiled(z,w_q) & : \langle u, st\rangle \end{bmatrix}$$

The output is a record where the semantic representation encodes a set of utterances (type u) that can be quoted by the string $\ulcorner$Alfred smiled$\urcorner$. Each utterance of type u is a string of symbols representing expressions, both grammatical and not. With this general picture in mind, let us now have a look at how the offered approach accounts for discontinuous quotation.

4.2.2 Quotation and holes

Quotational CBs give rise to a puzzling effect. Consider (1b), repeated below as (43):

(43) Peter said 'Yesterday such-and-such man came'.

The sentence is true iff Peter uttered any string obtained by replacing the phrase *such-and-such man* by a string with the feature [+PERSON] within the string appearing between quotes. However, as argued for in subsection 4.2.1, quotation provides constants. If this is so, then expressions like *such-and-such man* should provide variables ranging over parts of constants. This, however, is far from trivial.

A natural approach is to let CBs create bound variables as a result of raising.[15] This strategy was chosen by Sudo (2013), and then developed by Koev (2017), who takes CBs to be indefinites; they undergo QR turning a term of type u into a predicate of type $\langle u, t\rangle$:

(44) $[\,\text{CB}\,[_{\alpha':\langle u,t\rangle}$ 'Yesterday x smiled'(x) $\ldots\,[_{\alpha:u}$ 'Yesterday CB smiled' $\ldots\,]]]$

QR

However, this solution is not costless. Sudo's account is based on providing variants of standard composition principles defined solely for quotation. Moreover, the same must be assumed about

[15] More precisely, as a result of Ā-movement, but here I do not go into detailed discussion. First, the A/Ā-movement distinction is less obvious on Minimalist grounds (Safir 2017). Second, creating a bound variable is not necessarily limited to Ā-movement (Chierchia 1995).

QR as in (44). Quotational CBs 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. $\rightsquigarrow (\exists x_e)(person(x)\&say\_that(John, control(x, media)))$
c. $\rightsquigarrow say\_that(John, (\exists x_e)(person(x)\&control(x, media)))$

(46) a. John says 'Such-and-such man controls the media'.
b. $\rightsquigarrow (\exists x_u)(person([\![x]\!])\&say_{quot}(John, \ulcorner x \text{ controls the media} \urcorner))$
c. $^{*} \rightsquigarrow say_{quot}(John, (\exists x_u)(person([\![x]\!])\&control(x, media)))$

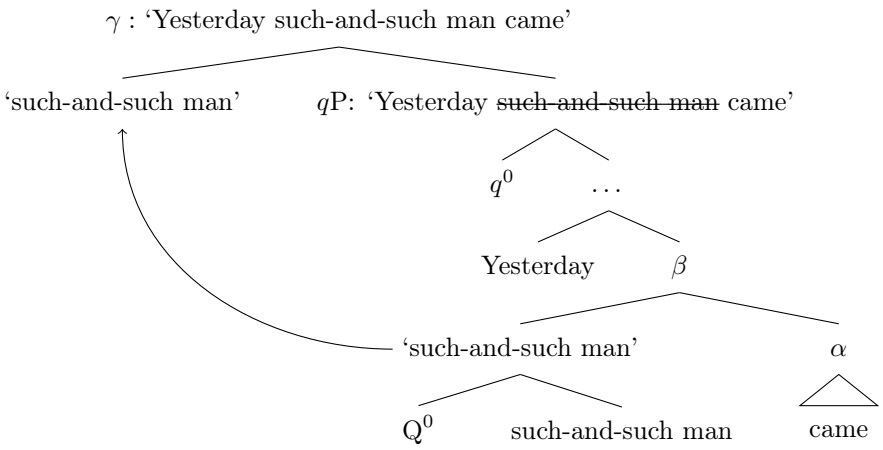
That is, while quantifying into quotation might be possible, it is at least very problematic to take a quantified phrase to be an object of quotational report. Therefore, the discrepancy between (45) and (46) suggests that QR of quotational CBs must be special.[16]

Bearing this in mind, I propose a different approach. Leaving aside whether QR can be derived as a special type of *wh*-movement (Johnson 2012), I let CBs undergo $\bar{A}$-movement which shares some properties of 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 of light heads. Their core semantic property, as presented in (31), is that they create predicates with new constants. It is then natural to expect that traces generated by $\bar{A}$-movement are interpreted as variables ranging over missing parts of new constants. In this sense they range over strings representing expressions used in the predicate formation operation. Accordingly, I propose the following rule:

Definition 1 (Traces below light heads) *For an $\bar{A}$-chain $[\alpha_i \ldots [h^0\,[_\gamma \ldots t_i \ldots]] \ldots]$ and a light head h^0, $[\![[h^0\,\gamma]]\!]^g$ is a term $\lambda\mathcal{X}_u.M$, where $\mathcal{X}_u$ occurring in M ranges over strings of symbols representing expressions identified on t_i.*

To see how this works, consider the following structure of quotation:

(47)



Let us follow the derivation in (47) step-by-step:

[16] Interestingly, the discussion in Wurmbrand (2018) suggests that QR could not explain the effect in (46) in terms of cyclicity, a natural approach to the islandhood of quotation. See also Dobrovie-Sorin & Beyssade (2012) for arguments against a QR-based approach to indefinites.

1. Forming *such-and-such man*. I let it be an output of merger of a non-light head Q^0 and the nominal *such-and-such man*. The head provides the feature $[iF : quot]$, but it does not yield quotation as in (40).

2. Forming *Yesterday such-and-such man came* as a standard CP interpreted extensionally at the points marked for cyclic Transfer.

3. The CP is merged with the light head q^0 reaching the phase level. The head provides the interpretable $[iF : quot]$ feature as well as edge features opening up the Ā-bar position in [Spec, qP].

4. Ā-movement. *Such-and-such man* raises to [Spec, qP] leaving a trace. The cycle is complete and the phase complement (the sister of q^0) undergoes Transfer.

The derivation in (47) has two crucial points, i.e. forming the CB and providing a phase by means of q^0. Let us discuss some immediate consequences of the two architectural aspects.

Since in many languages phrases standing for CBs can also be interpreted as non-quotational indefinites,[17] their quotational reading seems to be derived, rather than simply lexical. Moreover, since they are interpreted as variables ranging over missing parts of quoted strings, and not as proper quoting strings, Q^0 is not a light head forming a new predicate. It provides the $[iF : quot]$ feature which is crucial for movement. The mechanism is based on Labelling Algorithm (LA) as proposed by Chomsky (2013, 2015b). For an XP to be able to move to [Spec, YP], the two must share a common feature. Neither standard features ([CASE], ...) seem to appear on qP, nor does $[iF : quot]$ appear on SOs c-commanded by q^0 (except the CB). Therefore, if any SO of quotation raises to [Spec, qP], the resulting phrase cannot be labelled by Chomsky's LA. Accordingly, the islandhood of quotation as in (4), (5b) follows from the labelling failure. There is no part of quotation which, when moved to [Spec, qP], could share the common feature $[iF : quot]$. By contrast, CBs can raise (covertly) without labelling failure thanks to the presence of $[iF : quot]$ on CBs and qPs. Thus bearing in mind the fact that $[iF : quot]$ does not enter agreement, I assume one version of LA (Chomsky 2013; Takita et al. 2016) according to which α in the $[_\alpha$YP XP] structure is labelled by the most prominent feature shared by its daughters. In the case of (47), this means that γ is labelled $[iF : quot]$ by the most prominent feature shared by CB and qP.[18] Interestingly, the above architecture of features explains yet another problem, namely why CBs raise covertly, but never overtly. The answer follows from the traditional Minimalist approach to features and movement. Driven by economy principles, Chomsky (1995b) proposes that covert movement, with features' checking taking place only at the semantic interface, is preferred to overt movement, where features' checking takes place at the semantic and phonological interface. Recall, however, that quotation does not involve checking of $[iF : quot]$ at all. The reasoning sketched at the beginning of subsection 4.2.1 is that enquotation can be applied to any material, including gibberish; thus it does not involve agreement. The impossibility of overt movement of CBs provides yet another argument. Since there are no features to be checked, overt movement of CBs is ruled out on economy grounds. On the other hand, covert movement is required, since otherwise the necessary operator-variable structure could not arise.

The second crucial aspect of (47) is the quotational head q^0. Its contribution is three-fold. First, its edge features create the Ā-position. These allow Ā-movement of CB creating the operator-variable structure. Second, q^0 is a phasal head. This means that once the phase is complete, SOs below the sister of q^0 that did not undergo raising to its edge are trapped for movement (Phase Impenetrability Condition). Hence the islandhood of quotation, as exemplified

[17] As, e.g. in Polish the INDEF+*tam* constructions, illustrated in (18c).

[18] This is a weaker version of LA. The stronger version (Chomsky 2015b) requires agreement of features.

in (4) and (21). Third, q^0 is a light head providing predicate formation. This accounts for the conflict between the complex and atomic behaviour of quotation. On the one hand, quotation is derived from standard expressions. Below q^0 the derivation secures the relevant morphosyntactic relations. These are required by split constructions as in (6) and the verb-qP relation as in (11)–(13) as well as copredication illustrated in (10a), (10b). As for copredication, note that in the case of idioms, as in (34), it is the whole idiom that undergoes head movement. Its parts are not subject to Transfer in the course of derivation. Thus there is nothing like a full-fledged semantic term *door* interpreted in the idiomatic reading and stored in the lexicon, as required by copredication (Asher 2011). By contrast, this does not hold for quotation. First, since any material can be quoted, the lexicon does provide two logically polysemous words, i.e. the quotational and the extensional version of every word. Second, parts of quotation undergo standard cyclic Transfer, as secured in (47). Thus there is no obstacle for copredication, as expected. On the other hand, the light head q^0 secures the semantically atomic character of quotation by forming a new predicate. The computation proceeds as in (42), with the proviso that the CB is identified as an SO undergoing $\bar{\text{A}}$-movement. Accordingly, if r_i stands for the output of Transfer applied to the sister of q^0, then qP is interpreted as follows:

(48) $[\![q^0]\!]^g(r_i) =$

$$\lambda r : \text{TYPE}\left(\begin{bmatrix} \text{ph}_1' = \Phi & : \text{PHON} \\ \text{sem} = \lambda z.\lambda w_q.f(z,w_q) & : \langle u, st\rangle \end{bmatrix}\right)(r_i) =_{\text{FA}}$$

$$\begin{bmatrix} \text{ph}_1' = /\text{Yesterday } t_i \text{ came}/ & : \text{PHON} \\ \text{sem} = \lambda z.\lambda w_q.f(z,w_q) & : \langle u, st\rangle \\ \quad \text{s.t. } g(/\text{Yesterday } t_i \text{ came}/, f(z,w_q)) & \end{bmatrix} =_{\text{Def. 1}}$$

$$\begin{bmatrix} \text{ph}_1' = /\text{Yesterday } t_i \text{ came}/ & : \text{PHON} \\ \text{sem} = \lambda\mathcal{X}.\lambda z.\lambda w_q.f'\_\mathcal{X}\_f''(z,w_q) & : \langle u, \langle u, st\rangle\rangle \\ \quad \text{s.t. } g(/\text{Yesterday } t_i \text{ came}/, f'\_\mathcal{X}\_f''(z,w_q)) & \end{bmatrix} =_g$$

$$\begin{bmatrix} \text{ph}_1' = /\text{Yesterday } t_i \text{ came}/ & : \text{PHON} \\ \text{sem} = \lambda\mathcal{X}.\lambda z.\lambda w_q.Yesterday\_\mathcal{X}\_came(z,w_q) & : \langle u, \langle u, st\rangle\rangle \end{bmatrix}$$

The algorithm identifies the $\bar{\text{A}}$-chain whose head crosses the light head q^0, triggering the trace rule formulated in Definition 1. The predicate formation mechanism identifies the missing part in the phonological structure. Accordingly, it yields a new predicate with the missing part replaced by the bound variable $\mathcal{X}$. The variable ranges over strings of symbols representing parts of the originally quoted string.

Finally, the CB is remerged from its $\bar{\text{A}}$-position with qP and identified as the chain head. Assuming a simplified interpretation of CBs (for details, see Koev 2017; Sudo 2013) and the general semantics of $\bar{\text{A}}$-chains developed by Kotek (2019), the last step of computation proceeds as follows:

(49) $[\![q\text{P}]\!]([\![\text{'such-and-such man'}]\!])=$

$$\lambda\mathcal{X}.\lambda z.\lambda w_q.[Yesterday\_\mathcal{X}\_came(z,w_q)](\lambda\mathcal{X}.\mathcal{X} : [+\text{PERSON}]) =_{\bar{\text{A}}\text{-chain}}$$
$$\{\lambda z.\lambda w_q.Yesterday\_\mathcal{X}\_came(z,w_q) \mid \mathcal{X} : [+\text{PERSON}]\}$$

The output is a set of strings of symbols that are quotable by the result of substituting a string representing an expression with the feature [+PERSON] for $\mathcal{X}$ in the string ⌜Yesterday $\mathcal{X}$ came⌝. The effects discussed in section 2 are borne out.

4.3 Syntactic cycles and derived atoms: Consequences and discussion

Since the development of Phase Theory (Chomsky 2001), numerous syntactic categories have been argued to mark phases (Bošković 2014). As a result, Chomsky's idea of defining phases in terms of completeness of features' computation has been modified. Rather, phases have been perceived in terms of referential completeness, being assumed 'when the descriptive information within a head is sufficient in a given discourse context for a hearer to identify the intended referent within the speaker's deictic frame' (Arsenijević & Hinzen 2012:433).

In the preceding pages I have been at pains to show that for some expressions that kind of referential completeness covers also predicate formation. Nevertheless, I have also shown that this does not require a substantial extension of grammar. Rather, predicate formation can be formalized as being essentially phasal in two senses. First, it is introduced by phasal heads. Second, it has a dual pattern. On the one hand, creating idiomatic predicates involves incorporation to light head, one crucial cog of Chomsky's lower (v^*P) phase. On the other hand, creating quotational predicates involves $\bar{\text{A}}$-dependencies, exactly like in Chomsky's higher (CP) phase. In this regard the offered solution keeps certain balance. It yields the effect of single meaning being assigned to a structure, rather than a terminal, as proposed by Svenonius (2016), but makes use of simpler machinery. Still, it shows two remarkably different effects that can be hardly distinguished in the approach proposed by Zwart (2009), where syntactic atomicity has only one pattern.

The result sheds much new light on predicate formation and cyclicity in syntax. On the one hand, the proposed machinery accounts for three empirical aspects of idioms and quotation. First, light heads providing predicate formation effectively account for the non-compositional character of such expressions. Second, phasal heads and the impossibility of movement (either due to incorporation to v' or LA based on the $[iF : quot]$ feature) turn idioms/quotation into islands, as expected. Third, the structural complexity below each of the two phasal heads secures morphosyntactic relations holding between the constituents of the discussed expressions.

On the other hand, the proposed machinery unearths further conceptual aspects of Chomskyan phasal derivation. Note that the present proposal adds very little to the existing apparatus. The structure of idioms involves the same mechanism of incorporation to verbal head, keeping them complex below the head. Quotation assumes a new phasal head, but its properties are analogous to those of C^0; each of them provides sentential embedding (though q^0 is more flexible) and opens up $\bar{\text{A}}$-positions. Moreover, the proposed solution is methodologically parsimonious. It keeps the syntactic engine simple, without making use of modified Merge (Riemsdijk 2006a,b; Svenonius 2005) or reprojection (Gallego 2016). In this sense Chomskyan phases are shown to be in a position to cover yet another area, i.e. predicate formation fed by complex structures. Finally, the general, minimalist character of the applied syntactic account contributes the explanatory value to the discussion on predicate formation. That is, in the present account new predicates are formed at the point of Transfer, which is formalised within the TTR framework. Cooper (2005) argues that TTR is explanatory in Chomsky's sense. However, for Chomsky a grammar becomes an optimally explanatory apparatus if no semantic assumptions are made whatsoever, all the phenomena being accounted for in terms of structure-building alone (Chomsky 2015b, but see also a less strict view in Chomsky 2015a, 2016b). In this sense TTR is not explanatory, despite the parsimonious semantic machinery. Nevertheless, in the present account predicate formation is shown to be regulated by a more general mechanism of cyclic derivation, with incorporation to light head and movement to $\bar{\text{A}}$-position as its fundamental properties. Thus, while its formalization in TTR cannot be explanatory in Chomsky's sense, the fact that predicate formation follows as part of phase theory does explain its presence in the grammar of natural languages.

4.4 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, idioms and quotation have been shown to share to much extent the properties of lower (v^*P) and higher (CP) Chomskyan phases. Idioms can be derived as verbal phrases by means of incorporation; quotation as a phrase whose edge allows Ā-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 Cooper's TTR secures a general, cyclic predicate formation mechanism. Finally, the mixture of Minimalist syntax and TTR has been shown to both yield the expected results and contribute the explanatory value to predicate formation.

5 Summary and future prospects

In recent years, Marantz's idea of light heads has spread across distinct accounts. Much discussion has been devoted to word formation yielding basic SM units. However, the mechanism creating basic C-I units, in particular predicates, has gained less attention. This paper partially fills in this gap. It shows how to encode dependencies going beyond standard semantic composition by making use of TTR. These are required by the mechanism of predicate formation driven by the syntax-semantics mapping of Marantzian light heads. Moreover, the mechanism has been shown to have basic properties of Chomskyan phases. First, it may involve incorporation to the verbal phasal head. Second, it may create Ā-dependencies analogous to those observed for CP-phases. The obtained results show how the general mechanisms of two Chomskyan phases, assuming the proper formalism, account for expressions that behave like both atomic and complex.

Apart from this, the paper opens up new paths for future research on syntax-semantics mapping. Perhaps the most important element is the formal account of Transfer encoding the semantic role of syntactic labelling. That is, much recent work on DM and Nanosyntax resulted in formal semantic accounts of numerous morphosyntactic features, mostly interpreted in an analogous way to traditional lexical items. However, despite various general proposals and constraints (Goto 2019; Kučerová 2018b), Chomsky's idea of labels required for the sake of C-I interpretation has remained formally undeveloped. The present framework takes labelling to constrain semantic interpretation by creating dependent types. Such dependent types block some syntax-semantics mappings of roots, but allow those compatible with the properties of the label at hand. The formal framework proposed in this paper opens up further paths for investigating relations between various types of labels, patterns of labelling and constraints they impose on C-I.

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