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# One move but two movements: an alternative account of the middle construction

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The A-movement analysis of the middle construction leaves the oblique middles untouched and fails to explain the unique syntactic and semantic properties of middle clauses. Under the assumption that the tense-defective Mod (Modal) INFL heads the middle structure, we advocate a combination of A-movement and A'-movement analysis of the middle construction. Specifically, we propose that the seemingly patient/adjunct subject of a middle clause is the external argument of cause licensed by the causative *verb*. Also, the relevant NP-movement from spec-*vP* to spec-ModP (specifier of the Modal Phrase) is one move but two movements in that C might DONATE both [TOP] feature and phi-features to the tense-defective Mod. This analysis provides a package account for the syntax and semantics of middle clauses and theoretically proves the existence of a universal syntactic entity of the middle construction. Our study incorporates various Chinese middle sentences into the universal grammar framework and verifies that the middle construction is a cross-language universal syntactic entity, adding evidence to its psychological reality.

## KEYWORDS

movement, the middle construction, Mod INFL, feature DONATE, universal syntactic entity

## 1 Introduction

Despite the abundant literature, there is no consensus on the definition and derivation of a middle clause. Typical examples of English middles are patient–subject sentences, as in (1).

- (1) a. The car drives quickly.
- b. His new novel sells well.

Such sentences as illustrated in (2), with adjunct subjects, are also recognized as oblique middles:

- (2) a. The knife cuts well.
- b. This key opens metal doors easily.

Middle clauses are documented to exhibit unique characteristics. Syntactically, middles have non-agent subjects (Fagan, 1988; Iwata, 1999). An adverbial is generally needed for a middle clause to be acceptable, that is, “the adverbial requirement” (Zwart, 1998; Wee, 2006; Lekakou, 2006). Furthermore, middle predicates appear only in the present tense and are incompatible with the progressive aspect (Keyser and Roeper, 1984; Massam, 1992). Semantically, a middle clause is a categorical judgment (Kim, 2001; Lekakou, 2002; Simargool, 2005; Wee, 2006). Interestingly, with eventive predicates, the middle clauses are always stative/non-eventive because they are used to describe a property of the surface

subject entity (Ackema and Schoorlemmer, 1994; Cinque, 1988, 1995; Marelj, 2004). Besides, a middle clause involves both generic and modality interpretation (Fagan, 1992; Massam, 1992; Zwart, 1997a).

Some relevant studies take middles as either similar to passives or parallel to actives, giving rise to a lexical vs. syntactical debate on middle clause formation. The lexical approach (Fagan, 1988, 1992; Ackema and Schoorlemmer, 1994, 1995, 2006) assumes an externalization process for the internal argument of a middle verb in the lexicon, whereas the syntactic approach (Keyser and Roeper, 1984; Stroik, 1992, 1995, 1999, 2006) argues that middle verbs have the same argument structure as their transitive counterparts. To explain the cross-linguistic variation of middle clauses, a lexicon-syntax parameter was proposed (Marelj, 2004) that middles are derived pre-syntactically in the lexicon in languages like English, Dutch, and Hebrew but syntactically derived in French, Italian, and Serbian-Croatian. The minimalist approach still adheres to the belief that middles are derived the same way as passives by proposing the Tr(ansitivity)P hypothesis (Bowers, 2002). Although most studies presuppose that middles are allowed only for transitive or agentive verbs, Rapoport (1999) argues that middle verbs are not inherently agentive at all, meaning that a verb does not need to have an agent or an affected argument to appear in a middle clause (Fagan, 1992).

A big problem in the previously mentioned studies is that they merely explain the patient-subject middles, leaving the question of the oblique middles unsettled. Furthermore, they do not explain how such semantic properties as genericity, modality, the topic effect, and the adverbial requirement about middle clauses are syntactically represented. To address these issues, we advocate an A&A'-movement analysis of the middle construction. Specifically, we propose that the structure of a middle clause is headed by a tense-defective Mod INFL. The seemingly patient/adjunct subject of a middle clause is, in practical terms, the external argument of cause licensed by a causative light *v*. In addition, the relevant NP-movement from spec-*v*P to spec-ModP is a mixture of A-movement and A'-movement in that C might DONATE both the [TOP] feature and the phi-features to the tense-defective Mod. Based on the tenseless Mod, this A&A'-movement analysis provides a package account for the non-eventive, generic, and modality interpretation; the topic effect; and the adverbial requirement of the middle construction.

Compared to the relatively rich literature in generative grammar, few psychological studies have undertaken explaining middle construction formation and restriction, and few cognitive studies have been done on the middle sentences in modern Chinese. He (2004), for instance, proposed a unified cognitive account of the middle constructions in three West Germanic languages and modern Mandarin Chinese. Based on cognitive linguistics and cognitive psychology theories, Li (2018) provided the cognitive processes and motivations for the conceptualizations of middle sentences in modern Chinese. Nevertheless, there has always been a controversy about whether middle sentences in modern Chinese exist or not and how to define this grammatical category.

In what follows, we first review the existing A-movement analysis of the middle construction and point out the remaining problems (Section 2); then, we argue that English middle clauses are

invariably topic sentences (Section 3). In Section 4, we propose an alternative A&A'-movement approach to explain the overlapping effect of the categorical topic and the grammatical subject in the middle construction. Section 5 is a brief discussion of the conflict between eventive middle predicates and stative middle clauses. In Section 6, the analysis is extended to Mandarin middle constructions, and Section 7 concludes the study.

## 2 A-movement analysis of the middle construction

### 2.1 Lexical vs. syntactic debate

According to the syntactical approach, the patient of a middle verb undergoes A-movement from the object position to become the grammatical subject in syntax. The missing agent is syntactically realized as an empty category, whether it be a null reflexive (Keyser and Roeper, 1984), *pro* (Hoekstra and Roberts, 1993), or PRO (Stroik, 1992, 1995, 2006). Stroik (1992) suggests that the agent, a covert PRO in (3), functions as the antecedent licensing the otherwise unbound anaphor.

- (3) a. Books about oneself never read poorly.  
 b. [IP e [I' VP [VP [VP never read books about oneself poorly] PRO]]]

Ackema and Schoorlemmer (1995, p. 178), however, point out some non-middle sentences in which an anaphor occurs without a corresponding antecedent, which are illustrated in (4).

- (4) a. Physicists like yourself are a godsend.  
 b. Persons like myself should not aspire.  
 c. Books about oneself can bring much grief.  
 d. Letters to oneself usually stink.

For the A-movement syntactic approach, middles are formed on a par with unaccusatives and passives; that is, the internal argument of a middle verb has to move to spec-IP to get its case feature checked. This undoubtedly achieves a theoretically unitary analysis of passive and middle constructions. The remaining problem, however, shifts to the explanation of the semantic and syntactic distinctions between them and why, in some languages, middles pattern with unergatives (Ackema and Schoorlemmer, 1995). Although Newman (2020) claims that middles are well formed with objects of prepositions, Bruening (2024), based on a statistical survey, argued that prepositional middles are unacceptable and do not allow prepositional objects. This line of inquiry adds more evidence to the argument that middles do not involve A-movement. In addition, the case-driven A-movement is tied to thematic restrictions, unable to account for the oblique middle clauses in which verbs are still followed by their objects as (5) demonstrates.

- (5) a. The knife cuts (meat) quickly.  
 b. This key opens metal (doors) easily.

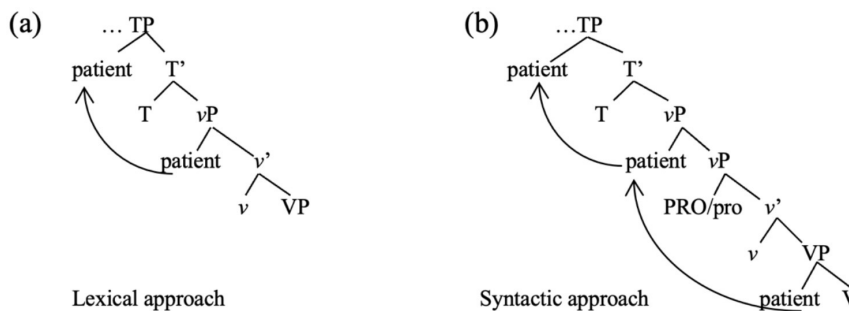
Differently, the lexical approach assumes the lexical operation of externalize (X) that converts a transitive verb to its intransitive middle counterpart (Hale and Keyser, 1987; Fagan, 1988, 1992). Ackema and Schoorlemmer (1994, 1995, 2006), for instance, argue

that a middle is derived pre-syntactically by suppressing the agent and syntactically by merging it with the patient as the subject. Therefore, (6a) is derived from (6b).

- (6) a. Walls paint easily.
- b. [IP walls<sub>i</sub> [I' I [VP t<sub>i</sub> [V' paint easily]]]]

A big problem with the externalize (X) operation, as Hoekstra and Roberts (1993) point out, is that not only internal arguments but also adjuncts are possible grammatical subjects of middle clauses. Theoretically, a lexical mechanism must determine and constrain what type of argument (and whether adjuncts) could be externalized. Under scrutiny, the lexical approach also faces the deficiencies of its syntactic counterpart because it cannot do without A-movement if we take the VP-internal subject hypothesis or the phase theory, whereby all theta roles have to be assigned locally within the predicate or the first phase vP. In other words, the surface subject of a middle clause—wherever it originates, at V-complement as the syntactic approach claims, or at spec-vP as the external argument as the lexical approach argues—has to undertake A-movement from within the predicate vP to spec-TP to be the grammatical subject. The difference between the two approaches is merely how far (or how many steps) the patient has to move, as (7) indicates (Wang and Dai, 2020).

(7) A-movement in a middle clause



Obviously, taking middle formation as an intransitivization process, be it a lexical manipulation or a syntactic operation, cannot circumvent the A-movement analysis. Because the parameterized approach combines (7a) and (7b), it faces similar problems.

## 2.2 TrP hypothesis

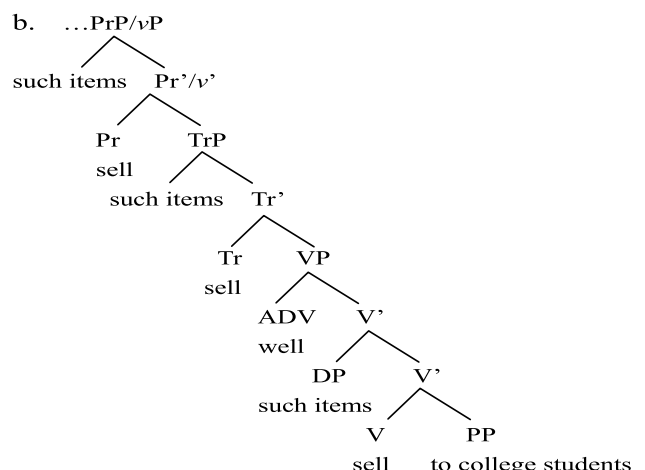
Bowers (2002) proposes the TrP hypothesis wherein the fundamental property shared by transitives, passives, and middles is transitivity represented by the presence of a TrP in their structures.<sup>1</sup> Specifically, Tr permits another syntactic element besides the subject to be brought into a relation with a predicate.

<sup>1</sup> Bowers (2002) proves the existence of Tr and suggests that both Tr and Pr (Predicate) are relational. For Bowers (1993, 2001), Pr is more general than v. In English, Pr is realized not only as v in a main clause but also lexically as as in small clauses with predicate nominals/adjectives. When Pr brings two syntactic objects into relation, Tr permits another syntactic element besides the subject to be brought into relation with a predicate.

With a syntactic TrP in its structure, middle verbs are still transitive. Under this assumption, the necessary conceptual correlation between case checking and theta-role assignment does not exist.

Actually, the function of v is split between vP and TrP. As an independent substantive category, TrP is optionally selected by v and is universally present in all transitive predicates. Apart from an EPP-feature, Tr may contain a probe with phi-features, and it may assign the accusative case. In contrast to v, Tr does not assign a theta role to its specifier. Bowers (2002) proposes that, in English, Tr in middle clauses are realized as a null middle voice marker, which makes them akin to -EN in passives in that they do not have phi-features but different from them in that they do not require an auxiliary. Like passives, in a middle structure, Tr fails to function as a probe to agree with the NP object. No external argument prevents the nominative case from being checked with the object by T because no PRO-like external argument appears in between as an intervener. The internal argument moves first to spec-TrP, then to spec-PrP, and eventually to spec-TP, where its case feature can be valued and deleted. Given these assumptions, (8a) is derived as (8b).

- (8) a. Such items sell well to college students.



Different from the earlier syntactic approach, (8b) abandons the idea that there is an external argument PRO<sub>arb</sub> at spec-vP and advocates an additional projection of TrP to the middle predicate structure. An obvious advantage is that the relevant movement is local and thus does not violate the Minimal Link Condition when

the object DP moves to spec-TP. Nevertheless, the TrP hypothesis still parallels middles with passives and only explains the patient–subject middles, leaving the oblique middles untouched. Likewise, it fails to account for the genericity, modality, topic effect, and adverbial requirement of middle clauses.<sup>2</sup>

### 3 Middle constructions as topic sentences

#### 3.1 Topic subject constraint on middles

Semantically, a middle clause is a statement about what would normally happen if the relevant property of the subject entity holds. Pragmatically, a middle construction evaluates the property of an entity plus the possibility of a potential event. In this sense, the surface subject is the shared knowledge between communicators, a topic in terms of information structure. Kim (2001) claims that English middle clauses are always interpreted as categorical statements and, accordingly, that their subjects must be taken as topics. Such a condition is called the topic-subject constraint in (9).

(9) The topic subject constraint on middles.

The subject of a middle clause must be able to be interpreted as a topic.

Some evidence supports the topic status of sentence-initial NP in English middle clauses because middle clauses cannot be changed into a cleft sentence, as (10) shows.

(10) a. This article reads easily.  
b.\* It is this article that reads easily.

Similarly, we cannot raise a question about the subject of a middle clause because it is never the new information needed by the speaker, as the sentences in (11) prove.

(11) a.\* What reads easily?  
b.\* What drives quickly?

It is a well-known fact that the post-verbal NP in a *there* construction cannot be a topic with a specific interpretation (the definiteness effect). If the subject of a middle clause is indeed a topic, it is predicted that it cannot appear postverbally in a *there* construction. This prediction is true in (12).

(12) a. Chickens kill easily (for butchers).  
b.\* There are chickens killing easily (for butchers).

#### 3.2 Overlap of topic and subject in middle clauses

Provided the sentence-initial NP of a middle clause is a topic, what and where is the grammatical subject? If PRO is the grammatical subject, why does the middle verb grammatically agree

with a topic? Given that every English finite clause needs an overt subject, the only choice left is to admit the topic-and-subject status of the beginning NP in a middle clause. The most salient evidence for the subject status of the sentence-initial NP in a middle clause is the fact that it agrees with the predicate verb in terms of phi-features, and, as (13) shows, the nominative case feature of the sentence-initial NP has been checked.

(13) a. I like this knife. It cuts well.  
b. I like these knives. They cut well.

English middle clauses appear in the raising construction involving the A-movement, as shown in (14).

(14) a. The car seems to drive quickly.  
b. These knives appear to cut well.

Besides, the sentence-initial NP can A-bind an anaphor, as (15) illustrates.

(15) a. The blouse washes itself.  
b. The car drives itself.

All these examples point to the fact that sentence-initial NP in a middle clause is both a subject and a topic. Is it possible in English for a grammatical subject to be, simultaneously, the topic of a categorical sentence? Fortunately, this fact is supported by the diachronic development of the English language. Typologically, present-day English (PDE) is different from Old English (OE) in that the former is a grammatical word-order language whereas the latter is a pragmatic word-order language. Generally, OE is rich in morphology, thus being free to follow the pragmatic principle (topic–comment) for its sentence structure. Being grammatically marked by inflections, the subject could freely occur anywhere in a sentence without leading to ambiguity. When English gradually developed into a language with poor inflection, location became important to indicate the syntactic functions of NPs. As a result, PDE no longer follows the topic–comment pattern, whereby any argument could be in the sentence-initial position. However, the motivation to comply with the pragmatic order causes the language to expand the range of semantic roles allowed in the subject position from merely agent to non-agents so that topics have to overlap with subjects. The emergence of the middle construction is the consequence of such a change (Simargool, 2005, p. 138–139); that is, the different syntactic structures between OE and PDE produce semantic and pragmatic reasons for the existence of the middle construction (Simargool, 2005, p. ii). Specifically, the middle construction reflects the pragmatic attempt of PDE to have a non-agent subject that can also function as a topic.

### 4 An alternative approach: one move as both A-movement and A'-movement

#### 4.1 C-to-T feature DONATE

As discussed in Section 3, the sentence-initial NP of an English middle clause is a grammatical subject as well as a topic. The remaining task is to represent this dual function of the same NP syntactically. In this section, the C-to-T feature-inheritance system is adopted to illustrate how C could DONATE [TOP]

<sup>2</sup> Similarly, Bruening (2024) proposes a specific functional category, Voice<sub>m</sub>, unique for the middle construction. However, neither the TrP hypothesis nor the VoiceP proposal is in line with the principle of conceptual minimalism.

feature as well as phi-features to the tenseless Mod that heads a middle clause. In light of this feature DONATE hypothesis, A-movement and A'-movement are combined into one, leading to the overlapping effect of a categorical topic and a grammatical subject in a middle clause.

According to the feature-inheritance mechanism proposed by Chomsky (2007), all uninterpretable features originate from the phase head. The functional category T, being not a phase head, bears no uninterpretable features inherently. Consequently, T itself cannot search for a goal as a probe until C is introduced into derivation. By appealing to the timing of transfer and feature valuation, Richards (2011) convincingly argues for the conceptual necessity for C to transfer all uninterpretable features to T. However, in (16), the italicized C (*dank*) overtly inflects for agreement in person and number with the complement clause subject. At the same time, the finite verb phi-agrees with the subject. It seems to show that phi-features are copied (rather than transferred) from C to T so that both C and T end up bearing the relevant agreement features.

- (16) a. Kpeinzen *dank* ik morgen goan.  
I.think that<sub>1.sg</sub>I tomorrow go  
I think that I'll go tomorrow.
- b. Kpeinzen *daj* gie morgen goat.  
I.think that<sub>2.sg</sub>you tomorrow go  
I think that you will go tomorrow.
- c. Kpeinzen *dan* Valère en Pol  
I.think that<sub>3.pl</sub> Valère and Pol  
I think that Valere and Paul  
morgen goan.  
tomorrow go  
will go tomorrow. (Radford, 2010, p. 397–398)

Observing some typological differences, Ouali (2008, 2010) argues that the feature-inheritance mechanism allows three logical possibilities of DONATE, KEEP, and SHARE that are all empirically attested. DONATE is the case of simple declarative clauses, as stated in (17a) and schematized in (17b). KEEP is the case of an anti-agreement effect, where the subject does not agree with T, as stated and schematized in (18). In contrast, SHARE happens when T agrees with the subject and C with the object, as stated and schematized in (19).

- (17) a. DONATE: Transfer phi-features from C to T without keeping a copy.  
b. C T Subject (*declaratives*)  
┌ DONATE ─┐ ┌ AGREE ─┐
- (18) a. KEEP: No phi-features transfer from C to T.  
b. C T Subject (*anti-agreement effect*)  
┌ KEEP ─┐ ┌ ×AGREE ─┐
- (19) a. SHARE: Transfer phi-features from C to T and keep a copy.  
b. C T Subject Object  
┌ SHARE ─┐ ┌ AGREE ─┐  
└──────────┘ └──────────┘  
AGREE

Crucially, the three choices of DONATE, KEEP, and SHARE are ordered. DONATE applies first; if that yields a derivation crash, KEEP then applies; and if that again yields a crash, SHARE eventually applies.

### 4.2 Topicalization in deriving a middle clause

Given that all uninterpretable features could DONATE to T, KEEP on C, or SHARE between them, an interaction of features between C and T in the middle construction obtains a theoretical grounding; namely, the topic effect is achieved if we hypothesize that C might DONATE both the [TOP] feature and phi-features to T. To be specific, the relevant A-movement to spec-TP also involves topicalization for the [*uCase*], and the [*uTOP*] features of the relevant NP are valued simultaneously, giving rise to the subject-and-topic status of the sentence-initial NP in a middle clause. The possibility that both edge and agreement features may be transferred from C to T in the same language was attested to by Ángel (2011), who argues that, in some of the languages of Spanish groups, the landing site of displaced topics is actually Spec-TP.<sup>3</sup>

Why should C DONATE both the [TOP] feature and phi-features to T in a middle clause? The key lies in the structure of a middle clause being headed by an inflectional Modal, as Massam (1992) proposes. Explicitly, Massam (1992, p. 120) defines a middle construction as an inflectional projection headed by a null X<sup>0</sup> Modal.<sup>4</sup> Based on similarities among middle clauses and tough constructions like “the book is hard to understand,” Massam (1992, p. 128) labels the null modal as a tough AD modal and suggests that all middle clauses are assumed to contain a modal-like element in INFL.

- (20) NP INFL V ec  
|  
null CAN

Under Massam’s assumption, the AD modal helps stativize the middle predicate and comment on the predicated event’s possibility/ability/likelihood. Although we disagree with Massam that the INFL-like modal is semantically equal to a tough adverb or that this null CAN harbors all the modality involved in a middle clause, we agree that a modal INFL (instead of a tense morpheme) is heading the structure of a middle clause and that this INFL, being [*iMOD*]-featured, mainly contributes epistemic modality to the interpretation of middle

3 It is noticeable that T has always been argued to show special properties in Romance languages. On one hand, preverbal subjects in these languages display typical A-properties (binding, control, and agreement). On the other hand, DPs in Spec-T also behave as A'-moved constituents showing edge semantics. For example, unlike postverbal subjects, preverbal subjects cannot undergo LF-raising.

4 Roberts (1987) also suggests that a middle clause is governed by an “appropriate” INFL that subsumes such operators as modals, contrastive stresses, and negations.

constructions.<sup>5</sup> The connection between modal auxiliaries and epistemic modality is self-evident. The notions basic to modal auxiliaries are subjective judgments (Lyons, 1977, p. 845–846). Actually, subjectivity is the very characteristic that distinguishes modals from other verbs because they are typically used in utterances involving speakers' judgment, will, and evaluation.

A conceptual reason for C to DONATE both the edge [TOP] feature and phi-features to Mod INFL is that Mod, contrary to tense inflection, is tenseless. Based on the fact that both modal auxiliaries and tense inflections could head finite clauses and that they cannot coexist in English, we assume that the functional Mod, similar to the infinitival *to*, projects a type of tense-defective ModP. The canonical clausal head Tense has an interpretable [*i*TNS] feature, whereas a tense-defective Mod lacks this [*i*TNS] feature. Instead, Mod carries a somewhat [*i*MOD] feature, which renders it interpretable at the C-I (Conceptual-Intentional) interface. Semantically, an [*i*MOD]-featured Mod INFL functions as a modal operator mapping the predicated event into a possible world, whereas a Tense INFL with an [*i*TNS] feature serves as a temporal operator linking the predicated event with the actual world.<sup>6</sup> In derivation, making a complex choice of DONATE (of phi-features) plus KEEP or SHARE (of [TOP] feature) is obviously less economical than making a simple choice of DONATE. Normally, the [TOP] feature is valued in the C domain in an English clause headed by Tense. Given that a middle clause is headed by a Mod INFL saturated with modality, it is easy for the discourse-linked [TOP] feature to transfer to this particular clausal head. Consequently, when A-movement to spec-TP happens in deriving the middle clause, the [*u*TOP] and [*u*Case] features on the relevant NP are simultaneously valued, hence the combination of the A-and-A'-movement.

### 4.3 Combination of A-movement and A'-movement

Given that A-movement and A'-movement have been widely taken as distinct, this section argues for the theoretical possibility of combining the two. The most pervasive way of formulating the A/A' distinction is based on positions in a phrase structure. Generally, the edges of phasal heads C and *v* are taken as A'-position, whereas the argument positions, whether in *v*P through an external merge or at spec-TP through an internal merge, are A-position. The position-based A/A' distinction is undoubtedly dependent on the top-down representational approach. But

5 Zagona (2008) holds that epistemic modals merge in TP and dynamic modals merge in *v*P. Following this, we hold that the dynamic modality of a middle clause is mostly represented as the causative light verb (see Section 4.4).

6 Davidse and Heyvaert (2007) claim that finite (the counterpart of INFL in functional grammar) plays a crucial function in a sentence in that it serves to "ground" the lexical VP, that is, give it a point of reference in the "here and now" of the speech exchange. A common finite locates the utterance relative to the time of speaking, whereas the finite of a middle clause construes the speaker's attitude toward the necessity/likelihood of a proposition.

the position-based perspective on the A/A' distinction loses its conceptual charm through the bottom-up derivational approach of minimalism. Basically, A/A'-position types are not primitives but stipulated relational concepts that can be eliminated from the theory (Obata, 2012, p. 187). From this perspective on the A/A' distinction, movement types are differentiated based on what features are involved in the derivation. If a movement involves only edge features, it is categorized as A'-movement. If additional inflectional features are involved, the relevant movement is also A-movement. In the case of the middle clauses, if C could DONATE both the [TOP] feature and phi-features to Mod as we assume, the same one movement values two types of features at once, thus creating the possibility of combining the two types of movement. If a single movement represents both A-movement and A'-movement, the A/A'-mixed positions are simply natural in that the A-properties and A'-properties are not being forced by the grammar to be realized as two different syntactic positions.

### 4.4 Structure of the middle predicate

Until now, we have solely analyzed the landing site of the NP movement without mentioning how the movement starts. This section explores how a middle predicate is generated, namely, where the sentence-initial NP originates in the structure of a middle *v*P.

We tend to adopt a causative analysis of middle predicates. Chomsky (1995, p. 315) proposes that the light *v* is responsible for either agentivity or causativity, and it follows that the light *v* can license either agent or cause.<sup>7</sup> McConnell-Ginet (1994) proposes that the subject of a middle clause is somewhat in the external argument position with causative semantics. The causative analysis of middle predicates is similarly proposed by Chung (1995), who argues that "the causative relation holds between a non-volitional argument of the verb and the caused event in which the cause is a participant." Zwart (1998, p. 111) holds that the surface subject in an English middle clause is a "more or less circumstantial external argument," which originally is merged as the specifier of the causative/permissive light verb. Oya (2017) argued that the subject of Dutch "let" middles is merged as the external argument of the matrix predicate *laten* (let) and that the reflexive pronoun *zich* is merged as an embedded predicate's thematic internal argument. Putting aside some details in these analyses, the grammatical subject of the middle clause, be it seemingly patient or instrument theta-related with the verb, is widely recognized to merge syntactically at spec-*v*P as the external argument of cause. This being the case, the property of the subject entity can be understood as being responsible for the predicated event. If this is true, there are actually no

7 An agent is an animate entity that intentionally performs an action, whereas a cause, which may be animate or inanimate, does not involve intentionality—at least not with respect to the event at hand. Another difference between the two external arguments is that an agent involves an individual, whereas a cause may include individuals, events, and the properties of an entity.

oblique middle clauses. As Ackema and Schoorlemmer (1994, 1995) and Marelj (2004) argue, the surface-deceiving adjunct subject middles are so called because the sentence-initial NPs usually appear as adjuncts in an agentive *vP*. In a causative middle *vP*, however, the seeming adjunct does not provide supplementary information as genuine adjuncts do; rather, it is the external argument of cause.

Generally, an invisible agent is assumed, semantically, syntactically, or both, in the middle predicate (Keyser and Roeper, 1984; Ackema and Schoorlemmer, 1994, 1995; Iwata, 1999; Fagan, 1992; etc.). Nevertheless, English middles are not inherently agentive at all. Whether or not the middle demonstrates agentivity hinges on the properties of the verb supporting the middle rather than on any property integral to the middle structure itself (Rapoport, 1999). Middle clauses like (21) show that there is no agentivity requirement.

- (21) a. This kind of glass breaks easily (all by itself).  
 b. Milk chocolate melts smoothly (all by itself).  
 c. These heavy windows open easily (all by themselves).  
 (Rapoport, 1999, p. 151)

Evidently, middle verbs are either agentive or non-agentive. Furthermore, the semantically implied agent in a middle verb, even if there is one, does not necessarily project. According to Zwart (1998), the middle verb does not necessarily project any argument syntactically. This is in line with the non-lexicalist view that theta grids do not exist in the lexicon and that a lexical verb is a root unspecified for categorical features. As Sybesma (1999, p. 6) suggests, the transfer of what is generally called thematic information exists vaguely, and the concrete assignment of thematic roles is determined by the structure in which the whole phrase occurs as well as by knowledge of the world. By presenting the relation between the notional subject and the middle VP as basically being between an agentive role and an active VP, the analysis becomes that of an agentive clause and, in fact, cancels the notion of the middle construction. It follows that subject selection in the middle construction should be detached from any canonical motivation such as agentivity, a fact supported by the intuition that a middle clause is a subjective evaluation of the property of the subject entity rather than a description of any actual event initiated by an agent.

If the middle predicate does not allow the agent to project as the external argument, then how is the agent projected if a middle verb does contain agentive information in its lexical semantics? Our answer is that the agent is either unprojected or projected elsewhere [at spec-VP as experiencer] or is to be licensed by a preposition (as *for*-PP). The crucial point is that none of these choices blocks the agentive interpretation because the semantic job is done at the C–I interface. There are middle clauses where agent and cause co-appear.

- (22) a. Latin texts do not translate easily for Bill.  
 b. French books read easily for educated people.  
 (23) a. This flower should transplant easily if I do it carefully.  
 b. This car handles smoothly when Sophy drives it.  
 (Chung, 2001, p. 221)

In (22), the agents of the predicate verbs are realized as PPs that merge at spec-VP as either experiencer (Lekakou, 2006) or beneficiary (Zribi-Hertz, 1993). By contrast, the agents of the matrix middle predicate in (23) are not projected. With the help of the conditional clauses, the agents of the middle verbs are easily recoverable at the C–I interface.

In light of the causative *vP* analysis, the *let-itself* middle clauses found in Dutch and German obtain a straightforward account. In this construction, the subject entity plays the theta role of cause and binds the reflexive *itself*, as illustrated by (24) and (25).

- (24) GSM-antwoordapparaat *laat zich gemakkelijk kraken*.  
 (Dutch)  
 mobile phone-answering machine lets itself easily hack  
 Mobile phone-answering machine is easy to hack.  
 (25) Der Wagen *läßt sich angenehm fahren*. (German)  
 the car lets itself pleasantly drive  
 The car is pleasant to drive. (Fagan, 1992, p. 211)

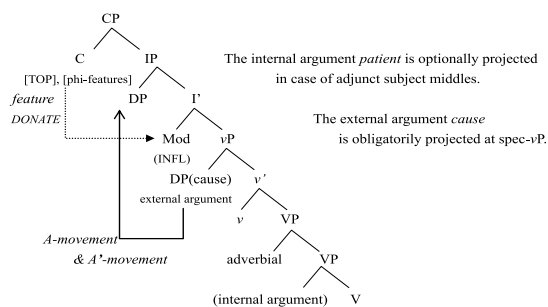
The causative light *v* in these clauses is overtly realized. Because *let* is an individual word rather than an affix, there is no V-to-*v* head movement; hence, the adverbs *gemakkelijk* (easily) and *angenehm* (pleasantly) precede (rather than follow) the lexical verbs *kraken* (hack) and *fahren* (drive).

## 5 An eventive and non-eventive puzzle about the middle construction

An obvious but less studied puzzle about the middle construction is the paradox between event-denoting middle predicates and non-eventive/stative readings of middle clauses. On one hand, middle predicates are observed to denote an activity, which confirms the presence of an event argument.<sup>8</sup> According to Davidson (1967) and Parsons (1990), adverbials are predicates of the event argument. If the latter is missing, the modification fails. The fact that most English middle predicates have the “adverbial requirement” corroborates the existence of an event argument. On the other hand, it is generally agreed that middle clauses are non-eventive/stative—not describing an event but attributing generic properties to objects regardless of time (Ackema and Schoorlemmer, 1994; Matsumoto and Fujita, 1995). The question is why the middle construction involves an event argument but not yet an eventive clause. For a middle clause, three elements are crucial: (1) the event-denoting VP for which a morph-syntactic device is required to bind the event argument, (2) the *vP* predicate headed by a causative light *v*, and (3) the tenseless ModP headed by Mod. The structure of a middle construction is represented by (26).

<sup>8</sup> Fagan (1992) proposes that only transitive activities and accomplishments undergo middle formation, whereas Zwart (1997b) claims that only activity verbs are allowed in middles.

## (26) The structure of a middle clause



The grammatical category of tense plays a vital role in deciding the eventive/stative reading at the clausal level. Roberts (1987, p. 198) suggests that V (the lexical verb) could optionally co-index with the functional tense. When V temporally depends on tense, an event reading is produced; otherwise, a state reading is obtained. In the case of event reading, thematic relations between a verb and its arguments are understood to hold with respect to the time or interval specified by tense. In cases of state reading, however, thematic relations hold regardless of the time specified by tense in that the temporal argument of V is not bound. Simply, tense serves as a temporal operator for deciding the clausal eventive/stative reading. If our assumption that a middle clause is headed by tenseless Mod is on the right track, the previously mentioned puzzle obtains a reasonable account. The answer lies in the tenseless Mod INFL being unable to provide a suitable temporal operator to bind the event argument as a tense INFL does and thus is unable to map the predicated event onto the realistic world. Instead, Mod links the predicated event with a possible world by means of providing a modal operator to the event argument and in this way changes an eventive middle predicate to a stative middle clause.

To some degree, the tenseless Mod INFL can also explain the adverbial requirement of a middle clause. According to the hypothesis on constraining the event argument (henceforth HCEA) proposed by Huang (1996, p. 133), the event argument denoted by a syntactic predicate must be properly constrained by some overt morphological/lexical element. Otherwise, the relevant event argument is not available for interpretation. This factor being the case, when a null Mod in a middle clause fails to serve as morpho-syntactical binder of the predicated event, other elements like a dummy *do*, a negation, or an adverbial could provide an overt morpho-syntactic device to rescue the otherwise unavailable interpretation. What is to be emphasized is that these devices, although they morpho-syntactically bind the predicated event, can never function as temporal binders as tense does and are thus unable to lead to an eventive clause reading. The HCEA also explains the non-obligatory adverbial presence in Romance languages. In these languages, there are morpho-syntactic devices instantiated by the imperfective aspectual marker (in Greek) or reflexive clitic (in French and other Romance languages), which can bind the event argument. Therefore, in the absence of adverbials, the event argument could be morpho-syntactically bound, and its existence guaranteed at the C-I interface. Naturally, there is no stringent “adverbial requirement.”

In short, the eventive reading of a middle predicate survives thanks to the overt Mod or an adverbial. The middle clause as a whole, however, is still non-eventive because it is not headed by

tense. Evidently, the tenseless Mod INFL is vital in this eventive-to-stative alteration.

## 6 An extension to the Mandarin middle construction

### 6.1 “NP + V-*qilai* + AP” sentences

Such “NP + V-*qilai* + AP” sentences that begin with NP<sub>Patient</sub> or NP<sub>Adjunct</sub> as shown in (27) are sometimes taken as middle clauses in Mandarin Chinese.

- (27) Zhe-liang che kai-*qilai* hen kuai.  
this-CL car drive-*qilai* very fast  
This car drives very fast.

Sung (1994, p. 62) claims that *qilai*, as a middle morpheme, gives rise to a non-eventive generic reading as reflected in the English middle construction. However, some linguists argue against the middle status of “-*qilai* sentences” (Kurukawa, 2005; Tao, 2010). Do these sentences belong to the middle construction? If yes, how do linguists analyze them parallel to their English counterparts?

In (27), the inherent property of the surface subject entity renders it possible for the predicated event (together with a manner or result) to happen. Therefore, assuming that a causative light *v* heads the relevant predicate is plausible. Given our assumption that the middle light *v* is causative and does not license an agent, only the “-*qilai* sentences” with non-agent subjects are middle clauses. Sentences like (28) with an agent subject should be ruled out of the group of middles.

- (28) Ta pao-*qilai* feikuai.  
he run-*qilai* quickly  
He runs quickly.

Is (28) also headed by a Mod-like INFL in the same way as an English middle clause? The answer seems affirmative in that these sentences are topic sentences expressing a non-eventive evaluation of the subject entity. We suggest that, similar to the English middle construction, a null Mod is in this construction and that -*qilai* is a default inflectional form realized on V to be properly interpreted at the SM (Sensory-Motor) interface. To be exact, the null aspect-like modal auxiliary is heading the structure of these clauses if we assume that a Chinese clause is usually an AspP (Aspect Phrase), the counterpart of an English TP. Accordingly, Chinese Mod INFL lacks the aspect feature in the same way that an English Mod INFL lacks the tense feature; thus, the Chinese example fails to value the aspect feature of the lexical V. With this knowledge, -*qilai* is but the default imperfective aspect marker realized on V—similar to the situation where the present tense is adopted as a default to realize the tense feature on V of English middle clauses.<sup>9</sup> This assumption is not implausible because Mandarin Chinese is

<sup>9</sup> A reviewer asks, “Why is an A-not-A construction formed on the AP (Adjectival Phrase) instead of the main predicate V?” Our answer is that A-not-A is a semantic contrastive construction. “NP + V-*qilai* + AP” sentences should be viewed through three different dimensions. Syntactically, V-*qilai* serves as the predicate, fulfilling the function of expressing a dynamic event involving the subject NP. Semantically, AP plays the core role in semantic



considered an aspect-prominent language (Lin, 2003, 2006; Smith, 2008), with aspect being a highly grammaticalized category usually realized by such overt makers as *-guo* (the experiential marker), *-le* (the perfective marker), *-zhe* (the durative marker), and *zai-* (the progressive marker).

Tense and aspect are so closely bound in linguistic expression that analyzing one fully apart from the other is impossible. Lin (2003, 2006) emphasizes that there is no tense category in Chinese grammar and that the temporal interpretation in Chinese is basically determined by aspect. It is possible that a single Asp category in Chinese does the dual job of both tense and aspect in English-like languages. It is widely agreed that *-qilai* is an inchoative aspect marker. As a subtype of the imperfective aspect marker, *-qilai* fails to ascribe an endpoint to the predicated event; namely, “V-*qilai*” does not describe a particular event but initiates and extends a relevant activity. Being the most frequently used imperfective aspect marker, *-qilai* seems to be the first choice to morphologically realize the unvalued [*uASP*] feature on V to be properly interpreted at the SM interface.<sup>10</sup>

Besides *-qilai*, other imperfective aspect markers like *-zhe* (the progressive one) and *-shangqu/xiaqu* (the extensional one) are also possible in Chinese middle clauses as documented by Cao (2004). In contrast, the perfective and experiential aspect markers like *-le* and *-guo* cannot appear in this construction. The examples in (29) show such a contrast.

- (29) a. Zhe-jian fengyi chuan-zhe hen heshen.  
this-CL garment wear-zhe very fit  
This garment is well-tailored for the body/fits  
the body well
- b. Shafa zuo-shangqu hen shufu  
Sofa sit-shangqu very comfortable  
The sofa sits comfortably.
- c. \*Ta xiao-guo/le hen ke'ai.  
she smile-guo/le very lovely  
She (has) smiled very lovely.

The topic analysis of the “NP + V-*qilai* + AP” construction is popular. Yin (2006a,b), for instance, divides this construction into two subtypes, as outlined in (30).

- (30) Type I: NP+V-*qilai*+AP=topic/subject+adverbial  
+predicate  
Type II: NP+V-*qilai*+AP=topic+subject+predicate

In Type I, the beginning NP plays the dual roles of topic and subject, while in Type II, the topic and subject are, respectively, realized by NP and “V-*qilai*.” This correctly captures the topic status of the sentence-beginning NPs but engenders a misconception of “V-*qilai*.” If “-*qilai*” in both cases are uniformly understood as the default aspect realization in the case of a null Mod heading a middle clause as we assume, then “V-*qilai*” in both types are neither

contrast. Pragmatically, AP conveys new information or comments on the topic/ subject NP.

<sup>10</sup> He (2004, p. 58) labels *-qilai* as a temporal marker (a separate category not indicating any specific time), which functions to lower the degree of elaboration of an event denoted by the verb and to assign an atemporal feature to V as well as to enhance the stative flavor of the predicate. This atemporal insight is in essence similar to our analysis.

adverbials nor subjects but predicates. When the subject status of “V-*qilai*” in Type II is abandoned, the sentence-initial NPs in both types are undoubtedly subjects and topics, parallel to English middle clauses.

Is there a modifier requirement in the “NP + V-*qilai* + AP” construction? In the “V-*qilai*” sentences in which the functional Mod is null, the default imperfective aspect marker *-qilai* could effectively bind the event argument as a morpho-syntactical device, but its semantic vacancy weakens its capability to trigger the modality interpretation essential for middle clauses. Consequently, a modifier is needed to enrich the bare VP, making it a more semantically saturated predication. For a “V-*qilai*” middle clause to hold true, there is actually a postverbal “adjectival requirement,” that is, a counterpart of the “adverbial requirement.” Nevertheless, both requirements (adverbial and adjectival), when viewed syntactically, are, in essence, the same because Mandarin does not reveal a systematic inflectional adjective vs. adverb difference as English does. In effect, “adjectives could be used as adverbials to modify events in Mandarin Chinese” (Zhu, 1982, p. 75/154).

## 6.2 Other middle clauses in Mandarin Chinese

If our assumption that the middle predicate involves a causative *vP* is right, the middle status of the “NP + *neng/ke* + V” construction exemplified by (31) can be well established. In Mandarin, *neng/ke* (can/may) is generally considered a dynamic modal with scope over VP (Tao, 2010; Lin, 2012). Similar to the *let itself* in Dutch and German, the causative light *v* in this construction is overtly realized.

- (31) Zhe-liang zixingche hai neng/ke qi.  
this-CL bike still can/may ride  
This bike is still rideable.

In the same vein, “NP + *hao* + V” sentences like (32) could be treated as middle clauses if *hao* (good) is taken as a dynamic modal, as Tao (2010) suggests.

- (32) Zhe-ben shu hao dong.  
this-CL book good understand  
This book is easy to understand.

The “NP + *nan/yi* + V” sentences like (33) are also perfect middle candidates (Kurukawa, 2005; Tao, 2010; Shen and Tao, 2010).

- (33) a. Shiqing dique bu rongyi ban.  
thing indeed Neg. easily do  
The matter is really not easy to deal with.
- b. Na-ci jingli zhen nan-wang.  
that-CL experience indeed difficult-forget  
That experience is indeed unforgettable.

There is always a debate on the category of *hao* and *nan/yi* (difficult/easy). The focus is on whether they are adjectives or modals. If treated as adjectives, the examples in (32) and (33) should be analyzed parallel to English tough constructions. However, in our personal communication with 10 native Mandarin

speakers, all consider these sentences as mono-clausal, obviously different from the bi-clausal English tough constructions. If taken as dynamic modals, these *hao/nan/yi* adjectives are really the morphological realization of the causative light *v*. In other words, they have been de-adjectivized to the functional category because of grammaticalization.

An interesting fact about the “NP + *hao* + V” construction is that *hao* has nothing to do with its literal meaning of “goodness” but actually means *rongyi* (easiness; [Zhu, 1982](#), p. 66; [Kurukawa, 2005](#)), and both involve subjectivity ([Hiroshi, 2000](#), p. 254). The sentences in (34) show the interchangeability of *rongyi* and *hao*.

- (34) a. Nüren hen *rongyi/hao* hong.  
women very easy/good please  
Women are very easy to please.  
b. Yasi kaoshi bu *rongyi/hao* tongguo.  
IELTS test not easy/good pass  
The IELTS test is not easy to pass.

Considering *nan/yi* and *hao* as modals has the advantage of highlighting their interchangeability with *neng/ke*, as (35) demonstrates.

- (35) Zhe-ge wenti *neng/ke/hao/rongyi/nan* jiejie.  
this-CL problem can/may/good/easy/difficult solve  
This problem may (can) be solved/is easy to solve/is  
difficult to solve.

Another common property of *hao* and *nan/yi* is that they could all be used as a monosyllable attached to V to form a compound word, as the examples in (36) demonstrate.

- (36) *hao-chi* (good-eat) *hao-kan* (good-look) *hao-ting*  
(good-hear) *hao-chu* (good-get along) *hao-xiu*  
(good-repair) *hao-guo* (good-pass/feel) *hao-dafa*  
(good-tackle)  
*nan-chi* (hard-eat) *nan-kan* (hard-look)  
*nan-ting* (hard-hear) *nan-chu* (hard-get along)  
*nan-xiu* (hard-repair) *nan-guo* (hard-pass/feel)  
*nan-dafa* (hard-tackle)  
*yi-xi* (easy-wash)  
*yi-bian* (easy-change) *yi-chao* (easy-cook)  
*yi-gan* (easy-dry)  
*yi-sui* (easy-break) *yi-chang* (easy-sing)  
*yi-nu* (easy-angry)

These compounds are telling evidence that adjectives like *hao* and *nan/yi* (in this usage) are actually grammaticalized to non-word elements. For this very reason, [Zhu \(1982\)](#) and [Lyu \(1984\)](#) suggest that linguists take them as auxiliaries. It should be noted that, in these middle constructions, there is no adverbial requirement. The overt causative light *v* *neng/ke*, *hao*, and *nan/yi* could all function as morpho-syntactic means for binding the event argument for its proper interpretation. Another piece of evidence for their middle clause identity is that these sentences are all categorical judgments, that is, expressing the speaker’s evaluation of the property of the subject entity rather than describing an event. In this sense, they fit perfectly into our Mod INFL analysis of the middle construction. Similar to many English middle clauses, the clausal head Mod could be either overtly or covertly realized, as (37) shows.

- (37) Zhe-ge wenti (*hui*) *neng/ke/hao/rongyi/nan* jiejie.  
this-CL problem (will) may/can/good/easy/difficult solve  
This problem can (may) be solved/is easy to solve/is  
difficult to solve.

### 6.3 Are notional passives Mandarin middles?

[Ting \(2006\)](#), following [Cheng and Huang \(1994\)](#), takes the notional/unmarked passives exemplified in (38) as Mandarin middle clauses.

- (38) a. Yifu xi-*hao-le*  
clothes wash-good-*le*  
The clothes have been washed.  
b. Zhang’ai paichu-*le*  
barrier exclude-*le*  
The barriers have been removed.

Obviously, these sentences share the stative reading in common with middle clauses. Nevertheless, the perfective aspect marker *-le* presupposes the actual happening of the predicated events. If middle clauses are indeed headed by a tenseless Mod, (38) should be non-middle clauses because they presuppose an actual event that is properly licensed by the temporal operator INFL. There is no causative interpretation of the predicated event. Neither is there any subjective evaluation made by the speaker in (38). Rather, they are objective descriptions of some events that happened with a resultant state. Although they do not have overt passive markers, they are authentic passive clauses. Unsurprisingly, a passive marker *bei* could be added to help recover their passive identity, as (39) shows.

- (39) a. Yifu *bei* xi-*hao-le*.  
clothes *bei* wash-good-*le*  
The clothes have been washed.  
b. Diren *bei* da-tui-*le*.  
enemy *bei* beat-retreat-*le*  
The enemy has been repelled.

Another group of seeming middle clauses reported by [Shen and Sybesma \(2010\)](#) and [Shen and Tao \(2010\)](#) includes the “NP + *gei* + VP” sentences in (40):

- (40) a. Haizi *gei*-bing *le*.  
child *gei*-sick *le*  
The child got sick.  
b. Maodun *gei*-baolu *le*.  
conflict *gei*-expose *le*  
The conflict has been exposed.

Taking *gei* as a middle voice marker that semantically introduces an implicit external argument, [Shen and Tao \(2010\)](#) claim that these sentences are intransitive middles because the relevant verbs are evidently unaccusative.

However, neither the causative interpretation nor the epistemic evaluation can be made from the sentences in (40). Rather, they just describe a state through the typical usage of unaccusative predicates. If [Shen and Tao’s \(2010\)](#) claim

that *gei* implies an external cause is true, these sentences are, at most, notional passives, not middle clauses. After all, in terms of transitivity, passive predicates are indistinct from unaccusative ones. Obviously, the notional passive clauses and the unaccusative “NP + *gei* + VP” sentences are not middle constructions in that neither T<sub>MOD</sub> nor causative light *v* is involved in their derivation.

## 7 Conclusion

We have sketched a middle clause structure as a tenseless ModP with a causative *v*P complement, which, in turn, selects an event-denoting VP. This structure provides a package account for the syntactic and semantic properties of the middle construction. First, the light *v* in a middle predicate is causative, and hence, it naturally licenses the external argument of cause but disallows the agent to merge at spec-*v*P. The seeming patient/adjunct subjects in middle clauses are, in fact, the external argument of cause. This fact accounts for the responsibility reading—an inherent property of the subject entity leads to the predicated event. Second, the Mod INFL heading of a middle clause fails to bind the predicated event as a temporal operator, hence the non-eventive reading at the clausal level. Although unable to map the event on to the actual world, Mod could function as a modal operator linking the event with a possible world, thus the possibility reading. The generic reading follows as a side effect of a stative clause. Third, the uninterpretable tense feature on V cannot be valued through Agree with Mod, so a default present tense is employed for the structure to be properly interpreted at the interface (hence the reported present-tense constraint of middle clauses). The progressive aspect is evidently in conflict with the stativity semantics of middle clauses; therefore, middle predicates are seldom found in progressive form.

The key to our A&A'-movement analysis of the middle construction is the tenseless Mod INFL. It helps solve two middle puzzles: the subject and topic dual status of the sentence-initial NP and the conflict between the event predicate and the non-eventive middle clause. First, C might DONATE both edge features and phi-features to the clausal head Mod, making the A&A'-movement possible. Second, Mod fails to bind the predicated event argument as a proper temporal operator, giving rise to the stative reading of middle clauses. As a means of rescue, a modifier (as well as an overt modal or a dummy *do*) is required to serve as a morpho-syntactic device to recover the event argument at the interpretation interface.

Apparently, there is no middle-clause-specific derivation. Neither the causative light *v* nor the tenseless Mod is unique for the middle construction.<sup>11</sup> A combination of them creates the middle structure and interpretation. To our satisfaction, such

11 Actually, neither the causative light *v* nor the Mod INFL is our original proposal (see Sections 4.2 and 4.4). Our contribution is to combine them and paraphrase them under the minimalist framework, in particular, the tense T is redefined under the C-to-T Feature Donate mechanism. Fortunately, this analysis could be extended to Mandarin Chinese.

controversial Chinese constructions as “NP + *neng/ke* + V” sentences, “NP + *hao* + V” sentences, “NP + *nan/yi* + V” sentences, and “NP + V-*qilai* + AP” sentences naturally fit into the same underlying middle structure. This phenomenon effectively reveals how a cross-linguistic universal middle structure can be realized similarly and differently in various sentences. In both English and Chinese, the functional category of Mod INFL could overtly or covertly head a middle clause. In Mandarin Chinese, the causative light *v* is usually overtly realized as dynamic modals, whereas in English, it is usually an empty category. In the case of the null Mod, English adopts the default present tense and Chinese the imperfective aspect to meet the interface condition. In English middle clauses, the adverbial requirement is mostly met by adverbs, whereas in Chinese middle clauses, it might be met by AP. Theoretically, we prove that there is indeed a universal syntactic entity of the middle structure, with Mandarin Chinese being no exception. By incorporating various Chinese middle sentences into the middle syntactic structure of universal grammar, our study essentially adds evidence to the psychological reality of UG (Universal Grammar), especially its core functional categories. The differences between languages are indeed due to the feature differences between these functional categories, as minimalism advocates.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by Academic Committee of the School of Foreign Languages, Guangdong University of Technology. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

## Author contributions

HD: Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing. HW: Conceptualization, Methodology, Visualization, Writing – original draft, Writing – review & editing.

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