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CONSTRUCTIONAL MODELING IN THE FORMALISM OF COGNITIVE-QUANTITATIVE CONSTRUCTION GRAMMAR

Abstract

This paper discusses the findings of constructional modeling in the formalism of cognitive quantitative construction grammar, a newly developed research framework within a cognitive-quantitative grammar approach. Triangulating theoretical tenets, methodological principles and research tools of cognitive-semiotic frameworks with quantitative corpus studies, cognitive quantitative construction grammar provides a comprehensive qualitative-quantitative approach to examining cognitive foundations, general and idiosyncratic linguistic features, usage patterns and distribution of linguistic constructions. In this context, constructional modeling entails applying a computerized linguoquantitative procedure for a construction profile parametrization. This procedure yields operationalized and statistically verified data on the essential parameters that determine a construction’s linguistic behavior. The modeling uses the box-bracket notation, which integrates the box notation to represent holistic construction-level information and construction’s constituent-level information, and the bracket notation to detail specific linguistic properties and constructional constraints.

The constructional modeling in the integrated box-bracket notational system applied to English 'detached nonfinite/nonverbal with explicit subject'-constructions allows for a comprehensive representation of their external and internal linguistic properties and captures inheritance links between the constructions at macro-, meso- and micro-levels of the constructional network. The research findings demonstrate the feasibility of applying the cognitive quantitative construction grammar formalism to model the linguistic properties and constraints of complex clause-level constructions and how these constructions are likely to be represented in the mental grammar of speakers.

Keywords: cognitive quantitative construction grammar, linguistic constructions, constructional modeling, box-bracket notational system.

Анотація

У статті проаналізовані результати конструкційного моделювання у формалізмі когнітивно-квантитативної граматики конструкцій як нової дослідницької моделі когнітивно-квантитативного напряму. Ця дослідницька модель, виявлена в тріангуляції теоретико-методологійних положень й аналітико-дослідницького інструментарію когнітивно-семіотичних студій і квантитативно-корпусної лінгвістики, пропонує комплексний кваліативно-квантитативний підхід до вивчення когнітивних основ, загальних та ідіосинкратичних лінгвальних властивостей, вживаності та дистрибуції *лінгвальних конструкцій*. У цьому контексті конструкційне моделювання передбачає застосування комп’ютеризованої лінгвоквантитативної процедури параметризації профілю *конструкції*. Вказана процедура надає операціоналізовані й статистично перевірені дані про основні параметри, що детермінують лінгвістичну поведінку *конструкції*. Моделювання проводиться з використанням рамково-скобкового нотаційного запису, який інтегрує рамковий запис для представлення цілісної інформації на рівні *конструкції* та інформації на рівні її складників, і скобковий запис для деталізації специфічних лінгвальних властивостей і конструкційних обмежень.

Конструкційне моделювання в інтегрованій рамково-скобковій системі нотаційного запису, застосоване до англійських *'відокремлених нефінітних/недієслівних з експліцитним підметом'-конструкцій*, уможливлює комплексне представлення їхніх зовнішніх і внутрішніх лінгвальних властивостей та фіксує зв’язки успадкування між *конструкціями* на макро-, мезо- та мікрорівнях

конструкційної мережі. Результати дослідження демонструють можливість застосування формалізму когнітивно-квантитативної граматики конструкцій для відображення лінгвістичних властивостей і обмежень складних *лінгвальних конструкцій* рівня клаузи та моделювання, як ці *конструкції* ймовірно репрезентуються в ментальній граматиці мовців.

Ключові слова: когнітивно-квантитативна граматика конструкцій, лінгвальні конструкції, конструкційне моделювання, рамково-скобковий нотаційний запис.

Introduction. The current stage in the development of society and science has been marked by a transition to a new knowledge paradigm. The preceding paradigm was distinguished by disciplinarity, homogeneity, hierarchy and a focus on the interests of academic communities (Fox, 2019). In contrast, the new paradigm has been characterized by multidisciplinarity, heterarchy, dynamism and a strong emphasis on acquiring innovative research tools and analytical techniques (Boas, 2019). The increasing demand for digitalized linguistic resources and multifunctional computer programs for language data analysis has led to a methodological shift towards empirical linguistic and cognitive research, highlighting the significance of triangulating qualitative and quantitative approaches to investigate linguistic phenomena, with the quantitative approach holding an obvious advantage. This notable methodological breakthrough has resulted in the development and advancement of a cognitive-quantitative approach in grammar studies that is currently gaining remarkable recognition and attention in the field (Kortmann, 2021; Lai et al., 2018; Yan & Zhang, 2023). The *cognitive-quantitative construction grammar* (hereinafter refered to as CQCxGr) is a newly developed research framework within a cognitive-quantitative approach.

The study of complex syntactic structures and their components is at the forefront of contemporary grammatical research due to significant changes in linguistics under the influence of the most recent theoretical frameworks. A topical issue in grammatical theory that requires investigation from the perspective of contemporary linguistic frameworks is a cognitive-quantitative analysis of English nonfinite/nonverbal clauses with an explicit subject, illustrated by examples such as [[$_{NP}$***the color***] [$_{XP}$***draining from her cheeks***]]; [[$_{AUG}$***with***] [$_{NP}$***thick spectacles***] [$_{XP}$***perched at the very end of his nose***]]; [[$_{AUG}$***without***] [$_{NP}$***insects***] [$_{XP}$***crawling in my hair and vermin nibbling my toes***]]; [[$_{AUG}$***despite***] [$_{NP}$***oil being***] [$_{XP}$***the lifeblood of industrial (modern) society***]]; [[$_{AUG}$***what with***] [$_{NP}$***her mother***] [$_{XP}$***being immaculate too***]]. These nonfinite/nonverbal clauses exhibit relatively idiosyncratic properties, occupying a distinct niche in the syntactic system of the English language and raising several research challenges.

Literature review. Various linguistic approaches and schools have focused their research on specific aspects of the analyzed syntactic units in both diachronic and synchronic contexts: traditional grammar (Stump, 1985; Kortmann, 1991), generative grammar (Felser & Britain, 2007; Nakagawa, 2011), corpus-based linguistics (van de Pol & Petré, 2015), systemic functional grammar (He & Yang, 2015), and construction grammar (Riehemann & Bender, 1999; Bouzada-Jabois & Guerra, 2016). The given syntactic patterns have also been considered in linguotypology (Haff, 2012; Hasselgård, 2012), translation studies (Davydiuk, 2010) and segmental representation of discourse (Asher & Lascarides, 2003).

Although much research deals with English nonfinite/nonverbal clauses with an explicit subject, some critical questions have yet to be answered. It is now essential to investigate the correlation between the syntactic patterns under study and the underlying cognitive structures and mechanisms. Until recently, most studies have focused on qualitative rather than quantitative characteristics, leaving a gap in the functional and contextual study of these units. Moreover, a unified, holistic representation of their essential linguistic properties and constraints has not been undertaken. The issues that have been identified can be solved by

utilizing categorical and conceptual apparatus along with analytical and research tools from the most recent linguistic framework of *cognitive-quantitative construction grammar*.

This paper **aims** to represent English nonfinite/nonverbal clauses with an explicit subject in the formalism of CQCxGr. With this in mind, two **objectives** are attained: 1) to discuss the nonfinite/nonverbal clauses with an explicit subject as *clause-level linguistic constructions*; 2) to model their external and internal linguistic properties and constructional constraints using a box-bracket notation system.

Theoretical and methodological background. Triangulating theoretical tenets, methodological principles and research tools of cognitive linguistic frameworks (Boas, 2021; Croft, 2020; Fillmore, 2012; Goldberg, 2019; Hoffmann, 2022) with quantitative corpus studies (Gries, 2020; Lai et al., 2018; Stefanowitsch, 2020), CQCxGr provides a comprehensive qualitative-quantitative approach for examining cognitive foundations, general and idiosyncratic linguistic features, usage patterns and distribution of *linguistic constructions* within natural language data. The term '*construction*' in italics is part of the terminological apparatus of a particular linguistic framework – construction grammar (specifically *cognitive-quantitative construction grammar*). From the framework's perspective, the basic unit of language analysis is a *linguistic construction* – a generalized cognitively motivated pairing of specific form with definite conceptual meaning/function. *Linguistic constructions* are conceptualized as holistic semiotic schemas representing all language levels (text/discourse, syntax, vocabulary, and morphology). Thus, language constitutes a repertoire of *linguistic constructions* with different degrees of schematicity and syntagmatic complexity stored in a *constructicon* – a structured inventory of taxonomic networks of *constructions*. A comprehensive examination of the linguistic properties of a particular *linguistic construction* is achieved by analyzing its form/meaning parameters (prosodic, morphological, syntactic, semantic, distributional, functional, pragmatic, etc.) and applying a corpus-driven and computerized procedure of linguoquantitative parametrization of a *construction* profile.

In the light of CQCxGr, nonfinite/nonverbal clauses with an explicit subject acquire a constructional status and are referred to as "*D(etached) N(on)F(inite)/N(on)V(erbal) (with) E(xplicit) S(ubject)*" – *constructions* (*DNF/NVES-constructions*). The *DNF/NVES-constructions* represent a class of syntagmatically and semantically complex *clause-level constructions*. Their argument-predicate structure minimally consists of a predicate expressed by a nonfinite/nonverbal phrase (XP) and a subject (the external argument of the nonfinite/nonverbal predicate) expressed by a (pro)nominal phrase (NP). The analyzed *constructions* are partially schematic, represented by obligatory lexically unspecified slots [$Subj_{NP}$] and [$Pred_{NF/NV}$], with an open slot for an augmentor [Aug/ØAug] that in modern English is expressed by a limited number of units {AUG: *with, without, despite, what with*}. The constructions represent a syntactically independent configuration, detached from a matrix clause by intonation or a punctuation mark. The morphosyntactic arrangement of the components is displayed as [[Aug/ØAug][$Subj_{NP}$][$Pred_{NF/NV}$]]. The *DNF/NVES-constructions* constitute a taxonomic constructional network where individual *constructions* are projected onto the network as nodes with different degrees of schematicity, lexical specification and productivity.

Like most modern grammatical frameworks, CQCxGr asserts that the only way to explain and adequately understand the relations between linguistic elements is to formalize such relations. These formalizations are carried out in the form of a notation system that uses symbolic representations to capture the linguistic information about the phonological, morphological, syntactic, semantic, pragmatic and discourse properties of a particular *construction*.

The input data for the formalization of essential linguistic properties and constructional constraints of the *DNF/NVES-constructions* contain the results of the multiparametric constructional profiling based on the computerized linguoquantitative procedure for the parametrization of a *construction* profile. The results provide retrieved from the British National Corpus (Davis, 2004), operationalized and statistically verified data on the linguistic parameters (factors/values of factors) of the plane of expression (form) and the plane of content (meaning/function) (morphosyntactic, relational, referential, syntactic-functional, positional, distributive, collocational-collexeme, conceptual-semantic) that determine the linguistic behavior of the *DNF/NVES-constructions* in present-day English (Жуковська, 2021a, 2021b; Zhukovska et al., 2023).

The modeling is carried out in the box-bracket notation that draws on the notational systems of the updated and modernized version of Ch. Fillmore's Berkley Construction Grammar (*boxes-within-boxes diagrams*) (Fried, 2015) and Usage-Based Construction Grammar (*bracket notation*) (Kim & Davies, 2019; Hoffmann, 2022). The box notation system is a convenient way to organize all the information necessary to adequately describe *constructions* of all types, including *complex clause-level constructions*. A step-by-step clause parsing of a box notation can represent the *construction's* constituents and build a comprehensive description of hierarchical relations between *constructions* in a network, indicating how one *construction* is superimposed onto another (Fillmore, 1988, p. 37). A bracket notation is applied to detail and specify the constructional constraints of individual *constructions*, which allows focusing on specific aspects and not overloading the box notation.

The box notation reflects two levels of linguistic information specification: holistic *construction-level information* and *constituent-level information*. Two planes of representation are specified: ***external*** organization (i.e., characteristics of a *construction* as a whole) and ***internal*** organization (i.e., characteristics of the constituents of a *construction*). The *construction* is represented by a set of boxes inside a larger box. The outer box represents the most generalized and schematic *construction* (*macroconstruction*) and specifies external features characterizing the *construction* as a whole, while the inner boxes provide relevant information about each constituent separately (internal features). Detailed information on the linguistic properties of individual *constructions* is specified in bracket notation entries.

The distinction between the external and internal planes shows that a *linguistic construction* is a holistic language unit and not just the sum of its constituents; more complex and less apparent relations exist between its components, which can be differently manifested when combined in one *construction*. For a descriptively appropriate generalization about a *construction*, the empirically motivated set of features is the minimum set of features that may vary depending on a particular *construction*. By default, each *construction* should carry information about the conventional association between form on the one hand and meaning or function on the other. However, the details and extent of each type of information will vary depending on what is specific to a particular form-function configuration versus what can be inferred from other *constructions*.

Results and discussion. The taxonomic network of the *DNF/NVES-constructions* presents a hierarchy of *constructions* that are organized around a *macroconstruction*. The *macroconstruction* properties are inherited by less abstract *mesoconstructions*, then by more specific *microconstructions*, and are further acquired by lexically specific *miniconstructions*.

The *macroconstruction* of the network represents a *construction* of a high degree of schematicity, a complex semiotic unit of the clause level that licenses the use of detached nonfinite/nonverbal clauses with an explicit subject in English. The *macroconstruction* constitutes a cognitively motivated correlation of **form** (organization of constituents) and conceptual **meaning/function**, which is actualized at the linguistic level by interconnected

and interacting *constructions* of the meso-, micro- and mini-levels of the constructional network that inherit its essential linguistic properties. The notation of the external and internal organization of the *macroconstruction* is shown in Figure 1.

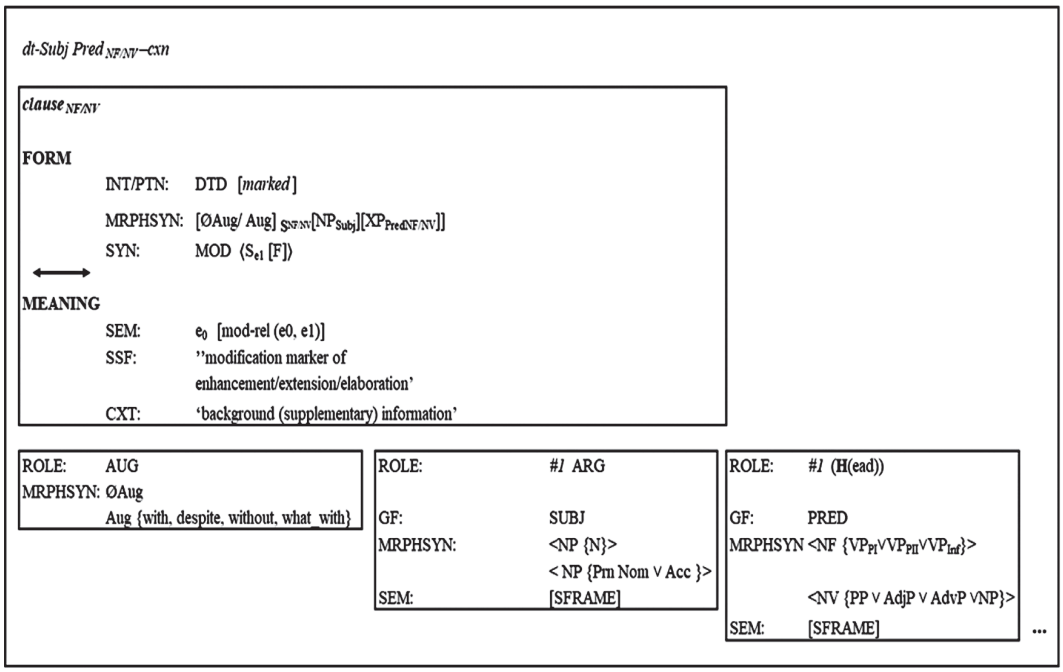

Fig.1. **The *DNF/NVES*-macroconstruction in the CQCxGr formalism**

From the notation, it follows that the external morphosyntactic structure (M(O)RPH(O) SYN(tax)) of the *macroconstruction* represents it as a (partially) schematic *construction* of a nonfinite (N(on)F(inite))/nonverbal (N(on)V(erbal) clause (S) with a nonfinite/nonverbal predicate ($Pred_{NF/NV}$)) and its explicit subject (Subj), (un)introduced by an augmentor (ØAug(mentor)/Aug).

In the external structural representation of the *DNF/NVES-macroconstruction*, the slot [ØAug/Aug] implies the absence/presence of a lexically fixed augmenter, followed by a nonfinite/nonverbal clause $S_{NF/NV}$[NP XP], where the initial NP is a (pro)nominal head that serves as a subject and XP is a nonfinite/nonverbal predicate (Kim, 2013) are characterized by the absence of unique lexical content associated with them.

The *DNF/NVES-macroconstruction* is marked intonationally (INT(onation)) and/or punctuated (P(unc)T(uatio)N), i.e., detached (D(e)T(ache)D) from the matrix clause. Syntactically (SYN), the *DNF/NVES-macroconstruction* modifies the finite matrix clause (S_{e1}[F]), which denotes the event *e1*.

The external semantics (SEM) of the *DNF/NVES-macroconstruction* denotes an event *e0* that is in a modification relation (*mod-rel*) with S_{e1}, performing an inherent semantic and syntactic function (S(emantic)S(yntactic)F(unction)) of a marker of enhancement/extension/elaboration of the matrix (Se1) proposition, and in the discourse context (C(onte)XT) serving as a background for the matrix proposition, providing supplementary information.

The internal characteristics of the *DNF/NVES-macroconstruction* indicate its fixed structure, which includes three obligatory constituents: an augmenter (AUG), a subject constituent (SUBJ), followed by a head-predicate constituent (PRED) requiring a subject.

These relations are indicated by co-indexation (#1) between the predicate constituent and the subject constituent.

The first constituent of the *macroconstruction* plays the syntactic role of an augmenter (AUG). The augmentor can either be expressed in the morphosyntactic structure of the *macroconstruction* (AUG) and take on the values {*with, despite, without, what_with*} or be absent (ØAUG).

The second constituent of the *macroconstruction* performs the grammatical function of the subject (SUBJ) of a nonfinite/nonverbal clause, which is the external (first) argument (ARG(ument)) of the nonfinite/nonverbal predicate. Co-indexation (#1) indicates the relationship between the predicate constituent and the subject. In the morphosyntactic aspect, the external (first) argument is expressed by a (pro)nominal phrase that takes on the values {nominative (Nom)/accusative (Acc) case} in the case of pronominal expression. Semantically, the subject (SUBJ) is not specified, but it can be filled with constructionally congruent lexemes whose meaning is actualized in the semantic frame (SFRAME).

The predicate of the *macroconstruction* is the head of a nonfinite/nonverb clause. Morphosyntactically, the predicate is realized by a nonfinite phrase with present participle I (VP_{PI}), past participle II (VP_{PII})), infinitive (VP_{Inf}) or a nonverbal phrase expressed by a prepositional (PP), adjectival (AdjP), adverbial (AdvP), noun (NP) phrase. Semantically, the predicate of a *macroconstruction* is specified through the meaning of semantically congruent filler lexemes actualized in semantic frames. Due to the limited space of the article, the set of semantic frames evoked by lexemes filling the SUBJ and PRED will not be discussed.

The suspension points (...) denote the arguments/adjuncts of the predicate that can potentially be actualized in specific *miniconstructions* and can be represented in additional boxes if necessary.

The notational conventions adopted in our study are flexible and allow adding information if necessary. The constructional constraints of the generalized clause-type *detached nonfinite/nonverbal with an explicit subject'-macroconstruction* (*dt-nf/nv-ds-cl–cxn*, where *ds* stands for *"*different from the matric (explicit) subject*",* in contrast with the nonfinite/nonverbal patterns that share the matrix subject) in the hierarchy of inheritance for clause-level *constructions* and the linguistic features of the of *meso*- and *micro*-level *DNF/NVES-constructions* are specified in bracket notation entries.

The meso-level *constructions* of the investigated constructional network acquire the properties of the macro-level *construction – dt-nf/nv-ds-cl–cxn*. In its turn, *dt-nf/nv-ds-cl–cxn* inherits properties from the higher level *construction* in the hierarchy of clause-level *constructions* – the *adjunct clause construction* (*adj-cl–cxn*), following its constructional constraints as a clause modifier, which is represented in the bracket notational entry (1):

$$adj\text{-}cl\text{–}cxn \Rightarrow \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} \mid \text{MOD} & \langle S_{e1}[f] \rangle \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle\ \rangle \\ \text{COMP} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{IND} & e0 \\ mod-rel & (e0,e1) \end{bmatrix} \end{bmatrix}$$

This constructional constraint specifies that the *adj-cl–cxn* syntactically (SYN) modifies the finite (f(inite)) clause (S), which denotes the event *e1* and does not require a subject (SUBJ) or complement (COMPS) (an empty list of their values represents this). Semantically (SEM), the *construction* denotes the event *e0*, which is in a modification (*mod-rel*) relationship (mainly of an adverbial nature) with the matrix sentence (*Se1*).

At the same time, in addition to the restrictions inherited from *adj-cl–cxn*, *dt-nf/nv-ds-cl–cxn* also has its constructional constraints, motivated by the fact that, unlike other adjunct clauses, the *dt-nf/nv-ds-cl–cxn* must be nonfinite or nonverbal (examples 1–4):

(1) [*With Louis watching*], *they nodded in dumb misery* (BNC, AMU)

(2) *[*With Louis is watching*], *they nodded in dumb misery*.

(3) *[*Despite Louis is watching*], *they nodded in dumb misery*.

(4) *[*What-with Louis is watching*], *they nodded in dumb misery*.

To explain nonfinite/nonverb predication, the inheritance hierarchy for clause-level *constructions* is considered. The *adjunct clause construction* as a clause *construction* inherits the syntactic properties and constraints of the *construction* of the highest level of generalization (*constructional scheme*) – the *subject-predicate construction* (*Subj-Pred–cxn*).

The *subject-predicate construction* exhibits the following constructional constraints (Kim, 2013, p. 83):

(2) $\begin{bmatrix} subj & - & pred & - & cxn \\ \text{SUBJ} & \langle\ \rangle & & & \end{bmatrix} \Rightarrow [\#1\ ] \qquad \mathbf{H}\ [\text{SUBJ} \quad \langle [\#1\ ] \rangle]$

The *subject-predicate construction* indicates that the predicate as a head (H), when combined with its subject, forms a grammatically correct phrase structure, the properties/characteristics of which will be inherited in its subconstructions. Depending on the predicate finiteness, two subconstructions of the *subject-predicate construction* are distinguished: finite (f)) and nonfinite (*nf*)/nonverbal (*nv*) *constructions*, which license finite and nonfinite/nonverbal clauses (see Figure 2):

Fig. 2. **Inheritance hierarchy for the *Subject-Predicate construction* in English**

The *nonfinite/nonverbal subject-predicate construction* (*nf/nv-subj-pred–cxn*) inherits the syntactic properties of the *subject-predicate construction* characteristic but semantically (and/or pragmatically) specifies its idiosyncratic properties: the interpretation of *nf/nv-subj-pred–cxn* is not entirely the same as the primary finite predication.

One of the essential characteristics of the *subject-predicate construction* is assigning the CASE feature to the subject. In English, structural cases (*scase*) are realized as NOM, ACC, or GEN, and each subconstruction is limited to the realization of CASE features (Kim, 2013):

(3) $[f - subj - pred - cxt\ ] \Rightarrow [\#1\ [\text{CASE} \quad nom\ ] \qquad \mathbf{H}\ [\text{SUBJ} \quad \langle [\#1\ ] \rangle]$

(4) $[nf - subj - pred - cxt\ ] \Rightarrow [\#1\ [\text{CASE} \quad scase\ ] \qquad \mathbf{H}\ [\text{SUBJ} \quad \langle [\#1\ ] \rangle]$

Constructional constraint 3 specifies that the subject of a finite predicate is marked with the nominative case (*nom*), and the *construction* licenses typical sentences like *He left*. The subject of the *Nonfinite Subject-Predicate Construction* (4) can have any structural case marking, such as gerunds with an accusative or genitive subject (examples 5–6) and structures with a subject in the nominative case (examples 7–8):

(5) *Pat disapproved of **me** quietly leaving before anyone noticed*.

(6) *Pat disapproved of **my** quietly leaving before anyone noticed*.

(7) *John suggested that **he** go to Seoul in March*.

(8) *I recommend that **she** not smoke* (Kim, 2013, p. 83).

In the case of *detached nonfinite/nonverbal with explicit subject constructions* in present-day English, the subject is assigned both the accusative and nominative case. This method of case assignment implies that the nominative case does not depend on finiteness but on the *construction* (Kim, 2013, p. 84).

Thus, by integrating the syntactic properties and restrictions of the *nonfinite/nonverbal subject-predicate construction* (*nf/nv-subj-pred–cxn*) and the *adjunct clause construction* (*adj-cl–cxn*), the *clause-level macroconstruction 'detached nonfinite/nonverbal with explicit subject'–construction* (*dt-nf/nv-ds-c–cxn*) receives an extended morphosyntactic record as *dt-SubjPred*$_{NF/NV}$*–cxn*, realizing the following constructional constraint represented in a bracket notation entry:

(5) *dt-SubjPred*$_{NF/NV}$*–cxn* $\Rightarrow \left[\text{SYN} \left| \mathbf{S} \left| \begin{matrix} \text{PRED} & \text{H} \langle NF \vee NV \rangle \\ \text{SUBJ} & \langle NP \rangle \end{matrix} \right| \right| \right]$, (**S** *nf/nv*)

The *dt-SubjPred*$_{NF/NV}$*–cxn* – is a clause (S) that minimally includes a predicate that realizes the features attributed to a nonfinite verb (VP_{PI}, VP_{PII}, VP_{Inf}) or a nonverbal phrase (AdjP, PP, NP, AdvP). A nonfinite/nonverbal predicate has an explicit subject (NP). In the given notational system, both finite and nonfinite clauses are represented with the symbol S, and if necessary, the corresponding specification is added, e.g., S[*n*(on)*f*(inite)]/ S[*n*(on)*v*(erbal)].

The presented inheritance system makes it possible to outline the linguistic properties of the *mesoconstructions* in the network of the *DNF/NVES-constructions*: unaugmented (*dt-øaug-SubjPred*$_{NF/NV}$*–cxn*) and augmented (*dt-aug-SubjPred*$_{NF/NV}$*–cxn*) *mesoconstructions*.

The unaugmented *dt-øaug-SubjPred*$_{NF/NV}$*–cxn* is unmarked for an introductory constituent ([*the road winding narrowly*], [*all things considered*], [*nothing to cheer about*], [*the pitlane a scene of chaos*]), realizing the following constraint (6):

(6) *dt-øaug-SubjPred*$_{NF/NV}$*–cxn*

$$S\left[\text{øaug} - SubjPred_{NF/NV} - cxn\right] \rightarrow [AUG\ unmarked], S_{nf/nv}$$

A marked feature of augmented *dt-aug-SubjPred*$_{NF/NV}$*–cxn* is the use of augmentors such as *with, despite, without, what_with* ([*with lighted cigarettes to give warning of our presence*], [*despite the blood streaming from his nose*], [*without any whistles blowing*], [*what with her mother being immaculate too*]):

(7) *dt-aug-SubjPred*$_{NF/NV}$*–cxn*

$$S\left[aug - SubjPred_{NF/NV} - cxn\right] \rightarrow [AUG\ marked], S_{nf/nv}$$

The notation reflects that *dt-aug-SubjPred*$_{NF/NV}$*–cxn* includes two components: an augmentor (AUG) and a nonfinite/nonverbal clause (S(*nf/nv*)). The given notation differs from the point of view of other linguists, who believe that the augmentor does not introduce a nonfinite/nonverbal clause in these structures but forms the so-called *'head-functor construction'* with the predicate head (Kim & Davies, 2019). However, considering the analyzed *constructions'* status as clauses (*nonfinite/nonverbal*) with their predicate-argument structure, the suggested interpretation is quite justified. Hence, the feature AUG is marked (i.e., lexically expressed), and the nonfinite/nonverbal clause inherits the predicate-argument structure of the *dt-SubjPred*$_{NF/NV}$*–cxn*. The augmented *mesoconstruction dt-aug-SubjPred*$_{NF/NV}$*–cxn* licenses the following *microconstructions*:

(8) *dt-with-SubjPred*$_{NF/NV}$*–cxn*

$$S\left[with - SubjPred_{NF/NV} - cxn\right] \rightarrow [AUG\ with], S_{nf/nv}$$

(9) *dt-despite-SubjPred*$_{NF/NV}$*–cxn*

$$S\left[despite - SubjPred_{NFNV} - cxn\right] \rightarrow [AUG\ despite], S_{nf/nv}$$

(10) *dt-without-SubjPred*$_{NF/NV}$*–cxn*

$$S[without - SubjPred_{NF/NV} - cxn] \rightarrow [AUG\ without], S_{nf/nv}$$

(11) *dt-what_with-SubjPred*$_{NF/NV}$*–cxn*

$$S[what\_with - SubjPred_{NF/NV} - cxn] \rightarrow [AUG\ what\_with], S_{nf/nv}$$

At the same time, augmentors bring specificity to the meaning of *constructions*. For example, in the syntactic-functional aspect, *dt-**despite**-SubjPred*$_{NF/NV}$*–cxn* and *dt-**what_with**-SubjPred*$_{NF/NV}$*–cxn* are more limited than the unaugmented *dt-**øaug**-SubjPred*$_{NF/NV}$*–cxn* and the augmented *dt-**with**-SubjPred*$_{NF/NV}$*–cxn*. In our previous studies (Жуковська, 2021a), it was proved that *dt-**øaug**-SubjPred*$_{NF/NV}$*–cxn*, *dt-**with**-SubjPred*$_{NF/NV}$*–cxn* and *dt-**without**-SubjPred*$_{NF/NV}$*–cxn* show the largest number and variability of syntactic functions. In particular, *dt-**øaug**-SubjPred*$_{NF/NV}$*–cxn*, *dt-**with**-SubjPred*$_{NF/NV}$*–cxn* and *dt-**without**-SubjPred*$_{NF/NV}$*–cxn* implement the functions of extension and enhancement of the matrix proposition.

In addition, *dt-**øaug**-SubjPred*$_{NF/NV}$*–cxn* and *dt-**with**-SubjPred*$_{NF/NV}$*–cxn* perform the extension function. In the function of elaboration, these *constructions* realize adverbial relations of cause, mode of action, condition, time, purpose, result and concession. Thus, the unaugmented and *with*-augmented *constructions* do not show any differences in terms of syntactic functions. This fact indicates that in present-day English, the augmentor *with* is semantically bleached (van de Pol & Hoffmann, 2016). While in the early stages of English development, the augmentor *with* was used to convey the meaning of the mode of action and accompanying circumstances, in present-day usage, it has undergone grammaticalization, acquiring the status of a semantically empty marker of the *DNF/NVES-constructions*. This shift has impacted other augmented *constructions*. The augmentors *without*, *despite*, and *what_with* also acquire the status of syntactic markers of the *DNF/NVES-constructions*, which introduce *constructions* with clearly defined adverbial meanings: *dt-**despite**-SubjPred*$_{NF/NV}$*–cxn* – concession; *dt-**what_with**-SubjPred*$_{NF/NV}$*–cxn* – reason.

The structural constraints of unaugmented and augmented *mesoconstructions* are reflected in the notation entries (12–13):

(12) *dt-**øaug**-SubjPred*$_{NF/NV}$*–cxn*

$$\begin{bmatrix} SYNF & enhancement < \cdots > -rel\ (e0,e1) \\ & extension - rel\ (e0,e1) \\ & elaboration\ - rel\ (e0,e1) \\ CXT| & SUPPLEMENTARY\ e1\ expansion \end{bmatrix} \rightarrow [\emptyset\ AUG\ ], \boldsymbol{S_{e0}}$$

The constructional constraints specify that the *dt-**øaug**-SubjPred*$_{NF/NV}$*–cxn* lacks an augmentor introducing a nonfinite/nonverbal clause. The *construction* realizes the syntactic functions of enhancement, extension and elaboration. The enhancement functions are not specified (<⋯>) and are determined in a specific context. Contextually, the event *e0* of the *construction* explicates the supplementary (background) information that expands the event (*e1*) of the matrix clause by actualizing the functions of enhancement, extension and elaboration.

(13) *dt-**with**-SubjPred*$_{NF/NV}$*–cxn*

$$\begin{bmatrix} SYNF & enhancement < \cdots > -rel\ (e0,e1) \\ & extension - rel\ (e0,e1) \\ & elaboration\ - rel\ (e0,e1) \\ CXT| & SUPPLEMENTARY\ e1\ expansion \end{bmatrix} \rightarrow [AUG\ with\ ], \boldsymbol{S_{e0}}$$

The constructional constraints (13) state that *with* acts as an augmentor of the *construction* and introduces *Se0*. The *dt-**with**-SubjPred*$_{NF/NV}$*–cxn* implements the syntactic functions of enhancement, extension and elaboration and explicates supplementary background information that expands the event (e1) of the matrix clause.

(14) *dt-**without**-SubjPred*$_{NF/NV}$*–cxn*

$$\begin{bmatrix} SYNF & enhancement < \cdots > -rel\ (e0,e1) \\ & extension - rel\ (e0,e1) \\ CXT| & SUPPLEMENTARY\ e1\ expansion \end{bmatrix} \rightarrow [AUG\ without\ ], \boldsymbol{S_{e0}}$$

The constructional constraints (14) specify that the augmentor *without* introduces *Se0*. The *construction* explicates supplementary background information that expands the event (e1) of the matrix clause through enhancement and extension functions.

(15) *dt-**despite**-SubjPred*$_{NF/NV}$*–cxn*

$$\begin{bmatrix} SYNF & enhancement\_concession - rel\ (e0,e1) \\ CXT| & SUPPLEMENTARY\ e1\ expansion \end{bmatrix} \rightarrow [AUG\ despite\ ], \boldsymbol{S_{e0}}$$

In Example 15, the constructional constraints state that *despite* being an augmentor introduces the clause *Se0*. The *construction* actualizes only one of the enhancement functions, precisely that of concession, and contextually, the *construction* explicates the supplementary information that expands the event (e1) of the matrix clause.

(16) *dt-**what_with**-SubjPred*$_{NF/NV}$*–cxn*

$$\begin{bmatrix} SYNF & enhancement\_reason - rel\ (e0,e1) \\ CXT| & SUPPLEMENTARY\ e1\ expansion \end{bmatrix} \rightarrow [AUG\ what\_with\ ], \boldsymbol{S_{e0}}$$

The constructional constraints (16) specify that *what_with* as an augmentor introduces the nonfinite/nonverbal clause *Se0*, which contextually explicates the supplementary information by expanding the event (*e1*) of the matrix clause by actualizing enhancement relations through the syntactic function of reason.

Concluding remarks. The results of the constructional modeling in the formalism of cognitive quantitative construction grammar conclusively show the effectiveness of the integrated box-bracket notational system in capturing the linguistic properties and constraints of *complex clause-level constructions*. The formal modeling applied to the nodes of the network of the *DNF/NVES-constructions* enabled to holistically represent their external and internal properties and show inheritance links between the *constructions* at macro-, meso- and micro-levels of the constructional network.

The findings presented in this study show the need for future investigations. The integrated box-bracket notational system should be tested to formalize the linguistic properties of other types of *linguistic constructions* and model how *linguistic constructions* are likely to be represented in the mental grammar of speakers.

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