Reconsidering the construct state in Modern Hebrew

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In this paper, I reconsider the Hebrew construct state from a semantic point of view. I show that construct states have a variety of different interpretations, beyond the modificational/referential contrast discussed in Borer (2009). I shall argue that (almost) all nominally headed construct states have predicate NP complements, even those that look 'referential', and that this allows the NP to be interpreted in one of a number of ways: as an incorporated predicate, as a nominal modifier or as the semantic 'head' of the construct state. I will further show that the account given extends to construct states headed by non-nominal constituents, in particular adjectives and numerical expressions.

1. Introduction: The Hebrew construct state

Studies of the Hebrew construct state have largely focused on its syntactic properties and, with some exceptions, on construct states headed by nominals, such as the example in (1):

(1) beyt ha-mora (he-xadaš)[1]
house.M DEF-teacher.F (DEF-new.M)
'the teacher's (new) house'

Issues discussed have included word order and constituent structure, the assignment of genitive case to the complement *ha-mora* and the distribution of definiteness features, but there has been very little discussion of semantic interpretation. Borer (2009) argues that there are two types of nominally headed construct states, R-construct states, such as those in (1), where the complement *ha-mora* is a referential constituent, and M-construct states, such as those in (2), where the syntactic complement has a modificational function.

(2) beyt ha-ec
house.M DEF-wood
'the wooden house/the house of wood'

She argues that the complement *ha-ec* in (2) is an NP constituent, while the complement in (1) is a referential DP. Her analysis is syntac-

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tic and does not include a compositional semantic interpretation for either type of expression.

In this paper, I reconsider the Hebrew construct state from a semantic point of view. I show that construct states have a variety of different interpretations, beyond the modificational/referential contrast noted by Borer. I shall argue that (almost) all nominally headed construct states have NP complements, even when those complements look 'referential' and/or definite. This NP can be interpreted in one of a number of ways: as an incorporated predicate, as a nominal modifier or as the semantic 'head' of the construct state. Crucially, it is the NP predicate status of the complement which allows this flexibility. I will further show that the account given extends to construct states headed by non-nominal constituents, in particular adjectives and numerical expressions.

I start by reviewing the important syntactic properties of the construct state (CS), using (1) as an example. The CS in (1) consists of a nominal head *beyt* 'house', followed by an NP 'complement' *ha-mora* 'the teacher'. Since 'complement' is a theoretically loaded term, we will from now on call this second constituent by the theoretically neutral term 'annex', following Shlonsky (2004). The head and annex each show characteristic properties. First, the syntactic head *beyt* is the phonologically reduced form of the free nominal *bayit*. Second, the definite marker *ha-* appears only on the annex. But, despite the fact that only the annex is marked for definiteness, the whole CS is interpreted as definite. Third, no material intervenes between the head and the annex. Adjectives in Hebrew agree in number, gender and definiteness with the noun they modify. As in (1), the adjective modifying the head noun must follow the annex. It is clear that the adjective *he-xadaš* does modify the head noun and not the annex since it agrees with *beyt* in gender. Note that the adjective modifying the head noun is also marked definite. Since adjectives agree in definiteness with the phrase they modify, this clearly indicates that definiteness features have percolated to the whole CS although they are marked explicitly only on the annex.

These syntactic properties have led to a general agreement that the construct state involves a grammatically 'close' relation between the head and annex which Shlonsky (2004) calls 'freezing'. Borer (1999, 2009) argues that the construct state is a 'syntactic word', involving syntactic incorporation, mirroring at the syntactic level the phonological and morphological effects of lexical-compounding which we see in compounds such as (3):

(3) a. beyt avot
house.M.SG father.M.PL
'old age home'

b. beyt sefer
house.M.SG book.M.SG
'school'

These expressions both have the same lexical head as (1), *beyt,* meaning 'house'. The bare annex in (3a) is *avot* 'fathers', and in (3b) it is *sefer* 'book'. However, in contrast to (1) and (2), the meanings are non-compositional. As in (1), if the compound is marked definite, the definite clitic appears only on the annex as in *beyt ha-avot* 'the old-age home', but unlike in (1), as Borer (1999, 2009) shows, the annex in a lexical compound never has an independent definite interpretation, and definiteness is semantically a property of the whole NP. In general, she shows that the lexical compound and the syntactic word have different grammatical properties which indicate their different status.[2]

Construct states contrast with free or absolute forms, illustrated in (4a) and clitic-doubling constructions, illustrated in (4b) which have none of the characteristic features of the examples in (1) or (2):

(4) a. ha-bayit (he-xadaš) šel ha-mora
DEF-house.M (DEF-new.M) of DEF-teacher.F
b. beyt-a (he-xadaš) šel ha-mora
house.M-her (DEF-new.M) of DEF-teacher.F
Both: 'the teacher's (new) house'

Note especially that the element which appears as an annex in (1) is the complement of a preposition in the examples in (4). The construct state has been much discussed in the literature (Ritter 1988, 1991, Borer 1999, 2009, Engelhardt 2000, Shlonsky 2004, Siloni 2001, 2002), in an attempt to explain the salient properties just mentioned, as well as the order and distribution of arguments in construct states with nominalized gerundive heads as in (5). Despite basic SVO word order in Hebrew, V-raising is allowed in certain contexts. In the construct state in (5), the nominal head precedes its external argument, thus mimicking the word-order in V-raising sentences:

(5) kibuš roma al-yedey napoleon
conquering Rome by Napoleon
'Napoleon's conquering of Rome.'

Many analyses of the construct state have included the suggestion that these constructions involve raising of some kind, in particular that the nominal head, *beyt* in (1), (2) and *kibuš* in (5), raises to determiner position. It is suggested that raising to DET position allows the head to assign genitive case to the annex, thus explaining both the absence of a prepositional case-assigner and the closeness between the head and the annex, as well as the absence of a definite marker on the head in definite CS forms and the fact the nominal head precedes the external argument in (5).

However, as Siloni (2002) points out, analyses which derive the properties of the CS from a relation between the nominal head and determiner position are far too narrow. This is because construct states may be headed by numericals and adjectives and possibly even prepositions, and these CS forms have the same characteristic properties as (1). Some examples are given in (6). The strings marked in italics are construct states, with (6a) and (6b) headed by adjectives, and (6c) headed by a numerical expression:

(6) a. ha- yalda *šxorat* *ha- se'ar*
DEF- girl.F black.F DEF-hair.M
'the black-haired girl'

b. hi *šxorat se'ar*
she black.F hair.M
'She has black hair.'

c. *šlošet ha-* *yeladim*
three DEF- child.PL
'the three children'

In (6a,b), the adjectivally headed CS form *šxorat ha-se'ar* is clearly an independent constituent. It modifies the head noun in (6a) and is a sentential predicate in (6b). Crucially, the noun in *ha-yalda* 'the girl' (6a) is not part of the construct state, as can be seen from the fact that it is marked with a definite clitic and is not phonologically reduced. The adjectivally headed construct state is headed by the phonologically reduced adjective *šxorat* which is marked feminine to agree with the feminine noun *yalda* 'girl', even though the noun it modifies semantically is the masculine *se'ar*. Adjectival modifiers agree with the nominal they modify in terms of definiteness in Hebrew, as in (7).

(7) a. ha - yalda ha- nexmada
DEF- girl.F DEF- nice.F
'the nice girl'

b. yalda nexmada
girl.F nice.F
'a nice girl'

Thus in (6a) the adjectival phrase is marked definite in a way typical of construct states: as a well-behaved adjective it agrees in definiteness with the definite nominal *ha-yalda* 'the girl', but crucially, as in a well-behaved construct state like (1), the definite clitic appears only on the annex *ha-se'ar* and not on the adjectival head.[3] In (6c), the construct state is headed by a numerical expression *šlošet* 'three'. Again, all the syntactic properties of construct states are present. *šlošet* is the reduced phonological form of the free numerical expression *šloša* 'three', definiteness is marked only on the annex and no material intervenes between the numerical head and the annex.

In the course of this paper, I reconsider the construct state by examining a variety of data which together provide evidence that the construct state is both simpler and more complex than previous analyses have suggested. I will show that construct states apparently consist always of a head +NP string, but that the syntactic and semantic relations between these two constituents can be analyzed in a number of different ways. Thus the construction is more complex than has previously been thought. These analyses all depend on adjacency between the head and the annex, and on the annex being an NP, which prima facie rules out a head-raising analysis[4] and also the necessity for genitive case assignment (on the assumption that only arguments are assigned case). Thus, syntactically, they are simpler than has previously been thought.

I will begin in the next section by reviewing results from Rothstein (2009, 2012a) concerning nominally headed construct states, where the nominal head is a classifier, as in (8).

(8) a. šloša bakbukey mayim
three bottle.PL water
'three bottles of water'

b. [šloša [bakbukey mayim]]
c. [[šloša bakbukey] mayim]

(8) is ambiguous semantically between a counting reading, in which the NP denotes three bottles filled with water, and a measure reading in which it denotes water to the quantity of three bottles. The crucial syntactic fact relevant here is that the semantic ambiguity

is reflected in an ambiguous syntactic structure. On the count reading, the string is analyzed as in (8b). The syntactic head is *bakbukey* 'bottles' and the annex is the complement *mayim* 'water' interpreted via incorporation. On the measure reading, the structure is as in (8c). In (8c), *bakbukey* has all the syntactic properties of a construct state head, but the NP *mayim* is semantically the head in the sense that it determines the reference of the construct state which denotes quantities of water which equal the volume contained in three bottles. The classifier is a measure expression which combines with the numerical to form a complex modifier which modifies the syntactic annex, and specifies the measure. In both cases, the syntactic annex is an NP. These results constitute the first piece of evidence that it is not possible to give a single syntactic analysis of construct state forms and that the flexibility is dependent on the annex being an NP and not a DP.

In section three, I look at the highly restricted distribution of proper names in the annex of construct states, data which I have not yet found discussed in the literature. This further supports the hypothesis that the annex is an NP and not a DP. I then argue that the definite annex in examples such as (1) is in fact a predicate NP, with the definite marker a clitic attached to the NP predicate. In section four I give a semantic analysis of these constructions. In the final section, I return to a discussion of the non-nominal construct states such as those illustrated in (6), and show that these provide more evidence that the construct state is a general mechanism of syntactic word formation in which the annex is an NP.

2. Measure phrases and count classifiers in Hebrew

Rothstein (2009) shows that expressions like (8a) above are ambiguous between a count and a measure reading in Modern Hebrew. As stated above, on the count reading, the expression denotes three bottles filled with water, and on the measure reading it denotes water to the quantity of three bottles. (8a) contrasts with the free absolute form given in (9), which has only the count reading:

(9) šloša bakbukim šel mayim[5]
three bottle.PL of water
'three bottles of water'

Thus, in contexts in which the count reading is possible, either the construct state or the free genitive can be used, while in contexts

in which only the measure reading is plausible, only the construct state can be used. For example, if I ask a waiter to bring me and two friends each a bottle of water, I can use either the free genitive as in (10a) or the construct state form, as in (10b) to express the counting interpretation. But, in order to denote a quantity of water, the construct state must be used. The context in (10c) makes this clear: if Danny is mixing paint and needs to add a quantity of water equaling three bottles to get the consistency right, then the construct state, analogous to (10b), is the only felicitous expression.

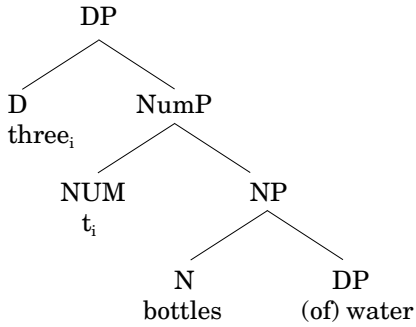
(10) a. melcar, tavi lanu šloša bakbukim šel mayim, bevakaša!
Waiter, bring us three bottles of water, please!

b. melcar, tavi lanu šloša bakbukey mayim, bevakaša!
Waiter, bring us three bottles water, please!

c. Context: Danny is mixing paint and he needs to add water.
ten lo *šloša bakbukey mayim* be-kad plastik bevakaša
give to-him three bottles water in- jug plastic please.
'Give him three cups of water in a plastic jug please.'
#ten lo *šloša bakbukim šel mayim* be-kad plastik bevakaša
give to-him three bottles of water in-jug plastic please.

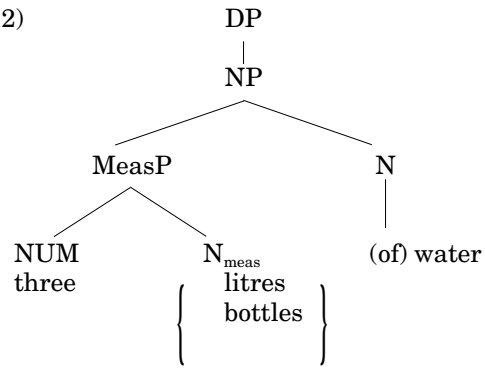
Rothstein (2009), based on the analysis in Landman (2004), argues that cross-linguistically, the measure and count interpretations have different structures. In the count interpretation, in which we are counting containers full of water, the container noun is the nominal head of the phrase and takes a complement. The numerical is an adjective modifying the complex nominal, and counts "bottles of NP". (11) illustrates this for English. We assume that the numerical originates in NUM and raises to the determiner position when this is not filled by a definite article. The preposition *of* is semantically uninterpreted and is inserted late in the derivation.

(11)



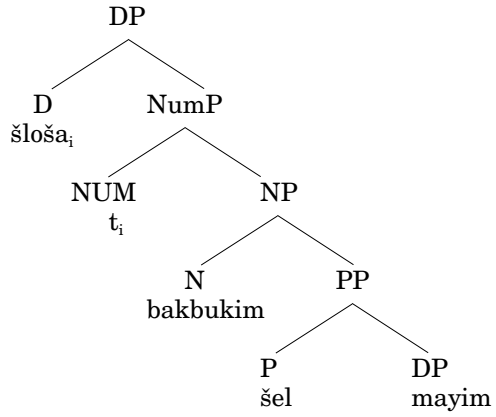
In the measure construction, the substance noun, in this case *water* is the head of the phrase and the number and the measure head form a complex predicate which modifies *water*. The structure is as in (12). Note that the measure head can be either a noun such as *bottles* or an explicit measure expression such as *litres*:

(12)



Rothstein (2009) gives an explicit semantic interpretation for these nominals, and argues that essentially the same structures are responsible for the interpretations in Hebrew, but with some important differences. In particular I show there that the preposition *šel* is a genuine preposition in Hebrew expressing a relation between a nominal head and its complement. Thus in the absolute form illustrated in (9) in which the head-complement relation is marked prepositionally, *bakbukim* must be interpreted as a nominal head and the only structure possible is (13):

(13)



As a consequence, only the count interpretation is possible.

The ambiguity of the construct state is illustrated in (8) and repeated here as (14). *šloša bakbukey mayim* in (14a) can be analyzed either as (14b) (=(8b)), which is analogous to the English count structure in (11), or as (14c) (=(8c)), which is geometrically analogous to the English measure structure in (12).

(14) a. šloša bakbukey mayim
three bottle.PL water
'three bottles of water'

b. [šloša [bakbukey mayim]]

c. [[šloša bakbukey] mayim]

In (14b), *bakbukey* is the head of the phrase and the syntactic annex *mayim* is the complement with which it forms a constituent. *šloša* is a straightforward indefinite modifier (and thus in its unreduced form) modifying the construct state *bakbukey mayim*. The counting reading is then available: the construct state *bakbukey mayim* 'bottles of water' denotes pluralities of bottles of water, and the numeral modifier *šloša* 'three' picks out the pluralities which consist of three atomic bottles. Thus we are counting bottles of water. In (14c), however, *šloša bakbukim* forms a complex modifier modifying the (indefinite) NP annex *mayim,* and this gives rise to the measure reading in which the CS denotes quantities of water with a certain measure property. Rothstein (2009) shows that this analysis makes a strong prediction: if the grammar blocks reanalyzing NUM + the measure nominal as a complex modifier, then only the count reading should be available. This prediction is supported by definite numerical construct state interpretations. Numericals have a free form e.g. *šloša* 'three' used in enumerative counting and in indefinite constructions as in (15a), and a phonologically 'reduced' form specific to the construct state, e.g. *šlošet* as illustrated in (6c) above. Definite numerical modifiers must occur as heads of construct states as illustrated in (15b). Note that as well as the nominal form of *šloša* being phonologically reduced, the definite clitic *ha-* appears only on the annex. (15c), or any other combination of the free numeral and the definite marker, is ungrammatical:[6]

(15) a. šloša bakbukim
three.M bottle.M.PL
'three bottles'

b. šlošet ha-bakbukim
three.M DEF-bottle.M.PL
'the three bottles'

c. * šloša ha-bakbukim

The definite correlate of (14a) must thus be the complex structure illustrated in (16). The construct state headed by the numerical takes an embedded construct state as annex. Note that both *šlošet* and *bakbukey* are in the phonologically form specific to the construct state, and the definite marker appears only on the most deeply embedded nominal.

(16) šlošet bakbukey ha-mayim
three bottles DEF-water
'the three bottles of water'

There are good syntactic reasons to analyze this as a right branching structure, since the complement of *šlošet* is a construct state and a constituent, as in (17):

(17) [šlošet [bakbukey ha-mayim]]

Given the structure in (17), expressing the fact that *bakbukey ha-mayim* is a constituent, we predict that the numerical and *bakbukey* cannot form a complex predicate and thus the measure reading is ruled out. This prediction is correct. Rothstein (2009) illustrates this with the following example:

(18) hizmanti esrim orxim ve- hexanti esrim
invited-I 20 guest.PL and prepared-I 20
ka'arot marak be-sir gadol.
bowl.PL soup in- pot big
'I invited twenty guests and I prepared twenty bowls of soup in a big pot'

#rak šiva-asar orxim higi'u, ve- *šloš* *ka'arot* *ha- marak*
only 17 guest.PL came, and three bowls DEF- soup
ha-axronot nišaru b- a- sir.
DEF- last.PL remained in-DEF- pot.
Intended reading: "Only 17 guests arrived, and the last three bowls of soup remained in the pot"

On the measure reading, (18) is infelicitous. The only interpretation for the definite construct state here is the implausible reading that three bowls, each filled with soup, remained in the pot.

The second prediction of the analysis is that definite measure constructions are ungrammatical. If a definite construct state nominal does not allow a measure reading syntactically but the content of the construct state only allows a measure reading semantically, then the resulting conflict between syntax and interpretation will result in an ungrammatical construction. This is illustrated in (19). (19a) shows that indefinite measure constructions are possible with measure heads such as *kilo* and the numerical in its indefinite free form. (19b) shows that the definite forms are not grammatical.

(19) a. xamiša kilo kemax
five kilo flour
'five kilos of flour'

b. *xamešet kilo ha- kemax
five kilo DEF- flour
Intended reading: 'the five kilos of flour'

Rothstein (2009) argues that the ambiguity of (14a) is possible because these classifier headed construct states are instances of what Borer (2009) calls modificational construct states, where the annex does not denote a referential entity and is an NP rather than a DP. Since the annex is an NP, Rothstein (2009) argues that it can either be analyzed as the head of the construct state (or rather a projection of the head of the construct state), modified by a complex measure predicate, as in (14c), or as an indefinite complement of a nominal head as in (14b). In both cases, the appropriate semantic interpretation is possible. In the measure interpretation, the NP denotes a property as in (20a), and the nominal denotes a measure expression (20b) which combines with the numerical to give a complex measure property, the property of being a quantity which equals the quantity contained in three bottles. This modifier modifies the property denoted by NP to give the set of quantities of water which equal three bottlefuls. The NP denotation in (20d) then raises to the generalized quantifier meaning if it is an argument, or is quantified over by default existential quantification.

(20) (= 14c) [[šloša bakbukey] mayim]

a. *mayim*: $\lambda x.\text{WATER}(x)$

b. *bakbukey*: $\lambda n \lambda x.\text{MEAS}(x) = \langle n, \text{BOTTLE}\rangle$

c. *šloša bakbukey*: $\lambda x.\text{MEAS}(x) = \langle 3, \text{BOTTLE}\rangle$

d. *šloša bakbukey mayim*: $\lambda x.\text{WATER}(x) \wedge \text{MEAS}(x) = \langle 3, \text{BOTTLE}\rangle$

In the counting reading illustrated in (14b), the NP complements are interpreted via semantic incorporation. There is ample evidence that predicates are allowed as complements of head cross-linguistically (see e.g. van Geenhoven (1998) for Inuit languages) and in fact Doron (2003) argues that indefinite complements of verbs in Hebrew are always NPs interpreted via incorporation. She assumes a standard incorporation rule modeled on (21) which affects a predicate expression such as λx.P(x) when another predicate occurs as its complement, as in (21a). The type shifting rule in (21b) allows the predicate to apply to a property rather than to an individual.

(21) a. λx.P(x) (λx.Qx(x))

b. SHIFT (λx.P(x)) (λx.Q(x)) =
λQ.∃x [P(x) ∧ Q(x)] (λx.Q(x)) =
∃x[P(x) ∧ Q(x)]

In the simple case, a one-place property of individuals of type <d,t>, λx.P(x) applies to an individual j of type d, and the result is a truth value P(j), the assertion that the individual j has the P property. In (21b), the expression λx.P(x) has shifted to an expression which can apply to a property. The result is also a truth value: the assertion that there is some Q entity that has the P property. While Doron's (2003) claim that all indefinites are interpreted via incorporation is probably too strong, the incorporation analysis of construct state indefinite nominal annexes explains a number of the properties that we have already mentioned. In particular, the fact that the head and annex cannot be separated by any adjectival material follows naturally if the annex is incorporated into a complex nominal phrase. We thus assume an incorporation interpretation for the counting reading of (14), with the structure in (14b). We assume first that the noun *bakbukey* shifts from its normal interpretation at which it denotes a set of individuals λx.BOTTLES(x) to a relational nominal denoting a set of entities which contain something, as in (22a). (A more explicit semantics defining also the relation CONTAIN and taking plurality into account is given in Rothstein 2012a) *mayim* denotes the set of quantities of water, (22b). As a result we have the same configuration that we had in (21a), where the denotation of the head expression must apply to a predicate, as shown in (22c). The head nominal shifts as it did in (21b), to an expression which can take a predicate as a complement, (22d). The complement is then incorporated into the head via predicate incorporation, and the resulting constituent is a one-place predicate, denoting the set of bottles containing some quan-

tity of water as in (22e). The numerical counts the number of bottles of water via the cardinality function CARD as in (22f):

(22) (= 14a) [šloša [bakbukey mayim]]
a. *bakbukey:* λyλx.BOTTLES(x) ∧ CONTAIN(x,y)
b. *mayim*: λx.WATER(x)
c. *bakbukey mayim*:
λyλx.BOTTLES(x) ∧ CONTAIN(x,y) (λx.WATER(x))
d. SHIFT(*bakbukey*):
λPλx.∃y[BOTTLES(x) ∧ P(y) ∧ CONTAIN(x,y)]
e. *bakbukey mayim*:
λPλx.∃y[BOTTLES(x) ∧ P(y) ∧ CONTAIN(x,y)] (λx.WATER(x))
= λx.∃y[BOTTLES(x) ∧ WATER(y) ∧ CONTAIN(x,y)]
f. *šloša bakbukey mayim*:
λx.∃y[BOTTLES(x) ∧ WATER(y) ∧ CONTAIN(x,y) ∧ CARD(x) = 3]

The insights that these classifier constructions give us into nominally headed construct state forms can be summed up as follows. A string of the form [(Num) N_1 N_2] when headed by a classifier does not have a fixed syntactic analysis but can be analyzed in either of two ways, with either N_1 or N_2 as head. If N_1 is the head, then N_2 must be the complement of the head, incorporated into the nominal classifier, and Num modifies the complex nominal. If N_2 is the head, then Num and N_1 must combine to form a complex modifier. This is reminiscent of what Bach 1980 called "shake and bake semantics", a situation when the interpretations of expressions can be shuffled around as long as the result is a structure in which all the parts fit together appropriately. Under this view, the construct state is a constituent whose internal structure is not fixed, though it is constrained grammatically. It has a bare head and an NP annex, and definiteness is marked only on the complement and percolates to the whole constituent.

An obvious question is how this applies in construct states where the annex is marked definite. Usually incorporation is assumed to apply to indefinite predicate NPs, i.e. NPs at type <d,t>. We will argue in the next section that incorporation applies here also in the definite cases. This is because the definite marker *ha-* is not a determiner, but a clitic which attaches directly to the predicate, and the definite NP is thus also a predicate at type <d,t>. Since incorporation applies to predicates and not DPs, incorporation cannot apply to definite expressions if definiteness is expressed via a determiner at the DP level. However, if a language allows definiteness to be marked on the predicate NP and definite NPs are of type <d,t>, then there is no rea-

son why incorporation should not apply to a definite NP too. In the next section, we will show that there is good evidence to assume that definite NPs in Hebrew are predicates at type <d,t>, and we will show how they are interpreted semantically.

3. Proper names in construct states

Borer (2009) distinguishes between two kinds of syntactic construct states, both to be distinguished from the lexical compounds discussed above. R-constructs (or referential constructs) are examples such as (1), repeated without a modifier in (23). The annex in (23) is apparently a referential expression denoting an individual, in this case a particular teacher.

(23) beyt ha-mora
house.M DEF-teacher.F
'the teacher's house'

M-constructs (or modificational constructs) are constructs where the annex clearly does not denote an individual. The classifier constructions which we have been discussing are considered M-constructs, as is the classic example in (24):

(24) beyt ha-ec
house DEF-wood.m
'the wooden house'

With respect to phonological reduction, adjective placement and definiteness percolation, both types of constructs work the same way. Borer shows that in M-constructs the annex is more restricted than in R-constructs, in particular with respect to adjectival modification. The annex of an M-construct cannot be modified by a definite adjective (25a,b), and when indefinite, it can be modified only by a property modifier (25c,d) (examples from Borer 2009):

(25) a. beyt ha- zxuxit *he- xadaša
house.M DEF-glass.F DEF- new.F
Intended reading: 'the house of new glass';

b. beyt ha- zxuxit ??ha– venezianit
house.m DEF-glass.F ??DEF-Venetian.F
Intended reading: 'the house of Venetian glass'

c. beyt zxuxit *xadaša
house.M glass.F new.F
Intended reading: 'a house of new glass';

d. beyt zxuxit venezianit
house.M glass.F Venetian.F
'a house of Venetian glass'

In contrast the definite modification with R-constructs is acceptable.

(26) a. beyt ha- mora ha- vatika
house.M DEF- teacher DEF- senior
'the house of the senior teacher'

The annex in the M-constructs does not license pronominal anaphora, as in (27a) but the R-construct does, as (27b) shows.

(27) a. *xalon (ha)- zxuxit$_i$ ve- dalt-a$_i$
window.M (DEF)- glass.F$_i$ and door.SG- her$_i$
Intended: 'the /a glass$_i$ window and its$_i$ door'

b. beyt (ha)- mora$_i$ ve- rehite-ha$_i$
house.M (DEF)- teacher.F.SG$_i$ and furniture.PL-her$_i$
'the/a teacher$_i$'s house and her$_i$ furniture'

In each case, the feminine pronominal clitic is used, indicating that the anaphor is dependent on the annex and not on the masculine head. Note that the anaphor can also be dependent on the whole construct state, as in (28).

(28) [beyt (ha)- mora]$_i$ ve- rehit-av$_i$
house.M (DEF)- teacher.F and furniture.PL-his$_i$
'the/a teacher's house$_i$ and its$_i$ furniture'

Both (27b) and (28) also have felicitous readings where the clitic refers to some independently salient entity in the discourse.

Borer argues that this is good evidence that the annex of the M-construct states is not a full DP, but only an NP. Thus in (29), the nominal head *beyt* takes the NP *ec* as its complement. There are a number of possibilities for interpretation. One is to assume that, as in the counting classifier constructions, the head nominal shifts to a relational type, with the MADE-OF relation replacing CONTAIN, as in (29a). The annex is interpreted as a predicate, presumably the set of instantiations of the kind WOOD and the construct state is interpreted via incorporation:

(29) a. *beyt*: λyλx.HOUSE(x) ∧ MADE-OF(x,y)

b. *ec*: λx.WOOD(x)

c. (SHIFT(*beyt*)) (*ec*):[7]
λPλx.∃y[HOUSE(x) ∧ P(y) ∧ MADE-OF(x,y)] (λx. WOOD(x))
= λx.∃y[HOUSE(x) ∧ WOOD(y) ∧ MADE-OF(x,y)]

Another possibility is to assume that the annex is interpreted as a modifier and directly modifiers the head. On this approach, the basic meaning of both N_1 and N_2 is a one-place predicate, as in (30a,b), but it would be the annex which shifts its type to the modificational type, as in (30c), and applies to the nominal head as if it were an adjective:

(30) a. *beyt*: λx.HOUSE(x)

b. *ec*: λx.WOOD(x)

c. SHIFT(*ec*): λPλx.P(x) ∧ MADE-OF-WOOD(x)

d. *beyt ec*: λx.HOUSE(x) ∧ MADE-OF-WOOD(x)

I shall not attempt to decide between these options here. The first option has the advantage of being more general, since it involves the same process that was used in the interpretation of relational classifier heads in (20). The second option has the advantage that the shift in (30c) can be associated with a change in meaning, as indicated. We will see below that at least some construct states seem to use direct modification by the annex, and that there is thus good reason to assume that both structural operations are in principle available. This would be in line with the spirit of a "shake-and-bake" syntax and semantics for construct states as suggested above. The important thing however, is that both options require the annex to be an NP predicate.

We come back now to what Borer calls R-constructs. Here, the annex appears to denote an individual, and Borer suggests that it is a DP constituent. On close examination, they raise a number of interesting issues. The most important fact, which to my knowledge has not been mentioned in the literature at all, is the following; although the annex of the construct state maybe marked definite, proper names are highly restricted in this position, and cannot be used with a referential interpretation. While (23), incorporated into a sentence as in (31a), is acceptable, (31b), where the definite is replaced by a proper name, is not, even if the teacher's name is Ariella.

(31) a. ani holexet le-beyt ha-mora
I go to- house.M DEF-teacher.F
'I am going to the teacher's house.'

b. #ani holexet le-beyt ariella
I go to-house.M Ariella
Intended reading: "I am going to Ariella's house"

The only reading that we get for (31b) is if the whole construct state names an institution. Thus (31b) has a felicitous reading in which the speaker states that she is going to the city library in Tel Aviv, which is called *beyt ariella*. Further examples of this contrast are given in (32) and (33). (32) shows that generally proper names are not allowed in the annex of construct states as possessors or other arguments of underived nominals. (We will see later that derived nominals are different). (33) gives a list of attested examples in which the proper name is allowed as the annex, but only because the construct state as a whole is a complex name of an entity. (33a) is the name of the house in which Ben-Gurion lived, and which is now a museum and (33b) is the name of the Reform Synagogue in Tel Aviv. In no case can the proper name be interpreted as the possessor, or in any other referential way.

(32) a. #misrad lior
office Lior
Intended: 'Lior's office'

b. #et yael
pen Yael
Intended: 'Yael's pen'

c. #sefer fred
book Fred
Intended: 'Fred's book'

d. #šir lea goldberg
poem Lea Goldberg
Intended: 'Lea Goldberg's poem/a poem by Lea Goldberg'

e. #sefer amos oz
book Amos Oz
Intended reading 'A book byAmos Oz/ a book owned by Amos Oz.'

(33) a. beyt ben-gurion
house Ben Gurion
'Ben-Gurion house'

b. beyt daniel,
house Daniel
'Daniel house'

c. sefer amoz oz,
book Amos Oz
'the Amoz Oz book'

Particularly interesting is the minimal contrast between (32e) and (33c). While *amos oz* cannot be interpreted referentially in (32e), it is allowed in (33c) where it is incorporated into a construct state which is the title of a book containing essays discussing Amos Oz's work.

There is a second way in which proper names can be interpreted in the annex of a construct state, and this is as a modifier defining a certain kind of entity. This is illustrated in (34):

(34) a. et vaterman
pen.M.SG Waterman
'a Waterman pen'

b. rexev honda
car.M.PL Honda
'a Honda(car)'

c. tošav tel aviv
resident.M.PL Tel Aviv
'a Tel Aviv resident'

d. iriyat tel aviv
city council.F.SG Tel Aviv
'the Tel Aviv city council'

e. širey lea goldberg
poem.M.PL Lea Goldberg
'poems written by Lea Goldberg'

f. sifrey amoz oz
book.M.PL Amos Oz
'books by Amos Oz'

(34a) is a kind of pen, and (34b) is a kind of car, while (34c,d) show that place names are also acceptable with the same modificational interpretation. (34e,f) are the most interesting, since they form a minimal contrast with (33d,e) above. Apparently, while the singular examples in (33d,e) do not have a plausible interpretation except under the 'title' reading for (33e), the examples in (34e,f) headed by a plural N are acceptable. The proper name is interpreted as a modifier determining a certain kind of poetry, or books, and the expression can be used to denote the general collective 'poetry written by Lea Goldberg' 'books written by Amos Oz'. This is acceptable only in contexts in which the reference is quite general. These construct states

cannot be used to denote a specific subset of the poems or books written by the relevant author.

We assume that proper names with a referential interpretation are full DPs with an interpretation at type d. If the so-called R-construct states took referential complements in the annex, proper names should be prime candidates to fill that position. The fact that proper names are not freely allowed in the annex of construct states with a referential interpretation strongly implies that the annex is not truly a referential or argument position, but is always an NP or predicative position. This is supported by the fact that proper names are allowed as annexes when they can be interpreted as modificational, as in (34), and are thus plausibly predicates. We show how this works in detail in section 4 below.

If we assume that the annex of a construct state is always a predicate, then presumably, the definite annex in examples like (23), repeated here, is also a predicate.

(35) beyt ha-mora
house.M DEF-teacher.F
'the teacher's house'

This is prima facie counterintuitive, since predicate nominals are frequently assumed to be indefinite. However, on closer examination, there is good reason to assume that the definite annex of the construct state is indeed an NP. Definiteness in Hebrew, as is well known, is not expressed via a determiner but by a clitic. The definite marker in (35) is thus not associated with a determiner position, but may be affixed directly onto the NP predicate, forming a definite predicate. While semantically, the definite determiner is classically associated with an operation from a predicate into a plural entity, as proposed in Link (1983), we will show in section 4 that definiteness can also be semantically analyzed as a predicate modifier.

The hypothesis that the definite annex in (35) is a predicate NP is supported by two sets of facts. First, quantifier phrases, as well as proper names, are infelicitous in the annex of construct state positions, indicating that it is not a position which naturally hosts DPs. My informants give the following judgments:

(36) a. *beyt kol mora
house every teacher
Intended: 'the house of every teacher'

b. ?beyt šaloš morot
house three teacher.PL
'the house of three teachers'

(36a) shows that a true determiner such as *kol* 'all' cannot appear in the annex of a construct state, while numericals, which can be analyzed as predicate modifiers such as *šaloš* 'three' are just possible.

Second, verbless nominal sentences provide independent evidence that definite NPs can be predicates in Hebrew. As is well known (Rubinstein 1968, Ben David, 1971, Doron 1983, Rapoport 1987, Rothstein 2001 and others), there is no present tense verbal copula in Hebrew. Instead, in simple subject-predicate present tense sentences, a pronominal copula, PRON, may occur. In some syntactic contexts, PRON is obligatory and in some contexts it is optional. Relevant for us here are the facts pointed out in Doron (1983) concerning sentences with nominal predicates. When the second expression in a verbless sentence is a proper name used referentially, the pronominal copular *hu* is obligatory (37a,b). When the second expression is a predicate nominal, it is optional (37c). Crucially definite nominals pattern with predicates and not with proper names, as shown in (37c). The examples are taken from Doron (1983):

(37) a. dani *(hu) moše
Dann PRON Moshe
'Danny is Moshe'

b. ha- more le-matmatika *(hu) dani
DEF- teacher to-mathematics PRON Danny
'The maths teacher is Danny.'

c. dani (hu) more le- matmatika
Danny PRON teacher to- mathematics
'Danny is a maths teacher.'

d. dani (hu) ha- more le- matmatika
Danny PRON DEF- teacher to- mathematics
'Danny is the maths teacher.'

If PRON is omitted when the second constituent is a proper name, then the only possible interpretation of the proper names is predicational. Doron's example is (38), uttered in the context of handing out parts in a play:

(38) hayom, dani ben-gurion
today, Danny Ben-Gurion
'Today, Danny is (plays) Ben-Gurion.'

Doron argues that the definite nominal must have an interpretation at predicate type since it can occur without PRON in (37d), and she supports this by showing that in PRON-less sentences, the definite nominal does not support a non-restrictive relative clause, as shown in (39). (Note that the resumptive pronoun forces the non-restrictive reading of the relative clause.):

(39) *dani ha-more$_i$, še- ani makira oto$_i$ šanim
Danny DEF-teacher, that I know him years
Intended reading: 'Danny is the teacher, whom I have known for years.'

The definite expression in the annex of a construct state does not support a non-restrictive relative clause either, as shown in (40):

(40) *ze beyt ha-mora$_i$, še ani makira ota$_i$ šanim
this house DEF-teacher.F, that I know her years
Intended reading: 'This is the house of the teacher, whom I have known for many years.'

Note that Doron and Meir (2011) also observe that definiteness is not necessarily associated with DP structure. They propose that the definite clitic is a word-level N marker indicating what in traditional grammar has been known in the grammar of Aramaic as 'the emphatic state', a form of the nominal which indicated determinateness, and which is equivalent in Aramaic to the absolute state with the definite article. Definite NPs for them too are naturally interpreted as predicates.

There is thus good reason to suppose that there are definite predicates in Modern Hebrew in general, and that the definite-marked NP in the annex of a construct state is also a predicate.

We conclude this section by noting one syntactic context in which a proper name in an annex is possible with a truly referential interpretation. This occurs in construct states headed by a gerund, as in (5), repeated here as (41):

(41) kibuš roma al-yedey napoleon
conquering Rome by Napoleon
'Napoleon's conquering of Rome'.

Apparently the thematic roles assigned by the gerund licenses the proper name with a referential interpretation, while in simple construct state nominals this is not possible.

4. Semantic interpretation

In this section we consider what are the principles of semantic interpretation which (i) allow definite NPs in the annex of the construct state but prevents proper names from occurring there as illustrated in (32-33) above, (ii) allow proper names to occur in examples such as (34).

We begin with the definite example in (35) *beyt ha-mora*, 'the teacher's house'.

Based on the arguments in the previous section, we assume that the annex of the construct state is a predicate and that definiteness is a feature marked on the N. When a definite NP appears in argument position, we assume that the definiteness feature moves to determiner position or is coindexed with it, but since we are concerned only with the annex of the construct state, which is not an argument position, the mechanisms which permit shift to argument are not our concern.[9] What does concern us is how definiteness is interpreted when it is a feature marked on the predicate. Following Link (1983) and references cited there, I assume that the standard definite operation in English expressed by the definite determiner is the sigma operation, which is an operation from predicates to individual entities as given in (42):

(42) [the] (X) = σ(X) = $\sqcup$(X) iff $\sqcup$(X) $\in$ X, otherwise undefined.

The definite operator applies to a set X and gives an entity which is the maximal sum of entities in X if this sum is in X otherwise it is undefined. This correctly gives the denotation of *the boys* as the unique maximal sum of boys (since this sum is in the set denoted by boys), and the denotation of *the boy* as the unique contextually relevant boy if *boy* in context denotes a singleton set, but is undefined if *boy* denotes a set with more than one member. The operation in (42) thus correctly captures the intuition that definiteness presupposes uniqueness.

The operation of definiteness which is used in examples like (35) is a function from predicates to predicates which captures the same uniqueness presuppositions expressed in (42). We call this operation σ', and define it as in (43):

(43) [ha-] (X) = σ'(X) = {⊔(X)} iff {⊔(X)} ⊑ X, otherwise undefined.

In other words, σ' maps a set X onto the singleton set which has only the sum of X as a member if that singleton set is a subset of X, otherwise it is undefined. We will remain agnostic here as to whether Hebrew has only the operation defined in (43), or whether both the function from sets to individuals in (42) and the function from sets to sets are available (see footnotes 6 and 9). We can now use the operation in (43) to give an interpretation for (35). We assume that *beyt* shifts from a sortal to a relational use (line (44d)) as it did in the derivation in (29). For readability, we will write {y: TEACHER(y)}, the set of teachers, simply as TEACHER. Since definiteness percolates to the whole NP, the σ' operation will apply to *beyt ha-mora* as in (44e), to give the singleon set whose only member is the contextually relevant house of the contextually relevant teacher.

(44) a. *mora*: TEACHER
b. *ha-mora*: σ'(TEACHER)
c. *beyt*: λx.HOUSE(x)
d. SHIFT(*beyt*): λXλx.∃y [HOUSE(x) ∧ y ∈ X ∧ R(x,y)]
e. *beyt ha-mora*: λXλx.∃y [HOUSE(x) ∧ y ∈ X ∧ R(x,y)] (σ'(TEACHER))
= λx.∃y[HOUSE(x) ∧ y ∈ σ'(TEACHER) ∧ R(x,y)]
f. σ'(λx.∃y[HOUSE(x) ∧ y ∈ σ'(TEACHER) ∧ R(x,y)])

We start with the predicate NP *mora* denoting the set of (women) teachers. We assume, following Borer (1999) and Danon (2008) that definiteness is a feature marked on the noun, although unlike them, we assume that the annex remains an NP and that there is no D node. Semantically, the definiteness operation expressed by the definite clitic *ha-* maps the set denoted by *mora* onto the set containing the unique contextually relevant teacher. *beyt* denotes the set of houses. It shifts into the relational interpretation, and applies to definite set σ'(TEACHER), to give the set of houses which stand in the appropriate R relation with the unique member of σ'(TEACHER) i.e. the unique, contextually relevant teacher. We do not specify R, but normally it will be interpreted as some version of the possessor relation. Incorporation allows percolation of the definiteness feature from the annex, or complement N, onto the head noun. This expression in (44a) is a predicate, as the translation indicates, and this can either raise to argument type, or can be embedded as the (complex) annex of another construct state head as in (45a). Since definiteness percolates to the head of the construct state, the complex annex in (45a) is definite. The σ' operation

applies to the complex annex to give the expression in (45b). This is the annex of the construct state, as in (45c), and as definiteness percolates, the σ' operation applies to it as in (45d), giving the set whose only member is the contextually relevant door of the contextually relevant house of the contextually relevant teacher:

(45) a. [delet [beyt ha-mora]]
door house DEF-teacher
'the door of the house of the teacher'

b. σ'(λx.∃y[HOUSE(x) ∧ y ∈ σ'(TEACHER) ∧ R(x,y)])

c. λz.∃x[DOOR(z) ∧ x ∈ (σ'(λx.∃y[HOUSE(x) ∧ y ∈ σ'(TEACHER) ∧ R(x,y)]) ∧ R'(z,y)]

d. σ'(λz.∃x[DOOR(z) ∧ x ∈ σ'(λx.∃y[HOUSE(x) ∧ y ∈ σ'(TEACHER) ∧ R(x,y)]) ∧ R'(z,y)])

It is plausible to assume, following Danon (2008), that the syntactic mechanism which requires phonological reduction on the head of the construct state and allows incorporation in this construction also blocks an independent marking of definiteness. Danon shows that while the definiteness feature may spread onto the head noun, this is not necessary. In (35), spreading does take place, and the construct state is interpreted as denoting a definite house of a definite teacher. However, in an example like (46), from Danon (2008), definiteness does not spread from the annex onto the head, and the construct state is interpreted as an indefinite:

(46) etmol ne'ecar *tošav* *ha-* *štaxim* *ha-* *kvušim.*
yesterday was-arrested inhabitant DEF- territories DEF- occupied.
tošav axer ne'ecar ha- boker.
resident another was arrested DEF- morning
'Yesterday an inhabitant of the occupied territories was arrested. This morning another inhabitant was arrested.'

We can now explain why anaphoric reference to a definite annex is easily available in so-called R-construct states, and not in M-construct states. This was illustrated in (27) above, repeated here:

(47) a. *xalon (ha)- zxuxit$_1$ ve- dalt- a$_1$
window.M (DEF)- glass.F$_1$ and door- her$_i$
Intended: 'the /a glass$_i$ window and its$_i$ door'

b. beyt (ha)- mora$_i$ ve- rehit- eha$_i$
house.M (DEF)- teacher.F$_i$ and furniture-PL. her$_i$
'the/a teacher$_i$'s house and her$_i$ furniture'

(47b), the 'R' construct state, denotes the union of the set containing the house of the teacher and the set containing the sum of furniture of that same teacher. Without discussing the intricacies of anaphora here, we can assume that in (47b), the denotation of the antecedent is copied into the position indicated by the anaphor. This gives us the denotation in (48).

(48) $\sigma'(\lambda x.\exists y[\text{HOUSE}(x) \wedge y \in \boldsymbol{\sigma'(\text{TEACHER})} \wedge R(x,y)]) \cup$
$\sigma'(\lambda x.\ \exists y[\text{FURNITURE}(x) \wedge y \in \boldsymbol{\sigma'(\text{TEACHER})} \wedge R(x,y)])$

We assume the following. A pronominal clitic is naturally dependent on an individual. The first line of (48) is the interpretation of line (44d) above. In (44d), the annex of the construct state is a definite predicate denoting a singleton set, and thus makes salient the single member of that set which is prominent and easily available as the antecedent for the anaphor in the second conjunct. It is copied into the position of the anaphor, as in (48). In (47a), the annex is mass noun. The definiteness operation applied to a mass predicate gives the sum of all the instances of the mass predicate. This is not an individual, and is thus not an appropriate antecedent for the anaphor.[10,11]

We now return to the interpretation of proper names. Let us assume that proper names are DPs and denote individuals. They are then ruled out from occurring in the annex of construct state positions, since this is a position which is constrained to be a predicate position, filled by an NP at type <d,t>. This explains the infelicity of the examples in (32). The question then is what does allow proper names in the restricted cases illustrated in (34) above, and repeated here as (49):

(49) a. et vaterman
pen Waterman
'a Waterman pen'

b. rexev honda
car Honda
'a Honda (car)'

c. tošav tel aviv
resident Tel Aviv
'a Tel Aviv resident'

d. iriyat tel aviv
city council Tel Aviv
'the Tel Aviv city council'

e. širey lea goldberg
poems Lea Goldberg
'Lea Goldberg's poems'

f. sifrey amoz oz
book.m.pl Amos Oz
'books by Amos Oz'

In these positions, the proper name has an interpretation as a predicate. Now, Longobardi (1994) suggests that proper names begin as predicate expressions in NP and acquire referentiality by movement to D (or by co-indexing with D in the case of languages which allow or require proper names to appear with determiners as in the Italian *La Callas*). An obvious question then is whether the proper names in (49) are predicates in the sense in which Longobardi intended it. The answer must be no. The denotation of a proper name as NP before it raises to D is presumably the singleton set of individuals identical with the denotation of the proper name. Thus if the individual we think of as named Lea Goldberg is represented as **lg**, then the predicate *lea goldberg* that Longobardi identifies would naturally denote the property of being identical to Lea Goldberg, and denote the singleton set in (50a), or equivalently the function represented by the lambda expression in (50b). In languages such as Italian where proper names can occur with determiners, the definite determiner will denote the σ operation defined above in (42) and then apply to the singleton set denoted by the predicate to give the single entity which is in its denotation, as illustrated in (50c):

(50) a. {x:x = *lg*}
b. λx. x = *lg*
c. *Callas* = {x: x=*callas*}
La Callas = σ{x: x = *callas*}
= ⊔{x: x= *callas*}
= *callas*

However, in the examples in (49), the interpretation of the predicate NP cannot be the singleton sets which are derived as in (50). Such an expression would denote the property of being identical to Lea Goldberg, and the property expressed by the annex in (49e) is the property of being written by Lea Goldberg. Thus, in the annex of a con-

struct state, the proper name is not an NP predicate in Longobardi's sense but has shifted from its referential reading at type d, in which it denotes the individual, to a property, the property of having the appropriate relation to the relevant individual. We find this in English too when proper names are used adjectivally as in (51).

(51) a. Have you read the new Chomsky book?
b. I just bought a Waterman fountain pen and a Chateau Margaux wine.

In both (49) and (51) the property interpretation of the proper name is highly restricted. In English, the adjectival use of the proper name seems to be the result of a lexical operation, deriving the property of being related to the denotation of the proper name in very restricted way. A 'Chomsky book' is a book written by Chomsky, a 'Waterman fountain pen' is a pen manufactured by Waterman in the characteristic way and so on. We assume that the predicative use of the proper names in (49) is the result of a similar lexical operation.

We assume then that the structure of the construct state *širey lea goldberg* in (40e) is as in (52):

(52) a. [širey$_{N}$ [lea goldberg]$_{NP}$]
b. λx.R(x, *lg*)
c. λP λx.P(x) ∧ R(x, *lg*) (λx.POEMS (x))
d. λx.POEMS(x) ∧ R(x, *lg*) i.e. the set of poems standing in the R-relation to Lea Goldberg, where 'R' is lexically determined to mean 'written-by'

The predicate denoted by the proper name is given in (52b). We assume this predicate is derived by a lexical operation, and that R is lexically constrained by this operation. In this case 'R' is constrained to be 'written by' and the predicate denotes the set of entities written by Lea Goldberg. The proper-name-predicate then shifts to the modifier interpretation and applies to the nominal head *širey* 'poems', as in (52c), and the whole construct state has the interpretation in (52d), denoting the set of poems written by Lea Goldberg. As in the previous derivations, the expression in (52d) is itself a predicate which shifts to the argument type if it occurs in argument position, but which can also remain at the predicate type and become the annex of a new construct state as in (53). This process can be iterated indefinitely, within the limits of pragmatic plausibility:

(53) sefer [širey lea goldberg]
book poem.PL Lea Goldberg
'a book of Lea Goldberg('s) poems'

At the moment, I have no explanation for why the predicate expression in (52b) cannot appear in the annex of a construct state headed by a singular noun as we saw in (32d-e), and I leave this to further research.

I conclude this section by summarizing our findings so far.

We have seen that there is good evidence that the annex of a construct state is always a predicate NP. Predicate NPs can be interpreted in three different ways. They can be interpreted via incorporation, they can be interpreted as modifiers, and they can be analyzed as heads of predicate expressions. All three possibilities are attested in construct state forms. The most common way of interpreting a construct state is to analyze the nominal head as a relational nominal which incorporates the predicate annex. Definiteness is marked on the predicate in Hebrew, and thus both definite and indefinite nominal predicates can be incorporated in this way. Proper names at type d cannot occur in the annex of construct state nominals, since they are not predicates.

The predicate nominal in the annex of the construct state can also be analyzed as a modifier, directly modifying the nominal head. This is apparently what happens in examples like (49), where the proper name has been shifted by a lexical operation to a predicate. Finally, the predicate nominal in the annex can also be analyzed as the semantic head of the construct state, with the higher nominal modifying the annex. This is what happens in measure constructions such as (14c), *šloša bakbukey mayim* 'three bottles of water', where *bakbukey* 'bottles' is interpreted as a measure expression which combines with *šloša* 'three' to form a complex predicate which semantically modifies the annex, *mayim* 'water'.

Finally, we return to the example in (41) where a proper name is allowed with a referential interpretation in the annex of a construct state. It is repeated here in (54a) and a second example is given in (54b), although my informants find the second example, where the proper name annex is the agent of the derived nominal, less good than (54a), where it is the theme. Still, even this example is much better than the infelicitous examples in (32). DOM is the direct object marker which appears before definite direct objects and proper names.

(54) a. kibuš roma al-yedey napoleon
conquering Rome by Napoleon
'Napoleon's conquering of Rome.'

b. (?)ktivat dani et ha- sefer ha- madhim[12]
writing Danny DOM DEF- book DEF- wonderful
'Dani's writing the wonderful book.'

The crucial difference between these examples and the cases discussed up to this point is that the nominal heads of the construct state are derived from verbs and thus assign thematic roles. We suggest the following. The nominal *beyt* is inherently a predicate and crucially does not license an argument in its complement position. The construct state allows a concatenation of two nominal predicate and creates a 'syntactic word' within which incorporation or modification can take place. However, it does not involve any assigning of thematic roles. In contrast, the gerundive head *kibuš* in (54a) is derived from the same root as the verb *koveš* and denotes a set of conquering events. *kibuš* assigns thematic roles determining the participants in the events, and these thematic roles license arguments. As a result, proper names can occur in these positions with a referential interpretation. The same is the case for the nominal head in (54b) which is derived from the theta-assigning verb *kotev* 'writes'.

5. Construct states with non-nominal heads

In the previous sections we have examined a number of different N-headed construct state constructions. What we have seen is that all consist of an N NP string with the same morphosyntactic syntactic features: a phonologically reduced head, definiteness marked on the annex, and no modificational material intervening between the head and the annex. However, the semantic relations between the head and annex have differed from construction to construction. The annex can be interpreted either as via incorporation, as a modifier or as a head which is itself modified. The different interpretations of nominally headed construct states supports the hypothesis that a construct state really is a 'syntactic word' with a variety of possible internal structures, and that the important thing is the internal compositional coherence of the structure. Crucially, what makes the variety of compositional interpretations possible is the NP predicate status of the annex, which gives it a flexibility which the construction exploits.

In this final section of the paper, I want to examine briefly a number of other construct states which are headed by non-nominal constituents, in the cases under discussion adjectives and numericals. I am not going to discuss these constructions in detail here, but I will show that the interpretation of each construction depends on the annex being interpreted as a predicate nominal, although the head is not nominal.

The first example is the adjectivally headed construct state exemplified in (55). The construct states are marked in italics. Note that in

(55a-b), the adjectival construct state modifies a nominal head which is not part of the construct state. The construct state can also stand alone as a predicate as in (55c):

(55) a. yalda *šxorat* *se'ar*
girl.F black.F -hair.M
'(a) black-haired girl'

b. yalda *arukat* *raglayim*
girl.F.SG long.F.SG -legs.F.PL
'(a) long-legged girl'

c. ha-yalda hayta gvoha u- *šxorat* *se'ar*
DEF-girl.F was.F tall.F and- black.F -hair.M
'The girl was tall and had black hair'.

In (55a), the head *šxorat* 'black' apparently gives a property of the annex *se'ar* 'hair', and the entire construct state modifies the nominal *yalda*. As the examples in (55) show, the adjectival head of the construct state agrees in gender with the nominal that the construct state is modifying, and not with the annex which it apparently modifies. (55b) shows that number agreement on the head is also with the external nominal and not with the annex which the adjective modifies semantically.

The adjectivally headed construct state has all the standard construct state properties. The head is phonologically reduced, and it is adjacent to the annex. Adjectivally headed construct states, like all adjectives in Hebrew, agree in definiteness with the noun they modify, and when definiteness needs to be marked, it is marked only on the annex as in (56).

(56) ha-yalda šxorat ha- se'ar
DEF-girl.F black.F DEF -hair.M
'the black-haired girl'

Siloni (2002), Hazout (2000) and Rothstein (2012b) discuss the properties of these constructions in some detail and show, among other things, that these are genuine construct state forms and not lexical compounds. While the nominal construct state forms are strings [N NP], the string here is [A NP].

Rothstein (2012b) argues that these constructions are instances of metnonymic predication, where a property is predicated of an entity in virtue of the fact that part of the entity actually displays the property. In English this occurs in expressions such as *black of hair, blue of*

eye, and so on. In Hebrew, these predications are expressed using construct states, thus in (56a) *black* is predicated of the girl because her hair is black, or, put differently, she is said to be 'black with respect to her hair'.

Black or *šxorat* lifts from its basic predicate use at type <d,t>, where it denotes the set of things which are black to a relational use where it denotes a relation between entities and their parts which are black. This then allows the predicate NP in the annex to be incorporated.

(57) a. *se'ar*: $\lambda x.\mathrm{HAIR}(x)$

b. *šxorat*: $\lambda x.\mathrm{BLACK}(x)$

c. LIFT(*šxorat*): $\lambda y \lambda x.\mathrm{BLACK}_{\mathrm{w.r.t.}}(x,y) \wedge y \sqsubseteq_{\mathrm{integral}} x$

d. *šxorat* (*se'ar*):

$\lambda P \lambda x.\exists y[P(y) \wedge \mathrm{BLACK}_{\mathrm{w.r.t.}}.(x,y) \wedge y \sqsubseteq_{\mathrm{integral}} x] (\lambda x.\mathrm{HAIR}(x))$

$= \lambda x.\exists y[\mathrm{HAIR}(y) \wedge \mathrm{BLACK}_{\mathrm{w.r.t.}}(x,y) \wedge y \sqsubseteq_{\mathrm{integral}} x]$

(57d) denotes the set of entities which are black with respect to some integral part of themselves.

As in the nominal construct states, the possibility of deriving the right interpretation depends on the annex's status as a predicate NP which allows it to be incorporated into the head adjective.

In addition to the adjectivally headed construct states, there are three kinds of construct states headed by numericals which have properties relevant for our discussion. The first is the definite numerical construction, illustrated in (58):

(58) šlošet ha- yeladim
three.M DEF -child.M.PL
'the three children'

Here the head is the numerical *šlošet*, which, as we have already seen, is the reduced form of the free numerical *šloša*, and the annex is the definite NP *ha-yeladim*. The construct state is generally only used for counting in definite expressions (except for the numerical *šnayim* 'two', which appears in its construct state form also in indefinites). As we saw above, an indefinite numerical is in the absolute form:

(59) šloša yeladim
three.m child.m.pl
'three children'

In the construct state in (58) as in the measure constructions discussed in section 2, the annex is semantically the head of the construct state, since it is the annex which determines the denotation of the complex NP, i.e. that (58) denotes a plurality of children. We assume the following interpretation:

(60) a. *šlošet*: $\lambda x.CARD(x) = 3$
b. *yeladim*: $\lambda x.CHILDREN(x)$
c. *ha-yeladim*: $\lambda x.\ x \in \sigma'(\{x: CHILDREN(x)\})$
d. SHIFT(*šlošet*) $\lambda P \lambda x.P(x) \wedge CARD(x) = 3$
e. *šlošet ha-yeladim*: $\lambda x.\ x \in \sigma'(\{x: CHILDREN(x)\}) \wedge CARD(X) = 3$

The nominal annex is the predicate NP *yeladim*, while the morphosyntactic head of the construct state is the numerical expression *šlošet*. *šlošet* shifts to the standard modificational adjective type as in (60d), and modifies the definite predicate *ha-yeladim* to give the interpretation in (60e). In argument position, the predicate expression shifts to the type of individuals to give the plural individual which is the unique contextually relevant sum of three children. However, at the predicate type, the numerically headed construct state can itself be the NP annex of another construct state. (61) gives some attested examples:

(61) a. kvucat šlošet ha-tayarim
group three DEF-tourist.PL
'the group of the three tourists'
b. kvucat xamešet ha-nezirim
group five DEF-monk.PL
'the group of the five monks'

Thus, although the morphosyntactic properties of the construct state are identical to the nominal examples already discussed, the categorical properties of the constructs state are determined by the annex and not by the head. The interesting question is why the construct state is used for definite numerical expressions and not for indefinite expressions.

In fact, as noted above, the indefinite construct state always occurs in Modern Hebrew with the numerical *šnayim* 'two':

(62) a. šney (ha-) yeladim
two (DEF-) child.M.PL
'(the) two children'
b *šnayim yeladim
two child.M.PL

A few examples of indefinite numerical construct states occur also in Biblical Hebrew, all of them temporal expressions such as (63).

(63) *šibat* *ya:mi:m* maço:t to:ʔ ke:lu: (Exodus 12:15)
7 day.pl unleavened breads eat.IMPERFECTIVE.2.pl.
'You shall eat unleaved bread for seven days'

These examples show that the numerical construct state is in principle compatible with indefiniteness. The question thus is why is the construct state form obligatory for definite numerical expressions when it is not generally used for indefinite numerical expressions. One possibility is that the construct state 'solves' a grammatical agreement conflict. As noted above, adjectives in Hebrew agree with the nouns they modify in terms of definiteness, and since *šloša* is an adjective, we would expect it to agree with a definite nominal such as *ha-yeladim*. However, *šloša,* unlike other adjectives, precedes the nominal head, rather than following it. Thus (59) contrasts with the indefinite in (64a) and the definite in (64b):

(64) a. yeladim gdolim
child.M.PL big.M.PL
'big children'

b. ha- yeladim ha-gdolim
DEF- child.M.PL DEF-big.M.PL
'the big children'

Since agreement is apparently to the right, the numerical, which as we have seen precedes the head, cannot be marked for definiteness, as (65) shows:

(65) *ha-šloša ha-yeladim
DEF-three DEF-child.M.PL

On the other hand, a numerical which is not marked for definiteness, as in (66), conflicts with the principle that adjectives agree in definiteness with the head, and is therefore ungrammatical:

(66) *šloša ha-yeladim
three DEF-child.M.PL

A grammatical 'solution' is to use the construct state form, where definiteness is marked only on the NP annex, but percolates to the numerical which heads the construction. Thus the construct

state form in (58) provides a grammatical solution to the agreement problem. This explains why the indefinite construct states headed by numericals are so rare: there is nothing ungrammatical about the indefinite construct state numerical, as shown in (62a-63), but on the other hand, there is usually no grammatical reason to use it.

A different kind of numerically headed construct states occurs with complex numerical expressions such as in (67):

(67) šlošet alafim
three thousand.PL
'three thousand'

Rothstein (2012a) discusses the syntax and semantics of complex numericals such as *two hundred* and *three thousand* where the head is a multiplicative numerical that requires another numerical as a 'determiner'. I argue in that paper that a number is a special type of individual, and that simple numericals such as *three*/*šloša* denote numbers at type n, and shift to the modifier type on their adjectival interpretation. However, multiplicative numericals, such as *hundred* and *thousand* are of a different type. They must occur with another numerical or an indefinite article, as shown in (68), and thus denote functions from numbers into numbers as in (69a). The numerical expression in (69b) shifts into the cardinal adjective in (69c):

(68) a. *hundred, *thousand, *million
b. a hundred/three thousand/ten million

(69) a. *thousand*: = λn.n × 1000
b. *three thousand*$_{\text{NUM}}$: = λn.n × 1000 (3) = 3 × 1000 = 3000
c. *three thousand*$_{\text{ADJ:}}$ = λx. CARD(x) = 3 × 1000

In Hebrew, the process is identical with two twists. First, the multiplicative numeral can appear bare in the singular form, as in *mea* 'a hundred' and *elef* 'a thousand'. This is not suprising, since Hebrew has a null indefinite article. The second twist is that the multiplicative numerical and its argument form a construct state as in (70), indicating morphosyntactically that the complex numerical is a 'syntactic word'. Multiplicative numerical expressions such as *mea* 'hundred', and *elef* 'thousand' have nominal-like properties and they take the appropriate nominal plural endings when they occur with numericals over 2. (There is a special dual affix to express 200 and 2000.)

The complex numerical modifies a nominal head like any other adjective. (Note that the nominal head *yeled* may take either singular or plural morphology, as is customary when preceded by a high numerical.)

(70) šlošet alafim yeled/yeladim
three thousand child.M.SG/child.M.PL
'three thousand children'

The plural marking on *alafim* is the unreduced form, indicating that *šlošet alafim* is an independent modificational constituent modifying a syntactically independent nominal head. Crucially, in these constructions, 'thousands' cannot appear in the phonologically reduced form, and it is not possible to construct a complex construct state, as the infelicity of (71) shows:

(71) *šlošet alfey yeled/yeladim
three thousand child.M.SG/child.M.PL

The third numerically headed construct state which we will mention here is the classifier construction illustrated in (72a), in which *alfey*, the phonologically reduced form of *alafim* is used. (72a) is directly analogous to the English (72b):

(72) a. alfey yeladim
thousand.PL child.m.PL
"thousands of children"

b. thousands of children

Rothstein (2012a) analyzes *thousands* in (72b) as a classifier modifying an NP predicate, giving the cardinality of the sums of children as being 'somewhere in the thousands', that is, greater than 2000. It is straightforward to adopt that analysis for the Hebrew example in (72a). The classifier interpretation is based on the same interpretation of the numerical given in (69). First the plural morphology on *alfey* indicates that the complex numerical λn.n × 1000 applies to a number greater than one. Let us assume that this is 2, as above, giving the expression in (73a), analogous to (69b). This then shifts to the predicate type, but instead of giving the set of entities whose cardinality is greater than 2 × 1000, it gives the set of entities whose cardinality is greater than 2 × 1000; as in (73a). This then shifts to the predicate modifier type, in the familiar way. The resulting modifier applies to the NP predicate *yeladim* as in (73c), giving the set of pluralities of children whose number is 'in the thousands':

(73) a. *alfey:* $\lambda x.CARD(x) > 2 \times 1000$

b. SHIFT(*alfey*) $\lambda P \lambda x.\ P(x) \wedge CARD(x) > 2 \times 1000$

c. *alfey yeladim*: $\lambda x.\ CHILDREN(x) \wedge CARD(x) > 2 \times 1000$

What we have seen in this section is that non-nominal construct state constructions show the same kind of variety of internal semantic relations that the nominal ones display. In the adjectivally-headed construct states, the head of the expression is a relational adjective, and the NP annex is interpreted via incorporation. In the definite numerical and classifier constructions the head of the construct state is a modifier modifying the NP annex. In the complex numericals in (73), the annex is a numerical with nominal properties and denotes a function which applies to the numerical denoted by the head of the construct state, to form a complex numerical.

These data thus strengthen the conclusions from section 4: there is no single compositional mechanism or rule for interpreting construct state forms. Instead a multiplicity of interpretive strategies are available depending on the semantic content of both head and annex. Crucially, these strategies are dependent on the annex being an NP, both when the head is nominal and when it is non-nominal, as in the cases discussed in this last section.

I have not given a detailed syntactic analysis of the construct state in this paper. But I hope I have shown what factors need to be taken into account when a full syntactic analysis is given. In general, the account given suggests a syntactic analysis in which the structure of construct states is very close to what we actually see 'on the surface'. The existence of adjectivally and numerically headed construct states indicates that a general syntactic analysis cannot be dependent on raising to determiner position (as Siloni 2002 already pointed out), or on the assumption that the head has nominal properties. But raising accounts of construct states were often intended to solve the problem of how to assign genitive case to the annex. Assuming that only DPs are assigned case, an account of the construct state which treats annexes as predicate NPs means that no case assignment is necessary. We have shown that a variety of interpretive strategies are available, and they are all dependent on a close semantic relation between the syntactic head and the annex – either incorporation or some form of modification. This suggests that the structure of construct states is very close to surface syntax: inherently unanalyzed strings with NP annexes can be composed in a number of ways depending on the semantic interpretations of the constituents involved.

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Notes

[1] *he-* (pronounced with a short 'e' as in 'egg', is the variant of the definite article *ha-* used before words beginning with *xa* in standard Modern Hebrew. In colloquial speech it is often replaced by *ha-*.

[2] Note that in principle a construct state is ambiguous between a lexical compound and a compositionally interpreted syntactic construction, especially when marked definite. The examples in (3) do not have plausible compositional interpretations for pragmatic reasons. (i) however, is ambiguous between a lexical interpretation and a compositional interpretation. (ii) is unambiguously compositional, since, as Borer (1999,2009) shows, compounds do not allow the annex to be modified:

(i) beyt ha- yetomim
house DEF- orphan.M.PL
'the orphanage'
'the house of the orphans'

(ii) beyt ha- yetomim ha- miskenim
house DEF-orphan.M.PL DEF- unfortunate.M.PL
only 'the house of the unfortunate orphans'

[3] I discuss these properties in detail in Rothstein (2012b). See also Siloni 2002, Hazout 2000.

[4] It does allow for raising of the type proposed by Shlonsky (2004) in which the whole construct state is raised to DP.

[5] Note that numerical modifiers are the only kind of modifier which precedes the noun in Hebrew. The only way to say *three blue bottles* is as in (i). Numericals cannot follow the nominal, as (ii) shows, although demonstratives do as in (iii). Note that demonstratives, like other adjectives are marked with definite clitics in agreement with a definite nominal, as in (iv). Numericals are never explicitly marked definite in standard Hebrew, as(iv) shows, although you can find them in colloquial speech (see footnote 6)

(i) šloša bakbukim kxulim
three bottle.m.pl blue.m.pl
'three blue bottles'

(ii) *bakbukim kxulim šloša/ *bakbukim šloša kxulim
bottle.m.pl blue.m.pl three/ bottle.m..pl three blue.m.pl

(iii) šloša bakbukim elu
three bottle.m.pl DEM.m.pl
'these three bottles' (indefinite)

(iv) šlošet ha- bakbukim ha- kxulim ha-elu
three DEF- bottle.m.pl DEF- blue.m.pl DEF-DEM..m.pl
'these three blue bottles' (definite)

[6] Doron and Meir (2011) point out that in colloquial Modern Hebrew *ha-šloša yeladim* lit: 'The three children' is possible. They suggest that this is because *ha-* is being reanalyzed as a phrase-level clitic with scope over the whole DP, and point out some subtle meaning contrasts with the standard form illustrated in (15b), which need not concern us here.

[7] We have shifted *beyt* directly from the sortal use at type <d,t> to the type <<d,t> <d,t>>. It is of course possible to shift *beyt* at type <d,t> first to the expression $\lambda y \lambda x.HOUSE(x) \wedge MADE\text{-}OF\ (x,y)$ at type <d,<d,t>> at which it expresses a relation between individuals and from there to the expression in (29c). Crucially, the shift proposed in (30c) cannot move through the type <d,<d,t>>, but shifts directly from the predicate type at <d,t> to the modifier type at <<d,t>,<d,t>>.

[8] There are counterexamples to this generalization, in particular copular constructions with role predicates such as *Mary is the teacher* and superlatives such as *The Jungfraujoch is the highest train station in Europe.*

[9] Landman (2003) shows how predicative indefinites in English such as *three boys* shift to the generalized quantifier type in argument position. Adapting this mechanism for definites is not difficult. Doron and Meir (2011) suggest that in Modern Hebrew *ha-* is undergoing a shift from a word level affix marking the 'emphatic state', essentially a definite predicate, to a phrase-level clitic marking a definite DP. See footnote 6.

[10] Rothstein (2010) argues that mass nouns are of a different type from count nouns. If pronominal anaphors are of the count type, then the failure of anaphoric reference is because the mass noun is the wrong type to serve as the antecedent for the pronominal anaphor.

[11] In fact, it is not clear that the definite operator is interpreted on the annex in these cases at all. *beyt ha-ec* lit: 'house DEF-wood' is interpreted as a definite house made of non-specific wood'. But I will leave the question of how to interpret definiteness in these cases to another time.

[12] Note that the definite NP *ha- sefer* is preceded by the DOM *et* which precedes proper names and other referential expressions in direct object position, and which is usually assumed to assign accusative case. This is good evidence that definite predicates raise to argument type in argument position.

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