HEBREW QNP AGREEMENT: TOWARDS AN EMPIRICALLY BASED ANALYSIS

Gabi Danon[*1]

Abstract: Quantified noun phrases (QNPs) in subject position may trigger agreement with the quantifier or with the noun. Previous work (Danon 2011 and 2013) has proposed a theoretical model for explaining such alternations, but left open the empirical question of speaker preference. This paper describes preliminary findings from an ongoing research project aimed to answer this question. It is shown that speakers have a strong preference for noun agreement when the noun in the QNP is plural, whereas a much more heterogeneous pattern emerges when the QNP contains a singular/group noun. The empirical findings are argued to support an analysis in which the features involved in agreement are formally distinct from those marked morphologically on Q and N, which allows us to maintain a syntactic model of agreement even for apparent cases of "semantic agreement".

Keywords: QNP, agreement, quantifiers, index

1. Introduction

Deviations from the canonical subject agreement pattern found in most nominative-accusative languages pose an important theoretical challenge to current syntactic theories. One class of subjects for which this agreement pattern[2] is not always evident is quantified noun phrases. In sentences where the subject is a QNP, as in (1) below, many languages allow an alternation between two or more agreement patterns on the predicate.

(1) $[_{QNP}$ Q N] Predicate.

Specifically, different languages may allow the predicate to bear features associated with the noun, with the quantifier, or with neither. This paper follows Danon (2013), where an analysis was proposed for the fact that Modern Hebrew allows such an alternation in QNP agreement. Danon (2013) focuses on providing a syntactic analysis which accounts for the possibility of generating more than one agreement pattern; the focus of the current paper, on the other hand, is on the empirical question of speaker preference for one or the other pattern, which has far-reaching consequences for the abstract theoretical analysis.

Morphological marking of φ-features may be present both on the quantifier and on the noun. The two agreement patterns corresponding to these will be labeled Q-agr

[*] Department of English, Bar-Ilan University Ramat Gan, gabidanon@gmail.com.

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[2] Abbreviations used in this paper: F = feminine; M = masculine; N-agr = noun agreement; P = plural; Q-agr = quantifier agreement; QNP = quantified noun phrase; S = singular; S-agr = semantic agreement.

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(agreement with Q) and N-agr (agreement with N). These are illustrated in the following example:

(2) Esrim axuzim me-ha-zman mukdaš / mukdašim le-kri'a.
twenty percents.M.P from-the-time.M.S devoted.M.S. devoted.M.P to-reading
'Twenty percent of the time is devoted to reading.'

A third agreement pattern, often referred to as "semantic agreement" (henceforth S-agr), is agreement based on the QNP's denotation. This pattern, which is also found in Hebrew, is illustrated below:

(3) Reva me-ha-kita lo hexinu ši'urim.
quarter.M.S from-the-class.F.S NEG prepared.P homework
'A quarter of the class didn't do their homework.'

A fourth pattern, found in some other languages but never in Hebrew, is default agreement. Thus, default (3rd person singular masculine) agreement on the verb is not possible in Hebrew unless either the quantifier or the noun is marked for these values:

(4) *Maxacit me-ha-yeladim hevin.
half.F.S from-the-children.M.P understood.M.S
'Half of the children understood.'

As discussed in Danon (2013), the existence of multiple agreement patterns for what looks like a single structure is theoretically unexpected. Under the assumption that agreement is fully determined by the structure, we do not expect to find (free) alternation between several agreement patterns. Assuming that agreement is subject to strict locality constraints, we might expect Q(P)'s features to block the possibility of N-agr (or vice versa, depending on the hierarchical relation between the projection of the Q and that of the noun).

Another important question that arises from this phenomenon is why it is restricted to QNPs, as opposed to non-quantified (complex) noun phrases. As will later become clear, the alternating agreement patterns of QNPs provide important clues as to how quantifiers differ formally from nouns.

While Danon (2013) provided a theoretical analysis that accounts for the existence of both N-agr and Q-agr, two important empirical questions were left unanswered by that work. First, speakers' preference given a choice between these two patterns were not dealt with beyond a somewhat vague discussion of several factors that seem, informally, to have an effect on judgments of acceptability. Second, S-agr is only mentioned in passing, with no attempt to make any claims about its distribution or to account for that distribution.

These omissions in Danon (2013) were due, in large part, to the complexity of the empirical data involved. Using standard linguistic methodology, we might attempt to study QNP agreement by basing our analysis on informal grammaticality judgments of a relatively small number of native speakers, as is usually done in other domains. This

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methodology presupposes that the judgments are (relatively) clear and consistent. As this paper will show, this is not the case with QNP subjects. The goal of this paper is to discuss some of these empirical difficulties, and to outline a research project which uses several different methodologies to gather robust empirical data regarding the level of acceptability of the different agreement patterns under various conditions.

The structure of this paper is as follows. In section 2 we present some basic data, followed by a brief overview of the theoretical analysis of Danon (2013). Section 3 then illustrates some of the empirical difficulties with using a simple data collection methodology for the study of QNP agreement. Section 4 then surveys preliminary results collected using three different methodologies, which despite being tentative and incomplete at this stage seem nevertheless to converge on some very clear empirical generalizations. We then discuss some conclusions and theoretical consequences of these preliminary empirical findings.

2. Basic data and overview of previous work

2.1 QNP agreement in Hebrew

Since the early days of generative linguistics, most research in theoretical syntax has been carried out under the assumption that the major empirical generalizations can be deduced with no special methodological "machinery". A representative quote from Chomsky (1965) is the following:

> Even though few reliable operational procedures have been developed, the theoretical (that is, grammatical) investigation of the knowledge of the native speaker can proceed perfectly well. The critical problem for grammatical theory today is not a paucity of evidence but rather the inadequacy of present theories of language to account for masses of evidence that are hardly open to serious question (Chomsky, 1965, 19-20).

In the case of QNP agreement, this approach was indeed in the background of the analysis of Danon (2013), where the mere existence of two alternating agreement patterns was taken as central, rather than the nuanced and subtle details of speaker preference. Somewhat surprisingly, this matches the prescriptive rules of normative Hebrew set by the Academy of the Hebrew Language, according to which all three agreement patterns (Q-agr/N-agr/S-agr) are considered acceptable with QNP subjects.

In reality, however, speakers do not judge all agreement patterns as grammatical with all QNPs. In the following example, for instance, Q-agr is judged as clearly ungrammatical:

(5) Mispar yeladim ixaru / *ixer.
number.M.S children.M.P was.late.P was.late.M.S
'A number of children were late.'

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This poses both a descriptive challenge and a theoretical one: We must identify the generalizations regarding which agreement pattern is allowed in which cases, and explain why these generalizations hold. To start achieving better descriptive adequacy, we first note two simple morpho-syntactic factors that constrain Q-agr: quantifier morphology and QNP structure.

Morphologically, Hebrew quantifiers can be classified into those that have noun-like morphology, such as *xelek* 'part/some', *maxacit* 'half' or *rov* 'most/majority'; and those that lack such morphology, such as *harbe* 'many' or *kama* 'some'[3]. As gender and number are often associated with nominal morphology, not surprisingly only the former class of quantifiers allows Q-agr.

Structurally, Hebrew QNPs can be classified into three types:

(i) construct state QNPs, in which the Q is followed by a definite-marked noun[4];
(ii) prepositional partitives, which involve the preposition *me-*;
(iii) "simple" QNPs consisting of a quantifier followed by a bare noun

These three types, respectively, are illustrated below:

(6) marbit ha-mikrim
majority the-cases
'the majority of cases'

(7) xelek me-ha-mikrim
some/part from-the-cases
'some of the cases'

(8) harbe mikrim
many cases
'many cases'

Of these three QNP types, only the first two allow both Q-agr and N-agr; the third type, on the other hand, allows only N-agr. Note, however, that simple QNPs are possible only with Qs that lack nominal morphology; hence, it might be the case that the structural constraint is only a secondary consequence of the morphological one (see also the related discussion in Danon 2012 regarding the relation between morphology and structure in the case of numerals). These observations are summarized in the following table:

(9)

QNP type	**Q-agr**	**N-agr**	**N-like Q**	**non-N-like Q**
Construct state	+	+	+	–
Prepositional partitive	+	+	+	+
Simple	–	+	–	+

[3] The exact morphological characterization is beyond the scope of this paper; it is sufficient to note that only quantifiers of the former type may undergo nominal morphological processes such as taking plural morphology or having definite article prefixed to them.

[4] The Hebrew construct state is a preposition-less genitive construction which may be headed by elements of various lexical categories.

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2.2 Structure or features?

The central question in Danon (2011 and 2013) was what makes the Q-agr/N-agr alternation possible for those QNPs that allow both. In this section I briefly summarize the main arguments raised in these works against an analysis based on structural ambiguity and in favor of an analysis based on alternative feature specifications.

Pesetsky (1982) and Franks (1994) propose that Russian QNP agreement alternations are associated with an alternation in the QNP's internal structure: when the QNP is an NP/DP, N-agr is observed, while default agreement is associated with the QNP being a QP. In Danon (2013) however, it was argued that there is no evidence for such a structural ambiguity in Hebrew, and that the fact that the alternation is found in two distinct QNP types – partitive and construct state – further weakens the appeal of this approach. To this we should add that this kind of analysis says nothing about S-agr.

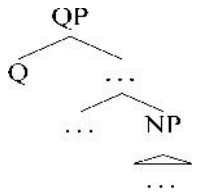
Another aspect of the proposal in Pesetsky (1982) and Franks (1994) is that agreement pattern correlates with subject position: N-agr, in this analysis, is associated with NP in high subject position, whereas default agreement is associated with QP in low subject position. For Hebrew, however, none of the tests proposed in these works provide any evidence for two (or three) different subject positions. Perhaps more importantly, there is no good reason to try and apply an analysis meant to account for an alternation between presence and absence of subject agreement to a language in which there is no default agreement option with QNP subjects.

Following Wechsler and Zlatić (2003), I proposed in Danon (2011 and 2013) that the source of the alternation is not structural but feature-based. Thus, rather than assuming structural ambiguity, I assume that a QNP's *features* can be determined in different ways. As to the structure, the following hypothesis will be assumed:

Hypothesis: Agreement alternations are restricted to QNPs where Q c-commands NP.

Abstracting away from details that play no role in the analysis, the structure assumed is therefore roughly along the following lines (for much more elaborate analyses of the structure of Hebrew noun phrases, see for instance Ritter 1991, Shlonsky 2004, Borer 2005):

(10)



In such a structure where Q c-commands NP, Q-agr is the expected agreement pattern, as Q is a closer goal for T than N:

(11) T … [$_{QP}$ Q [$_{NP}$ N]]

Therefore, what has to be explained is how N-agr and S-agr are derived.

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One line of explanation for the N-agr pattern is what I refer to as **percolation**, which can be found in different forms in LeTourneau (1995) and Bošković (2006). According to this approach, N-agr is the result of a 2-stage derivation:

(i) Q (optionally) agrees with NP
(ii) T agrees with QP

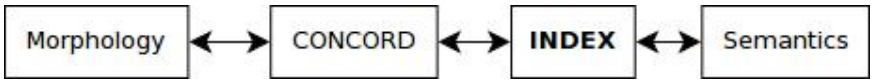
The main problem with simply adopting this approach is that if, as we have seen, Q has its own morphological features, it is not clear how step 1 can be possible. Thus, in the following example, simply stipulating that *maxacit* 'half' agrees with the NP *ha-yeladot* 'the girls' ignores the fact that the Q here is morphologically feminine **singular**.

(12) Maxacit me-ha-yeladot yašvu al ha-šati'ax.
half.F.S from-the-girls.F.P sat.P on the-carpet
'Half of the girls sat on the carpet.'

The solution proposed in Danon (2011and 2013), following Kathol (1999) and Wechsler and Zlatić (2000 and 2003), Pereltsvaig (2006), is that noun phrases carry *two* distinct bundles of syntactic features. As a consequence, Q may agree with NP despite having its own morphological gender/number. More specifically, the following two bundles of **syntactic** features are assumed:

INDEX features: Restrict an NP's referential index; used in binding and in NP-external agreement
CONCORD features: Usually correlate with morphology; used in NP-internal concord

In the typical case, the values of INDEX and CONCORD match, giving the impression of a single feature bundle[5]. According to Wechsler and Zlatić (2003), INDEX usually matches both CONCORD (which usually matches morphology) and semantics, giving rise to the following correspondences:



In exceptional cases, mismatches (which give rise to "exceptional" agreement) make the distinction between the two bundles overtly visible.

Within this framework, and assuming that subject-predicate agreement is INDEX agreement, the question raised by QNPs is what determines a QNP's INDEX. A related question is what characterizes noun-like quantifiers as distinct from nouns.

2.3 Analysis: The features of Q

As mentioned above, many Qs have gender and number morphology and are morphologically indistinguishable from nouns. For instance, the quantifiers in (12) share the same morphology as the nouns in (13):

[5] See also Pereltsvaig (2006: 484): φ-features versus grammatical gender and number.

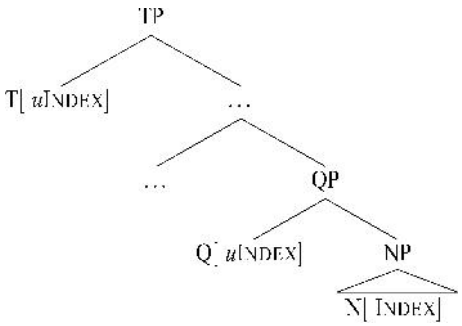
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(13) Quantifiers: *maxacit* 'half', F.S, *xelek* 'some, part', M.S…
(14) Nouns: *masa'it* 'truck', F.S, *kelev* 'dog', M.S…

Thus, what makes QNPs different is not their CONCORD features. Furthermore, these quantifiers also allow adjectival modifiers and numerals just like nouns, which casts a doubt on the possibility that these are an entirely separate lexical category.

The proposal put forth in Danon (2011 and 2013) is that quantifiers differ from nouns in how their INDEX features are determined. Using the distinction between valued and unvalued features, it was proposed that unlike nouns, which must enter the derivation with valued INDEX, Q may **optionally** enter the derivation with **unvalued** INDEX. Under this analysis, N-agr is the result of Q entering the derivation with unvalued INDEX:

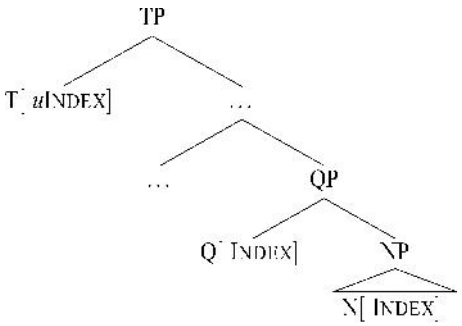
(15)



Assuming that N enters the derivation with valued INDEX matching its CONCORD (as is the typical case for nouns), the derivation proceeds by Q probing for the INDEX features of NP, followed by T probing for the INDEX features of QP[6].

In order to derive Q-agr, the only change that is needed is for Q to enter the derivation with **valued** INDEX, matching its CONCORD:

(16)



[6] As discussed in these works, this requires a feature **sharing** model of Agree in order for the features of QP not to be deleted once they have been valued.

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In this derivation, T simply agrees with QP in INDEX.

While in previous work I focused on showing that it is possible to derive both agreement patterns from a single hierarchical structure, the issue of ranking these options has been left open. Note, however, that this analysis makes the prediction that Q used "normally" does not carry its own INDEX, under the hypothesis that the central property of a quantifier is that it is not independently referential and that INDEX is the syntactic manifestation of a referential index. Thus, N-agr is expected to be the default pattern with a QNP subject, while Q-agr is expected to be the exception. Preliminary support for this relation between agreement and referentiality of the quantifier comes from the observation that a referential interpretation of a Q like *zug* 'a couple, two' seems to correlate with Q-agr in cases like the following:

(17) Zug studentim mexapes mexapsim dira
couple.M.S students.M.P seeks.M.S seek.M.P flat
'A couple of students/student couple seeks a flat.'

A remaining question is what is the status of S-agr. This is first of all an empirical question, as "semantic agreement" is often dismissed as a marginal and exceptional phenomenon that should not be a major concern for theoretical analyses of agreement. Within the model of QNP agreement proposed above, two possible accounts of S-agr seem possible: Under the first analysis, N may enter the derivation with valued INDEX matching the QNP's semantics, followed by the same 2-step derivation as in the case of N-agr. Under the second analysis, it is the Q which may enter the derivation with valued INDEX matching the QNP's semantics, followed by a single Agree operation between T and QP. Under both of these analyses, S-agr is not "semantic **agreement**"; what is semantic is the choice of features for Q or for N, prior to agreement. We return to the status of S-agr in section 5.

3. QNP agreement data: Further considerations

A major obstacle to previous theoretical works on this topic is the variability of the data. In many cases, typical speaker reaction to tasks involving the choice of agreement for a QNP subject is hesitation, uncertainty, and frequent self corrections.

As an example, consider the sentences in (18)-(20), which differ only in terms of the agreement type – N-agr, Q-agr and S-agr, respectively:

(18) Maxacit ha-cava niš'ar ne'eman la-melex.
half.F.S the-army.M.S remained.M.S loyal.M.S to.the-king
'Half of the army remained loyal to the king.'

(19) Maxacit ha-cava niš'ara ne'emana la melex.
half.F.S the-army.M.S remained.F.S loyal.F.S to.the-king
'Half of the army remained loyal to the king.'

(20) Maxacit ha-cava niš'aru ne'emanim la melex.
half.F.S the-army.M.S remained.P loyal.M.P to.the-king
'Half of the army remained loyal to the king.'

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In informal testing with a number of speakers, none of these sentences were consistently judged as grammatical, but all were judged as grammatical by at least some informants. Another example that illustrates the seemingly chaotic nature of the data is the contrast in judgments between the following two sentences, both with the Q-agr pattern:

(21) ?Xelek me-ha-anašim xošev še- ha-sar ta‘a.
some.M.S from-the-people.M.P thinks.M.S that the-minister erred
‘Some of the people think that the minister was wrong.’
(22) *Asirit me-ha-našim maskima im ha-katava ha-zo.
tenth.F.S from-the-women.F.P agrees.F.S with the-report the-this
‘One tenth of the women agree with this report.’

While the structure of these sentences seems essentially the same, speakers seem to judge the first as significantly better than the second.

In light of data like this, one might wonder whether there is any hope of providing a descriptively accurate generalization, or is it totally chaotic. Luckily, upon closer investigation, some patterns seem to emerge.

The first observation is that Q-agr with singular group nouns tends to be judged as better than Q-agr with plural nouns. Thus, while (23) is judged by most speakers as ungrammatical, (24), with the group noun *cibur* ‘public’, seems to be considerably better:

(23) *Asirit me-ha-našim maskima im ha-katava ha-zo.
tenth.F.S from-the-women.F.P agrees.F.S with the-report the -this
‘One tenth of the women agree with this report.’
(24) ?Asirit me-ha-cibur maskima im ha-katava ha-zo.
tenth.F.S from-the-public.M.S agrees.F.S with the-report the-this
‘One tenth of the public agree(s) with this report.’

Considering the examples above, note that the contrast is not only between an individual denoting noun and a group denoting one, but also between a plural and a singular. Looking at singular non-group nouns, there seems to be a similar contrast in grammaticality of Q-agr, where Q-agr seems to be more acceptable with singular nouns than with plurals, as illustrated below:

(25) Reva me-ha-mexonit hitlaxlex.
quarter.M.S from-the-car.F.S got dirty.M.S
‘A quarter of the car got dirty.’
(26) ??Reva me-ha-kisa‘ot hitlaxlex.
quarter.M.S from-the-chairs.M.P got.dirty.M.S
‘A quarter of the chairs got dirty.’

The problem, at this stage, is first of all an empirical one: While some speakers’ judgments of the sentences just given are quite clear, many others are much more hesitant. The question is thus to what extent these are robust generalizations, rather than

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just a vague anecdotal tendency. As noted in Danon (2013), there is significant variability in this domain; one should be quite careful in developing a theory that attempts to account for this data as it is not obviously clear how reliable the data is. Since a theory is a model of reality, we should therefore start with the obvious: clarifying our description of reality.

In the next section, we describe preliminary results from an empirical study of QNP agreement in Hebrew. Using a variety of methods, this study tries to assess grammaticality of N-agr/Q-agr/S-agr as a function of several factors. This study involves careful and balanced collection of grammaticality judgments from a sufficient number of informants, as well as production tasks under experimental conditions and collection of production data from pre-existing texts. This is an ongoing project; what is reported below are partial and incomplete results from a pilot study, which nevertheless display, even at this early stage, some interesting and important empirical patterns.

4. Empirical study of QNP agreement: Preliminary findings

4.1 Grammaticality judgments

The fact that native speaker judgments of sentences involving QNP subjects are often unclear does not mean that this kind of data is not useful – it simply means that more careful attention is needed when collecting such data, both in terms of experimental design and in terms of the number of judgments necessary for obtaining reliable results. In the first study, we designed a grammaticality judgments task involving masculine and feminine quantifiers and both singular group nouns and plural count nouns, presented in randomized order and mixed with filler sentences. In the full experiment currently underway, participants are presented with a total number of 120 sentences and are asked to rate them on a scale of 1-5; in the pilot experiment reported below, 8 participants were presented with 52 sentences where the task was a binary grammaticality judgment task. Despite the small scale of the pilot, some interesting patterns emerge.

The first observation is that for QNPs in which the noun is plural, acceptability of Q-agr is quite low, compared to the total acceptability of N-agr. Consider sentences with subjects such as the following:

(27) Xeci me-ha-talmidim…
half.M.S from-the-students.M.P
'Half of the students…'

Speaker judgments on QNPs with plurals in the pilot are summarized below, where 32 responses have been collected for sentences with Q-agr and 32 for N-agr (which, in this case, is indistinguishable from S-agr):

(28)

	acceptable	**unacceptable**
Q-agr (S)	6/32	26/32
N-agr/S-agr (P)	32/32	0/32

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We hence see an extremely strong preference for N-agr over Q-agr, where sentences with the Q-agr pattern were not consistently judged as acceptable.

The picture gets more complicated, however, once QNPs with group nouns are considered; sentences with QNPs like those in (29) below gave some surprising results.

(29) Xeci me-ha-kita…
half.M.S from-the-class.F.S
'Half of the class…'

Unlike the case with plural nouns, where there was an overwhelming preference for one pattern, N-agr, QNPs with (singular) group nouns give rise to much more heterogeneous judgments, as summarized below:

(30)

	acceptable	**unacceptable**	**no answer**
Q-agr (S)	13/32	19/32	
N-agr (S)	23/32	8/32	1/32
S-agr (P)	23/32	8/32	1/32

Even though N-agr is still judged as acceptable more often than Q-agr, the contrast here is not so sharp. And somewhat surprisingly, S-agr was judged as acceptable in the same number of cases as N-agr. It is interesting to note that no form was consistently judged as acceptable in the case of group nouns. This correlates with the observation that there were many self corrections with these nouns, where informants first marked a sentence as (un)acceptable and then changed their answer.

It thus seems to be the case that determining the choice of agreement pattern with group nouns is much more challenging than what one would expect on the basis of a simple model of agreement that makes reference only to the available morphosyntactic features. Hence these results seem to argue against a purely "mechanical" derivation where syntactic features stand in a one-to-one relation with morphological features and where agreement is a straightforward syntactic operation, as is standardly assumed in most of current Minimalist work.

Comparing the results with plural nouns to those with group nouns, we see that Q-agr is better with group nouns than with plurals, while N-agr is better with plurals than with group nouns:

(31)

	Q-agr	**N-agr**
N.P	6/32	32/32
N.S(group)	13/32	23/32

This too would be unexpected under a purely morphosyntactic model of agreement, where the type of noun would not be expected to affect the kind of agreement.

Grammaticality judgment data thus provides some interesting generalizations:

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(i) The choice between plural individual-denoting nouns and singular group nouns has a dramatic effect on agreement.
(ii) S-agr, at least in the case of group nouns where it is overtly distinct from N-agr, is not at all a marginal and exceptional pattern.
(iii) Q-agr acceptability, across the board, is lower than that of N-agr; at the same time, the alternation between the two is clearly a real phenomenon.

4.2 Production: Elicitation data

The second methodology used to assess the status of the different agreement patterns is a production task based on a visual stimulus. Participants are shown a sequence of pictures depicting various objects, and asked to describe what they see by completing a sentence in which the subject QNP is given. For instance, for a picture showing 3 red books and 3 blue ones, the task would be to complete a sentence like 'Half of the books…'. The participants are the same as in the grammaticality judgment task (8 in the pilot, 30 in the ongoing experiment)[7].

Consider first the results for QNPs with plural nouns like the following:

(32) Xeci me-ha-sfarim…
half.M.S from-the-books.M.P
'Half of the books…'

Out of 43 sentences produced in the pilot experiment, the vast majority were with the N-agr pattern, as shown in the table below:

(33)

Q	**N**	**Q-agr (S)**	**N-agr/S-agr (P)**
M.S	M.P	2	19
F.S	F.P	2	20
Total		4/43	39/43

In addition to QNPs with plurals, QNPs with a singular noun were also tested. Unlike in the grammaticality judgment task, the singular nouns used here were concrete object-denoting nouns rather than group nouns. For instance, given a picture of a dress which is half red and half blue, subjects would have to complete the following sentence:

(34) Xeci me-ha-simla…
half.M.S from-the-dress.F.S
'Half of the dress…'

[7] The production task is actually performed first, such that participants at this stage are not consciously aware of the fact that subject-predicate agreement is what the experiment is meant to test.

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Just like with plurals, in this task participants showed a strong preference for using N-agr rather than Q-agr:

(35)

Q	N	Q-agr	N-agr
M.S	F.S	3	19
F.S	M.S	0	21
Total		3/43	40/43

Unlike in the grammaticality judgment task, there seems to be no difference between singular and plural nouns in this task; this difference between the results of the two tasks might be due either to the nature of the task (production versus judgment) or to the difference in the type of singular noun used (individual-denoting versus group-denoting).

4.3 Production: Web data

An additional source of production data is existing written texts. While the currently available corpora of Modern Hebrew are too limited to provide a sufficiently large number of tokens of QNP subjects, the amount of freely accessible texts on the web provides an abundance of useful production data.

In order to assess the relative frequency of Q-agr and N-agr, we performed indirect Google searches through WebCorp[8] in order to construct an ad-hoc corpus of QNP usage.[9] We chose 3 masculine quantifiers and 3 feminine ones, and combined each with 6 nouns that differ from the quantifier in gender and with 6 that differ from it in number, hence giving rise to 18 QNPs for each of the following 4 conditions:

(i) Q.M.S + N.M.P
(ii) Q.F.S + N.F.P
(iii) Q.M.S + N.F.S(group)
(iv) Q.F.S + N.M.S(group)

The raw search results (up to a maximum of 100 per QNP) were analyzed one by one, and after eliminating irrelevant items (such as sentences where the QNP is not in subject position, or sentences where orthography makes it impossible to determine the agreement pattern) the remaining sentences were classified by agreement type.

[8] http://www.webcorp.org.uk/live.

[9] The use of WebCorp provides not only the convenience of showing the exact search phrase in its linguistic context, but also provides a means to neutralize the effect of a standard search engine's property of providing "personalized" search results, which might potentially introduce an unpredictable linguistic bias into the results. Given that the actual algorithm used by Google is essentially a "black box" from the point of view of the user, there are still significant methodological issues with basing any kind of research on such search results; hence we believe that such methods should always be performed alongside other research methods, as done in the current study.

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We start by looking at QNPs containing plural nouns (i.e. Q.S + N.P) like the following:

(36) Xeci me-ha-talmidim…
half.M.S from-the-students.M.P
'Half of the students…'

Similar to what the previous methodologies have shown, here too we found a clear preference for N-agr over Q-agr, to the extent that Q-agr was almost non-existent:

(37)

Q	**N**	**Q-agr (S)**	**N-agr/S-agr (P)**
M.S	M.P	0	274
F.S	F.P	1	59
Total		1/334 (0.3%)	333/334 (99.7%)

Consider next QNPs with *committee*-type group nouns, like the following:

(38) Xeci me-ha-kita…
half.M.S from-the-class.F.S
'Half of the class…'

As shown in the following table, even though N-agr was still clearly the dominant pattern, both Q-agr and S-agr were also found in a significant number of cases:

(39)

Q	**N**	**Q-agr (S)**	**N-agr (S)**	**S-agr (P)**
M.S	F.S	14	190	56
F.S	M.S	3	73	23
Total		17/359 (4.7%)	263/359 (73.3%)	79/359 (22%)

Several observations should be pointed out. First, even though the frequency of Q-agr was quite low with both plural nouns and group nouns, its frequency with the latter (4.7%) was significantly higher than with the former (0.3%). This matches the pattern found in the grammaticality judgment task.

A second observation is that the frequency of S-agr with group nouns was quite high (22%), which again confirms the findings from the grammaticality judgment task and suggests that so-called "semantic agreement" cannot be dismissed as a rare and marginal case.

4.4 Comparing methodologies

Putting together the results from the different methodologies, it is clear that all three sources of data converge towards the same conclusions.

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First of all, all three methods show an overwhelming preference for N-agr over Q-agr. The use and acceptability of Q-agr is surprisingly low, but nevertheless it is clear that this pattern exists, especially when looking at group nouns. As to S-agr, which can only be clearly distinguished from N-agr when using a singular group noun, the degree of use and acceptability of this pattern is surprisingly high, a fact which to the best of my knowledge has never been noticed in the literature on agreement in Hebrew.

A second pattern that emerges across methodologies is the contrast between QNPs with plural nouns and QNPs with singular group nouns: While Q-agr is nearly nonexistent with plurals, both its use and acceptability with QNPs in which the noun is a singular group noun is dramatically higher. In both cases, grammaticality clearly bypasses production, as shown in the table below, but the directionality of the group versus plural contrast (group > plural) is the same:

(40)

Method	**Q-agr, group**	**Q-agr, plural**
Grammaticality	40.6%	18.7%
Production (web)	4.7%	0.3%

Looking at N-agr and S-agr, the only place where grammaticality is higher than production rate is for S-agr with group nouns:

(41)

Method	**N-agr, group**	**S-agr, group**	**N/S-agr, plural**
Grammaticality	71.9%	71.9%	100%
Production (web)	73.3%	22.0%	99.7%

Note, however, that both methods demonstrate the indecisive status of both patterns in the case of group nouns, as opposed to plurals.

5. Conclusions

The first conclusion from these empirical studies is that there is indeed a real – but not free – alternation between 3 agreement patterns in Hebrew. The distribution of these patterns is summarized below:

N-agr: the default pattern
Q-agr: a marked option, which is extremely rare when the noun is plural and much more common with group nouns
S-agr: a surprisingly common pattern (which can only be overtly distinguished from N-agr when the noun is a group noun)

The data regarding N-agr and Q-agr is perfectly compatible with the analysis in terms of INDEX features, and to a large extent is even predicted by it, as discussed in

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section 2.3. Assuming, following Pollard and Sag (1994), Wechsler and Zlatić (2000 and 2003) and others, that INDEX features are constraints on an XP's referential index, we do not expect a quantifier to have its own lexically determined INDEX in the unmarked case. The marked case where a Q does have its own INDEX is with the "identifiable unit" interpretation, where the quantifier is not truly quantifying over entities but is rather naming a unit of a certain size; for instance, when **half of the class** is used to identify a specific part of the class (e.g. this half versus that one), rather than simply to denote a quantity. For reasons that are not entirely clear, this seems to be much more natural with group nouns than with pluralities.

With this in mind, we can now ask what accounts for S-agr, which we now see cannot be dismissed as a marginal phenomenon demonstrated by merely anecdotal evidence. A related question is to what extent S-agr is indeed "semantic" agreement.

Two possible analyses of S-agr are possible within the proposed theoretical framework, as discussed already at the end of section 2. The first option is that the INDEX of N can optionally be determined semantically (rather than by it morphologically-related CONCORD), which would give rise to a derivation that is identical to that of N-agr other than the value of N's INDEX. The second option is that the INDEX of Q is determined semantically, giving rise to a derivation similar to that of Q-agr. The fact that the distribution of S-agr turned out to be more similar to that of N-agr than to that of Q-agr in our studies seems to support the first analysis, but this is still inconclusive.[10] What is perhaps the most important theoretical point, however, is that both of these analyses locate the contribution of semantics in the case of S-agr at the lexical stage rather than at the syntactic one, allowing us to maintain the hypothesis that agreement itself is a syntactic operation which is blind to semantics, even in the case of S-agr.

Another important theoretical conclusion from the empirical findings is that agreement is not merely a matter of copying of morphologically visible features. Specifically, a model in which the only features visible to the syntax are the standard morphosyntactic φ-features would fail to account for the difference in agreement patterns between plurals and group nouns, as well as for the existence of S-agr. As discussed above, this does not require us to abandon the syntactic model of agreement, but this depends on having a richer model of features, and hence the empirical facts provide further support for the argumentation in Danon (2011 and 2013).

Our findings thus support a model which locates the alternation within pre-syntactic lexical choice of feature values. For quantifiers, the choice is between valued and unvalued INDEX. For group nouns, the choice (under one of the two possible analyses) is between a singular and a plural INDEX.

At a methodological level, the results reported here show that even where speaker judgments are highly variable and vague, important generalizations emerge once a sufficiently large number of samples is collected; furthermore, we see that where individual judgments are unclear, it is a methodological mistake to simply treat this as

[10] One way to distinguish between these two analyses is that the former, but not the latter, predicts S-agr to be available with group nouns even without a QNP; it is somewhat unclear to me to what extent this is indeed the case.

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"noise", as this unclarity of judgments is indicative of a real linguistic issue. Finally, as to the use of different methodologies, we see that production and judgment data converge to the same conclusions, with the patterns being clearest when looking at results from different methods as a whole.

Several questions are left open for further research. First, while the findings above show that morphological features are not the main determining factor in QNP agreement, it is still left open whether morphology is nevertheless a factor here; we are currently looking into the effect of gender morphology, as gender morphology in Hebrew is often asymmetrical, with feminine being overtly marked and masculine lacking any overt marking in the singular.

A second issue is to what extent the semantic distinction between quantifiers used in the "measuring" sense and those used in the "identificational" sense, as discussed above, is a robust predictor of agreement pattern.

A third question is to what extent the factors governing the choice of agreement pattern might be universal. As noted above, the range of agreement patterns allowed with QNPs varies from language to language; nevertheless, within the limits imposed by this variation, it could be that the same factors affect agreement choice; this is left for further research.

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