Acquiring the mass/count distinction in Hebrew: How does it compare with English?[*]

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1. Introduction

In this paper I report results of an experiment exploring the mass/count distinction in adult and child Hebrew. Adopting Barner & Snedeker's (2005) experimental methodology I tested how Hebrew speakers use singular/plural morphology to distinguish nouns that quantify over individuals from nouns that do not. I found that Hebrew-speaking adults performed in an essentially identical manner to the English-speaking adults in Barner & Snedeker's study. The child data, on the other hand, revealed very surprising discrepancies between Hebrew and English. While the children in Barner & Snedeker's study clearly showed sensitivity to the mass/count distinction, the Hebrew speaking children I tested behaved very differently from both the Hebrew speaking adults and Barner & Snedeker's young English acquiring children, with sensitivity to the mass/count distinction only emerging at around age 7 and never reaching adultlike levels, even at age 12. I suggest that these discrepancies are due to crosslinguistic differences in the morphosyntactic encoding of the mass/count distinction in the two target languages.

Before turning to the description of the current study, let me first present and discuss some theoretical background on the mass/count distinction in general, as well as some previous findings regarding the acquisition of this distinction.

2. Background
2.1 The mass/count distinction in adult language

Nouns may be categorized as either mass or count. Being one or the other, they show different syntactic and semantic properties crosslinguistically. Following Chierchia (1998), it is assumed that Hebrew (and English) mass nouns have the syntactic properties listed in (1)):

(1)　(i)　no plural morphology
　　　(ii)　no numerals
　　　(iii)　need classifier/measure phrases to be quantized

The first property, namely, that mass nouns cannot be pluralized, is illustrated in (2). For comparison, I also provide examples with count nouns, which **can** be pluralized.

(2)　a.　*bigudim　zolim　yoter bakaic*.
　　　　　clothing-plf cheap-plm　more in-the-summer
　　　　　*'Clothings are cheaper in the summer.'

　　　b.　*bgadim　zolim　yoter bakaic*.
　　　　　clothes-plf cheap-plm　　more in-the-summer
　　　　　'Clothes are cheaper in the summer.'

The second property, namely, that mass nouns cannot be counted directly (as opposed to count nouns) is exemplified in (3):

(3)　a.　*kaniti　shalosh han'alot*.
　　　　　bought-1sg three-f　footwear
　　　　　*'I bought three footwear.'

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    b. *kaniti   shalosh na'alaim.*
       bought-1sg three-f   shoes
       'I bought three shoes.'

Finally, in order to count mass nouns (the third property), they must occur with a classifier, whereas count nouns cannot occur with classifiers as shown in (4):

(4)   a. *yesh   li   shalosh ma'araxot levush.*
        there-is to-me three   sets   clothing
        'I have three sets of clothing.'

      b. **yesh   li   shalosh ma'araxot xultsa/xultsot.*
         there-is to-me three   sets   shirt/shirts
        *'I have three sets of shirt(s).'

This set of distributional data (exemplified in 2-4) for Hebrew works very similarly in English, as can be seen from the translation tier in each example. Crucially for this study, though, the Hebrew (morpho)syntactic mechanisms grammaticalizing the mass/count distinction constitutes merely a small subset of the abundance of such mechanisms in English. This issue will be addressed further in the discussion of the Hebrew child data in section 5.1.

    Semantically (or conceptually), the distinction can be seen in terms of two criteria: cumulativity and divisity. As first observed by Quine (1960), mass nouns refer cumulatively: if we combine two items that are referred to by a mass noun, the result can still be referred to by the same mass noun. For example, if we take two quantities of rice and put them together, what we get is still *rice*. This is not the case for count nouns: if we take two cats and put them together, the result could never be referred to as *cat*. According to the second criterion, divisity of reference (a term first introduced by Cheng (1973), mass nouns are divisive: if something is referred to by a mass noun, parts of that thing may also be referred to by the same mass noun. So, for example, any part of a quantity of rice is also referred to as *rice*. Conversely, parts of a cat could never be referred to as *cat*. This has led researchers to suggest that the mass/count distinction can be accounted for in terms of individuation (e.g. Quine, 1960; Bloom, 1994; Gordon, 1985). So while count nouns quantify over individuals, mass nouns do not.

    These criteria, however, do not seem to provide the correct predictions. The first criterion, cumulativity, fails to distinguish between mass nouns and plural count nouns, as both types are interpreted as cumulative (see e.g. Pelletier, 1979; Gillon, 1996). As for the second criterion, divisity, numerous count nouns such as *string*, *rope*, *cake*, *ash* are certainly divisive. A further problem for this approach is found in mass nouns such as *furniture*, *footwear*, *silverware*, that clearly refer to a group of individual objects. This failure has led to the suggestion by Gillon (1996), who uses individuation as a criterion but claims that it is not the case that mass nouns refer to non-individuals, but rather that mass nouns are *unspecified* with respect to individuation. That is, according to Gillon (1996), count nouns indeed refer to individuals while the reference of mass nouns is determined by world knowledge.

    Thus, according to this proposal, while both *furniture* and *milk* are linguistically categorized as mass nouns, our world knowledge distinguishes between them in terms of individuation, since we know from experience that *furniture* refers to distinguishable, individual items while *water* does not. Chierchia (1998) expands on this in his claim that in fact all mass nouns refer to individuals and the only difference between count and mass nouns is in the plurality value of each noun type. Chierchia assumes (following Link, 1983 and Landman, 1989) that the domain of discourse contains both singular and plural entities and claims that count nouns refer to singular entities, or *atoms*, while mass nouns refer to *sets of atoms*. In other words, the difference between mass and count nouns is not in the real world, nor is it a difference in syntactic categories. Rather, the difference lies in the lexical denotation of each noun type in the sense that "mass nouns come out of the lexicon with plurality already built in" (p. 53). The tenants of this proposal are also assumed by Rothstein (2007).

Although the proposals of Gillon (1996) and Chierchia (1998) seem to solve the problems posited by so-called "object-mass nouns" such as *furniture*, they fail to account for flexible nouns such as *string*. Barner & Snedeker (2005) experimentally show that it is the linguistic context (mass or noun syntax), rather than world knowledge, which determines speakers' judgments.[1]

Based on the results of their study, Barner & Snedeker (2005) propose an account of the mass/count distinction, according to which, the distinction lies in the individuation entailments of each noun phrase. This is captured by the postulation of a grammatical feature, [+ *individual*], which licenses individuation. This feature is available either structurally, through count noun syntax (such as articles, plural morphology, etc.) or lexically, as in nouns like *furniture*, which are lexically retrieved with this feature as part of their denotation. According to this view, regular mass noun phrases fail to individuate since the + *individual* feature is unavailable to them both lexically and syntactically. His analysis views the mass/count distinction as a grammatical phenomenon, particularly, driven by syntax (with the exception of object-mass nouns such as *furniture*, whose individuation feature is specified in the lexicon).

2.1 Acquisition of the mass/count distinction
Over the past three decades, it has been shown that, at least for English, young typically developing children acquire the mass/count distinction relatively early and without particular difficulty. This has been argued by, for example, Gordon (1985; 1988), who found that English speaking 2-3 year olds obey pluralization restrictions, applying the plural morpheme only to count nouns. Also for English, Gathercole et al (1995) have shown that when presented with unfamiliar objects accompanied by novel names, 3- and 4- year olds extended the use of the novel noun to a new item of the same shape (but of different material) if the object was named using count syntax (*a blicket→blickets*). If the item presented was introduced by using mass syntax, these children could extend the noun to a new item of the same substance (but of a different shape), i.e. *some blicket→blicket*. Similar results were reported for by Soja and colleagues (Soja, 1992; Soja, Carey & Spelke, 1991; 1992) for English acquiring children aged 2-2;6.

More recently, Barner & Snedeker (2005) showed that English speaking 4 year olds systematically use syntax to distinguish between mass and count nouns, quantifying over individuals when presented with count and object-mass nouns (e.g. *furniture*) but not when presented with mass nouns.

3. Hypothesis and predictions
Based on the findings of Barner & Snedeker (2005) for English, I hypothesize that in adult Hebrew, count nouns, such as *efronot* ('pencils'), quantify over individuals, while mass nouns, such as *kemax* ('flour') do not. I further hypothesize that flexible nouns, such as *niyar(ot)* ('paper(s)'), quantify over individuals when they appear in count syntax (i.e. *niyarot-*'papers'), but not when they appear in mass syntax (i.e. *niyar-*'paper'). Finally, I hypothesize that so called 'object-mass' nouns, such as *do'ar* ('mail'), quantify over individuals. Following from these hypotheses, I predict that when asked *lemi yesh yoter* X? ('who has more X?'), Hebrew speaking adults will base their judgments on number only if the stimuli contain a count noun, a flexible-count nouns or an object-mass nouns. Otherwise, Hebrew speaking adults will base their judgments on quantity, rather than number of items. The prediction for Hebrew speaking children is that they will behave similarly to the English speaking children in Barner & Snedeker's study, i.e. that already at age 4, the rate of their number-based judgments in the two count and the object-mass conditions will be significantly higher than on the two mass conditions.

4. Methods
4.1 Participants
Twenty four typically developing, monolingual Hebrew speaking children aged 4;4-12;0 participated in this study, as well as a control group of 5 Hebrew speaking adults. Participants were recruited from two kibbutzim and one city and the geographic area covered the north and the south of Israel. The

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[1] This study will be extensively discussed throughout this paper.

adult controls were all from the same kibbutz as the majority of the children. All participants were tested individually by the author.

4.2 Design and procedure

Using Barner & Snedeker's (2005) Quantity Judgment Task, I examined five different noun types, using five experimental conditions: count nouns (e.g. *efronot* 'pencils'), substance-mass nouns (e.g. *kemax* 'flour'), flexible-count nouns (e.g. *niyarot* 'papers'), flexible-mass nouns (e.g. *niyar* 'paper'), and object-mass nouns (e.g. *do'ar* 'mail'). There were four items per condition and 12 filler items, all randomly ordered. As illustrated in (5), for each item, participants were presented with two characters, one with two large objects and the other with five small objects of the same kind. The fewer items always consisted of more overall volume. The verbal stimulus, *lemi yesh yoter X*? ('who has more X?'), was the same across items and items were all randomly arranged.

(5) Example items from each condition

a. **Count**
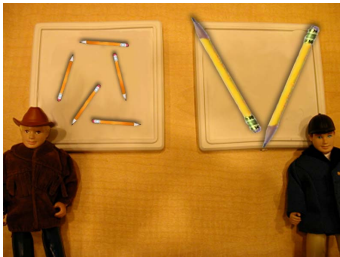
Stimulus: *lemi   yesh   yoter efronot*?
         to-who there-is more pencils
         Who has more pencils?
Expected target:*lakowboy*.
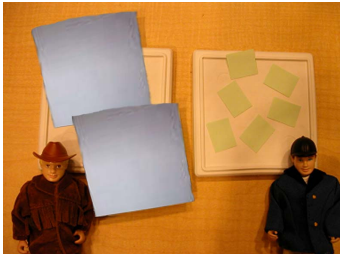   to-the-cowboy
         'The cowboy.'

b. **Substance-mass**

Stimulus: *lemi   yesh   yoter kemax*?
         to-who there-is more flour
         Who has more flour?
Expected target:*lakauboi*.
         to-the- cowboy
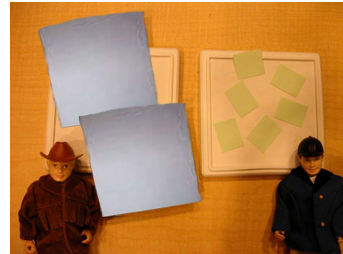   'The cowboy.'

c. **Flexible-count**

Stimulus: *lemi   yesh   yoter niyarot*?
         to-who there-is more papers
         'Who has more papers?'
Expected target:*lasayas*.
         to-the-horseman
         'The horseman.'

d. **Flexible-mass**

Stimulus: *lemi   yesh   yoter niyar*?
         to-who there-is more paper
         'Who has more paper?'
Expected target:*lakowboy*.
         to-the- cowboy
         'The cowboy.'

d. **Object-mass**

Stimulus: *lemi   yesh   yoter do'ar*?
         to-who there-is more mail
   Who has more mail?
Expected target: *lasayas*.
         to-the-groom
         'The horseman.'

It is important to note that, as can be seen from the examples above, in the two flexible conditions (the flexible-count and the flexible-mass) the visual stimulus remains constant while the verbal stimulus, i.e. count and mass syntax, is manipulated.

5. Results and discussion
The data were coded such that responses based on individuation, i.e. judging the character with the larger number of items as having 'more', were given a score of 1. The opposite response, i.e. judging the character with the more overall volume as having 'more', was given a score of 0. The results are presented in figure 1 below:

(6) **Figure 1: % of quantity judgments based on number (Hebrew)**
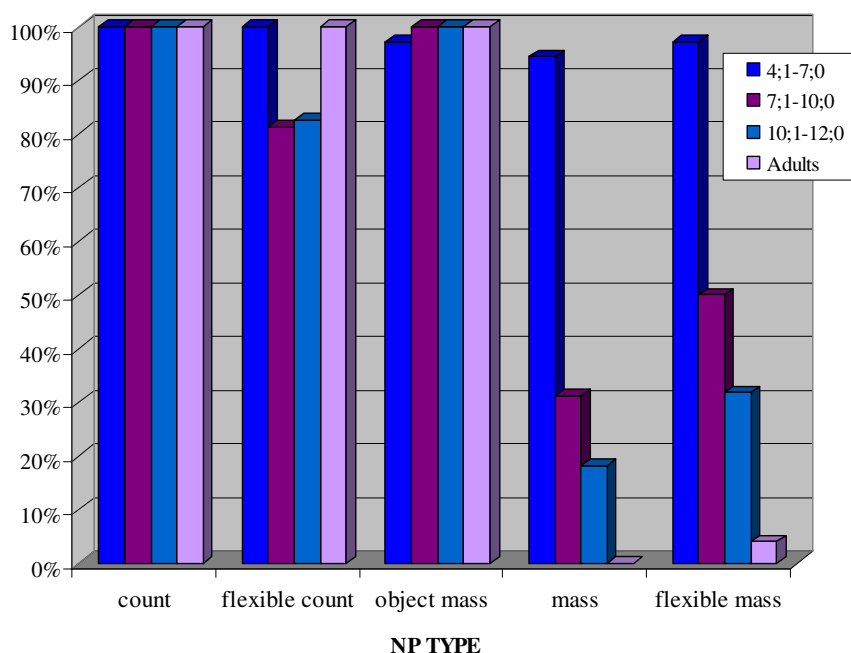

As can be seen from the graph in figure 1, adult Hebrew speakers behaved according to the predictions. They always based their judgments on number of individual items in the two count conditions and in the object-mass condition (at 100% for all three conditions). Conversely, they almost never based their judgments on number in the two mass conditions (0% for the substance-mass condition and 4% for the flexible-mass condition). As for the child data, these are in sharp contrast with the adult results, as the graph above clearly shows. Children in the youngest age group (4;1-7;0) almost always based their judgments on number in all conditions, constantly choosing the character with the larger number of items as having "more", regardless of the noun type in the stimuli. Sensitivity to noun type starts to emerge with the 7;1-10;0 year olds, who show a distinction between the two count conditions and the object-mass on the one hand and the two mass conditions on the other, basing their judgments on number much more frequently in the two count and object-mass conditions than in the two mass conditions. A further development towards adultlike behavior is seen with the oldest group (10;1-12;0), who evince a decrease of number-based judgments in the two mass conditions, resulting in a sharper contrast between the two count and object-mass conditions on the one hand and the two mass conditions on the other.

An analysis of variance (ANOVA) was conducted with age group (4;1-7;0, 7;1-10;0, 10;1-12;0, adults) as a between-subject variable and NP type (count, flexible-count, object-mass, mass, flexible-mass) as a within-subject variable. Main effects were found for group ($F(3,26)=23.48, p<.0001$) and NP type ($F(4,104)=91.22, p<.0001$). Moreover, the 2-way interaction was significant ($F(12,104)=14.37, p<.0001$).

Planned comparisons looked at the differences between the age groups in the two mass conditions. The difference between the 4;1-7;0 year olds and the 7;1-10;0 year olds was significant ($F(1,26)=19.56, p<.001$); however, the difference between the 7;1-10;0 year olds and the 10;1-12;0 year olds was not significant ($F(1,26)=1.67, p=.21$). Finally, the difference between the 10;1-12;0 year olds and the adults was significant ($F(1,26)=4.71, p<.05$). These data are presented in figure 2 below.

(7)   **Figure 2: % judgments based on number for the mass conditions (by age)**
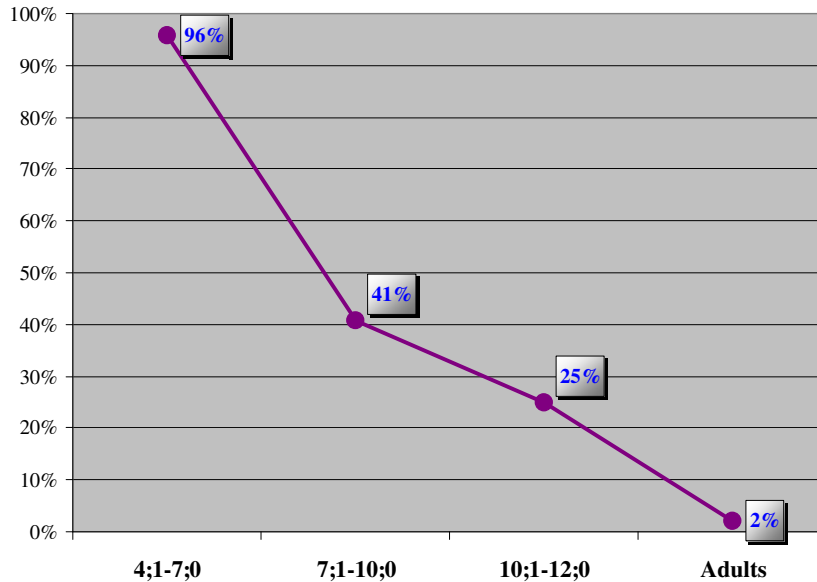
To sum up, the child data clearly show a developmental trend, but nevertheless, even the oldest children, aged 10;1-12;0 are not yet adultlike.

So how do these findings compare with what Barner & Snedeker (2005) found for English acquiring children? The comparison is given in (8) below:

(8)   **Figure 3: % of judgments based on number (Hebrew vs. English)**
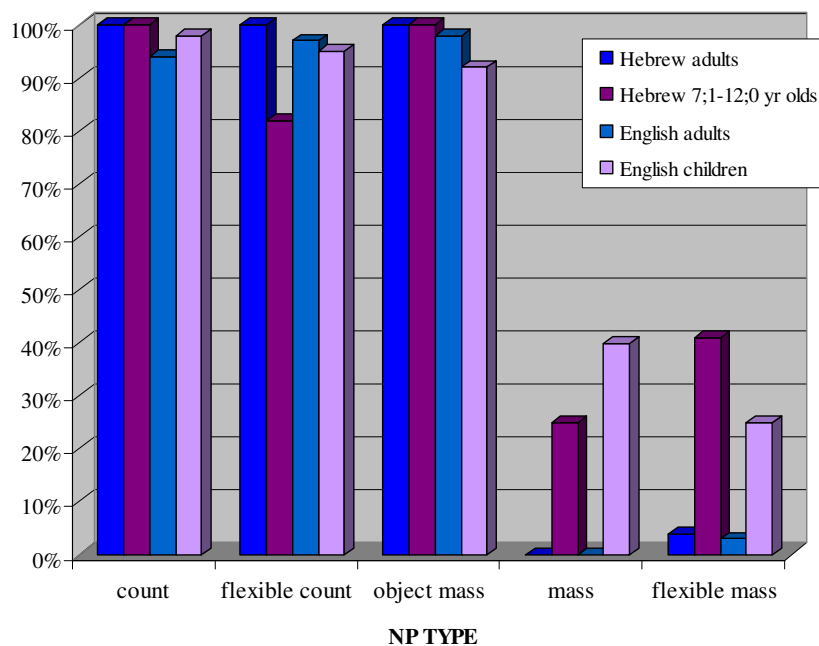
As can be seen from the graph in figure 3 above, comparing the Hebrew data to the English findings of Barner & Snedeker (2005) reveals that the Hebrew speaking adults behaved almost exactly the same as the English speaking adults. As for the children, the Hebrew speakers are more adultlike than the English acquiring children on the mass condition. Conversely, in the flexible-mass condition, the picture is reversed, with the English speaking children's responses being more similar to those provided by the adults. Both groups are non-adultlike, on either of the mass conditions, but, crucially, the English speaking children are much younger (with an average age of 4;3). Furthermore, it is important to note, that the youngest Hebrew speaking age group (the 4;1-7;0 year olds) was excluded from this comparison, since, as the data in figures 1 and 2 reveal, Hebrew speaking children under the age of 7 almost always base their judgments on number, regardless of noun type. Given this, the crosslinguistic discrepancy that was found between Hebrew and English in terms of the acquisition of the mass/count distinction becomes even clearer. In Hebrew, 7-12 year olds behave similarly to English acquiring 4 year olds. Hebrew acquiring 4 year old children, and even children as old as 6;11, seem to be completely oblivious to the category of the NP, basing their judgments on number in all 5 conditions.

5.1 Accounting for the crosslinguistic discrepancy
What could be the source of these surprising and unexpected results? A natural direction to take is to examine the two target languages and how they linguistically encode the mass/count distinction.

As mentioned in the background section, in English, the distinction is quite ubiquitous, both in terms of the variety of different syntactic structures encoding it, as well as in terms of the prevalence and the centrality of those structures in the language. Probably the most prominent structure is the indefinite article, which is obligatorily used with count nouns, while being ungrammatical with mass nouns. Other structures in English include: modification by *much/a little/less*, which is only grammatical for mass nouns, versus modification by *many/few/fewer*, which is restricted to count nouns, and modification by *each/every*, which is only available for count nouns. This is in sharp contrast to what Hebrew offers. None of these structures distinguishes between mass and count nouns in Hebrew, as illustrated in (9)-(12) below, where the (a) and (b) sentences exemplify mass and count nouns respectively.

Firstly and most importantly, the indefinite article is phonetically null in Hebrew and does therefore not distinguish between mass and count nouns, as illustrated by the example in (9):

(9)　　a.　*orit oxelet　orez* .
　　　　　Orit eat-sgf　rice
　　　　　'Orit is eating rice.'

　　　　b.　*orit oxelet Ø　tapuax.*
　　　　　Orit eat-sgf (an) apple
　　　　　'Orit is eating an apple.'

Moreover, the Hebrew counterpart of both *much* and *many* is *harbe*, which modifies both count and mass nouns, as in the example below:

(10)　a.　*lo nish'ar* **harbe**　*orez ba'aron.*
　　　　　no left-3pl much　rice　in-the-cupboard
　　　　　'There isn't much rice left in the cupboard.'

　　　　b.　*lo nish'aru* **harbe**　*tapuaxim basal.*
　　　　　no left-3pl many　apples　　in-the-basket
　　　　　'There aren't many apples left in the basket.'

The same applies for *a little* and *few*, which in Hebrew are both expressed by *ktsat*:

(11) a. *toxal*   ***ktsat*** *orez*!
          eat-2sgmfut a-little rice
          'Eat a little rice!'
     b. *toxal*   ***ktsat*** *tapuaxim*!
          eat-2sgmfut few   apples
          'Eat a few apples!'

Finally, *paxot* is the Hebrew equivalent of both *less* and *fewer*:

(12) a. *ata*   *tsarix*   *le'exol* ***paxot***   *orez* beyom.
          you-sgm need-sgm eat-inf less   rice   in-day
          'You should eat less rice every day.'
     b. *ata*   *tsarix*   *le'exol* ***paxot*** *tapuxim* beyom.
          you-sgm need-sgm eat-inf less   apples   in-day
          'You should eat fewer apples every day.'

Thus, the only prevalent, widespread, syntactic mechanism distinguishing mass from count nouns in Hebrew is pluralization.

I suggest that it is this relative paucity of triggers and/or cues in the Hebrew input, which makes the acquisition of the mass/count distinction more laborious, causing Hebrew acquiring children to lag behind their English acquiring peers.

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