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Conflicting cues and competition between notional and grammatical factors in producing number and gender agreement: Evidence from Hebrew ☆

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ABSTRACT

The present study investigated the process of producing subject–predicate agreement for conceptually driven distinctions which are morphologically specified, such as natural gender and number, and arbitrary morphological specification of gender and number. The study was conducted in Hebrew, in which agreement rules are very prevalent and include both gender and number agreement between the subject and the predicate. This feature of Hebrew makes it possible to directly compare processes within one language and to better generalize the findings across languages. Using a sentence completion task for complex noun phrases, we tested the effect of conceptual versus grammatical features of the number (Exp. 1 and 2) and gender (Exp. 3 and 4) of the local (Exp.1 and 3) and head (Exp. 2 and 4) nouns on the probability of agreement errors in producing the predicate. The results revealed that the notional meaning of the local noun does not affect the frequency of producing agreement errors although, with almost the same set of stimuli, manipulation of the notional meaning of the head noun does affect this frequency. These results are discussed in connection with Bock et al.'s [Bock, K., Eberhard, K., M., Cutting, J. C., Meyer, A. S., & Schriefers, H. (2001). Some attractions of verb agreement. *Cognitive Psychology, 43*, 83–128] two-mechanism model for the implementation of agreement.

Agreement rules are syntactic rules that use inflectional morphology to define various grammatical dependencies between sentential elements. In English, for example, the subject and predicate agree in number in the present tense, with singular nominal forms taking singular verbal forms. These types of grammatical dependency are a syntactic tool for marking structural relationships between words in a sentence, which in turn stand for the conceptual relationships between the notions of the pre-verbal message. Agreement is a very widespread phenomenon that appears in about three-quarters of world's languages (Mallinson & Blake, 1981) and includes various features such as number, gender, and person.

Although agreement is an abstract grammatical relation between word forms, usually indicated by inflectional morphology, it may also involve notional factors anchored in the concepts the words represent, such as the biological gender (i.e., sex) of animate nouns and the singularity versus plurality notions of nouns. A fundamental question is the extent to which the processing of agreement rules is affected by conceptual factors. In other words, what is the relation between meaning-based versus form-based control of agreement? Two major psycholinguistic hypotheses present different approaches to this issue. One assumes that both notional and lexical–syntactic information combine to produce agreement. This approach incorporates both the "maximal input" hypothesis postulated by Vigliocco and colleagues (e.g., Vigliocco & Franck, 2001;

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Vigliocco & Hartsuiker, 2002), which emphasizes the conceptual foundation of agreement, and constraint-satisfaction models (e.g., Haskell & MacDonald, 2003), in which a central theme is the correlation between meaning and form. The second hypothesis postulates that the ultimate step in the morphological implementation of agreement, specifically the determination of verb number, is insulated from notional sources, and is based solely on lexical and syntactic specifications (e.g., Bock, Eberhard, Cutting, Meyer, & Schriefers, 2001; Eberhard, Cutting, & Bock, 2005).

A common way of investigating the cognitive processes involved in implementing agreement during production is via the well-documented phenomenon of attraction. Attraction occurs in sentences in which the subject head noun is separated from the verb by another noun, i.e., the local noun, which differs from the head noun in its grammatical properties. In an attraction situation the verb agrees with the grammatical feature (such as number or gender) of the local noun directly preceding it, instead of the number of the head noun (Zandvoort, 1961), as in the sentence "'The key to the cabinets are lost" (Bock & Miller, 1991). The attraction phenomenon has been demonstrated in various Indo-European languages, mostly for subject–predicate number and gender agreement. A common paradigm for eliciting attractions that has been used in almost all previous studies, and is used in the present one as well, is the one developed by Bock and Miller (1991). This paradigm uses sentence-completion tasks for preambles in which the number (or gender) of the head and local noun are mismatched, as in the above example. The percentage of attraction is compared with those for preambles in which the head and local nouns are matched.

A consistent property of this type of attraction is asymmetry. If the two nouns differ in morphological specification, attraction occurs when the head noun is a morphologically unspecified form (i.e., is a grammatical default, such as singular in English) and the local noun is a specified form (in English: Bock & Miller, 1991; Bock, 1995; Bock & Eberhard, 1993; Eberhard, 1997; Bock, Nicol, & Cutting, 1999; Bock, Eberhard, & Cutting, 2004; in French: Fayol, Largy, & Lemaire, 1994; in Spanish: Vigliocco, Butterworth, & Garrett, 1996a; in Italian: Vigliocco, Butterworth, & Semenza, 1995). Furthermore, it is also sensitive to syntactic variables, so that it more likely to occur when both nouns are part of the same clause, rather than different clauses (Bock & Cutting, 1992). These characteristics challenge a simple proximity account of the attraction phenomenon, supporting the hypothesis that it reflects a deeper hierarchical structure (e.g., Eberhard, 1997; Hartsuiker, Antón-Méndez, & Van Zee, 2001; Vigliocco & Hartsuiker, 2002; Vigliocco & Nicol, 1998).

Moreover, various studies have explored how notional factors affect the incidence of attraction. For number agreement, this line of research includes studies using nouns in which grammatical and notional number diverge, such as collective and mass nouns (e.g., Bock et al., 2006; Bock & Eberhard, 1993; Bock et al., 1999; Haskell & MacDonald, 2003; Bock et al., 2001; Bock et al., 2004). For example, Bock and Eberhard (1993) compared the occurrence of attraction for preambles in which the notional number of the local noun (in the case of a collective noun) and the grammatical number of the head noun differed, as in "The strength of the army...," to sentences in which the notional and grammatical number were the same, as in "The strength of the soldier....". The crucial question was whether the plural notion of the local collective noun (in this case "army") would promote the occurrence of attraction. The only factor that reliably created attractions was the grammatical properties of the noun, thus supporting the hypothesis that the process of agreement implementation is not open to conceptual effects (Bock & Miller, 1991; Vigliocco et al., 1996a; Bock et al., 2001). In contrast, the notional features of the entire subject noun phrase do affect the occurrence of plural agreement (in English: Eberhard, 1999; Bock et al., 1999, 2006; Haskell & MacDonald, 2003 (Exp. 1); in French: Vigliocco, Hartsuiker, Jarema, & Kolk, 1996b; in Dutch: Hartsuiker, Kolk, & Huinck, 1999; Vigliocco et al., 1996b; in Spanish: Vigliocco et al., 1996a; in Italian: Vigliocco et al., 1995). These notional features often involve a distributive meaning of the complete phrase. We will discuss this later on, because this kind of plural agreement response may not be a type of attraction.

A comprehensive model to explain the attraction phenomenon specifically, and through it the general principle that governs the process of syntactic agreement was originally proposed by Bock et al. (2001), and further developed by Eberhard et al. (2005). This model is consistent with the idea that certain linguistic components can function autonomously, and draws on a general model of syntactic processing in language production which postulates two mapping mechanisms. The first one consists of mapping the pre-verbal message onto a lexical–grammatical representation. This process involves the lexical selection of lemmas and assembling them by assigning syntactic function to the lemmas. The second one consists of mapping the abstract grammatical lexical representation onto the positional form (i.e., morpheme retrieval). According to the proposed model, the implementation of agreement progresses in two directions, corresponding to the two mapping procedures. One of these—'number marking'—is the process by which the pre-verbal message is mapped into the lexical–grammatical representation. In this process the lemma or the complete noun phrase that will constitute the sentential subject is marked for number (and/or grammatical gender). This process is governed by the meaning of the notions that constitute the pre-verbal message. According to the model, only the subject noun phrase goes through the marking procedure. The second procedure—'number morphing'—is the process by which the lexical–grammatical representation is mapped onto the surface form. In that process the number (or gender) markings are morphologically instantiated. However, notional features affect the process only indirectly at this point, while the main factor governing this process is the grammatical characteristics of the words. Thus, the process of agreement production includes a stage that is insensitive to the conceptual meaning of the elements under agreement. In light of the results in English and Dutch, in which the crucial factor for attractions was the grammatical inflection of the local noun (Bock & Eberhard, 1993; Bock

et al., 2001; Bock et al., 2001) concluded that, at least in those languages, attractions reflect a miscomputation during the morphing phase. In this model, the information flow among the various processes is unidirectional, and each of the processing mechanisms is a specialized mechanism that is unaffected by any other information or processing taking place in the system. Consequently, one of the central claims of this model is that only grammatical features—not notional features—are available to the morphing procedure.

This claim leads to a very specific prediction about the effect of the notional meaning of the local versus the head noun on the occurrence of attraction. Accordingly, if attraction occurs at the morphing phase, and if this phase is not vulnerable to notional features, attraction should occur only in mismatched sentential structures in which the local noun is morphologically specified and the head noun is morphologically unspecified, regardless of the notional meaning of the local noun. Thus, if the local noun is a singular (morphologically unspecified) form, but has a notional meaning of plurality, as illustrated in Example 1a, no attractions should occur, simply because the local noun's grammatical form matches that of the head noun. However, notional effects are possible for the subject as a whole, including cases when the notional plurality behind the grammatically singular head noun may lead to plural agreement, as in Example 1b. This is because the notional meaning of plurality may affect the marking phase, which, as described above, is applied only to the head of the phrase, and derives its conceptual specification directly from the intended message. Consequently, the sentential subject will get plural specification. In sum, no notional effects should occur for the local noun, although the same notions may affect agreement when they are carried by the subject as a whole.

1a. Mass local noun:
The container (count, sing.) with the ice (mass, sing.) . . .
1b. Mass head noun:
The ice (mass, sing.) in the container (count, sing.) . . .

Recently, the Marking and Morphing model was instantiated in a mathematical model that details the algorithm which computes first the number specification of the subject, i.e., the agreement controller, in the morphing process, and then the implementation of the agreement, namely, the number specification of the agreeing element (Eberhard et al., 2005). The model applies to number agreement between subject and predicate as well as between a pronoun and its antecedent. The principle that governs the computation of the subject number is based on reconciliation of the number specification of the subject noun phrase that was given in the marking process (which is derived from the notional meaning of the noun and/or the complete phrase) and the number specification of its lexical (morphological) features. This process of reconciliation leads to a numerical realization within the range of 1 (plural) to −1 (specific individuation). A singular unspecified unit is given the value of 0. According to this model, attraction might occur when the lexical specification of the local noun's number differs from that of the head noun, so that the local noun represents a morphologically specified plural value (1) and the head noun represents a morphologically unspecified value (0). Attraction occurs when the morphological specification of the local noun replaces the number of the subject, which (in formal terms) is carried at the structural root of the subject phrase. Attraction is relatively rare because of the lower position of the local noun in the hierarchical structure, which gives greater weight to phrase features than to attractor features.

According to the model, notional effects are also possible in phrases in which the complete subject phrase has a distributive meaning, as in Example 2a:

2a. Distributive meaning:
The label on the bottles
2b. Unitary meaning:
The key to the cabinets

(Bock & Miller, 1991)

The distributive meaning of the complete phrase is derived from the conceptual level, and thus may affect the marking (rather than the morphing) phase. Accordingly, the probability of plural agreement may be higher in 2a than in 2b, despite the similar grammatical structure; the plural notion of many labels—one for each bottle in 2a—will cause the complete noun phrase to be marked as plural, as opposed to a singular marking of the complete phrase of 2b, which refers to only one object—one key. However, Bock suggests that this is notionally driven agreement, which is anchored in the pre-verbal conceptual meaning of the utterance rather than the syntactic domain (Bock et al., 2001). Thus, this type of notional effect, which leads to plural agreement, cannot shed light on the syntactic process of computing the agreement. A more powerful investigation of the model's claim therefore requires manipulating the notional meaning of the head noun without affecting the unitary notion of the phrase.

The purpose of the present study was to test the above prediction, derived from the Marking and Morphing model of the effect of notional meaning of the local and head noun, on the occurrence of plural/feminine agreement. Accordingly, it includes a direct comparison of the effects of manipulating the notional meaning of the head versus the local noun on the occurrence of plural/feminine agreement, using almost the same stimuli. Furthermore, we tried to minimize as much as possible the use of phrases with a distributive meaning. Since this research was conducted in Hebrew, the test of the prediction could be extended across two types of grammatical agreement, as Hebrew requires both gender and number agreement.

A careful reading of the literature revealed only one study in which a direct comparison was made between manipulating the notional head and the local noun within one experiment (Bock et al., 2004). In other studies the manipulation of the notional meaning of the head noun in fact involved manipulating the distributive versus unitary meaning of the *complete* phrase (e.g., Vigliocco et al., 1996a). Using collective nouns as head nouns, Bock et al. demonstrated a clear notional effect of the head noun, so that sentences like 3a yielded significantly more plural agreement than sentences like 3b. However, when collective nouns were used in a local

noun position, as in 3c, no plural agreement was found, despite the plural notion of the collective noun. A result somewhat different from this pattern was the outcome that collective *plural* local nouns, like the one in 3e, yield more attraction than count plural forms, like the one in 3f. This finding was explained by the authors in terms of the contrastive frequencies of the singular and the plural forms of the words in the experiment; the difference in word frequency between the singular and plural forms of the collective nouns used in the experiment was much larger than the difference between the singular and plural forms of the natural count nouns.

3a. A collective head noun:
The fleet with the distinctive flags. . ..
3b. A count head noun:
The ship with the distinctive flags. . .
3c. A collective local noun:
The record of the team. . .
3d. A count (sing.) local noun:
The record of the player. . ..
3e. A collective (pl.) local noun:
The record of the teams. . .
3f. A count (pl.) local noun:
The record of the players. . ..

(Bock et al., 2004)

At this point we would like to discuss a common distinction usually made between two types of nouns which incorporate notional plurality—mass and collective nouns. The formal distinction between these two types of nouns is that mass nouns do not have plural forms, whereas collective nouns have both singular and plural inflections (Corbett, 2000). Furthermore, even in those cases when mass nouns do have plural inflections, the plural form does not simply indicate the plurality of the meaning of the single form. Rather, it has a different meaning, as in "salt" (table salt) versus "salts" (various kinds of chemical substances). The present research used only mass nouns in the investigation of notional versus grammatical effects on the occurrence of plural agreement, as we found the use of mass nouns, which do not have plural forms, essential for establishing the differential influence of the notional features of the head and local noun on the appearance of agreement, as predicted by the two-mechanism Marking and Morphing model. However, before continuing we would like to discuss the plural notion of mass nouns. Aside from their clear grammatical features, mass nouns also have interesting semantic properties. Although there is a very broad semantic definition of mass nouns that involves the general concept of numerosity of the referents denoted by such nouns, there is a great deal of variance between the features of nouns that are included in the category of mass nouns by virtue of their grammatical features. They may, for example, be aggregates, substances, or superordinate category names. Furthermore, there are many examples of inconsistencies between languages in the categorization of nouns into mass (or collective) nouns versus natural count nouns. Even within languages there are usually examples of words which have similar semantic features, such as "rice" and "beans," which are categorized in one case as a mass noun and in the other case as a natural count noun. All these facts can lead to the extreme view that there is no conceptual basis for this categorization at all (e.g., Gleason, 1969; Whorf, 1964). However, among those theoreticians who claim that the definition of mass nouns has a conceptual ground, various hypothesis have been raised concerning its conceptual origin, some of which have even been tested empirically. Between the two extremes is claim Wierzbicka's claim (1988) that the classification of nouns into count versus mass nouns depends on (1) the way people interact with the referents—in small amounts, only a few items (various small fruits, such as cherries) or in large amounts, and/or (2) the ease of cognitively individualizing the items in the referent (for empirical support see Middleton, Wisniewski, Trindel, & Imai, 2004). Another approach was suggested by Chierchia (1998), who claims that mass nouns form a linguistic category that intentionally emphasizes the complex structure of a concept and blurs the singular structure of the referent. According to this view the prototypical examples of mass nouns are words like "furniture" and "livestock," rather than substances (including all liquids) and things that are made up of small units, like rice. The latter are included in the category of mass nouns due to our perceptual limitations in identifying their small units.

In the following, we summarize the available findings on the effect of the notional meaning of the head and the local noun on plural/feminine agreement.

Attraction in number agreement: The notional meaning of the *head* noun has been manipulated previously in a few studies in English (Bock et al., 2006, 1999; Haskell & MacDonald, 2003; Bock et al., 2004), revealing notional effects on the occurrence of attraction. In particular, the frequency of plural agreement was greater when the grammatically singular head noun had a plurality notion like the meaning of a collective noun. As to the crucial prediction of the model, that the notional meaning of the *local* noun will have no effect on the results, there are again only a few studies that manipulate this meaning (Bock & Eberhard, 1993; Bock et al., 2004 in English; Bock et al., 2001 in English and Dutch; Bock et al., 2006 in American and British English). No notional effects were found, apart from the possible influence of plural collectives mentioned earlier (Bock et al., 2004). It has, however, been argued that the occurrence of plural attraction after a collective local noun in British English stems from a lexical specification of collective nouns in British English as *grammatically plural*. Thus plural attraction in this case is in fact analogous to the attraction that occurs with plural nouns like "people".

Attraction in gender agreement: The effect of the notional meanings of nouns on attraction in gender agreement has been investigated in only a few studies conducted in French and Italian (Vigliocco & Franck, 1999), which applied the same basic paradigm for eliciting attraction that is generally used in the study of number agreement. In these studies only the notional meaning of the head noun of the preamble was directly manipulated, as in Examples 4a and 4b:

4a. Head noun with grammatical gender:
Il cero (masc.) *in chiesa* (fem.)
The candle in the church. . .

4b. Head noun with conceptual gender:
Lo sposo (masc.) *in chiesa* (fem.)
The groom in the church...
(Vigliocco & Franck, 1999)

The results showed a greater tendency for gender attraction when the head noun has only a grammatical gender than when it also has a matching conceptual gender. It has been suggested that the conceptual meaning of the gender of animate head nouns strengthens the gender specification of the subject and thus assists the process of producing subject–predicate agreement. However, unlike the case of number agreement, no evidence is available for a notional effect of the gender of the *local* noun, which is crucial for testing the prediction of the two-mechanism model described above (see Vigliocco & Franck, 1999, Exp. 2, for indirect null results).

In regard to the asymmetrical properties of number attraction discussed earlier, while the data are rather straightforward for number attraction, the picture is more complex for gender attraction in French, Italian and Slovak. While two studies conducted in Italian did not find asymmetrical properties of gender attraction (Vigliocco & Franck, 1999; Vigliocco & Zilli, 1999), one indicated that feminine head nouns with masculine local nouns are more prone to attraction than masculine head nouns with feminine local nouns (Vigliocco & Franck, 2001). Importantly, however, in Italian both forms, the masculine as well as the feminine, are morphologically specified. Asymmetry was also observed in Slovak (Badecker & Kuminiak, 2007). However, it seems to be conditioned by morphological ambiguity of the lexical forms. French demonstrates clear asymmetry, as a morphologically specified feminine head noun with a morphologically unspecified masculine local noun elicits more attractions than a masculine head noun with an unspecified feminine local noun (Vigliocco & Franck, 1999, 2001). These results do not fit the morphological markedness account, since the morphologically unspecified form in French is masculine. However, one should take into consideration the language's low transparency.

A systematic investigation of the issue in different types of agreement, namely, gender and number agreement is essential for establishing any broad regularity in the behavior of inflectional systems in language production. However, comparing the production of agreement for number and for gender is not trivial. On the one hand, number agreement may be more conceptually meaningful because marking the number of the predicate makes sense, as each individual denoted by the subject has the feature denoted by the predicate. This is unlike the gender marking of the predicate, where a "feminine" or "masculine" predicate has no notional meaning. On the other hand, the distinction between purely grammatical features and notional meaning is probably more clearly defined for gender than for number. This is because grammatical gender for inanimate nouns has no conceptual basis, and does not go through a process of feature marking in mapping the conceptual notion onto a linguistic code. Number is different, however, as the referent denoted by a word may have a sense of quantity even when the word's grammatical number is arbitrary and conflicts with the notional meaning (Bock et al., 2001; Bock et al., 2004; Eberhard et al., 2005; Vigliocco, Antonini, & Garrett, 1997). Thus, grammatical features with notional meaning for gender allow us to compare purely grammatical features which do not involve any conceptual meaning with the obvious feature of sex. If the production of agreement is indeed sensitive to conceptual factors, these two features of agreement may exhibit different behavior. These differences may highlight the more specific features that govern the interaction between conceptual and grammatical factors in producing grammatical agreement.

The present study was conducted in Hebrew. Investigating attraction in Hebrew is interesting and important for several reasons. First, this phenomenon has been repeatedly demonstrated in various languages, all of them in the Indo-European family. Demonstrating the same phenomenon in Hebrew, a Semitic language, is important for establishing the claim that attraction reflects a general linguistic mechanism for producing agreement. Second, and even more important, is the fact that Hebrew provides an opportunity to compare gender and number agreement within one language. Thus investigating attraction in Hebrew may facilitate the generalization of previous findings across different agreement relations and different languages. Finally, the inflectional morphology of gender and number in the nominal and verbal systems in Hebrew makes this language very appealing for investigation. Gender and number inflections both have wide distributions in Hebrew: all nouns (and adjectives) are inflected for number (singular and plural)[1] and gender (feminine and masculine); all verbs are inflected for number and gender in three different persons and in the three main tenses (Aronoff, 1994). (In some cases the paradigm includes identical forms, as it is the case for the second and third person plural forms of the past tense.) Thus the production of subject–predicate agreement occurs often, and is also used as a cue for discovering the syntactic relations in a sentence. (Note that unlike many other languages, the determiner in Hebrew is not marked.) Second, and more importantly, the same form is specified in the nominal and the verbal systems. For number inflection, the morphologically specified form is the plural in both systems, and for gender inflection, the specified form is the feminine in both systems, as illustrated in Table 1. This is unlike English (in which most of the studies on number agreement have been carried out), where the suffix 's' denotes the morphologically specified plural form in the nominal system, but the morphologically specified singular form in the verbal system.

Thus, unlike the case of English, the morphological system of Hebrew is prominent and transparent, so the conceptual factor can be nicely isolated from formal grammatical regularities.[Recent studies in the domain of *language comprehension* (Berent, Pinker, Tzelgov, Bibi, & Goldfarb, 2005) have revealed that Hebrew speakers derive number specification automatically, on the basis of

[1] Some nouns are also inflected for dual number, with the morpheme /ayim/. For example, *regel–raglayim* [a leg–legs].

Table 1
Examples for the basic inflections of gender and number in Hebrew (the inflectional suffixes of the morphologically specified forms are in bold)

	Morphological specification	Nouns	Verbs
Number	Unspecified—singular	/zamar/ (a male singer)	/diber/ (he talked)
	Specified—plural	/zamar**im**/ (male singers)	/dibr**u**/[a] (they talked)
Gender	Unspecified—masculine	/zamar/ (a male singer)	/diber/ (he talked)
	Specified—feminine	/zamer**et**/ (female singer)	/dibr**a**/ (she talked)

[a] As inflectional morphology is synthetic, the addition of inflectional suffixes may also entail some changes in the syllabic structure and/or vowels of the source form.

inflectional morphological markers.] A more comprehensive description of number and gender inflections in Hebrew is provided in the introduction to Experiments 1 and 3. Moreover, in Indo-European languages other than English, such as Italian, where gender attraction has already been studied, gender has two morphologically specified forms, one for the feminine (e.g., *pietra*, stone) and one for the masculine (*e.g., astro*, star), unlike Hebrew, in which only the feminine form is morphologically specified. Thus, gender manipulation in Hebrew should be similar to number manipulation in English in that it involves transparent morphological specified and unspecified forms, allowing a more direct comparison between number and gender agreement within one language.

Experiment 1: Production of subject–predicate number agreement for local nouns with conceptual versus grammatical number

The aim of Experiment 1 was to see whether the numerical notional meaning of the local noun affects the occurrence of attraction in subject–predicate number agreement. Accordingly, the frequency of plural agreement in preambles in which the local noun was a mass noun with an arbitrary grammatical number specification was compared with the frequency of plural agreement in preambles in which the local noun was a natural count noun, whose numerical agreement properties are rooted in its meaning. An example of one set of preambles is presented in Table 2.

As mentioned above, we chose to use mass nouns rather than collective nouns because they do not have plural inflections. Thus the use of mass nouns to study notional effects on grammatical agreement enables us to avoid any implicit effects of the counterpart plural inflection (Bock et al., 2004).

In light of the theoretically and empirically equivocal definition of the notional meaning of mass nouns discussed in the introduction, in the present research we considered a noun to be a mass noun based on the empirical classification of nouns into one of two categories according to whether the noun represents "one entity" or "a non-count quantity", i.e., indeterminate or uncountable quantity (this will be elaborated below). This classification highlights the complexity of the structure of non-count entities, for both aggregates and substances. This conceptualization of the notional meaning of plurality regards the singleton as a fundamental atom, whereas plurality is regarded as "non-singular". However, the conceptual basis for the classification of mass nouns is beyond the scope of this study, which relies mainly on empirical data distinguishing between "one entity" and "a non-count quantity".

Extrapolating from previous research in other languages, we predicted that the mismatched head\local noun condition, in which the head noun is a grammatical singular form and the local noun a grammatically plural form, would yield more attraction, i.e., a greater percentage of plural predicates. If this occurred, it would demonstrate the attraction phenomenon in Hebrew for the first time. However, the crucial comparison is whether local mass nouns yield a significantly higher percentage of plural predicates than singular count nouns in the matched condition.

As noted, all nouns, adjectives and verbs in Hebrew are inflected for number (singular and plural), except for a few groups of nouns, such as mass nouns. The nominal system uses two inflectional marking morphemes, the suffixes /im/ and /ot/, to denote a plural form. Whereas the suffix /im/ is usually used for masculine forms, the suffix /ot/ is usually used for feminine forms, as in the example presented in Table 2: *mamtak* (masc., sing.)–*mamtakim* (masc., pl.), meaning 'one candy' and 'candies', respectively. Moreover, this regularity exists for adjectives as well. However, there are exceptions to this rule, in which masculine nouns use the /ot/ plural suffix and vice versa. Accordingly, while the suffixes /im/ and /ot/ are unequivocal cues for the plu-

Table 2
An example of a set of preambles used in Experiment 1

Type of local noun	Head-local condition	
Mass	Grammatical match	/*ha-cincenet* (sing.) *ʕim ha-dvaʃ* (sing.)/ The jar with the honey
Natural count	Grammatical match	/*ha-cincenet* (sing.) *ʕim ha-mamtak* (sing.)/ the jar with the candy[b]
	Grammatical mismatch	/*ha-cincenet* (sing.) *ʕim ha-mamtakim* (pl.)/ The jar with the candies

[b] "Mamtak" is exclusively a count noun in Hebrew, even though its English translation "candy" can be either a count or a mass noun.

ral feature, they are not completely reliable cues for gender. In fact, the gender of a nominal form can be unequivocally recognized only by the inflection of the adjective, which is completely regular. To avoid any complications, no irregular nouns were used in our experiments.

The structure of the inflectional morphemes used by the verbal system is more complicated, as verbs in Hebrew are inflected for tense and person as well as number. Thus, there are naturally more inflectional morphemes used by the verbal system. A comprehensive description of the paradigm is beyond the scope of this introduction (such a description can be found in Aronoff, 1994). Therefore, we will only highlight a few characteristics that are important for understanding the present research. As in the nominal system, the morphologically specified form in the verbal system is the plural form, and the paradigm is totally transparent for the number specification of the verb. Furthermore, in those cases where the verbal system uses the same inflectional suffixes used by the nominal system, i.e., /im/ and /ot/, it uses them regularly, with /im/ denoting a plural masculine verb, as in /*holx**im***/, meaning 'going', for first, second and third person in the present tense, and /ot/ denoting a plural feminine verb, as in /*holx**ot***/, meaning 'going', for first, second and third plural person in the present tense.

All the experiments in the present study used the sentence-completion task (Bock & Miller, 1991) for eliciting subject–verb agreement. Accordingly, subjects heard preambles like the one presented in Table 2, and were instructed to repeat each preamble and complete it with a predicate derived from the root of a noun or infinitive form that appeared on the screen before the spoken preambles. We calculated the percentage of plural predicates in the various conditions.

Method

Participants

The participants were 60 undergraduate students at the Hebrew University. All were native speakers of Hebrew who participated in the experiment for course credit or payment.

Materials and design

The experiment included 30 sets of spoken preambles, each one a complex noun phrase consisting of a noun (the head noun) + a prepositional phrase (containing the local noun). The number type (mass, count) of the local noun was manipulated, creating three experimental conditions: (1) "Mass, matched"—the local noun was a mass noun, a grammatically singular noun (without a productive plural) which is considered to have a plural sense. The head noun was a count noun, and matched the local noun in grammatical number. (2) "Count, matched"—the local noun was a natural singular count noun, semantically related to the matched mass noun in condition 1. The head noun was a count noun that matched the local noun in grammatical number. (3) "Control"—the local noun was the plural inflection of the natural count noun in condition 2. The head noun was a count noun that did not match the local noun in grammatical number. An example of one set of stimuli is presented in Table 2 above. Except for two preambles, all head nouns were inanimate nouns, to avoid any special affinities of animate nouns with subjecthood. All count nouns were morphologically regular (in both their singular and their plural inflections), and all local nouns within a set of stimuli had the same gender.

The number properties of the mass nouns were verified by a norming procedure, in which 30 participants (who did not participate in the experiment itself) were asked to indicate whether each word in a list represented "one entity" or "a non-count quantity". A "one entity" response was assigned the value 1, and a "non-count quantity" response was assigned the value 2. We then calculated the mean response for each word. Only words whose means equaled or were greater than 1.7 were included in the experiment. The list included 50 mass nouns. In addition, it included 50 fillers of singular count nouns to create stimulus variability within the list. Only 43 mass nouns met the cutoff point of 1.7. Thirty of these 43 items, for which we could compose the most reasonable and comprehensive preambles meeting all the constraints that we had impose on the preambles as detailed below, were chosen for the experiment. The list of the mass nouns and their ratings can be found in Appendix A.

In the actual experiment, participants were asked to complete the preambles with a verb derived from the root of a nominal form that appeared on the screen before the presentation of the spoken preamble. In the above example the nominal form *sgira*, meaning "closure," which is derived from the root s.g.r., appeared before the spoken preamble, and the participants were expected to produce a predicate derived from the same root, such as the present participle *sgura*, meaning 'is closed'. To verify that each complex noun phrase could plausibly be used with the target predicate in both the mass and the semantically related condition, a pre-rating procedure for sentence plausibility was carried out. In this procedure participants read the complete sentences and were asked to rate them on a 1–7 scale. Only sentences that were rated within a range of 4.25–7, and for which the difference between the two foils within each pair was not greater than 1.5 units, were included in the experiment. We had to conduct four rounds to find 30 preamble sets that achieved this criterion. Thirty participants performed the rating in the first round. Each of the following rounds included 10 participants.

Three lists of plausibility ratings were constructed, so that each list included each sentence variation only once. In addition to the 30 experimental items (10 with each variation), the rating lists included 15 fillers with very low plausibility to create variability within the list. The experimental stimuli are presented in Appendix C.

The experimental preambles were divided into 3 lists, each with 30 preambles, including 10 in each of the local-noun conditions. Each list contained only one version of any preamble set. In addition to the experimental items there were 30 filler preambles with a plural head noun. Both the head and the local nouns of each filler were natural count nouns. Twenty of the fillers had a singular local

noun, and ten had a plural one. Thus half of the preambles in the list (stimuli and fillers) were matched for the number of the head and local nouns, and half were not. In this experiment, as well as in the following ones, the experimental items and the fillers within each list were randomized. We randomized the preambles only once, keeping the same random order for each of the three lists. The same random order was used for all participants.

The preambles were recorded by a male native speaker of Hebrew at a natural speaking rate. The intonation was that of the beginning of a sentence that needs to be completed. The recording procedure was identical for all the experiments.

Procedure

At the beginning of each trial, a printed word appeared at the center of the screen, (such as *sgira*, "closing") followed by the spoken preamble (such as "the jar with the honey" in the above example) 300 ms after the onset of the printed word. The word remained on the screen until the preamble was over. Participants were told that on each trial they would hear a spoken preamble at the same time that they would see a print noun or infinitive form of a verb at the center of the screen. They were asked to repeat the preamble and complete it with a predicative form derived from the root of the print form presented on the screen. Participants were asked to respond as quickly as possible, but maintain clear articulation. The experimenter controlled the display of each successive trial. The print stimuli were presented on a MicroScan 4GP/ADI monitor. The spoken preambles were presented via Hi-Tex LX-18 loudspeakers connected to an Intel Celeron computer. The experiment started with 6 training trials. The experimental session lasted approximately 10 min. The experimenter wrote down the participants' responses.

Results

The participants' spoken completions were coded into three categories: (1) "singular responses"—the participant produced a grammatically correct completion of the preamble with the singular inflection of the predicate; (2) "plural responses"—the participant created an ungrammatical sentence by using a plural inflection of the predicate (this category also included predicates concordant both with the number and gender features of the local noun, instead of those of the head noun, which occurred only once); and (3) "other", which included no response, an unclear response, a completion that was ungrammatical in some other respect than number agreement, or an incorrect repetition of the spoken preamble. The percentage of "other" type of responses was about 7% across all experimental conditions (37 "other" type of responses (6.2%) for the mass—matched condition, 58 (9.7%) for the natural count—matched condition and 34 (5.7%) for the natural count—mismatched condition). To minimize the impact of the "other" responses on the data analysis, in each condition we calculated the proportion of plural responses out of the sum of the singular and plural responses, omitting the "other" responses. This procedure was applied in all subsequent experiments as well. The distribution of the plural responses and the corrected percentages in the various local-noun type conditions is presented in Table 3.

Table 3
Distribution of plural responses in each of the conditions in Experiment 1 (the corrected percentages are given in parentheses)

Condition	Plural responses
Mass, grammatically matched	2 (0.4%)
Count, grammatically matched	3 (0.5%)
Count, grammatically mismatched	20 (3.6%)

As shown in Table 3, the highest percentage of plural agreement occurred, as predicted, in the control condition, in which the singular head noun did not match the plural local noun in number. In contrast, the percentage of plural predicates was very low when the head and local nouns agreed in number. Most interestingly, no difference was observed between the mass and the singular natural-count local nouns within the matched conditions. In other words, the plural notion of the grammatically singular mass nouns did not seem to have any effect on the frequency of number attraction.

This pattern of plural responses for the different types of local noun was subjected to a one-way analysis of variance with the variable of local-noun type. MinF' statistics (Clark, 1973) are provided throughout the analyses, and subject (F_1) and item (F_2) analyses when the minF' value does not reach significance. For direct mean comparisons we also report 95% confidence intervals (CIs) around differences between means, computed on subject proportion means (Masson & Loftus, 2003).

The analysis revealed a significant effect of local-noun type: $\min F'(2,174) = 4.96$, $p < .01$. Planned comparisons revealed that the percentage of plural responses was significantly higher in the mismatched control condition (3.6%) than in the matched condition of natural count nouns (0.5%), $\min F'(1,88) = 5.42$, $p < .05$ (CI = ±2.1% for a means difference >3.1%). The percentage of plural responses for the singular count local nouns and the mass local nouns did not differ, $Fs < 1$.

Due to the overall low percentages of plural agreement observed in the experiment, an arc-sin transformation was performed on the obtained percentages, followed by a further one-way analysis of variance, to further validate the results. This analysis revealed the same result: a significant local-noun type effect, $\min F'(2,174) = 5.38$, $p < .01$. Planned comparisons revealed a significantly higher percentage of plural agreement in the mismatched control condition than in the matched condition of natural count nouns, $\min F'(1,88) = 5.54$, $p < .05$. The mass and the singular natural-count conditions did not differ, $Fs < 1$.

Arc-sin transformations were carried out throughout the entire set of experiments reported below. In the following, only results whose pattern deviated from the line of results presented in the basic ANOVA will be reported.

As seen in the table, there was a slightly greater percentage of "other" responses in the natural count matched condition (9.7%) than in the other conditions. However, this finding was not repeated in any of the following exper-

iments, so we believe that it was merely a random local occurrence.

Discussion

The results of Experiment 1 demonstrated the attraction phenomenon in sentence production in Hebrew for the first time, in this case for number attraction. The frequency of attraction, around 3%, was lower than the percentages (around 10%) observed in other studies that used other variations of the same basic methodology for eliciting attractions (e.g., Bock & Eberhard, 1993; Bock et al., 2004; see also Vigliocco et al., 1996a in Spanish). Similar results of 2% attractions were reported in an experiment conducted at Cambridge University in England, while almost 9% were reported in American English (Bock et al., 2006). We will resume our discussion of this issue in General discussion, after presenting the data on the attraction frequencies for the next three experiments.

The most interesting finding is the almost identical results for the mass and the grammatically matched (singular) natural-count local nouns. This similarity indicates that the notional meaning of plurality does not seem to have any effect on the process of constructing grammatical agreement, in accordance with Bock's previous findings (Bock & Eberhard, 1993; Bock et al., 2001) in which mass and/or collective nouns were used in the local position. These findings support the two-mechanism model discussed in the introduction, which predicts no notional effects of the local noun on the implementation of subject–predicate agreement.

As was discussed in the introduction to Experiment 1, the definition of a mass noun is controversial issue. Although we chose to define mass nouns as "a non-count quantity", we ran a post hoc norming procedure to verify whether the mass nouns used in the number experiments (Experiments 1 and 2) correspond to the notional plurality criteria as well. Accordingly, 8 subjects were asked to indicate whether each word represented "one thing" or "more than one thing". (Fifty percent of the words of the norming list were regular singular forms.) As in the original norming procedure, a "one thing" response was assigned the value 1, and a "more than one thing" response was assigned the value 2. The means obtained were 1.11 for the singular count nouns and 1.54 for the mass nouns ($t_1(7) = 5.05$, $p < .001$, $t_2(80) = 8.51$, $p < .000$), supporting the notional distinction between these two groups of nouns used in the experiments.

One possible problem with using this norming procedure is that, since we used only singular and mass nouns in the list, we anchored only the bottom end (i.e., singular count nouns) but not the top end of the scale. Thus it is impossible to determine where the mass nouns lie on the continuum between singular and plural count nouns. Accordingly, we repeated the "one thing" vs. "more than one thing" norming procedure, this time including plural forms of count nouns (one third of the complete list). In this case another 8 participants were asked to rate each word on a 1–7 scale, in which 1 represented "one thing" and 7 "more than one thing". The means obtained revealed clear differences between the three groups of nouns, with the mass nouns situated about halfway between the two ends of the scale: singular counts: 1.31, mass nouns: 3.77, plurals: 6.49. Statistical analysis revealed a significant main effect for the differences, $\min F'(2,18) = 91.49$, $p < .000$. Planned comparisons revealed a significant difference between the singular count and the mass nouns, $t_1(7) = 6.31$, $p < .000$, $t_2(80) = 15.37$, $p < .000$, as well as between the mass and the natural plural nouns $t_1(7) = 12.24$, $p < .000$, $t_2(80) = 16.83$, $p < .000$.

Experiment 2: Production of subject–predicate number agreement for head nouns with conceptual versus grammatical number

In Experiment 2, the mass versus natural-count number of the head noun was manipulated. Thus, a list of mass nouns similar to those used in Experiment 1 was used in Experiment 2 (21 of the original 30). Although new preambles had to be constructed for Experiment 2, so that the mass nouns would be in the head rather than the local noun position, we tried to make the new preambles as similar as possible to those of Experiment 1. We devoted special attention to minimizing the distributive meaning of the complete phrases in both the mass and the natural-count conditions, as preambles with a mass noun in the head position are more vulnerable to a distributive interpretation. This constraint prevented us from including nine of the mass nouns that had been used in Experiment 1, so we had to use others. The similarity between the stimuli in the two experiments allows a fairly direct comparison between the effects of the notional meaning of the head versus the local noun on the implementation of subject–predicate agreement. As outlined in the introduction, the investigation of the effect of notional meaning of the local versus the head noun is based on the two-mechanism model, according to which notional meaning of the local noun is not possible, while the plural notion of the subject phrase may increase the frequency of plural agreement. In other words, although nouns with a plural notional meaning are not supposed to affect the frequency of plural agreement when embedded in a local noun position, they can do so when embedded in a head noun position. Since no notional effects of the local noun were observed in Experiment 1, if the present experiment, which shares a large proportion of mass nouns with the previous experiment, does produce notional effects, any alternative interpretation of Experiment 1 for the absence of an effect, such as a semantic interpretation, will be ruled out.

The experiment included four different conditions, as illustrated in Table 4. The head noun had either a mass or a natural count number. The local noun was either matched in number with the head noun—the singular form of a natural count noun—or mismatched with it—the plural form of a natural count noun. The interesting question was whether mass nouns would create more plural predicates than singular count nouns in the mismatched conditions. This effect was investigated by comparing the percentage of plural predicates in the matched and the mismatched head-local conditions for mass and count head nouns. If notional meaning does indeed affect the occurrence of

Table 4
An example of one set of preambles used in Experiment 2

Type of head noun	Head-local condition	
Mass	Grammatically matched	/ha-dvaʃ (sing.) *leyad ha-konanit* (sing.)/ The honey by the shelf-rack
	Grammatically mismatched	/ha-dvaʃ (sing.) *leyad ha-konaniyot* (pl.)/ The honey by the shelf-racks
Natural count	Grammatically matched	/ha-vafel (sing.) *leyad ha-konanit* (sing.)/ The wafer by the shelf-rack
	Grammatically mismatched	/ha-vafel (sing.) *leyad ha-konaniyot* (pl.)/ The wafer by the shelf-racks

plural agreements, a higher percentage of plural predicates should occur in the mass than the natural count mismatched condition.[2]

Method

Participants

The participants were 96 undergraduate students at the Hebrew University. All were native speakers of Hebrew who participated in the experiment for course credit or payment.

Materials and design

The experiment included 32 sets of spoken preambles with the same syntactic structure of a complex noun phrase as used in Experiment 1. Unlike Experiment 1, however, the number type (mass, count) of the *head* noun was manipulated, creating 4 experimental conditions: (1) "mass matched"—the head noun was a mass noun, and the local noun was a singular inflection of a natural count noun; (2) "mass mismatched"—the head noun was a mass noun, but the local noun was the plural inflection of a natural count noun; (3) "count matched"—the head and the local nouns were singular natural count nouns; (4) "count mismatched"—the head and the local nouns were natural count nouns, with the head noun being a singular form and the local noun a plural form. An example of one set of stimuli is presented in Table 4 above. As in Experiment 1, all the count nouns were morphologically regular (in both their singular and their plural inflections), and all head nouns within a set of stimuli had the same gender.

Twenty-one of the mass nouns were the same as those used in Experiment 1. The other 11 nouns were chosen from the initial list of 43 mass nouns that met the criteria of being judged as representing uncountable things in the norming procedure performed before Experiment 1. (The mass nouns and their ratings are listed in Appendix B.) After constructing the preambles we performed the same procedure as in Experiment 1 to find out whether each complex noun phrase could plausibly be used with the target predicate in the mass and the semantically related conditions. This procedure eliminated 9 of the mass nouns that had been used in Experiment 1, and therefore we had to add new mass nouns for the present experiment. We had to conduct 4 rounds of plausibility ratings until we found 30 preambles that achieved the criteria established in Experiment 1. The experimental stimuli are presented in Appendix C.

The experimental preambles were divided into four lists; each list contained 32 preambles, 8 in each of the local-noun type conditions. Each list contained only one version of any preamble set. There were also 32 filler preambles. In all of the fillers, both the head and the local noun were natural count nouns, half of them singular and half plural. Thus, within each experimental list, half of the preambles (stimuli and fillers) were matched for number of the head and the local nouns, while half were mismatched.

Procedure

The procedure was identical to the one described in Experiment 1. The experiment started with 6 training trials.

Results

The spoken completions of the preambles were coded into the same three categories as in Experiment 1: (1) "singular responses"—the participant produced a grammatically correct completion of the preamble with the singular inflection of the predicate; (2) "plural responses"—the participant created an ungrammatical sentence by using a plural inflection of the predicate (this category also included predicates concordant both with the number and gender features of the local noun, instead of those of the head noun, which occurred 13 times); and (3) "other"—no response, an unclear response, an ungrammatical completion without number mismatch, an incorrect repetition of the spoken preamble, and the like. The percentages of "other" type of responses were about 7% across all experimental conditions (51 "other" type of responses (6.6%) for the mass matched condition, 49 (6.4%) for mass mismatched condition, 51 (6.6%) for the count matched condition, and 57 (7.4%) for the count mismatched condition). Apparently, the percentage of "other" responses was relatively small, with similar percentages in all the conditions. The distribution of the plural responses and their corrected proportions (i.e., not including the "other" types of response) in the various conditions is presented in Table 5.

As shown in Table 5, the highest percentage of plural agreement occurred, as predicted, in the mismatched con-

[2] In Experiment 1 we could not construct a parallel design in which each of the mass and count head noun conditions had its own mismatched condition. This is because the mass nouns were located in the local noun position. Because of the asymmetry of attraction, any effects on attraction have to be investigated in a mismatched condition in which the local noun is a plural form. Since no plural forms exist for mass nouns, we could not compare the probability of attraction for each mass and count local noun condition relative to its own control.

Table 5
Distribution of plural responses in each of the conditions in Experiment 2 (the corrected percentages are given in parentheses)

Condition	Plural responses
Mass, grammatically matched	3 (0.5%)
Mass, grammatically mismatched	42 (6%)
Count, grammatically matched	2 (0.3%)
Count, grammatically mismatched	23 (3.3%)

ditions, in which the singular head noun did not match the plural local noun in number. In contrast, the percentage of plural agreement was very low when the head and local nouns agreed in number. Most interestingly, within the mismatched conditions that led to plural agreement, the percentage of plural predicates seemed to be higher when the grammatically singular head noun had a plural notion than when it was both grammatically and notionally singular. In other words, the plural notion of a grammatically singular mass noun seems to facilitate plural agreement.

This pattern of distribution of plural responses was subjected to a two-way analysis of variance with the independent variables of head-noun type and head-local grammatical matching. The analysis revealed a significant main effect of grammatical matching, $\min F'(1,81) = 10.20$, $p < .005$, as well as a main effect for the type of the head noun, $F_1(1,95) = 5.19$, MSE = .004, $p < .05$, $F_2(1,31) = 5.22$, MSE = .001, $p < .05$, $\min F'(1,94) = 2.60$. Furthermore, the analysis revealed a significant interaction between the two variables in the subject analysis, $F_1(1,95) = 4.52$, MSE = .004, $p < .05$, but only a marginal one in the item analysis, $F_2(1,31) = 3.57$, MSE = .001, $p = .068$, $\min F'(1,83) = 1.99$. Planned comparisons revealed that the percentage of plural responses was significantly greater in the mass than the count mismatched condition, $F_1(1,95) = 5.26$, MSE = .014, $p < .05$, $F_2(1,31) = 4.62$, MSE = .004, $p < .05$, $\min F'(1,87) = 2.45$ (CI = ±2.4% for a means difference >2.8%).

The two-way analysis of variance conducted on the arc-sin transformation of the percentages of the plural responses revealed the same pattern of results, even though the interaction between the two variables was only marginally significant in the subject analysis $F_1(1,95) = 3.24$, MSE = .015, $p = .075$, and not significant at all in the item analysis $F_2(1,31) = 2.79$, MSE = .01, $p > .05$, $\min F'(1,86) = 1.49$. The planned comparisons did, however, reveal the same pattern of results obtained in the previous analysis on the raw percentages.

Discussion

The results of Experiment 2 replicated the attraction in number agreement in Hebrew found in Experiment 1; the overall percentage of plural predicates in the natural count mismatched condition is similar in the two experiments, about 3%. Furthermore, the percentage of "other" responses in Experiment 2 is about 6%, similar to the percentage observed in Experiment 1 (except for the unexpectedly greater percentage of this type of response in the count matched condition observed in Experiment 1). In addition, as predicted, the "other" responses were spread across the different experimental conditions.

The most interesting result of this experiment is the greater percentage of plural agreement in the mismatched condition when the head noun was a mass noun. Thus, unlike Experiment 1, where the plural notional meaning of the local noun did not affect the frequency of plural predicates, this meaning did increase the frequency of plural predicates when the mass noun was the head noun. Thus, manipulating the sentential position of the mass noun between the two experiments, which were as similar as possible (66% of the nouns were the same), led to different outcomes in the two cases.

As mentioned, we aimed to avoid any distributive meaning of the preambles. However, since at least some of the nouns that were included in this category have the semantic feature of being divisible, they may lend themselves to a distributive interpretation when they serve as head nouns. Therefore, we carried a norming procedure in a post hoc test to assess the meaning of the preambles. The instructions of this procedure included an explanation of unitary and distributive meanings, accompanied by two examples of each meaning. The participants were asked to indicate whether each preamble has a unitary (1) or a distributive (2) meaning. The procedure included all the experimental stimuli of Experiment 2, with the addition of 16 fillers which had a typical distributive meaning of the type "the label on the bottles" (Bock & Miller, 1991). The means obtained from 28 participants were 1.16 for preambles with a natural singular head noun, 1.37 for preambles with a mass head noun, and 1.85 for the fillers with unequivocal distributive meaning. Apparently, preambles with a head mass noun are distinguished from those with a distributive notion; however, they were also scored, on average, as less unitary than the natural singular count nouns. A careful examination of each of the preambles with a mass noun revealed that 5 out of the 32 items were indeed scored with deviant higher mean score (item #6, butter—1.77; item #11, money—1.71; item #13, paperwork—1.79; item #19, fog—1.86; item #30, heat wave—1.79). After these items were omitted, the observed means were 1.13 for preambles with natural singular head nouns and 1.29 for mass head nouns. We then re-analyzed the results of Experiment 2 with 27 rather than 32 items. The obtained means were very similar to the original ones presented in Table 5 (mass, matched—0.5%, mass, mismatched—5.3%, count, matched—0.3%, count, mismatched—2.8%). The two-way analysis of variance revealed once again a significant interaction for the subject analysis, $F_1(1,95) = 3.96$, MSE = .004, $p < .05$, but unlike the marginal interaction for the items in the original analysis, no interaction was observed for items in the current analysis, $F_2(1,26) = 2.79$, MSE = .001, $p = .11$, $\min F'(1,67) = 1.64$. Planned comparisons between the percentages of plural responses in the mass and the count mismatched conditions revealed a significant difference for subjects, $F_1(1,95) = 4.69$, MSE = .013, $p < .05$, and a marginal difference for the item analysis, $F_2(1,26) = 3.25$, MSE = .004, $p = .08$, $\min F'(1,66) = 1.92$.

The two-way analysis of variance conducted on the arc-sin transformation of the percentages of the plural responses revealed the same pattern of results.

The fact that notional effects were observed in the current experiment refutes an alternative interpretation of the

absence of any notional effect in Experiment 1, as resulting from the weakness of the conceptual plural notion of the mass nouns used in that experiment. Moreover, the percentage of plural responses was negligible in the grammatically *matched* conditions, in both the mass and the natural count conditions. This outcome supports our basic working hypothesis that the plural responses indeed reflect a grammatical process triggered by grammatical mismatching, and not a purely conceptual effect.

Experiment 3: Production of subject–predicate gender agreement for local nouns with conceptual versus grammatical gender

The aim of Experiment 3 was to see whether the natural, biologically based, gender of the referent of a noun affects the occurrence of attraction in subject–predicate gender agreement. Accordingly, we compared the frequency of attraction in preambles with local nouns that have arbitrary, grammatical, gender specification, such as nouns that denote inanimate entities, with that for animate nouns, which have a clear conceptual feature of sex. Thus, in all preambles the head noun was the masculine form of an inanimate noun. The local noun was either an inanimate or an animate local noun (manipulating the conceptual notion of the local noun) with a feminine or a masculine gender (manipulating the grammatical match of the gender of the head and the local noun). Many of the animate masculine nouns in Hebrew also have a counterpart feminine inflected form. This is not true for the inanimate nouns, which usually do not have a counterpart feminine inflection. (When an inanimate noun appears in both a masculine and a feminine form, the two forms rarely have the same or even a similar meaning, and might be considered as two derived forms of the same root.) Accordingly, in the present experiments we included only animate nouns that have both masculine and feminine forms, and inanimate nouns that have either a masculine or a feminine form, but not both. An example of a set of such preambles is presented in Table 6.

As noted above, in Hebrew the masculine is the morphologically unspecified form and the feminine is the specified form, and the same inflectional suffixes are used to denote the feminine form for both animate and inanimate nouns. Moreover, notional sex is correlated with grammatical gender, denoted by inflectional morphology. In most cases the grammatical structure of the noun is deducible from its morphological structure. To avoid any ambiguity concerning the gender specification of the noun, all head and local nouns in Experiments 3 and 4 were nouns with morphologically transparent gender, in both their singular and plural inflections.

As with number agreement, we predicted a higher percentage of feminine predicates in the mismatched conditions, in which the head and local noun differ in their grammatical gender, than in the matched conditions. The most interesting question was whether attraction would interact with the notional meaning of the local noun, so that the percentage of feminine predicates for local nouns with conceptual gender (animate) would be higher than for those with grammatical gender (inanimate). This could happen if the notional feminine feature of the local noun causes it to be more prominent, thus increasing the attraction of the predicate to the grammatical features of the local noun.

Method

Participants

The participants were 80 undergraduate students at the Hebrew University. All were native speakers of Hebrew who participated in the experiment for course credit or payment.

Materials and design

The experiment included 40 sets of spoken preambles of a complex noun phrase consisting of a noun (the head noun) + a prepositional phrase (which included the local noun). The gender type (conceptual, grammatical) of the local noun was manipulated, as was the grammatical match between the gender specification of the head and the local noun (matched, mismatched), creating four experimental conditions: (1) grammatical gender, matched—both the local and the head nouns were masculine inanimate nouns; (2) grammatical gender, mismatched—as in #1, except that the local noun was a feminine form; (3) conceptual gender, matched—the local noun was an animate masculine noun, while the head noun was an inanimate masculine noun; (4) conceptual gender, mismatched—as in #3, except that the local noun was the counterpart feminine inflection of the animate local noun. An example of a set of such stimuli is presented in Table 6. Whereas an animate noun usually has two forms, one masculine and one feminine, so that one could be used in the matched and the other one in the mismatched condition, this is not the case for inanimate nouns. Nevertheless, in an attempt to keep the preambles across conditions within a set as similar as possible, we

Table 6
An example of a set of preambles used in Experiment 3

Type of local noun	Head-local condition	
Inanimate	Grammatically matched	/*ha-tavʃil* (masc.) *ba-pundak* (masc.)/ The cooked dish at the inn
	Grammatically mismatched	/*ha-tavʃil* (masc.) *ba-miskada* (fem.)/ The cooked dish at the restaurant
Animate	Grammatically matched	/*ha-tavʃil* (masc.) *ʃel ha-tabax* (masc.)/ The cooked dish of the (male) cook
	Grammatically mismatched	/*ha-tavʃil* (masc.) *ʃel ha-tabaxit* (fem.)/ The cooked dish of the (female) cook

chose inanimate masculine and feminine local nouns that were as closely semantically related as possible (see the above example). All nouns in the head and the local position were always singular forms.

To find out how plausibly each complex noun phrase could be associated with the target predicate in the conceptual and grammatical conditions, the same pre-test rating procedure for sentence plausibility (on a 1–7 scale) that was used in the previous experiments was also carried out in the current experiments, using the same criteria. The stimuli used in the experiment are presented in Appendix C.

The experimental preambles were divided into four lists, each including 40 preambles, 10 in each of the local-noun type conditions. Each list contained only one version of any preamble set. There were also 40 filler preambles, each with a feminine head noun, to prevent any strategy of always inflecting the target word as a masculine form. In 20 of the fillers the local noun was a feminine form (matched condition) and in 20 of the fillers it was a masculine form (mismatched condition). Thus, half of the preambles in the list (stimuli and fillers) were matched for gender with the head and local nouns, and half were mismatched.

Procedure

The procedure was identical to the one described in Experiment 1. The experiment was preceded by 6 training trials.

Results

The spoken completions of the preambles were coded into three categories: (1) "masculine responses"—the participant produced a grammatically correct completion of the preamble with the masculine inflection of the predicate; (2) "feminine responses"—the participant created an ungrammatical sentence by using a feminine inflection of the predicate; and (3) "other"—no response, an unclear response, an ungrammatical completion without number mismatch, an incorrect repetition of the spoken preamble, and the like. The distribution of the feminine responses and their corrected percentages in the various conditions is presented in Table 7. The percentage of "other" type of responses across all experimental conditions was about 2.5% (20 "other" type of responses (2.5%) for the inanimate matched condition, 14 (1.8%) for the inanimate mismatched condition, 19 (2.4%) for the animate matched condition and 33 (4.1%) for the animate mismatched condition).

Table 7
Distribution of feminine responses in each of the conditions in Experiment 3 (the corrected percentages are given in parentheses)

	Feminine responses
Condition	
Inanimate, grammatically matched	3 (0.4%)
Inanimate, grammatically mismatched	16 (2%)
Animate, grammatically matched	9 (1.2%)
Animate, grammatically mismatched	22 (2.9%)
Replication	
Inanimate, grammatically matched	2 (0.3%)
Inanimate, grammatically mismatched	24 (3%)
Animate, grammatically matched	14 (1.9%)
Animate, grammatically mismatched	31 (4.5%)

The pattern of distribution of the feminine agreement was subjected to a two-way analysis of variance with the independent variables of head-noun type and head-local grammatical matching. There was a greater percentage of feminine responses in the mismatched conditions than in the matched conditions, as shown by a significant main effect of grammatical matching, $\min F'(1,118) = 4.40$, $p < .05$. Although there was also a greater percentage of feminine agreement in the conceptual versus grammatical conditions, this difference was only marginally significant, $F_1(1,79) = 3.09$, MSE = .002, $p = .083$, $F_2(1,39) = 3.87$, MSE = .001, $p = .056$, $\min F'(1,112) = 1.71$. No interaction was observed between the two factors, $Fs < 1$.

The two-way ANOVA conducted on the arc-sin transformation of the percentages of the feminine responses revealed the same pattern of results for the main effect for grammatical matching, as well as the lack of an interaction. Moreover, the marginal effect found in the original agreement analysis failed to reach significance in the transformational analysis, $F_1(1,79) = 1.83$, MSE = .013, $p > .05$, $F_2(1,39) = 2.19$, MSE = .006, $p > .05$, $\min F'(1,110) < 1$.

We later replicated this experiment with another 80 subjects. As shown in Table 7, the replication revealed the same pattern of results. A two-way ANOVA revealed a significant main effect of grammatical matching, $\min F'(1,118) = 6.30$, $p < .05$, as well as type of gender, $F_1(1,79) = 4.79$, MSE = .004, $p < .05$, $F_2(1,39) = 5.79$, MSE = .001, $p < .05$, $\min F'(1,111) = 2.62$. However, no interaction was observed between the two factors, $Fs < 1$. An arc-sin transformation revealed the same pattern of results for the main effect for grammatical matching, as well as the lack of interaction.

In the original experiment, the percentage of feminine agreement in the conceptual *matched* condition was slightly higher (1.2%) than the almost zero percentage usually obtained in matching conditions (e.g., 0.4% in the inanimate matched condition in the present experiment). However, a post hoc analysis with the Bonferroni correction, comparing the two matched conditions, did not reach significance, neither by subjects nor by items, $t_1(79) = 1.88$, $p > .05$, $t_2(39) = 1.31$, $p > .05$. The same analysis performed on the arc-sin transformation of the percentages of the feminine responses yielded similar results. Furthermore, the replication once again revealed a higher percentage of feminine responses in the *animate matched* condition.

Apparently, the percentages of "other" responses (in the original experiment) seem to be distributed unequally between the four stimulus conditions, with the largest percentage in the animate mismatched condition. However, this pattern of distribution of "other" responses was not observed in the replication; the percentage of "other" responses across all experimental conditions was about 4% (37 "other" responses (4.6%) for the inanimate matched condition, 20 (2.5%) for the inanimate mismatched condition, 34 (4.3%) for the animate matched condition and 37 (4.6%) for the animate mismatched condition).

Discussion

The results of this experiment revealed attraction for gender agreement in Hebrew for the first time. These results are similar to those observed for number agreement in Experiments 1 and 2. The overall percentage of attraction, around 2%, resembles the percentage found in the previous experiments.

The most interesting outcome of this experiment is the fact that the frequency of attraction does not seem to be affected by the conceptual properties of the gender specification of the local noun. Relative to their controls, the increases in feminine agreement in the inanimate and animate mismatch conditions were 1.6% and 1.7%, respectively; in the replication, the increases in feminine agreement in the same two conditions were 2.7% and 2.6%, respectively. As far as we are aware, this is the first time that the conceptual versus grammatical gender of the local noun has been manipulated. These results are similar to the findings obtained when the conceptual versus natural count number of the local noun was manipulated in Experiment 1, and fit the prediction of the two-mechanism model that the notional meaning of the local noun would not affect the occurrence of the attraction.

A deviant outcome was the higher percentage of feminine agreement in the animate *matched* condition (more than 1%, in contrast to less than 0.5% in all the other matched conditions across experiments). This outcome was indeed replicated, and it seems that the baseline for feminine agreement in the animate condition (across matched conditions) is somewhat higher than in the inanimate condition. Thus we believe that the lack of interaction reflects a genuine phenomenon.

Experiment 4: Production of subject–predicate gender agreement for head nouns with conceptual versus grammatical gender

Experiment 4 was basically identical to Experiment 3, except that conceptual gender was manipulated for the head noun rather than the local noun. An example of a set of preambles is presented in Table 8. The purpose of the experiment was to investigate whether the same manipulation of animacy that had no effect on the frequency of feminine predicates when embedded in the local noun position (in Experiment 3) would affect the frequency of feminine predicates when embedded in the head noun position. The correlation between conceptual and grammatical gender might strengthen the specification of the gender properties of nouns with conceptual gender (i.e., the marking mechanism), so that these nouns, when embedded in a subject position, would cause their preambles to be less vulnerable to attraction induced by the form of the local noun.

Method

Participants

The participants were 80 undergraduate students at the Hebrew University. All were native speakers of Hebrew who participated in the experiment for course credit or payment.

Materials and design

The experiment included 40 sets of spoken preambles—a complex noun phrase, with the same structure of a head noun + a prepositional phrase (including a local noun) that was used in the previous experiments. The same factors—gender type (conceptual, grammatical) and grammatical match between the gender specification of the head and the local noun (matched, mismatched)—were manipulated, creating four experimental conditions: (1) grammatical gender, matched—both the local and the head nouns were masculine inanimate nouns; (2) grammatical gender, mismatched—as in #1, except that the local noun was a feminine form; (3) conceptual gender, matched—the head noun was an animate masculine noun, and the local noun was an inanimate masculine noun; (4) conceptual gender, mismatched—as in #3, except that the local noun was the feminine inflection of the animate local noun. An example of a set of stimuli is presented in Table 8. All nouns in both the head and the local position were always singular forms.

To find out how plausibly each complex noun phrase could be associated with the target predicate in the conceptual and grammatical conditions, the same pre-test rating procedure for sentence plausibility that was used in the previous experiment was carried out in the current one. Only sentences that were rated within a range of 4–7, and for which the difference between the two foils within each pair was no greater than 1.6 units, were included in the experiment. The stimuli used in the experiment are presented in Appendix C.

The experimental preambles were divided into four lists, each containing 40 preambles, with 10 in each of the local-noun type conditions. Each list contained only one version of any preamble set. In addition to the experimental items there were 40 filler preambles, with a feminine head noun, to prevent the strategy of inflecting the target word as a masculine form. In all fillers, the local noun was the feminine form (matched condition).

Table 8
An example of one set of preambles used in Experiment 4

Type of head noun	Head-local condition	
Inanimate	Grammatical match	/*ha-tavʃil* (masc.) *ʃel ha-pundak* (masc.)/ The cooked dish at the inn
	Grammatical mismatch	/*ha-tavʃil* (masc.) *ʃel ha miʦada* (fem.)/ The cooked dish at the restaurant
Animate	Grammatical match	/*ha-tabax* (masc.) *ʃel ha-pundak* (masc.)/ The cook at the inn
	Grammatical mismatch	/*ha-tabax* (masc.) *ʃel ha miʦada* (fem.)/ The cook at the restaurant

Procedure

The procedure was identical to the procedure of the previous experiments. The experiment was preceded by 6 training trials.

Results

The spoken completions of the preambles were coded into the same three categories as in Experiment 3. The distribution of the feminine responses and their corrected percentages is presented in Table 9. The percentage of "other" type of responses was about 2.5% (21 "other" type of responses (2.6%) for the inanimate matched condition, 25 (3.1%) for the inanimate mismatched condition, 15 (1.9%) for the animate matched condition, and 22 (2.7%) for the animate mismatched condition). As predicted, feminine agreement appeared in the mismatched conditions, whereas the percentage in the matched conditions was negligible. The percentage of feminine predicates was much higher in the inanimate than in the animate mismatched condition.

The pattern of distribution of the feminine responses was subjected to a two-way analysis of variance with the independent variables of head-noun type and head-local grammatical matching. The analysis revealed a significant main effect of grammatical matching, $\min F'(1,118) = 7.77$, $p < .01$, as well as a main effect for the type of head noun, $F_1(1,79) = 4.95$, MSE = .001, $p < .05$, $F_2(1,39) = 5.25$, MSE = .001, $p < .05$, $\min F'(1,106) = 2.54$. Furthermore, the analysis revealed a significant interaction between the two variables, $F_1(1,79) = 6.47$, MSE = .001, $p < .05$, $F_2(1,39) = 6.30$, MSE = .001, $p < .05$, $\min F'(1,103) = 3.19$, $p = .077$. Planned comparisons revealed that the percentage of feminine responses was significantly higher in the grammatical than in the conceptual mismatched condition, $F_1(1,79) = 5.81$, $p < .05$, $F_2(1,39) = 5.91$, MSE = .003, $p < .05$, $\min F'(1,105) = 2.92$, $p = .09$ (CI = ±1.65% for a means difference >2%).

The two-way analysis of variance conducted on the arcsin transformation of the percentages of the feminine predicates mirrored the results found in the percentages of the original feminine agreement analysis.

Discussion

The results of the present experiment once more confirmed the existence of attraction in gender agreement. However, the most important result is that, whereas the manipulation of the conceptual gender of the local noun did not affect the percentage of feminine predicates in Experiment 3, the same manipulation did affect the frequency of feminine agreement when applied to the head noun. The percentage of feminine responses in the mismatched condition for inanimate nouns was about 3%, similar to the percentage observed for the mismatched conditions in Experiment 3 (2% for inanimate and 2.9% for animate mismatched nouns). The occurrence of a notional effect on the frequency of feminine predicates only when the head noun, but not the local noun, carries conceptual meaning resembles the findings observed for plural agreement in Experiments 1 and 2.

Table 9
Distribution of feminine responses in each of the conditions in Experiment 4 (the corrected percentages are given in parentheses)

Condition	Feminine responses
Inanimate, grammatically matched	0 (0%)
Inanimate, grammatically mismatched	22 (2.9%)
Animate, grammatically matched	1 (0.1%)
Animate, grammatically mismatched	7 (0.9%)

The effect of conceptual gender of the head noun seems to be a lower frequency of feminine agreement (0.9%), similar to what was found in the pioneering study of Vigliocco and Franck (1999), who manipulated the conceptual gender of the head noun in Italian and French. These results suggest that the conceptual meaning underlines the grammatical properties of the head noun, thus reducing the likelihood of attraction induced by the grammatical properties of the local noun. Possible sources of the conceptual information of natural gender on the grammatical process of agreement will be addressed in General discussion. There is, however, an alternative factor, other than animacy, that may have been confounded with the manipulation of animacy and caused the reduction in feminine agreement. This factor is the concreteness of the head nouns, since animate nouns usually refer to concrete objects while inanimate nouns do not necessarily do so. This may cause the preambles in the animate condition to be more easily visualized than those in the inanimate condition. Since subjecthood is correlated with concreteness, so that concrete nouns tend be perceived as more like subjects than abstract nouns (e.g., Clark & Begun, 1971), the concreteness feature of the animate head noun might have made it more prominent as the sentential subject, thus making attraction less likely (Eberhard, 1999). However, we believe that the contribution of the concreteness factor was fairly subtle, and thus the reduction of feminine responses in the animate condition was not caused by this confounding variable. A careful examination of the stimuli (see Appendix C for a list of the stimuli in Experiment 4) reveals that the majority of the inanimate nouns (about 75% of them) within each set of stimuli denote a fairly concrete object. A post hoc analysis in which we omitted those 10 items in which the head nouns in the inanimate condition had an abstract meaning yielded a very similar pattern of results—0.7% feminine predicates for animate head noun versus 2.4% for inanimate head noun. An analysis of variance revealed a marginally significant interaction between the head-noun type and head-local grammatical matching, $F_1(1,79) = 3.80$, MSE = .001, $p = .055$, $F_2(1,29) = 3.75$, MSE = .001, $p = .06$, $\min F'(1,84) = 1.89$.

General discussion

In the present study we investigated the effect of the notional meaning of words on the implementation of subject–predicate agreement. The processing of agreement was investigated via the phenomenon of attraction, in which the predicate wrongly agrees with the local noun of a complex noun phrase rather than the head noun, which is the subject of the sentence. The study made use of a well-documented methodology to induce attraction in an

experimental setting, in which participants are required to complete preambles consisting of a complex noun phrase to form a whole sentence. The main focus of the study was a systematic investigation of one of the predictions derived from the two-mechanism model suggested by Bock et al. (2001) and Eberhard et al. (2005) for the implementation of agreement, namely, that the notional meaning of the local noun does not affect the frequency of plural agreement, while the notional meaning of the complete noun phrase could have such an effect. The study was conducted in Hebrew, a highly inflected language, in which agreement rules are very common and constitute a major syntactic tool for marking syntactic functions and the relations between words. Since Hebrew grammar includes number as well as gender agreement, the present study manipulated conceptual factors for both number (Exp. 1 and 2) and gender (Exp. 3 and 4) agreement, making it possible to generalize the findings across various rules, on the one hand, and carefully study the various factors that may affect the different phases of agreement processing, on the other.

In general, the results across number and gender agreement supported this prediction. In Experiment 1 we manipulated the notional meaning of the local noun by placing mass nouns in the local position. The results indicated that the plural notion of the local noun (which conflicted with its arbitrary grammatical singular specification) did not lead to plural agreement, as the percentage of plural agreement in this condition was negligible and did not differ from a control condition in which the local noun was a singular count noun. However, placing a mass noun in the head position in Experiment 2, using a set of mass nouns similar to the one used in Experiment 1, did increase the number of plural responses, as reflected by a significantly higher percentage of plural predicates when the head noun was a mass noun than when it was a singular count noun. In parallel to the experiments on number agreement, Experiment 3 manipulated the notional meaning of the gender of the local noun by comparing the frequency of feminine agreement in preambles whose local noun was an animate noun denoting natural sex, as opposed to preambles whose local noun was an inanimate noun with arbitrary, grammatical gender specification. As with the results for number agreement, the notional meaning of the local noun did not affect the implementation of agreement, as the percentage of feminine predicates in the mismatched animate condition did not differ from that in the mismatched inanimate one. However, manipulating the animacy feature of the head noun in Experiment 4 did affect the processing of agreement, as reflected by a significantly lower percentage of feminine predicates in the mismatched condition when the head noun was animate than when it was inanimate.

Before discussing more theoretical issues, we would like to comment on the overall low percentage of attraction observed in the present study. Across the two types of agreement—gender and number—the percentages were similar and quite small, around 3 percent. In general, such occurrences may have complicated statistical implications. Even though an arc-sin transformation was conducted to make the distribution of the data better fit the assumption of normal distribution, it does not fully solve the problem of a floor effect that could be concealing real effects. In particular, the absence of notional effects in Experiments 1 and 3 may be due to this statistical problem. Nevertheless, we would like to point out that, with the same low percentages of responses, significant conceptual effects were observed in Experiments 2 and 4. Thus, although this statistical constraint of the floor effect should definitely be taken into consideration in evaluating the theoretical interpretation of the data of Experiments 1 and 3, the complete set of experiments seems to weaken the possibility that real effects are indeed prevented by a floor effect.

Major differences in the overall rate of attraction for different studies have, however, been observed previously (e.g., English versus Dutch results, both reported in Bock et al., 2001, Exp. 1; Bock et al. (2006) report a systematically lower percentage of attraction in British English than in American English). A possible cause of the low percentages found in the present study may be methodological. Except for general instructions to respond quickly, we avoided any explicit time pressure on participants, as did exist in some other studies. Furthermore, the participants did not have to find a novel predicate, as in some other studies, since a nominal form derived from the same root as the intended predicate was presented on the screen. Moreover, this word was semantically consistent with the head noun. This consistency may have underlined the grammatical function of the subject head noun and helped prevent attraction (see Thornton & MacDonald, 2003, for further discussion). However, the low percentage of attraction may also have a more substantive cause, namely the resistance of the agreement process to breakdown, probably due to its prevalence in Hebrew and its important role in Hebrew syntax. Indeed, low percentages of attraction were also observed in some other languages, such as Russian and Slovak, which share with Hebrew the feature of being highly inflected languages (Badecker & Kuminiak, 2007; Lorimor, Bock, Zalkind, Sheyman, & Beard, in press). It was suggested that a morphologically rich system may restrain any notional effect. This might be especially true when the system is transparent, as is the case in Hebrew (Hartsuiker, Schriefers, Bock, & Kikstra, 2003).

Indeed, applying the same methodology to equivalent (translated) English stimuli for Experiment 1, we observed more than 10% attraction produced by native English speakers (unpublished data).

In the following we describe the predictions of the present study in terms of the mathematical instantiation of the Marking and Morphing model (Eberhard et al., 2005), and examine the observed data in light of the model's predictions. Adopting the terms of the mathematical model for the Marking and Morphing hypothesis (Eberhard et al., 2005), the plural inflection of natural count nouns at the notional level (Sn) gets the value 1, a unit (i.e., a singular count noun) gets the value 0, and mass nouns get an empirical value between 0 and 1. (In the model, only specific individuated forms, those preceded by a quantifier, get the value −1.) At the morphological level (Sm), a mass noun, being morphologically unspecified, gets always a lexical specification of 0, similar to the singular unspecified form of the regular natural count noun, whereas the plural inflection of a count noun gets the value 1. In the model,

these values are weighted by the contrastive frequency (C_{freq}) of the singular and plural inflections of any given noun. However, the zero value of the lexical specification of the mass and singular forms will cause their weighted lexical values to always be zero, whereas the Sm of a plural inflection will always be equal to or greater than 1. Attraction is represented by the sum the contribution of the notional component (Sn) and the weighted lexical morphological number specification (Sm). (The weights, represented by constant multipliers, correspond to the position of the nouns in the syntactic hierarchy.)

Thus, in cases where the head noun consists of a singular natural count noun and the local noun is a plural inflection form, the attraction rate will be represented solely by the lexical value of the local noun, as the notional value (Sn) and the lexical value (Sm) of the head noun each equals zero. (To be sure, this is true only for subject phrases that do not have a distributive interpretation.) The sum of these effects on the root of the subject noun phrase (Sr) is expressed by the formula:

$$\mathrm{Sr} = W_{\mathrm{L}} * [\mathrm{Specification}_{\mathrm{L}} * C_{\mathrm{freq}}] = W_{\mathrm{L}} * S(m_{\mathrm{L}}).$$

W_{L}—the weight of the local noun, which represents its distance from the root of the subject noun phrase;

$S(m_{\mathrm{L}})$—the morphological specification value of the local noun.

In cases where the head noun is a mass noun (and the local noun is a plural inflection form), the mean probability of plural agreement is higher, since in this case the contribution of the notional component (Sn) is not zero, but a value θ between 0 to 1, as expressed by the formula:

$$\mathrm{Sr} = \theta + W_{\mathrm{L}} * S(m_{\mathrm{L}}).$$

When we attempted to apply this model to gender attraction, we distinguished between animate and inanimate nouns. We assumed that inanimate nouns do not have any gender specification at the conceptual level, i.e., the conceptual element (Sn) is a missing value. At the morpheme level, in analogy with number, we assumed that the morphologically unspecified masculine forms get the value 0, and the morphologically specified feminine forms get the value 1. Since inanimate nouns represent exclusively either a masculine or a feminine form, we assumed that the contrasting frequency (C_{freq}) of the feminine forms equals 1, in analogy to invariant plural nouns, which do not have alternative inflectional forms (see Eberhard et al., 2005 who argue that the value 1 represents cases in which there is no contrasting unspecified form). In the case of masculine nouns, Sm equals zero, due to the lack of morphological specification. In cases where the head noun consists of an inanimate masculine form and the local noun is a feminine form, the attraction is represented solely by the lexical value of the local noun (both the notional value (Sn) and the lexical value $S(m_{\mathrm{H}})$ of the head noun are zero), as shown in the formula:

$$\mathrm{Sr} = W_{\mathrm{L}} * [\mathrm{Specification}_{\mathrm{L}} * C_{\mathrm{freq}}] = W_{\mathrm{L}} * S(m_{\mathrm{L}}) = W_{\mathrm{L}}.$$

For animate nouns, on the conceptual level, we assumed that feminine forms inherit the value 1, whereas the masculine forms have the value −1. This assumption reflects the conceptualization that being notionally masculine (i.e., male) is not only being 'not feminine' (in analogy to singular versus plural), but a feature by itself, and therefore is conceptually marked, just like the feature of 'being feminine' (i.e., female). (This assumption refers to the examples used in this study (Experiments 3 and 4), which were restricted to clear cases in which the referents are, by definition, male or female.) At the lemma level, as with inanimate forms, we assume that morphologically unspecified masculine forms have the value 0, and morphologically specified feminine forms have the value 1. These specifications are weighted by their contrastive frequencies, which result in a zero value for masculine forms, and a value that is equal to or greater than 1 for feminine forms. C_{freq} is greater than 1 in all cases in which the feminine form has a masculine counterpart (with no connection to its actual frequency, provided it is not 0), including cases in which both masculine and feminine forms have the same frequency. That is also the case for natural count nouns, as it is demonstrated in the Eberhard et al. (2005) model. In cases where the head noun consists of an animate masculine form and the local noun is a feminine (inanimate) form, the weighted value of the head noun consists only of the notional component, i.e., −1, and the value of the local noun. The latter is its lexical specification, i.e., 1 weighted by its constant. The sum of these components demonstrates the attraction, as expressed by the formula:

$$\begin{aligned}\mathrm{Sr} &= \mathrm{Sn} + W_{\mathrm{L}} * [\mathrm{Specification}_{\mathrm{L}} * C_{\mathrm{freq}}] = \mathrm{Sn} + W_{\mathrm{L}} * S(m_{\mathrm{L}}) \\ &= W_{\mathrm{L}} - 1.\end{aligned}$$

Comparing the expected value of attraction for an *inanimate* masculine head noun with that of an *animate* one, in cases when both have inanimate feminine local nouns, yields a lower value in the animate case. As previously mentioned, this analysis is based on the assumption that the animate masculine form inherits a value of −1, rather than zero, from the conceptual level. If, however, masculine forms get the value 0, no difference in the frequency of feminine agreement is expected for animate and inanimate nouns.

In calculating the expected percentages of attraction in each of the experiments, we assumed the following: first, the weights (W) of the binding sites of the head (W_{H}) and local nouns (W_{L}) are the same as in the Eberhard et al. (2005) study. Second, the free parameter (b) used in the transformation of the formula for spreading activation to the observed data might vary across languages. Accordingly, we extracted this parameter using the data of the first and second experiments on number agreement. The number obtained was −5.21. Then we substituted this value in the formula to calculate the expected percentage of feminine predicates in Experiment 4, in which the animacy of the head noun was manipulated. These calculations led to a predicted attraction rate of 2.1% when the head noun was a masculine inanimate noun, as compared to the observed attraction rate of 2.9%, and a predicted rate of 0.8% when the head noun is an animate noun, as compared to an observed rate of 0.9%. It is very likely, however, that these results may not be reliable, for two reasons. First, the calculation of the contrasting frequency (C_{freq}) in Hebrew is very problematic, since the only existing data for frequency rates is in for unpointed Hebrew script, which

means that they reflect mainly orthographic rather than phonological frequency. This is the case because, when the points that represent the vowels are left out, words which look the same in Hebrew may actually be pronounced differently, with concomitantly different meanings, depending on the context. Accordingly, the frequency data for orthographic forms that represent homographs were not included in the calculation of C_{freq}. Second, unlike the mathematical model, which incorporated data from more than a dozen experiments, our calculation was based on a very limited number of data points.

Although the values of the present results fit the prediction of the Marking and Morphing model, one can still claim that the lack of notional effects in Experiment 1 might be due to the fact that the effects in general are small. As discussed above, we do not think that the claim for floor effect is very plausible, specifically in light of the values predicted by the model. Nevertheless, if this is the case, and the notional effects of the local noun are simply hidden by a floor effect, the present results may be in line with an alternative approach, according to which notional effects are plausible for the local noun as well, as postulated by constraint-based models (e.g., Thornton & MacDonald, 2003). However, such an account should incorporate a hierarchical structure for the contribution of the notional information to the head and the local noun, in order to explain the differences in the strength of notional influence on agreement production. In fact, when no such assumption of hierarchical structure is included in modeling agreement attraction, an overestimation of plural agreement is predicted, as calculated by Eberhard et al. (2005).

As the results of the present study are based on manipulating the head and the local noun within one language, across two types of subject–predicate agreement, using the same experimental methodology, and with a fairly large overlap of stimulus content, these results provide solid support for a major prediction of the two-mechanism model for the implementation of agreement, which claims that there are two distinct processing mechanisms. The first one is the marking mechanism, which is accessible to conceptual meaning, while the other one, the morphing mechanism, operates on grammatical specifications of morphemes. The second mechanism specifies grammatical agreement as well as word order, but is insensitive to notional effects.

As mentioned in the general introduction, the main difference between number and gender agreement is the notional meaning of the conceptual features of number versus gender, and consequently the meaning of marking the predicate for number and gender in the course of producing the agreement. However, the fact that similar findings were obtained for these two types of agreement when the local noun was manipulated, but opposite effects were found when the head noun was manipulated, further supports the claim that there is a mechanism in which the process is in fact inaccessible to higher conceptual effects, and therefore indifferent to notional distinctions. Furthermore, the fact that almost the same type of stimuli, in identical experimental conditions, yielded notional effects when embedded in the head noun position but not when embedded in the local noun position—in the case of both number and gender agreement—obviates any simple explanation for the absence of notional effects induced by the manipulation of conceptual versus grammatical features in the case of local noun in Experiments 1 and 3, such as a semantic explanation.

The present study was conducted in Hebrew, and thus extends the demonstration of attraction, and the findings of notional effects on grammatical agreement, into Semitic languages, which are quite different from Indo-European ones. Interestingly, despite the fact that Hebrew is a highly inflected language, the results obtained, particularly with respect to the local noun, resemble those obtained in less inflected ones, mainly English, where no effects of notional meaning of the local noun were found for number agreement.

The results of the present study indicate that the notional meaning of the head noun affects the implementation of subject–predicate agreement, as reflected by a higher percentage of plural or feminine predicates in the mismatched than in the matched conditions. According to the two-mechanism model, plural agreement when the subject noun phrase is notionally plural is different from plural attraction induced by the local noun. The plural marking process for subjects can be initiated from the message. However, complement phrases within the subject noun phrase cannot be marked in this way because they are not independent referring expressions. Apparently, the biological gender of the referent of subject noun phrases may lead to an analogous marking process. Here we would like to point out that according to this explanation, one would expect that plural agreement for notionally plural head nouns would appear not only in mismatched conditions but also in matched conditions. This, however, was not the case in Experiment 2, as the two matched conditions, i.e., head count noun and head mass noun, did not differ. Plural agreement appeared only in the mismatched condition. Admittedly, this outcome is not fully addressed by the Marking and Morphing model.

An important element of the logic behind these experiments is that the linguistic-semantic properties of the head nouns are the same as those of the local nouns. One potential objection to the results of Experiment 2 is that the plural agreement observed might have been driven not by the semantics of the head noun, but by a distributive meaning of the subject noun phrase as a whole. This is because distributive construals are possible in the absence of semantic plurality in the head noun. However, as elaborated in the discussion of Experiment 2, we believe that the notional plural effect of mass head nouns in the present study cannot be accounted for by a distributive interpretation of the preambles. Of course, distributivity is a slippery construct, so the data cannot definitively rule it out.

In the present study we took special care to manipulate the conceptual notion of number using mass nouns rather than collective ones. Collective nouns usually have two different conceptual meanings—a unitary meaning, referring to the group as a whole, and a distributive one, referring to the elements of the group. (This is unlike mass nouns,

which do not seem to have two distinguished notions, but probably have a less defined notion of number.) Accordingly, the notion behind a collective noun at the conceptual level might induce competition at this level between the two distinct notions—the unitary one and the distributive one. In the absence of any supporting context for a unitary or a distributive notion, the resolution at the conceptual level might be governed by frequency factors, so that the more frequent notion will be chosen. If this suggestion is correct, there should be little facilitation of plural agreement by collective head nouns, if the frequency of the distributive notions of the concept is low, and the context does not support a distributive notion. This is so because, if there is no contextual or frequency bias, these types of noun should not lead to any special competition at the conceptual level, making them more similar in conceptualization to mass nouns. This hypothesis should be investigated in future research.

In sum, the present results are in line with the general claim of the two-mechanism model that the process of agreement has two parts, one that is accessible to conceptual effects of the complete noun phrase, and another one that is not affected by conceptual effects per se. The first process, called the "marking process", takes place during the functional stage, while the second, called the "morphing process", takes place during the positioning stage. This model was originally constructed to account for findings obtained for number agreement, mainly in English. The present study extends the model prediction to gender agreement as well, and offers further support for the model from a different family of languages. Note that although gender and number reflect different mapping relations between the conceptual and linguistic domains, they nevertheless show a similar pattern of behavior.

Appendix A. Mass nouns used in Experiment 1

Phonetic transcription	English translation	Mean score of rating on a 1 or 2 scale
/ʔorez/	Rice	1.73
/barzel/	Iron	1.83
/basar/	Meat	1.73
/dvaʃ/	Honey	1.93
/meyda/	Information	2
/melax/	Salt	1.83
/melet/	Cement	1.87
/mamon/	Money	1.87
/margarina/	Margarine	1.7
/nazelet/	Mucus	1.97
/nayeret/	Paperwork	1.83
/nəsoret/	Sawdust	1.93
/neft/	Petroleum, oil	1.87
/svax/	Shrubbery, thicket	1.93
/sukar/	Sugar	1.77
/ʂoʃer/	Wealth	2
/ʂarafel/	Fog	2
/ʂaʃan/	Smoke	1.97
/pexam/	Coal	1.83
/piʂax/	Soot	2
/katif/	Fruit-picking, harvest	1.77
/kinamon/	Cinnamon	1.8
/kafe/	Coffee	1.83
/rəxuʃ/	Property (capital)	1.88
/refeʃ/	Slime, mud	2
/seʂar/	Hair	1.93
/ʃemen/	Oil	1.87
/ʃamenet/	Cream	1.8
/ʃarav/	Heat wave	1.93
/te/	Tea	1.77

Appendix B. Mass nouns used in Experiment 2

Phonetic transcription	English translation	Mean score of rating on a 1 or 2 scale
/ʔovex/	Haze	2
/ʔorez/	Rice	1.73
/bakar/	Cattle (livestock)	1.9
/basar/	Meat	1.73
/dvaʃ/	Honey	1.93
/xemʔa/	Butter	1.7
/yeda/	Knowledge, information	2
/meyda/	Information	2
/melax/	Salt	1.83
/melet/	Cement	1.87
/mamon/	Money	1.87
/margarina/	Margarine	1.7
/nayeret/	Paperwork	1.83
/nəsoret/	Sawdust	1.93
/svax/	Shrubbery, thicket	1.93
/sukar/	Sugar	1.77
/oʃer/	Wealth	2
/ʂafar/	Dust	1.93
/ʂarafel/	Fog	2
/ʂaʃan/	Smoke	1.97
/psolet/	Litter, rubbish	1.87
/con/	Sheep (flock)	1.9
/tziyud/	Equipment	1.95
/katif/	Fruit-picking, harvest	1.77
/kemax/	Flour	1.83
/kerax/	Ice	1.73
/rəxuʃ/	Property (capital)	1.88
/refeʃ/	Slime, mud	2
/ʃamenet/	Cream	1.8
/ʃarav/	Heat wave	1.93
/te/	Tea	1.77
/taxmoʃet/	Ammunition	1.95

Appendix C. Experimental preambles used in experiments 1–4 and their average plausibility rating score, on a 1–7 scale (1—very low plausibility, 7—very high plausibility)

Experiment 1

1. הזן של התפוח (5.5)/ הזן של התפוחים (5.3)/ הזן של האורז (5.8) (יבוא)

The species of apple/the species of apples/the species of rice (to be imported)

2. הגלולה של הוויטמין (6)/ הגלולה של הוויטמינים (6.2)/ הגלולה של הברזל (5.6) (יעילות)

The pill of the vitamin/the pill of the vitamins/the pill of the iron (to be effective)

3. הצידנית עם התבשיל (6.7)/ הצידנית עם התבשילים (5.8)/ הצידנית עם הבשר (6.1) (להישכח)

The hamper with the cooked dish/the hamper with the cooked dishes/the hamper with the meat (to be forgotten)

4. הצנצנת עם הממתק (6.4)/ הצנצנת עם הממתקים (6.7)/ הצנצנת עם הדבש (6.9) (סגירה)

The jar with the candy/ the jar with the candies/ the jar with the honey (to be closed)

5. הדף עם ההסבר (6.5)/ הדף עם ההסברים (6.5)/ הדף עם המידע (6) (הפצה)

The page with the explanation/ the page with the explanations/ the page with the information (to be distributed)

6. התוספת של הדובדבן (6.4)/ התוספת של הדובדבנים (6.1)/ התוספת של המלח (6.4) (ייתור)

The addition of the cherry/the addition of the cherries/the addition of the salt (to be superfluous)

7. הטנדר עם המקרר (6.1)/ הטנדר עם המקררים (6.7)/ הטנדר עם המלט (6.9) (להתעכב)

The truck with the refrigerator/ the truck with the refrigerators/ the truck with the cement (to be delayed)

8. הויתור על הפסל (5.4)/ הויתור על הפסלים (5.4)/ הויתור על הממון (6.5) (תמיהה)

The concession of the statue/the concession of the statues/the concession of the money (to be wondered at)

9. הכריך עם העגבנייה (6.2)/ הכריך עם העגבניות (6.1)/ הכריך עם המרגרינה (6.6) (להשביע)

The sandwich with the tomato/the sandwich with the tomatoes/the sandwich with the margarine (to be satisfying)

10. הילד עם השריטה (6.5)/ הילד עם השריטות (6.2)/ הילד עם הנזלת (6.6) (אומללות)

The child with the scratch/the child with the scratches/the child with the running nose (to be miserable)

11. התיק עם המחברת (5.9)/ התיק עם המחברות (6.2)/ התיק עם הניירת (6.6) (להיפתח)

Conflicting cues in producing number and gender agreement

The briefcase with the notebook/the briefcase with the notebooks/the briefcase with the paperwork (to be opened)

12. הארגז עם המדפסת (6)/ הארגז עם המדפסות (5.8)/ הארגז עם הנסורת (6.4) (לכלוך)

The box with the printer/the box with the printers/the box with the sawdust (to be dirty)

13. הגילוי של הנעדר (6)/ הגילוי של הנעדרים (5)/ הגילוי של הנפט (6.1) (לרגש)

The discovery of the missing person/the discovery of the missing persons/the discovery of the oil (to be exciting)

14. (להתפשט) (6.5) השריפה בסבך (6.5)/ השריפה במטעים (6.6)/ השריפה במטע

The fire in the plantation/the fire in the plantations/the fire in the undergrowth (to spread)

15. (להיקרע) (6.4) השקית עם הסוכר (6.6)/ השקית עם הכריכים (6.5)/ השקית עם הכריך

The bag with the sandwich/ the bag with the sandwiches/ the bag with the sugar (to be torn)

16. (טבעיות) (5.4) השאיפה לעושר (5.4)/ השאיפה לילדים (6.2)/ השאיפה לילד

The aspiration for a child/ the aspiration for children/ the aspiration for wealth (to be natural)

17. (סכנה) (6.9) הטיול בערפל (7)/ הטיול בג'ונגלים (6.4)/ הטיול בג'ונגל

The tour in the jungle/ the tour in the jungles/ the tour in the fog (to be dangerous)

18. (לזהם) (5.1) הארובה עם העשן (6.1)/ הארובה עם הסדקים (6.1)/ הארובה עם הסדק

The chimney with the crack/ the chimney with the cracks/ the chimney with the smoke (to pollute)

19. (לטבוע) (6.8) האוניה עם הפחם (6.2)/ האוניה עם המפרשים (6.7)/ האוניה עם המפרש

The boat with the sail/ the boat with the sails/ the boat with the coal (to sink)

20. (שליליות) (6.5) ההשפעה של הפיח (5.8)/ ההשפעה של הסמים (6.1)/ ההשפעה של הסם

The effect of the drug/ the effect of the drugs/ the effect of the soot (to be bad)

21. (מצוינות) (5.8) התמונה של הקטיף (5.7)/ התמונה של העצים (6)/ התמונה של העץ

The picture of the tree/the picture of the trees/the picture of the harvest (to be excellent)

22. (יוקר) (5.2) הבקבוקון עם הקינמון (6)/ הבקבוקון עם התבלינים (5.8)/ הבקבוקון עם התבלין

The bottle with the condiment/the bottle with the condiments/the bottle with the cinnamon (to be expensive)

23. (שבח) (6.1) הסוג של הקפה (5.9)/ הסוג של האריגים (6.2)/ הסוג של האריג

The type of fabric/the type of fabrics/the type of coffee (to be praised)

24. (להיתפס) (6) הגנב של הרכוש (5.8)/ הגנב של היהלומים (6.6)/ הגנב של היהלום

The thief of the diamond/the thief of the diamonds/the thief of the property (to be caught)

25. (להסריח) (6.6) הפח עם הרפש (6.3)/ הפח עם הפגרים (6.5)/ הפח עם הפגר

Conflicting cues in producing number and gender agreement

The trashcan with the carcass/the trashcan with the carcasses/the trashcan with the mud (to reek)

26. (להקסים) (6) העיצוב של השיער (6.6)/ העיצוב של התלתלים (6)/ העיצוב של התלתל

The set of the curl/the set of the curls/the set of the hair (to be enchanting)

27. (להיסדק) (5.9) הכד עם השמן (6.8)/ הכד עם הפרחים (6.1)/ הכד עם הפרח

The pitcher with the flower/the pitcher with the flowers/the pitcher with the oil (to be cracked)

28. (להתפרק) (5.7) הקופסה עם השמנת (6.1)/ הקופסה עם המתנות (6.5)/ הקופסה עם המתנה

The box with the present/the box with the presents/the container with the cream (to fall apart)

29. (שגיאה) (6) התחזית על השרב (5.8)/ התחזית על ההוריקנים (5.9)/ התחזית על ההוריקן

The forecast of the hurricane/the forecast of the hurricanes/the forecast of the heat wave (to be mistaken)

30. (להתנפץ) (6.5) הקנקן עם התה (6.4)/ הקנקן עם התיונים (5.8)/ הקנקן עם התיון

The teapot with the tea bag/ the teapot with the tea bags/ the teapot with the tea (to be shattered)

Experiment 2

1. האובך מעל לישוב (6.8)/ הענן מעל לישוב (6.2)/ האובך מעל לישובים (6.8)/ הענן מעל לישובים (6.8) (להתפזר)

The haze over the settlement/the cloud over the settlement/the haze over the settlements/the cloud over the settlements (to disperse)

2. האורז עם הקציצה (6.3)/ התבשיל עם הקציצה (6.4)/ האורז עם הקציצות (6.6)/ התבשיל עם הקציצות (6.9) (טעם)

The rice with the cutlet/the cooked dish with the cutlet/the rice with the cutlets/the cooked dish with the cutlets (to be tasty)

3. הבקר מן הגבעה (4.5)/ השור מן הגבעה (5.7)/ הבקר מן הגבעות (5.8)/ השור מן הגבעות (6) (להשתולל)

The cattle[3] from the hill/the bull from the hill/the cattle from the hills/the bull from the hills (to go wild)

4. הבשר עם התוספת (6.3)/ הסטייק עם התוספת (6.7)/ הבשר עם התוספות (6.5)/ הסטייק עם התוספות (6) (עילוי)

The meat with the vegetable/the steak with the vegetable/the meat with the vegetables/the steak with the vegetables (to be superb)

5. הדבש ליד הכוננית (5.6)/ הוופל ליד הכוננית (5.2)/ הדבש ליד הכוננויות (5.3)/ הוופל ליד הכוננויות (5.2) (מתיקות)

The honey near the shelf unit/the wafer near the shelf unit/the honey near the shelf units/the wafer near the shelf units (to be sweet)

6. החמאה של המחלבה (5.3)/ התדמית של המחלבה (6.6)/ החמאה של המחלבות (5.6)/ התדמית של המחלבות (6.3) (להשתפר)

The butter of the dairy/the image of the dairy/the butter of the dairies/the image of the dairies (to be improved)

7. הידע על התגלית (5.7) / הסרט על התגלית (6.6)/ הידע על התגליות (5.8)/ הסרט על התגליות (6.9) (לרתק)

The information about the discovery/the movie about the discovery/the information about the discoveries/the movie about the discoveries (to be fascinating)

8. המידע על התקציב (6.4)/ ההסבר על התקציב (6.7)/ המידע על התקציבים (6.4)/ ההסבר על התקציבים (6.8) (ערפול)

Conflicting cues in producing number and gender agreement

The information about the budget/the explanation about the budget/the information about the budgets/the explanation about the budgets (to be unclear)

9. המַלח לפשטידה (5.2)/ הכלי לפשטידה (4.7)/ המַלח לפשטידות (5.8)/ הכלי לפשטידות (5.4) (להיעלם)

The salt for the quiche/the container for the quiche/the salt for the quiches/the container for the quiches (to disappear)

10. המֶלֶט ליד העמוד (6.8)/ הצמח ליד העמוד (6.2)/ המֶלֶט ליד העמודים (7)/ הצמח ליד העמודים (6.7) (להתייבש)

The cement near the pole/the plant near the pole/the cement near the poles/the plant near the poles (to be dried up)

[3] In the meaning of livestock.

11. הממון של המיליונרית (5.8)/ המטוס של המיליונרית (5.1)/ הממון של המיליונריות (5.4)/ המטוס של המיליונריות (5) (להישדד)

The money of the millionairess/the plane of the millionairess/the money of the millionairesses/the plane of the millionairesses (to be stolen)

12. המרגרינה עם הגבשושית (6.1)/ העוגייה עם הגבשושית (5)/ המרגרינה עם הגבשושיות (6.1)/ העוגייה עם הגבשושיות (6) (בחילה)

The margarine with the lump/the cookie with the lump/the margarine with the lumps/the cookie with the lumps (to be nauseating)

13. הניירת של המחלקה (6.1)/ המדפסת של המחלקה (6.6)/ הניירת של המחלקות (5.6)/ המדפסת של המחלקות (5.9) (גניבה)

The paperwork of the department/the printer of the department/the paperwork of the departments/the printer of the departments (to be stolen)

14. הנסורת ליד הכלוב (5.2)/ הקערית ליד הכלוב (6.3)/ הנסורת ליד הכלובים (5.8)/ הקערית ליד הכלובים (6.2) (לכלוך)

The sawdust near the cage/the saucer near the cage/the sawdust near the cages/the saucer near the cages (to be dirty)

15. הסבך ליד הבִּיצָה (6.4)/ השיח ליד הבִּיצָה (6.6)/ הסבך ליד הבִּיצות (6)/ השיח ליד הבִּיצות (6.6) (דקירה)

The thicket near the swamp/the bush near the swamp/the thicket near the swamps/the bush near the swamps (to pierce)

16. הסוכר ליד המדף (6.1)/ הבקבוק ליד המדף (6.7) / הסוכר ליד המדפים (5.5) / הבקבוק ליד המדפים (5.4) (דביקות)

Conflicting cues in producing number and gender agreement

The sugar near the shelf/the bottle near the shelf/the sugar near the shelves/the bottle near the shelves (to be sticky)

17. העושר של היורש (5.8)/ הבית של היורש (6)/ העושר של היורשים (5.9)/ הבית של היורשים (5.6) (להדהים)

The wealth of the heir/the house of the heir/the wealth of the heirs/the house of the heirs (to be amazing)

18. העפר ליד החפירה (5.9)/ הצריף ליד החפירה (6.3)/ העפר ליד החפירות (6.3)/ הצריף ליד החפירות (6.5) (פינוי)

The dust near the dig/the shack near the dig/the dust near the digs/the shack near the digs (to be taken away/evacuated)

19. הערפל בכביש (6.2)/השיפוע של הכביש (5.9)/ הערפל בכבישים (6.7)/ השיפוע של הכבישים (5.8) (בעייתיות)

The fog on the road/the work on the road/the fog on the roads/the work on the roads (to be problematic)

20. העשן מהפגז (6.1)/ החור מהפגז (5)/ העשן מהפגזים (6.1)/ החור מהפגזים (5.7) (להבהיל)

The smoke from the artillery shell/the hole from the artillery shell/the smoke from the artillery shells/the hole from the artillery shells (to be frightening)

21. הפסולת ליד המפעל (7)/ הרחבה ליד המפעל (6.7)/ הפסולת ליד המפעלים (6.6)/ הרחבה ליד המפעלים (6.1) (צחנה)

The rubbish near the factory/the square near the factory/the rubbish near the factories/the square near the factories (to stink)

22. הצאן מן העמק (5.6)/ הצבי מן העמק (6)/ הצאן מן העמקים (6.5)/ הצבי מן העמקים (5.5) (לשוטט)

The sheep[4] from the valley/the deer from the valley/the sheep from the valleys/the deer from the valleys (to wander)

23. הציוד של הקצין (6.6)/ הטנק של הקצין (6.4)/ הציוד של הקצינים (5.8)/ הטנק של הקצינים (6.3) (הסוואה)

The equipment of the officer/the tank of the officer/the equipment of the officers/the tank of the officers (to be camouflaged)

24. הקטיף של הפרדס (6.3)/ הטרקטור של הפרדס (5.8)/ הקטיף של הפרדסים (5.3)/ הטרקטור של הפרדסים (6.2) (השחתה)

Conflicting cues in producing number and gender agreement

The harvest of the orchard/the tractor of the orchard/the harvest of the orchards/the tractor of the orchards (to be destroyed)

25. הקמח עם הזחל (5)/ הכריך עם הזחל (5)/ הקמח עם הזחלים (6.2)/ הכריך עם הזחלים (5) (גועל)

The flour with the caterpillar/the sandwich with the caterpillar/the flour with the caterpillars/the sandwich with the caterpillars (to be disgusting)

26. הקרח ליד האיגלו (6.8)/ המבנה ליד האיגלו (5.6)/ הקרח ליד האיגלואים (6.2)/ המבנה ליד האיגלואים (5.8) (להיסדק)

The ice near the igloo/the building near the igloo/the ice near the igloos/the building near the igloos (to be cracked)

27. הרכוש של המושב (6)/ המפעל של המושב (6.3)/ הרכוש של המושבים (6.3)/ המפעל של המושבים (5.8) (עיקול)

The property of the village/the factory of the village/the property of the villages/the factory of the villages (to be repossessed)

28. הרפש ליד הקרוון (6.4)/ המחסן ליד הקרוון (5.4)/ הרפש ליד הקרוונים (6.7)/ המחסן ליד הקרוונים (5.4) (להסריח)

The mud near the mobile home/the shed near the mobile home/the mud near the mobile homes/the shed near the mobile homes (to reek)

29. השמנת עם הדובדבן (6)/ העוגה עם הדובדבן (6.6)/ השמנת עם הדובדבנים (6.7)/ העוגה עם הדובדבנים (6.7) (מצוינות)

The whipped cream with the cherry/the cake with the cherry/the whipped cream with the cherries/the cake with the cherries (to be excellent)

30. השרב בערבה (6.3)/ הקיץ בערבה(6.6)/ השרב בערבות (6)/ הקיץ בערבות (5.5) (קושי)

The heat wave in the prairie/the summer in the prairie/the heat wave in the prairies/the summer in the prairies (to be difficult)

31. התה עם הביסקוויט (6) / החטיף עם הביסקוויט (6.4)/ התה עם הביסקויטים (6.3)/ החטיף עם הביסקויטים (6.3) (שבח)

The tea with the cracker/the snack with the cracker/the tea with the crackers/the snack with the crackers (to be praised)

32. התחמושת עבור הצלף (6.5) / ההקצבה עבור הצלף (5.4) / התחמושת עבור הצלפים (6.3) / ההקצבה עבור הצלפים (5.8) (להיגמר)

The ammunition for the sniper/the allocation for the sniper/the ammunition for the snipers/the allocation for the snipers (to be used up)

[4] In the meaning of flock.

Experiment 3

1. (6.6) המחשב של המעבדה (6.2)/ המחשב של המשרד (6.5)/ המחשב של הפקידה (6.8)/ המחשב של הפקיד (תקינות)

The computer of the clerk/office/laboratory (to be in working order)

2. (6) המשרד של ההנהלה (6.6)/ המשרד של הארגון (6.1)/ המשרד של המנהלת (5.6)/ המשרד של המנהל (להיסגר)

The office of the administrator/organization/administration (to be closed)

3. (6.6) הליווי של המקהלה (6.5)/ הליווי של ההרכב (6.1)/ הליווי של הזמרת (6.1)/ הליווי של הזמר (מצוינות)

The escort of the singer/band/choir (to be excellent)

4. (6.7) המחסן של החנות (6.6)/ המחסן של המפעל (5.4)/ המחסן של התעשיינית (6.2)/ המחסן של התעשיין (להישרף)

The warehouse of the industrialist/factory/store (to be burned)

5. (6.1) הניסוי על התרופה (5.8)/ הניסוי על החיסון (6.1)/ הניסוי של המדענית (6.1)/ הניסוי של המדען (להיפסק)

The experiment of the scientist/on the immunization/drug (to be stopped)

6. (5.5) (ידידותיות) המסר בוועידה (5.9)/ המסר בכינוס (6.5)/ המסר של השגרירה (6.5)/ המסר של השגריר

The message of the ambassador/at the conference (masc.)/conference (fem.) (to be friendly)

7. (6.6) התקליט של ההופעה (5.8)/ התקליט של המופע (6.5)/ התקליט של הכוכבת (6.2)/ התקליט של הכוכב (להימכר)

The record by the star/of the performance (masc.)/performance (fem.) (to be sold)

8. (5.8) (להתקלקל) הרכב של הלשכה (6.7)/ הרכב של המדור (5.5)/ הרכב של הנהגת (6.3)/ הרכב של הנהג

The car of the driver/department/office (to be out of order)

9. (6.8) (להתעכב) המשלוח מהמכולת (6)/ המשלוח מהשוק (5.9)/ המשלוח מהמוכרת (5.9)/ המשלוח מהמוכר

The delivery from the salesman/saleswoman/market/grocery (to be delayed)

10. (6.1) המסוק עם המשלחת (6.4)/ המסוק עם הציוד (6.2)/ המסוק עם הנווטת (6.1)/ המסוק עם הנווט (לנחות)

The helicopter with the navigator/equipment/delegation

11. הקונצרט עם הפסנתרן (6.7)/ הקונצרט עם הפסנתרנית (5.3)/ הקונצרט באודיטוריום (6.6)/ הקונצרט של התזמורת (6.1) (ביטול)

The concert with the pianist/in the auditorium/of the orchestra (to be canceled)

12. התיק של המחבל (6)/ התיק של המחבלת (6.1)/ התיק עם המטען (6.1)/ התיק עם הפצצה (6.3) (להתגלות)

Conflicting cues in producing number and gender agreement

The backpack of the terrorist/with the bomb (masc.)/bomb (fem.) (to be discovered)

13. הבגד של האופנאי (6.5)/ הבגד של האופנאית (6.2)/ הבגד בצילום (5.7)/ הבגד בתצוגה (6.8) (להקסים)

The dress of the designer/in the photograph/display (to be enchanting)

14. המשחק של הכדורסלן (5.8)/ המשחק של הכדורסלנית (6.1)/ המשחק על המגרש (6.6)/ המשחק של הקבוצה (5.8) (להלהיב)

The playing of the football player/on the field/of the team (to be exciting)

15. (6.8) הטיעון של הפרקליט (6.7)/ הטיעון של הפרקליטה (6.4)/ הטיעון במשפט (6.5)/ הטיעון של התביעה (היגיון)

The argument of the lawyer/at the court/of the prosecution (to be logical)

16. (6.3) (להיבדק) המניע של החשוד (6.4)/ המניע של החשודה (5.5)/ המניע למעשה (6.4)/ המניע להתנהגות

The motive of the suspect/for the action/behavior (to be investigated)

17. החיפוש אחר הנעדר (6.6)/ החיפוש אחר הנעדרת (6.8)/ החיפוש אחר האושר (6.5)/ החיפוש אחר האהבה (להימשך) (6.5)

The search for the missing person/happiness/love (to continue)

18. המרק של האורח (6.7)/ המרק של האורחת (6.5)/ המרק בסיר (6.6)/ המרק בקערה (6.2) (להתקרר)

The soup of the visitor/in the pot/bowl (to become cold)

19. (6.6) הנשק של המאבטח (5.4)/ הנשק של המאבטחת (6.1)/ הנשק של הגדוד (6.8)/ הנשק של הפלוגה (שכלול)

The weapon of the guard/battalion/company (to be up-to-date)

20. (6.7) המעיל של הדוגמן (5.7)/ המעיל של הדוגמנית (6.2)/ המעיל על הקולב (5.4)/ המעיל עם הפרווה (להתלכלך)

The coat of the model/on the hanger/with the fur (to get dirty)

21. התרמיל של המטייל (6.2)/ התרמיל של המטיילת (6.7)/ התרמיל ליד הנחל (6.2)/ התרמיל עם המימייה (להירטב) (6.3)

The backpack of the traveler/near the stream/with the canteen (to get wet)

22. הנאום של הדובר (6.7)/ הנאום של הדוברת (6.2)/ הנאום בקונגרס (5.6)/ הנאום בממשלה (6.1) (תקיפות)

The speech of the spokesman/spokeswoman/in Congress/government (to be vehement)

23. התבשיל של הטבח (5.9)/ התבשיל של הטבחית (6.5)/ התבשיל בפונדק (5.9)/ התבשיל במסעדה (פרסום) (5.8)

The cooked dish of the cook/at the inn/restaurant (to be famous)

24. היחס לתלמיד (6.3)/ היחס לתלמידה (6.7)/ היחס בשיעור (6.7)/ היחס בכיתה (6.1) (להעליב)

The treatment of the student/the attitude[5] in the class/classroom (to be insulting)

Conflicting cues in producing number and gender agreement

25. הנושא של החוקר (6.4)/ הנושא של החוקרת (6.3)/ הנושא של הדיון (6.7)/ הנושא של ההרצאה (לעניין) (6.7)

The subject of the researcher/discussion/lecture (to be interesting)

26. העונש של האסיר (6.1)/ העונש של האסירה (5.4)/ העונש על הפשע (6)/ העונש על העבירה (אכזריות) (6.3)

The punishment of the prisoner/for the crime/offense (to be cruel)

27. הביקור של השר (6)/ הביקור של השרה (6)/ הביקור באתר (6.4)/ הביקור בנסיכות (להתאפשר) (5.7)

The visit of the minister/at the site/principality (to be made possible)

28. האוסף של המיליונר (6.4)/ האוסף של המיליונרית (6.7)/ האוסף של המוזיאון (6.2)/ האוסף של הגלריה (להיגנב) (5.4)

The collection of the millionaire/museum/gallery (to be stolen)

29. הפרס של המנצח (6.6)/ הפרס של המנצחת (5.8)/ הפרס על ההישג (5.9)/ הפרס על התגלית (יוקרתיות) (5.9)

The prize of the winner/for the achievement/discovery (to be prestigious)

30. הציון של הנבחן (6.8)/ הציון של הנבחנת (6.7)/ הציון במבחן (6.7)/ הציון בבחינה (גובה) (6.6)

The grade of the examinee/on the quiz/test (to be high)

[5] Note that in Hebrew the same noun was used in all conditions.

31. הריחוק מן החבר (6.7)/ הריחוק מן החברה (6)/ הריחוק מן הבית (5.5)/ הריחוק מן המשפחה (6.5) (קושי)

The separation from one's boyfriend/girlfriend/house/family (to be hard to bear)

32. הפינוי של המתיישב (5.5)/ הפינוי של המתיישבת (6)/ הפינוי של המאחז (6.1)/ הפינוי של ההתנחלות (6.4) (להישקל)

The evacuation of the settler/outpost/settlement (to be considered)

33. הפיקוח על העובד (5.4)/ הפיקוח על העובדת (6)/ הפיקוח על המוצר (6.5)/ הפיקוח על התוצרת (5.4) (הסרה)

The supervision over the worker/product/produce (to be removed)

34. המיקום של השומר (6.4)/ המיקום של השומרת (6.2)/ המיקום של המחסום (6.5)/ המיקום של החומה (6.6) (בעייתיות)

The location of the guard/barrier/wall (to be problematic)

35. הקידום של הקצין (6.6)/ הקידום של הקצינה (6.6)/ הקידום בתפקיד (6.6)/ הקידום בדרגה (6.7) (עיכוב)

The promotion of the officer/on the job/to a higher position (to be delayed)

36. הטיפול בחולָה (6.3)/ הטיפול בחולָה (6.3)/ הטיפול בזיהום (6.6)/ הטיפול במחלה (6.3) (להיכשל)

The treatment of the patient/infection/illness (to fail)

37. התרגיל של המתעמל (6.3)/ התרגיל של המתעמלת (6.6)/ התרגיל על המתח (6.9)/ התרגיל על הקורה (5.6) (יופי)

Conflicting cues in producing number and gender agreement

The performance of the gymnast/on the horizontal bar/balance beam (to be beautiful)

38. הגיור של העולָה (6.1)/ הגיור של העולָה (6.2)/ הגיור במכון (5)/ הגיור ברבנות (5.5) (להסתיים)

The conversion (to Judaism) of the immigrant/at the institute/Rabbinate (to be completed)

39. הדירוג של הספורטאי (6)/ הדירוג של הספורטאית (6.3)/ הדירוג בטורניר (6.4)/ הדירוג בליגה (6.3) (להיקבע)

The rating of the sportsman/sportswoman/at the tournament/in the league (to be determined)

40. המצב של המאושפז (6.6)/ המצב של המאושפזת (6.3)/ המצב באזור (6.7)/ המצב במדינה (6.1) (להתדרדר)

The status of the hospitalized patient/in the area/nation (to deteriorate)

Experiment 4:

1. הצנחן עם הציוד (6.1)/ הצנחן עם האספקה (5.3)/ המסוק עם הציוד (6.5)/ המסוק עם האספקה (6.8) (לנחות)

The parachutist with the equipment/the parachutist with the supplies/the helicopter with the equipment/the helicopter with the supplies (to land)

2. המורֶה בשיעור (4.6)/ המורה בכיתה (5)/ היחס בשיעור (5.9)/ היחס בכיתה (5.7) (להעליב)

The teacher in the class/the teacher in the classroom/the attitude during the class/the attitude in the classroom (to be insulting)

3. הנהג של הקיבוץ (5.8)/ הנהג של ההתנחלות (5.6)/ הג'יפ של הקיבוץ (5.8)/ הג'יפ של ההתנחלות (4.3) (להאט)

The driver of the kibbutz/the driver of the settlement/the jeep of the kibbutz/the jeep of the settlement (to slow down)

4. האצן במרוץ (5.2)/ האצן בתחרות (6)/ האופנוע במרוץ (4.8)/ האופנוע בתחרות (4.4) (לנצח)

The runner in the race/the runner in the competition/the motorcycle in the race/the motorcycle in the competition (to win)

5. החשוד בשוד (7)/החשוד בפריצה (6.9)/המניע לשוד (5.5)/המניע לפריצה (6.4) (להיחקר)

The suspect in the robbery/the suspect in the break-in/the motive for the robbery/the motive for the break-in (to be investigated)

6. הקופאי בבנק (5.8)/ הקופאי בחנות (6.8)/ המכשיר בבנק (6.2)/ המכשיר בחנות (6.7) (לעבוד)

The teller at the bank/the cashier at the store/the cash machine at the bank/the cash machine at the store (to work)

7. הכומר של המבצר (4.3)/הכומר של הטירה (4.2)/הצריח של המבצר (5.2)/הצריח של הטירה (5.3) (להתמוטט)

Conflicting cues in producing number and gender agreement

The priest of the fortress/the priest of the castle/the turret of the fortress/the turret of the castle (to collapse)

8. הסולן של ההרכב (5.8)/ הסולן של הלהקה (6.1)/ האוטובוס של ההרכב (5.3)/ האוטובוס של הלהקה (5.9) (לאחר)

The soloist in the group/the soloist in the band/the bus of the group/the bus of the band (to be late)

9. הפותר של הצופן (5.8)/ הפותר של החידה (5.4)/ הפענוח של הצופן (6.6)/ הפענוח של החידה (6.5) (להצליח)

The solver of the code/the solver of the riddle/the interpretation of the code/the solution of the riddle (to succeed)

10. התצפיתן של הגדוד (5.1)/ התצפיתן של הפלוגה (4.6)/ המוצב של הגדוד (5.7)/ המוצב של הפלוגה (6.2)(להינטש)

The lookout of the battalion/the lookout of the company/the outpost of the battalion/the outpost of the company (to be abandoned)

11. המחבל עם המטען (6.3)/ המחבל עם הפצצה (6.7)/ התיק עם המטען (6.2)/ התיק עם הפצצה (5.8) (להתגלות)

The terrorist with the (masc.) bomb/with the (fem.) bomb/the backpack with the (masc.) bomb/with the (fem.) bomb (to be discovered)

12. הפרשן ברדיו (6.3)/ הפרשן בטלוויזיה (6.2)/ התשדיר ברדיו (6.1)/ התשדיר בטלוויזיה (6.1) (לשעמם)

The commentator on the radio/the commentator on television/the program on the radio/the program on television (to be boring)

13. המנקֶה של החדר (5.6)/ המנקה של הדירה (5.6)/ הריהוט של החדר (6.3)/ הריהוט של הדירה (5.8) (להתלכלך)

The cleaner of the room/the cleaner of the apartment/the furniture in the room/the furniture in the apartment (to get dirty)

14. השחקן בסרט (5.3)/ השחקן בהצגה (6.2)/ המשחק בסרט (6.4)/ המשחק בהצגה (6.8) (לרגש)

The actor in the movie/the actor in the play/the acting in the movie/the acting in the play (to be touching)

15. הניצול מן הפיצוץ (4)/ הניצול מן השריפה (4)/ הגורם לפיצוץ (5.5)/ הגורם לשריפה (5.3) (להימצא)

The survivor of the blast/the survivor of the fire/the cause of the blast/the cause of the fire (to be found)

16. המנחֶה של הדיון (5.8)/ המנחה של השיחה (5.1)/ הנושא של הדיון (6.6)/ הנושא של השיחה (6.7) (לרתק)

Conflicting cues in producing number and gender agreement

The moderator of the discussion/the moderator of the talk/the subject of the discussion/the subject of the talk (to be fascinating)

17. הנציג של הסניף (5.3)/ הנציג של העירייה (6.4)/ הטלפון של הסניף (6.7)/ הטלפון של העירייה (6.9) (לצלצל)

The representative of the branch/the representative of the city council/the telephone at the branch/the telephone at the city council (to ring)

18. הדוגמן בצילום (6)/ הדוגמן בתצוגה (6.8)/ הבגד בצילום (6.3)/ הבגד בתצוגה (6.3) (להדהים)

The model in the photograph/the model in the show/the dress in the photograph/the dress in the show (to be amazing)

19. הילד בלול (6.4)/ הילד בעריסה (6)/ הצעצוע בלול (6.4)/ הצעצוע בעריסה (6) (להרעיש)

The child in the playpen/the child in the cradle/the toy in the playpen/the toy in the cradle (to be noisy)

20. היצרן של הוידיאו (5.3)/ היצרן של המצלמה (5)/ השעון של הוידיאו (6.4)/ השעון של המצלמה (5.1) (להיעצר)

The manufacturer of the video/the manufacturer of the camera/the timer in the video/the timer in the camera (to stop)

21. המחזר עם הפרח (6.3)/ המחזר עם הכלנית (6.2)/ הכובע עם הפרח (6.6)/ הכובע עם הכלנית (6) (להקסים)

The suitor with the flower/the suitor with the anemone/the hat with the flower/the hat with the anemone (to be charming)

22. הכוכב של המופע (5.4)/ הכוכב של ההופעה (6.4)/ השיא של המופע (6.5)/ השיא של ההופעה (6.3) (להלהיב)

The star of the (masc.) show/of the (fem.) show/the climax of the (masc.) show/of the (fem.) show (to be exciting)

23. המאמן של המועדון (4.6)/ המאמן של הנבחרת (5)/ הסגל של המועדון (5.4)/ הסגל של הנבחרת (4.3) (להפסיד)

The trainer at the club/the trainer of the team/the staff at the club/the staff of the team (to lose)

24. הטבח של הפונדק (6.4)/ הטבח של המסעדה (6.7)/ התבשיל של הפונדק (6.2)/ התבשיל של המסעדה (5.8) (להתפרסם)

The cook at the inn/the cook at the restaurant/the cooked dish at the inn/the cooked dish at the restaurant (to become famous)

25. המנצח על הקונצרט (6.3)/ המנצח על הסימפוניה (5.6)/ הביצוע של הקונצרט (5.7)/ הביצוע של הסימפוניה (5.8) (לאכזב)

Conflicting cues in producing number and gender agreement

The conductor of the concert/the conductor of the symphony/the performance of the concert/the performance of the symphony (to be disappointing)

26. הבוחן מטעם האגף (5.7)/ הבוחן מטעם המדינה (5.5)/ המבחן מטעם האגף (5.8)/ המבחן מטעם המדינה (5.8) (להכשיל)

The examiner sent by the department/the examiner sent by the state/the test given by the department/the test given by the state (to cause [people] to fail)

27. הנוסע באוטובוס (5.2)/ הנוסע במונית (5.5)/ המזגן באוטובוס (5.5)/ המזגן במונית (5.8) (להציק)

The rider on the bus/the rider in the taxi/the air conditioner on the bus/the air conditioner in the taxi (to be annoying)

28. המלחין של השיר (5.4)/ המלחין של היצירה (4.9)/ הפזמון של השיר (5.1)/ הפזמון של היצירה (4.8) (להישכח)

The composer of the song/the composer of the work/the refrain of the song/the refrain of the work (to be forgotten)

29. המנהל של המשרד (5.8)/ המנהל של הלשכה (5.8)/ המצב של המשרד (5.8)/ המצב של הלשכה (6) (להשתפר)

The director of the (masc.) office/of the (fem.) office/the state of the (masc.) office/of the (fem.) office (to improve)

30. התותחן של הבסיס (5.7)/ התותחן של החטיבה (6.3)/ התותח של הבסיס (6)/ התותח של החטיבה (5.8) (לירות)

The gunner at the base/the gunner of the brigade/the cannon at the base/the canon of the company (to shoot)

31. השיכור בפארק (6.5)/ השיכור בשדרה (6.5)/ הרעש בפארק (5.4)/ הרעש בשדרה (5.9) (להבהיל)

The drunk at the park/the drunk on the boulevard/the noise at the park/the noise on the boulevard (to frighten)

32. המטייל ליד הנחל (5.3)/ המטייל עם המימייה (5.2)/ התרמיל ליד הנחל (5.9)/ התרמיל עם המימייה (6.7) (להירטב)

The tourist at the stream/the tourist with the canteen/the backpack at the stream/the backpack with the canteen (to get wet)

33. הנואם של הארגון (6.7)/ הנואם של המפלגה (6.4)/ הסרט של הארגון (6.1)/ הסרט של המפלגה (6.1) (להרשים)

The speaker for the organization/the speaker for the party/the film of the organization/the film of the party (to be impressive)

34. המנהיג של העם (5.8)/ המנהיג של האומה (5)/ הביטחון של העם (6.3)/ הביטחון של האומה (6.3) (להיפגע)

Conflicting cues in producing number and gender agreement

The leader of the (masc.) nation/of the (fem.) nation/the security of the (masc.) nation/of the (fem.) nation (to be worsened)

35. הבדואי ליד הסלע (5.2)/ הבדואי ליד הדיונה (5.5)/ השתיל ליד הסלע (5.3)/ השתיל ליד הדיונה (5.3) (להתייבש)

The Bedouin near the boulder/the Bedouin near the dune/the sapling near the boulder/the sapling near the dune (to become dehydrated/to dry up)

36. המתאבד ליד המחסום (6.7)/ המתאבד ליד העמדה (6.7)/ הרימון ליד המחסום (5.3)/ הרימון ליד העמדה (5.3) (להתפוצץ)

The person committing suicide near the barrier/the person committing suicide near the post/the hand grenade near the barrier/the hand grenade near the post (to explode)

37. השבוי מן האי (5.1)/ השבוי מן הפשיטה (4.3)/ השלל מן האי (5.1)/ השלל מן הפשיטה (4.8) (להיקבר)

The captive from the island/the captive from the raid/the loot from the island/the loot from the raid (to be buried)

38. הגיבור של המדור (4.3)/ הגיבור של המחלקה (5.7)/ הרכב של המדור (5.8)/ הרכב של המחלקה (5.9) (להישרט)

The hero of the (masc.) department/of the (fem.) department/the vehicle of the (masc.) department/of the (fem.) department (to be scratched)

39. המוכר מהמרכול (5)/ המוכר מהמכולת (5.7)/ המשלוח מהמרכול (6.2)/ המשלוח מהמכולת (6.3) (להתעכב)

The clerk at the supermarket/the clerk at the grocery/the delivery from the supermarket/the delivery from the grocery (to be delayed)

40. הרב של הישיבה (4.6)/ הכסף של הכולל (5.1)/ הכסף של הישיבה (6) (להיעלם)/הרב של הכולל (4.6)

The rabbi of the seminary/the rabbi of the yeshiva/the money of the seminary/the money of the yeshiva (to disappear)

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