SHORT COMMUNICATION

Production of the double object construction: An experiment

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In the double object construction (e.g. *the man gave the woman some flowers*) a preference has been observed for placing definite arguments before indefinite arguments when both appear post-verbally. In Danish it has been reported that examples with the indefinite–definite order are read more slowly than those with the definite–indefinite order in speeded acceptability judgement tasks, and they are less frequent in corpus texts. This short communication presents a memory recall experiment showing that the preference observed in comprehension and written production is also observed in on-line oral production. Participants produce definite–indefinite orders when attempting to recall definite–indefinite orders in 95% of the cases, but when attempting to recall indefinite–definite orders they alter the definiteness of one or both of the arguments and produce indefinite–definite orders only in 6% of the cases.

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1. INTRODUCTION

In Danish a preference for the definite argument to precede the indefinite argument has been observed in the double object construction – so (1a) is preferred over (1b).

(1) a. Sælger-en   lovede   kund-en   en   mobiltelefon fra Korea.
       salesman-DEF promised customer-DEF a[INDEF] mobile.phone from Korea
       'The salesman promised the customer a mobile phone from Korea.'
    b. Sælger-en   lovede   en   kunde   mobiltelefon-en   fra Korea.
       salesman-DEF promised a[INDEF] customer mobile.phone-DEF from Korea
       'The salesman promised a customer the mobile phone from Korea.'

In a speeded acceptability judgment study, the definite–indefinite orders were read significantly faster than the indefinite–definite orders (Kizach & Balling 2013). This

is not a general preference: We do not see it in the very similar PP-construction shown in (2).

(2) Sælger-en   lovede   en   mobiltelefon til en   kunde.
salesman-DEF promised a[INDEF] mobile.phone to a[INDEF] customer
'The salesman promised a mobile phone to a customer.'

Here both orders (definite–indefinite and indefinite–definite) are processed equally fast – a pattern also found in English (Clifton & Frazier 2004, Brown, Savova & Gibson 2012).

This pattern is also reflected in corpora, where the indefinite–definite order is very infrequent compared to the definite–indefinite order in the double object construction. Kizach & Vikner (published online 21 March 2016) found only one example of the indefinite–definite order out of the 208 double object constructions in their sample which had both a definite and an indefinite post-verbal argument. In comparison, 87 of the 127 PP-constructions in their sample with both a definite and an indefinite post-verbal argument had the indefinite–definite order (Kizach & Vikner published online 21 March 2016).

To explain the observed preference for definite-first in double object constructions, a general discourse preference for given referents to precede new ones has been suggested (Givón 1983, Arnold et al. 2000, Clifton & Frazier 2004, Brown et al. 2012; but see Hawkins 1994, Newmeyer 2000 for critique and discussion of this explanation). Indefinite nouns are often used to introduce new discourse referents, whereas definite nouns typically refer to familiar referents and hence the link between definiteness and givenness or newness.

The idea that the definite-first preference reflects a general discourse preference is slightly weakened by three observations. Firstly, there is no such preference observed in the PP-construction (Clifton & Frazier 2004, Brown et al. 2012, Kizach & Balling 2013). Secondly, the preference is the same independently of whether a context introduces the referents or not (for English, see Brown et al. 2012; for Danish, see Kizach & Balling 2013), and thirdly, the preference for definite-first goes away when the first argument is longer (measured in number of words) than the second, i.e. when the word order is long-before-short (Kizach & Balling 2013).

However, explaining why we see this preference is outside the scope of this short communication. Here the goal is to see if the same preference for the definite–indefinite order over the indefinite–definite order in the double object construction that so far has been attested in comprehension (Kizach & Balling 2013) and in written production (Kizach & Vikner published online 21 March 2016) can be found in on-line oral production. The present study presents a memory recall experiment exploring this question.

2. MEMORY RECALL EXPERIMENT

Memory recall is a method to test on-line production experimentally (Bock & Warren 1985, Potter & Lombardi 1998): Participants hear a set of sentences (a block) and then attempt to repeat them (one by one in the same order, aided by a visual presentation of a prompt). The method relies on the assumption that people remember the meaning of a sentence, but not necessarily the exact wording. But if the task is too easy (i.e. if only one or two sentences have to be remembered) participants may be able to recall the sentences verbatim, and then it is less obvious that production is investigated (and not just memory capacity). Consequently the task has to be quite difficult to ensure that participants cannot remember everything precisely, but have to produce their own utterances relying on the meaning of the stimuli. Bock & Warren (1985) report an error rate varying between 71.1% and 73.5% in their recall experiment where they used blocks of twelve sentences, and Potter & Lombardi (1998) exclude participants with more than 32% (experiment 1) and 30% (experiment 2) errors – and despite having just two sentences per block, eight participants out of a total of 50 are excluded for having too many errors. In the present experiment, there are four sentences per block, so the error rate is expected to be quite high, i.e. somewhere between the ones reported in Bock & Warren (1985) and Potter & Lombardi (1998).

Since previous research has shown that the definite–indefinite order is more frequent in written corpora and induce lower reading times than the indefinite–definite order in the double object construction, we would expect that all else being equal indefinite–definite orders should be harder to produce orally as well (MacDonald 2013). This makes clear predictions for the present experiment: We expect to observe greater difficulty and less precision with recalling the indefinite–definite items. More specifically, participants should make more errors when they attempt to recall the indefinite–definite items, and they should be more prone to changing the definiteness of the arguments thus avoiding the indefinite–definite order in their utterances.

2.1 Materials, method and participants

Sixteen sentences with double object constructions were constructed using eight dative-alternating verbs (see the Appendix). Each sentence had two post-verbal arguments and the THEME (the direct object) was two words longer than the RECIPIENT (the indirect object) in all cases. This served to ensure that all items had short-before-long order as several studies show that this order is preferred over a long-before-short order in Danish (Hawkins 1998, Kizach & Balling 2013, Kizach & Vikner published online 21 March 2016). Each item occurred in a definite–indefinite condition and in an indefinite–definite condition as in (1). To ensure that no participant saw the same item in both conditions, the items were distributed among two lists. Sixteen fillers were added to each list and the sentences were divided into eight blocks with four

sentences in each block. The first and last item in each block was a filler, so the experimental items were the middle two items.

A typical block would be as in (3) below, with an initial and a final filler, and the two experimental items in the middle. In each list 6 blocks contained one experimental item from each condition (one definite–indefinite and one indefinite–definite – half of these had the definite–indefinite first and the other half had the indefinite–definite first), and 2 blocks contained two of the same type (two definite–indefinite or two indefinite–definite items). The blocks without variation were included to prevent participants from detecting a pattern.

(3) a. Diktator-en fik mulighed   for mere vækst.
      dictator-DEF got opportunity for more growth
      'The dictator got an opportunity for more growth.'
   b. Butiksindehaver-en gav brudepig-en   en   kjole fra Italien.
      shopkeeper-DEF   gave bridesmaid-DEF a[INDEF] dress from Italy
      'The shopkeeper gave the bridesmaid a dress from Italy.'
   c. Kong-en sendte en   minister figur-en   med paryk.
      king-DEF sent   a[INDEF] minister figure-DEF with wig
      'The king sent a minister the figure with a wig.'
   d. Influenza-en udryddede   en stor   del af befolkning-en.
      influenza-DEF exterminated a Large Part of population-DEF
      'The influenza exterminated a large part of the population.'

After listening to a block, prompts would be displayed on a screen (the subject and verb of each sentence in the block displayed in the order of presentation). Thus, for (3), the prompts would appear as in (4), one at a time starting with (4a):

(4) a. Diktatoren   fik ...
      dictator-DEF got
      'The dictator got ...'
   b. Butiksindehaveren gav ...
      shopkeeper-DEF   gave
      'The shopkeeper gave ...'
   c. Kongen   sendte ...
      king-DEF sent
      'The king sent ...'
   d. Influenzaen   udryddede ...
      influenza-DEF exterminated
      'The influenza exterminated ...'

Participants would then finish the sentences orally and their answers were recorded.

The items and fillers were recorded using Praat (Boersma & Weenink 2015) by a male speaker, who did not know the purpose of the experiment. He was instructed to read the sentences as naturally as possible and with a neutral intonation. In cases

of disfluencies, the recording was repeated until no disfluencies were detected. The participants were introduced to the stimuli in a sound-proof room. Presentation of stimuli and recording of participant answers were done using DMDX (Forster & Forster 2003). The data was collected, transcribed and coded for analysis by a research assistant (who remained naïve as to the purpose of the experiment). Errors were defined as failure to recall the main nouns in the two post-verbal arguments, but omissions of adjectives/PP-adjuncts or additions of adjectives/PP-adjuncts were accepted. This means, for example, that (5a) was coded as an error, because the head noun in the stimuli was *kvinden* 'the woman', but the recalled sentence has *damen* 'the lady'.

(5) a. Boghandler-en anbefalede dam-en en kogebog fra Frankrig.
    bookseller-DEF recommended lady-DEF a[INDEF] cookbook from France
    'The bookseller recommended the lady a cookbook from France.'
   b. Boghandler-en anbefalede kvind-en kogebog-en fra Frankrig.
    bookseller-DEF recommended woman-DEF cookbook-DEF from France
    'The bookseller recommended the woman the cookbook from France.'

In (5b), both nouns are recalled correctly, and so the example was coded as correct. Changes in definiteness were not coded as errors because the second prediction is that the dispreferred indefinite–definite items should be more prone to change than the preferred definite–indefinite items. Coding changes in definiteness as errors would make it impossible to test this prediction.

In (5b), the definiteness of the second argument is changed from indefinite to definite, so there is a change in this example but no error (both head nouns are recalled correctly). The reason for defining errors as described above is that the focus in the experiment is on the definiteness of the head nouns in the RECIPIENT and THEME arguments – so failure to recall these head nouns is the only pertinent error that can be made.

Thirty students from the University of Aarhus volunteered to participate by responding to invitations posted on a university webpage. There were 25 females and 5 males, with ages between 20 and 26 years (mean age = 22.8 years).

2.2 Results

The first prediction was that the indefinite–definite items should induce more errors, because of the heavier burden on processing. The error distribution is shown in Table 1.

A GLMM (generalized linear mixed-effects model) was run with error as the dependent variable and original order (definite–indefinite or indefinite–definite order) as the predictor. The software R (R Development Core Team 2015) and the package lme4 (Bates, Maechler, Bolker & Walker 2015) was used to run the model (specifically

Original order:	Definite–indefinite	Indefinite–definite
Error	164	160
Correct	76	80
Total	240	240

Table 1. Distribution of responses based on whether they were correct or errors.

the function *glmer* was used and the family was set to binomial). Following Barr et al. (2013), the maximal random effects structure was first calculated. But since Bates, Kliegl, Vasishth & Baayen (2015) suggest that the maximal model should be justified through comparisons with a zero-correlation-parameter model, I followed their suggested procedure. Since the model has one predictor and two random factors (subjects and items) the only possible simplifications were to remove the random slopes for original order (by-item random slopes and by-subject random slopes) and compare the reduced models to the zero-correlation-parameter model. Neither the model without by-item slopes for original order, nor the model without by-subject slopes for original order were significantly different from the zero-correlation-parameter model. I then compared an intercepts-only model to the zero-correlation-parameter model and again no difference was found ($p = .667$). A more complex model is therefore not justified. The predictor – whether the original order had definite–indefinite or indefinite–definite order – was not significant in the model: estimate $= -.091$, standard error $= .210$, $p = .668$ (the *p*-value was calculated using likelihood ratio tests). Following recommendations in Baayen (2008:280), Somers' D_{xy} and C were calculated to evaluate the model fit using the package Hmisc (Harrell & Dupont 2015). Somers' D_{xy} was .579 and C was .790, suggesting an acceptable fit.

The second prediction was that the definite–indefinite items should be less susceptible to change, whereas the indefinite–definite items should be more likely to be changed.

As is standard procedure in psycholinguistic experiments, the errors were removed before analyzing the change factor. In addition, the single correct example where a PP-construction had been recalled instead of the expected DP-construction (three other examples with PP-constructions had the wrong head nouns) was removed too – the example did not constitute an error according to the definitions given above, but since there has been observed no preference for the definite–indefinite order in PP-constructions, the example is not relevant for the investigation. The remaining examples were distributed as shown in Table 2.

A change is any change in definiteness of any of the two arguments, so logically there are four possible patterns that participants can produce (definite–definite, definite–indefinite, indefinite–definite and indefinite–indefinite). Note that the changes are solely in definiteness, not in the order of the arguments – the RECIPIENT

Original order:	Definite–indefinite	Indefinite–definite
Same	72	5
Changed	4	74
Total	76	79

Table 2. Distribution of responses based on change.

Original order:	Definite–indefinite	Indefinite–definite
Definite–definite	2	30
Definite–indefinite	72	40
Indefinite–definite	0	5
Indefinite–indefinite	2	4
Total number of changes	4	74

Table 3. Detailed overview of the observed changes in definiteness.

precedes the THEME in all cases. Table 3 shows what the original items were changed into.

A GLMM was fitted to change as the dependent variable with original order (definite–indefinite or indefinite–definite) as the predictor. The same procedure and software were used as with the model fitted to error described above. The maximal model did not converge, but comparisons with the zero-correlation-parameter model did not justify a simpler model. However, a model with by-item random slopes for original order (and random by-subject and by-item intercepts) converged and is reported here. The model showed a significant effect of original order (estimate = –4.377, standard error = 1.935, $p < .001$). Somers' D_{xy} is .995 and C is .990, so the fit is excellent.

3. DISCUSSION AND CONCLUSION

There is no effect of original order on the error rate, and we see as expected that the task is very difficult judging by the proportion of errors, which is 67.5%. The error rate is approximately twice as high as the accepted error rate in Potter & Lombardi (1998), and the number of sentences per block is also twice as high. The error rate is slightly lower than reported in Bock & Warren (1985), where the blocks contained twelve sentences. The high error rate suggests that participants really did produce sentences and did not simply remember them verbatim – this is also supported by the occurrence of four PP-constructions, exemplified in (2) above, in the recalled sentences (no targets or fillers had PP-constructions) and finally by the fact that definiteness was changed at all. It is possible that no effect of original order on error

rate is observed because the processing difficulty involved with the indefinite–definite items simply drowns in the face of the huge processing burden of trying to remember four sentences.

The effect of original order on change is on the other hand very strong and the result is very clear: Indefinite–definite items are almost always altered (only in five cases is the indefinite–definite pattern retained), and the definite–indefinite items are never altered into the indefinite–definite pattern, and only changed at all in four of the cases (see Table 3 above). This is in line with the aforementioned studies that report a processing disadvantage for post-verbal indefinite–definite orders in the double object construction in Danish (Kizach & Balling 2013, Kizach & Vikner published online 21 March 2016; see also Kizach & Mathiasen 2013).

The indefinite–definite pattern in post-verbal arguments in the double object construction is harder to comprehend (induces higher reading times than the definite–indefinite pattern), is infrequent in written production, and the present experiment shows that the indefinite–definite pattern is avoided in oral on-line production as well.

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APPENDIX

Stimuli used in the memory recall experiment

1. Butiksindehaveren gav brudepigen en kjole fra Italien.
2. Butiksindehaveren gav en brudepige kjolen fra Italien.
   'The shop-owner gave the/a bridesmaid a/the dress from Italy.'
3. Rigmanden gav vagabonden en kasse med ordener.
4. Rigmanden gav en vagabond kassen med ordener.
   'The rich man gave the/a vagabond a/the box with medals.'
5. Boghandleren anbefalede kvinden en kogebog fra Frankrig.
6. Boghandleren anbefalede en kvinde kogebogen fra Frankrig.
   'The bookseller recommended the/a woman a/the cookbook from France.'
7. Tjeneren anbefalede gæsten en hvidvin fra Australien.
8. Tjeneren anbefalede en gæst hvidvinen fra Australien.
   'The waiter recommended the/a guest a/the white wine from Australia.'
9. Da gplejemoderen sendte barnet en dukke med briller.
10. Dagplejemoderen sendte et barn dukken med briller.
    'The childminder sent the/a child a/the doll with glasses.'

11. Kongen sendte ministeren en figur med paryk.
12. Kongen sendte en minister figuren med paryk.
   'The king sent the/a minister a/the figure with a wig.'
13. Sælgeren lovede kunden en mobiltelefon fra Korea.
14. Sælgeren lovede en kunde mobiltelefonen fra Korea.
   'The salesman promised the/a customer a/the mobile phone from Korea.'
15. Politikeren lovede vælgeren en bolig i Aarhus.
16. Politikeren lovede en vælger boligen i Aarhus.
   'The politician promised the/a voter a/the residence in Aarhus.'
17. Socialrådgiveren skaffede pigen en bamse med sløjfe.
18. Socialrådgiveren skaffede en pige bamsen med sløjfe.
   'The social worker got the/a girl a/the teddy bear with a bow.'
19. Pusheren skaffede junkien en joint fra Marokko.
20. Pusheren skaffede en junkie jointen fra Marokko.
   'The pusher got the/a junkie a/the joint from Morocco.'
21. Gartneren rakte assistenten et æble fra Danmark.
22. Gartneren rakte en assistent æblet fra Danmark.
   'The gardener handed the/a assistant a/the apple from Denmark.'
23. Ekspedienten rakte pigen en taske i læder.
24. Ekspedienten rakte en pige tasken i læder.
   'The clerk handed the/a girl a/the leather bag.'
25. Statsministeren tilbød politikeren en stilling på Færøerne.
26. Statsministeren tilbød en politiker stillingen på Færøerne.
   'The prime minister offered the/a politician a/the position on the Faroe Islands.'
27. Mekanikeren tilbød manden en bil fra USA.
28. Mekanikeren tilbød en mand bilen fra USA.
   'The mechanic offered the/a man a/the car from the USA.'
29. Instruktøren viste forfatteren en film fra Hollywood.
30. Instruktøren viste en forfatter filmen fra Hollywood.
   'The director showed the/a writer a/the movie from Hollywood.'
31. Frisøren viste damen en frisure med reflekser.
32. Frisøren viste en dame frisuren med reflekser.
   'The hairdresser showed the/a lady a/the hairstyle with highlights.'

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