Word order in French: the role of animacy

JULIETTE THUILIER [iD]

MARGARET GRANT

BENOÎT CRABBÉ

ANNE ABEILLÉ [iD]

Author affiliations can be found in the back matter of this article

Abstract

A major goal of the quantitative study of syntax has been to identify factors that have predictive power on speaker choices in the face of word-order or valence alternations (e.g. Arnold et al. 2000; Bresnan et al. 2007; Bresnan & Ford 2010; Bader & Häussler 2010). In this paper, we study the role of animacy on the order of constituents in French. Animacy has been shown to affect sentence production in other languages, either directly (Feleki & Branigan 1999; Kempen & Harbusch 2004; Tanaka et al. 2011) or indirectly through grammatical role assignment (McDonald et al. 1993). Corpus studies however, have failed to find such an effect in French (Thuilier 2012a; Thuilier et al. 2014). Using a sentence recall task, we examined whether animacy has an impact on linear ordering or on grammatical function assignment. While we do find evidence for a role of animacy in the choice between active and passive voice, we do not find a preference to place animate arguments first with ditransitive verbs nor with nominal coordinations. While these findings tend to support the indirect hypothesis (McDonald et al. 1993; Kempen & Harbusch 2004), we also find what may look like an anti-animacy effect: inanimate direct objects tend to precede animate indirect objects. We propose that canonical mappings between syntactic function and semantic role play a role in putting (inanimate theme) direct objects before (animate recipient) indirect objects, thus overriding the animacy first tendency in French.

CORRESPONDING AUTHOR:

Anne Abeillé

Université de Paris & LLF, CP 7031 – 5, rue Thomas Mann, 75205, Paris Cedex 13, France

anne.abeille@linguist.univ-paris-diderot.fr

1 Introduction

Given a particular message to be expressed, the language production system is faced with an array of options about the ultimate syntactic form of the associated utterance. Linguists and psycholinguists have long sought to understand what factors condition speaker's choices when there are a number of equally grammatical possibilities. Linguistic factors, such as information structure and constituent length, have been shown to play a role, as have psycholinguistic factors such as recent exposure to a particular structure (structural priming, see e.g., Bock 1986; Ziegler et al. 2019) and the conceptual accessibility of a referent (Bock & Warren 1985). The role of animacy of a referent can be seen as a psycholinguistic factor (animate referents are thought to be conceptually more accessible, and therefore easier to retrieve during production, see e.g., Branigan et al. 2008) and as a linguistic factor, since animacy is encoded grammatically in many languages. In Section 2, we discuss these two perspectives on the relationship between animacy and word order in more detail. Importantly, one might expect that an effect of animacy due to accessibility might hold across languages, while an effect of animacy due to its encoding in a grammar is expected to vary. In Section 3, we review the factors that have been identified in influencing postverbal complement order in French, and two empirical studies (a corpus study and an experiment) that have failed to find a preference to order animate complements first. The goal of the current study is to reexamine the role of animacy on French constituent ordering from a broader perspective. In Section 4, using a sentence recall task, we examine two cases that have previously been studied for English (Bock & Warren 1985) and for Japanese (Tanaka et al. 2011) in similar experiments, namely voice alternations for transitive sentences and order alternations in nominal coordination. We add to these two cases ditransitive alternations, which in French allow for free word order of direct and indirect objects without changing other aspects of the structure (unlike dative alternation in English). To preview our results, we find evidence of an animacy effect for voice choice, but not for coordination. Furthermore, we find what may look like an anti-animacy effect for ordering the complements of ditransitive verbs. We discuss these results in light of previous literature and propose an alternative explanation based on canonical mapping between grammatical functions and semantic roles in Section 5, before concluding in Section 6.

2 Animacy and word order
2.1 Cross-linguistic overview

Animacy is an inherent semantic property of referents, which is generally described as spreading across a hierarchy, ranging from the most animate entities (human) to the least animate and least concrete ones (abstract entities). Despite the variety of categories and hierarchies that can be found in the literature (Yamamoto 1999; Zaenen et al. 2004), it is generally acknowledged that the animacy hierarchy can be represented as : human > other animate > concrete > abstract, or as animate > inanimate, in its simplified version. This semantic property is grammaticalized in some languages. For example, the difference between human/animate pronoun *he/she* and inanimate pronoun (*it*)) may play a role in syntactic phenomena such as agreement (see e.g. Comrie 2081; Croft 1988) or differential object marking (see e.g. Lazard 1998; Dalrymple & Nikolaeva 2011).

In some languages, word order is sensitive to animacy. In Sesotho (a Bantu language), the verbal complement ordering depends on the referent's animacy (Morolong & Hyman 1977). Ditransitive verbs selecting a theme and a benefactive are followed by their complements. When both arguments are human/animate or both non-human/inanimate, they may be freely ordered (1). On the other hand, if the theme is human/animate and the benefactive non-human/inanimate (or the other way around), the animate argument must precede the inanimate one (2). Thus Sesotho is an example of a language where animacy is a hard grammatical constraint, affecting word order (examples from Morolong and Hyman, 1977: 202–3).

(1)   a.   ke-phehétsé mokété lijó
              1SG-cooked feast   food
              'I cooked food for the feast'

        b.   ke-phehétsé lijó   mokété
              1SG-cooked food feast
              'I cooked food for the feast'

(2) a. ke-phehétsé *ngoaná* lijó
         1SG-cooked child   food
         'I cooked food for the child'

    b. *ke-phehétsé lijó *ngoaná*
         1SG-cooked food child
         'I cooked food for the child'

In other languages, animacy is a soft constraint in the sense of Bresnan et al. (2001). For instance, several studies on the dative alternation in English (Thompson 1990; Gries 2003; Bresnan et al. 2007; Bresnan & Hay 2008; Bresnan & Ford 2010) have shown that a referent's animacy partly determines the choice between the prepositional construction (3a) and the double object construction (3b).

(3) a. Kim handed [the toy] [to the baby].
    b. Kim handed [the baby] [the toy].

More precisely, corpus data and experimental data (acceptability judgement and sentence completion) show that speakers tend to choose the construction that allows putting the animate referent first: if the recipient is animate (4a), the speaker prefers the double object construction, whereas if it is not, the prepositional construction is favored (4b). Bresnan et al.'s (2007) corpus study showed that an inanimate recipient is over twelve times more likely to be expressed in the preposition structure than an animate recipient.

(4) a. She gave [her mother] [a smile].
    b. She gave [a great deal of thought] [to her situation]

Using corpus data, Kempen & Harbusch (2004) identified a similar effect of referent animacy on German word order. They studied the relative order of pronominal direct object (DO) and non-pronominal subject (S), as well as the relative order of indirect object (IO) and subject. In the first case, complying with the general tendency of putting pronouns before non-pronouns, the DO-S order is much more frequent when the non-pronominal subject is inanimate (85%). But, the proportion decreases to 51% when the subject is animate, which reveals a tendency to put animate referents first. As for the ordering between IO and S, they noted that 93% of the data follow the S-IO order when the IO is inanimate, while the percentage is only 54% with an animate IO. All these observations comply with animate-first as a soft constraint.

These studies show that the grammar may be sensitive to the animacy of referents, and order animates before inanimates, and that animacy can be implicated in hard, grammatical constraints (Sesotho) or in soft constraints (English, German). In this paper, we focus on the way in which animacy can condition word order in French.

2.2 Animacy and processing

In the psycholinguistic literature, it is widely accepted that language processing and sentence production are sensitive to conceptual accessibility, that is "*the ease with which the mental representation of some potential referent can be activated in or retrieved from memory*" (Bock & Warren 1985: 50). Assuming incrementality in sentence production (Bock 1982), words that are more easily accessed from memory tend to be produced first (Bock & Warren 1985). Animate referents have been argued to be conceptually more accessible than inanimates. Thus they tend to be produced first, influencing word order in language production (Branigan et al. 2008).

However, there has been a debate as to the stage of sentence production at which animacy has an effect. One possibility, which Kempen & Harbusch (2004) call the *indirect hypothesis*, is that animacy has an effect on word order solely through its influence on grammatical function assignment. For example, animate subjects are preferred, and subjects tend to appear linearly before other arguments, thereby creating a word order effect. The opposing view, the *direct hypothesis*, proposes that in addition to its impact on grammatical function assignment, animacy also has a direct effect on linear word order.

The results of McDonald et al.'s (1993) experiments on English support the *indirect hypothesis*. They conducted sentence recall experiments, with active and passive transitive sentences and coordinations of NPs, and noted that animate nouns tend to be used as subjects, either in active or passive sentences, whereas the order of coordinated NPs in a sentence is not affected by

their relative animacy. They concluded that animacy affects function assignment but not word order if the manipulated nouns share the same grammatical function. In their view, the animate before inanimate effect is only a consequence of grammatical function position in the sentence.[1] However, English word order is largely determined by the grammatical functions assigned to the phrases, and therefore experiments on English cannot convincingly disentangle the direct and the indirect hypothesis.

Studies examining languages where function assignment and word order are less strongly confounded have supported the *direct hypothesis*. Feleki & Branigan (1999) studied Greek SVO and OVS sentences, using the sentence recall experiment paradigm. They observed that whatever the function of the NP is, speakers tended to recall the sentences by putting the animate referent before the verb and the inanimate one after it. Also using a sentence recall task, Tanaka et al. (2011) found evidence for effects of animacy on both function assignment and linear constituent order for Japanese. They tested SOV and OSV orders by manipulating the animacy of the S and the DO, as well as the voice of the sentence (active vs. passive). Their results showed that animacy affects both the choice of voice and the choice of linear order, but they did not find an animacy effect for conjunct ordering. Thus Japanese data clearly support the *direct hypothesis*.

In the present study, we examine the effect of animacy on constituent order in French. French has a more fixed word order than Japanese or Greek, but a more flexible one than English. In English, ditransitive verbs combining with a theme and a recipient can be realized either in the prepositional construction (5a) or in the double object construction (6a). In the first construction, the theme precedes the recipient, whereas in the second, the theme follows the recipient. However, the change of ordering is also a change in grammatical function assignment. While in the prepositional construction, the theme is a direct object, as shown by the possibility to promote it as the subject of a passive sentence (5b), in the double object construction, the theme has not the full properties of a direct object, because, notably, it can not be the subject of the passive counterpart of double object construction (6b). In this construction, the direct object is the recipient, which is confirmed by its ability to be promoted as a subject in the passive context (6c); the theme is a second object.

(5)   a.   The man gives the toy to the baby
        b.   The toy is given to the baby by the man

(6)   a.   The man gives the baby the toy
        b.   *The toy is given the baby by the man
        c.   The baby is given the toy by the man

In French, only the prepositional construction is possible, and two orders are possible for the same syntactic functions (*donner un jouet au bébé/ donner au bébé un jouet*). We aim to compare the *indirect* vs *direct* hypotheses in our study, shedding further light on the role of animacy in sentence production. We present corpus results, and experimental results (using acceptability judgements and sentence recall). Our results show that animacy plays a role in function assignment, but not in linear order *per se*. They thus support the *indirect* hypothesis.

3 The case of French
3.1 Postverbal complement ordering

Postverbal complements are rather freely ordered in French. In the case of ditransitive verbs, the indirect object (IO) can either precede or follow the direct object (DO), as shown in example (7).

(7)   a.   Anne donne   [une part de gateau]DO [à son fils]IO
               Anne give.3SG a   piece of cake   to her son
               'Anne gives a piece of cake to her son'

        b.   Anne donne   [à son fils]IO [une part   de gateau]DO
               Anne give.3SG to her son   a   piece of cake
               'Anne gives her son a piece of cake'

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1   In three production experiments on active/passive choice, Ferreira (1994) showed an effect of the semantic verb class (*frighten* type verb trigering more passives than other verb classes) and an interaction with animacy: *frighten* type verbs trigger more passives with an animacy mismatch (inanimate theme and animate experiencer).

In his 1928 book, Blinkenberg claimed that the French canonical order is DO before IO. This has been confirmed by Thuilier (2012a) on the basis of a corpus of more than 1400 occurrences of ditransitive verbs extracted from four different corpora: the newspaper corpus *French Tree Bank* (Abeillé et al. 2019), the newspaper corpus *Est-Républicain* (Seddah et al. 2012), the radio corpus ESTER-2 (Galliano et al. 2006) and the spoken corpus C-ORAL-ROM (Cresti & Moneglia 2005). The corpus data reveal a strong preference for DO-IO ordering (70.4%). Moreover, when both constituents have the same length in number of words, this proportion goes up to 77.7%.

Previous studies have shown that this ordering can be probabilistically influenced by several factors: the grammatical *weight* of each constituent (Blinkenberg 1928; Abeillé & Godard 2004; 2006; Thuilier 2012a), the *semantic class* of the verb subcategorizing the complements (Schmitt 1987a; b; Thuilier 2012b; a) and the *givenness* of the referents (Faghiri & Thuilier 2018).

To our knowledge, Blinkenberg (1928) is the first to mention the idea that DO and IO are ordered by increasing length in French, for example making (8a) preferred over (8b).

(8)   a.   Paul dit   [à son fils]IO [qu' il fera   beau demain]DO
              Paul tells to his son   that it do.FUT fine   tomorrow
              'Paul tells his son that the weather will be fine tomorrow'

        b.   ?Paul dit [qu' il fera   beau demain]DO [à son fils]IO.
              Paul tells that it do.FUT fine   tomorrow   to his son
              'Paul tells that the weather will be fine tomorrow to his son'

While "heavy" constituents such as complement clauses tend to be second, Abeillé & Godard (2004; 2006) observe that "light" constituents, such as bare nominals, tend to be first (9).

(9)   a.   Le   clown fait   [peur]DO [aux   enfants]IO
              the clown make.3SG fear   to.ART.PL child.PL
              'The clown frightens the children'

        b.   *Le clown fait   [aux   enfants]IO [peur]DO
              the clown make.3SG to.ART.PL   child.PL   fear
              'The clown frightens the children'

(10)   a.   Le   clown fait   [une grande peur]DO [aux   enfants]IO
              the clown make.3SG a   big   fear   to.ART.PL child.PL
              'The clown gives a big fear to the children'

        b.   Le   clown fait   [aux   enfants]IO [une grande peur]DO
              the clown make.3SG to.ART.PL   child.PL   a   big   fear
              'The clown gives the children a big fear'

They propose the notion of *lightness*, which is defined as a new type of syntactic deficiency (Cardinaletti & Starke 1999), and which is the counterpart of heaviness. Light (or X°) constituents (Toivonen 2003) display specific syntactic properties: they are not mobile and cannot be extracted. Contrary to *heaviness*, that tends to put the complement as far as possible from the verb (8), *lightness* puts it as close as possible to the verb. While bare Nouns are *light*, noun phrases are not, and are thus more mobile, as shown in examples (10).

Following Wasow's (1997; 2002) corpus study on grammatical weight in English, Thuilier (2012a) observes a clear effect of weight in a corpus of about 1400 sentences. In 82.5% of the cases, DO and IO are ordered by increasing length. Moreover, Thuilier (2012a) shows that constituent weight should be measured in terms of syntactic complexity but that the number of words is a good estimation of this complexity.

Following the idea by Schmitt (1987a; b), Thuilier (2012b) showed that the semantic verb class also plays a role in complement ordering. In three different corpora (two newspaper and one spoken corpus), she extracted 1434 sentences containing ditransitive verbs directly followed by their two complements, and annotated the semantic verb class according to the semantic classification of the dictionary *Les Verbes Français* (Dubois & Dubois-Charlier 1997; Thuilier & Danlos 2012). She points out that one can get a better modeling of the order of verbal complements when taking into account the verb associated with its semantic class. The most frequent classes were transfer (11), locative (12) and communication (13) verbs with respectively 70.3%, 78% and 57.6% of DO-IO ordering (Thuilier 2012b).

(11)   […] offrir la   mini-console tant   désirée à leurs chers petits
         […] to-give the   mini-console much   desired to their dear little
         '[…] to give the much desired mini-console to their dear little ones'

(12)   [il] avait   mis   des   documents dans un coffre d' une banque
         [he] have.PST.3SG put.PCPT INDF.PL   documents in   a   safe   of a   bank
         à l' étranger
         at the foreign
         'he had put documents in a safe of a bank abroad'

(13)   […] montrer des   armes   à ces   soldats américains.
         […] to-show INDF.PL   weapons to these soldiers americans
         '[…] to show weapons to these American soldiers'

In addition to the semantic class of the verb, the information structure of sentences plays a role in their ordering. (Faghiri & Thuilier 2018) found that postverbal complement ordering is sensitive to the discursive accessibility of the referents, defined as givenness or newness (Prince 1981; Gundel 1988; Arnold et al. 2000). The results of a semi-guided sentence production experiment support the idea that the givenness of the referent affects word ordering as follows: when the referent of the DO is new (not mentioned in the previous context), speakers tend to put it after a given IO (mentioned in the previous context) more frequently than after a new IO. The givenness effect is, however, smaller than the effect of weight.

The above studies show that while postverbal constituent order is relatively free in French, the ordering of any individual IO and DO is probabilistically influenced by at least constituent weight, the semantic class and the discourse status (given vs. new) of the referents involved.

3.2 On the effect of animacy: previous results

According to the studies in other languages (English, Greek, German, Japanese a.o.), the animacy constraint can be spelled out as: animate referents tend to appear before inanimate ones. Then, all else being equal, an animate DO should appear before an inanimate IO, as in (14a), and conversely, an animate IO should precede an animate DO (14b).

(14)   a.   affecter [un employé]DO [à une tâche]IO
              assign   an employee   to a   task
              'to assign an employee to a task'

        b.   assigner [à un employé]IO [une tâche]DO
              assign   to an employee   a   task
              'to assign an employee a task'

Thuilier (2012a) conducted a corpus study based on the data presented in section 3.1: among the 1434 sentences containing a ditransitive verb followed by a DO and an IO, there were 578 animate IOs and 187 animate DOs. Animate DOs appear in first position in 79.1% of the cases, and this proportion decreases to 65.1% when the IO is animate (see *Table 1*).

	DO-IO ORDER	**IO-DO** ORDER	**TOTAL**
animate DO	148 (79.1%)	39 (20.9%)	187 (100%)
animate IO	379 (65.6%)	199 (34.4%)	578 (100%)
total	527 (68.8%)	238 (31.2%)	765 (100%)

Table 1 Relative ordering of DO and IO according to animacy in Thuilier's (2012) corpus data.

At first glance, this indicates a tendency to put animate referents first. However, using multifactorial statistical modelling, which takes into account the effect of several factors simultaneously, Thuilier (2012a) shows that, when the relative length of DO and IO and the semantic class of the verb are included in the model, the effect of animacy disappears. This can be explained by the fact that in the corpus data, animacy is correlated with length and grammatical complexity: animate referents tend to be realized as shorter and less complex constituents than inanimate referents. Hence, the effect of weight seems to override the slight effect of animacy. In other words, the small number of cases where animacy could have an

explanatory power is better explained by a length effect in the corpus data. The corpus data also show a preference for animate IO (75.5%), which can be explained by the tendency to interpret IO as a recipient or beneficiary.

(Thuilier et al. 2014) report an acceptability judgment experiment aiming to test the effect of animacy on complement ordering in a more controlled way, independently of other potentially correlated factors, such as grammatical weight. 38 participants (students in Paris, native speakers of French) judged the acceptability of 16 items on a Likert scale ranging from 1 to 5. The 16 items consisted of sentences containing a ditransitive verb followed by its DO and IO (same length in number of words, both definite). They were manipulated for word order (DO-IO vs. IO-DO) and animacy of the IO (animate vs. inanimate) varied across items, the DO being systematically inanimate (cf. examples in (15)–(16)).

(15)   Il faut que les Israéliens maintenant, dans les prochaines semaines, dans les prochains mois
        [DO-IO/-anim] donnent les réponses précises à ces questions.
        [IO-DO/-anim] donnent à ces questions les réponses précises.
        'It is necessay that the Israelis now, in the next few weeks, in the next few months give the precise answers to these questions'

(16)   Fier de sa pêche, il se promenait sur la rive et
        [DO-IO/+anim] montrait son précieux butin à son copain.
        [IO-DO/+anim] montrait à son copain son précieux butin.
        'Proud of his catch, he walked on the bank and showed his precious loot to his friend'

The results show an overall preference for DO-IO ordering, and there was no significant effect of IO animacy nor any interaction of IO animacy with word order. Thus, French speakers do not seem to be sensitive to the animacy of the referents.

Thus far, empirical results fail to support an influence of animacy in determining French complement ordering, either in production (corpus data) or in comprehension/judgement (questionnaire data). Given the importance of animacy cross-linguistically (see Section 2.1) and in language processing more generally (see Section 2.2), this result is somewhat surprising. However, this may be a methodological problem. The results from Greek (Feleki & Branigan 1999) and Japanese (Tanaka et al. 2011) showed animacy effects on subject-object order during sentence production, rather than ratings as the result of sentence comprehension. To address the question of whether animacy has an influence on word order during the production of French sentences, we designed a sentence recall experiment aiming to test animacy effects in different grammatical constructions.

4 A sentence recall study

We report an experiment that investigated whether animacy affects sentence production in French. Since the relative ordering of two constituents may interact with their grammatical function, we selected three sentence types to test whether animacy affects grammatical function assignment, linear order or both: voice alternations (17), the complements of ditransitive verbs (18) and coordination of NPs (19).

(17)   Voice Alternation
        a.   Le policier   a   trouvé le revolver   (Active)
              the policeman AUX found the revolver
              'The policeman found the revolver'

        b.   Le revolver a   été   trouvé par le   policier   (Passive)
              the revolver AUX been found by the policeman
              'The revolver was found by the policeman'

(18)   Ditransitive verb
        a.   Le chef   du   projet a   confié un nouveau budget à un
              the manager of.the project AUX entrusted a new   budget to a
              décorateur   (DO-IO order)
              decorator
              'The project manager entrusted a new budget to a decorator'

    b.   Le chef   du   projet a   confié   à un décorateur un nouveau
         the manager of.the project AUX entrusted to a   decorator a   new
         budget   (IO-DO order)
         budget
         'The project manager entrusted to a decorator a new budget'

(19)   Coordination of NPs
    a.   Ce jeune homme a   toujours fui   les traîtres et   les
         this young man   AUX always avoided the traitors and the
         échecs   (NP1-NP2 order)
         failures
         'This young man has always avoided traitors and failures'
    b.   Ce jeune homme a   toujours fui   les échecs et   les
         this young man   AUX always avoided the failures and the
         traîtres   (NP2-NP1 order)
         traitors
         'This young man has always avoided failures and traitors'

With voice alternation, transitive verbs may enter either an active structure (17a), where the agent role matches the Subject function, or a passive structure (17b) with the subject function assigned to the patient, and an oblique function to the agent (*par*-phrase, akin to an English *by*-phrase). We tested whether the manipulation of patient animacy may affect the choice between active and passive structure in production. If French behaves like other languages (English, Japanese), we expect an animacy effect on voice choice and grammatical function assignment: we expect animate patients to be more likely to be produced as subjects in passive structures (20b), than inanimate patients (17b), all other things being equal.[2]

(20)   Voice Alternation
    a.   Le policier   a   trouvé le voleur   (Active)
         the policeman AUX found the thief
         'The policeman found the thief'
    b.   Le voleur a   été trouvé par le policier   (Passive)
         the thief   AUX been found by the policeman
         'The thief was found by the policeman'

In case of coordination, the NPs are relatively freely ordered in French. One may say either "les avions et les voitures" or "les voitures et les avions" (*the planes and the cars*, Abeillé et al. 2018). Numerous factors seem to be at play in the choice between both orderings (for English, see Benor & Levy 2006; McDonald et al. 1993; Fenk-Oczlon 1989; Cooper & Ross 1975 among others) and one of them might be animacy. In this study, we focus on coordination of an animate with an inanimate NP, as in (19). If animacy affects ordering in French independently of grammatical function, we expect animate NPs to come first (as in (19a)), all other things being equal. If French behaves like other languages (English, Japanese), we expect no animacy effect for coordination.

Finally, our study tests the effect of animacy on the order of complements in ditransitive constructions. As discussed before, two grammatical functions are concerned (DO and IO) here, but there is no possible alternation in grammatical function assignment in French; there is only a word order alternation, as show examples in (18). If animacy affects French ordering directly, we expect that animate DOs are more likely to occur directly after the verb, than inanimate DOs, all other things being equal. If on the other hand, animacy affects French word order indirectly, via grammatical function assignment, we expect no animacy effect since DO-IO is the most common order.

4.1 Sentence recall

Following established research in sentence production (see Branigan et al. 2008 for a review), we conducted a sentence recall experiment. The participants task is to recall sentences they have previously read or listened to. Previous evidence (Potter & Lombardi 1990; Lombardi & Potter 1992) suggests that sentences in a recall task are reproduced starting at the message level, going through all stages of sentence production, rather than simply being recalled at a

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2   In a recent corpus study, da Cunha & Abeillé (2020) found a significant (first argument) animacy effect for active/passive alternation in French.

surface level representation. The produced sentences are then compared to the input in order to identify the deviations ("errors") found in participants' productions. Those errors are assumed to reflect underlying biases in the sentence production system, and the analysis of these errors aims to reveal the effect of hypothesized biases.

To test our hypotheses that animacy is involved in grammatical assignation and/or word order in French, we examined the recall of sentences comprising the three structures presented above. In each of the three types, the animacy of one of the NPs varied across the experimental items, while the animacy of the other relevant NP was fixed as "animate", making it possible to examine rates of order/structure inversions as a way to detect effects of animacy on production.

4.2 Method

4.2.1 Participants

Seventy-seven native speakers of French, between 18 and 30-years-old, participated in the experiment for payment. They were recruited via a French National Centre for Scientific Research (CNRS) mailing list of people volunteering to take part in cognitive experiments (expesciences.risc.cnrs.fr). Participants were split in two experimental groups: Group 1, thirty-nine participants, saw the items with voice alternation; and Group 2, thirty-eight participants, was exposed to coordination and ditransitive verbs.

4.2.2 Items

We constructed three sets of 24 items each: Voice alternations (Set 1), Coordinations (Set 2) and Ditransitives (Set 3). All experimental items are displayed in Appendix 1. Items of Set 1 started with a prepositional phrase (PP) modifying the critical main clause which contained a transitive verb with two arguments. The verbs belonged to various semantic classes: change of state (*bénir* 'bless', *censurer* 'censor', *interrompre* 'interrupt') and change of location verbs (*porter* 'carry') with an agentive subject; perception (*observer* 'observe', *regarder* 'watch', *trouver* 'find') and psychological verbs (*mépriser* 'contempt', *ignorer* 'ignore') with an experiencer subject.[3] Each item had four versions such as those in (21), constructed by crossing the animacy of the patient (animate-patient [an-pat] vs. inanimate-patient [in-pat]) with the structure (active vs. passive).

(21)	Set 1	
	[in-pat active]	Au bout de la ruelle, le policier a trouvé le revolver
		'At the end of the alley, the policeman found the revolver'
	[in-pat passive]	Au bout de la ruelle, le revolver a été trouvé par le policier
		'At the end of the alley, the revolver has been found by the policeman'
	[an-pat active]	Au bout de la ruelle, le revolver a été trouvé par le policier
		'At the end of the alley, the policeman found the thief'
	[an-pat passive]	Au bout de la ruelle, le voleur a été trouvé par le policier
		'At the end of the alley, the thief has been found by the policeman'

In Set 2, items consisted of a verb with its subject and a complement that contained a coordination of NPs (NP1 and NP2), NP1 being set as animate. As with Set 1, we created four versions of each item (22) by crossing the animacy of NP2 (animate NP2 [an-NP2] vs. inanimate NP2 [in-NP2]) and the NPs order (NP1-NP2 vs. NP2-NP1). In order to control the effect of other factors at play in coordinated words ordering, we made sure that the frequency of the coordinated nouns was similar in the subtitle part of Lexique 3 (New 2006) and that the length difference between the two coordinated nouns was not more than one syllable.

(22)	Set 2	
	[in-NP2 NP1-NP2]	Ce jeune homme a toujours fui les traîtres et les échecs
		'This young man has always avoided traitors and failures'
	[in-NP2 NP2-NP1]	Ce jeune homme a toujours fui les échecs et les traîtres
		'This young man has always avoided failures and traitors'
	[an-NP2 NP1-NP2]	Ce jeune homme a toujours fui les traîtres et les lâches
		'This young man has always avoided traitors and cowards'
	[an-NP2 NP2-NP1]	Ce jeune homme a toujours fui les lâches et les traîtres
		'This young man has always avoided cowards and traitors'

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3   Note that Set 1 verbs do not belong to the psychological class favoring passive (with an experiencer object) in Ferreira (1994).

The items of Set 3 are composed of a ditransitive verb combined with an animate subject and an animate PP as indirect object. The four versions of each experimental item (23) were constructed by crossing the animacy of the NP functioning as the verb's direct object (animate DO [an-DO] vs. inanimate DO [in-DO]) with the relative order of the verb complements (DO-IO vs. IO-DO). We controlled for a possible length effect on complement ordering by ensuring that the NP had the same length as the PP, in number of words. To control for information structural effects, the NP and PP were either both definite or both indefinite. We chose verbs from two semantic classes that were the most frequent in our previous corpus studies (Thuilier 2012b): transfer (11) (23) and communication (13). These two verb types can be considered to form a homogeneous class because they both take a dative [à]PP and assign similar semantic roles to their arguments: source-agent, theme, goal-benefactive. Transfer verbs, however, have a stronger preference for DO-IO ordering in Thuilier's corpus study (70.3 %) than communication verbs (57.6%).

(23)   Set 3
[in-DO DO-IO]   Le chef du projet a confié un nouveau budget à un décorateur
                     'The project manager entrusted a new budget to a decorator'
[in-DO IO-DO]   Le chef du projet a confié à un décorateur un nouveau budget
                     'The project manager entrusted to a decorator a new budget'
[an-DO DO-IO]   Le chef du projet a confié un agent commercial à un décorateur
                     'The project manager entrusted a business agent to a decorator'
[an-DO IO-DO]   Le chef du projet a confié à un décorateur un agent commercial
                     'The project manager entrusted to a decorator a business agent'

Set 2 and 3 were used for the experiment of Group 2, and Set 1 for the experiment of Group 1.[4] There were 24 additional items in the Group 1 experiment, which are not relevant for the issues at stake here. In both experiments we added the same 48 fillers. Each participant saw 96 sentences (48 experimental sentences + 48 filler sentences) and only one version of each item. The 192 experimental sentences (48 items * 4 conditions) of each group were placed in a Latin square design, which means that each version of an item was seen by at least 9 participants, and each participant saw six items in each condition.

4.2.3 Procedure

The sentence recall task we used took inspiration from Tanaka et al. (2011), but our method differed somewhat from theirs in that the study phase was visual and the recall phase was spoken, and in the number of sentences per block.[5] Participants were tested individually in a quiet room. The sentences were presented on a computer screen in 24 blocks, each containing 4 sentences (2 experimental items + 2 fillers). Each block was composed of 3 phases as shown in *Figure 1*. During phase 1, participants read the 4 sentences of the block one at a time: each sentence was on the screen for 7 s and a 600 ms pause separated each sentence display. Phase 2 was the distractor phase, where participants had to do mental arithmetic. Phase 3 was dedicated to the recall task: participants were prompted for spoken recall using the preambles (e.g. "Au bout de la ruelle…" for (21); "Ce jeune homme…" for (22); "Le chef de projet…" for (23)) in a randomized order different from the presentation phase. Participants were required to respond within 10 s. They completed two blocks of 4 practice sentences before the main experiment.

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4   The sub-experiments were split between participants to reduce the overall length of the experimental session. We also had concerns that an overload of active sentences within the experiment would affect the results with the voice alternation items, which was another reason why we separated voice alternations from our ditransitive and coordination items.

5   Tanaka et al. (2011)' experiments included eight sentences per block, while our experiment only included four sentences per block. We decided on this reduced number because in our pilot testing, we observed that it was very difficult to recall the lexical content of the sentences when more sentences were added to each block of the study phase. We can hypothesize a number of reasons why our task was more difficult than that of Tanaka et al. (2011). First, it is very likely that our sentences were on average longer than those used in the Tanaka et al. (2011) studies (S + O + V in Japanese / S + V + DO + IO in French), and therefore more difficult to recall. Second, visual presentation of the sentences, as compared to auditory presentation, could have made the task more difficult. Third, we added our arithmetic distractor task both to prevent participants from responding based on purely visual recall of the sentences (rather than encoding at the syntactic or message levels), and to prevent any phonological rehearsal of the sentences between the study and the recall phase. For these reasons, even though we had less material to recall in our study, we believe that our participants' productions in the recall task would have the same biases toward a more 'natural' word order as did those in Tanaka et al. (2011) and other sentence recall experiments.
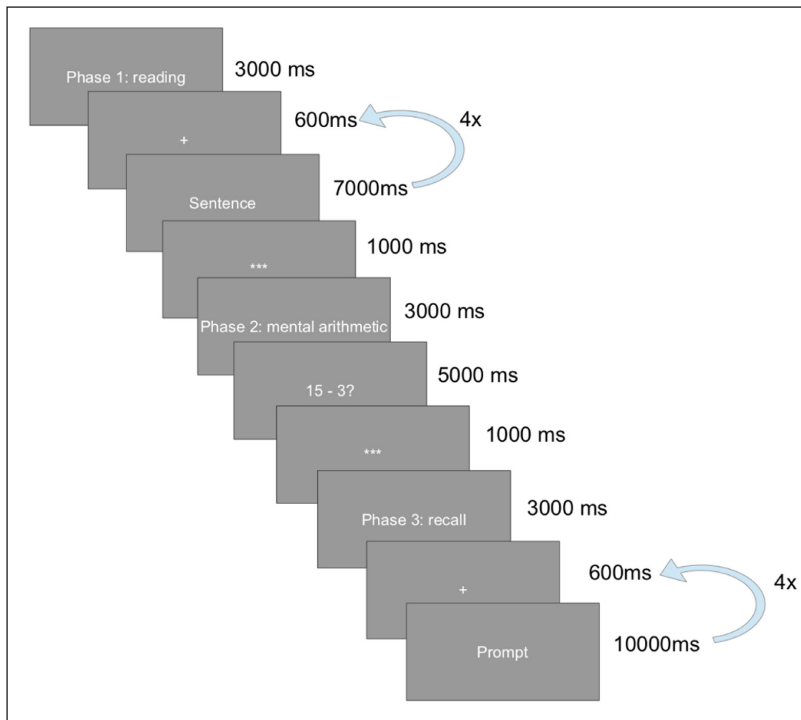
4.2.4 Scoring

We transcribed participants' responses and grouped them into three categories: Correct, Inversion, and Other. Responses were scored as Correct when participants recalled correctly the meaning and the structure that had been presented. We accepted synonyms if the animacy was respected. The category Inversion stood for both, word order inversion (Coordination and Ditransitive verb items) and voice inversion (Voice items). Thus, we used the Inversion label when participants correctly recalled the meaning and the animacy of the referent, but used the inverse structure in comparison to the structure that has been presented. All other responses were coded Other.[6] Participants with less than 30% of data points in the Correct and Inversion categories together were excluded from the analysis (3 participants), as well as subjects and items that had zero observations in a condition. This selection left us with 31 participants and 22 items for Voice alternation; 33 participants and 23 items for Coordination of NPs; and 33 participants and 22 items for Ditransitive verbs. We collected 2200 responses, among which 680 were coded Other (30,9%).[7]

4.3 Results

4.3.1 Voice Alternation

The frequency of Correct, Inversion and Other responses for each condition are shown in *Table 2* and *Figure 2*. To analyse the results statistically, we used mixed effect logistic regression (Agresti 2007; Gelman & Hill 2007) to model the binary dependent variable "Recalled response" (Correct vs. Inversion; Other responses were left out the statistical analysis). This model predicts the probability of having an Inversion given the fixed and random effects. Our models were implemented using the lme4 package (Bates et al. 2015) in R (R Development Core Team 2011). In the model, the fixed effect was Animacy and the random effects were intercepts for Subject and Item. There were only two inversions from active to passive, with zero inversions from active to passive in the Inanimate condition. This was not unexpected, given that sentence recall experiments tend to elicit errors toward the more natural variant in an alternation, in this case the active form, rather than toward the more marked form, in this case the passive.

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6   Responses coded as 'Other' included failures to respond or responses that diverged from the studied sentence. These divergent responses could include, for example, cases where participants substituted lexical items unrelated to the meaning of the sentence.

7   A reviewer was concerned about the fact that the task might be too easy, compared to Tanaka et al. (2011), because of the low number of sentences per block. First, the percentage of responses that do not correspond to the inputs (Other) is high enough to show that participants were not able to recall the sentences easily. Second, as we will see in Section 4.3, we observe an effect of animacy in voice alternation and ditransitive verbs data, which would be unexpected if the participants only used their short-term memory to recall the sentences.

These small values eliminate the possibility of conducting our planned statistical analysis, logistic mixed-effects regression. To avoid the issue of zero and near-zero observations in two cells, we conducted our analysis on the passive-active inversions only. We observe that there were many more inversions in the Inanimate condition. In other words, participants tended to recall passive sentences with inanimate patient as active sentences (see examples in (21)), by putting the inanimate patient in direct object position. This observation is confirmed by statistical analysis. The model is summarized in Table 8 (Appendix 2). The results of the Voice Alternation experiment showed that participants changed the structure of the sentence only when the input was passive. Moreover, the passive to active inversions are significantly affected by the animacy of the patient: an inanimate patient favors Inversion from passive to active, like in English and Japanese.

PATIENT ANIMACY	INPUT WORD ORDER	RECALLED RESPONSES		
		CORRECT	**INVERSION**	**OTHER**
Animate	Active	110	2	56
	Passive	101	13	62
Inanimate	Active	124	0	44
	Passive	66	42	62

Table 2 Results of the recall experiment (voice alternation).
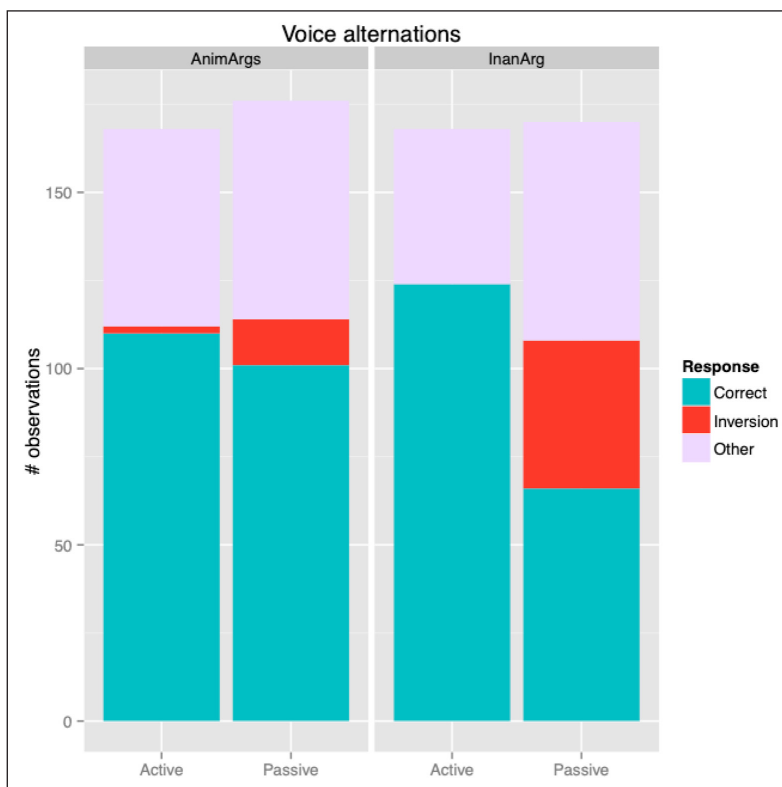
Figure 2 Results of the recall experiment (voice alternation). AnimArgs: Conditions with both arguments animate; InanArg: Conditions where the theme argument is inanimate.

4.3.2 Coordination of NPs

The frequency of Correct, Inversion and Other responses for each condition are shown in *Table 3* and *Figure 3*. There are inversions in every condition, but animacy did not show an effect on the distributions of these inversions. We used the same statistical tool as for Voice Alternation, with Recalled response as dependent variable, Subject and Item as random effects. The fixed effects were NP2 animacy, Word order, and the interaction between them. The model is displayed in Table 9 (Appendix 3). None of these factors has a significant effect on the probability of having a word order inversion. Thus, the results indicate a lack of animacy effect on conjunct ordering, like in English and Japanese.

NP2 ANIMACY	INPUT WORD ORDER	RECALLED RESPONSES		
		CORRECT	INVERSION	OTHER
Animate	NP1-NP2	114	22	53
	NP2-NP1	111	25	54
Inanimate	NP1-NP2	102	17	70
	NP2-NP1	110	14	67

Table 3 Results of the recall experiment (coordination).
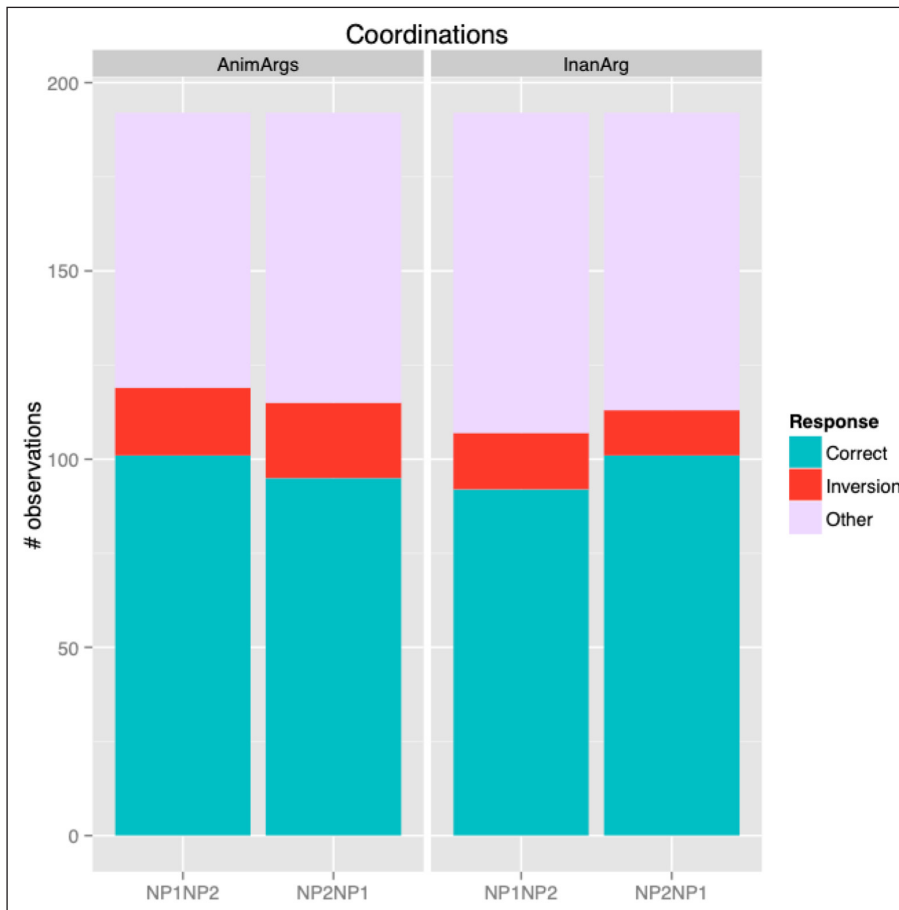
Figure 3 Results of the recall experiment (coordination). AnimArgs: Conditions where both conjuncts are animate; InanArg: Conditions where NP2 is inanimate.

4.3.3 Ditransitive verbs

The frequency of Correct, Inversion and Other responses for each condition is shown in *Table 4* and *Figure 4*. There were some inversions in each condition, but we notice that when the DO is inanimate, there were very few inversions from DO-IO to IO-DO (only 6, making 4% of considered responses), while the number of IO-DO to DO-IO inversions is the highest (28 total, or 21% of considered responses). In other words, participants tended to produce DO-IO order with inanimate DO, which does not bear out the predicted bias to place animate arguments before inanimates. This observation is confirmed by statistical analysis: a mixed effect logistic regression, with Recalled response as dependent variable, Subject and Item as random effects, and DO animacy, Word Order and the interaction between them as fixed effects. The model is summarized in Table 10 (Appendix 4). The interaction between Animacy and Word Order is significant and can be interpreted as follows: if the stimulus contains an inanimate DO with IO-DO order, the probability of having an inversion increases. Thus, the results show that participants are sensitive to the referent's animacy when ordering postverbal complements, but the interaction seems the reverse of what has been observed for dative alternation in English: French speakers tend to put inanimate complements before animate ones.

DO ANIMACY	INPUT WORD ORDER	RECALLED RESPONSES		
		CORRECT	INVERSION	OTHER
Animate	DO-IO	126	17	48
	IO-DO	110	19	60
Inanimate	DO-IO	138	6	47
	IO-DO	103	28	57

Table 4 Results of the recall experiment (ditransitive verbs with animate IO).
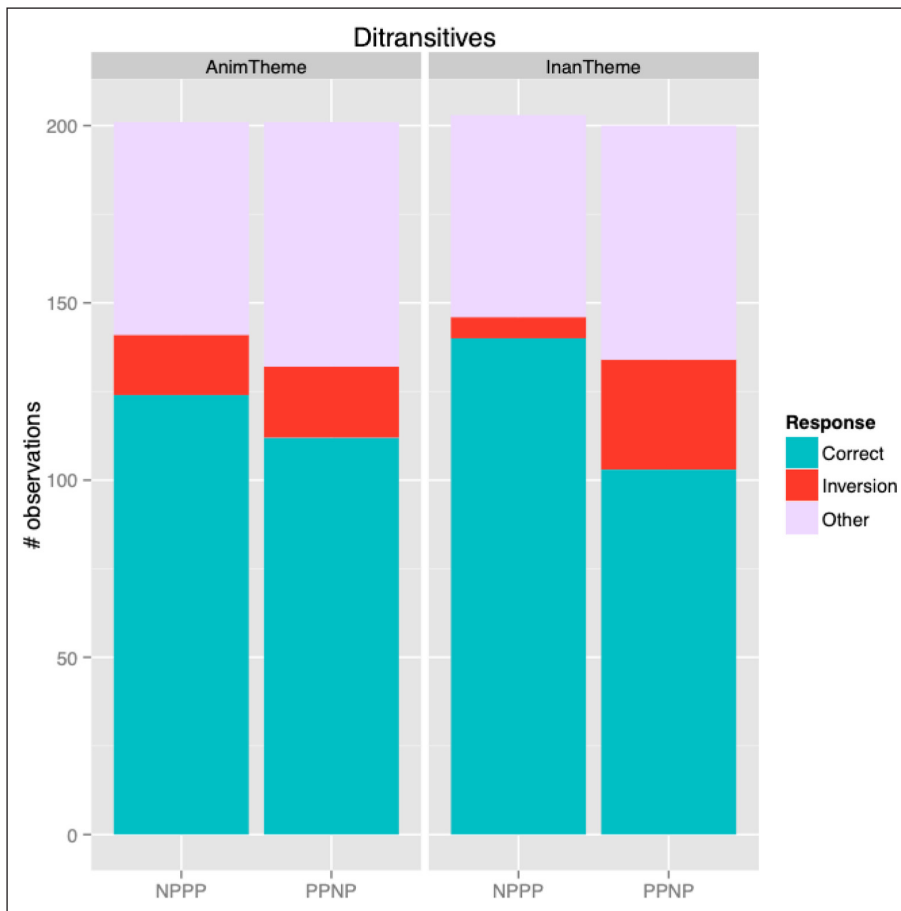
Figure 4 Results of the recall experiment (ditransitive verbs). AnimTheme: Conditions where the theme argument was animate; InanTheme: Conditions where the theme argument was inanimate.

4.4 Comparison of Filler Items Across Groups

As mentioned in the procedure, we recruited two groups of participants for our experiment: Group 1 saw items from Set 1 (voice alternations), and Group 2 saw items from Sets 2 (ditransitive alternation) and 3 (coordinations). This design, while essential for maintaining experiment length and avoiding a strong bias toward active sentences in Set 1, limits the conclusions we can draw across item sets seen by different participants. However, in addition to the identical recruitment procedure and random assignment between groups, we argue that rates of correct responses on our filler items, which were the same across Groups, can provide evidence that our groups were equivalent. *Table 5* shows the rates of correct and incorrect responses across groups.

	Group 1	Group 2
Correct	1170 (76.2%)	1344 (77.8%)
Incorrect	366 (23.8%)	384 (22.2%)

Table 5 Rates of correct vs. incorrect responses to filler items by participant group.

A mixed-effects logistic regression with Group as a fixed effect and random intercept for items showed no significant difference between groups (Estimate = .100, SE = 0.087, Z = 1.151, p = .25). The similarity in overall accuracy between groups on the filler items provides some evidence that there was no systematic difference in sentence recall between our groups of participants.

5 Discussion

Our experimental results show that voice alternation in French is affected by the animacy of the agent and the patient. This means that conceptual accessibility affects function assignment in French, and confirms what has been observed in other languages (English, Japanese) (Bock et al. 1992; Tanaka et al. 2011). The lack of an animacy effect for coordinations is consistent with previous results in other languages (English and Japanese) (McDonald et al. 1993; Tanaka et al. 2011). Thus the Voice Alternation and the Coordination results comply with what has been found in previous literature and argue in favor of the indirect hypothesis (see Section 2.2): as in English, we observe that conceptual accessibility determines function assignment, but not the relative ordering of phrases sharing the same function.

The results of the ditransitive Verb experiment, on the other hand, seem like an anti-animacy effect: inanimate DOs tend to be produced before animate IOs. Models of processing do not predict this, because they expect an animate before inanimate effect or no effect at all (such as for coordination). At first, our results seem to contradict previous studies on the effect of animacy on verbal arguments ordering (Tanaka et al. 2011; Feleki & Branigan 1999). However, it is worthwhile to note that we are not dealing with the same kind of verbal arguments as Tanaka et al. (2011) on Japanese or Feleki & Branigan (1999) on Greek: they studied the relative position of Subject and DO, whereas we are looking at DO and IO ordering. The English dative alternation is more closely related to what we are dealing with, because it involves recipient and theme arguments, but, while the English alternation implies a change in function assignment, the phenomenon we are interested in here only falls under constituent ordering. Thus, rather than contradictory to previous studies, our results are bringing a new piece in the complex puzzle of animacy effect on word order.

In order to give an account of French results that is consistent with the results in other languages, we suggest that animacy effects on word order are constrained by the canonicity of the structures at play. We define canonical structures in terms of grammatical function assignment, linear ordering and prototypical arguments.

- French canonical sentences have an active structure, with an animate argument assuming the Subject function and an inanimate patient being the Direct Object;

- French postverbal canonical ordering is DO-IO, typically with a Direct Object being an inanimate theme; and an Indirect Object being an animate recipient.

The verbs used in our experiments do take prototypical arguments: in Set 1, animate subject (agent or experiencer), and inanimate DO (theme or patient); in Set 3, animate recipient as IO and inanimate theme as DO of transfer and communication verbs. As the status of the DO is crucial for our results and our hypothesis, we checked whether its alleged prototypical inanimacy is verified in ecological data. Corpus data confirm that DO of the verbs used in Set 3 are prototypically inanimate: depending on the verb, between 75 and 100% of the DOs are inanimate in Thuilier's (2012a) data.

Our hypothesis is that speakers tend to select structures that embody canonical forms, but this tendency can be inhibited by conceptual properties that fail to match the prototypical properties: canonical structure/order is reinforced by prototypical animate or inanimate arguments; and non-canonical structures/orderings tend to be produced by speakers when the arguments have non-prototypical properties –in the case of our experiment, when the patient/theme is animate. With respect to the active-passive voice alternation, the hypothesis generates two predictions:

- As prototypical arguments of transitive verbs, animate agent/experiencer and inanimate patient strengthen canonical active structure, and then favor inversions from passive to active;

- As non-prototypical arguments, animate patients weaken active structure and reduce the likelihood of triggering passive to active reversals.

The results comply with these predictions: the number of passive to active inversions is proportionally lower when the patient is animate (11.4%: 13 INVERSION *vs.* 101 CORRECT), than when it is inanimate (38.9%: 42 INVERSION *vs.* 66 CORRECT); and both inversions from active to passive occurred with an animate patient.

As for DO and IO ordering, the hypothesis predicts that:

- As prototypical arguments of ditransitive verbs, animate recipient and inanimate theme strengthen canonical DO-IO ordering, and then favor inversions from IO-DO to DO-IO orders;

- As non-prototypical arguments, animate themes weaken canonical DO-IO ordering and are more likely to trigger DO-IO to IO-DO reversals.

The results comply with these predictions: the number of IO-DO to DO-IO inversions is proportionally lower when the theme is animate (non-prototypical) (14.7%: 19 INVERSION *vs.* 110 CORRECT), than when it is inanimate (21.4%: 28 INVERSION *vs.* 103 CORRECT); and the proportion of DO-IO to IO-DO inversions is higher with an animate theme (11.9%: 17 INVERSION *vs.* 126 CORRECT), than with an inanimate prototypical one (4.2%: 6 INVERSION *vs.* 138 CORRECT). The mapping between canonical order (DO-IO) and prototypical arguments (inanimate theme) is sharper for transfer verbs (27.5% of inversions) than for communication verbs (15.5% of inversions). In return, the inhibition of the canonical ordering tendency due to non-prototypical arguments (animate theme) is stronger for communication verbs (14.5% of inversions) than for transfer verbs (9.9% of inversions). More investigations should be done in order to confirm this pattern.

This hypothesis is also compatible with previous cross-linguistic results, including those of McDonald et al. (1993) on English and Tanaka et al. (2011) on Japanese. As in French, and nominative-accusative languages in general, the active voice is canonical in English and Japanese. Thus, we predict the same tendency as in the current experiment. McDonald et al. (1993) and Tanaka et al.'s (2011) active-passive sentence recall experiments are designed with prototypical arguments (animate agent and inanimate patient) or non-prototypical arguments (inanimate agent and animate patient). In both languages, the passive to active inversions are more frequent with prototypical arguments (25.7% in Tanaka et al. (2011) Experiment 2 results; 60.9% in McDonald et al. (1993) results) than with non-prototypical arguments (11.4% in Japanese; 18.9% in English). As predicted, the active to passive reversal is more likely to be produced with non-prototypical arguments (32.9% in Japanese; 12.5% in English) than with prototypical arguments (9.7% in Japanese; 1% in English). The figures are summarized in *Table 6*.

	Passive to Active inversions		Active to Passive inversions	
	prototypical arguments	non-prototypical arguments	prototypical arguments	non-prototypical arguments
Japanese	25.7%	11.4%	9.7%	32.9%
INVERSIONS	96	44	34	119
CORRECT	278	342	315	243
English	60.9%	18.9%	1%	12.5%
INVERSIONS	67	7	1	8
CORRECT	43	30	97	56

Table 6 Inversions between active and passive structures in Tanaka et al.'s (2011) Experiment 2 and McDonald et al. (1993) results.

With respect to the verbal arguments ordering, Japanese preverbal ordering is Subject before DO, with an animate Subject as the agent, and an inanimate DO as the patient (that is animate Subject before inanimate DO).

In Tanaka et al. (2011), the proportion of OSV to SOV inversions is higher with prototypical arguments (56.3% in their Experiment 1 results, with animate agent and inanimate patient) than with non-prototypical ones (37.4% in their Experiment 1 results, with inanimate agent and animate patient). There are few SOV to OSV inversions, because there is a clear bias toward the canonical SOV order. However, non-prototypical arguments slightly favor these inversions (5.4% in their Experiment 1 results, with inanimate agent and animate patient), compared to prototypical arguments (1.8% in their Experiment 1 results, with animate agent and inanimate patient). *Table 7* gives the exact figures. Note that our hypothesis accounts for the animacy effect on word order in Japanese observed by Tanaka et al. (2011): the canonical SOV ordering is strengthened by an animate subject (i.e. prototypical) and inhibited by an animate object (i.e. non-prototypical). Both these facts lead to an animacy first effect: an animate subject favors SOV and an animate object OSV.

	OSV to SOV inversions		SOV to OSV inversions	
	prototypical arguments	**non-prototypical arguments**	**prototypical arguments**	**non-prototypical arguments**
Japanese	56.3%	37.4%	1.8%	5.4%
INVERSIONS	81	46	3	8
CORRECT	63	77	161	147

Table 7 Inversions between SOV and OSV ordering in Tanaka et al.'s (2011) Experiment 1 results.

English postverbal canonical ordering is DO first, and the DO can be either an animate recipient and occur before an inanimate theme as DO2 (double object construction, with animate DO before inanimate DO2), or an inanimate theme preceding an IO not prototypically animate (DO inanimate before IO). Results of corpus studies (Bresnan et al. 2007; Bresnan & Hay 2008) showed that the canonical double object construction is favored by prototypical animate recipient to a great extent. Moreover, other types of experimental data go in our direction. For instance, in a priming study using dative alternation, Buckle et al. (2017) manipulated the animacy-semantic mappings in order to observe whether animacy affects sentence production apart from structural priming. In their experiment, the animacy-semantic mapping had two possible levels: either an animate recipient and an inanimate theme (*transfer of a ball (theme) from a boy to a tiger (recipient)*) corresponding to the prototypical mapping, or an inanimate recipient and an animate theme (*transfer of a monkey (theme) from a boy to a zoo (recipient)*), being the non-prototypical mapping. Their other experimental manipulation was the prime, which was either a double object dative prime or a prepositional dative prime. The participants were asked to describe an animation depicting a scene of transfer, after viewing another animation associated with a dative construction (prime). The results reveal that adult participants tend to produce more double object constructions with animations showing prototypical mappings, whatever the prime condition, and conversely the number of double object constructions is lower when the mapping is non-prototypical, whatever the prime condition. This is in line with our hypothesis: the canonical structure is reinforced by prototypical arguments, and inhibited by non-prototypical arguments. It also shows that the effect is strong, as it is not overridden by syntactic priming.

According to our analysis, animacy effects interact with the mapping between canonical syntactic structure and prototypical arguments. In most of the cases, the canonical structure or ordering makes a prototypical animate argument match the highest grammatical function and/or the first linear position; but, in some cases, as with French postverbal complement ordering, the canonical order puts an inanimate argument first, leading to what we call an anti-animacy effect. Unlike English ditransitive verbs, which have two constructions with two different prototypical mappings (a double object construction with an animate (recipient/ beneficiary) NP1 and a prepositional construction with an inanimate (theme) NP1), French only has one construction with a DO-IO order and a prototypical inanimate (theme) DO. Our proposal suggests taking into account more seriously the semantic roles of the arguments and the semantic verb classes in the study of animacy effect on constituent ordering. It could be tested by gathering experimental data comparing different semantic verb classes and arguments with different semantic roles, and checking whether prototypicality of their arguments affects complement ordering. We leave this for future work.

6 Conclusion

In this paper, we reported the results of a sentence recall study examining the effect of the animacy status of referents on constituent ordering in French, testing three different constructions: active/passive sentences, sentences with coordinated NPs, and ditransitive sentences. Our results support a role for animacy in influencing whether a passive or an active sentence is produced in French, congruent with other studies claiming that animacy has an effect on grammatical function assignment (McDonald et al. 1993; Tanaka et al. 2011). On the other hand, similar to results from other languages, we do not find a bias toward placing an animate entity first with coordinated NPs. With respect to the ordering of postverbal complements in ditransitive sentences, our results show what looks like a French-specific anti-animacy effect. We propose to reformulate the preference for animate argument first as follows: we suggest a more general preference to place prototypical arguments in their canonical positions, which applies to different constructions (active/passive as well as ditransitive) and to different languages (French, English, Japanese) with different results: an animate (recipient) NP1 first in English NP1-NP2 construction, an inanimate (theme) NP1 first in French NP1-PP2 construction.

Abbreviations

1SG = first person singular, 3SG = third person singular, ART = article, AUX = auxiliary, FUT = futur, INDF = indefinite, PL = plural, PST = past, PCPT = participle, SG = singular.

Additional files

The additional files for this article can be found as follows:

- **Appendix 1.** Stimuli. DOI: *https://doi.org/10.5334/gjgl.1155.s1*

- **Appendix 2.** Results on voice recall. DOI: *https://doi.org/10.5334/gjgl.1155.s2*

- **Appendix 3.** Results on coordination of NPs. DOI: *https://doi.org/10.5334/gjgl.1155.s3*

- **Appendix 4.** Results on complement ordering . DOI: *https://doi.org/10.5334/gjgl.1155.s4*

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Competing interests

The authors have no competing interests to declare.

Author Affiliations

Juliette Thuilier ⓘ *orcid.org/0000-0003-4290-553X*
Université Toulouse Jean Jaurès & CLLE, 5, allées Antonio Machado, 31058, Toulouse Cedex 9, France

Margaret Grant
Dept of Linguistics, Simon Fraser University, Burnaby, BC V5A 1S6, Canada

Benoît Crabbé
Université de Paris & LLF, Université de Paris & LLF, CP 7031 – 5, rue Thomas Mann, 75205, Paris Cedex 13, France

Anne Abeillé ⓘ *orcid.org/0000-0002-9187-2298*
Université de Paris & LLF, CP 7031 – 5, rue Thomas Mann, 75205, Paris Cedex 13, France

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