Tel Aviv University
Lester and Sally Entin Faculty of the Humanities
Department of Linguistics

The Compassionate Parser:
Animacy, Attitudes and Sentence Processing

MA thesis submitted by

Noa Geller

Prepared under the guidance of

Prof. Aya Meltzer-Asscher

September 2020

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Abstract

Sentence processing is modulated by various types of information: syntactic, semantic, and pragmatic. Recently, it has also been suggested that comprehenders' beliefs and attitudes may affect real-time sentence comprehension. In this study, I explore this suggestion by looking at animacy. One robust effect regarding animacy is that while object relative clauses (ORCs) headed by animate nouns (1a) are harder to process than subject relative clauses (SRCs) (1b), this processing difficulty is alleviated when the head of the ORC is an inanimate noun (1c). This was explained by applying to the Animacy Hierarchy, stating that animate nouns typically appear in subject positions and are interpreted as agents; in ORCs headed by animate nouns, when a different subject appears inside the RC (1a), it causes disruption.

(1) a. I like the employee [that the manager noticed ___]
b. I like the employee [that ___ noticed the manager]
c. I like the jacket [that the manager noticed ___]

The animacy hierarchy is usually considered to show at least a three-way distinction – humans, non-human animals, and inanimates – as reflected in the grammar of some languages (Hebrew not included). Studies about the effect of animacy on processing, however, have used only humans as the animate entity. In this study, I aim to start filling this void by examining whether the distinction between human and non-human animals influences real-time processing. Specifically, I wanted to test whether the subject in an animal-headed ORC will be processed similarly to its processing in a human-headed or inanimate-headed ORC. In addition, I test whether a reader's attitude towards animals, as assessed by the Animal Attitude Scale (AAS, Herzog et al., 1991), is in correlation with such processing effects.

In experiment 1, I compared ORCs with human-, animal-, and inanimate- denoting heads in a self-paced reading task. I found no significant effects on the subject of the RC, possibly due to artifacts from preceding material in the sentence, i.e. an adjective modifying the head noun .

In experiment 2, materials were altered so that a three-word temporal phrase opened the RC. There were again no significant effects on the subject. Thus, I did not replicate the finding from the literature that animacy modulates the processing of RCs. However, the last word of the temporal phrase was read faster for the animal and human conditions compared to inanimate condition. There was also an interaction with attitude, such that for participants with high AAS scores, namely favorable attitudes towards animals, NPs referring to animals and inanimates differed, while for those with low AAS scores, only humans and inanimates differed. This provides preliminary evidence that nouns denoting humans and nouns denoting non-human animals may differ in real-time processing, and that the effect varies in correlation with attitudes towards non-human animals.

Acknowledgments

First and foremost, I would like to thank my advisor, Professor Aya Meltzer-Ascher, for her guidance, support and enthusiasm for the subject of my thesis, without which this work would not have been completed the way it was. It has been a privilege to be guided and taught by her, and to work with her as a teaching and research assistant.

I would also like to thank past and current faculty members whose courses I participated in during my B.A and M.A studies: Prof. Mira Ariel, Prof. Outi Bat-El, Dr. Irina Botwinik ,Dr. Evan Cohen, Dr. Roey Gafter, Dr. Nirit Kadmon, and Prof. Tal Siloni. Each one has taught me something about linguistics from a different perspective and inspired me in some aspect of linguistic research.

My deepest gratitude goes to Ruti Zussman, who was always at the ready to lend a helping hand in dealing with bureaucracy, and always listened and helped with everything else around.

To my friends in the linguistics department, thank you for helpful advice, but more than anything – the moral support I would not have finished this thesis without. Hila Davidovich, Alon Fishman, Maayan Keshev, Nicole Katzir, Daniel Asherov, Hezi Shabanov, Stav Klein, Avital Zaruvimsky, Hagar Scutelsky and Adi Elad. I am eternally grateful and promise to continue feeding you for a long time.

To my parents, Hilla and Zvi, and my brother Ofir, thank you for constantly asking me "how is your thesis going?", even though I got annoyed every time you asked, I often needed that push. Thank you for always believing in me, and for supporting my decisions even when you did not understand or agree with them.

Finally, this work is dedicated to all the animals who have suffered, are suffering and will suffer in the animal agriculture industry. I hope I live to see a real change in your lives, and I promise to never stop fighting for your freedom.

1. Introduction

The field of psycholinguistics studies the relationships between linguistic behavior and psychological processes. One of those relationships involves the various mechanisms at work during real-time language comprehension. As one processes language, they will encounter sentences they have never heard or read before, and yet be able to create a meaningful semantic representation for them quickly, easily, and accurately. Many years of research in the field have taught us that the comprehender is able to do that using various types of information, including:

1. Information associated with the words in the sentence, e.g. syntactic information (a word's lexical category and thus the role it can assume in a sentence), semantic information (the word's meaning or meanings), morphological information (marking properties such as gender and number) and pragmatic information (a choice of register, for example).
2. Information about the probability of different structures in the language.
3. Information derived from the linguistic or discourse context.

Recently, research has begun to investigate whether comprehenders' beliefs and attitudes can also affect language processing in real time. One recent study explored this idea by looking at linguistic behavior prior to the US 2016 elections where, uncommonly, there was a prominent female candidate (von der Malsburg et al., 2020). The researchers looked for influence of the likelihood of the female candidate winning the election on participants producing related sentences using *she/her*, as well as on their comprehension of sentences that referred to the head of government as *she* (as opposed to *he* or singular *they*). The authors found that the more the female candidate was expected to win, the more participants tended to produce sentences with *they* (but were still least likely to use *she/her*). In terms of comprehension, though, they found that *she* caused a disruption to reading, regardless of world-event expectations, even among those more likely to desire and believe in the possibility of a female president (female Democrats).

In the current study, I explored whether people's attitudes towards animals may have an effect on their online sentence comprehension. To do that, I utilized the notion of animacy and its effect on the processing of ORCs. The rest of the introduction continues to discuss the role of animacy in sentence processing, and specifically in relative clauses,

in section 1.1, and human attitudes towards animals in section 1.2. In section 2 I will present my research questions, followed by a presentation of the two experiments I performed in sections 3 and 4, along with their results and a discussion of those. Finally, section 5 offers a general discussion of both experiments' results and recommendations for future research.

1.1 Animacy in sentence processing

Animacy, the feature determining whether a noun refers to a living or non-living entity, is a lexical feature that shows relevance both in theoretical linguistics and in sentence processing as studied by psycho- and neurolinguistics. While on the surface it may seem to be a semantic feature (since it is part of a word's meaning), it is also syntactically relevant, as it has grammatical implications. For example, in English, *he/she* pronouns are used for animate entities, while *it* is used for inanimate entities.

Several of the effects of animacy on the grammar are captured by the Animacy Hierarchy, a generalization stating two main claims. First, animate noun phrases tend to appear earlier in a sentence compared to inanimate noun phrases, and second, animate NPs are more likely to receive the more agentive semantic roles, and to be interpreted as the entity initiating an action (Aissen, 2003; Comrie, 1989; Dixon, 1979). The Animacy Hierarchy is relevant for grammatical theory, for language acquisition, and most importantly for the purpose of the current study, for language processing. For example, violations of this hierarchy have been shown to invoke processing disruption both behaviorally (Ferreira, 2003; Trueswell, Tanenhaus, & Garnsey, 1994) and neuronally (Bornkessel-Schlesewsky & Schlesewsky, 2009).

For example, Ferreira (2003) tested the comprehension of various types of sentences, including passives, actives, and clefts. Participants were asked to listen to sentences that manipulated voice (active/passive), reversibility, and plausibility, for example – *the man bit the dog* (active, reversible, implausible) and *the cheese was eaten by the mouse* (passive, nonreversible, plausible). They were then asked a question about the sentence they heard, such as who was the "do-er" of the action, or what was the action. Overall, participants were less accurate when asked about passive sentences compared to active sentences and took longer to answer questions about them, even more so when the sentences were implausible. This shows that comprehenders use a heuristic by which

the first NP in the sentence and/or the animate NP in the sentence is the agent of the action.

1.1.1 Animacy in relative clauses

In general, there is wide evidence showing that object relative clauses (ORC) as in (1a), where the modified head noun corresponded to the object position in the clause, are harder to process than subject relative clauses (SRC) as in (1b). This difficulty has been shown to be reflected in reading times (Wanner & Maratsos, 1978; King & Just, 1991; among others), as well as in eye-tracking measures such as first-path regression and regressions-path time (Traxler et al., 2005; for a review see Gibson, 1998).

(1) a. I like **the employee** [that **the manager** noticed ___]
b. I like **the employee** [that ___ noticed **the manager**]

For example, King & Just (1991) compared processing of subject and object relative clauses with an extrinsic working memory load in participants of high and low working memory capacity (as assessed in a reading span task). SRCs were sentences such as *"the reporter that the senator attacked admitted the error publicly after the hearing"*, while ORCs were sentences such as *"the reporter that attacked the senator admitted the error publicly after the hearing*". All sentences were constructed such that they were reversible and both the correct and reverse order were equally plausible. The sentences appeared by themselves, and were preceded by one or two other, related sentences. Participants were asked to recall the last word of each sentence presented, as well as answer a yes/no question about the target sentence. Reading times were measured for four regions: *"the [reporter that the senator] [attacked] [admitted] [the error]"* for ORCs, and similar for SRCs: *"the [reporter that attacked the] [senator] [admitted] [the error]*". The researchers expected to find evidence of processing difficulty, reflected in longer reading times, in the second and third regions of the ORC compared to those regions in the SRC (relative clause ending/embedded verb and main verb, respectively). A difference was found which correlated with working memory capacity, but importantly for the current study, ORCs showed longer reading times regardless of one's working memory capacity, especially in the second and third regions (the embedded and main verb, respectively).

Several researchers attempted to find out whether manipulating any properties of the nouns can influence the level of complexity, and/or eliminate the difference between ORCs and SRCs. One of the properties that has been broadly inspected is animacy. It has been found that when the noun in object position is inanimate, as in (2c) and (2d), there is no statistically significant difference between the reading times of ORCs and SRCs (Mak et al., 2002; Mak et al., 2006).

Mak et al. (2002) report a self-paced reading experiment which compared subject and object relative clauses with variations on animacy, in Dutch. They manipulated relative clause type (SRC vs. ORC) and the animacy of the relative clause object, comparing SRCs and ORCs where both NPs were animate (2a and 2b, respectively) with SRCs with an animate relative head and inanimate object (2c) and ORCs with an inanimate relative head and animate subject (2d):

(2) a. SRC, animate RC object:

Because of the investigation, **the burglars**, [who ___ robbed **the occupant**], had to stay at the police station for some time.

b. ORC, animate RC object:

Because of the investigation, **the occupant**, [who **the burglars** robbed ___], had to stay at the police station for some time.

c. SRC, inanimate RC object:

Because of the investigation, **the burglars**, [who ___ stole **the computer**], had to stay at the police station for some time.

d. ORC, inanimate RC object

Because of the investigation, **the computer**, [that **the burglars** stole ___], had to remain at the police station for some time.

It should be noted that the word order in Dutch is different to English: inside the relative clause, the verb follows both the subject and the object, creating ambiguity which is resolved at the inflected verb, which agrees with the subject. For example, sentence (2a) would look like this: "*Because of the investigation must the burglars, who the occupant robbed have, some time stay at the police station.*" The disambiguation site is *have,* which signals that this is a SRC with *the burglars* as the subject.

Reading times were measured for all words, and analyzed starting from the main verb (in the example above, *must*) up to two words after the auxiliary (in the example above, *time*), as well as the last word in the sentence. There was an interaction between relative clause type and the animacy of the relative clause head at the word following the auxiliary, where the sentence is syntactically disambiguated. Specifically, when the object was animate (2a-b), reading times were longer for ORCs compared to SRCs. However, there was no difference between SRCs and ORCs when the object was inanimate (2c-d). In addition, reading times for this position were equal for ORCs with an inanimate object (2d) and SRCs with an animate object (2a), indicating that the difficulty with ORC only arises when both subject and object are animate.

Similarly, in a series of three eye-tracking experiments, Traxler et al. (2002) showed that ORCs are harder to process than SRCs at the relative clause and the matrix verb. However, this difficulty is greatly reduced when the relative head is inanimate. The authors created sets of four sentences, crossing clause type (SRC or ORC) and relative head animacy (if it was animate, the other noun was inanimate, and vice versa), as shown in (3).

(3) a. SRC, animate relative head:

The director [that ___ watched **the movie**] received a prize at the film festival.

b. ORC, animate relative head:

The director [that **the movie** pleased ___] received a prize at the film festival.

c. SRC, inanimate relative head:

The movie [that ___ pleased **the director**] received a prize at the film festival.

d. ORC, inanimate relative head:

The movie [that **the director** watched ___] received a prize at the film festival.

Participants read the sentences while their eye movements and fixations were tracked. The researchers looked at two regions – the relative clause and the matrix verb (underlined in (3)). Clause Type and Animacy interacted in both regions, such that ORCs with an animate relative head (4b) were more difficult to process than the three other conditions, that is there were longer fixations and more returns to previous words. This finding implies that the use of an inanimate relative head and an animate

subject inside the relative clause reduces the difficulty that is commonly associated with ORCs.

Similar findings have arisen in different languages (In Dutch and German: Mak, Vonk, & Schriefers, 2002, 2006; In Japanese: Sato, Kahraman, & Sakai, 2012; In Mandarin Chinese: Wu, Kaiser, & Anderson, 2011). For example, Wu, Kaiser, & Anderson (2011) tested the effects of animacy and clause type in Mandarin speakers. Similar to the experiments described above, they contrasted SRCs and ORCs with variation on NP animacy, resulting in four conditions:

(4) a. SRC, animate relative head:

The reporter [that __ dodged **the stone]** successfully slipped into the camp.

(dodge stone DE reporter successfully slip-into-ASP camp)

b. ORC, animate relative head:

The reporter [that **the stone** hit __] successfully slipped into the camp.

(stone hit DE reporter successfully slip-into-ASP camp)

c. SRC, inanimate relative head:

The stone [that __ hit **the reporter]** fell to the ground heavily.

(hit reporter DE stone heavily fall-to-ASP ground)

d. ORC, inanimate relative head:

The stone [that **the reporter** dodged __] fell to the ground heavily.

(reporter dodge DE stone heavily fall-to-ASP ground)

As in Mak et al.'s experiments, it should be noted that the word order in Mandarin is different than in English, with RC appearing pre-nominally. Therefore, the word order of the sentences used, for example (4a), would be *"___ dodge stone DE reporter successfully slip-into-ASP camp"*, where DE is the relativizer and ASP is an aspect case marker. The word order is provided above for the remaining three conditions as well.

Participants read the sentences word-by-word, and reading times was recorded for each word. The findings showed an interaction in the second word position (i.e, the verb *dodge* / *hit* for ORCs and *stone* / *reporter* for SRC), such that in ORCs, it was read faster when inanimate (4d) compared to when it was animate (4b). There was no animacy-

based difference between the two SRC conditions (4a and 4c). Interestingly, this position showed a difference even though the head of the RC and thus its animacy is not yet known at this point. This difference can plausibly be attributed to the difference in the animacy of the RC subject, i.e. the first word in the sentence. However, the same pattern emerged for the other positions tested, showing overall that while animacy has no effect in SRCs, for ORCs an inanimate head was preferred (meaning it was processed faster). At the fourth word, the relative head, the longest reading times was for ORCs with an animate head, arguably the least expected and accepted option.

In addition, corpus studies have shown that ORCs are not very frequent, and even less so with animate head nouns. For example, Roland, Dick, & Elman (2007), in a study of eight English corpus data sets, found that SRCs made up 41.47% and ORCs made up only 28% of the relative clauses found. While the corpora was not fully coded for head animacy due to insufficient accuracy using automatic methods, a sample of 100 hand-coded sentences showed that usually, an animate head was modified by a SRC, while an inanimate head was modified by an ORC.

How can these observations be accounted for? One possible account has been argued for by Fedorenko & Gibson (2008). They suggest that the difficulty with ORCs comes from similarity-based interference (see also Gordon, Hendrick, & Johnson, 2004; Lewis, Vasishth & Van Dyke, 2006). The relative clause verb needs to identify its object, namely the filler, but the subject of the relative clause, which appears between the filler and the gap, and is similar to the filler, causes retrieval interference. This interference is greatly reduced when the filler is an inanimate entity while the subject of the relative clause is an animate entity, rendering them, at the very least, different in this prominent property.

Another possible account, proposed by Gennari & MacDonald (2008), is that the findings can be explained by the animacy hierarchy mentioned above. An ORC headed by an animate NP (as in (1a)) could be harder to process than an SRC headed by an animate NP (as in (1b)) simply because when the comprehender encounters an animate NP head of the relative clause, they expect it to act as the subject/agent of the relative clause, as is often the case in natural language. When the comprehender subsequently encounters an additional NP, instead of a gap, at the subject position of the relative clause, it becomes clear that the structure is an ORC (and the animate head is to be

interpreted as an object/theme), thus causing a delay in processing. Such a view would explain why ORCs with an inanimate head, such as (2d), are easier to process than (1a). In this case, the head noun that the comprehender encounters is an inanimate one, which is often found in the object position (as a theme/patient), leading to an expectation of an ORC. Thus, the appearance of a subject NP inside the RC is not surprising or difficult to process.

As is clear from the discussion above, psycholinguistic studies investigating animacy effects have most often used human NPs in the animate conditions, contrasting them with inanimate NPs. However, typically, when the Animacy Hierarchy is discussed in theoretical linguistics, it is considered to include at the very least a three-way distinction – humans, animate non-humans and inanimates (Dixon, 1979). This is reflected in various ways in different languages. For example, in Muna (spoken in the Indonesian island of Muna), plural pronouns and nouns that denote humans obligate a plural agreement on the verb and inanimates obligate a singular agreement (regardless of number), while for nouns that denote non-human animates, the verb can take either a singular or plural agreement (Corbett, 2012).

While there has been a lot of research and therefore documented effects of animacy on sentence processing, to the best of my knowledge, no research was done to test whether animate human nouns and animate non-human nouns may be processed differentially. The current study, therefore, seeks to start filling this void and to test whether this distinction carries real-time processing implications, and whether these implications may be different for comprehenders holding different attitudes towards animals.

1.2 Human attitudes towards non-human animals

Human attitudes towards animals show great variation, depending on the person's cultural and personal attributes or history. Anecdotally, we know that animals that are pets in one culture are considered food in another. Attitudes towards animals were shown to be affected by multiple factors, e.g. a person's beliefs regarding related issues such as the value of nature, a person's lifestyle, and their past and current experiences with animals. For example, Vigorito (1996) has shown that psychology students show a more supportive attitude towards animal research the further they are into their psychology studies. Paul & Serpell (1993) found a correlation between pet-keeping in

childhood and more positive attitudes towards pet animals and greater concerns about the welfare of non-pet animals (and humans). Similarly, Serpell (2005) found that pro-animal values were credited by veterinary students to observed behavior by their parents during their childhood. Ownership of pets in childhood has also been found as a common characteristic among people who volunteered in wildlife preservation (Hdd et al., 1996). In contrast, Signal & Taylor (2006) found that past pet ownership did not significantly correlate with attitudes towards animals, while occupation did – people in healthcare professions showed the most positive attitudes.

Human attitudes towards animals also vary with the animal in question. It is a rather accepted generalization that humans tend to prefer animals that are biologically, behaviorally, or cognitively similar to them (Batt, 2009; Serpell, 2004). In general, birds and mammals are favored over reptiles and invertebrates.

Belief about animal sentience has also been researched extensively and has been found to be modulated by the same factors, such as lifestyle and experience with animals. Bilewicz et al. (2011) compared the extent to which vegetarians and omnivores attribute psychological characteristics to humans versus animals, showing that vegetarians attributed more secondary (i.e. uniquely human) emotions to animals. While omnivores attributed even fewer secondary emotions to traditionally edible animals, vegetarians did not distinguish between traditionally edible and other animals. Taking a broader look at the question of sentience in animals, a large study with students from different nationalities, found that the order of sentience attributed to different species was monkey > dog > fox > pig > chicken > rat > fish (Phillips & McCulloch, 2005).

2. Research Questions

In this study I asked whether, when processing a sentence in real-time, animal nouns are treated on par with human nouns, on par with inanimate nouns, or altogether differently. In addition, I tested whether processing of animal nouns is modulated by the reader's beliefs and values, namely their attitude towards animals.

The experiments measured reading times for ORCs with a manipulation of the relative head noun, as exemplified in (6). Previous studies have shown these effects of animacy either on the relative clause verb, on the entire relative clause, or on the matrix verb. I

chose the relative clause subject (*the artist* in (6)) as the main critical region, since disruption in this region is predicted both under interference-based accounts and under animacy hierarchy accounts, as explained below.

(6) a. This is **the baby** that the artist painted ___ last week
b. This is **the plant** that the artist painted ___ last week
c. This is **the chicken** that the artist painted ___ last week

As explained in section 1.1, sentences like (6a) are predicted to exhibit more difficulty than (6b), a difficulty which should be reflected in increased reading times on the relative clause subject *the artist*. This happens either (1) because the animate head (*the baby*), but not the inanimate head (*the plant*) is associated with an agentive role, hence favoring a prediction of a SRC, thus, a processing difficulty arises when the RC turns out to have a different subject, or (2) because of a similarity-based encoding interference that results in higher reading times, as the RC subject is human and thus more similar to the animate head noun than to the inanimate head noun (see Ness & Meltzer-Asscher, 2019). The novel hypothesis in the following study is regarding processing of sentences such as (6c). If speakers treat animal nouns the same as human nouns, then a processing difficulty, manifesting in increased reading times, is expected on the relative clause subject (*the artist*). If, instead, speakers treat animal nouns the same as inanimate nouns, then (6c) is expected to behave similarly to (6b). Potentially, animal nouns may differ from both human and inanimate in the way they are processed, and thus end up somewhere in between the two.

3. Experiment 1

3.1 Methods

3.1.1 Participants

36 people participated in the experiment (23 female), all native Hebrew speakers, with an average age of 24 (range 20-33). All participants had normal or corrected to normal vision. Participants volunteered for the study or were paid 20 ILS for their participation. One participant was dropped from the analysis due to below-chance performance in the comprehension questions.

Participants were divided to two groups based on their scores on the Animals Attitude Scale questionnaire (AAS, Herzog et al., 1991), which they completed after the main

experiment. The questionnaire consists of 20 statements (e.g. "Much of the scientific research done with animals is unnecessary and cruel"), and participants are asked to rate the level of their agreement with each statement on a scale of 1 (strongly disagree) to 5 (strongly agree). Participants were defined as High AAS if they scored above the median (which was 75), and Low AAS if they scored below it, resulting in 18 participants in the High AAS group and 17 in the Low AAS group.

3.1.2 Design and Materials

The experiment had a 3x2 design, crossing object RC head (inanimate, animate-human and animate-animal) and AAS score (high vs. low). These factors will be referred to as Condition and Attitude.

The materials consisted of 21 sets of three sentences each, such that in every set, sentences differed only in the noun used as the RC head, as can be seen in Table 1:

Table 1: Example set for experimental conditions

1.	**Animate human**	
	ze ha-gever ha-metupax	še-ha-davar zaxar milifney shanim
	This-is the-man the-groomed	that- the- mailman remembered from-years
	This is the groomed man	that the mailman remembered from years ago
2.	**Animate animal**	
	ze ha-xazir ha-metupax	še-ha-davar zaxar milifney shanim
	This-is the-pig the-groomed	that- the- mailman remembered from-years
	This is the groomed pig	that the mailman remembered from years ago
3.	**Inanimate**	
	ze ha-deše ha-metupax	še-ha-davar zaxar milifney shanim
	This-is the-lawn the-groomed	that- the- mailman remembered from-years
	This is the groomed lawn	that the mailman remembered from years ago

The animals chosen were all farmed animals and all but one (chicken) were mammals. This was decided because mammals and birds are usually preferred by humans, and farmed animals specifically fall between animals that are perceived as close to humans (like monkeys and dogs) and those which are distant (like wolves and bears). In addition,

I expected this type of animals to provoke a difference between the groups of participants, as people with High AAS likely oppose the use of animals in farming and view farmed animals as sentient.

Each participant saw only one sentence from each set, using Linger's automatic Latin Square design. In addition to the target sentences, 42 filler sentences were included. A third of the fillers featured human subjects, a third featured animal subjects, and a third featured inanimate subjects. Twenty-one filler sentences were SRCs (e.g.. " זה האוגר המפונק שלעס בוטנים כל הבוקר") and 21 included a complex NP in the subject position (e.g.. " הידיעה שהארון מלא בממתקים שימחה את האורחים"), of similar length and syntactic complexity to the target sentences. The stimuli were randomized for each participant, with at least one filler sentence separating every two target sentences.

3.1.3 Procedure

The task was self-paced word-by-word reading, ran using the Linger 2.88 software by Doug Rohde (available at http://tedlab.mit.edu/~dr/Linger/). Each trial began with a row of dashes masking the sentence. Participants pressed the space bar to reveal each word in the sentence while making the previous word disappear. The amount of time the participant spent reading each word was recorded as the time between key presses.

To make sure participants read the sentences for meaning, comprehension questions were presented after half of them (both targets and fillers). Participants pressed one key for "yes", and another for "no". After a correct answer, the words *correct answer* ("תשובה נכונה") flashed briefly on the screen, and after an incorrect answer, the words *wrong answer* ("תשובה שגויה") did. Participants were instructed to read the sentences as naturally as possible and make sure they understood what they read. Before the experiment started, four practice items were presented to familiarize the participants with the task and make sure they understood the instructions. Participants took approximately 15 minutes to complete the experiment.

3.2 Results

Reading times, in milliseconds here and throughout the paper, for the critical word (the relative clause subject) are presented in Table 2 and Figure 1, and word-by-word reading times for the entire sentence are presented in Figure 2.

Table 2: Mean RT (SD) for the relative clause subject, Experiment 1

	Animate – Human	Animate - Animal	Inanimate
Overall	401.34 (192.15)	408.24 (178)	423.58 (209.58)
High AAS	394.37 (205.06)	419.32 (196.4)	421.1 (234.66)
Low AAS	408.71 (178.03)	396.51 (156.18)	426.21 (180.23)

Figure 1: Mean RT for the relative clause subject, Experiment 1

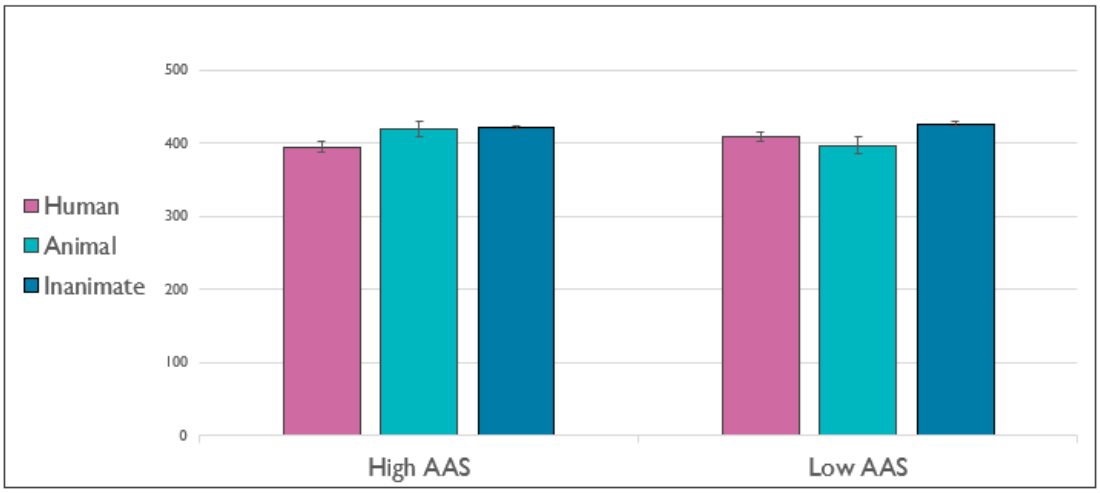
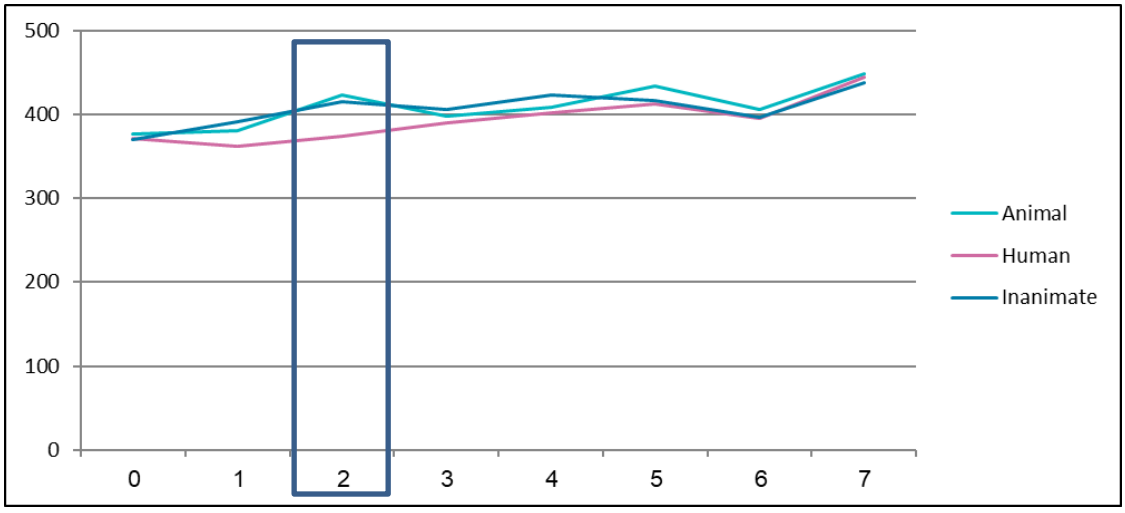


Figure 2: Word-by-word mean RTs, Experiment 1



ze	ha-gever	ha-metupax	še-	ha-davar	zaxar	milifney	shanim
0	1	2	3	4	5	6	7

I analyzed the data with mixed-models regression using R, with Condition, Attitude and reading times of the previous word as fixed effects. I began with the full random effects structure (random intercepts and slopes for participant and item) for each analysis, and reduced the structure as needed to achieve convergence (the converging models are provided in footnotes).

On the critical word (the relative clause subject), there were no main effects found for Condition or for Attitude, and no interaction. [1] Since effects in self-paced reading often arise after the relevant region, a similar analysis was done for the spillover region, namely the verb following the critical word[2], and there were no main effects or interaction found.

From visual inspection of the reading times, I observed an effect of Condition on the third word in the sentence, the adjective following the head RC noun. The observed difference was found to be significant, with a main effect for Condition ($p = .011$) in this position. Post-hoc comparisons revealed that the word was read significantly faster in the Human condition relative to the Inanimate condition ($p = .008$, Bonferroni-corrected for multiple comparisons).

3.3 Discussion

Overall, there was no effect found for either of the factors tested in the above experiment on the critical word (or its spillover). Thus, I did not replicate the effect reported in the literature, namely that ORCs headed by inanimate nouns are easier to process than those headed by human nouns. I also did not find effects involving the additional animacy level, or effects of attitude.

For this experiment, the relatedness of the two nouns in each sentence (the relative head and the relative clause subject, e.g. *the mailman* and *the man* or *the mailman* and *the pig*) was not assessed or controlled. It is possible that no effect of Condition was found in the experiment because some pairs were more likely to appear together in a sentence, and therefore the relative clause subject was less surprising in specific

[1] model.subject <- lmer(logRT ~ sentype*Att_binary + logRT_prev + (1+sentype | subject) + (1+sentype*Att_binary | setnum), data = data.subject)

[2] model.verb <- lmer(logRT ~ sentype*Att_binary + logRT_prev + (1+sentype | subject) + (1+sentype*Att_binary | setnum), data = data.verb)

conditions in certain items. For this reason, the second experiment was preceded by a pre-test, as detailed below.

Since I found a significant difference between the conditions on the adjective, I suspected that the use of it may have confounded the effects later in the sentence. It is possible that the use of some of the adjectives caused a distraction for participants, therefore obscuring any subsequent differences in reading times. I therefore decided to create another experiment, this time using temporal adjuncts as a "barrier" between the head of the relative clause and the disambiguating embedded subject.

4. Experiment 2

4.1 Methods

4.1.1 Participants

36 people participated in the experiment (23 female), all native Hebrew speakers, with an average age of 25 (range 20-32). All participants had normal or corrected to normal vision. Participants volunteered for the study or were paid 20 ILS for their participation. Participants were split into the two groups using the AAS questionnaire. Participants were defined as High AAS if they scored above the median score (76.5), and Low AAS if they scored below it, resulting in 18 participants in each group.

4.1.2 Design and Materials

The experiment had a 3x2 design, crossing object RC head (inanimate, animate-human and animate-animal) and AAS score (high vs. low). The materials consisted of 21 sets of three sentences, using the same content words aside from the RC head, as can be seen in Table 3. All sentences had a three-word temporal adjunct, separated by commas, at the beginning of the relative clause.

Table 3: Example set for experimental conditions

1. **Animate human**

raiti et ha-gever ašer	hayom mukdam ba-boker	ha-calam cilem ba-hacer
I-saw the-man that	today early in-the-morning	the-photographer photographed in-the-yard
I saw the man that,	earlier this morning,	the photographer photographed in the yard

2. **Animate animal**

raiti et ha-para ašer	hayom mukdam ba-boker	ha-calam cilem ba-hacer
I-saw the-cow that	today early in-the-morning	the-photographer photographed in-the-yard
I saw the cow that,	earlier this morning,	the photographer photographed in the yard

3. **Inanimate**

raiti et ha-kufsa ašer	hayom mukdam ba-boker	ha-calam cilem ba-hacer
I-saw the-box that	today early in-the-morning	the-photographer photographed in-the-yard
I saw the box that,	earlier this morning,	the photographer photographed in the yard

As mentioned in the discussion of experiment 1, prior to compiling the materials for this experiment, a pretest was run to assess the perceived relatedness between the two nouns in the sentences. The pretest was run through Google Forms. Participants saw a list of noun pairs, such that each pair consisted of a possible relative clause subject and one of the nouns used as the head of the RC in experiment 1 (e.g. "man"-"photographer", "cow"-"photographer", "box"-"photographer"). Fifty-four participants were asked to rate how related they feel the nouns are on a 7-points Likert scale. Experimental materials for experiment 2 were then complied such that for each set, the three RC heads had similar relatedness score with the embedded noun. For example, the noun *old man* ("זָקֵן") was paired with *young lady* ("בחורה"), *donkey* ("חמור") and *oven* ("תנור"), which had relatedness ratings with it of 2.73, 2.8 and 2.48, respectively.

Each participant saw only one sentence from each set, using Linger's automatic Latin Square design. In addition to target sentences, 42 filler sentences were included. A third of the fillers featured human subjects, a third featured animal subjects, and a third featured inanimate subjects. Twenty-one filler sentences were SRCs (ex. "הערצתי את הרופאה אשר, במשך כל היום, טיפלה בפצועים מהתאונה") and 21 were sentences with complement

clauses with similar adjuncts (ex. "דיווחנו לזוג שאתמול בשעות הצהריים הכלב נמצא בפארק"), of similar length and syntactic complexity to the target sentences. Half of the filler sentences and half of the target sentences were followed by a comprehension question. The stimuli were randomized for each participant, with at least one filler sentence separating every two target sentences.

4.1.3 Procedure

The procedure was the same as in experiment 1.

4.2 Results

I analyzed the data with mixed-models regression using R, with Condition, Attitude and reading times of the previous word as fixed effects. I began with the full random effects structure (random intercepts and slopes for participant and item) for each analysis, and reduced the structure as needed to achieve convergence (the converging models are provided in footnotes).

Reading times for the relative clause subject and the subsequent verb are provided in Tables 4-5 and Figures 3-4, and word-by-word reading times for the entire sentence are provided in Figure 5.

Table 4: Mean RT (SD) for relative clause subject, Experiment 2

	Animate - Human	**Animate - Animal**	**Inanimate**
Overall	448.25 (252.96)	440.58 (213.16)	449.76 (238.41)
High AAS	473.7 (293.72)	457.41 (229.47)	470.72 (265.5)
Low AAS	421.3 (198.74)	422.77 (193.78)	427.57 (204.67)

Figure 3: Mean RT for relative clause subject, Experiment 2

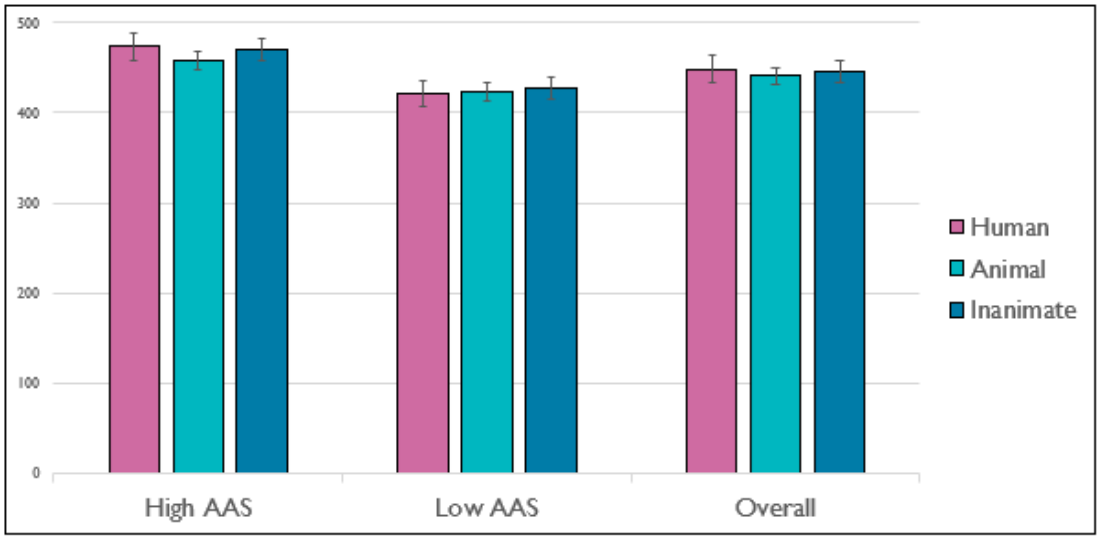


Table 5: Mean RT for spillover region (relative clause verb), Experiment 2

	Animate - Human	**Animate - Animal**	**Inanimate**
Overall	454.5 (214.86)	445.84 (192.7)	435.67 (169.42)
High AAS	471.87 (236)	459.06 (201.64)	455.52 (183.72)
Low AAS	436.1 (189.18)	431.84 (182.56)	414.66 (150.76)

Figure 4: Mean RT for spillover region (relative clause verb), Experiment 2

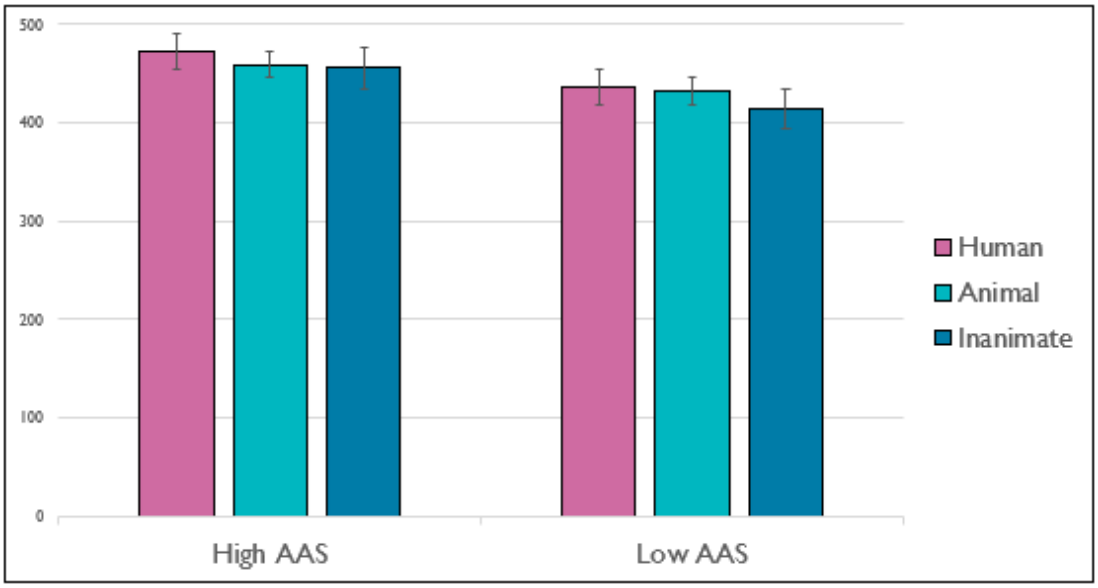
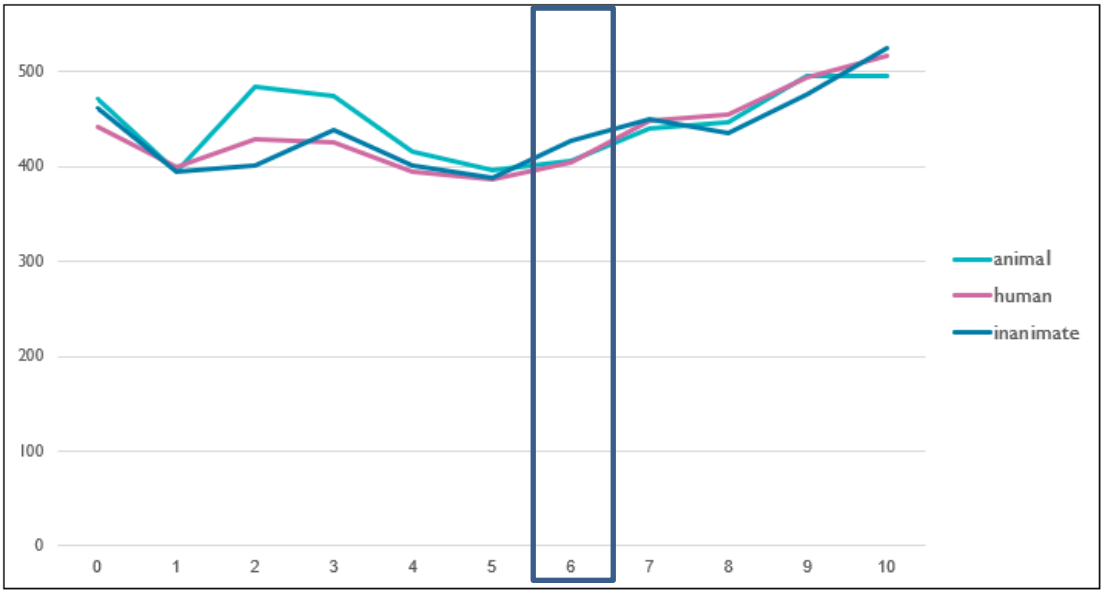


Figure 5: Word-by-word mean RTs, Experiment 2



raiti	et	ha-para	ašer,	hayom	mukdam	ba-boker,	ha-calam	cilem	ba-xacer
0	1	2	3	4	5	6	7	8	9

There were no main effects of Condition, Attitude, and no interaction either on the critical region or on the spillover. [3] [4]

Apart from the unsurprising difference in reading times on the relative head noun (since this word was different between conditions), visual inspection of the reading times suggested a possible effect of Condition in the last word in the adjunct (region 6), which is accompanied by the comma and directly precedes the relative clause subject position. Reading times for this region are presented in Table 6.

[3] model.subject4 <- lmer(log_RT ~ Condition*Attitude + log_RT_n.1 + (1 | Subject) + (0 + Condition | SetNum), data = data.subject)

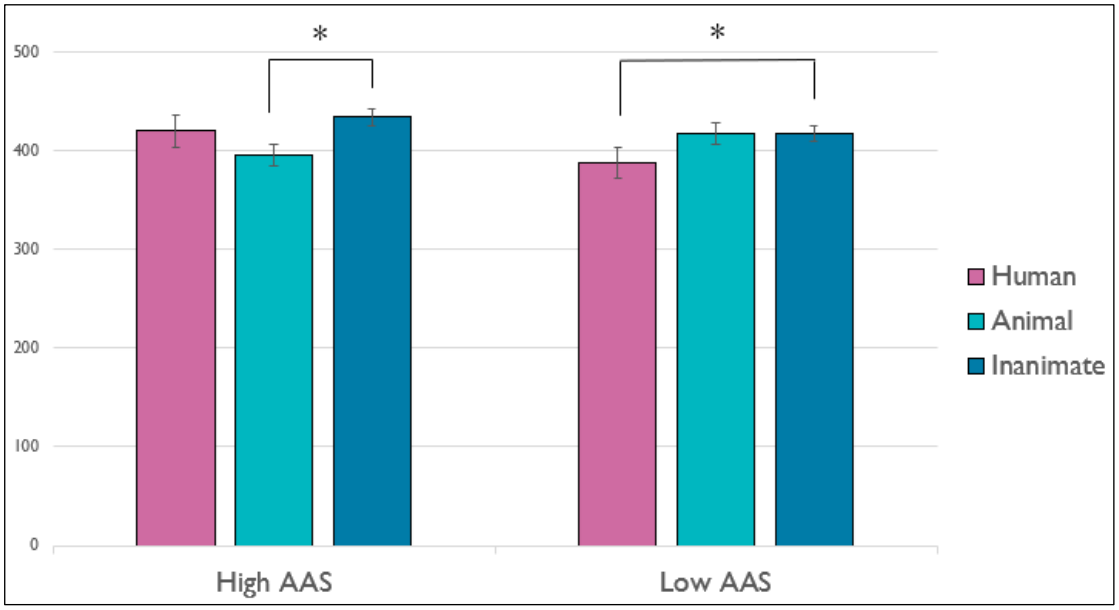
[4] model.verb <- lmer(log_RT ~ Condition*Attitude + log_RT_n.1 + (1+Condition | Subject) + (1+Condition*Attitude | SetNum), data = data.verb)

Table 6: Mean RT for the last word in the adjunct, Experiment 2

	Animate - Human	Animate - Animal	Inanimate
Overall	404.5 (184.2)	406.06 (186.24)	426.24 (195.36)
High AAS	420.13 (195.02)	395.6 (169.23)	434.2 (207.14)
Low AAS	387.93 (171.25)	417.15 (202.84)	417.82 (182.56)

In this region, a main effect of Condition ($p = .01$) was found.[5] Post-hoc comparisons revealed that the word was read significantly faster in the Animal and Human conditions relative to the Inanimate condition ($p = .021$ and $p = 0.04$, respectively). I also found an interaction between Condition and Attitude in this region ($p = .04$) such that the effect of Human vs. Animal was different in the High AAS vs. Low AAS group. In the High AAS group, the difference between Animal and Inanimate was found to be significant ($p = .001$) and the difference between Animal and Human was not significant ($p = .1$). In the Low AAS group, the difference between Human and Inanimate was significant ($p = .046$) and the difference between Animal and Inanimate was not significant ($p = .489$).

Figure 6: Mean RT for the last word in the adjunct, Experiment 2



[5] model.adjunct3 <- lmer(log_RT ~ Condition*Attitude + log_RT_n.1 + (1+Condition | Subject) + (1 | SetNum), data = data.adjunct)

4.3 Discussion

The reading times for the relative clause subject and verb positions did not show an effect of Condition. Therefore, I was again not able to replicate the effect from the literature, namely that ORCs with inanimate heads are easier to process than those with inanimate heads.

It should be noted that the studies quoted above, which have shown this effect, did not include an adjunct at the beginning of the relative clause. The addition of an adjunct, which was done in order to add distance between the RC head and its subject in an attempt to differentiate effects on the head from effects on the subject, may have ended up obscuring the distinction between the different animacy levels. In addition, the adjunct was preceded by the word *ašer* ("that"), which is not commonly used in spoken Modern Hebrew, and may have rendered the entire sentence less natural for readers and disturbed their processing in an unforeseeable way. In addition, I did not control for plausibility of the sentences, namely the pairing of the RC head and the RC verb, and so any possible effects may have been obscured or influenced by some sentences being more plausible to readers than others.

4.3.1 Numerical trends at the critical region and its spillover region

Although the effects on the subject and verb positions were not significant, I would like to discuss the numerical trends in the data. In the verb position, which indicates spillover effects from the subject position, there is a numerical trend which is in line with my predictions. Namely, the shortest reading times are for inanimate nouns, followed by animal nouns and finally the longest reading times for human nouns.

In the subject position, namely the critical region, the Inanimate and Human conditions were hardly distinct from one another, whereas the Animal condition showed numerically faster reading times compared to both. An examination of the mean reading times when comparing the participants based on their AAS scores shows a different trend for the two groups. For participants with High AAS, the trend is the same as in the entire sample, though the average difference between Inanimate and Human on the one hand and Animal on the other is slightly larger. For those with low AAS, the reading times for all three conditions are close together. This suggests that while there was no significant main effect for Condition, any trend in the direction of one is mostly a result of a difference in the High AAS group's reading times.

Naturally, as those differences were not found to be statistically significant, definite conclusions cannot be drawn from them. However, it is possible to assume that given a larger sample, these differences may become statistically significant. Such results would show that there is a difference in processing between people with High and Low AAS and that for all readers, different levels of animacy show an effect slightly later than expected, at the verb/spillover position.

4.3.2 Effects on the last word of the adjunct

Analysis of reading times on the last word of the adjunct was not planned and was carried out exploratorily following inspection of the data. Therefore, the discussion here should be read cautiously, as the results need to be replicated before they can be considered reliable.

Looking at the mean reading times for the last word of the adjunct, both a main effect for Condition and an interaction between Condition and Attitude were found. Since the last word of each adjunct was followed by a comma, thus clearly marking it as the end of an adjunct, it can be assumed that readers viewed it as an indication that the following word will be a return to the relative clause. This might have encouraged retrieval or reactivation of the filler in anticipation of having to integrate it into the upcoming clause, regardless of whether the reader anticipates a subject or an object relative clause. Any difference at this point could thus indicate the ease of retrieval, commonly associated with strength of the memory trace, its distinctness from other memory traces, and its activation level (e.g. Lewis & Vasishth, 2005). If the filler was accurately encoded and kept active, retrieving it will be faster. Indeed, it seems that the main effect found for Condition, namely that the inanimate condition elicited slower reading times at this position, could indicate that inanimate nouns are encoded and maintained more weakly than animate ones (both human and non-human). The significant interaction between Condition and Attitude found in this position indicates that not only were the fillers encoded and retrieved differently but that this difference was modulated by the reader's attitude towards animals. The High AAS group showed no significant difference between humans and animals, possibly indicating that they are encoded and maintained in a similar fashion. The Low AAS group, in contrast, showed a far from significant difference between animals and inanimates, indicating that those two are processed similarly. These two findings are in line with my expectations that there will be a

difference between the two groups, namely that readers from the High AAS group will process human and animal heads more similarly, while the Low AAS group will process inanimate and animal heads more similarly.

5. General Discussion and Future Research

ORCs were chosen for this study due the established finding of their relationship with animacy, namely that they are easier to process when their head is an inanimate entity. As such, I expected to find a significant effect on reading times of the relative clause subject that will reflect the readers' surprise that an animate entity is in fact the head of an ORC, not an SRC, or encoding interference due to a similar noun phrase. However, there was no effect found in this position or its spillover (the following verb), in either of the experiments. It should be noted that both experiments differed from previous work in several ways, some of which may have been relevant to the results and the lack of effect replication. In the works cited in the introduction, the relativized head and the RC subject always differed in animacy – meaning that the effect of relativized head animacy was not completely isolated in previous experiments – while in my experiments the subject was always animate, while the relativized heads differed. In addition, most experiments looked at different positions than I did, or at multi-word regions and not singular words. The different design, measurements, and the resulting comparisons, then, can be a reason, or one of several reasons, why other works showed significant effects, while the experiments described here did not.

It is possible that the adjective (in experiment 1) and the temporal adjunct (in experiment 2) that followed the RC's head, and were placed there in order to add distance between the relative clause head and its subject in an attempt to differentiate effects on the head from effects on the subject, created artifacts that prevented such an effect from manifesting. In addition, effects may have not arisen due to the use of the word *ašer* ('that'), which is not common in spoken Modern Hebrew and has possibly made the entire sentence seem unnatural to readers and disturbed their processing in ways I did not foresee. Plausibility of the RC head and RC verb being paired together was not controlled or assessed, which might have obscured possible effects if some pairings were more likely than others.

Another possible reason for the lack of replication might be that the use of a temporal adjunct (perhaps specifically one that is separated by commas) swayed readers' prediction towards ORC, though a small sentence completion experiment I ran after analyzing the results of experiment 2 did not support this explanation. The experiment offered sentence fragments consisting of a human, animal, or inanimate relative head, *ašer* ('that'), and a temporal adjunct with or without commas, and participants were asked to complete the sentence. In that experiment, participants almost always completed the sentences as SRCs, even those with inanimate heads which included adjuncts separated by commas. The few cases where they did complete them as ORCs were only for inanimate heads. The results of this experiment therefore do not explain the lack of effect for the Human and Animal conditions.

Finally, since the reading times for the verb in Experiment 2 did show a numerical trend in the proposed direction (with Animal between Human and Inanimate), it is possible that the effect does exist and would have been significant given a larger sample. Regardless of the reason for this artifact, any future research should take my experience into consideration when constructing materials.

As noted in the introduction, this research ventured into relatively unexplored territory in the study of animacy, attitudes and sentence processing. As such, the results and conclusions show only the tip of what could be explored and discovered. The fact that there were some significant findings shows that there is more to be learned about this topic, and with more research, more concrete ideas and theories could be constructed.

For any future research done in this field, I suggest examining sentence processing while looking both at a bigger variety of animals and at participants' more implicit characteristics when comparing their performance.

In terms of a bigger variety of animals, past research has shown that in general, people have different perceptions of different animals, and different attitudes towards them. People prefer animals which are biologically, behaviorally or cognitively similar to humans, resulting in a preference for mammals and birds over reptiles and invertebrates, and so it will be interesting to see if and how those different groups of animals effect the processing of sentences where they appear.

As for the participants themselves and how their experiences may affect their comprehension performance, I suggest two attributes to look at. First, some studies have found a relationship between pet ownership and attitudes towards animals in general, namely that it correlated with a more positive attitude towards animals and a care for their welfare. It seems worthwhile, then, to collect this data about any future participants and analyze the results with it in mind.

Second, it will be interesting to see if participants are active in advocating for animal rights in any way (and for how long), and if so, if that affects their language processing when animacy is manipulated. Indeed, von der Malsburg et al.'s (2020) work has shown that perceived likelihood of world events did not seem to influence production and comprehension. However, that study dealt with the immediate effect of current events on gender stereotypes that are life-long and notoriously hard to change, both implicitly (comprehension) and explicitly (production). It will be interesting to see if long, on-going active involvement in the animal rights movement has any relation to comprehension, as, differently from the elections study presented in the introduction, it involves opposing the prevailing world view on a regular basis. Being an animal rights activist might also be a better indicator of a deep change in cognitive processes than merely expressing your agreement with theoretical statements when prompted to do so.

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Appendix A – Animal Attitude Scale

זה לא נכון מוסרית לצוד חיות בר רק בשביל הספורט.
אני לא חושב/ת שיש משהו לא נכון בשימוש בבעלי חיים במחקר רפואי.
צריכים להיות עונשים נוקשים, כולל מאסר, לאנשים שמעורבים בקרבות תרנגולים.
חיות בר, כמו שועלים ודביבונים, לא צריכים להילכד ולא צריך לעשות מהם מעילי פרווה.
אין בעיה מוסרית עם צייד של חיות בר לצורך אכילה.
אני חושב/ת שאנשים שמתנגדים לגידול בעלי חיים לצורך אכילתם הם יותר מידי סנטימנטליים.
מרבית המחקר המדעי שנעשה עם בעלי חיים הוא מיותר ואכזרי.
אני חושב/ת שלגמרי מקובל לגדל בקר וצאן לצריכה של בני אדם.
בעקרון, לבני אדם יש את הזכות להשתמש בבעלי חיים כפי שאנחנו רואים לנכון.
הטבח של דולפינים ולווייתנים צריך להיעצר מיד, גם אם זה אומר שיהיו אנשים מחוסרי עבודה.
לפעמים אני נעשה/נעשית מוטרד/ת כשאני רואה חיות בר בכלובים בגני חיות.
באופן כללי, אני חושב/ת שרווח כלכלי של בני אדם חשוב יותר מהקצאת יותר שטח לחיות בר.
יש יותר מידי רעש סביב רווחת בעלי חיים בימינו, בזמן שיש הרבה בעיות אנושיות שצריך לפתור.
הרבעת בעלי חיים כדי להשתמש בעור שלהם היא שימוש לגיטימי בבעלי חיים.
ישנם אספקטים של ביולוגיה שניתן ללמוד רק דרך נתיחת בעלי חיים משומרים, חתולים למשל.
מחקר מתמשך עם בעלי חיים הכרחי כדי שנוכל יום אחד לרפא מחלות כמו סרטן, מחלות לב ואיידס.
זה לא אתי להרביע כלבים גזעיים כחיות מחמד כאשר מיליוני כלבים מומתים בכלביות כל שנה.
הייצור של מוצרי חלב, בשר וביצים לא יקרים מצדיק גידול בעלי חיים תחת תנאי צפיפות.
השימוש בבעלי חיים כמו ארנבים כדי לבדוק את הבטיחות של מוצרי קוסמטיקה וניקיון הוא מיותר וצריך להיעצר.
השימוש בבעלי חיים בקרקסים וברודאו הוא אכזרי.

Appendix B – Experiment 1 Materials

סט 1	זה הילד האלגנטי ש השכן סחב אל הגינה זה העץ האלגנטי ש השכן סחב אל הגינה זה הסוס האלגנטי ש השכן סחב אל הגינה
סט 2	זו הילדה המשונה ש הצָלַם צילם אתמול בצהריים זה הענף המשונה ש הצָלַם צילם אתמול בצהריים זו הפרה המשונה ש הצָלַם צילם אתמול בצהריים
סט 3	זו האישה הנמוכה ש הזָקֵן חיפש ליד הנחל זה השיח הנמוך ש הזָקֵן חיפש ליד הנחל זו הכבשה הנמוכה ש הזָקֵן חיפש ליד הנחל
סט 4	זה הגבר הגבוה ש הדייר הפיל היום בבוקר זה העציץ הגבוה ש הדייר הפיל היום בבוקר זה החזיר הגבוה ש הדייר הפיל היום בבוקר
סט 5	זה הבחור הצעיר ש הסדרן הרחיק מהשביל הראשי זה השִׁתִיל הצעיר ש הסדרן הרחיק מהשביל הראשי זה החמור הצעיר ש הסדרן הרחיק מהשביל הראשי
סט 6	זה התינוק המרתק ש העוזר הזיז לאיזור אחר זה הפרח המרתק ש העוזר הזיז לאיזור אחר זה העגל המרתק ש העוזר הזיז לאיזור אחר
סט 7	זו התינוקת הנאה ש המשרת העביר לחדר השני זה הפרי הנאה ש המשרת העביר לחדר השני זה הטלה הנאה ש המשרת העביר לחדר השני
סט 8	זו הבחורה הידועה ש המרואיין הילל כל הבוקר זה השיח הידוע ש המרואיין הילל כל הבוקר זו התרנגולת הידועה ש המרואיין הילל כל הבוקר
סט 9	זה הילד המוזנח ש המתלמד קירב אל הבית האדום זה השִׁתִיל המוזנח ש המתלמד קירב אל הבית האדום זה העגל המוזנח ש המתלמד קירב אל הבית האדום
סט 10	זו הבחורה המפורסמת ש המטייל הבחין בה לקראת הערב זה העציץ המפורסם ש המטייל הבחין בו לקראת הערב זה הסוס המפורסם ש המטייל הבחין בו לקראת הערב
סט 11	זה הבחור המשעמם ש הגולש ראה בחוף הים זה הענף המשעמם ש הגולש ראה בחוף הים זה החמור המשעמם ש הגולש ראה בחוף הים
סט 12	זה הגבר המטופח ש הדוור זכר מלפני שנים זה הדשא המטופח ש הדוור זכר מלפני שנים זה החזיר המטופח ש הדוור זכר מלפני שנים
סט 13	זו הילדה המֻוכֶּרת ש האספן זיהה מהתמונה בעיתון זה הפרי המֻוכָּר ש האספן זיהה מהתמונה בעיתון זה הטלה המֻוכָּר ש האספן זיהה מהתמונה בעיתון

סט 14	זו האישה הזקנה ש החשוד תיאר בפני הקהל זה העץ הזקן ש החשוד תיאר בפני הקהל זו הכבשה הזקנה ש החשוד תיאר בפני הקהל
סט 15	זו התינוקת היפה ש האמן צייר בשבוע שעבר זה העציץ היפה ש האמן צייר בשבוע שעבר זו התרנגולת היפה ש האמן צייר בשבוע שעבר
סט 16	זה הילד הגדול ש המורה הזכיר במפגש הקודם זה הִשְׁתִּיל הגדול ש המורה הזכיר במפגש הקודם זו הפרה הגדולה ש המורה הזכיר במפגש הקודם
סט 17	זה הגבר המוזר ש הקוסם חשב עליו לפני יומיים זה הפרי המוזר ש הקוסם חשב עליו לפני יומיים זה החמור המוזר ש הקוסם חשב עליו לפני יומיים
סט 18	זה התינוק העדין ש הנסיך פיסל בשיעור הראשון זה הפרח העדין ש הנסיך פיסל בשיעור הראשון זה הטלה העדין ש הנסיך פיסל בשיעור הראשון
סט 19	זה הבחור המיוחד ש הקבצן הביט בו במשך שעה זה השיח המיוחד ש הקבצן הביט בו במשך שעה זו התרנגולת המיוחדת ש הקבצן הביט בה במשך שעה
סט 20	זו הבחורה הנהדרת ש המציל החזיק מעל המים זה הפרח הנהדר ש המציל החזיק מעל המים זו הכבשה הנהדרת ש המציל החזיק מעל המים
סט 21	זו הילדה הקטנה ש האציל טיפח במשך חודשים זה הדשא הקטן ש האציל טיפח במשך חודשים זה העגל הקטן ש האציל טיפח במשך חודשים

Appendix C – Experiment 2 Materials

סט 1	ראינו את הגבר אשר, אתמול מאוחר בערב, השכן סחב לגינה ראינו את המטאטא אשר, אתמול מאוחר בערב, השכן סחב לגינה ראינו את התרנגול אשר, אתמול מאוחר בערב, השכן סחב לגינה
סט 2	ראיתי את הגבר אשר, היום מוקדם בבוקר, הצַלָם צילם בחצר ראיתי את הקופסא אשר, היום מוקדם בבוקר, הצַלָם צילם בחצר ראיתי את הַפָּרָה אשר, היום מוקדם בבוקר, הצַלָם צילם בחצר
סט 3	שמענו על הבחורה אשר, אתמול בשעות הצהריים, הזַקָן הפיל ברחוב שמענו על התנור אשר, אתמול בשעות הצהריים, הזַקָן הפיל ברחוב שמענו על החמור אשר, אתמול בשעות הצהריים, הזַקָן הפיל ברחוב
סט 4	שמענו על הילדה אשר, לפני חודש וחצי, הדייר חיפש בבית שמענו על התמונה אשר, לפני חודש וחצי, הדייר חיפש בבית שמענו על התרנגול אשר, לפני חודש וחצי, הדייר חיפש בבית
סט 5	קראנו על הבחורה אשר, לפני כמה ימים, הסדרן הרחיק מהשביל הראשי קראנו על הכרית אשר, לפני כמה ימים, הסדרן הרחיק מהשביל הראשי קראנו על הַפָּרָה אשר, לפני כמה ימים, הסדרן הרחיק מהשביל הראשי
סט 6	בחנתי את האישה אשר, לפני כמה שעות, העוזר הזיז לאיזור אחר בחנתי את התנור אשר, לפני כמה שעות, העוזר הזיז לאיזור אחר בחנתי את החמור אשר, לפני כמה שעות, העוזר הזיז לאיזור אחר
סט 7	קראתי על הגבר אשר, בשעות אחר הצהריים, המשרת העביר למקום אחר קראתי על הכיסא אשר, בשעות אחר הצהריים, המשרת העביר למקום אחר קראתי על התרנגול אשר, בשעות אחר הצהריים, המשרת העביר למקום אחר
סט 8	שאלתי על הבחורה אשר, אתמול בשעות הערב, המרואיין הילל כל השיחה שאלתי על המיטה אשר, אתמול בשעות הערב, המרואיין הילל כל השיחה שאלתי על הַטָלֶה אשר, אתמול בשעות הערב, המרואיין הילל כל השיחה
סט 9	תיארתי את הילדה אשר, לפני כמה שעות, המתלמד הכניס לתוך הבית תיארתי את הקופסא אשר, לפני כמה שעות, המתלמד הכניס לתוך הבית תיארתי את הַכְּבְשָׂה אשר, לפני כמה שעות, המתלמד הכניס לתוך הבית
סט 10	התלוננו על האישה אשר, שלשום בשעות הבוקר, המטייל הבחין בה בדרך התלוננו על הקופסא אשר, שלשום בשעות הבוקר, המטייל הבחין בה בדרך התלוננו על הַפָּרָה אשר, שלשום בשעות הבוקר, המטייל הבחין בה בדרך
סט 11	הסתכלנו על התינוקת אשר, לפני שבוע וחצי, הגּוֹלֵשׁ ראה בכפר הסתכלנו על המיטה אשר, לפני שבוע וחצי, הגּוֹלֵשׁ ראה בכפר הסתכלנו על העגל אשר, לפני שבוע וחצי, הגּוֹלֵשׁ ראה בכפר
סט 12	דיברתי על התינוק אשר, לפני כמה ימים, הדוור נזכר בו פתאום דיברתי על המיטה אשר, לפני כמה ימים, הדוור נזכר בה פתאום דיברתי על העגל אשר, לפני כמה ימים, הדוור נזכר בו פתאום
סט 13	הבטנו על הילד אשר, מוקדם יותר הבוקר, האספן זיהה מהעיתון הבטנו על הכיסא אשר, מוקדם יותר הבוקר, האספן זיהה מהעיתון הבטנו על הַכְּבְשָׂה אשר, מוקדם יותר הבוקר, האספן זיהה מהעיתון

סט 14	השגחתי על הבחורה אשר, שלשום בשעות הערב, החשוד תיאר לקהל השגחתי על השולחן אשר, שלשום בשעות הערב, החשוד תיאר לקהל השגחתי על הַחֲזִיר אשר, שלשום בשעות הערב, החשוד תיאר לקהל
סט 15	חיפשנו את הילד אשר, במהלך השבוע שעבר, האמן צייר בקורס חיפשנו את הכיסא אשר, במהלך השבוע שעבר, האמן צייר בקורס חיפשנו את הַכְּבָשָׂה אשר, במהלך השבוע שעבר, האמן צייר בקורס
סט 16	הצבענו על התינוקת אשר, לפני שבוע בערך, המורה הזכיר בשיעור הצבענו על המטאטא אשר, לפני שבוע בערך, המורה הזכיר בשיעור הצבענו על העגל אשר, לפני שבוע בערך, המורה הזכיר בשיעור
סט 17	שאלתי על התינוק אשר, לפני שלושה ימים, הקוסם שיבח באריכות שאלתי על התמונה אשר, לפני שלושה ימים, הקוסם שיבח באריכות שאלתי על הסוס אשר, לפני שלושה ימים, הקוסם שיבח באריכות
סט 18	שיבחתי את התינוק אשר, כבר בשיעור הראשון, הנסיך פיסל בהצלחה שיבחתי את הכרית אשר, כבר בשיעור הראשון, הנסיך פיסל בהצלחה שיבחתי את הסוס אשר, כבר בשיעור הראשון, הנסיך פיסל בהצלחה
סט 19	מצאנו את האישה אשר, במשך יותר משעה, הקבצן הביט בה מצאנו את השולחן אשר, במשך יותר משעה, הקבצן הביט בו מצאנו את התרנגול אשר, במשך יותר משעה, הקבצן הביט בו
סט 20	שמרתי על התינוקת אשר, במשך זמן רב, המציל הרים גבוה שמרתי על השולחן אשר, במשך זמן רב, המציל הרים גבוה שמרתי על הַחֲזִיר אשר, במשך זמן רב, המציל הרים גבוה
סט 21	איתרנו את הבחור אשר, במשך חודשים רבים, הָאָצִיל החביא בביתו איתרנו את הכרית אשר, במשך חודשים רבים, הָאָצִיל החביא בביתו איתרנו את הסוס אשר, במשך חודשים רבים, הָאָצִיל החביא בביתו

תקציר

עיבוד משפטים מתווך ע"י סוגי מידע שונים: תחבירי, סמנטי ופרגמטי. לאחרונה הועלו השערות לכך שגם לאמונות ולגישות של מקבל המסר ישנה השפעה על עיבוד משפטים בזמן אמת. במחקר זה בחנתי הצעה זו תוך הסתכלות על מאפיין ה-animacy של שמות העצם במשפטים. אחד האפקטים הרווחים בהקשר של animacy הינו שבעוד שזיקות מושא שראשן הוא שם עצם animate (1a) קשות יותר לעיבוד בהשוואה לזיקות נושא (1b), הקושי העיבודי מופחת כאשר ראש הזיקה הינו שם עצם inanimate (1c). ממצא זה הוסבר באמצעות היררכיית ה-animacy, לפיה שמות עצם animate מופיעים בדרך-כלל בעמדת הנושא ומפורשים כמבצעי הפעולה. כאשר מופיע נושא שונה בתוך פסוקית הזיקה בזיקות מושא עם ראש animate, נגרמת הפרעה בעיבוד.

(1) a. I like the employee [that the manager noticed ___]

b. I like the employee [that ___ noticed the manager]

c. I like the jacket [that the manager noticed ___]

לרוב מתייחסים להיררכית ה-animacy כמבחינה בין שלוש רמות לפחות – בני אדם, בעלי חיים שאינם בני אדם, ו-inanimates - הבחנה הבאה לידי ביטוי בדקדוק של כמה שפות (אך לא בעברית). עם זאת, מחקרים שבחנו את ההשפעה של animacy על עיבוד השתמשו רק בבני אדם כישות ה-animate.

במחקר זה, מטרתי הייתה להתחיל למלא את החלל הזה על-ידי בחינת ההשפעה של האבחנה בין בני אדם לבע"ח שאינם בני אדם על עיבוד בזמן אמת. ספציפית, רציתי לבדוק האם הנושא בזיקת מושא עם ראש שהינו בע"ח יעובד באופן דומה לנושא כאשר ראש הזיקה הוא בן-אדם או inanimate. בנוסף, בדקתי האם גישתו של הקורא כלפיי בע"ח, כפי שהוערכה ע"י Animal Attitude Scale (הרצוג ושות', 1991), נמצאת במתאם עם אפקטים עיבודיים אלו.

בניסוי 1, השוויתי בין זיקות מושא עם ראש אנושי, בע"ח ו-inanimate במטלת קריאה בקצב אישי. לא נמצאו אפקטים עיקריים על נושא הזיקה, כנראה בגלל ארטיפקטים מהמילים הקודמות במשפט, למשל התואר שצורף לשם העצם בעמדת הנושא.

בניסוי 2, החומרים שונו כך שתיאור/נספח זמן בן שלוש מילים הופיע בתחילת פסוקית הזיקה. גם כאן לא נמצאו אפקטים עיקריים בעמדת נושא הזיקה, כלומר לא הצלחתי לשחזר את הממצאים בספרות לפיהם animacy מווסת את העיבוד של פסוקיות זיקה. עם זאת, המילה האחרונה בפסוקית הזמן נקראה מהר יותר בתנאי בני-אדם ובע"ח בהשוואה לתנאי inanimate. בנוסף, הייתה אינטראקציה בין סוג ראש הזיקה לבין גישה, כך שעבור משתתפים בעלי AAS גבוה נמצא הבדל בין בע"ח לבין inanimate, בעוד עבור משתתפים בעלי AAS נמוך נמצא הבדל רק בין בני-אדם לבין inanimates. ממצאים עלו מספקים ראיות ראשוניות לכך שייתכן שישנו הבדל בעיבוד בזמן אמת בין שמות עצם שמייצגים בני-אדם לשמות עצם שמייצגים בע"ח, ושהבדל זה הינו בעל מתאם לגישת הקורא כלפיי בע"ח.

אוניברסיטת תל-אביב
הפקולטה למדעי הרוח ע"ש לסטר וסאלי אנטין
החוג לבלשנות

הנושא:

עיבוד משפטים ועמדות כלפיי בעלי חיים

חיבור זה הוגש כעבודת גמר לקראת התואר
"מוסמך אוניברסיטה" - M.A. באוניברסיטת ת"א

על ידי

נעה גלר

העבודה הוכנה בהדרכת:

פרופ' איה מלצר-אשר

תאריך:

ספטמבר 2020