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Cognitive animacy and its relation to linguistic animacy: evidence from Japanese and Persian

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ABSTRACT

Animacy, commonly defined as the distinction between living and non-living entities, is a useful notion in cognitive science and linguistics employed to describe and predict variation in psychological and linguistic behaviour. In the (psycho)linguistics literature we find linguistic animacy dichotomies which are (implicitly) assumed to correspond to biological dichotomies. We argue this is problematic, as it leaves us without a cognitively grounded, universal description for non-prototypical cases. We show that 'animacy' in language can be better understood as universally emerging from a gradual, cognitive property by collecting animacy ratings for a great range of nouns from Japanese and Persian. We used these cognitive ratings in turn to predict linguistic variation in these languages traditionally explained through dichotomous distinctions. We show that whilst (speakers of) languages may subtly differ in their conceptualisation of animacy, universality may be found in the process of mapping conceptual animacy to linguistic variation.

1. Introduction

Few cognitive distinctions are as salient as that based on animacy. Classifying an entity in the world as either living or non-living has direct consequences for the way we conceptualise it, and in turn its behavioural entailments and affordances – the way we predict it to act and the way we are expected or able to act upon it. A cognitive classification of animacy has been widely attested in a great number of studies in varying psychological and developmental domains. Perhaps not surprisingly, given its apparent cognitive relevance, a great number of the world's languages exhibit some effect of animacy (Dahl and Fraurud, 1996; Yamamoto, 1999; Vihman and Nelson, 2019).

But is animacy universal? The answer is contingent on the level of animacy examined. Linguistics has identified at least three relevant levels (de Swart and de Hoop, 2018; Bayanati and Toivonen, 2019) easily conflated as in our paragraph above: 1) biological, ontological or 'actual' animacy, the extent to which an entity is living or non-living according to certain biological criteria; 2) cognitive, semantic or construed animacy, the way we conceptualise the entity based on some notion of attributed 'animate' morphology or behaviour, and 3) linguistic or formal animacy, the ultimate grammatical reflection of the assumed cognitive animacy classification process.

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These three levels are crucially different in kind. Whilst a definition of biological animacy is no trivial matter (cf. e.g. Bedau and Cleland, 2010; Machery, 2012), the eventual outcome is presumably universal. As a physical property of entities in the world, biological animacy is universally fixed; that is, culturally and cognitively independent. Furthermore, biological animacy is traditionally dichotomous: a two-way distinction between living and non-living entities. Cognitive and linguistic animacy allow for considerably more variation, both in universality as in granularity. Cross-linguistic comparison has shown that linguistic animacy is not dichotomous, but follows an implicational hierarchy. Even in its most basic form, this hierarchy distinguishes at least three categories (e.g. Aissen, 2003; Croft, 2003; cf. Gardelle and Sorlin, 2018 for an overview):

(1) Human > animate > inanimate

As this cross-linguistic hierarchy cannot be a direct reflection of dichotomous biology, cognitive animacy has been proposed as an intermediate level. Like linguistic animacy, cognitive animacy is assumed to be governed by a gradual hierarchy. This hierarchy is best categorised as radial in nature, departing from the self as the prototypical animate (Yamamoto, 1999; Nelson and Vihman, 2018). Cognitive animacy is determined not by referential properties, but constructed or ascribed: 'animate' properties can be present in a given cognitive construct to varying degrees and are contextually dependent. As an example, many animacy effects in language are sensitive to criteria not inherent to the referent's biology: e.g. supernatural entities, vehicles, toys, natural phenomena and even simple geometric shapes are routinely ascribed some (degree of) animate properties such as agentivity, experience, motion or volitionality (Yamamoto, 1999; Dahl, 2008; Rosenbach, 2008; Lowder and Gordon, 2015; Nelson and Vihman, 2018) and gain linguistically animate expression as a result. This ascription can differ contextually: given the right contexts, non-human animals and even inanimate objects can receive linguistically human expression (Nelson and Vihman 2018; Trompenaars et al., 2018), to the extent that, *in extremis,* it makes more sense to speak of peanuts falling in love than being salted (Nieuwland and van Berkum, 2006). As such, cognitive animacy describes not how alive something is, but how 'alive' we consider it to be.

This allows for a great degree of personal, contextual and cultural flexibility in the cognitive dimension of 'animacy'. This flexibility complicates any claim we wish to make about its universality, as well as that of linguistic animacy by implication. We take, as a case study, the grammatical dichotomies present in Japanese existential verbs and Persian number agreement. These linguistic distinctions are naively explained in terms of (biological) animacy: living entities gain one type of expression, non-living entities gain another type of expression, as we find it traditionally described in prescriptive or L2 grammars. This explanation is appealing, since it maps a discrete grammatical dichotomy onto a discrete biological dichotomy. Furthermore, if indeed linguistic animacy were based on biological animacy, the universality of this explanation is also straightforward. Since biological animacy is inherent to the referent – and thus remains universally fixed – we can assume 'animacy' to be objective, and there should be no issues applying the same (dichotomous) notion of animacy cross-linguistically and cross-culturally as an explanatory factor for linguistic variation. If linguistic animacy is translated through a level of cognitive animacy, however, then the classification of specific nouns need not be universal or culturally independent, and applying the same concept universally becomes problematic.

This paper will examine the interface between cognitive and linguistic animacy, questioning the universal applicability of these notions. We first collect animacy ratings for a large set of nouns in two diverse languages, Japanese and Persian, to examine the content of cognitive animacy. Next, we test these cognitive ratings as predictors for linguistic variation traditionally associated with 'animacy'. Before we turn to our experimental results, we discuss animacy and detail the role it is argued to play in the languages under investigation.

1.1. Animacy as a cognitive and linguistic universal?

Is cognitive animacy universal? There are grounds to assume it might not be. As a measure of how alive we consider something to be, cognitive animacy is undoubtedly influenced by how alive something *is*, i.e., an objective, biological animacy that provides a universal starting point. However, cognitive animacy is more flexible, subject to additional influences that need not be universal, such as contextual or cultural considerations. For instance, pets and other domesticated animals are routinely expressed using linguistic constructions higher in animacy in a variety of languages (Yamamoto, 1999; Aissen 2003; Gardelle and Sorlin 2018; Kaiser, 2018), and one can imagine that different entities may be found in these categories cross-culturally. For instance, kangaroos, dogs and emus linguistically group with humans in the aboriginal language Ritharngu (Aissen 2003:456).

To complicate the picture further, one of these cultural influences may be linguistic animacy itself. Accidents of history or phonology can lead to languages linguistically classifying e.g. strawberries as inanimate and raspberries as animate (Anderson, 1997; de Swart et al., 2008). Since the interface between cognitive and linguistic animacy runs both ways, the single fact that a novel entity resembles an established entity that is linguistically classified as animate or inanimate can influence the categorization of the novel entity by analogy, or the single fact that an inanimate entity is expressed in a linguistically animate construction might make it cognitively animate in that instance (cf. de Swart 2014; de Swart and de Hoop, 2018), regardless of biological criteria. For example, assuming a linguistic influence on cognition, we would not be surprised to find raspberries rated higher in animacy than strawberries in some cultures whereas this difference is completely absent in others.

Typologically explaining grammatical variation by a limited, culturally biased and/or ad-hoc definition of animacy in one's first language is not without risk given this attested variation – what speakers from one culture consider to be alive need not be what a speaker from other culture considers to be alive –, and it seems sensible to first establish whether our notion of cognitive animacy is indeed universal before applying it universally. The content and universality of 'semantic' (cognitive) animacy ratings were explored by Radanović et al. (2016). Radanović et al. note that animacy is often treated as a universal, dichotomous factor in psychology research, and were interested in testing this assumption. They carried out an off-line subjective rating task on 72 Serbian and English nouns. The nouns denoted a variety of animate and inanimate categories, such as humans, animals, plants, vehicles, supernatural entities and objects, which they asked participants to judge on a 7-point Likert scale on 'how alive they were'. They obtained ratings in Serbian and English that were gradual, with no clear category boundaries between e.g. humans and non-human animals. They also found that 'lower animals' seem to consistently rank below humans and non-human higher animals. For these reasons Radanović et al. (2016) speculate that cognitive animacy ratings are codetermined by biological animacy as well as a 'linguistic' anthropocentrism – although it remains unclear why anthropocentrism should primarily be linguistic in nature. With regard to universality, they found that animacy ratings were highly correlated between the Serbian and English questionnaires. A limitation Radanović and colleagues note (2016: 1493) preventing them from making strong claims about universality is that English and Serbian are quite close linguistically, and, we would additionally argue, culturally. Our first study is aimed at gathering cognitive animacy ratings by replicating and expanding upon Radanović et al. (2016) in two additional, more distantly related languages: Persian (Indo-Iranian) and Japanese (Japonic), also making a within-language, between-culture comparison (Iranian speakers of Persian in Iran and Dutch-Iranian speakers of Persian in the Netherlands), to see what differences, if any, may be introduced by linguistic or cultural factors before claiming universality.

Armed with cross-linguistic ratings of cognitive animacy, we move on to the linguistic level of animacy in our second study. Persian and Japanese exhibit grammatical effects that are attributed to animacy, allowing us to directly relate ratings on cognitive animacy to linguistic variation. Attempts to explain linguistic variation with discrete, universal, and implicitly biological animacy scales inevitably run into category 'leakage': some obstinate referents do not adhere to their category expectations. We have already mentioned inanimate strawberries and animate raspberries; Aissen (2003:456) notes that in e.g. Yiddish, Differential Object Marking (DOM) is restricted to, but does not extend to the entire category of humans, and in Ritharngu, as mentioned above, DOM 'leaks' across the human-animate boundary where kangaroos, dogs and emus grammatically group with humans rather than other non-human animates. Explanations to account for this 'leakage' are forced to specify even more fine-grained discrete categorisations, and/or resort to cultural differences, and the universality is lost. Alternatively, novel analyses of the linguistic phenomenon might arise, which introduce factors to attenuate or even replace animacy as the explanatory variable. So too in Japanese and Persian. The linguistic dichotomies present in Japanese existential verbs and Persian number agreement are traditionally explained mostly in terms of biological animacy; we will discuss how exceptions to the biological dichotomy have led to more nuanced linguistic analyses which introduce additional factors. In our second study, we ascertained whether the analyses can be enriched by a better appreciation of the cognitive level of animacy instead. Specifically, we investigated the effects of cognitive animacy (as measured by our first study) on the linguistic dichotomies present in Japanese and Persian by means of grammatical acceptability studies, to explore both the universality of cognitive and linguistic animacy as well as the process by which cognitive animacy is translated into linguistic animacy. We will first discuss the effects of linguistic animacy in our target languages, Japanese and Persian, as these have been analysed in the literature, before turning to our cognitive rating and grammatical acceptability questionnaires.

1.2. Animacy in Japanese existential constructions

The Japanese existential construction distinguishes two existential verbs, *aru* and *iru*, which can enter into locative sentences. A generalization common to reference grammars and L2-materials (e.g. Banno et al., 1999:77; Maynard, 2011:102) is that the verbal distinction is based on the animacy of the referent: *iru* is used with animate subjects; *aru* with inanimate subjects, as illustrated by the locative constructions in (2) and (3).

(2)

kuruma	*no*	*naka*	*ni*	*okāsan*	*ga*	***iru***
car	GEN	inside	Loc	mother	NOM	EXIST

'There is a mother in the car.'

(3)

sōko	*no*	*naka*	*ni*	*hako*	*ga*	***aru***
warehouse	GEN	inside	Loc	box	NOM	EXIST

'There is a box in the warehouse.'

This distinction is also found in reference grammars, with slightly more nuance, where existence, possession and location are often discussed in conjunction. A thorough overview is available in Strauss (2008). Strauss (2008) cites Morita (1977), typifying *aru* as the verb used to denote the existence of (inanimate) objects in a location, but also notes the verb being used in possessive constructions, as in (4).

(4)

Nihon	*ni*	*wa*	*jiyuu*	*ga*	***aru***
Japan	LOC	TOP	freedom	SUBJ	EXIST

'Japan has freedom./There is freedom in Japan.'

Morita (1977) further states that animate referents can enter into this possessive construction with *aru*, but only if these 'exist in a strong relationship to the speaker such that it is impossible to break that relationship' (Strauss 2008:182). Strauss (2008) also discusses Kitahara (1984), which has *aru* as acceptable for animate referents provided these are indefinite, as in (5), and Mikami (1972), which treats *aru* as acceptable for animate referents when these denote no 'record of movement', as in (6).

(5)	*kiboosha*	*ga*	***attara***	*itsudemo*	*uketsukemasu*
	applicant	SUBJ	EXIST.COND	anytime	receive-POL

'If there are any applicants, I will accept them at any time.'

(6)	*oori*	*no*	*kata*	*wa*	***ari**mas-en*	*ka?*
	get.off	GEN	person	TOP	EXIST.POL-NEG	Q

'Is there anybody who wants to get off here?' (announced by a train conductor)

In contrast, *iru* is treated as applicable for existence only, in combination with volitional, sentient, prototypically animate subjects (Morita 1977). For inanimate subjects to occur with *iru*, Mikami (1972) argues they must be volitional, and Morita (1977) and Mikami (1972) argue they must be personified as being capable of movement (Strauss 2008).

Strauss' (1993; 2008) own cognitive account centres the definition of *aru* and *iru* not on existence, but on movement, associating *aru* with a lack of expected movement and *iru* with the expectation of movement. She tested this hypothesis using a rating study. Participants were asked to rate the acceptability of sentences including animate, inanimate and, specifically, inanimate vehicle nouns, which were completed with either *aru* or *iru*. She found that animate nouns combined almost exclusively with *iru*, unless conceptualized by participants as 'a thing', such as a crowd waiting at a bus stop. Inanimate vehicle nouns were sensitive to a potential for motion evoked by context: participants more readily accepted *iru* for a ship at sea or an elevator car between floors than they did for a yacht in port or an elevator entrance on a certain floor. Clearly, the biological animacy of the referent is an important factor determining the acceptability of *aru* and *iru*, but other cognitive considerations are relevant.

1.3. Animacy in Persian number agreement

Animacy is also held to play a role in Persian subject-verb agreement. Lazard (1992), in a contemporary grammar of Persian, notes that 'plural animate beings (having will or feeling)' combine with plural agreement, whereas 'inanimate beings (or things considered as inanimate)' combine with singular agreement. Mahootian (1997), in a descriptive grammar of Persian, describes the number agreement system as verbs agreeing with their subject on number and gender, but further notes that "[a]n important exception to subject–verb agreement is with inanimate plural subjects, which can take a singular verb" (Mahootian 1997:145). The optionality is exemplified by Mahootian (1997:136) in (7) and (8).

(7)	*chamedun-â*	*tu-ye*	*mâshin-e*
	suitcase-PL	in-EZ	car-COP.SG

'The suitcases are in the car.'

(8)	*chamedun-â*	*tu-ye*	*mâshin-**and***
	suitcase-PL	in-EZ	car-COP.PL

'The suitcases are in the car.'

Animacy effects on number marking are not exceptional typologically, with optional or absent plural marking, if such exists, typically possible only in combination with noun phrases towards the inanimate end of the scale (Comrie, 1989; Corbett, 2000).

Here too alternative or more nuanced explanations exist (cf. Bayanati and Toivonen, 2019 for an overview). As already noted by Lazard (1992), 'plural animate entities (having will or feeling)' may be contrasted with 'animate beings which are not conceived of as the agents of the process or as affected by it', the latter also optionally combining with singular agreement, hinting at an additional effect of Agency independent of the referent's biological status. Furthermore, Lotfi (2006) and Sharifian and Lotfi (2007) argue that plural agreement for inanimate noun phrases is not truly optional, but depends, amongst other factors, on the conceptualisation of the plural subject as more or less 'autonomous', i.e. whether its individual units are understood as carrying out the action denoted by the verb independently of each other or not. Sharifian and Lotfi (2007), in a variety of tasks, find that participants produce both singular and plural agreement with inanimate plural noun phrases, with the incidence of plural agreement increasing with autonomy and, indeed, with "inanimate subjects which share certain characteristics with animate ones" (Sharifian and Lotfi, 2007:800), such as clouds and boats moving in the absence of a visible Agent. Note that strikingly here too, as in the Japanese questionnaire by Strauss (2008), it is the ship at sea that exemplifies the more animate expression through its capacity for self-actualized movement.

2. Linguistic reflections of cognitive animacy

From the linguistic literature on the Japanese existential construction and Persian number agreement it is clear that an initial explanation purely in terms of biological animacy is indeed untenable. The more nuanced alternative explanations on offer show promising and striking similarities cross-linguistically, and are based on cognitive notions firmly related to animacy such as perceived capacity for motion, independence and agency.

If the cognitive animacy construct is informed by these properties, we would expect nouns possessing these properties to be rated higher on cognitive animacy, and for this effect to be reflected in corresponding gradually increasing acceptability ratings for 'animate' expressions including these nouns. To test this hypothesis, we first obtained measurements on the cognitive animacy of nouns by means of rating studies. The ratings were collected from three groups: Japanese speakers of Japanese (n = 40), Iranian speakers of Persian (n = 36), and Dutch-Iranian speakers of Persian (n = 47). We based the collection of nouns on a shared set of concepts adopted from Radanović et al. (2016). The cognitive animacy questionnaires will be discussed in Section 2.1. Next, we carried out two grammatical acceptability rating studies on simple sentences in Japanese and Persian. The cognitive ratings entered as predictors into these acceptability rating studies, with the (in)animate noun serving as the subject of simple sentences. The Japanese experiment explored the distinction between the *aru* and *iru* existential verbs; the Persian experiment explored the acceptability of singular verbal agreement with plural subjects. These acceptability rating studies are the topic of Section 2.2.

2.1. Experiment 1: cognitive animacy rating studies

2.1.1. Cognitive animacy–Japanese

2.1.1.1. Participants. 40 Japanese native speakers (22 female, mean age 31) were recruited, currently residing in Japan. Since we were interested in cultural conceptions, we asked participants about their cultural background and the number of years spent abroad. All participants identified exclusively or primarily as Japanese in terms of cultural heritage.

2.1.1.2. Materials. Seventy-two nouns by Radanović et al. (2016) were used as a basis for the cognitive rating studies in both languages. We expanded the Japanese list with 17 additional nouns adopted from Strauss (2008), including nine vehicle nouns to specifically explore the motion hypothesis in our subsequent experiment. We omitted three nouns from the combined questionnaire due to translation difficulties or overlap, for a total of 86.[2]

2.1.1.3. Procedure. The materials were implemented in an online questionnaire (Qualtrics, Provo, UT). After obtaining informed consent, collection of metadata, and a short introduction, all respondents were presented with all nouns in the set, and were asked to rate the nouns on a 7-point Likert scale, 1 being least animate and 7 being most animate. Animacy was defined to our participants in the instruction as (the translation equivalents of) 'living' and 'non-living'. An example question from the Japanese questionnaire is given in Fig. 1.

Fig. 1. Example rating question from the Japanese questionnaire. The noun *kappu* 'cup' is presented, to be rated between 最小有生性 'least alive' (1) and 有生性 'alive' (7).

Participants were first presented with a practice item (an inanimate, stationary noun not in the list), after which the items were presented one page at a time. The order of items was randomized per participant.

2.1.1.4. Results. The mean ratings for all nouns in all questionnaires are included in the Appendix. As a general pattern, human and animate nouns are rated above inanimate stationary nouns, with nouns referring to plants, lower animals and landscape features in the middle. No clear boundaries may be observed between the human and non-human animate nouns, or animate versus inanimate nouns. This pattern is best illustrated by the raw score counts, sorted by mean cognitive animacy ratings, in Fig. 2. The vehicle nouns adapted from Strauss (2008) consistently rank in the 2.2–2.6 range, which is slightly higher than more prototypical inanimate nouns.

[2] We omitted *raitaa* 'lighter', which in Japanese is ambiguous between 'lighter' and 'writer'. 'Queen' was omitted due to semantic overlap with 'empress' from Strauss (2008); 'girlfriend' as we were worried the Japanese *kanojo* 'girlfriend/she' might lead to ambiguities.

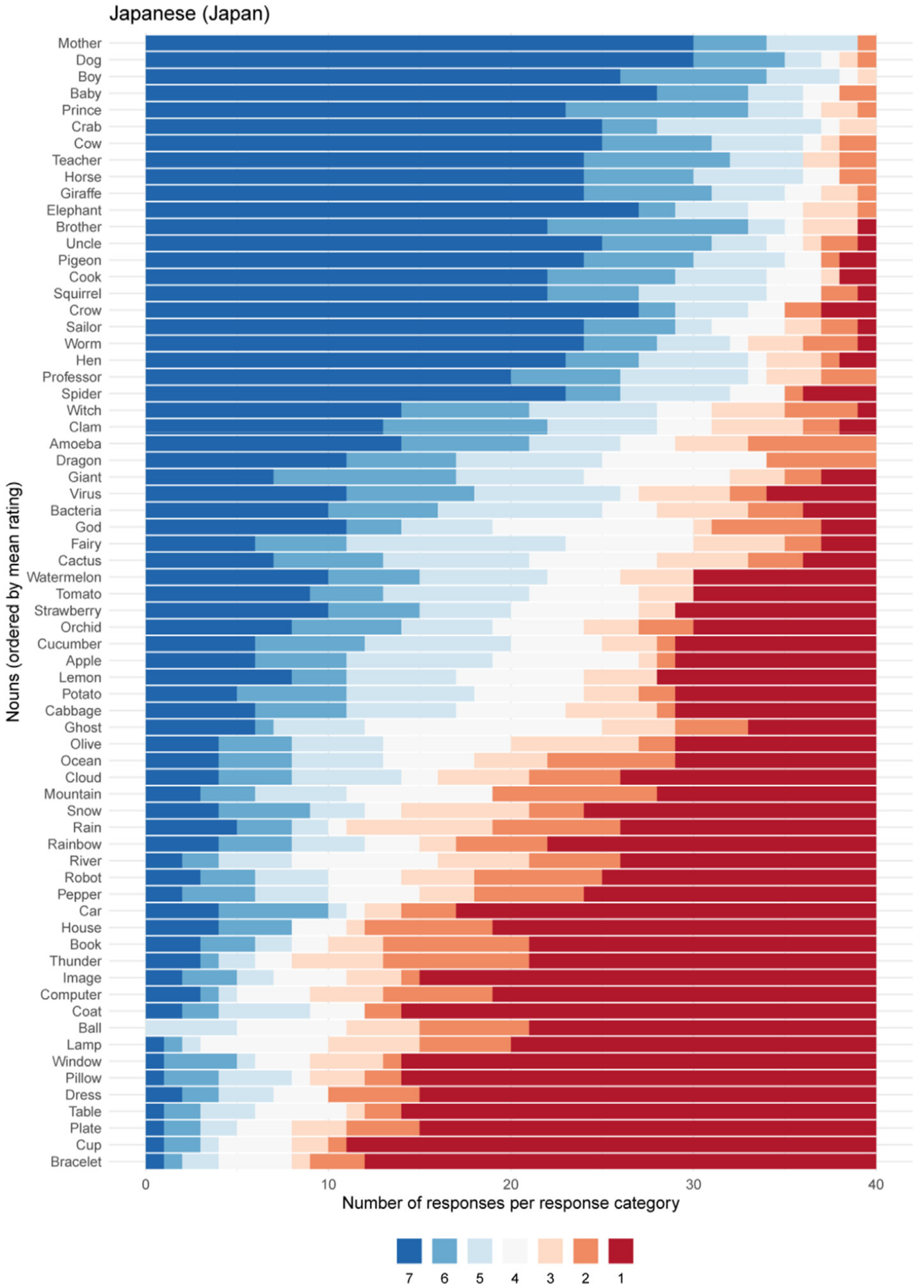

Fig. 2. Raw score counts for the Japanese nouns, on a 1–7 Likert scale, ordered by mean cognitive animacy rating. Mean ratings are available in the Appendix.

2.1.2. *Cognitive animacy–Persian*

2.1.2.1. Participants. 83 native speakers of Persian were recruited from two distinct backgrounds: 36 (18 female, mean age 29) Iranian native speakers of Persian and 47 (15 female, mean age 38) native speakers of Persian residing in the Netherlands. On average, participants had been in the Netherlands for 9 years [1–35 years].

2.1.2.2. Materials. Seventy-two nouns by Radanović et al. (2016) were used as a basis for the Persian questionnaire. One noun was omitted due to a mistranslation[3], for a total of 71.

[3] This concerned the noun ‘fly’, which was mistranslated as ‘flight’.

2.1.2.3. Procedure. The materials were implemented in an online questionnaire (Qualtrics, Provo, UT). After obtaining informed consent, collection of metadata, and a short introduction, all respondents were presented with all nouns in the set, and were asked to rate the nouns on a 7-point Likert scale, 1 being least animate and 7 being most animate. Animacy was defined to our participants in the instruction as (the translation equivalents of) ‘living’ and ‘non-living’. An example question from the Persian questionnaire is given in Fig. 3. Note that the direction of the scale is reversed from right to left to mimic the reading direction in Persian.

Fig. 3. Example rating question from the Persian questionnaire. The noun باران ‘rain’ is presented, to be rated between کاملا بی جان ‘completely alive’ and کاملا جاندار ‘non-living’.

Participants were first presented with a practice item (an inanimate, stationary noun not in the list), after which the items were presented one page at a time. The order of items was randomized per participant. We obtained mean ratings and standard deviations for all nouns.

2.1.2.4. Results. The mean ratings for all nouns in all questionnaires are included in the Appendix. Raw score counts are provided in Fig. 4. The pattern that emerges in both Persian questionnaires is very similar to that observed in the Japanese questionnaire: human and animate nouns are rated above inanimate stationary nouns, with nouns referring to plants in the middle. No clear boundaries may be observed between the human and non-human animate nouns, or animate versus inanimate nouns. These results will be discussed below.

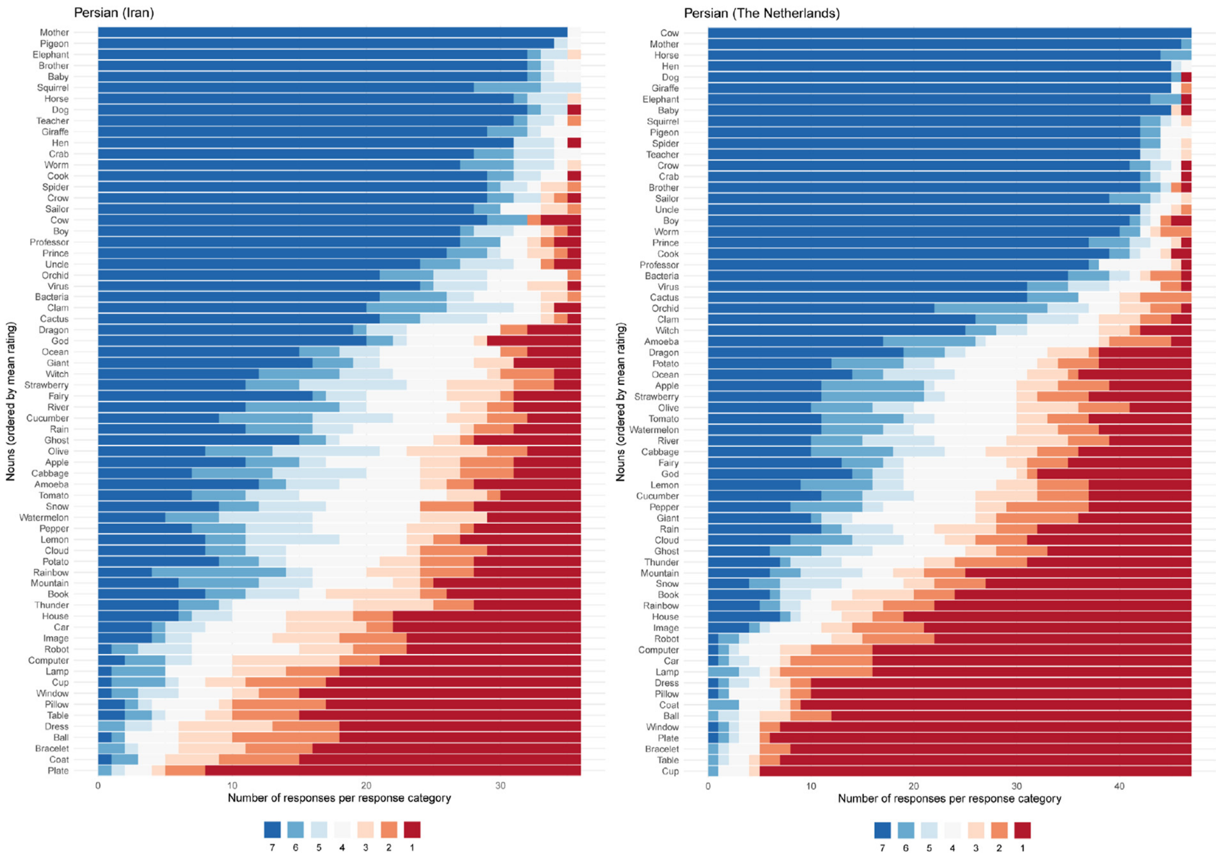

Fig. 4. Raw score counts for the Persian nouns, on a 1–7 Likert scale, ordered by mean cognitive animacy rating. Left: raw score counts for Iranian Persian speakers, right: raw score counts for Persian speakers residing in the Netherlands. Mean ratings are available in the Appendix.

2.1.3. General discussion

The questionnaires were designed to elicit cognitive animacy ratings for a set of nouns from Japanese speakers of Japanese, and Dutch-Iranian and Iranian speakers of Persian, in order to test whether cognitive animacy is best seen as a continuous variable, and to see whether cognitive animacy ratings can be considered to be universal.

With regards to the nature of cognitive animacy as a variable, the questionnaires show the expected difference between prototypical animates and prototypical inanimates, with human and higher animals at one pole and inanimate objects at the other. This would also be consistent with a classification based solely on biological criteria. However, as in Radanović et al. (2016), there is no clear cut-off point between the biologically animate and biologically inanimate ends of the scale; instead, we find a gradual decrease in biologically animate entities, with consistent patterns ranking 'higher' animals over 'lower' animals, with plants as the lowest rated, biologically animate entities. These results rule out a purely biological categorization, and are in line with e.g. Yamamoto (1999:14), noting that 'animacy' is entangled with anthropocentric cognition (see also Dahl, 2008): the further removed an animal is from human experience (the prototypical cognitive animate) – defined in terms of inferred consciousness, perceived ability to independently effect change, and capacity for motion – the less cognitively animate it will be construed to be. Our results show that this also holds for entities that are biologically inanimate: vehicles and machines, as well as natural and supernatural phenomena are ascribed ratings that are higher than other inanimate objects and thus might be closer to human experience. Note that the nature of a Likert-scale allows for gradual ratings, even for dichotomous phenomena. Is cognitive animacy a biological dichotomy then, producing gradual data as a result of task effects? Our results are not consistent with this hypothesis. The gradual ratings were internally consistent, i.e. whilst standard deviations are slightly higher for non-prototypical nouns as opposed to prototypical nouns, participants do generally agree on their ranking, even cross-linguistically. This suggests a consistent cognitive motivation underlying the granularity. Furthermore, the rankings are influenced by more than biology: entities that are biologically inanimate outrank entities that are biologically animate, as is the case for many supernatural entities. We return to this in the Discussion.

With regard to the universality of cognitive animacy ratings, Radanović et al. observe that their ratings in English and Serbian were highly correlated (2016:1493), noting that this is suggestive of universality given that they explored two different branches of the Indo-European language family. We can elaborate on these results with Persian (Indo-Iranian), a language from yet another branch of the Indo-European language family, as well as a completely unrelated language (Japanese, Japonic). Comparing the 66 overlapping nouns in both questionnaires we find a high correlation between the cognitive animacy ratings in Persian and Japanese ($r = 0.94$, 95% CI = [0.90, 0.96][4]). Furthermore, as Radanović et al. (2016) provide ratings for their nouns in Serbian and English[5], we were able to calculate the correlations between all four languages, see Table 1. Surprisingly, the original correlation reported by Radanović and colleagues between Serbian and English is actually the weakest amongst these, at $r = 0.88$, 95% CI = [0.82, 0.93]. We follow Radanović et al. (2016) cautioning against interpreting these correlations as indicative proof of the universality of cognitive animacy, but evidence from two additional languages, linguistically and culturally farther removed, does lend further credence to this hypothesis.

Table 1
Pearson's correlation coefficients for ratings of cognitive animacy by language, with 95% confidence intervals.

	Persian	Serbian	English
Japanese	0.94 [0.90–0.96] $t\,(66) = 22.14$	0.91 [0.85–0.94] $t\,(66) = 17.34$	0.97 [0.96–0.98] $t\,(66) = 34.54$
Persian		0.93 [0.89–0.96] $t\,(66) = 20.51$	0.93 [0.88–0.95] $t\,(66) = 19.80$
Serbian			0.88 [0.82–0.93] $t\,(66) = 15.42$

We do find subtle differences in cognitive animacy ratings between all questionnaires. In certain cases, these differences seemingly invite a cultural explanation. We note for instance that supernatural entities such as 'giant', 'God' and 'ghost' were rated higher by Persian speakers in Iran as opposed to Persian speakers in the Netherlands, who conversely considered the typically Dutch 'cow' and 'potato' to be more animate than did Persian speakers in Iran. We can speculate about the relevance of such distinctions, but we caution against over-interpretation: certain patterns that might be expected based on cultural influences did not obtain, and spurious patterns can be identified that have no obvious cultural link. In general, cross-cultural agreement is quite high, and we leave the exploration of specific exceptions to further research.

2.2. *Experiment 2: grammatical acceptability studies*

The cognitive ratings we collected in the first experiment were entered into the second experiment. Here, we used the cognitive ratings to predict the acceptability of the linguistic variation observed with the Japanese existential verbs and Persian number agreement in two additional questionnaire studies, to explore the universality of linguistic animacy distinctions as resulting from a cognitive evaluation of animacy.

[4] We supply 95% Confidence intervals for all correlations reported. P-values are less informative in this case since we are not interested in testing the null-hypothesis that no correlation exists.

[5] Radanović et al. (2016) provide ratings in English that appear to range from 1 to 100. The reason for the discrepancy is not supplied in the paper, but may explain the smaller correlation.

2.2.1. Grammatical acceptability–Japanese

The grammatical variation chosen for the Japanese participant group is the Japanese existential verbs in locative constructions. We constructed simple locative sentences using the rated nouns as subjects, ending in either *aru* or *iru*, presented counterbalanced to participants to be rated on a 1–7 acceptability scale.

2.2.1.1. Participants. 60 native speakers of Japanese (38 female; mean age 24) were recruited, currently residing in Japan. The participants identified exclusively or primarily as Japanese in terms of cultural heritage, and had not participated in the first study.

2.2.1.2. Materials. We selected 32 nouns pseudo-randomly from the rating study, sampled at regular intervals based on the cognitive questionnaire rankings, and such that all categories (i.e. nouns referring to human beings, higher and lower animals, vehicles, natural and supernatural phenomena, plants, and objects) were represented. These were embedded as the subject in *ni*-locative sentences, e.g. (9) and (10).

(9) *kuruma* *no* *naka* *ni* ***okāsan*** ***ga*** *aru/iru*
car GEN inside LOC mother NOM be
'There is a mother in the car.'

(10) *sōko* *no* *naka* *ni* ***hako*** ***ga*** *aru/iru*
warehouse GEN inside LOC box NOM be
'There is a box in the warehouse.'

The locative sentences were completed with *iru* or *aru*. We used the basic dictionary forms of these verbs instead of the polite forms, since these are the most common in written language and daily conversation. The word order in Japanese locative sentences is flexible between an order that places the subject before the location (SL), and one that places the location before the subject (LS). We opted for the LS-order as this is the most frequent and unmarked form (Han, 2013), and has the additional advantage of minimizing the syntactic distance between the noun and the verb.

2.2.1.3. Procedure. The sentences were implemented in an online questionnaire (Qualtrics, Provo, UT). Participants saw the sentences in random order, one sentence per page. The participants saw half the sentences completed with *iru*, half with *aru*, and this was counterbalanced between participants such that all participants saw all sentences and all combinations of sentences and verb were present equally throughout the experiment. We obtained informed consent and metadata, after which participants were provided with a short instruction. We asked the participants to rate the sentences on grammaticality, asking them not to focus on the meaning of the sentences but phrased as 'how natural or acceptable do you think this sentence is according to the rules of the Japanese language'. Participants were asked to rate the sentences on a 7-point Likert scale between 1 ('unacceptable') and 7 ('completely acceptable'). The experiment started with a practice sentence including an animate noun not in the set, completed with (the grammatical) *iru*.

2.2.1.4. Results and discussion. We obtained mean ratings and standard deviations for all sentences. Participants made full use of the scale, with mean acceptability ratings for *aru* sentences between 1.4 and 6.9 and acceptability ratings for *iru* sentences between 1.3 and 6.7.

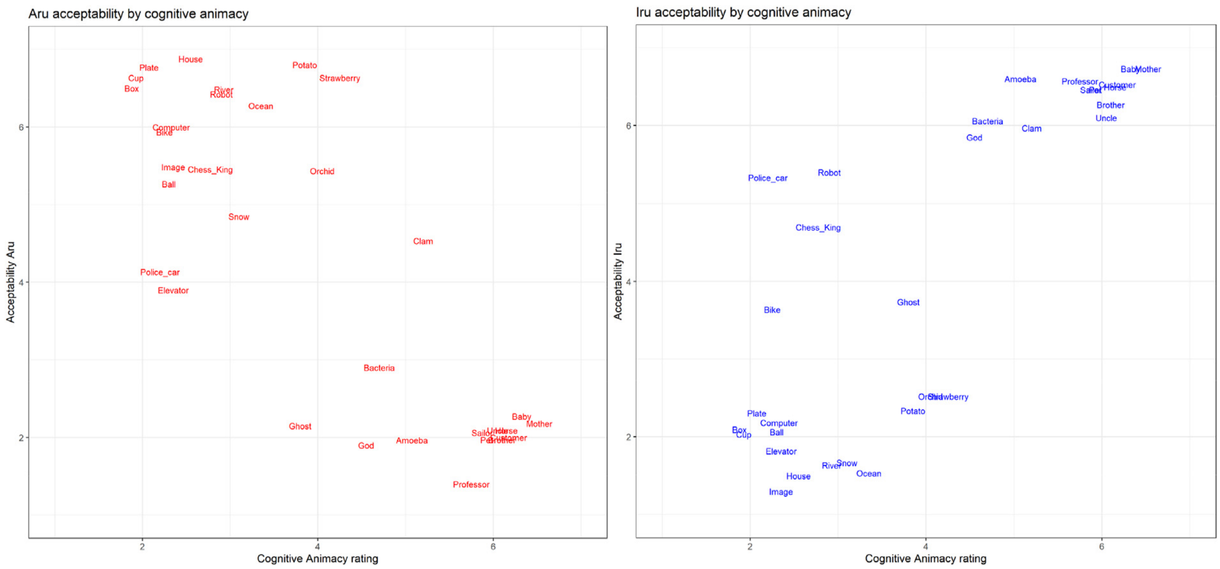

Fig. 5. Mean grammatical acceptability of Japanese *aru* (left) and *iru* (right) existential verbs in relation to the mean cognitive animacy ratings obtained in the first questionnaire. Acceptability of *aru* decreases with cognitive animacy ratings; acceptability of *iru* increases.

The results are given in Fig. 5. We found clear correlations between the first questionnaire's cognitive animacy ratings and the acceptability of the existential verbs *iru* ($r = 0.82$, 95% CI = [0.65, 0.91]) or *aru* ($r = -0.81$, 95% CI = [-0.90, −0.64]). As predicted, *iru* is more acceptable with nouns rated high on cognitive animacy; *aru* is more acceptable in combination with nouns rated low on cognitive animacy, as indicated by the strong clustering at the poles. This result is in line with the traditional animacy division we find in descriptive and teaching grammars (e.g. Morita, 1977; Maynard, 2011; Banno et al., 2011). Our results are also suggestive of an orthogonal dimension of motion, in line with Strauss (1993; 2008). Acceptability of *iru* with inanimate nouns increases when the inanimate noun is perceived to be capable of movement. This is demonstrated by several notable exceptions from the animacy correlation, such as 'robot', 'police car' and 'chess king'. Acceptability of *aru* with inanimate nouns shows a corresponding decrease as capacity for motion increases, e.g. in 'elevator' and 'police car'. Conversely, *aru* is more acceptable with animate nouns when these denote animals not easily conceptualized as moving, such as 'clam', or with nouns referring to plants and vegetables, as in 'orchid', 'strawberry' and 'potato'.

2.2.2. Grammatical acceptability–Persian

The grammatical construction chosen for the Persian participant groups was verbal number agreement. We constructed simple sentences using the rated nouns as grammatical subjects, with finite verbs with either singular of plural agreement, presented counterbalanced to participants to be rated on a 1–7 acceptability scale.

2.2.2.1. Participants. For the verb agreement task, 243 native speakers of Persian were recruited from two distinct backgrounds: 64 (29 female, mean age 34) Iranian native speakers of Persian and 179 (97 female, mean age 39) native speakers residing in the Netherlands. None had participated in the first study.

2.2.2.2. Materials. We selected 40 nouns pseudo-randomly from the rating study, sampled at regular intervals based on the cognitive questionnaire rankings, and such that all categories were represented. The plural forms of the respective nouns were embedded in simple intransitive sentences. These were either completed with plural or singular verb agreement, e.g. (11) and (12). Recall that animacy is expected to have an effect on the acceptability of the *singular* verb ending. Plural verb endings – which should in principle always be grammatical with plural subjects – were added to control for the acceptability of the sentence as a whole and to encourage participants to use the full range of the scale.

			/		
(11)	*mâdar-â*	*xâbid-and*	/	*mâdar-â*	*xâbid*
	mother-PL	slept-3PL		mother-PL	slept.3SG
	'The mothers slept.'			'The mothers slept.'	
(12)	*lâmp-â*	*terekid-and*	/	*lâmp-â*	*terekid*
	lamp-PL	burst-3PL		lamp-PL	burst.3SG
	'The lamps burst.'			'The lamps burst.'	

2.2.2.3. Procedure. The sentences were implemented in an online questionnaire (Qualtrics, Provo, UT). Participants saw the sentences in random order, one sentence per page. The participants saw half the sentences with singular verb agreement and half the sentences with plural verb agreement, and this was counterbalanced between participants such that all participants saw all sentences and all combinations of sentences and verb agreement were present equally throughout the experiment. We obtained informed consent and metadata, after which participants were provided with a short instruction. We asked the participants to rate the sentences on grammaticality, asking them not to focus on the meaning of the sentences but phrased as 'how natural or acceptable do you think this sentence is according to the rules of Persian'. Participants were asked to rate the sentences on a 7-point Likert scale between 1 ('unacceptable') and 7 ('completely acceptable'). The experiment started with a practice sentence including an animate noun not in the set, completed with (the grammatical) plural.

2.2.2.4. Results and discussion. The mean acceptability ratings of the sentences containing plural verb agreement were generally very high (Iranian mean = 6.2, Dutch mean = 6.3)[6]. This is in line with the literature (e.g. Mahootian, 1997): plural verb agreement is always acceptable with plural subjects, regardless of the subject's animacy. Looking at the acceptability of

[6] The -*hâ* in Persian *aždahâ*, 'dragon', is isomorphic to the plural morpheme in our other nouns. As such, the singular form was mistakenly used instead of the proper plural *aždahâyân* 'dragons'. Unsurprisingly, the sentences with the singular verb form were more acceptable than those with the plural as a result. The item is omitted from the data analyses.

singular agreement, we find that acceptability varies (Iranian 1.3–4.6, mean = 3.1; Dutch 1.5–4.7, mean = 3.0), indicating that even with inanimate subjects, participants generally preferred plural agreement. We do find the expected effect of cognitive animacy here too, however: singular agreement was relatively more acceptable with entities that ranked lower on cognitive animacy, for both participant groups, as shown in Fig. 6.

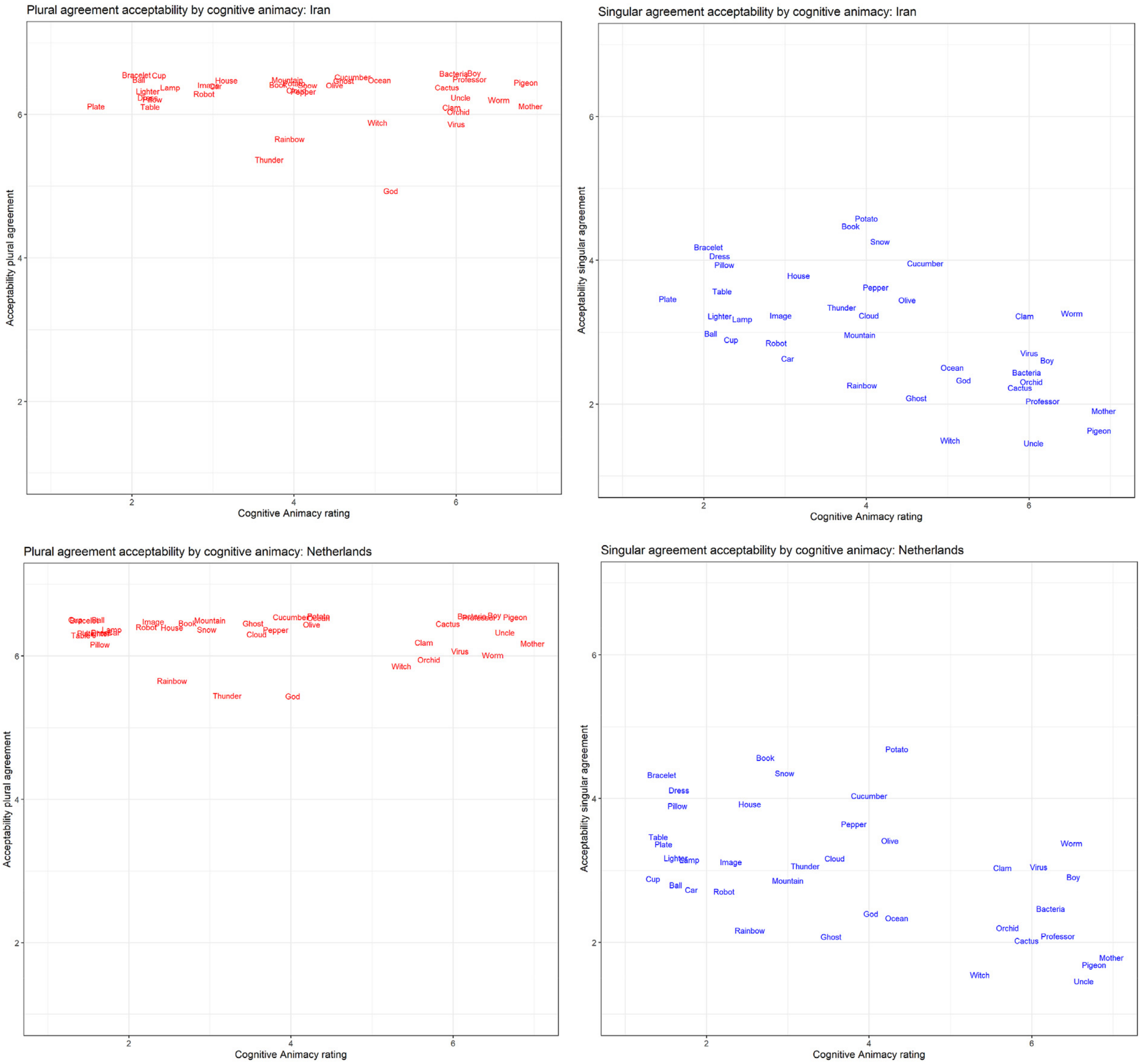

Fig. 6. Mean grammatical acceptability of plural (left) and singular (right) verb agreement with plural subjects in Persian in relation to the mean cognitive animacy ratings obtained in the first questionnaire, split by Iranian speakers of Persian (top) and Dutch-Iranian speakers of Persian (bottom). Acceptability of the plural is generally very high, singular agreement acceptability decreases as cognitive animacy ratings increase.

Given the generally high acceptability of the sentences with plural agreement, we subtracted the acceptability ratings in the singular condition from those in the plural condition, to abstract away from the acceptability of the meaning of the sentence. The difference in acceptability increased with cognitive animacy (Iranian $r = -0.54$, 95% CI = [0.73, 0.27]; Dutch $r = 0.51$, 95% CI = [0.71, 0.22]), indicating that singular agreement is decreasingly optional, as presented in Fig. 7.

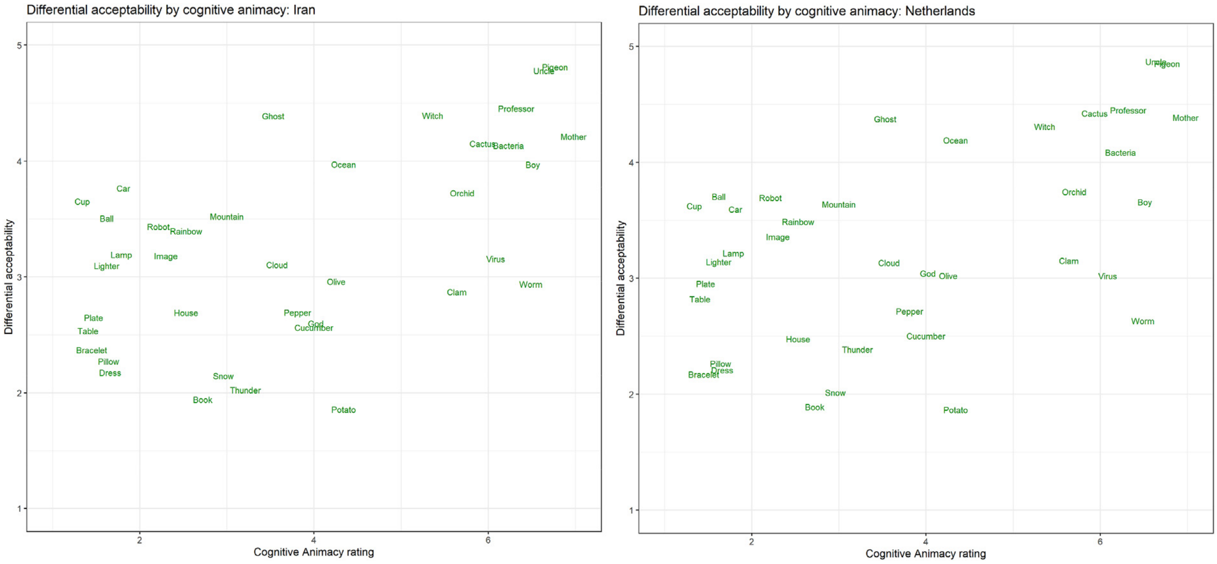

Fig. 7. Differential acceptability ratings, i.e. the grammatical acceptability ratings for the singular subtracted from the plural. The difference in acceptability between plural and singular increases with mean cognitive animacy ratings. This indicates that verbal number agreement becomes less optional with plural nouns as these are higher rated on cognitive animacy.

2.2.3. General discussion

In our second set of questionnaires, we set out to test to what extent linguistic variation can be informed by cognitive animacy. In Japanese, we investigated a linguistic dichotomy: the existential verb used was either *aru* or *iru*. We found that acceptability is predicted very well by cognitive animacy: the acceptability of *aru* decreased with cognitive animacy ratings, and the acceptability of *iru* increased with cognitive animacy ratings. In Persian, plural agreement should in principle always be grammatical with plural noun phrases, and we investigated the *optionality* of singular agreement. In this regard the Persian experiment was asymmetrical whereas the Japanese experiment was symmetrical, but here too we found a clear correlation with our cognitive animacy ratings: the optionality of number agreement increased as the cognitive animacy ratings decreased. Combined, we observe that a symmetrical linguistic dichotomy in Japanese as well as an asymmetrical linguistic optionality in Persian are both sensitive to a fine-grained, gradient rating of 'how alive something is', indicating that cognitive animacy functions as a predictor for linguistic variation.

Also common to both languages is a certain tension between biological animacy on the one hand and more orthogonal dimensions of cognitive animacy on the other. In Japanese, we find reflections of the patterns observed by Strauss (2008): the biologically inanimate 'police car' deviates positively from the general trend in its rating on *iru*. Conversely, the biologically animate but stationary 'clam' deviates positively in its rating on *aru.* Nevertheless, our results do not suggest implied or potential motion is the *primary* cognitive factor underlying the distinction, as evidenced by e.g. the acceptability ratings for vehicles such as the police car being lower than those of animate entities not as easily conceptualised as moving, such as clams, bacteria or amoebae. The tension between purely biological animacy and the acceptability of linguistically animate expressions also becomes clear when we consider supernatural entities. When asked to judge the animacy of ghosts, witches and gods in the cognitive rating questionnaires, ratings clustered towards the centre of the scale: supernatural entities are not considered to be 'alive' to the same extent as humans and animals, in certain cases rated even below plants. In terms of behaviour, however, these entities are very similar to (human) animates: a supernatural entity is construed as a human-like, conscious actor. This is reflected in their preference for grammatically animate expressions: supernatural entities combined more readily with *iru*, and resisted expressions with *aru* or the optionality of singular agreement.

3. Discussion

The results of our cognitive rating tasks show that people readily produce a gradient scale when asked 'how alive something is'. Whilst this is to be expected given the gradual nature of our task, we did not find a clear biological animate-inanimate split, or one between e.g. plants and vehicles, whilst we do find consistent differential rankings within both biologically animate and inanimate categories. As biological animacy is a dichotomous variable – an entity either is or is not alive – these results demonstrate that biological animacy *per se* is a poor predictor of cognitive reality. In addition, there was a great deal of consistency in cognitive animacy ratings cross-linguistically. This suggests that both the graded nature of the animacy scale as well as the place entities take on this scale are at least somewhat universal, in further support of Radanović et al. (2016), though we were also able to detect subtle differences. The extent to which these are culturally determined we leave to future research.

To what extent cognitive animacy can reliably predict linguistic variation was subsequently tested in two acceptability rating studies on simple sentences in Japanese and Persian. The cognitive ratings entered as predictors into these acceptability rating studies, with the nouns serving as the subject of simple sentences. The cognitive ratings predicted the variation in linguistic expression fairly well. Nouns with low animacy ratings are acceptable with *aru* in Japanese, and plural nouns with low animacy ratings are more acceptable with singular agreement in Persian.

Taken together, our results are in line with an understanding of animacy along distinct levels (de Swart and de Hoop, 2018; Bayanati and Toivonen, 2019). Animacy, as expressed in language, is not a binary factor that directly maps universal biology to formal linguistic constructions. Instead, the 'animacy' expressed in language is a fine-grained cognitive, gradient scale (Fraurud, 1996; de Swart and de Hoop, 2018). Exploring the content of this cognitive scale, we found a gradual ranking that is largely similar cross-linguistically. Despite residual cross-linguistic and cross-cultural differences, however, universality may be found in the *mapping* of cognitive animacy to linguistic animacy. In other words, even though the answer to the question of how 'alive' an entity is might not necessarily be completely universal, the answer given by speakers of a language does correlate very well to the acceptability ratings associated with certain, disparate linguistic phenomena in those languages.

The correlation between our cognitive animacy ratings and the acceptability of the linguistic constructions was not perfect, illustrating the difficulty in measuring the cognitive animacy construct indirectly through linguistic means. In our first task, we inferred cognitive animacy by asking participants to judge based on the denotation of nouns in isolation. Here, participants presumably employed some notion of biology to place plants and vegetables above artefacts. This did not increase the preference of these nouns for linguistically animate constructions, however, revealing aspects of cognitive animacy beyond those we could gather by asking 'how alive' the noun is, such as e.g. motion in the case of the Japanese existential verbs, in line with Strauss (1993; 2008), or higher linguistic propensity for Patienthood in the case of edible parts of plants. Biological and linguistic animacy are also sharply contrasted in the case of supernatural entities. The cognitive rating task was disproportionately penalizing to ghosts, witches and gods: these are not denotationally animate in a biological sense since they are inherently outside of any biological classification, yet they are cognitively construed as being capable of behaviour that closely reflects (human) animates, which drives their preference for linguistically animate expression. We suggest that our first task may have been more sensitive to the biological aspect of animacy, whilst the second task, including verbs as well as nouns, may have put more emphasis on (cognitively animate or inanimate) behaviour.

It is striking and exemplary that descriptive grammars and L2 materials for both Japanese and Persian put a heavy explanatory burden on (biological) animacy as the determinant of the observed grammatical variation, and we believe this reveals a powerful cognitive bias. Faced with two constructions, one dominated by living beings and one dominated by non-living objects, it seems self-explanatory to link the two binary factors together: biological animacy determines linguistic animacy. Subsequent (linguistic) studies will then take this double dichotomy as given, and explore its exceptions to reveal additional factors at play. For Strauss (1993; 2008), it was the observation that inanimate vehicles could combine with the 'animate' *iru* when personified or possessing a record of movement that caused her to propose motion as a candidate for the underlying cause of the observed grammatical dichotomy. For Lotfi (2006), it was autonomy, specifically autonomous motion, which seemingly influenced the supposed optional plural agreement within the class of inanimates. Common in these and other accounts (cf. Lowder and Gordon, 2015) are suggestions to supplement or supplant the role of biological animacy in determining grammatical expression, implicitly accepting the premise of the double dichotomy: 'inanimates', meaning biologically non-living entities, the argument goes, can still enter into 'animate' grammatical constructions when they become more like biologically living entities. Alternatively, the animacy premise is rejected altogether when the biology does not match the linguistic expression. As an example, we find illustrative quotes like the following: "While many cognitive and linguistic phenomena have been cited as showing the importance of animacy, *animacy per se may not be the critical factor*. Natural forces are semantically inanimate (nonliving), but behave in ways that are more similar to animates than inanimates in that they are able to initiate movement, change course without warning, and occasionally cause destruction, injury, and death." (Lowder and Gordon, 2015:86, emphasis ours). We believe this gets the argument exactly the wrong way around: it is never biological animacy *per se* that translates into linguistic expression. Language expresses cognitive reality, and cognitive animacy subsumes 'animate' behaviour that is either inherent to the referent or contextually ascribed to it. Ships at sea do not gain linguistically animate expression because they become more like marine animals, nor does the presence of ships at sea in linguistically animate constructions mean that this part of the grammar is better understood as an expression of motion. Instead, the ship at sea is *cognitively animate* to some extent: it is construed as possessing certain animate behaviour and from this it naturally follows that it enters into linguistically animate constructions. This is supported by studies looking at the linguistic expression of referents that are explicitly biologically inanimate, such as geometric shapes or toys (Heider and Simmel, 1944; Scholl and Tremoulet, 2000; Tremoulet and Feldman, 2000; Vihman and Nelson, 2019; cf. Primus, 2012), that nevertheless gain linguistically animate expression. The implication here is that autonomy and motion are not to be considered explanatory factors in addition to or instead of ‘animacy’ (in the biological sense, as in the quote above), but instead can be used to enrich the content of the conceptual animacy proper. Replacing a universal biological animacy with a universal mapping of cognitive to linguistic animacy instead also allows us to get around the issue of grammatical ‘leakage’ (cf. Aissen, 2003:457). By accepting that certain linguistic phenomena might not split on a universal biological ‘human – animal – inanimate’ border, but have become grammaticalized on the basis of a more fine-grained, culturally dependent scale, exceptions such as human expressions for kangaroos or animate expression for ships at sea cease being exceptions, and the explanatory burden shifts to an exploration of the content of cognitive animacy.

In this, our findings extend to psychology and neuroscience more generally. Here too the factor of ‘animacy’ is often unconsciously implemented as the researchers’ ad hoc notion of what animacy entails. Moreover, this ad hoc implementation is often in the form of a dichotomous variable, often on the basis of biology. We follow Radanović et al. (2016) suggesting this is an explanation for some of the discrepancies between findings in animacy classification studies: comparing ‘animate’ plants and animals versus ‘inanimate’ vehicles and tools will muddle the distinctions, as this is a dichotomy not necessarily held up by the data. Combining these results with the grammatical acceptability questionnaire, the picture becomes even more nuanced, revealing additional factors such as motion contributing to conceptual animacy. If we wish to explore how the brain handles ‘animate’ stimuli both in linguistics as well as other cognitive domains, then these are best construed in terms of cognitive animacy, i.e. gradient and selected with an awareness of animate features not inherent to the referent. Radanović et al. (2016) make this point specifically with regard to nouns in isolation, or visual depictions of isolated animate or inanimate referents. We argue the point holds more generally, such as when these nouns are embedded in linguistic contexts. In psycholinguistic studies, for example, items using less prototypical referents will not necessarily generate predictions on syntactic structure that are equally strong as those generated by more prototypical referents.

To conclude, grammatical variation based on ‘animacy’ is not generated by differences in biological animacy *per se*, and to ignore this is to trap ourselves into a double dichotomy the only escape from which is to supplement or supplant biological animacy with different explanatory factors when biology and language are not aligned. Instead, much can be gained by a better appreciation of the *cognitive* layer of animacy. Underscoring that language expresses cognitive reality – which in the case of animacy may be a combination of ‘animate’ features inherent to the referent’s biology as well as ‘animate’ features differentially ascribed –, animacy effects in language can be understood as gradient and contextually and culturally dependent. By using whatever additional factors emerge to enrich rather than replace (cognitive) animacy, we will be better equipped to answer questions as to what it is exactly that focuses our psychological and linguistic attention on certain entities as opposed to others; what makes certain constituents linguistically more alive than others.

4. Conclusion

We explored the content and universality of cognitive and linguistic animacy. In a series of questionnaires, we asked Japanese speakers of Japanese, and Iranian and Dutch-Iranian speakers of Persian to rate a large number of nouns (referring to e.g. objects, human beings, non-human animals and vehicles) on the extent to which they judged the noun as referring to something ‘alive’, to establish the content of cognitive animacy. We found a classification that is gradient in nature, with no clear boundaries between categories. Furthermore, we found that this classification, both in its gradient nature as well as in the ratings for individual entities, does not display large differences between groups, suggesting that cognitive animacy is to a large extent universal. We carried out two grammatical acceptability judgement tasks to test the suitability of cognitive animacy as a predictor for linguistic variation argued to be driven by ‘animacy’: the distinction between the Japanese existential verbs *iru* and *aru* and the acceptability of singular agreement with plural nouns in Persian. Our results indicate that cognitive animacy predicts linguistic variation to a high degree, also when implemented in a gradient manner. We conclude that whilst the conceptualisation and expression of animacy may differ cross-linguistically, the mapping of a gradient cognitive animacy to linguistic animacy is universal.

Declaration of competing interest

None.

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Appendix

Table A.1
Mean cognitive animacy ratings by noun from our first study, scored on a 1–7 Likert scale, by Japanese speakers of Japanese (n = 40), by native speakers of Persian in Iran (n = 36), and by native speakers of Persian in the Netherlands (n = 47). Serbian and English ratings are adopted from Radanović et al. (2016:1494) and included here for ease of comparison. The Japanese questionnaire included additional items adapted from Strauss (2008).

Noun	Japanese	Persian: Iran	Persian: Netherlands	Serbian, from Radanović et al. (2016)	English, from Radanović et al. (2016)
Amoeba	5.08	4.39	5.09	4.2	83.55
Apple	4.00	4.47	4.34	4.54	41.21
Baby	6.33	6.75	6.79	6.51	98.29
Bacteria	4.70	5.97	6.23	4.63	82.59
Ball	2.30	2.08	1.62	2.86	7.77
Bicycle	2.35				
Bike	2.25				
Book	2.53	3.81	2.72	3.23	8.5
Box	1.88				
Boy	6.43	6.22	6.51	6.43	97.44
Bracelet	1.90	2.06	1.45	2.06	7.11
Brother	6.10	6.75	6.68	6.34	95.53
Cabbage	3.85	4.39	4.11	3.94	44.77
Cactus	4.45	5.89	5.94	4.26	65.08
Car	2.70	3.03	1.81	2.77	16.92
Chess king	2.78				
Child	6.15				
Clam	5.20	5.94	5.64	4.23	82.03
Cloud	3.23	4.03	3.57	3.2	9.66
Coat	2.33	2.00	1.64	2	5.5
Computer	2.33	2.75	1.83	2.49	13.92
Cook	5.95	6.50	6.45	5.97	74.17
Cousin	6.08				
Cow	6.18	6.28	7.00	5.6	94.67
Crab	6.20	6.58	6.68	4.8	95.27
Crow	5.90	6.42	6.68	5.37	95.79
Crowd	4.90				
Cucumber	4.00	4.72	4.00	4.14	42.35
Cup	1.93	2.33	1.34	1.69	4.38
Customer	6.18				
Dog	6.48	6.69	6.85	6.34	97.92
Dragon	5.03	5.28	4.72	4.46	81.98
Dress	2.20	2.19	1.66	1.94	5.08
Elephant	6.10	6.75	6.81	5.63	95.38
Elevator car	2.35				
Empress	5.73				
Fairy	4.55	4.89	4.06	3.49	62.86
Fly	5.55				
Ghost	3.80	4.61	3.53	3.29	41.83
Giant	4.80	5.06	3.66	3.63	73.7
Giraffe	6.15	6.61	6.83	5.46	97.29
Girlfriend		6.50	6.55		
God	4.55	5.19	4.02	3.54	60.69
Hen	5.80	6.58	6.89	5.37	93.92
Horse	6.15	6.69	6.94	6.2	94.59
House	2.55	3.17	2.53	2.69	4.28
Image	2.35	2.94	2.30	3.17	15.67
Lamp	2.28	2.47	1.79	1.74	4.41
Lemon	3.90	4.11	4.00	4.31	39.39
Lighter		2.19	1.62		
Mother	6.53	6.92	6.98	6.51	97.68
Mountain	3.15	3.92	3.00	3.34	8.8
Ocean	3.35	5.06	4.34	4.71	32.67
Olive	3.53	4.50	4.26	3.89	40.19
Orchid	4.05	6.03	5.70	4.54	58.59
Pepper	2.88	4.11	3.81	4.17	30.71
Pet	5.93				
Pigeon	6.03	6.86	6.77	5.69	95.14
Pillow	2.20	2.25	1.64	1.8	3.35
Plane	2.60				
Plate	2.08	1.56	1.47	1.51	3.89
Police car	2.20				

(continued on next page)

Table A.1 (*continued*)

Noun	Japanese	Persian: Iran	Persian: Netherlands	Serbian, from Radanović et al. (2016)	English, from Radanović et al. (2016)
Potato	3.85	4.00	4.34	4.03	41.48
Prince	6.20	6.17	6.49	4.74	91.23
Professor	5.75	6.17	6.32	5.51	95.48
Queen		5.81	6.26		
Rain	2.98	4.67	3.64	3.43	15.19
Rainbow	2.95	3.94	2.53	2.94	9
River	2.93	4.78	4.19	4.89	29.85
Robot	2.90	2.89	2.21	2.91	33.13
Sailor	5.88	6.33	6.66	5.86	96.42
Ship	2.25				
Snow	3.10	4.17	2.96	3	11.83
Spider	5.68	6.42	6.74	5.23	93.67
Squirrel	5.90	6.69	6.77	5.91	95.41
Strawberry	4.25	4.89	4.28	4.34	38.72
Table	2.18	2.22	1.40	1.46	4.7
Taxi	2.45				
Teacher	6.15	6.64	6.70	5.8	91.42
Thunder	2.38	3.69	3.21	3.74	28.02
Tomato	4.25	4.28	4.23	4.2	38.86
Truck	2.15				
Uncle	6.05	6.06	6.64	5.97	97.29
Virus	4.70	6.00	6.09	4.57	69.41
Watermelon	4.33	4.11	4.19	4.31	40.77
Window	2.20	2.31	1.49	1.77	3.66
Witch	5.20	5.03	5.36	3.54	77.06
Worm	5.80	6.53	6.49	5.03	91.53
Yacht	2.30				

References

Aissen, J., 2003. Differential object marking: iconicity vs. Economy. Nat. Lang. Ling. Theor. 21 (3), 435–483. https://doi.org/10.1023/A:1024109008573.

Anderson, G., 1997. On “animacy maximization” in Fox (Mesquakie). Int. J. Am. Ling. 63, 227–247.

Banno, E., Ikeda, Y., Ohno, Y., Shinagawa, K., Tokashiki, K., 2011. Genki II: An Integrated Course in Elementary Japanese. The Japan Times, Tokyo.

Bayanati, S., Toivonen, I., 2019. Humans, animals, things and animacy. Open Ling. 5 (1), 156–170.

Bedau, M.A., Cleland, C.E., 2010. The Nature of Life: Classical and Contemporary Perspectives from Philosophy and Science. Cambridge University Press, Cambridge.

Comrie, B., 1989. Language Universals and Linguistic Typology. University of Chicago Press, Chicago.

Corbett, G., 2000. Number. Cambridge University Press, Cambridge.

Croft, W., 2003. Typology and Universals, second ed. Cambridge University Press, Cambridge.

Dahl, Ö., 2008. Animacy and egophoricity: grammar, ontology and phylogeny. Lingua 118, 141–150. https://doi.org/10.1016/j.lingua.2007.02.008.

Dahl, Ö., Fraurud, K., 1996. Animacy in grammar and discourse. In: Fretheim, Thorstein, Gundel, Jeanette (Eds.), Reference and Referent Accessibility. Benjamins, Amsterdam, pp. 47–64.

Fraurud, K., 1996. Cognitive ontology and NP form. In: Fretheim, Thorstein, Gundel, Jeanette (Eds.), Reference and Referent Accessibility. Benjamins, Amsterdam, pp. 65–88.

Gardelle, L., Sorlin, S., 2018. Introduction: anthropocentrism, egocentrism and the notion of animacy hierarchy. Int. J. Lang. Cult. 5 (2), 133–162.

Han, P., 2013. A classification of Japanese existential sentences with the existential predicate *aru/iru* (Articles). Jpn. Stud.: Res. Educ. Ann. Rep. 17, 33–52.

Heider, F., Simmel, M., 1944. An experimental study of apparent behavior. Am. J. Psychol. 57 (2), 243–259.

Kaiser, E., 2018. Effects of perspective-taking on pronominal reference to humans and animals: logophoricity in Finnish. Open Ling. 4, 630–656.

Kitahara, Y., 1984. *Nihongo Bunpoo no Shooten* [Focus of Japanese Grammar]. Kyoiku Shuppan, Tokyo.

Lazard, G., 1992. A Grammar of Contemporary Persian. Mazda, Costa Mesa.

Lotfi, A.R., 2006. Agreement in Persian. Linguist. Online 29 (4). https://doi.org/10.13092/lo.29.560.

Lowder, M.W., Gordon, P.C., 2015. Natural forces as agents: reconceptualizing the animate–inanimate distinction. Cognition 136, 85–90. https://doi.org/10.1016/j.cognition.2014.11.021.

Machery, E., 2012. Why I stopped worrying about the definition of life... and why you should as well. Synthese 185, 145–164.

Mahootian, S., 1997. Persian. Routledge, New York.

Maynard, S., 2011. Learning Japanese for Real. A Guide to Grammar, Use, and Genres of the Nihongo World. University of Hawaii Press, Honolulu.

Mikami, A., 1972. *Gendai Goho Josetsu: Shintakusu no Kokoromi* [Introduction to Modern Japanese: Syntactic Analysis]. Kuroshio, Tokyo.

Morita, Y., 1977. *Kiso Nihongo* [Basic Japanese]. Kadokawa Shoten, Tokyo.

Nelson, D., Vihman, V.-A., 2018. Bringing the toys to life: animacy, reference, and anthropomorphism in Toy Story. Int. J. Lang. Cult 5 (2), 203–223.

Nieuwland, M.S., van Berkum, J.J.A., 2006. When peanuts fall in love: N400 evidence for the power of discourse. J. Cognit. Neurosci. 18, 1098–1111. https://doi.org/10.1162/jocn.2006.18.7.1098.

Primus, B., 2012. Animacy, generalized semantic roles, and differential object marking. In: Lamers, M.J.A., de Swart, P. (Eds.), Case, Word Order, and Prominence: Interacting Cues in Language Production and Comprehension. Springer, Dordrecht, pp. 65–90.

Radanovic, J., Westbury, C., Milin, P., 2016. Quantifying semantic animacy: how much are words alive? Appl. Psycholinguist. 37, 1477–1499 https://doi.org/10.1017/S0142716416000096.

Rosenbach, A., 2008. Animacy and grammatical variation: findings from English genitive variation. Lingua 118, 151–171. https://doi.org/10.1016/j.lingua.2007.02.002.

Scholl, B.J., Tremoulet, P.D., 2000. Perceptual causality and animacy. Trends Cognit. Sci. 4 (8), 299–309.

Sharifian, F., Lotfi, A.R., 2007. ‘When stones falls”: a conceptual-functional account of subject-verb agreement in Persian. Lang. Sci. 29, 787–803.

Strauss, S., 1993. Do *aru* and *iru* exist as verbs of existence in Japanese? Japanese/Korean Ling. 3, 271–287.

Strauss, S., 2008. A conceptual approach to existential verbs in Japanese: the case of aru versus iru. Lang. Aware. 17 (3), 179–194.

de Swart, P., 2014. Prepositional inanimates in Dutch: a paradigmatic case of differential object marking. Linguistics 52, 445–468. https://doi.org/10.1515/ling-2013-0069.

de Swart, P., de Hoop, H., 2018. Shifting animacy. Theor. Ling. 44 (1/2), 1–23.

de Swart, P., Lamers, M., Lestrade, S., 2008. Animacy, argument structure, and argument encoding. Lingua 118, 131–140. https://doi.org/10.1016/j.lingua.2007.02.009.

Tremoulet, P.D., Feldman, J., 2000. Perception of animacy from the motion of a single object. Perception 29 (8), 943–951.

Trompenaars, T., Hogeweg, L., Stoop, W., de Hoop, H., 2018. The language of an inanimate narrator. Open Ling. 4, 707–721. https://doi.org/10.1515/opli-2018-0034.

Vihman, V.-A., Nelson, D., 2019. Effects of animacy in grammar and cognition: introduction to special issue. Open Ling. 5 (1), 260–267. https://doi.org/10.1515/opli-2019-0015.

Yamamoto, M., 1999. Animacy and Reference: A Cognitive Approach to Corpus Linguistics. John Benjamins, Amsterdam/Philadelphia.