Animation

An experimental study on the role of actorhood and experiencerhood in animacy conceptualisations

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Contents

Introduction

Research has shown that a referent's animacy influences the way it is referred to. Compared to inanimate entities, animate entities are referred to more often by pronouns. In (1) the animate 'hikers' are more likely to be referred to by a pronoun than the inanimate 'canoes', whether subject or object in the initial sentence (example from Fukumura & van Gompel 2011: 4).

(1) a. The hikers carried the canoes downstream. Sometimes...
b. The canoes carried the hikers downstream. Sometimes...

Importantly, it is not the animacy of the referent per se that influences the way it is referred to. Earlier studies have shown that animacy is not simply a property of entities themselves, but rather "a property of people's cognitive representations of entities" (Vogels et al. 2013: 2) For example, in the study by Vogels et al. (2013) participants were found to have conceptualised certain inherently inanimate objects as animates too. More specifically, simple geometric shapes (inherently inanimate objects) which were presented as moving on their own accord were referred to more often by pronouns than target shapes that appeared as having been set in motion. This suggests that the autonomous targets' perceived actorhood played a role in their conceptualisation as an animate.

Indeed, it has been suggested that the prototypical animate is a human and as such is an entity which experiences and acts upon its environment. From this view the typical animacy exemplar is thus both an experiencer and an actor. However, Looser & Wheatly (2010) suggest that for instance eyes play a large role in animacy judgements, as they in particular reveal mental states and, hence, mentality. Thus, the ascription of animacy is closely tied to the ascription of mind. From this view then, the prototypical animate could be assumed to be an experiencer only.

Extending on the work of Vogels et al. (2013), I tested the validity of these view. In this thesis I will explore the experimental approach taken to do so. To that end, I will first explore animacy, the conceptualisation of animacy and its influence on language in more detail in the next chapter. Then, I will layout my experimental and analytical approach. I will conclude with the results of my study and their implications. As the reader will find out, I will particularly entertain the idea that actorhood only plays a role in animacy conceptualisations in so far as it suggests mentality too. My results did not support the idea that actorhood is a feature of the animacy prototype.

Theoretical background

Introduction on animacy

Animacy is said to have a 'pervasive' influence on language (Dahl & Fraurud, 1996). Indeed, animacy appears to be involved in a number of linguistic phenomena. For instance, it has been shown to guide processing by resolving temporal ambiguities during incremental parsing. In example (2) (Ferreira & Clifton 1986: 352), both sentences are temporarily ambiguous until 'by' is encountered, since initially 'examined' could either be part of a main clause or a relative clause.

(2) a. The witness examined by the lawyer turned out to be unreliable.
b. The evidence examined by the lawyer turned out to be unreliable.

Given that main clauses are more common than relative clauses, when 'examined' is parsed during processing, the verb is predicted to be the finite verb of a main clause. This leads to the follow-up prediction of a direct object following the verb, resulting in the expectation of a typical Subject-Verb-Object structure. These expectations fail as soon as 'by' is parsed, since it precludes a direct object. The structure then needs to be reinterpreted, leading to processing difficulties. In sentence (2b) however, these difficulties are reduced. Since 'evidence' is inanimate, it is unlikely to be the external argument of 'examined'. This attenuates the SVO-prediction during processing, mitigating the need for a reinterpretation as soon as the ambiguity is resolved.

In addition to having an effect during processing, animacy is also found to have an effect during production. As mentioned already, a well-established pattern is that of animacy influencing the rate of pronominalization, such that animate entities are referred to more often by pronouns, compared to inanimates entities. This effect is independent of grammatical function: in (3) the animate 'hikers' are more likely to be referred to by a pronoun than the inanimate 'canoes', whether subject or object in the initial sentence (example from Fukumura & van Gompel 2011: 4).

(3) a. The hikers carried the canoes downstream. Sometimes...
b. The canoes carried the hikers downstream. Sometimes...

These effects are explained as a result of a higher conceptual accessibility of animate referents: representations of animate referents are more easily retrieved from working memory than representations of inanimate referents. They therefore require less linguistic coding, hence the use of a reduced rather than a full NP (Fukumura & van Gompel, 2011). Because of their accessibility, animate referents are also earlier accessible for processing than inanimate ones, resulting in animacy also affecting linear word order and subject-choices (Vogels et al., 2013).

Animacy is also involved in grammatical phenomena. Animacy for instance plays a role in differential object marking, in which an object may or may not be marked based on the argument's animacy properties. Crucially, "it is not only case marking and argument marking on verbs that is often dependent on animacy but in effect virtually any grammatical category that is somehow linked to reference." (Dahl 2008: 143-144)

Animacy conceptualisations driven by language

A concrete example of the role of animacy in differential object marking is found in (4) and (5). In Spanish, an object marker *a* is not required for inanimate objects (as in (4)) but is obligatory for animate objects (as in (5)) (examples from García García 2007: 63).

(4) Conozco *a/ø esta película
know.1SG A this film
'I know this film.'

(5) Conozco a/*ø este actor.
know.1SG A this actor
'I know this actor.'

In this example, morphosyntactic marking was trigged by animacy properties of the object argument. Animacy may therefore appear to be a dichotomous feature of the argument or referent itself, +/-[ANIMATE], perhaps mapping onto the referent's biological livingness. However, this view is far from complete as I will show below.

In the functionalist literature, the category of animacy is described as a hierarchy: human > animate > inanimate (Comrie, 1989; Aissen, 2003). This animacy scale is for instance used for cross-linguistic comparison and employed to capture implicational patterns in grammatical phenomena. When for example applied to the differential object marking above, the scale for example predicts that if an animate object is marked, so is a human object,. The animacy category is thus of ordinal nature, sorted such that humans outrank animates and inanimates, while animates outrank inanimates. This suggests that there are degrees to animacy: humans are treated as 'more alive' than other animates. In addition, the inclusion of a human category suggests that anthropocentrism is involved. Animacy appears to be, at least in part, a matter of humanness rather than just a matter of being alive. We must therefore conclude that linguistic animacy is indeed unlikely to map directly onto biological livingness or otherwise of dichotomous nature.

To shed light on the locus of animacy properties, we can look at animacy category membership across languages, that is, how entities are treated in terms of their animacy. It is for instance the case that plants are routinely treated as members of the inanimate category, while biologically alive (Trompenaars, 2021). In addition, things "such as machines and vehicles, or collectives such as companies and organizations, are treated linguistically as more animate than objects like books and tables" (Vogels et al. 2013: 2). Thus cross-linguistically we see a tendency to treat biological living entities as inanimate objects, while certain inanimate objects are treated as more alive than other inanimate objects. Clearly, animacy is not just a property of entities themselves. Rather, the locus of animacy is internal, it is "a property of people's cognitive representations of entities" (Vogels et al. 2013: 2). This raises the question what drives the conceptualisation of animacy. To shed light on this, I will first give another example of differential object marking.

In Dutch, some contact verbs such as *hit*, *bite* and *kick* show a pattern of differential object marking. As shown in (6) these verbs take animate direct objects. Example (7) however, shows that these verbs take inanimate arguments as prepositional objects (examples from de Swart & de Hoop 2018: 2-3).

(6) De hond beet de man.
the dog bit the man
'The dog bit the man.'

(7) De hond beet in het brood.
the dog bit in the bread
'The dog bit the bread.'

The differential pattern is "due to an implication of sentience (hence, animacy) on behalf of the undergoer argument of these verbs" (de Swart & de Hoop 2018: 2). As inanimates are not sentient, there is a type mismatch between the inanimate argument and the selectional restrictions of the verb. The use of a preposition then, is argued to overtly signal this mismatch, hence shifting the selectional restrictions and thus making the inanimate argument compatible. Crucially, this shift can also be reversed: animate arguments too may be used in conjunction with a preposition, as shown in (8). In this example, "the prepositional object obtains an inanimate interpretation of the man, for example that the man refers to a statue or a dead body" (de Swart & de Hoop 2018: 3).

(8) #De gier beet in de man.
the vulture bit in the man
'The vulture bit the man'

These examples suggest a few things regarding animacy conceptualisations. Firstly, the examples make clear that animacy conceptualisations are partly tied to the lexicon. Thus, lexical items (cf. 'man' and 'bread') do carry animacy information. In the literature this is called lexical animacy or inherent animacy – as opposed to contextual animacy (Vogels at al., 2013). Secondly, the conceptualisation of a referent as (in)animate is partly driven by context. As the examples make clear, this contextual animacy can even be grammatical in nature. Lastly then, the examples make clear that it is the implication of sentience that is varied within the differential marking pattern. From this we can conclude that animacy conceptualisations are, at least in part, a matter of supposing a referent's experiencerhood. We thus postulate experiencerhood, either implied by lexical or contextual means, to be part of the makeup of cognitive animacy.

Context, however, is not limited to grammatical constructions. Context in general, like the pragmatic or narrative context, may carry information too. An example of story driven contextual animacy information comes from an EEG study by Nieuwland & van Berkum (2006: 1106). In their study, inanimate objects were rendered as animate characters by means of narrative context, as in (9).

(9) *A woman saw a dancing peanut who had a big smile on his face. The peanut was singing about a girl he had just met. And judging from the song, the peanut was totally crazy about her. The woman thought it was really cute to see the peanut singing and dancing like that. The peanut was in love, and by the sound of it, this was definitely mutual. He was seeing a little almond.*

The latter parts of the stories were varied, such that the target character could either receive a lexically fitting predicate or a contextually fitting predicate. In (9) the character is presented as being in love: a contextually fitting predicate. The opposing story then, featured a peanut with a lexically fitting, but contextually ill-fitting predicate: a peanut that was salted. These contextually ill-fitting continuations were found to elicit an N400-effect, an event-related potential associated with semantic or discourse-level violations. Thus, context may override inherent animacy to such a degree that an otherwise unmarked utterance as 'a salted peanut' becomes difficult to process.

Importantly, with regard to potential animacy features in these narratives, Trompenaars (2021: 18) remarks: “an entire narrative (…) conversely, brings in a plethora of animate features, from agency to sentience”. Thus, if we conceptualise some referent as an animate due to the context it appears in, it may be the case that critical animacy features suggested by the context are experiencerhood and actorhood. Indeed, in the example we see a peanut that seems to be alive because it has mental states and *acts*, as it dances and sings.

Language use driven by animacy conceptualisations

So far, we have seen that animacy is a feature of people’s representation of referents. Referents may be conceptualized as less or more alive, which is at least partly a product of context. In addition, animacy conceptualisations appear to be anthropocentric in nature, with experiencerhood and agentivity as potential primitives for this anthropocentricity. A more formalised proposal of these ideas is found in Dahl (2008). Dahl observes the wide-spread influence of animacy on language and sets out to explain this observation by cognitively grounding the animacy scale in phylogeny. To that end, Dahl first proposes that animacy is an ontological category: a fundamental category like numbers, events, and locations. A key characteristic of ontological categories is that they are incommensurable: what can be said about for instance numbers is senseless when applied to for instance events. The same holds, according Dahl, for animates and inanimates. This fundamental nature of animacy is at the root of how language is organized around it. Thus applying his categorisation to linguistic phenomena, Dahl suggests that thematic roles can be divided up along the animacy distinction, as agents and experiencers are incommensurable with typical inanimate roles as theme and goal. Since agents and experiencers are typically animate and are usually found in subject position, we find an explanation for the large portions of animates in subject position too.

As for the cognitive mechanism behind animacy classifications Dahl (2008) proposes a three-step animacy model, corresponding to the animacy scale. He suggests that the self serves as a model for other animate beings, which in turn serve as a model for inanimate objects to which individuality is ascribed. This mechanism is argued to have deep phylogenetic origins, as the recognition of species members as individuals is a prerequisite for more complex social interactions. Thus, key to Dahl’s proposal is (the genesis of) the notion of individuality: an animate is modelled around the individual self. Crucially, Dahl makes clear that we should understand an individual to be both an experiencer and an agent.

Though less concerned with the diachronicity of the cognitive mechanisms at hand, we find a similar proposal in Yamamoto (1999). In her proposal too, animacy classifications revolve around the self – here more abstractly modelled as ‘human’. Yamamoto’s proposal is grounded in radial prototype theory, where category membership classifications revolve around a central exemplar. Specifically, the more prototype features are shared between the central exemplar and some instance of that category, the more that instance is deemed to be a prototypical instance. Category membership is therefore gradual rather than categorical, implying that cognitive animacy too should be understood to be gradual in nature. Importantly, the overlap in features between the central human exemplar and some instance of an (in)animate are argued to be a matter of perception. Yamamoto argues that the animacy values assigned to some entity are closely tied to empathy. Thus, the more empathy a language user has towards some entity, the higher the animacy value that is assigned, resulting from a perception of more shared features. Crucially, Yamamoto observes that it should not be surprising that animacy classifications are anthropocentric in nature, as there is a broader tendency to view the world egocentrically, with entities modelled as selves which have experiences and act upon their environment. In addition, it should be noted that actorhood plays a role in empathy as well. Linguistic empathy is defined as “the speaker’s identification, with varying degrees, with a person who participates in the event that he describes in a sentence" (Kuno & Kaburaki 1977). As Yamamoto's proposal relies on empathy, we thus observe again that animacy is understood to be a matter of both experiencerhood and agency.

In sum, from Dahl (2008) and Yamamoto (1999) we can distil an animacy model which makeup consists of experiencerhood and agentivity. Though more animacy features may be at play, the experiencing and acting human exemplar serves as the model for animates. From this view then, animacy conceptualisations should be influenced by manipulating a referent's (perceived) experiencerhood and agentivity. The effects of these manipulations must then be measured to test the validity of this account, using some well-established effects. A prime candidate would be conceptual accessibility effects, since the relationship between animacy and conceptual accessibility has been well-researched.

Noteworthy here, is the study of Vogels et al. (2013) in which the interplay between lexical and contextual animacy was researched. More specifically the authors were interested in the extent to which contextual animacy could override lexical animacy. To that end, participants were shown short animations of interacting simple geometric shapes, where the target figures moved in either an animate or inanimate matter (clearly moving of their own account or moving as been having set in motion, respectively). Target shapes were also lexically labelled, varying animate and inanimate lexical items. Participants were asked to retell the stories in a lively fashion, in order to elicit referential choices. Their narratives were coded on two types of referential choices: whether targets or competitors were chosen as subject on repeated reference and whether targets were or were not referred to by a reduced expression on repeated reference. They found that contextual animacy did override lexical animacy, such that animate moving targets were referred to by reduced pronouns regardless of lexical label. However, no such effect was found on subject choices: only lexical animacy influenced targets' subjecthood on repeated reference. In a follow-up experiment, testing the influence of visual animacy in isolation, nonsense words were used as lexical labels. Here the same pattern was found: animate movements did lead to reduced referring expressions, but did not have an influence on subject choices.

The study by Vogels et al. (2013) points at a good general paradigm for testing conceptual animacy models for several reasons. Firstly, the study shows that we can make use of even simple shapes as referents. As shapes are highly abstract, they may be even less animate than other more concrete, inanimate objects, such as for instance peanuts. At the very least they are less animate than objects with inherent animacy or agency, such as human(-like) characters or for instance cars. Secondly, the study establishes that we can make use of the visual domain for manipulating animacy manipulations. The visual domain allows us to prevent unwanted lexical animacy information, as we needn't make use of language to depict referents. It could even be the case that a square's squareness is less on the foreground when *shown* as an animate, compared to a square that is described as such. I'm speculating here, but arguing from the observation that all kinds of highly stylized protagonists are used in visual media such as cartoons, whereas literary occurrences of geometric shapes depicted as protagonists seem highly uncommon. Thirdly, it shows that not all accessibility effects are equal. In later work, Vogels et al. explore two potential accounts of the differential effects on referential choices (Vogels et al., 2019). One the one hand, the lack of influence on subject choices could be explained by assuming different kinds of accessibility effects, such that lexical animacy has other kinds of effects than non-linguistic representations driven by context. On the other hand, a more linear model of accessibility could be assumed: since the referent should be chosen *before* it is encoded, it could be the case that a higher degree of accessibility is needed for subject-choices to be influenced, whereas referential expressions may be influenced by a lesser degree of accessibility. This limits the conclusion that can be drawn from (the lack of) these kinds of accessibility effects if they were to be used as an outcome variable.

The study of Vogels et al. (2013) was not designed to investigate the makeup of cognitive animacy per se. As it studied motion only, it does not allow us to distinguish between experiencerhood and agentivity. Therefore, its design must also be extended to reliably test whether or not experiencerhood and agentivity are primitives of animacy. One obvious addition is to make use of visual cues that suggest targets to be experiencers rather than agents. Thus, experiencerhood must somehow be manipulated, in order to measure its influence independent of agentivity. However, just adding experiencerhood as a factor would be insufficient for our purposes. There is a more fundamental point to be addressed too.

To quote the authors themselves (Vogels et al. 2013: 13): “we cannot exclude the possibility that our perceptually animate objects were also more prototypical agents than our perceptually inanimate objects.” The problem here, is twofold. Firstly, although the manipulated variable was labelled as ‘visual animacy’, what was truly varied was motion type: the way targets acted. Thus, we can’t just exclude the possibility that perceptually animate targets were more agentive than inanimate targets and competitors; it is in fact highly likely to be the case. This brings me to the second, more fundamental point: it is inherently problematic to either oppose or disentangle animacy and agentivity. The issue is that agentivity itself includes a notion of animacy, as the prototypical agent not only acts of its own accord, but also intentionally. As it has intentions it is thus sentient - a prototypical agent is alive. This is made maximally clear in for instance Dowty (1991) who formulates a prototype model of agentivity which includes prototype features relating to sentience (i.e., sentience/perception and intentionality) and actorhood (i.e., autonomous motion, causation/having an effect on the environment). Thus, not only is it circular to define animacy in terms of experiencerhood and agentivity, animacy *is* agentivity if we assume the prototypical animate to both experience and act upon its environment. This entails firstly that we should strictly separate agenthood and actorhood, thereby defining the latter to only include independent motion and causation. It also entails that it is insufficient to manipulate for instance motion and draw conclusions from that. As the study of Vogels et al. (2013) makes clear, manipulation of motion may lead to the conceptualisation of a more prototypical sense of agentivity. In other words, it is not precisely clear what is perceived or conceptualised as a result of motion (or other visual cues). Thus, we should also look into the conceptual status of targets resulting from the visual manipulations. One way would be to look into the narrative contents of participants’ retellings, gauging targets conceptualizations by how they were described.

Current study

Our exploration of the literature has led us to a view on cognitive animacy where it is affected by language and extra-linguistic factors and has an effect on language use too. In terms of how it is affected, we have seen that the conceptualisation of a referent as (in)animate is some sort of sum total over animacy features, which populate an animacy feature space that spans multiple modalities that interact to yield the final conceptualisation. In terms of its effects, we have seen cognitive animacy may lead to grammatical and referential choices. I have modelled these observations in diagram 2.1.

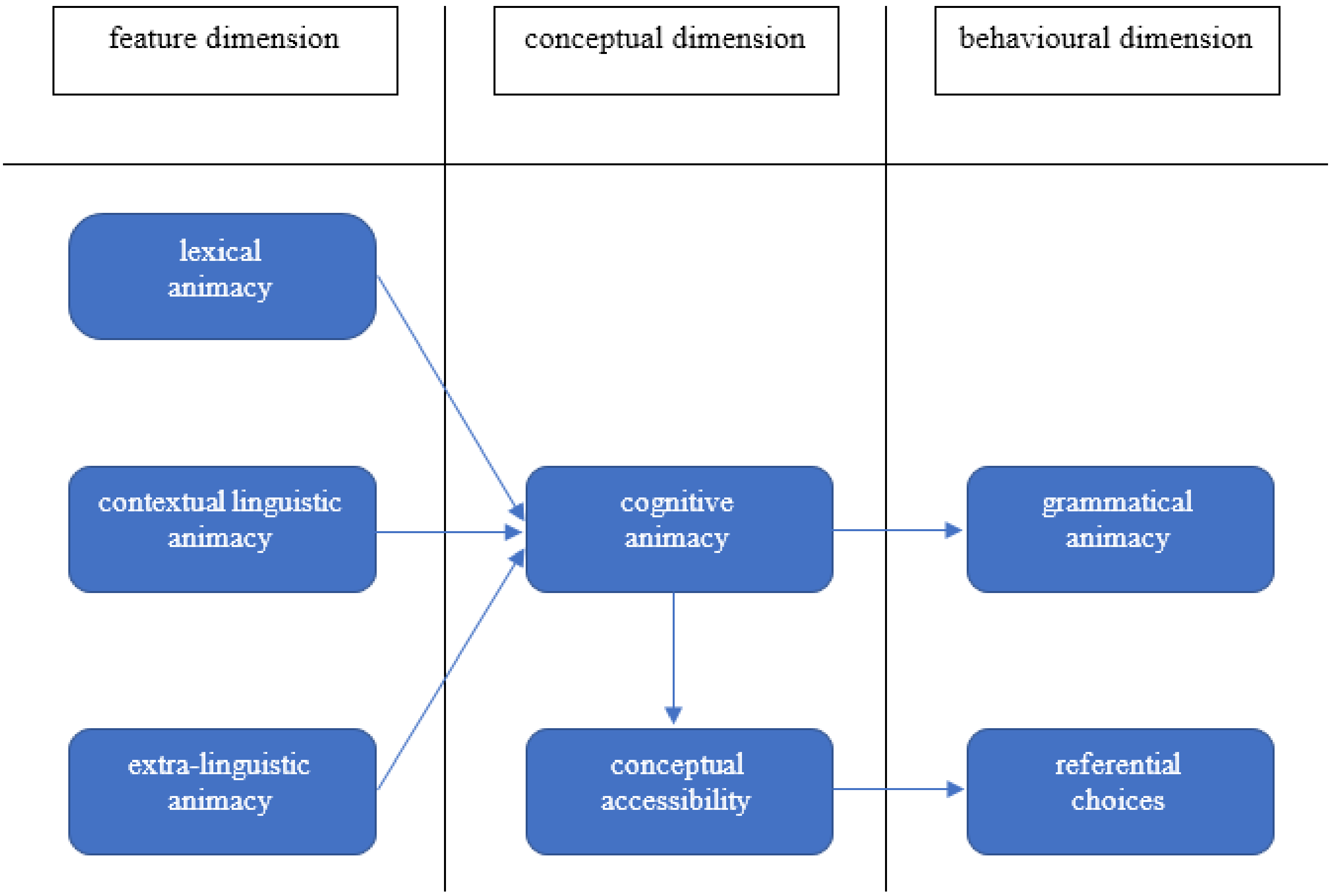

Diagram 2.1: Overview of the aspects to animacy

In diagram 2.1, the aspects to animacy are modelled as a feature, cognitive and behavioural dimension. The feature dimension is broken down into three modalities: lexical (or inherent) animacy, contextual linguistic and extra-linguistic animacy. Thus, non-inherent animacy is broken down into animacy derived from linguistic context (e.g., grammatical constructions, narrative means) and animacy derived from extra-linguistic cues (e.g., visual cues.) This is intended to capture that the animacy features a referent is perceived to possess of can be disclosed to a language user via several modalities. Combined, these modalities influence the way a referent is conceptualised as an (in)animate. The potential interactions on the feature dimension are not depicted. Thus, the depicted zero-directionality between, say, lexical and contextual animacy is intended, because I will remain agnostic as to how they interact. In this thesis only the animacy features themselves are explored, and not how they interact to yield a sum total.

In addition, the diagram depicts an assumption of equality between modalities in terms of their access to the feature space. Modalities may differ in how they carry animacy information (i.e., a lexical concept may carry animacy information in a highly compressed way, where contextual linguistic animacy may highlight certain features in a decompressed manner and visual cues perhaps both). Also, they may differ in their relative ‘weight’ (such that visual information may be more important for the final conceptualisation), but they do not project subsets of the total set of animacy features. I therefore assume that conclusions drawn from manipulations of animacy features in one modality, are generalisable to the feature space in se.

It should also be noted that, presented in this way, the cognitive dimension takes the form of a so-called black-box: a system or object viewed in terms of its inputs and outputs, without any knowledge of its internal functioning. Cognitive animacy is modelled as a black-box because we do not know yet how and when a referent is conceptualised as (in)animate, although we do know that the perceived animacy features of a referent have their effects on language use, such as grammatical and referential choices (input / output). As for conceptual accessibility, this is to reiterate that the picture isn't complete as of yet. To make it more concrete, this study will use both referential expressions and subject-choices as indicators for the conceptualisation of animacy, but with the explicit remark that we cannot conclude anything from an outcome in which subject-choices appear to be unaffected (Vogels et al., 2019). As it could be the case that the source of accessibility effects related to the choice for a referent are lexical, a null result would be uninformative. A non-null result, however, would be informative. One example would be an outcome in which subject-choices are influenced only if targets are clearly depicted or described as both an experiencer and actor, but not if either one is the case. As a by-product, this would also point at a more linear model of accessibility, such that subject choices are indeed only influenced if a referent is both animate and accessible enough. In the same vein, the precise relationship between animacy and accessibility is unclear. We could assume a threshold model, in which the degree to which something is conceptualised as an animate has no effect on its accessibility as long as some lower bound is met. Then again, we could assume a linear relationship, such that the more animate a referent is perceived to be, the more accessible it is. Finding additive results, such that a referent that is both an experiencer and an actor is more conceptually accessible (for instance by having a larger effect on reduced referrals compared to just experiencing or acting referent), would be a by-product pointing at such a linear relationship. Should either or both of these by-products be encountered they will be dealt with only shortly, as they are not the main focus of this thesis.

Having thus made explicit the theoretical implications for the current study, I will now turn to its setup.

The current study departs from the view that the cognition of animacy revolves around conceptualising referents as experiencing and acting. As an experiencing and acting entity is a prototypical agent, I will call this view the agentivity model. Though this view is distilled from the literature, one might have other intuitions too. It could be supposed, namely, that just a referent's sentience is both required and sufficient to deem it animate. As this is a simpler model of animacy, we should take it seriously. Crucially however, we can also distil an experiencerhood-only model from the cognitive psychology literature. For instance, in Looser & Wheatly (2010) it was researched how, when and where life is perceived in faces. One of their experiments showed that particularly the eyes were informative in animacy judgements, accounting for 75.3% of the variance in whole-face animacy judgements. This is in line with other work in the field, that has "demonstrated that a vast array of emotions and intentions can be communicated by subtle differences in the musculature in and around the eyes". They conclude (Looser & Wheatly 2010: 1861):

> "*Human survival depends on identifying beings with minds, and often mental states are telegraphed in the kinetics of facial and eye muscles (...) Linking facial cues to the meaningful attributions that sustain social interactions and predict behaviour requires more than detecting faces and recognizing their expressions. It requires perceiving animacy: understanding that the observable face is attached to an unobservable mind.*"

The point here is that perceiving animacy is supposed to be linked to conceptualising a referent as having a mind. The eyes play a key role here, in that they in particular communicate mental states. These mental states disclose the possessor's experiencerhood, which in turn informs animacy decisions. Strikingly, this mind-animacy correlation was directly shown by one of their other experiments too. In this experiment, participants were shown well-matched inanimate faces (dolls), real faces, and linear interpolations between the two. Stimuli thus consisted of faces along a ‘realness’ continuum. Participants were asked to rate the stimuli on several axes, notably animacy (whether the image was from a living referent) and whether a face had a mind. The latter judgements correlated nearly perfectly with the animacy ratings (rs =.922) strongly suggesting that (the perception of) mind is a correlate of animacy.

Thus, we distil two opposing views on the makeup of animacy from Dahl (2008) and Yamamoto (1999) on the one hand and the cognitive psychology literature on the other. This opposition leads us specifically to the question whether conceptualising a referent as sentient is necessary and sufficient to perceive it as an animate. We therefore set out to put these models to the test. To that end, we make use of the general paradigm of Vogels et al. (2013) but extend it according to the criteria described earlier. Participants will thus be shown animations of geometric shapes, where one target shape will interact with competitors. Targets’ potential animacy features will be varied along two dimensions: their actorhood and their experiencerhood. In line with Looser & Wheatly (2010) experiencerhood will be manipulated by depicting targets either with or without eyes. Following Vogels et al. (2013), targets’ actorhood will be manipulated by varying motion: targets will either be depicted as moving and interacting of their own accord or as a result of having been set in motion. Participants retellings will be inspected for target references, such that both choices for subjecthood and referring expressions will be used as indicators for cognitive animacy. Crucially, as certain kinds of motions may lead to the conceptualisation of a broader sense of agentivity (rather than just actorhood) the narrative content of participants’ retellings will be investigated too. Specifically, the verbal predicates used to describe targets will be used to measure if targets were described as actors, experiencers or both. Thus, in addition to researching the relationship between visual cues and referential choices, it will also be researched how visual cues affect the way targets are described and thus conceptualised. The relationship between target descriptions and referential choices will also be researched, allowing for a more direct investigation of strictly actorhood and experiencerhood and their influence on referential choices.

As for predictions, the mind-model of animacy would just predict an effect of experiencerhood on referential choices, and therefore a zero-effect of actorhood. Based on Looser & Wheatly (2010) we predict a relationship between eyes as visual cue for experiencerhood and targets being described as experiencers. If this prediction holds, then we also predict relationships between these visual cues and referential choices and in the same vein a relationship between retellings with experiencing targets and referential choices. In so far as motion (as a visual cue) indeed leads to the conceptualisation of prototypical agency, we also expect a relationship between motion and referential choices. Crucially however, for this relationship to be in line with the mind-only model, it should be the case that motion affects retellings such that targets are described as both actors and experiencers, while it also should be true that referential choices are unaffected by retellings with only acting targets.

As for the agentivity model of animacy, we predict a non-zero effect of actorhood in general. However, the way it could relate to referential choices is two-fold. On the one hand, it could be the case that both experiencerhood and actorhood are necessary for a referent to be perceived as animate. On the other hand, it could be the case that either of them is sufficient for a referent to be perceived as animate. In the latter case we thus predict a main effect of both narrations with experiencerhood and actorhood, and no interaction effect between the two. The former case would predict an interaction effect, such that referential choices are only influenced when targets were described as both experiencers and targets. Either way, the relationship between visual cues and referential choices would depend on the effect of motion type on participants' conceptualisations. Based on Vogels et al. (2013), who solely relied on motion and did find referential expressions to be affected, one would predict motion to influence retellings such that targets will be described as both actors and experiencers, assuming the agentivity model of animacy is true.

Method

Materials

Stimuli consisted of animations of one geometrical shape, the target, moving and interacting with two different shapes, the competitors. Competitors were of the same shape, though different from the target (e.g., a square as target and two circles as competitors). Shapes used were a circle, cross, diamond, square, triangle, and an up arrow. All shapes were of the same size across animations and thus the same for targets and competitors too. They were presented in one of eight colours: green, grey-blue, light blue, olive, orange, pink, purple or white. The colour of targets and competitors in one animation was kept the same. Shape and colour were assigned randomly to items and then matched or contrasted across conditions. Circles, however, were always used in scenes depicting ball-like movements like rolling or bouncing. Shapes were presented against a black background, though some animations featured a simple white line to more clearly create a scene and thereby aid interpretation, like a 'hill' that was moved up against.

I varied the movement type (+/-[MOVE]) of the target and whether the target had eyes (+/-[EYE]). In the -[MOVE] condition, the target moved in an inanimate matter: moving about as if set in motion by an external force and only interacting with competitors because they happened to be in the target's trajectory. In the +[MOVE] condition, the target moved in an animate matter. That is, the target would clearly move of its own accord and would intentionally interact with competitors. The type of movement of competitors was kept constant, such that competitors would only move in an inanimate matter.

In the –[EYE] condition, targets were presented 'as is', such that for example a moving square was presented as just a moving square. In the +[EYE] condition, a pair of eyes was added to the target. These eyes gazed at and followed competitors during the animation. To stay congruent with the overall animation style, eyes were kept simple and 'cartoony', consisting of white circles with black dots as pupils. Across animations, competitors never had eyes.

To elicit repeated references, the sequence of events in each animation consisted of three parts. The first part, the intransitive introduction, showed the target moving about alone, either in an animate or inanimate way. In the +[MOVE] condition targets would begin moving from standstill, change direction or move against the pull of gravity. In the –[MOVE] condition targets were depicted as having been set in motion off-screen and continuing their trajectory. Competitors were not yet present during the very first moments of the introductory parts. In the +[EYE] condition, targets would therefore just stare at the screen. Right before the second part the competitors came into the scene, always in an inanimate manner. In the +[EYE] condition, the targets would then start looking at them.

During the second part, targets interacted with competitors in an animate or inanimate way depending on the [MOVE] condition, as soon as they crossed paths. Inanimate interactions consisted of chance meetings: targets and competitors happened to be on each other's trajectory. Animate interactions were depicted by suggesting intent on the target's part, for instance by having it wait a bit after its intransitive movement and only then starting to interact. The latter part of the animation then, was an intransitive part too. While the target kept looking at the competitors in the +[EYE] condition, it would always be the only object moving, either in an animate or inanimate fashion, depending on the condition.

In this way, a total of 32 animations were created, consisting of 16 unique animations (see table 3.1 for an overview of all stimuli). These 16 animations were the original stimuli used in the study of Vogels et al. (2013), which were kindly provided by the first author, Jorrig Vogels. New stimuli were added to the set by re-using these animations and adding eyes to them. Thus construing the +[EYE] condition, a total of 32 animations was arrived at. Colours of objects differed between the +/-[EYE] conditions, though shapes were kept the same. 8 of the 16 animations were paired between the +/-[MOVE] condition, such that for each shape of some colour in the one condition, there would be an animation using the same shape in the same colour in the other condition.

	Shape	+/- [MOV]	Colour -[EYE]	Colour +[EYE]	Description of animation
1	plus	-	light blue	orange	Slides towards competitors and bounces back off of them
		+	orange	light blue	Starts sliding left and right, waits, bounces on competitors
2	circle	-	green	blue-grey	Bounces up and down losing momentum, bounces off of competitors
		+	blue-grey	green	Start bouncing up and down increasing frequency, waits, bounces on competitors
3	square	-	purple	olive	Flies / floats into screen while descending, bounces off of competitors
		+	olive	purple	Starts hopping left and right, hops on competitors
4	circle	-	white	pink	Rolls into screen, keeps rolling and pushes competitors back
		+	pink	white	Start rolling, waits and bounces, pushes back competitors
5	triangle	-	light blue	orange	Floats into screen, lands on competitors
		+	orange	light blue	Moves up a hill, waits, quickly moves down after competitors come into screen
6	circle	-	green	blue-grey	Rolls down from hill, pushes back competitors
		+	blue-grey	green	Rolls up a hill, pushes back competitors, rolls back
7	arrow	-	purple	olive	Slides ramp up and down losing momentum, is finally stopped by hitting competitors
		+	olive	purple	Flies left and right at top of screen, waits, rushes down when competitors come into screen
8	diamond	-	white	pink	Falls into screen, bounces on ground over competitors
		+	pink	white	Starts hopping left and right, waits, slides to and bounces on competitors

Table 3.1 | Overview of the stimuli.

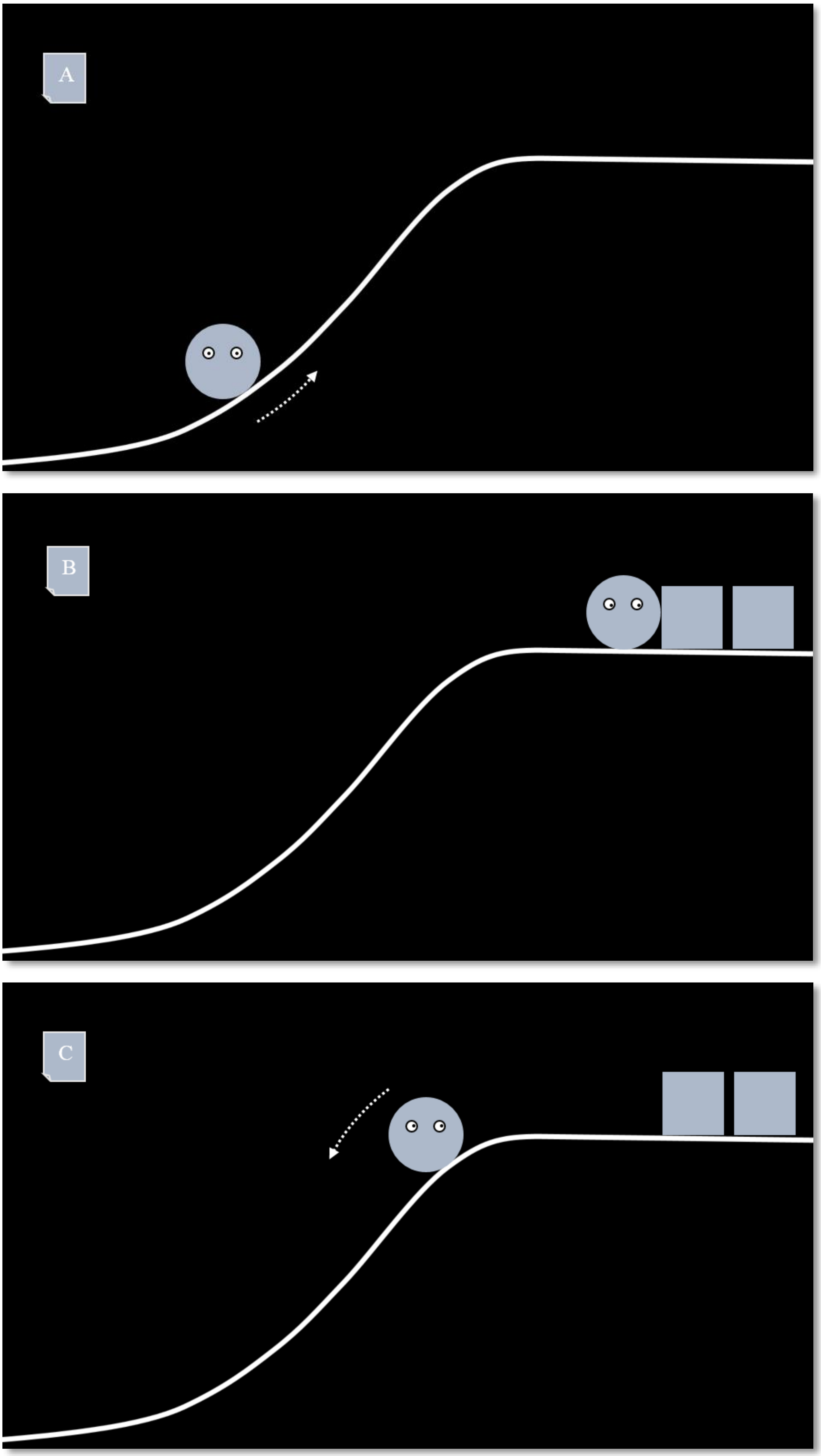

Figure 3.1 | A stimulus in the +[MOV] +[EYE] condition. In this condition the target moves in an animate way (out of its own accord, as it seems) and has eyes as well. This example also shows how some animations featured simple white lines as to create a coherent scene.

[A] shows the intransitive introduction: no competitors are present yet. In this example, the target is moving up a hill. Because the competitors are still absent, the target is looking at nothing in particular.

[B] depicts the transitive part of this animation. The competitors have entered the scene and the target is interacting with them. The positioning of the target's pupils give the impression of it looking at the competitors.

[C] shows the intransitive conclusion. Here too only the target moves, as in the introduction. Notice that the target keeps looking at the competitors, even while moving away.

Design

Crossing inanimate and animate movement with the absence or presence of eyes resulted in a 2x2 within participants and within items design. Four quasi-randomised lists were created, and participants were assigned randomly to one of four lists. All lists included all items in all conditions. Note that though re-using animations perhaps made the manipulation of eyes more apparent, this manipulation would have been apparent in any within participants design: it's impossible to not notice the difference between the presence and absence of eyes. As to keep the design closely to that of the original study by Vogels et al. (2013), there was no obfuscation of manipulations by including fillers or using a mixed-participant design (i.e., keeping movement type as a within subjects factor, but realising the manipulation of eyes as a between factor by presenting different groups of participants different eye conditions. Since between studies have less power than within ones (Field, 2013), this approach wouldn't be practical in the context of this thesis because of the large group of participants needed.)

To minimise any potential effect of re-using animations, however, lists were divided into two parts and randomisation was such that an item in a particular +/-[EYE] condition would not occur in the other condition in the same part of that list.

Running the experiment

The experiment was run in OpenSesame, an experiment builder for the social sciences (Mathôt et al., 2012). PyGame, a Python package with game development as its aim, was set up as the "back-end" in OpenSesame: the piece of software responsible for managing input and output, such as reading responses from buttons or updating the display during the experiment (PyGame Development Team, 2011). PyGame was chosen as back-end as this enabled me to (re)create and show the required animated manipulations. Though the original stimuli were created in PowerPoint and then saved and shown as independent movie clips, this approach was not taken. As PowerPoint's animation system is relatively simple (in that it does not have the tools to enrich animations with finer details such as gazing / following eyes) another approach was needed to create eyes that could follow some on-screen object. Note that using professional animation software was considered, but ultimately not chosen. This was due to expected difficulties in exactly recreating the original animations (as I have no practical knowledge of animation software, but I do know these applications to be relatively complex). Therefore, a computational approach was taken: using the original PowerPoint animations as input data, I recreated and extended the animations programmatically.

Raw animation data were extracted from the pptx-files using a Python parsing package, BeautifulSoup (Richardson, 2007), to parse the presentations' inner code. That is, a PowerPoint presentation, while stored as a single pptx-file, consists of several lower-level files which together define the presentation as a whole. These files contain structured text in the so-called eXtended Markup Language (XML) format, meaning they can in principle be read by a human although they are ultimately meant to be computationally parsed (see figure 3.1 for an example). All content found in PowerPoint presentations such as titles and text, but also the way text is formatted and, indeed, the way objects are animated, is thus stored as XML-code across several files contained within a pptx-file (ECMA International, 2006). When a user opens a pptx-file, the inner XML-files are then parsed by PowerPoint to (re)create the presentation. Parsing XML-files, however, can be done by any software parser equipped with XML-capabilities. Retrieving data from a PowerPoint presentation is therefore a matter of knowing the right XML-file the data are in and then setting up a parser to retrieve said data from the right node in the parse tree. In this way, data were extracted from all nodes defining the target and competitor objects themselves (e.g., geometrical shape, colour, starting coordinates) and their animation details.

```xml
<p:cTn id="14" presetID="63" presetClass="path" presetSubtype="0"
accel="50000" decel="50000" fill="hold" grpId="5" nodeType="withEffect">
    <p:stCondLst>
        <p:cond delay="2800"/>
    </p:stCondLst>
    <p:childTnLst>
        <p:animMotion origin="layout" path="M -0.3941 3.98705E-6 L 0 3.98705E-6 "
        pathEditMode="relative" rAng="0" ptsTypes="AA">
            <p:cBhvr>
                <p:cTn id="15" dur="1000" fill="hold"/>
                <p:tgtEl>
                    <p:spTgt spid="6"/>
                </p:tgtEl>
                <p:attrNameLst>
                    <p:attrName>ppt_x</p:attrName>
                    <p:attrName>ppt_y</p:attrName>
                </p:attrNameLst>
            </p:cBhvr>
            <p:rCtr x="197" y="0"/>
        </p:animMotion>
    </p:childTnLst>
</p:cTn>
```

Figure 3.2 | A PowerPoint XML-node defining an animation sequence. This node describes the animation of some object with id 6, as indicated by the SPID value. The object accelerates and decelerates at the end of the animation, as defined by the ACCEL and DECEL values. The animation consists of the object following the trajectory defined by PATH, taking up a length in time of DUR.

Raw animation data were then translated to a display coordinate system, to finally calculate each object's screen location for each point in time corresponding to one animation frame. That is, PowerPoint animations are described as an object's change in speed over time, and its path (see figure 3.2). These PowerPoint paths do not consist of a series of Cartesian coordinates to describe an object's on-screen location for each animation frame, but are defined as a series of lines, curves and arcs. Thus, a path is a series of *directions* rather than a series of coordinates mapping directly to on-screen pixels. This approach allows for sharp images regardless of the display resolution the image is rendered at, hence the name of the format: scalable vector graphics (W3C SVG Working Group, 2010). However, to display an object at some on-screen location, its coordinates are needed for each animation frame. Such a Cartesian interpretation was arrived at by dividing a path in an arbitrary number of segments, and then to associate display coordinates with these segments. By combining the linear, pixel-by-pixel interpretation of the paths with the objects' change in speed over time, it was then calculated where target and competitor objects were on the screen during each animation frame (see figure 3.3 for a visualisation).

After the PowerPoint path interpreter was written, a simple animation renderer was built around it, making use of PyGame's capabilities to manipulate display graphics. The animation code was then imported in OpenSesame, which was possible because of its support for PyGame as a back-end. The resulting system enabled the rendering of the erstwhile PowerPoint animations as native OpenSesame stimuli. Importantly, having direct access to the coordinates describing the animations via the path interpreter, the animation system could also be extended with functionality for rendering objects with eyes. That is, creating a pair of gazing eyes was now a simple a showing two black dots following the location of competitors for each animation frame.[1]

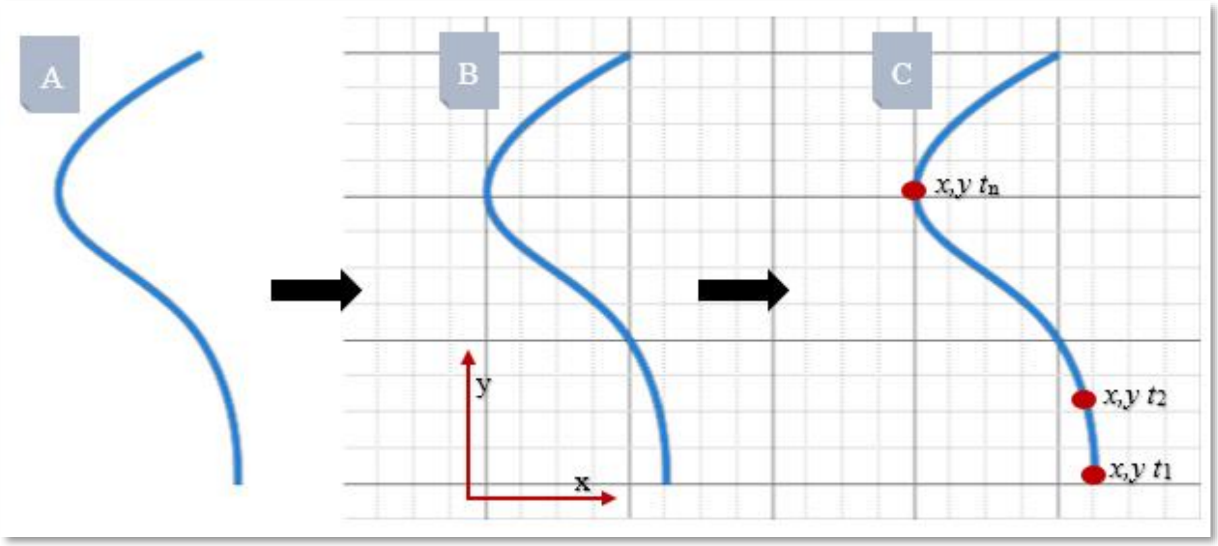

Figure 3.3 | Interpreting a smooth vector path as a location per time frame. [A] shows a smooth path as described by some vector. It does not consist of discrete points and therefore has no coordinates. [B] conceptualizes path segmentation: division in parts (squares) makes it possible to assign coordinates to each discrete part. [C] shows how to add a time dimension by following the segments linearly, yielding a time frame *t* for each location.

Procedure and participants

44 students from the Radboud University participated in the experiment, in exchange for course credits or a 5€ gift certificate. All participants were native speakers of Dutch. The experiment took place at the Radboud University's Centre for Language Studies. It was conducted under my supervision by a linguistics student for her bachelor's thesis (Van Wijk, 2017).

Prior to the first run, I instructed the experimenter with regard to such things as setting up the computers in the lab, the use of OpenSesame and running the experiment.[2] The procedure taken by Vogels et al. (2013) was employed for the current study as well. A few test runs were held to make sure that the experiment's software code was error free and that the procedure was understood.

During the experiment, participants were sat in a booth in a lab room across a computer screen. The experiment leader was seated outside of the booth. Communications took place via an intercom system. Participants were recorded using a recording device inside of the booth. Participants were instructed to look at the animations on screen. Their task was to retell the events in the animations in their own words. Each animation was shown twice in a row, in order to make sure that participants could narrate from memory correctly.

[1] Formalizing this simple idea in Python wasn't as simple. The scope of this thesis, however, will save the reader from the mathematical details involved.

[2] Note that details of the hardware involved in conducting the experiment (i.e., CPU specifications, type of recording devices) are not given/mentioned. The hardware used was not registered, and thus not mentioned here, due its non-critical nature. That is, because the experiment did not depend on such things as time frame resolution or hardware latency, it didn't matter on what hardware the experiment was run.

Participants were instructed to only start talking after the second showing had ended. In addition, participants were instructed to retell the animations in a lively fashion, as if talking to a child. The experiment started with three practice trials after which questions could be asked. Minimal feedback was given during the experiment.

Data (pre)processing

Coding referential choices

Audio recordings of participants' narrations were transcribed by Van Wijk (2017). Two student-assistants, both linguistics students, assisted with coding the transcriptions for the choice of (reduced) referring expressions. To this end I first drew up an initial annotation protocol, based on the approach as described in Vogels et al. (2013). All three coders then tested the protocol against the same 40 randomly chosen transcriptions. The results were then compared, and the protocol finalised. The test scores showed a very high initial agreement with only two mismatches between coders. Changes to the protocol were therefore minimal, and no new set of overlapping transcriptions was coded to re-test the protocol or calculate the inter-annotator agreement. This was done to save the student assistants' time which was limited. I argue this choice was justified due to the nature of what was to be coded: it is exceedingly clear whether or not a reduced referring expression is used.

Transcriptions were thought of as consisting of a maximum of three parts, A, B and C, following the narrative structure of the animations (see figure 3.1, see also fragment (10) below). Participants could, however, omit a part (i.e., not describing C or even B, see (11) and (12) below respectively). Alternatively, they could describe two parts together (i.e., introducing competitors while also describing the interaction as in (13) below). If only one part was described, the narration was coded as invalid by default, since no repeated reference and thus no choice for referring expression was possible.

(10) *oke nou er was eens een visser die wou heel graag gaan vissen maar hij heeft zeg maar z'n favoriete plekje* <u>*en iemand zat op zijn plek*</u> ***dus die moest ie eerst effetjes ehm opzij schuiven*** *voordat hij dan op z'n favoriete plekje kon zitten*

"Okay, well, there was a fisher that very much wanted to go fishing, but he has, like, his favourite spot and someone had taken his spot so he had to shove 'm aside before he then could sit at his favourite spot."

italics: intransitive parts (animations parts A and C)
<u>underlined</u>: introduction competitor (animation part A)
fat: interaction (animation part B)

(11) *nou de prins die is trampoline aan het springen maar* <u>*een paar kinderen zijn het er niet mee eens*</u> ***dus die eh die zorgen d'rvoor dat de prins van de trampoline af wordt gegooid***

"Well the prince, he is trampolining but a few kids disagree with it so they make sure that the prince gets thrown off of the trampoline."

<u>underlined</u>: introduction competitor (animation part A)
fat: interaction (animation part B)

(12) *eh d'r is een danseres en eh die doet ballet en die maakt allemaal sprongetjes over het podium en op een gegeven moment komen d'r twee nieuwe dansers* en dan gaat de danseres van het podium af

"Err, there is a dancer and err she does ballet and she performs little jumps on the stage and at a certain moment two new dancers arrive and then the dancer leaves the stage."

underlined:	introduction competitor (animation part A)
double:	intransitive end (animation part C)

(13) *een wit bolletje met oogjes gaat over het scherm heen* ***en ziet dan dat er twee driehoekjes*** *aan komen en dan springt ie in de lucht van blijdschap en die gaat dan de twee vierk- eh driehoekjes wegduwen*

"A white little ball with eyes moves across the screen and then sees two triangles approaching and he then jumps into the air of happiness and he then proceeds to push the two squa- err triangles away."

underlined:	introduction competitor (A)
fat:	transitive part (B)

If two or three parts were described, the coder first had to decide where the boundary between the first two parts was located. The criterion for this was that part B, the transitive part, would start from participants' description of any interaction between target and competitors. After determining the boundary between parts, coding of choice for referring expression proceeded as follows:

1. If the target is not referred to in part B (as in (12)), the narration is coded as invalid.
2. If in the second part a full NP is used to refer to the target (as in (11)), the choice of referring expression is coded as 1.
3. In all other circumstances in which the target is referred to in part B (as in (10) and (13)), the choice of referring expression is coded as 0. This also applies to elliptical references (as in (13)).

Narrations were also coded for the salience of the target, as to be able to control for any influence of discourse salience during the analyses. Targets' salience was coded following the heuristics below:

1. If the target is the subject of the clause directly preceding part B, target salience is coded as 1. This also applies to elliptical constructions.
2. If in the clause directly preceding part B, the target is rendered as an object because of an active story teller in the narration (i.e., *I see a square which…*), a subject interpretation is given and hence target salience is coded as 1.
3. If the target is not mentioned in the clause preceding part B, has an object function in that part or is indirectly referred to by means of a possessive, target salience is coded as 0.

Using this coding scheme, the work was divided between the three coders to code all transcriptions. Uncertainties during coding were resolved by discussion.

Coding whether the target was chosen as subject was done by Van Wijk (2017). We agreed upon following the methodology in Vogels et al. (2013, p. 13):

> "We focused on the descriptions of the transitive action, since these were the fragments that were expected to show most variation in choice of referent for the subject position […]. Next, the fragments were coded for whether the target figure was made the subject of the critical clause (referent choice) […]. We coded all grammatical subjects of both main and subordinate clauses as "subject," and everything else was coded as "object."

Coding renditions of targets as experiencers and actors

I scored observations on the rendition of targets' sentience and actorhood in the participants' narrations. This was done on the basis of verbal predicates used to describe the targets' experiences and actions. If at least one verb was used to describe the target as being sentient, thus having perceptions, emotions, thoughts or other experiences, the observation was scored as +[EXPERIENCER]. All other cases were scored as –[EXPERIENCER]. In addition, if at least one verb was used to describe the target as if acting out of its own accord, the observation was scored as +[ACTOR]. All other cases were scored as –[ACTOR]. Each observation thus received two scores: one reflecting the target's sentience, the other the target's actorhood.

Importantly, the coding scheme above only roughly equates to coding experiencer and actor verbs. On the one hand, while experiencer verbs as *horen* 'hear' and *zien* 'see' were scored as +[EXPERIENCER], instances of *luisteren* 'listening' and *kijken* 'look' were scored as both +[EXPERIENCER] and +[ACTOR] because the target was evidenced to have both experience and actorhood/volition. On the other hand, not all actor verbs were scored as +[ACTOR]. In particular, certain kinds of motion verbs did not give clear evidence of the target being volitional, examples being *gaan* 'go', *vallen* 'fall', *zweven* 'float', but also *schuiven* 'slide' and *stuiteren* 'bounce'. Note that stimuli in the –[MOVE] condition were explicitly designed to give the impression of targets having been set in motion by something else, and that as such a large portion of motion verbs was to be expected.

In addition, it should be noted that scores were assigned at the predicate level, abstracting away from utterances and narrations the predicates were used in. Verbal predicates were first extracted from the narrations, to then construe a list of unique occurrences (thus including each predicate only once) with back references to the narrations from which the predicates were extracted. Scores were assigned at this level manually; back references were then used to programmatically propagate scores to the narration level. Importantly this entails that truly *all* instances of, for instance, *going*, were scored as –[ACTOR], even those cases where context might have revealed it to be an intentional act. The crux, however, is that arriving at such an interpretation would be dependent on other verbal predicates making up the context, and that these predicates were included in my approach too. For example, consider a target described as starting to jump up and down first, to then be described as moving / going from left to right a few times. Here, we probably arrive at an agentive interpretation of moving/going, while these instances were nonetheless scored as –[ACTOR]. However, the evidence for the target's autonomy in the latter part of the example, lies in the first part: it starts to jump. This was scored as +[ACTOR]. The final score of this observation then, was +[ACTOR] too. Thus, even though I abstracted away from context when scoring predicates, final scores were very much dependent on the narrations as a whole, since all verbal predicates were considered for scoring at the observation level.

Coding utterances for renditions of targets as experiencers and/or actors, yielded two additional factors. Crossing these factors resulted in a derivative 2x2 within participants and within items design. In figure 3.4 it is shown how these fit into the overall-design.

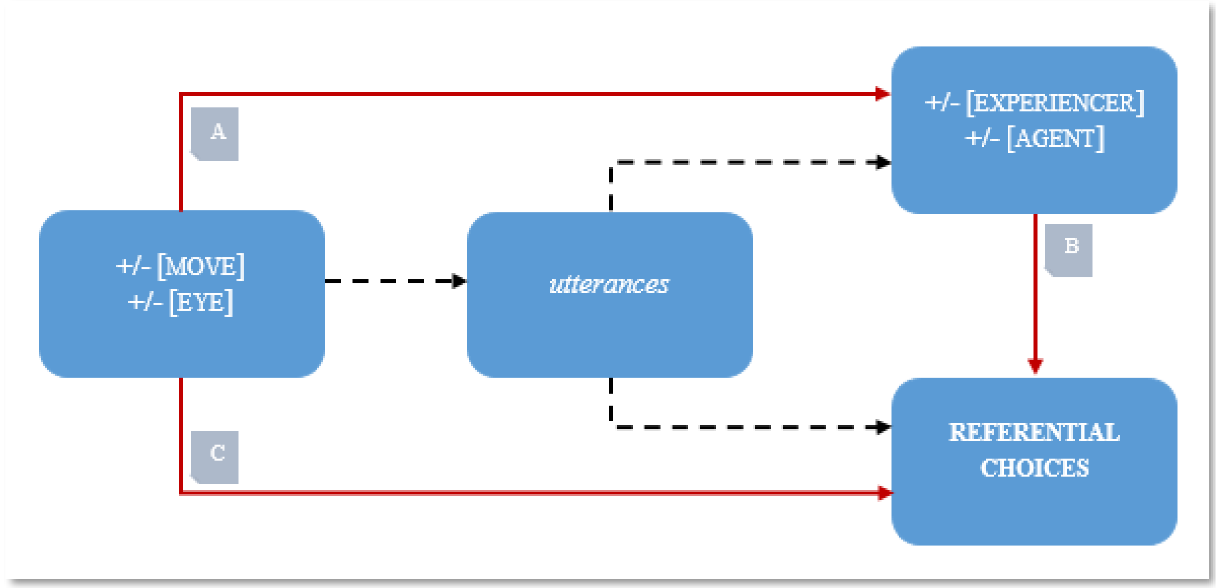

Figure 3.4 | Diagram of the designs and their relation. Black, dotted lines indicate data-processing steps (transcription and annotation). Red, continued lines indicate statistical modelling steps. Note that the annotations of experiencers and actors were used both as a dependent and predictor variable, in analysis B and C respectively. Analysis A is the model based on the primary design.

Data clean-up

Data of one participant were removed because of a strong tendency to take a second person perspective in the narrations. 32 $_{\text{items}}$ * 43 $_{\text{participants}}$ = 1376 cases remained. 170 of these cases were coded as invalid based on the heuristics in the coding protocol for referring expressions. In such cases no repeated reference was made, rendering the narration useless. In the coding for referent choices, distinction was made by Van Wijk (2017) between subject and plural subject. These plural subjects involved those cases in which both the target and competitors were made subject. 70 of these cases were found in the data and were coded as invalid by the present author.

With 240 (17%) of invalid cases, a total of 1136 cases remained for the final analyses.

Statistical analyses

Mixed modelling was taken as the key approach to inferential statistics. A mixed model can be thought of as a traditional regression model, expressed as one line or plane, with additional regression lines or planes around it to model clusters of variance in the error component. The key point here is that a basic regression model explicitly assumes the absence of correlating clusters in the error component (usually referred to as ‘the assumption of independence’), whereas a mixed model explicitly relies on some form of repeated measures to further compartmentalise the error component. To put this simply: since a mixed model estimates how clusters of error variance are distributed around the main regression model, clusters or variance should be present in the error component in the first place.

A mixed model thus allows to formalise intuitions about individual differences. One set of experimental items, for instance, may take longer to process than other sets, regardless of how individual items within the sets are manipulated. Participants too, obviously differ in their characteristics. They therefore may be quicker or slower to respond to an item, regardless of the experimental condition they are exposed to. Participants may even very well differ in how they respond to conditions, thus showing greater or smaller effects from the same manipulation between them. Precisely these intuitions can be formalised in a mixed model. They capture individual differences by allowing them to be expressed as normally distributed deviances around the main regression model.

What's more, a mixed model allows one to capture these differences for more than one source of variance at a time. Thus, whereas a standard regression model can only estimate the error associated with measuring *either* experimental items *or* participants, a mixed model can handle both at the same time. Intuitively, simultaneously formalising what is also simultaneously measured, is more elegant. More importantly however, it is also more rigorous than relying on separate models for each source of variance. This is so because the latter entails ending up with more than one, separate test statistics, or, synthesising one from them - neither being without issues (Rietveld & van Hout, 2007).

The data resulting from the current study were gathered by repeatedly measuring both participants and items. Thus, the data came from two sources of variances while the observations were not statistically independent. Because of the features of mixed models as described above, the data could therefore readily by analysed using mixed models. Therefore, mixed modelling was chosen as key approach.

As for the approach to model building, the procedure laid out in Barr et al. (2013) was taken. Models with correlating random intercepts (inherent individual differences) and random slopes (differences in effects) were assumed to be ideal and thus started from, but they were incrementally simplified to reach reliable results. That is, as the inclusion of each random effect entails the estimation of additional parameters, models with a maximal random effect structure may consist of too many parameters to be reliably estimated from the (limited) number of observations in the data. This in turn may lead to so-called convergence errors (the estimations could not be optimized) or boundary solutions (otherwise suspect estimations, such as a parameter with (near) zero variance), both indicative of parameter estimates that are not to be trusted. The model then needs to be simplified as to decrease the number of parameters, and hence the number of estimates to be made from the data.

When the data did not allow for the complexity in the random effect structures, I simplified the models in a principled way. Again based on Barr et al. (2013), simplifications were incrementally carried out in the following order: removing the assumption of correlation between random intercepts and slopes from the model, then removing the interaction effects from random effects components, deletion of random intercepts but keeping random slopes as a third simplification, and as a last resort keeping random intercepts only.

Checking for overparameterization (e.g., checking whether parameter estimates were suspect) was done by means of Principal Component Analysis (PCA). That is, rather than gauging the reliability of parameter estimates by 'eye-balling' the models' outcomes, a more formal approach was taken in the form of PCA. PCA can be thought of as rearranging the dimensionality of a dataset, such that each new dimension (called a principal component) is orthogonal to the previous one and captures increasingly less and less variance, while the first few principal components capture almost all variance. In the context of mixed models, PCA can be used to compare the number of parameter estimates (the original dimensionality) with the principal components gained from applying PCA on the variance matrices. If the original number of dimensions is higher than the number of principal components with variance associated with it, the model is overparametrized. In this way, models were formally checked for boundary estimates. If a model was found to be too complex for the data, the model was then simplified as described above.

Modelling was done in R (R Core Team, 2020). The R-package used for mixed modelling was the lme4 package (Bates et al., 2015). The glmer-function as implemented in lme4 was used to run binomial mixed models for all analyses, as per the dichotomous outcome variables. Models were run using sum coded contrasts, such that for instance –[EYE] was coded as -1 and +[EYE] as 1 (using the same contrast coding scheme for all other factors), leading to an ANOVA-style interpretation of results.

Manually created contrast matrices were used to construe random effect components in order to properly suppress random correlations. Although the lme4 package offers a shorthand notation to suppress the otherwise default correlations between random slopes and random intercept, this shorthand solution (the so-called ‘double bar notation’) was not used as it is not without problems. More specifically, using the shorthand may lead to a mismatch between the fixed and random effects estimations, such that fixed effect contrasts are not taking into account in the random effects structure (Kliegl, 2014).

Results

Predicate use

Targets as actors
Whether targets were described as actors or not was modelled as a function of movement type, eye presence and the interaction between movement type and eye presence, using a binomial generalized mixed effect model. Since participants and items were within factors, both were modelled as a random effect component. The maximal random effect structure supported by the data was: a random intercept and non-correlating random slopes for movement type and eye presence per item, and a random intercept and non-correlating random slopes for movement type per participant.

The analysis revealed a significant main effect of movement type on target descriptions (β = 0.865, SE = 0.171, χ^2 (1) = 11.44, p = .003) such that animate movements lead more frequently to narrations in which the target was depicted as an actor, compared to narrations after inanimate movements (M_{diff} = 18%).

The analysis did not reveal a main effect of the presence of eyes on target descriptions (β = 0.241, SE = 0.145, χ^2 (1) = 2.45, p = 0.171), thus whether the target had eyes or did not influence its rendition as an actor in participants' narrations (M_{diff} = 4%).

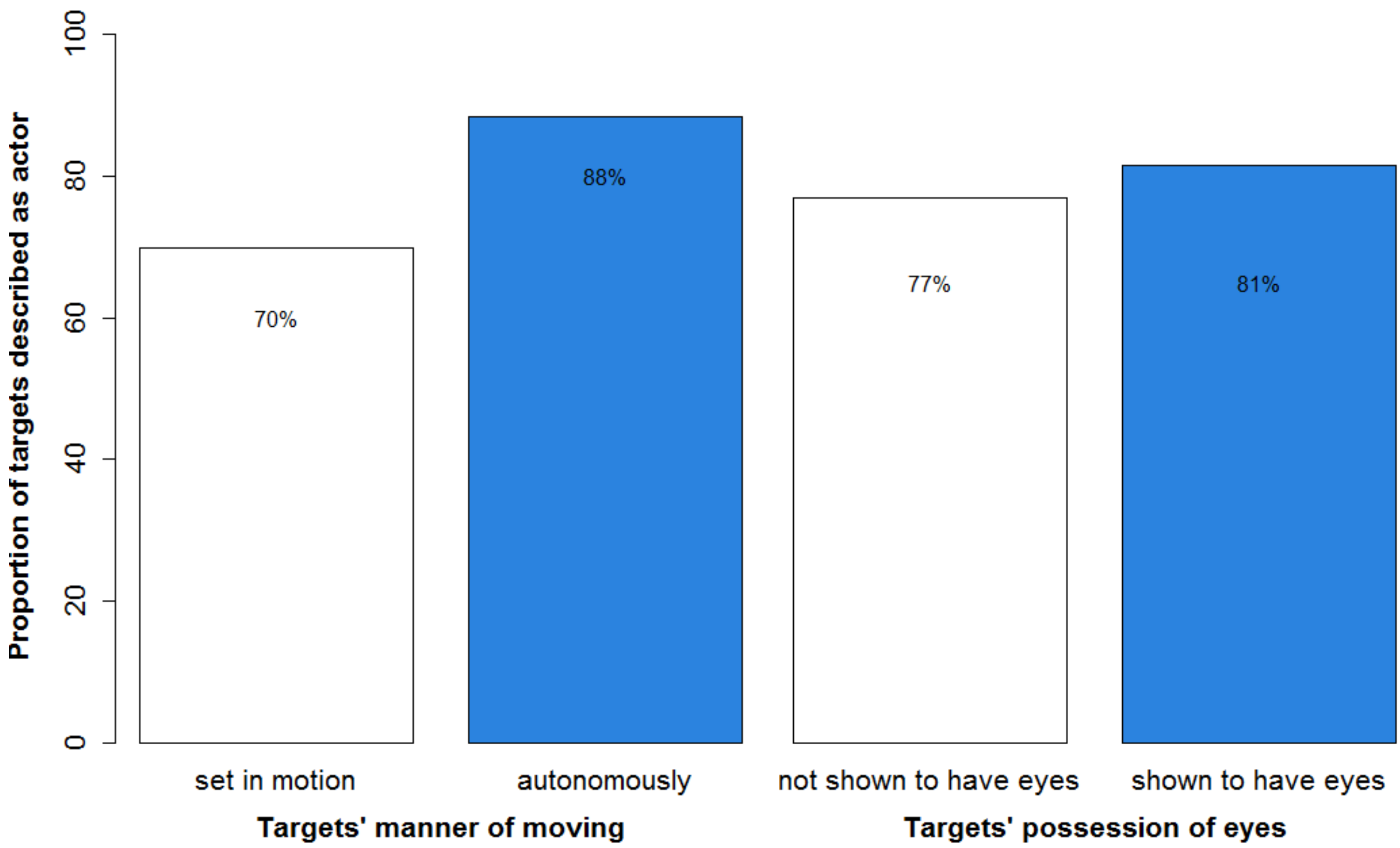

Figure 4.1 | Proportion of narrations in which targets were described as actors, by movement type and eye presence. The effect of movement type was found to be significant.

Formula	actor ~ movement * eyes + (1 + movement + eyes || item) + (1 + movement || participant)

Fixed effects	***β***	**SE**	**(DF)** χ^2	***p***
Intercept	2.516	0.718	-	-
Movement type (animate)	0.865	0.171	(1) 11.44	.003
Eye presence (present)	0.241	0.145	(1) 2.45	.171
Interaction	-0.009	0.097	(1) 0.01	.938
Observations, groups	*N* 1136, item: 8, participant: 41			

Table 4.1 | Model outcomes of the proportion of narrations with actors expressed as a function of movement type and eye presence

Targets as experiencers

Whether targets were described as experiencers or not was modelled as a function of movement type, eye presence and the interaction between movement type and eye presence, using a binomial generalized mixed effect model. Since participants and items were within factors, both were modelled as random effect components. The maximal random effect structure supported by the data was: a random intercept and non-correlating random slopes for movement type per item, and a random intercept and non-correlating random slopes for movement type and eye presence per participant.

The analysis revealed a significant main effect of movement type on target descriptions (β = 1.042, SE = 0.222, χ^2 (1) = 10.96, p = .004) such that animate movements lead more frequently to narrations in which the target was rendered as an experiencer, compared to narrations based on inanimate movements (M_{diff} = 30%).

The analysis also revealed a significant main effect of eye presence on target descriptions (β = 0.658, SE = 0.087, χ^2 (1) = 36.65, p = .002) such that targets were more frequently described as an experiencer when they were shown with eyes, compared to when they were shown without eyes (M_{diff} = 21%).

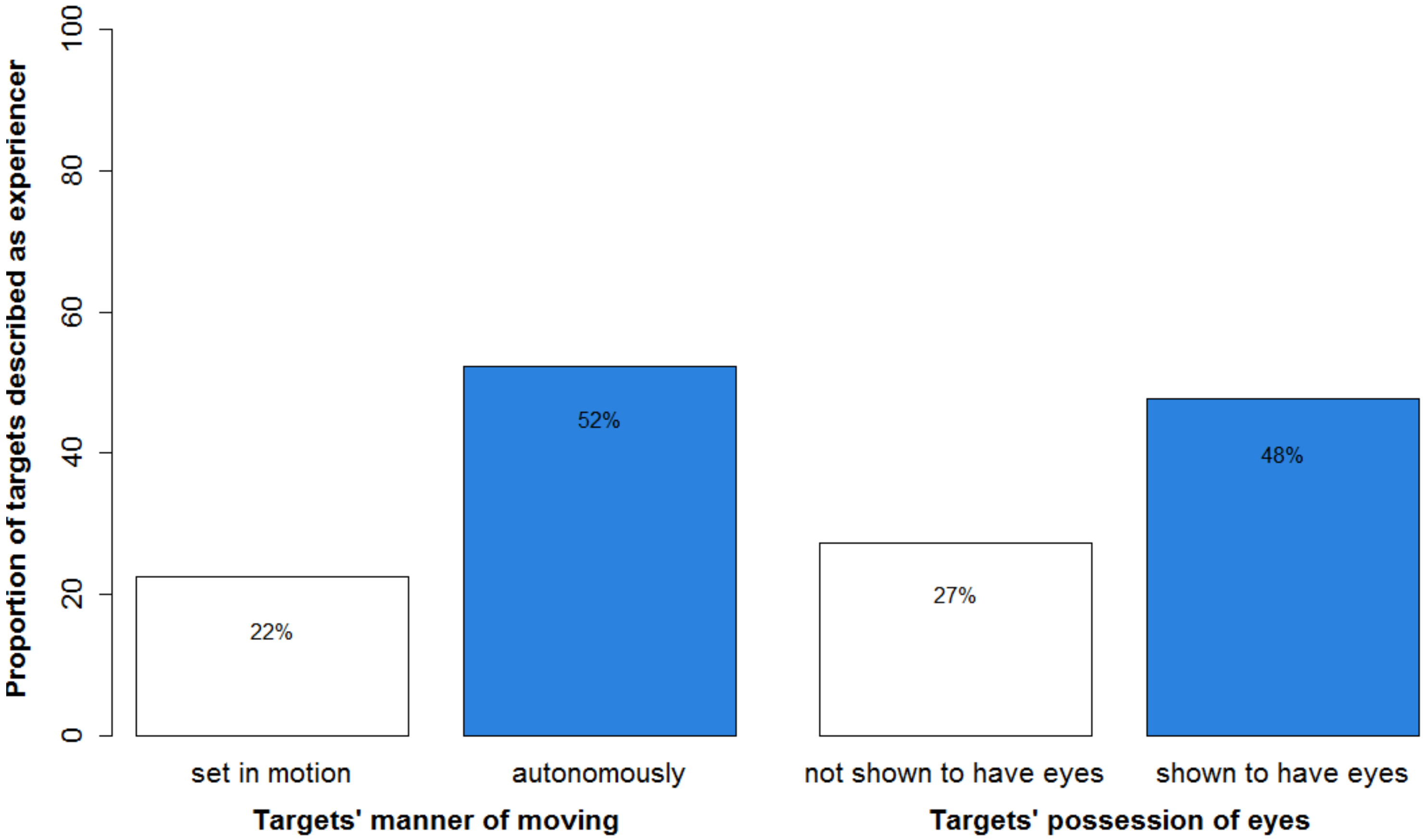

Figure 4.2 | Proportion of narrations in which targets were described as experiencers, by movement type and eye presence. The effects of both movement type and eye presence were found to be significant.

Formula	experiencer ~ movement * eyes + (1 + movement || item) + (1 + movement + eyes || participant)			
Fixed effects	***β***	**SE**	χ^2	***p***
Intercept	-0.709	0.333		
Movement type (animate)	1.042	0.222	(1) 10.96	.004
Eye presence (present)	0.658	0.087	(1) 36.65	.002
Interaction	0.113	0.080	(1) 1.88	.195
Observations, groups	*N* 1136, item: 8, participant: 41			

Table 4.2 | Model outcomes of the proportion of experiencer narrations expressed as a function of movement type and eye presence

Referential choices as a function of predicate use

Subject references

Whether targets were chosen as subjects on repeated reference was modelled as a function of whether targets were depicted as actors and experiencers in participants' narrations (including their interaction), using a binomial generalized mixed effect model. Since participants and items were within factors, both were modelled as a random effect component. The maximal random effect structure supported by the data was a random intercept per item, and a random intercept and non-correlating random slopes for targets' actorhood per participant.

The analysis did not reveal a main effect of actorhood on subject choice (β = 0.886, SE = 0.413, χ^2 (1) = 0.66, *p* = .9), thus targets being described as actors were as likely to be chosen as subjects in repeated reference as targets that were not depicted as actors (M_{diff} = 5%).

In addition, no effect of experiencerhood was found (β = -0.015, SE = 0.310, χ^2 (1) < 0.01, *p* = .90), thus targets that were described as experiencers were equally like to be chosen as subjects as targets that were not rendered as experiencers (M_{diff} = 1%).

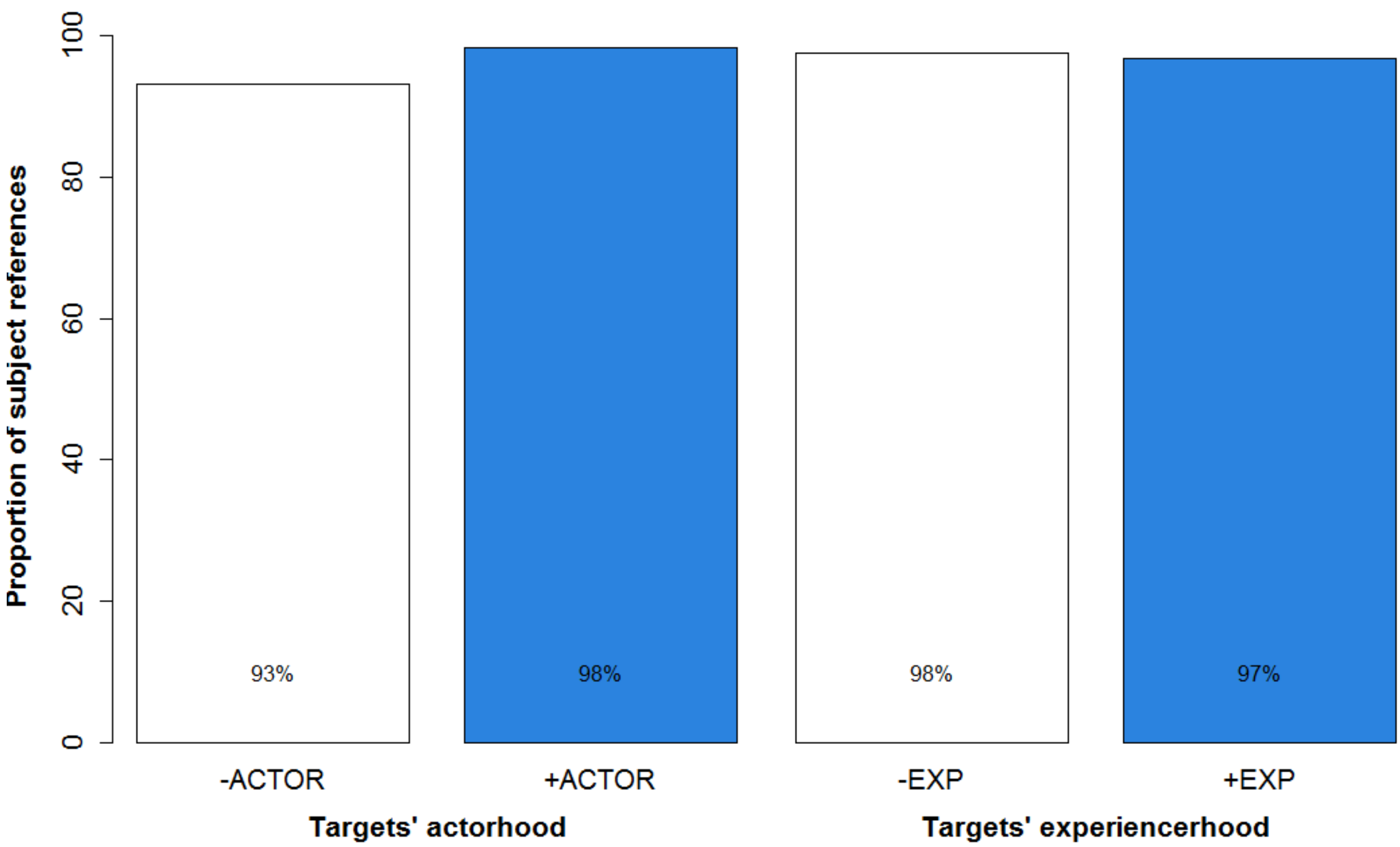

Figure 4.3 | Proportion of subject choices on repeated reference, by actorhood and experiencerhood. Neither was found to be significant.

Formula	subject ~ actor * experiencer + (1 | item) + (1 + actor || participant)			
Fixed effects	***β***	**SE**	**(DF) χ^2**	***p***
Intercept	6.258	1.878		-
Actorhood (actor)	0.886	0.413	(1) 0.66	.9
Experiencerhood (experiencer)	-0.015	0.310	(1) < 0.01	.9
Interaction	-0.261	0.295	(1) 0.83	.38
Observations, groups	*N* 1136, item: 8, participant: 41			

Table 4.3 | Model outcomes of the proportion of subject choices expressed as a function of actorhood and experiencerhood

Referring expressions

Whether targets were referred to by a reduced referring expression on repeated reference was modelled as a function of whether targets were depicted as actors and experiencers in participants' narrations (including their interaction), using a binomial generalized mixed effect model. Since participant and item were within factors, both were modelled as a random effect component. The maximal random effect structure supported by the data was a random intercept and non-correlating random slopes for experiencerhood per item and per participant.

The analysis did not reveal a significant main effect of actorhood on referring expression (β = -0.259, SE = 0.150, χ^2 (1) = 3.30, p = .079), thus targets described as actors were as likely to referred to by reduced expression as non-acting targets (M_{diff} = 1%).

However, the analysis did reveal a significant main effect of experiencerhood on referring expressions (β = 0.750, SE = 0.91, χ^2 (1) = 12.18, p = .001) such that targets that were described as experiencers were more frequently referred to by reduced expressions compared to those that were not described as experiencers (M_{diff} = 18%).

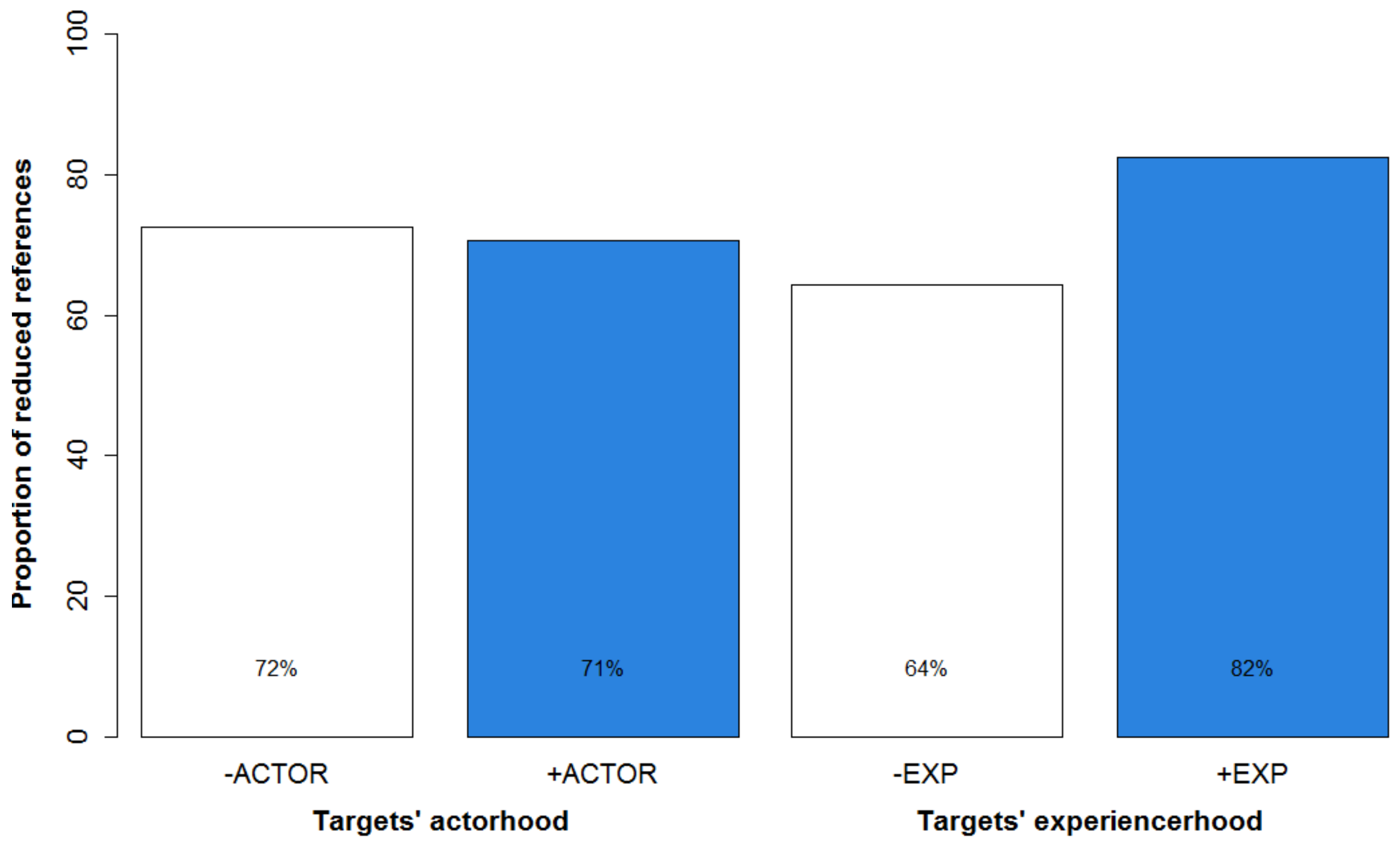

Figure 4.4 | Proportion of reduced referring expressions, by actorhood and experiencerhood. The effect of experiencerhood was found to be significant.

Formula	reduced expression ~ actor * experiencer + (1 + experiencer || item) + (1 + experiencer || participant)			
Fixed effects	***β***	**SE**	**(DF)** χ^2	***p***
Intercept	1.503	0.205		
Actorhood (actor)	-0.259	0.150	(1) 3.30	.079
Experiencerhood (experiencer)	0.750	0.191	(1) 12.18	.001
Interaction	-0.270	0.150	(1) 3.56	.060
Observations, groups	*N* 1136, item: 8, participant: 41			

Table 4.4 | Model outcomes of the proportion of reduced referring expressions as a function of actorhood and epxeriencerhood

Referential choices as a function of manipulations (visual cues)

Subject choices

Whether targets were chosen as subjects on repeated reference was modelled as a function of movement type, eye presence and the interaction between movement type and eye presence, using a binomial generalized mixed effect model. Since participant and item were within factors, both were modelled as a random effect component. The maximal random effect structure supported by the data was: a random intercept per item, and a random intercept and non-correlating random slopes for movement type per participant.

The analysis did not reveal a significant effect of movement type on subject choice (β = 0.930, SE = 0.366, χ^2 (1) = 0.29, p = .60), thus targets moving in an animate way were as likely to be chosen as subjects in repeated reference as targets that moved in an inanimate manner (M_{diff} = 3%).

The analysis did not reveal a significant main effect of eye presence on subject choice either (β = -0.133, SE = 0.249, χ^2 (1) = 0.29, p = .60), thus targets with eyes were equally likely to be chosen as subjects in repeated references as those without eyes (M_{diff} = 1%).

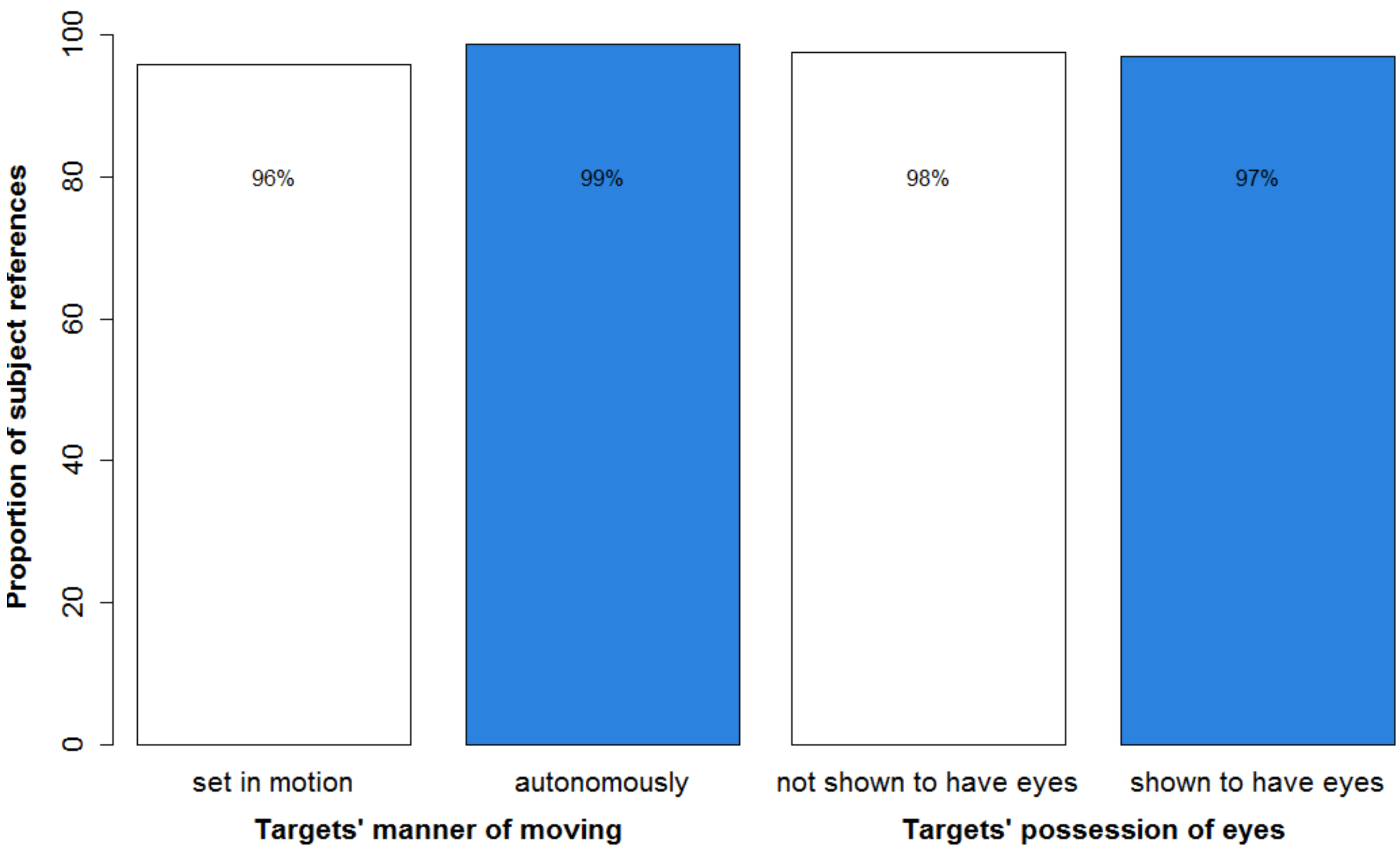

Figure 4.5 | Proportion of subject choices on repeated reference, by movement type and eye presence. Neither factor was found to be significant.

Formula	reduced expression ~ movement * eyes + (1 | item) + (1 + movement || participant)			
Fixed effects	***β***	**SE**	**(DF) χ^2**	***p***
Intercept	6.300	1.041		-
Movement type (animate)	0.930	0.366	(1) 0.29	.60
Eye presence (present)	-0.133	0.249	(1) 0.29	.60
Interaction	-0.030	0.248	(1) 0.02	.90
Observations, groups	*N* 1136, item: 8, participant: 41			

Table 4.5 | Model outcomes of the proportion of subject choices expressed as a function of movement type and eye presence

Referring expressions

Whether targets were referred to by a reduced referring expression on repeated reference was modelled as a function of movement type, eye presence and their interaction, using a binomial generalized mixed effect model. Since participant and item were within factors, both were modelled as a random effect component. The maximal random effect structure supported by the data was: a random intercept and non-correlating random slopes for movement type per item, and a random intercept and non-correlating random slopes for movement type and eye presence per participant.

The analysis did not reveal a significant effect of movement type on referring expressions (β = 0.078, SE = 0.135, χ^2 (1) = 0.32, p = .614), thus targets moving in an animate way were as often referred to by reduced expressions as targets moving in an inanimate way (M_{diff} = 4%).

However, the analysis did reveal a significant main effect of eye presence on referring expressions (β = 0.330, SE = 0.087, χ^2 (1) = 12.15, p = .002) such that targets were more frequently referred to by reduced expression when they were shown with eyes, compared to when they were shown without eyes (M_{diff} = 12%).

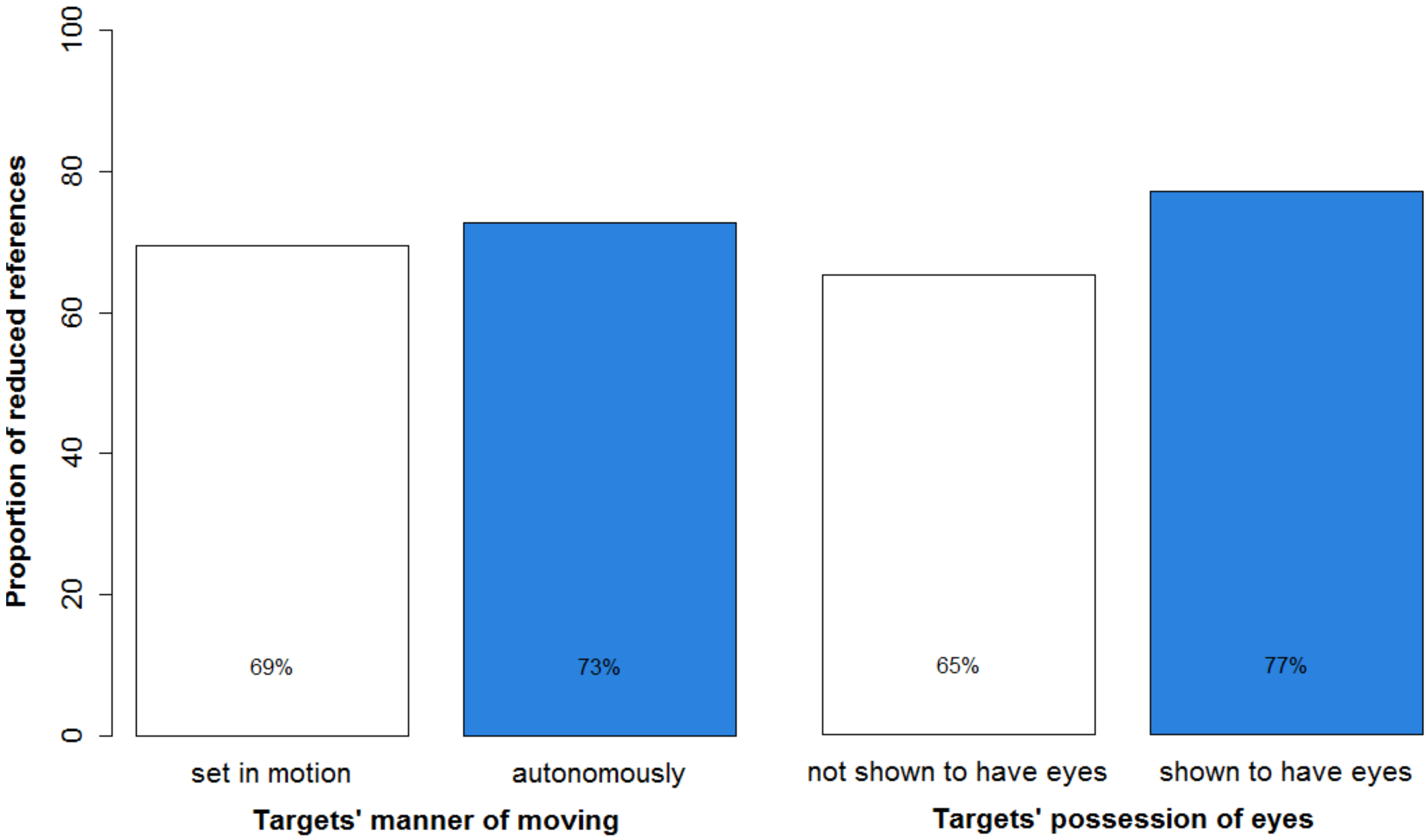

Figure 4.6 | Proportion of reduced referring expressions as a function of visual cues (motion type and eye presence)

Formula reduced expression ~ movement * eyes + (1 + movement || item) + (1 + movement + eyes || participant)

Fixed effects	***β***	**SE**	***(DF)*** χ^2	***p***
Intercept	1.15	0.177		
Movement type (animate)	0.078	0.135	(1) 0.32	.614
Eye presence (present)	0.330	0.087	(1) 12.15	.002
Interaction	0.001	0.071	(1) 0.00	.980
Observations, groups	*N* 1136, item: 8, participant: 41			

Table 4.6 | Model outcomes of the proportion of reduced expressions as a function of visual cues (motion type and eye presence)

Discussion

Per analysis discussion of results

Visual cues and referential choices

The first line of analysis looked into the effects of the experimental manipulations on referential choices. Targets' movement type (whether targets were presented as if moving of their own accord or not) and eye presence (whether targets were shown with or without eyes) were related to referential choices made on repeated reference to targets (whether the target was chosen as subject or object and whether targets were referred to by a full NP or a reduced expression). Thus the first analyses investigated the influence of different kinds of (potential) visual cues for animacy on different kinds of referential choices assumed to be influenced by conceptual accessibility.

The analyses showed no effect of movement type on subject choices. Whether targets moved autonomously or not had no influence on whether targets were chosen as subjects on repeated reference. For example, an autonomously moving target, intentionally waiting for competitors before interacting with them, was equally likely to be chosen as subject on repeated reference as a target that rolled about as if set in motion by an external force. This outcome is in line with Vogels et al. (2013) who also found subject choices to be unaffected by movement as a perceptual cue for animacy. The analyses showed no such effect of eye presence either. Whether targets were displayed with or without eyes had no influence on subject choices. Targets in both conditions were equally likely to be chosen as subject on repeated reference. Thus, neither type of perceptual cue for animacy, that is neither movement type nor eye presence, influenced subject choices.

These outcomes are both a replication and extension of the null effect in Vogels et al. (2013), suggesting that subject choices are not influenced by these visual cues for animacy. However, note that my sample had an extremely high overall percentage of targets in subject position. Targets were objects in only 3% of repeated references to them. Though Vogels' sample did not have such a high percentage of subject targets, their study only included one type of visual cue for animacy – motion – while motion may not be the strongest cue for animacy (see below). Thus, though both studies indicate an absence of an effect of visual animacy on subject choices, any hard conclusions cannot be drawn.

The analyses did not show an effect of movement type on referential expressions either. Whether targets moved autonomously or not had no influence on how they were referred to on repeated reference (that is, by either a full noun phrase or reduced expression). Crucially, however, the analyses did reveal an effect of eye presence on referential expressions. Targets shown with eyes were more likely to referred to by a reduced expression on repeated reference. Based on earlier research (i.e., Fukumura & van Gompel, 2011; Vogels et al. 2013) it is expected to find such an increase in the proportion of reduced expressions when referents are animate. My results therefore suggest that targets were conceptualised as being animate more often in the +[EYE] condition. This is in line with Looser & Wheatly (2010) who, as mentioned earlier, found that especially the eyes were informative in whole-face animacy decisions. Targets shown with eyes were thus conceptualised as animate because eyes were taken as cue for animacy. Hence, their conceptual accessibility increased, which in turn led to an increase in the proportion of reduced referring expressions.

Note that movement type was expected to have a similar effect, based on the study by Vogels et al. (2013), but this effect was not found. I suspect that eye presence was such a strong predictor for animacy that it worked as an attractor, thus detracting from other cues. Thus, factors otherwise predicting for animacy, such as motion, may have lost their effect in the face of the very strong predictor for animacy, i.e. eyes. (cf. Looser & Wheatly, 2010: "the appearance of the eyes is disproportionately informative in conveying whether something is alive").

Importantly however, despite the lack of replication of Vogels et al. (2013) in terms of perceptual animacy based on motion, my results too strongly suggest that perceptual animacy leads to conceptual animacy to the extent that measurable accessibility effects occur, at least for reduced referring expressions.

Visual cues and conceptualisations

The second line of analysis looked into the relationship between perceptual cues for animacy on the one hand, and how participants actually conceptualised targets on the other. This was done by investigating participants' renditions of targets in their retellings of the animations. Based on verbal predicates used to describe targets' experiences and actions a +/-[EXPERIENCER] and a +/-[ACTOR] score was construed for each retelling. The assumption is that if a target has been described as an experiencer or actor, it has also been conceptualised as such. The analyses thus investigated the effects of visual cues for animacy on the resulting conceptual status of targets more closely.

The analyses showed an effect of movement type on the conceptualisation of both experiencerhood and actorhood. If a target was shown to move in an animate way (clearly moving on its own accord and presented as if interacting with competitors intentionally), targets were more often described as both actors and experiencers. For example, in (1) a target shown to respond to appearing competitors by jumping up and down before pushing them away is described as 'disagreeing' with the competitors coming into the screen, thus providing us with a motive for the target's actions. This target did not have eyes; experiencerhood was strictly inferred from motion.

(1) *(…) En terwijl ie bijna helemaal rechts is, komen d'r twee driehoekjes, roze driehoekjes het scherm binnen. En het lijkt net alsof de- het bolletje het daar niet mee eens is, want dan springt ie een keer omhoog en dan gaat ie richting de driehoekjes en duwt ie ze bijna helemaal het scherm uit. En daarna gaat het bolletje zelf aan de rechterkant weg.*

"(…) And when he is almost at the right [of the screen], two triangles, pink triangles, come into the screen. And it seems as if the little ball does not agree with that, because he then jumps up and then moves towards the triangles and pushes them almost out of the screen. And the little ball himself then goes away at the right side."

These results are on the one hand in agreement with Vogels et al. (2013) in that they corroborate earlier findings that motion indeed acts as a perceptual cue for cognitive animacy. On the other hand however, they also validate the concerns that Vogels et al. (2013) raise themselves: "That is, the inanimate movements in our experiments may have been inherently less agentive than the animate movements". As targets were indeed described as actors more often in the animate motion condition, it does seem the case that agency too, was manipulated by using motion as a perceptual cue.

In fact, I take these results to suggest that motion is a perceptual cue for agency first and foremost: on the foreground are the targets' intentional acts and the way the environment (here: the competitors) is affected. But these animate movements were not only viewed as just intentional acts. Wider ranges of thoughts and emotions were envisioned as to causally embed the targets' intentions in a broader background of experiences. In other words, experiencerhood is implied from acting intentionally. I find support for this view in Dowty (1991), which, as mentioned earlier, proposes a model of agency that includes animacy in its prototype structure such that a referent that is a prototypical example of an Agent possesses features associated with animacy too. The targets were thus conceptualised as prototypical agents, as their actions were perceived as the direct result of intentions *and* experiences.

The analyses showed a different pattern for the manipulation of eye presence. An effect of eye presence on the conceptualisation of experiencerhood *was* found: if a target was presented with eyes, it was described more often as having thoughts and experiences. This was expected under the view that eyes are disproportionately informative for animacy decisions, as proposed in Looser & Wheatly (2010). This furthermore suggests that the earlier described effect of eye presence on referential expressions was indeed caused by cognitive animacy. That is, the presence of eyes led to targets being conceptualised as animate more often, and this conceptual animacy in turn led to the targets' increased accessibility such that measurable effects occurred. An effect of eye presence on actorhood was not found, however. Targets with eyes were not more often described as acting of their own accord. Thus, while the manipulation of motion measurably influenced the conceptualisation of both actorhood and experiencerhood, the manipulation of eye presence influenced descriptions of experiencerhood only.

Here, it could have been the case that the range of possible descriptions of the targets' actions was limited by the task. Though participants were asked to retell the stories shown to them in a lively fashion, they could not make up just anything. (Moreover, animations were presented to them twice in order to ensure a correct retelling.) Thus, *if* targets were conceptualised as prototypical agentive animates as a result of eye presence, participants may have had too little room to actually describe them as such, given the task at hand. We should therefore be careful with any hard conclusions about the (lack of) influence of eye presence on actorhood, though I do find it entirely plausible that eye presence indeed did not influence perceived actorhood.

Conceptualisations and referential choices

The third and last line of analysis looked into the relationship between the conceptual status of targets on the one hand, and, on the other, referential choices presumably affected by conceptual accessibility. The conceptual agenthood and experiencerhood of targets was modelled as a +/-[EXPERIENCER] and +/-[ACTOR] score for each animation retelling, based on verbal predicates used to describe targets' experiences and actions. The assumption is again that if a target has been described as an experiencer or actor, it has also been conceptualised as such. Referential choices looked at were subject choices and type of referring expression. This approach allowed for a more direct investigation of the relation between participants' conceptualisations and targets' conceptual accessibility.

The analyses showed no effect of conceptual agency on subject choices. Whether the target was, or was not, conceptualised as acting of its own accord had no influence on whether the target was chosen as subject on repeated reference. For example, a narration with an agentive rendition of the target like (2) and a non-agentive rendition like (3) were equally likely to have the target in subject position in the retelling of the second part of the animation. In addition, the analyses showed no effect of conceptual experiencerhood on subject choices. Whether the target was, or was not, conceptualised as having thoughts and experiences did not influence subject choices on repeated reference. For example, a narration featuring an experiencing target like (4) and a narration featuring a non-experiencing target like (5) were both equally likely to have the target in subject position in the narration of the second part of the animation.

(2) *Een blokje springt heen en weer in het scherm. Vervolgens komt aan de linkerkant twee bolletjes en daar springt ie op en vervolgens springt ie weer naar rechts.*

"A little cube jumps to-and-fro in the screen. Then, at the left, come to little balls and he jumps on them and then he jumps to the right."

(3) *D'r dwarrelt een blauwe driehoek naar beneden en dan komen er van de linkerkant komen twee plusjes het scherm binnen. En terwijl ie naar beneden dwarrelt (...)*

"There is a blue triangle slowly falling downwards and then two little plusses come into view from the left. And while he continues to fall downwards (…)"

(4) *Een kruisje met oogjes komt het scherm binnen vanaf links en ziet een obstakel van twee vierkantjes. Eh daar botst ie tegenaan en eh hij gaat weer terug eh naar waar die vandaan kwam het scherm af.*

"A cross with eyes enters the screen from the left and sees an obstacle of two squares. Err, he bounces on them and err he goes back err to where here came from, out of the screen."

(5) *Het blauwe kruisje glijdt heen en weer. Dan verschijnen er twee blauwe vierkantjes. Het kruisje schuift tegen de vierkantjes aan en schuift dan de andere kant op.*

"The blue cross slides to-and-fro. Then appear two blue squares. The cross slides against the squares and then slides the other way."

These results are in line with the previous analyses which revealed subject choices to be unaffected by visual cues for animacy. Here too, even when looking more directly at participants' conceptualisations resulting from those visual cues, no influence on subject choices was found. However, I should again remind the reader that the distribution of subject choices was fairly skewed. As overall only 3% of repeated references resulted in object choices for targets, it may very well be the case that the lack of power for any effect to be detected was due to sampling error. Thus, while on the one hand the null-result in Vogels et al. (2013) appears to be bolstered by replication and extension (viz., investigating additional visual cues and participants' conceptualisations) any conclusions about the (lack of) effect on subject choices from either visual cues for animacy or the conceptualisations resulting from them are arguably premature. As noted in the theoretical background, there are also theoretical reasons to be extra careful with interpreting these results (other than the usual statistical-theoretical issues with generalising a null-effect).[3] That is, it has been suggested in Vogels et al. (2017) that some referential choices, such a subject choices, may not be driven by conceptual accessibility but are rather influences by for instance lexical accessibility.

The analyses revealed an effect of conceptual experiencerhood on referring expressions. Whether the target was conceptualised as having thoughts and experiences or not

[3] That is, within the usual frequentist statistical paradigm, which relies on null hypothesis significance testing for generalisation, the null hypothesis can only be rejected. In other words: a null-result can never be generalised to the population level. This is so because the null hypothesis is already presupposed when calculating the likelihood of obtaining the data: a p-value literally is the probability of the data while assuming the null hypothesis to be true.

did influence the distribution of full NPs vs. reduced expressions on repeated reference. A narration featuring an experiencing target like (4) was more likely to include a reduced referring expression compared to narrations with a non-experiencing target like (5).

(4) *Een kruisje met oogjes komt het scherm binnen vanaf links en ziet een obstakel van twee vierkantjes. Eh daar botst ie tegenaan en eh hij gaat weer terug eh naar waar die vandaan kwam het scherm af.*

"A cross with eyes enters the screen from the left and sees an obstacle of two squares. Err, he bounces on them and err he goes back err to where here came from, out of the screen."

(5) *Het blauwe kruisje glijdt heen en weer. Dan verschijnen er twee blauwe vierkantjes. Het kruisje schuift tegen de vierkantjes aan en schuift dan de andere kant op.*

"The blue cross slides to-and-fro. Then appear two blue squares. The cross slides against the squares and then slides the other way."

Crucially however, the analyses revealed no such effect of conceptual agency. Whether the target was, or was not, conceptualised as acting of its own accord had no influence on how the target was referred to on repeated reference. A narration with an agentive rendition of the target like (2) and a non-agentive rendition like (3) were both equally likely to include a reduced referring expression or full NP.

(2) *Een blokje springt heen en weer in het scherm. Vervolgens komt aan de linkerkant twee bolletjes en daar springt ie op en vervolgens springt ie weer naar rechts.*

"A little cube jumps to-and-fro in the screen. Then, at the left, come to little balls and he jumps on them and then he jumps to the right."

(3) *D'r dwarrelt een blauwe driehoek naar beneden en dan komen er van de linkerkant komen twee plusjes het scherm binnen. En terwijl ie naar beneden dwarrelt (...)*

"There is a blue triangle slowly falling downwards and then two little plusses come into view from the left. And while he continues to fall downwards (…)"

From these results several conclusions can be drawn. First, some target A - acting of its own accord - and some other target B - not acting of its own accord - appeared to be equally conceptually accessible, judging by the unaffected distribution of reduced referring expressions. This is not congruent with a model of cognitive animacy that includes actorhood as a prototype feature. If we *do* assume such a model, targets that acted of their own accord would have been conceptually more animate than non-agentive targets. Then, as conceptual animacy would lead to greater conceptual accessibility, the proportion of reduced referrals would have been influenced by agentive narrations. However, this was not the case. I therefore take these results to be in support of a model of cognitive animacy that does not include actorhood as a prototype feature.

Note however, that I do not argue that some agent A cannot be more accessible than some agent B based on its agentive features. That is, if some agent A is more of a prototypical agent than agent B, it probably has more agentive features associated with animacy too (cf. Dowty, 1991). In that case we would expect agent A to be more accessible than agent B – though crucially *not* due to its actorhood per se, but rather its animacy. Therefore I argue for a model of cognitive animacy that does not include *acting* as a prototype feature. In my view, my data support a model in which some acting referent A will not be conceptualised as more animate just because it is acting.

Second, and using the same line of reasoning, some target A – conceptualised as an experiencer – and some target B – not conceptualised as such – appeared to be more conceptually accessible than B, judging by the effect experiencing targets had on the distribution of reduced referring expressions. This is congruent with a model of cognitive animacy that includes experiencerhood as a prototype feature. If we assume such a model, targets that had thoughts and experiences would have been conceptually more animate than non-experiencing targets. Then, as their conceptual animacy lead to their conceptual accessibility, the proportion of reduced referrals was influenced too. I therefore conclude that we should model cognitive animacy in such a way that it includes experiencerhood as a prototype feature.

Overall discussion of results

The agentivity model of animacy led to the prediction that a referent's actorhood contributes to its conceptualisation as an animate. More specifically, it predicts either main effects of both actorhood and experiencerhood (assuming both factors are sufficient conditions) or an interaction effect between actorhood and experiencerhood (assuming both factors are required conditions) on the referent's conceptual accessibility, as reflected by referential choices when the target is referred to. These predictions were not borne out.

Looking at the effects of visual cues under this account, one would expect motion type to affect referential choices, assuming at least that the depiction of autonomy results in a target being conceptualized as an actor. Importantly, the latter assumption was investigated and confirmed to be true. Inspection of participants' retellings revealed that autonomous targets were indeed conceptualised as actors more often than non-autonomous targets. Still, referential choices were unaffected by motion type, neither as main effect nor in interaction with eye presence. Looking at the effects of how targets were conceptualised under this account, one would expect referential choices to be influenced in retellings where targets were described as actors (main effect) or as actors *and* experiencers (interaction effect). However, also the investigation of participants retellings did not reveal any effect of actorhood on referential choices. Crucially then, we observe that several lines of investigation were taken and that all converged on the same outcome. The data are not in support of the agentivity model of animacy.

The mind-only model of animacy led to the prediction that only a referent's experiencerhood contributes to its conceptualisation as an animate. More specifically, it predicts (only) a main effect of experiencerhood on the referent's conceptual accessibility, as reflected by referential choices when the target is referred to. This prediction was not borne out.

Looking at the effects of visual cues under this account, one would expect eye presence to affect referential choices, assuming at least that targets depicted with eyes are conceptualized as experiencers. The latter assumption was investigated and confirmed to be true. Inspection of participant's retellings revealed that targets with eyes were indeed conceptualized as experiencers more often than targets without eyes. Thus, eye presence had a main effect on referential choices, which was revealed to be driven by the conceptual experiencerhood. Importantly, this account predicts motion as a visual cue to have an effect on conceptual experiencerhood too. This is so because earlier research (Vogels et al., 2013) found motion to influence referential choices, which, under this account, *must* be explained to be ultimately an effect of conceptual experiencerhood. Again, investigation of participants' retellings did reveal this to be the case. Targets moving autonomously were indeed conceptualised as experiencers more often than non-autonomous targets. In the current study, this effect was not robust enough to result in a correlation between motion type and referential choices too. However, this absence of this correlation does not go against the predictions of the mind-only model. The main prediction, in light of previous research, is that motion type influences experiencerhood and the data of this study are in support of this prediction. Moreover, a likely explanation for the diverging results can readily be given too. That is, the key difference between this study and the study by Vogels et al. (2013) is the inclusion of eyes as a visual cue for animacy. Eye presence may have been such a strong cue for experiencerhood that it detracted from the influence of motion on conceptual experiencerhood. Looking directly at the effects of conceptual experiencerhood then, one would expect under this account that referential choices are influenced in retellings where targets were described as experiencers. Indeed, the investigation of participants' retellings did reveal an effect of experiencerhood (and *only* experiencerhood) such that targets described as having experiences were referred to by reduced expressions more often. Crucially, we thus observe again that several lines of investigation were taken and that al converged on the same outcome. The data are in support of a mind-only model of animacy.

General discussion

On the one hand, this study's results do suggest that conceptual experiencerhood has an influence on conceptual animacy. Analysis of the effects of visual cues (here: eye presence) on how targets were conceptualized confirmed that targets shown with eyes were more often conceptualised as experiencers. Indeed, analysis of the influence of visual cues on referential choices revealed an effect of eye presence on referential choices, such that targets with eyes were referred to by reduced expressions more often. Moreover, analysis of the influence on the conceptual status of targets also revealed the same effect: targets conceptualized as experiencers were more often referred to by reduced referential expression. Thus, my results are in support of a mind-model of animacy.

On the other hand, this study's results suggest that conceptual actorhood has no influence on conceptual animacy. Analysis of the effects of visual cues (here: motion) on how targets were conceptualized, as gauged by how they were described, confirmed that targets shown to act autonomously were more often conceptualised as actors. Yet, analysis of the influence of visual cues on referential choices revealed no effect of motion on referential choices. Thus, it was not the case that autonomous targets were referred to by reduced expressions more often. Moreover, analysis of the influence on the conceptual status of targets also revealed no effect on referential choices: it was not the case that targets conceptualized as actors were more often referred to by reduced referential expression. However, previous research has shown that conceptual animacy does influence referential expressions. Assuming an agentivity-model of animacy in which both actorhood and experiencerhood play a role in the conceptualisation of animacy, such an effect was to be expected. My results do therefore not support the agentivity-model of animacy. The question then, is what these results tell us about current accounts of cognitive animacy in which agentivity does have its place. To that end, I will first come back to Dahl's proposal (2008) and then discuss Yamamoto's proposal (1999) again.

In terms of the cognitive underpinnings of animacy, Dahl (2008) proposes "a threestep cognitive scale, corresponding to the animacy hierarchy: the self is the model for other animate individuals, which are in their turn models for inanimate objects when understood as individual ‘things’.” Thus, the cognition of animacy is equated to the (re)cognition of individuality, which is rooted in self-awareness. There can be no misunderstanding as to what Dahl envisions as this self (and animates in general): a perceiving and acting entity (cf. Dahl 2008: 145: “the capacity for perceiving and acting upon the environment is more or less what one would see as the defining criterion for being animate.”). This goes against what one would predict on the basis of my findings, which suggest a model of cognitive animacy without actorhood. A first glance, we thus seem to run into problems.

The aim of Dahl (2008), however, is not to give a definitive account of cognitive animacy. Rather, Dahl’s aims are: “to develop the idea (…) that animacy is an ontological category” and to “to speculate on the cognitive and phylogenetic bases for the pervasiveness of animacy in language” because he is “convinced that we will not be able to understand the way language is organized as long as we do not have an account of the cognitive basis of these [animacy] categories” (Dahl 2008: 14; square brackets added by me). In essence, Dahl sees a ‘problem’ in the pervasiveness of animacy and sets out to explain this observation by proposing that animacy is a fundamental category in human cognition, thus deeply rooted in evolution. The question then, is what we can make of Dahl’s proposal, while we entertain the idea that his specific view on the notion of individuality might be wrong or incomplete.

Firstly, it should be observed that his reasoning behind the claim that animacy is an ontological category does not hinge on his idea of individuality. His proposal follows a general pattern of deduction and only one of his premises is weakly conditional on agentivity per se. Interestingly, I believe this premise actually fails and could in fact be saved precisely by removing agentivity from it.

> *“A relatively standard list of such [thematic] roles could be: Agent, Experiencer, Theme/Patient, Instrument, Cause, Location, Goal, and Source. Of these, the two first mentioned can only be filled by animate beings—and that is obviously what is behind the syntactic distribution of animates, since these two roles are also the ones that are normally realized as syntactic subjects. Indeed, the capacity for perceiving and acting upon the environment is more or less what one would see as the defining criterion for being animate. We can thus see that animate entities behave like an ontological type in the sense that membership in this type is important for determining what can be said about an entity.”*
> (Dahl, 2008: 145; square brackets by me.)

In sum, Dahls reasoning goes like this:

- Ontological types are incommensurable (What can be said about one type makes no sense for another type)
- Animate thematic roles (agents/experiencers) and other thematic roles are incommensurable
- Animates are an ontological type

But here is the catch. If we include acting as a membership property of the animacy category, it is *not* the case that the same can be said of all category members if they would consist of agents and experiencers. Experiencers do not act and it is therefore not always true that something sensible can be said of experiencers which does make sense for actors. In fact, agents and experiences are only fully commensurable if we assume just sentience as an animacy property (assuming in addition *prototypical* agents - that is, sentient ones, Dowty 1991). Thus, the one example of agentivity playing a role in his reasoning is not a strong one.

With regard to the cognitive underpinnings of animacy, Yamamoto (1999) proposes a radial category prototype model, with humans as the abstract, central exemplar of an animate.

The degree to which an entity is conceptualized as an animate is directly related to the similarity to the central exemplar. An entity sharing more prototype features will therefore be closer to the central category than entities sharing fewer features, resulting in its conceptualization as an 'higher' animate. Yamamoto argues further that these features are dependent on the language user's attitude towards their possessor: the animacy value assigned to an entity is clearly related to the empathy a language user feels for it. A pet cat or even a car may be perceived as more animate than other cats or cars because we perceive them to possess of more human-like traits. Importantly, Yamamoto too envisions the human prototype as perceiving and acting entities. In addition, it is clear that actorhood plays a role in empathy as well. As mentioned before, linguistic empathy is defined as "the speaker's identification, with varying degrees, with a person who participates in the event that he describes in a sentence" (Kuno & Kaburaki 1977).

Here, and contra to Dahl's work, I do feel that the core of Yamamoto's proposal is in the actual model of cognitive animacy itself. Thus, I lay out my argument by focussing on the model-theoretical aspects of Yamamoto's (1999) proposal. We therefore need to look more closely at the proposed radial prototype model.

In prototype theory, a prototype category is proposed to be radial in nature. The abstract prototype (the primary exemplar of the category) is placed at the centre. Instances of category C that have a high degree of C-ness are placed near the centre, as these are more prototypical instances. Instances of a low degree of C-ness are placed further away from the centre and are less prototypical instances of C. (Lakoff, 1987) Note here, that the distance between instances of C is a matter of their C-ness. Ergo, what is fundamental to C, is its C-ness. If we take the radiality of C-space literally, it is a 2D-space, suggesting that C-ness is a two-dimensional multivariate. Though it is probably the case that C-ness can be of an arbitrary dimensionality, the point of stressing its probable low-dimensionality is to contrast it with the potential high dimensionality of the prototype feature space. This makes abundantly clear that we should take the prototype feature space to be a projection of C-space. In other words, prototype features are not fundamental to C. Crucially then, we could in principle maintain a prototype category with agentive features, while we model C-ness differently, based upon what's fundamental to these features.

I will do so below, but first I wish to stress three points to solidify the above. Firstly, it is on the grounds of cognitive economy, that cognitive structures are relatively stable, while it is also true that prototypes are dynamic (Geeraerts, 1997). Indeed, new experiences need to be classified against stored knowledge, while stored knowledge also needs to be updated in light of new experiences. The implied dynamicity of the prototype features is important here: they truly cannot be fundamental to C. Secondly, above I assume a 'probable low-dimensionality' (of C-space) also on grounds of cognitive economy. it would be highly unparsimonious for the large amounts of Cs we have to deal with to also consist of large C-spaces. Thirdly, above I say 'potential high dimensionality' (of the prototype feature space) on the grounds of Yamamoto's empathy argument, as there seem to be many axes on which I could feel less or more empathy towards an entity. My argument doesn't hinge on this example though. If we take C-ness to be something arbitrary like, say, motherness, then too the dimensionality of the protype feature space is higher than that of C-ness (that is, we can come up many potential features of the mother prototype. From this observed difference in dimensionality, I therefore conclude that prototype features are not fundamental to C.

What I suggest in the light of my findings, is that the C-ness of animacy is (something like) experiencerhood. In addition, I suggest that the degree to which an entity is classified as less or more animate, is a matter of the evidence one has for its experiencerhood. I argue that this adequately explains Yamamoto's proposed correlation between empathy and animacy. For instances of experiencerhood (pertaining to others) to count as evidence of experiencerhood (for me), I have to be able to identify with said experiences, at least to a degree. As I only really have access to my own experiencerhood, at least some common ground is needed for other instances of experiencerhood to be classified as such. Thus, the more empathy I feel for an entity, the more shared experiences there are. In effect this increases my belief in the other's experiencerhood, precisely because I have access to it via my own experiences. Crucially, this could save a proposal which includes agentive prototype features in the following matter. Identification with certain kind of actions could ultimately also be a matter of gaining access to the mentality behind them. Indeed, knowing someone's mental states is a matter of reading several types of cues: facial expression, body language, but also how one behaves.

With regard to the latter, I again want to highlight that I am reasoning in line with Looser & Wheatley (2010). As already pointed out above, they suggest that the perception of animacy is something like the ascription of mind to an entity. Importantly, evidence plays a large role in this process. Looser & Wheatly (2010) contrast for instance the ascription of faces, which seems to be rather indiscriminate, with the ascription of mind, which seems to be anything but indiscriminate. The idea is that preliminary cues for life are processed indiscriminately because it is better to have some false positives rather than mistaking a bear for a stone. However, spending a large amount of attentional resources (for instance those playing a role in complex social interactions) on a false positive would not be advantageous. Thus, the definitive judgement about an entity possessing a mind or not is not indiscriminate. Crucially they suggest that this is why eyes play such a large role in the perception of animacy: "Eyes convey a wealth of information, from attention to emotion and intent." Ergo, the eyes are a prime source of evidence for experiencerhood which is why they are "disproportionately informative in conveying whether something is alive".

Strikingly, the approach taken in this study (specifically, also investigating how targets were conceptualized) also allows to explain why earlier studies did find motion to influence conceptual animacy (Vogels et al. 2013), while further bolstering support for the mind-model of animacy. That is, if we reason from the mind-model of animacy we must be able to explain earlier findings in terms of experiencerhood. We thus hypothesize that autonomously moving targets in earlier studies were conceptualized as prototypical agents (Dowty 1991), that is, entities that not just act, but are also sentient. What we expect then, is that also in the current study autonomous motion led to the conceptualisation of prototypical agentivity. Thus, targets shown to move autonomously are expected to be both conceptualized as actors and as experiencers more often. Crucially, my analyses did confirm this. Autonomously moving targets were significantly more often described as having thoughts and experiences compared to non-autonomous targets. However, this effect was not robust enough for motion to have an effect on referential choices too. The most likely explanation here, is that eye presence was such a strong predictor for experiencerhood that it detracted from the influence motion had on conceptual experiencerhood. Importantly, I suggest that this might not be a mere experimental artefact. If evidentiality for experiencerhood is indeed the mechanism behind animacy classifications, it could well be the case that evidence is weighed in relation to other evidence, if other evidence is present. I suspect this to be the case based on how critical participants were in the study of Looser & Wheatly (2010) with regards to their animacy judgements. Participants were shown morphed images of live-like dolls and real humans, along a 'realness continuum', where some morphs were thus more or entirely doll-like and other more or entirely human-like. Only when faces and eyes were clearly human, were pictures judged to be from an animate source. In the current study however, simple 'cartoony' eyes were sufficient to elicit accessibility effects – crucially, in the absence of real eyes or faces. In previous studies then, in the absence of eyes or other strong predictors for experiencerhood, motion was enough to reliably trigger accessibility effects. Thus, what counts as evidence for experiencerhood in one context, may not count or count to a lesser degree as evidence in a context in which stronger evidence is present too.

As for weaknesses of the current study, I have already mentioned that coding of participants' retellings was done on the predicate level, abstracting away from specific utterances. Though this is one area which could be improved upon (thus by coding predicates on a per instance level), I have also made clear that my approach still takes the entirety of the retellings into account. Final [actor] and [experiencer] scores were very much dependent on the narrations as a whole, since all verbal predicates were considered for scoring at the observation level.

A related potential area of improvement also has to do with coding of the predicates. That is, currently all predicate scores, and thus the resulting narration scores, were done by a single observer: me. An obvious way to improve on this, would be to have multiple observers score the predicates, which would also allow to calculate the inter-observer variability. Crucially however, all levels of analyses were in agreement with each other. For the sake of argument, we could in fact strip away the two lines of analyses that relied on the coding of utterances and still arrive at roughly the same conclusions. Not finding any effect of motion on referential utterances is not in line with a model of cognitive animacy in which actorhood is part of its makeup, while finding only an influence of eye presence is in line with a mind-model of animacy. This is not to say that the additional analyses were superfluous. Without the additional analyses we would, for instance, need to speculate more on this study's null-effect of motion while Vogels et al.'s study (2013) did find an effect. It was precisely the current approach which allowed to investigate this in more detail.

In sum, although the way predicates were scored could be improved upon, I do not expect different results. Moreover, I feel that considering the way targets were described added immensely to the conclusions that could be drawn from the data.

A last remark then, is that actorhood was strictly defined and manipulated in terms of autonomous motion. However, if we look at Dowty (1991) it is clear that agentivity can also be understood in terms of the affectedness of the environment. That is, a prototypical agent, because of its acts, has an effect on its environment. Though targets were shown to interact with competitors and thus to have some effect on then, this aspect to agentivity was not strictly controller for. Thus, additional research may be done in which the affectedness of competitors is controlled for or manipulated. The current experimental design would readily allow for this, by systematically modifying the latter parts of the animations such that the effects of the targets' acts on the competitors are more outspoken in specific experimental conditions.

Future research

In line with Looser & Wheatly (2010) I proposed that animacy classifications rely upon the ascription of experiencerhood. Crucially, I also noted that I only have access to my own experiences and that I therefore must *infer* another's mentality from all kinds of cues. I therefore suggested that 'gathering evidence for experiencerhood' plays a large role in the cognition of animacy. Obviously it could be said that any kind of classification relies on gathering evidence, in the sense that recognizing for instance a bottle is dependent on my evidence for its bottlehood. However our lives are not dependent on the classification of bottles. It is therefore unlikely that indiscriminatory processes to parse preliminary cues for bottlehood are at work. By extension it is also not needed to have highly discriminatory processes in place, as we are not generating false positives.

Although my view is still too general to make very specific predictions, the general prediction is that if the evidence for a referent's experiencerhood increases, so too will the probability increase that that referent is deemed to be an animate. Phrased differently, and assuming that cognitive animacy is gradual in nature, we thus say that we expect that the degree to which an animate is conceptualised as an animate is directly related to the evidence we have for its experiencerhood. Thus, to test this account we must vary the evidence for experiencerhood in an experimental context. This obviously needs to be operationalized further, where for instance linguistic theory about evidentiality might inform us. (I'm not suggesting we could influence conceptual animacy by varying evidentiality markers, though I do find the idea interesting). My preliminary idea would be to look into differences between first-order evidence (such as visual animacy information, for instance communicated by the eyes) and second-order evidence (such as evidence given by means of a story in which experiences are described which were not directly observed). Differences may also be found between first and second-order evidence and even less direct evidence, where experiencerhood needs to be inferred from some other cue. Here autonomous motion serves as an example, from which intentionality and hence experiencerhood is inferred.

Another preliminary idea is to look into effect of the quantity of evidence. Again, this needs a better operationalisation, but at its simplest interpretation if could be a matter of varying for instance low quantities (describing a mental state by *one* predicate, i.e., an *angry* referent, a *happy* referent) with higher quantities (using more phrases to describe a referent's mental state).

To conclude also *experiencerhood* needs to be explored further. There are many aspects to experiencerhood, such a bare perceptions, feelings/emotions, thoughts and intentions. Especially exploring intentionality further seems interesting, due to its relation to actorhood / agentivity. Another preliminary idea here, is to contrast stimuli in which intentions need to be inferred from a general depiction of actorhood / agentivity with stimuli in which intentions are more directly provided.

Strong support for my model would lie in for instances differences between a within-participant and a between-participant study. That is, in a within-participant design, participants should weigh lower quantities/qualities of evidence as even lower than in the between-participant design. I thus assume an experiment to be such a context in which evidence is weighed in relation to each based on my own findings that eye presence detracted from the influence of motion on experiencerhood. Therefore, the general effect of quantity/quality of evidence should be larger in a within-design.

Crucially, I argue that even these very general predictions differ from what one would expect under an account in which empathy is the main mechanism, though there probably are similarities (cf. Yamamoto, 1999). That is, if we increase the quantity/quality of evidence of the experiencerhood of a referent, we increase the experiences that are (perceived to be) shared too. It is therefore likely that the degree to which we identify with that referent increases too, though this would be so on average. Thus, the correlation between the quantity/quality of evidence for experiencerhood and empathy should be weaker than the correlation between evidentiality and animacy. In addition, I do not see why the correlation between quantity/quality of experiencerhood and empathy would differ between within-designs and between-designs. Thus, if we would want to test the empathy and evidentiality models in opposition, we could simply measure the strengths of the respective correlations.

Conclusion

This thesis set out to investigate the cognitive underpinnings of animacy. The (perceived) animacy of a referent plays a role in a number of linguistic phenomena. The influence of animacy on referential choices is particular relevant for this study. Research has for instance shown that animate referents are more often referred to by reduced referential expressions (such as pronouns), compared to inanimate referents. Other examples are the influence of animacy on incremental parsing and several types of grammatical phenomena. Given this pervasive influence of animacy on language use, the question was raised how animacy is cognitively organised.

In Dahl (2008) and Yamamoto (1999) anthropocentric models of cognitive animacy are proposed, in which animacy judgements are supposed to revolve around a central, human exemplar, such that the degree to which a referent is conceptualised as an animate is directly related to the traits it is perceived to share with the animacy prototype. Though these accounts are not fully specific on the animacy feature space (thus, do not specify all traits which should or could be shared between referent and prototype), they make abundantly clear that the prototype should be understood to be an experiencing and acting entity. The prototype thus has experiencerhood and actorhood as prototype features.

In Looser & Wheatly (2010) it is assumed that animacy judgements revolve around the ascription of mind, such that a referent will be conceptualised as an animate when it is perceived to have mental states. Referents are for instance perceived to have a mind when they are perceived to have (real) eyes, as eyes in particular communicate mental states.

From these proposals, two opposing models were distilled. Based on Dahl (2008) and Yamamoto (1999) the agentivity-model of animacy was construed. In the agentivity-model, both a referent's perceived experiencerhood and actorhood play role in its conceptualisation as an animate, either as primitives of animacy (both are required) or as correlates of animacy (either is sufficient). Based on Looser & Wheatly (2010) the mind-model of animacy was construed. In the mind-model, a referent's perceived experiencerhood is a required and sufficient condition for its conceptualisation as an animate.

An experiment was conducted to test the validity of these accounts. Participants were shown 32 short animations of a target geometrical shape interacting with two competitor geometrical shapes. The hypothesized animacy features, actorhood and experiencerhood, were manipulated using visual cues, in a 2x2 design (within-participant and within-item, using 8 different animations per experimental condition). Motion was used as a cue for actorhood and was systematically varied by showing targets as moving either autonomously or as having been set in motion (cf. Vogels et al., 2013). Eye presence was used as a cue for experiencerhood and was systematically varied by showing targets either with or without eyes (cf. Looser & Wheatly, 2010). Participants were asked to retell the animations in a lively fashion. The influence of the postulated animacy features on language use was explored by analysing participants' retellings of these animations.

As animacy has been shown to influence referential expressions, the proportion of reduced target referrals was used to gauge the targets' conceptual animacy. Thus, the relationship between visual cues (motion, eye presence) and referring expressions was statistically investigated to test the hypothesized animacy features' influence on cognitive animacy. However, analysing visual cues and analysing their *supposedly* related animacy features are not the same (and indeed, the relationship between visual cues and perceived experiencerhood and actorhood is a presupposition too). Therefore, the targets' perceived experiencerhood and actorhood was explored too. On the basis of verbal predicates that were used to describe the targets' actions, thoughts and feelings, a +/-[EXPERIENCER] and +/-[ACTOR] score was construed for each narration. This allowed to test both the relation between visual cues and their supposedly related animacy features and the relation between the supposed animacy features and referential choices.

The analyses revealed that eye presence was a cue for perceived experiencerhood. Targets with eyes were perceived as experiencers more often than targets without eyes. The analysis also revealed a relationship between eye presence and referential expressions and, in addition, a relationship between perceived experiencerhood and referential expressions. Targets were referred to more often by reduced expressions and were thus conceptualised as animates. Thus, perceived experiencerhood played a role in conceptual animacy.

The analyses revealed that motion was a cue for perceived actorhood. In addition, motion was revealed to be a cue for perceived experiencerhood too. Targets moving autonomously were more often perceived as actors and as experiencers. Yet, no relationship between motion and referential expressions was found. Also, no relationship between perceived actorhood and referential expressions was found. Here, targets were not referred to more often by reduced expressions and were thus not conceptualised as animates. Thus, perceived actorhood played no role in conceptual animacy.

The results support the mind-model of animacy. They do not support the agentivity-model of animacy. Importantly, the latter should not be taken to imply that agentivity has no role in animacy conceptualisations. As prototypical agency is both a matter of acting and sentience (Dowty 1991), a prototypical agent is likely to be perceived as having mental experiences too (cf. the effect of autonomous motion on perceived experiencerhood found in this study).

The findings of this study do not support current proposals which postulate animacy classifications to revolve around a human, experiencing and acting exemplar, if we take these proposals to suggest that a referent will be conceptualised as (more) animate just because it is acting. We must arrive at a weaker interpretation such that the prototype features of the central exemplar are strictly seen as projections of what's fundamental to animacy, namely experiencerhood. In other words, acts are mere physical projections of a mind in action. The animacy prototype could therefore still have acting as one of its prototype features, but it is only relevant to animacy conceptualisations in so far as it is perceived as *evidence for experiencerhood*.

The findings of this study do support a view on animacy in which animacy classifications are directly related to the ascription of mind (Looser & Wheatly, 2010). Looser & Wheatly (2010) found that referents are perceived to have a mind when they are perceived to have (real) eyes, as eyes in particular communicate mental states. I interpreted these findings such that a referent in possession of eyes is perceived to be alive, because the eyes communicate mental states and therefore give *evidence for experiencerhood*.

I have found evidence supporting a mind-model of animacy in which (gathering) evidence for experiencerhood is the mechanism behind the cognition of animacy.

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