

Is a tree more animate than the sun? Using the Implicit Association Task to study animacy

Animacy is widely thought to be conceptualized as a gradient, with humans on one end and artifacts (e.g. towel, fork) on the other ^{1,2}. We lack a clear understanding of the linguistic/conceptual organization of entities in the middle of the continuum (e.g., trees, fire, a river) — is there a single animacy continuum over all entities? If not, how do individuals represent the continuum in differing ways? Progress in answering these questions is constrained by over-reliance on aliveness judgments (e.g., “is a river alive?”) as a way of operationalizing animacy. We present a novel method for studying animacy, an adaptation of the Implicit Association Task (IAT) ³. While plants are judged to be alive more often than natural abiotic entities such as fire, our IAT suggests that U.S. English speakers conceptualize plants and natural abiotic entities as having similar levels of animacy. These findings highlight the need for a more comprehensive theory of how concepts of animacy are reflected in different ways across linguistic contexts.

Background Researchers often draw a distinction between three types of animacy: biological (how entities are in the world), cognitive (how we think about animacy), and linguistic (how animacy is grammaticalized in morphosyntax) ^{4,5}. Cognitive animacy is frequently operationalized through the word *alive*, which integrates two types of knowledge (Anonymous, 2025). First, *alive* imposes a biologically-based categorical distinction on the world, with an implied ground truth about which entities are alive and which are not. Second, *alive* integrates knowledge of conceptual gradients: on average, English speakers are more likely to judge animals as alive than plants (94% vs. 78% of trials) and to judge natural abiotic entities as alive than artifacts (13% vs. 6% of trials) ⁶. This supports animacy being conceptualized as a continuum. Indeed, the binary biological meaning of *alive* is difficult for children to learn, suggesting that other dimensions of animacy, such as goal-directed action, are conceptually prominent throughout the lifespan ⁷.

According to aliveness judgments, plants are more animate than natural abiotic entities. Is this asymmetry definitive of cognitive animacy broadly, such that it would surface across a variety of tasks, or is this asymmetry particular to the meaning of *alive*? To test this question, we adapted the IAT such that participants associated different sets of pictures (e.g., animals vs. artifacts) with animate vs. inanimate words (e.g., *lively* vs. *thing*). We compared the difference in participants’ reaction times when associating one set of pictures with one set of words over the reverse mapping. For example, if plants are conceptualized as more animate than natural abiotic entities, then participants should be faster at associating plants with animate words and natural abiotic entities with inanimate words than the reverse. This task differs from aliveness judgments in that no explicit judgment is given, and that the words do not imply a ground truth (e.g., there is no ground truth about what entities are lively).

Methods We recruited 413 U.S. English speakers on the online crowdsourcing platform Prolific. Each person did one of the nine experiments listed in Figure 1 (43 - 48 participants per experiment). Participants were excluded if they reported not knowing one of the study words.

Table 1. Images from each item category

Humans	3 men, 3 women
Animals	gorilla, rabbit, fish, dolphin, bear, lovebird
Plants	spruce, cactus, wild oats, oak, waterlily, cattail
Natural abiotics	sun, smoke, stars, wave, Earth, wildfire
Vehicles	bicycle, jet, sailboat, rickshaw, train, car
Artifacts	book, cup, fork, pillow, rag, pen

We selected five animate words (*aware, action, lively, moving, spirit*) and five inanimate words (*inert, object, static, still, thing*) based on Harvey’s definition of “person”⁸ and by asking English speakers to list words associated with “animate” and “inanimate.” Six images from each of six entity categories were also chosen (see Table 1).

We used a standard IAT blocking procedure. Participants first learned to map the two sets of words to different keys (e.g., pressing ‘D’ for animate words and ‘K’ for inanimate

words). We referred to these as ‘Category 1 words’ and ‘Category 2 words’ since *animate* and *inanimate* are not well-known words. Participants had to press the correct key before moving to the next trial. Then participants learned a mapping between sets of pictures and keys (e.g., ‘D’ for humans and ‘K’ for artifacts). Then in a combined block, participants responded to both words and images. Next, the key mapping for images switched (e.g., ‘K’ for humans and ‘D’ for artifacts). Finally, in a second combined block, participants viewed both words and images again, but with the new key mapping for images. We counterbalanced whether the first combined block was congruent (e.g., humans and animate words on ‘D’) or incongruent (e.g., humans and inanimate words on ‘D’). There were 312 trials in each experiment.

Results/Discussion We analyzed latency (ms) to a correct response in the combined blocks using linear mixed effects regression. Possible fixed effects were stimulus type (word vs. image), congruency (trials in congruent vs. incongruent blocks), and experiment. We computed effect size *d*-scores for each participant (see Figure 1), indicating the latency difference between congruent and incongruent trials. Higher values correspond to greater speed in congruent over incongruent trials.

All experiments showed a congruency effect except for

Plants/Vehicles. The effects for Humans/Artifacts and Animals/Artifacts support the construct validity of this task (e.g., participants were faster at associating humans with the animate words, reflecting their conceptual linkage). Plants and natural abiotics were more animate than artifacts but less animate than animals. Crucially, natural abiotics but not plants were more animate than vehicles. Finally, when in direct competition, plants were slightly but significantly more animate than natural abiotics. Taken together, these results suggest that plants and natural abiotics are conceptualized as having similar levels of animacy. The IAT thus indicates a different animacy continuum than *alive*, demonstrating the limitation of relying on aliveness judgments to operationalize cognitive animacy. There was also extensive individual variation in the final three experiments, raising the question of why people represent the middle of the animacy continuum in different ways. A comprehensive theory of animacy should account for these differences across tasks and individual participants.

References 1. Yamamoto. *Animacy and Reference* (1999). 2. Sha et al. *J. Cogn. Neurosci.* (2015). 3. Greenwald et al., *J. Pers. Soc. Psychol.* (1998). 4. Bayanati & Toivonen. *Open Linguist.* (2019). 5. Trompenaars et al. *Lang Sci.* (2021). 6. Goldberg & Thompson-Schill. *Psychol. Sci.* (2009). 7. Opfer & Siegler. *Cognit. Psychol.* (2004). 8. Harvey. *Animism.* (2005).

