Estimating ages of acquisition for animal words

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In designing the stimuli for our experiment, our goal was to use a set of target animals that varied in their average age of acquisition (AoA). To do this, we used two sources of information: (1) Concurrent parent-report estimates of their children's vocabularies (Wordbank; Frank, Braginsky, Yurovsky, & Marchman, 2017), and (2) Retrospective self-report estimates from a large group of adults on Amazon Mechanical Turk (Kuperman, Stadthagen-Gonzalez, & Brysbaert, 2012).

Wordbank is a large and growing repository of administrations of the MacArthur-Bates Communicative Development Inventory (CDI; Fenson et al., 2007)–a checklist of words and other items administrered to parents in order to estimate their child's vocabulary. Because Wordbank contains a mixture of cross-sectional and longitudinal data, and we wanted to ensure independence of data across measurements, we used only the first administration for each American English-learning child in the database, yielding 4706 children. For each animal word, we fit a separate robust general linear model, estimating the proportion of children whose parents reported their producing the word from eight to 30 months (including data from both the Words and Gestures and Words and Sentences forms). Each word's normative age of acqusition was defined to be the first month of age at which 50% or more children were estimated to know the animal.

Because only a subset of the animals in the Rossion & Pourtois (2004) image set are included on the MacArthur-Bates Child Development Inventory, and thus available in Wordbank, we also used adult self-report norms from Kuperman et al. (2012) to derive estimates for the remaining animals. Typically, adult self-report estimates of age of acquisition are highly correlated with parent-report estimates, and they were for the 28 animals in both data sources (r = 0.8, t = 6.91, $p < .001$). However, self-report estimates were made on a 1-7 Likert scale rather than on the scale of months.

In order to estimate the age of acquisitions for animals missing from Wordbank, the fit a a general linear model estimating Wordbank age of acquisition from Kuperman et al. (2012) age of acquisition for all animals in both sets (`Wordbank ~ Kuperman + 1`). We then used this model to scale age of acquisitons for the 22 animals in the Kuperman et al. (2012) set missing from Wordbank. Table 1 shows the final estimated ages of acquisition for each animal in the Rossion & Pourtois (2004) set as estimates from Worbank, Kuperman et al. (2012), and our regression models. For comparison, Figure 1 shows the proportion of parents of 2-2.5-year-olds in our study who reported that their child knew each of the tested animals. These proportions were highly correlated with the model-predicted ages of acquisition ((r = -0.94, t = -75.33, $p < .001$).

Table 1: Estimated age of acqusition (AoA) for each animal in months.

animal	Wordbank	Kuperman	model estimate	AoA
alligator	26.00	57.36	23.75	26.00
ant	25.00	51.84	22.37	25.00
bear	20.00	42.96	20.17	20.00
bee	22.00	60.00	24.40	22.00
bird	18.00	42.24	19.99	18.00
butterfly	23.00	44.04	20.44	23.00
camel		61.32	24.73	24.73
cat	18.00	44.16	20.47	18.00
caterpillar		62.04	24.91	24.91
chicken	23.00	39.12	19.21	23.00
cow	20.00	47.28	21.24	20.00
deer	27.00	62.04	24.91	27.00
dog	15.00	33.60	17.84	15.00
donkey	29.00	72.00	27.38	29.00
duck	18.00	42.00	19.93	18.00
eagle		69.96	26.88	26.88
elephant	23.00	57.60	23.80	23.00
fish	19.00	48.60	21.57	19.00
fly		36.60	18.59	18.59
fox		60.21	24.45	24.45
giraffe	25.00	60.00	24.40	25.00
goat		62.52	25.03	25.03
gorilla		68.88	26.61	26.61
grasshopper		69.36	26.73	26.73
horse	21.00	49.80	21.87	21.00
kangaroo		66.60	26.04	26.04
leopard		82.08	29.89	29.89
lion	23.00	53.04	22.67	23.00
lobster		89.28	31.67	31.67
monkey	22.00	50.52	22.05	22.00
mouse	23.00	59.28	24.22	23.00
ostrich		77.04	28.63	28.63
owl	24.00	74.52	28.01	24.00
peacock		69.16	26.68	26.68
penguin	27.00	68.16	26.43	27.00
pig	21.00	46.08	20.94	21.00
rabbit	21.00	47.28	21.24	21.00
raccoon		81.48	29.74	29.74
rhinoceros		72.00	27.38	27.38
rooster	28.00	76.92	28.60	28.00
seahorse		69.96	26.88	26.88
seal		65.04	25.65	25.65
sheep	23.00	51.00	22.17	23.00
skunk		63.84	25.36	25.36
snail		69.48	26.76	26.76
snake		61.20	24.70	24.70
spider		41.16	19.72	19.72
squirrel	25.00	53.28	22.73	25.00
swan		75.81	28.33	28.33
tiger	24.00	48.00	21.42	24.00
zebra	25.00	57.48	23.78	25.00

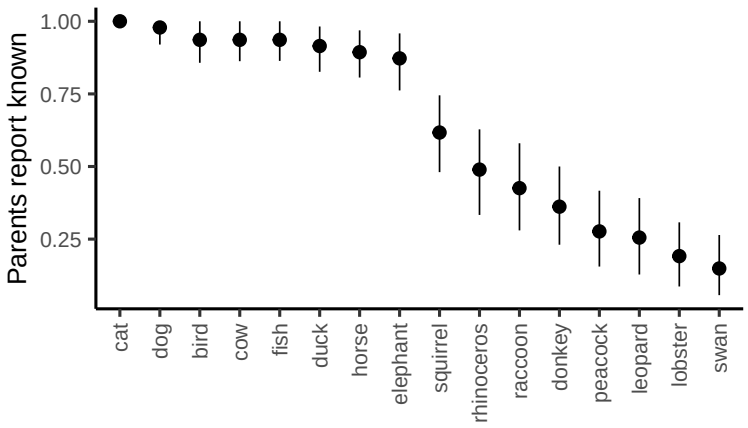

Figure 1: Proportion of parents who reported that their child understood the word for each of our target animals. Error bars indicate 95% confidence intervals computed by non-parametric bootstrap.

References

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