The English dative alternation: Evidence from first language acquisition

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1 The dative alternation

The dative alternation in English is the availability of both (1a), the double-object construction, and (1b), the prepositional construction, for many ditransitive (transfer) verbs.

(1) a. Rick gave Kate a coffee.
b. Rick gave a coffee to Kate.

Give is the arguably the prototypical verb for this alternation (see for example the terminological discussion in Lambert 2010:2–3 or the introduction to the dative alternation given in Bresnan et al. 2007:69–70), but there are many others: *show*, *show*, *tell*, *promise*, *teach*, and even recent innovations like *text*.

Similar alternations have been claimed to exist in many other languages, for example Dutch and Chinese:

(2) Dutch (Colleman 2010:271–272)

a. Jan heft [zijn broer] [een boek] gegeven.
Jan has his brother a book given
'Jan gave his brother a book.'

b. Jan heft [een boek] aan [zijn broer] gegeven.
Jan has a book to his brother given
'Jan gave a book to his brother.'

(3) Chinese (Liu 2006:863)

a. Wo song [ta] [yiben shu].
I give (as present) him one book
'I gave him a book.'

b. Wo song-le [yiben shu] gei [ta].
I give (as present)-PERF one book to him
'I gave a book to him.'

Not all of those involve a prepositional and a preposition-less construction—Croatian, for example, allows some verbs to alternate between marking the recipient with accusative case and the theme with instrumental case, as in (4a), and marking the theme with the accusative and the recipient with the dative, as in (4b).

(4) Zovko Dinković (2007:65):

a. Lena je poslužila [gost**e**] [čaj**em** i keks**ima**].
Lena serve$_{\text{PERF.PST}}$ guest$_{\textbf{ACC}\text{.PL}}$ tea$_{\textbf{INSTR}}$ and biscuit$_{\textbf{INSTR}\text{.PL}}$.

'Lena served the guests tea and biscuits.'

b. Lena je poslužila [gost**ima**] [čaj i keks**e**].
Lena serve$_{\text{PERF.PST}}$ guest$_{\textbf{DAT}\text{.PL}}$ tea$_{\textbf{ACC}}$ and biscuit$_{\textbf{ACC}\text{.PL}}$.
'Lena served tea and biscuits to the guests.'

1.1 Availability literature

Previous work on the English dative alternation based itself on intuitions about the availability of one of the two constructions. For example, Rappaport Hovav and Levin (2008) claim that verbs like *teach* implicate success or completion when used in the double object construction. It follows that the double object construction should not allow interruption of the act of transfer. In other words, both constructions in (5) are fine, but when the act of teaching is made explicitly unsuccessful, some speakers reject (6a) but accept (6b).

(5) a. Kate taught Rick Croatian.
b. Kate taught Croatian to Rick.

(6) a. ?? Kate taught Rick Croatian, but he didn't learn much.
b. Kate taught Croatian to Rick, but he didn't learn much.

However, Rappaport Hovav and Levin (2008:150) found examples of explicitly interrupted preposition-less uses of *teach*:

(7) Sandy taught the children the alphabet, but only got as far as the letter 'R'.

Others studied idioms that contain an alternating verb. The argument there was that, even though the verb *give* as such alternates, the idiomatic expressions containing *give* are frozen in their idiomatic construction, and the alternate construction is unavailable:

(8) a. You're giving me a headache.
b. * You're giving a headache to me.

If this were indeed the case, patterns the meanings expressed by idioms using the same construction (but not allowing the other construction) might provide some insight into the meaning that that construction expresses. Bresnan and Nikitina (2003:8)'s corpus study, however, did find idiomatic items with exactly these supposedly unavailable constructions:

(9) . . . unless you take pride in giving a headache to your visitors with a flashing background. . .

Yet another approach was to try and find a pattern in the verbs that, while being ditransitive and expressing transfer, do not participate in the dative alternation. For example, *pull* and other "verbs of continuous imparting of force" (Bresnan and Nikitina 2003:6) are acceptable only in the prepositional construction to some speakers (and linguists):

(10) a. * I pulled John the box.
b. I pulled the box to John.

Again, the supposedly unavailable construction is actually attested:

(11) He pulled himself a steaming piece of the pie. (Bresnan and Nikitina 2003:6)

Of course, it is true that (7), (8b), and (11), though attested from some speakers, remain unacceptable to other speakers. Nevertheless, any argument that is based on one construction not being available with a certain verb or context is critically weakened by these examples. The only recourse would be to change these arguments from categorical statements about availability and meaning into claims of 'tendencies', and even then their explanatory and predictive power would diminish greatly.

1.2 Ordering literature

A different point of view on the dative alternation sees the two different constructions primarily as two different orders of the objects. The interesting question then becomes what drives the choice between the two different orderings. Previous research (most prominently Wasow 2002 and Bresnan et al.

2007) found that several features of the two objects affect this choice. For example, they showed that shorter objects are preferentially placed before longer ones, as in (13), that objects which are given in context are preferred before new ones, as in (14) and (15), and that objects with animate referents are preferred before inanimate ones, as in (16).

(12) a. Rick gave Kate a coffee.
b. Rick gave a coffee to Kate.

(13)
a. Rick gave Kate a grande skim latte with two pumps of sugar-free vanilla.
b. ?? Rick gave a grande skim latte with two pumps of sugar-free vanilla to Kate.

(14) What did Kate do with the letter?
a. ?? She mailed **Rick** the letter.
b. She mailed the letter to **Rick**.

(15) What did Kate do to Rick?
a. She mailed Rick **the letter**.
b. ?? She mailed **the letter** to Rick.

(16) a. Rick gave Kate a coffee.
b. ? Rick gave a coffee to Kate.

(17) a. Kate gave Rick a puppy.
b. Kate gave a puppy to Rick.

Length and givenness are known to have effects on other phenomena that can be viewed as ordering choices, like heavy noun phrase shift or the ordering of a particle verb's object and particle (see also Wasow 2002): many speakers generally accept both (18a) and (18b) (given the right context, intonation, and so forth), but when the object NP is very long (or 'heavy'), the shifted option (19b) is preferred. Similarly, both (20a) and (20b) are acceptable, but (21a) is preferred to (21b).

(18) a. I saw [some people] there.
b. I saw there [some people].

(19) a. ?? I saw [some angry people who all needed a shower and a stiff drink] there.
b. I saw there [some angry people who all needed a shower and a stiff drink].

(20) a. Kate turned on [the lights].

b. Kate turned [the lights] on.

(21) a. Kate turned on [the ornate gold-laced crystal chandelier].

b. ?? Kate turned [the ornate gold-laced crystal chandelier] on.

The same shorter-before-longer preference that is apparent here seems to be active in the dative alternation, as seen in (13) above. This lends additional support to that length effect. The animacy effect, however, is less well attested. It appears to vary in different varieties of English and with speakers of different ages (Bresnan and Hay 2008), and two separate studies of child language corpora failed to find it (de Marneffe et al. 2012, Bürkle 2011). Therefore, we were interested in testing experimentally whether this animacy effect does indeed exist for children and adults.

2 The present study

2.1 Participants

Twenty-two adults (median age 21) and twenty four-year-olds (median age 4;3) were recruited on the campus of the University of Canterbury, through existing research participant pools, and via word of mouth. All were native speakers of New Zealand English, and none had any diagnosed or apparent language, speech, or developmental disorders. Adult participants were incentivized with a shopping voucher worth NZD 10 (roughly USD 8); children were given their choice of one item from a "box of treasures" containing small toy cars, stationery sets, foam dice, and the like (each worth about NZD 2.50). The incentive offered to children was worth less financially, but being allowed to choose provides additional (though harder to quantify) utility to children (Jacqueline Nokes, p.c.).

2.2 Procedure

Participants were seated in a swivel chair at a small desk with a wooden platform holding an HP EliteBook 2740p 12.1-inch touchscreen laptop and an upside-down Tobii X120 eyetracker (see Fig. 1). For shorter participants, a cushion and a booster seat were available. After completing the five-point fixed-pattern calibration procedure (as provided in the Tobii Analytics SDK, version 3.0.83), they were presented with 64 trials divided into four blocks. These trials presented either three smaller images near the top of the screen together with one larger image near the bottom and a pre-recorded instruction sentence (played over headphones) with the larger image as the recipient

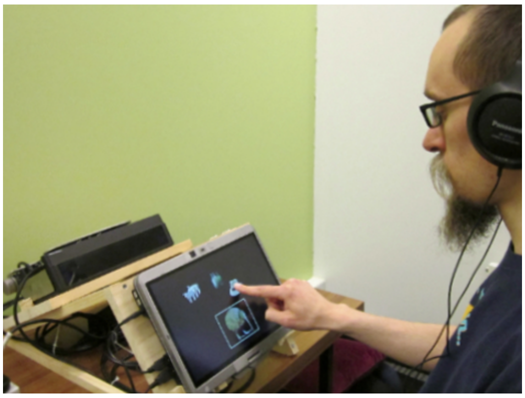
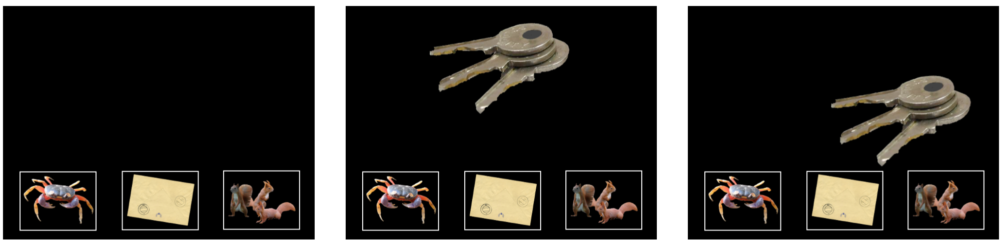


Figure 1: Experimental setup

(blocks 1 and 3, see Fig. 4 for an example), or three smaller images near the bottom of the screen together with one larger image near the top and an instruction sentence with the larger image as the theme (blocks 2 and 4, see Fig. 3 for an example). To reinforce their role, the recipient or recipients in all trials were marked with white boxes around them.

(a) (b) (c)

Figure 2: Example trial with theme masked by noise in instruction sentence



(a) (b) (c)

Figure 3: Example trial with recipient masked by noise in instruction sentence

In both types of trials, participants first saw only the row of three smaller images (see Fig. 2a and 3a) and had to touch each of them. On the first touch of each image, a recording of the intended name of that image (*baskets*, *camel*, and *lock* in the example in Fig. 4; *crab*, *letter*, and *squirrels* in Fig. 3) was played via headphones (Moshi VLH or Panasonic RT-HT 161, depending on the size of the participant's head). This was intended to ensure that participants did not rush through the trials, but were fully aware of these three images and names. Once the name of the third image had finished playing, the larger image appeared and a pre-recorded instruction sentence was played automatically. This instruction sentence contained the name of the larger image in its appropriate role (*dogs* as the recipient in the example in Fig. 4; *keys* as the theme in Fig. 3), while the respective other object was masked with 500ms of Brownian noise. Both possible dative alternation constructions were used for both types of trials—in other words, the instruction sentence accompanying the trial shown in Fig. 4 would have been either (22a) or (22c), and the instruction sentence for the trial in Fig. 3 would have been (22b) or (22d). (The grey block ▬ in these example sentences represents the Brownian noise.) Shirakawa (2013) showed that Brownian noise can be used to create a 'gap' in a sentence, even with very young participants.

(22) a. Now give the ▬ to the dogs!
b. Now give the ▬ the keys!
c. Now give the dogs the ▬!
d. Now give the keys to the ▬!

Once this instruction had finished playing, the images representing themes (*baskets*, *camel*, and *lock* in Fig. 4; only *keys* in Fig. 3) could be moved by touching and dragging on the screen. As soon as a theme image was moved into the white box surrounding a goal image, this combination was recorded as the participant's choice for this trial, a reward stimulus (orange and white stars, and one of three fanfares) were presented, and the trial ended. All of a participant's touchscreen input, the time taken on each trial, and eye gaze data were also recorded, though the eyetracker proved difficult to work with: no useable data was recorded for about 40% of participants, and data from others was often very spotty. For many participants, a constant offset was apparent in the gaze data; these were corrected manually.

This task was programmed and run in PsychoPy, version 1.80.00 (Peirce 2007, 2009). All audio recordings used in it were of the same adult female native speaker of New Zealand English. They were processed in Audacity, version 2.0.2, which was also used to generate the Brownian noise.

2.3 Results

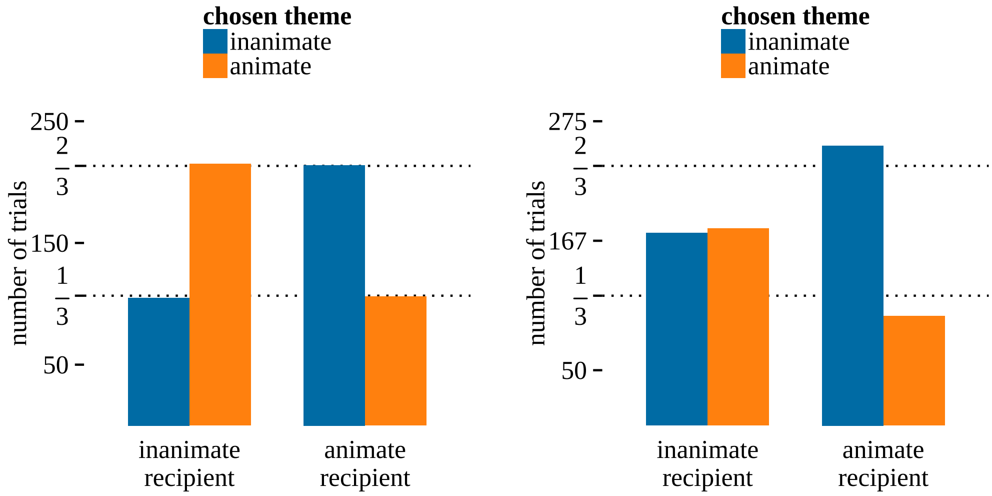
If there is a subconscious rule that orders animate objects before inanimates, the one animate choice *camel* should be preferred in the trial shown in Fig. 4 if it is accompanied by the instruction sentence (22a), which has the gap that the participant's choice fills before the explicit and animate *dogs*: either of the two inanimate choices (*baskets* and *locks*) would violate the animate-before-inanimate preference in that position. With (22c) as the instruction sentence, however, this preference should disappear, because none of the three possible choices strongly violates the animate-before-inanimate rule. By the same token, the one inanimate choice *letter* should be preferred in the trial shown in Fig. 3 if the instruction sentence is (22d), but not with (22b).[1] No such result was found.

However, adult participants preferred the inanimate theme choice much more when presented with an inanimate recipient (as they were in half of the trials of the type shown in Fig. 4 above): as Fig. 4b shows, about half of the choices across all these trials and across all participants were inanimate, even though there were twice as many animate options available. This is significantly different from the two-to-one pattern expected by chance ($\chi^2 = 41.0511$, $p < 0.0001$ (un-adjusted)). The animacy of choices when given an animate recipient is not significant (after Holm/Bonferroni correction for $m = 4$ hypotheses and $\alpha = 0.05$), and neither is it in the condition with an overt theme in the instruction sentence. The four-year-old participants also did not display this pattern (see Fig. 4a; all p-values > 0.05).

Interestingly, both four-year-olds and adults seem sensitive to animacy: Fig. 5 show that, across all of the theme-choice trials (regardless of the animacy of the given recipient), participants tend to look at the animate choice or choices first after hearing the instruction sentence. A growth curve analysis model (Mirman et al. 2008) for both groups shows this difference between the percentage of gazes directed at the animate choices and the percentage of gazes at inanimate choices to be significant (see Tables 1 and 2).

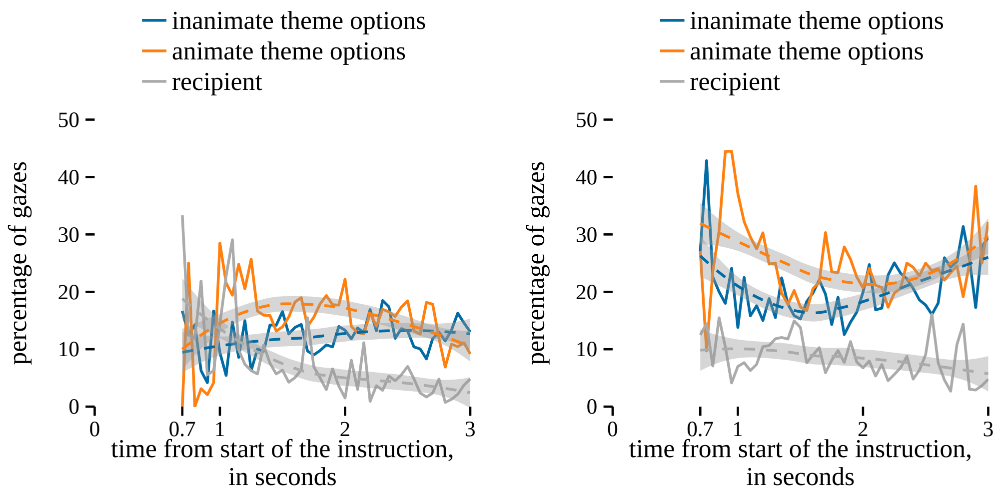
Although each trial can be completed in as little as five seconds mechanically, it is clear from Fig. 6 that both children and adults took much longer than that. The dashed grey lines in the figures represent simple regressions model of total time per trial on the sequential position of that trial, which shows a small effect of accommodating to the task: the slope of that line is -0.007852 for the four-year-olds and -0.03106 for the adults. Note that five trials from the four-year-olds' data were removed as outliers, since they had

[1]The experiment was also designed to look for the same pattern of results for short-before-long (with 'short' meaning monosyllabic and ''long' meaning disyllabic) and plural-before-singular preferences; these will not be discussed here.



(a) Four-year-old participants (b) Adult participants

Figure 4: Animacy of choice in trials with theme masked by noise and inanimate recipient



(a) Four-year-old participants (b) Adult participants

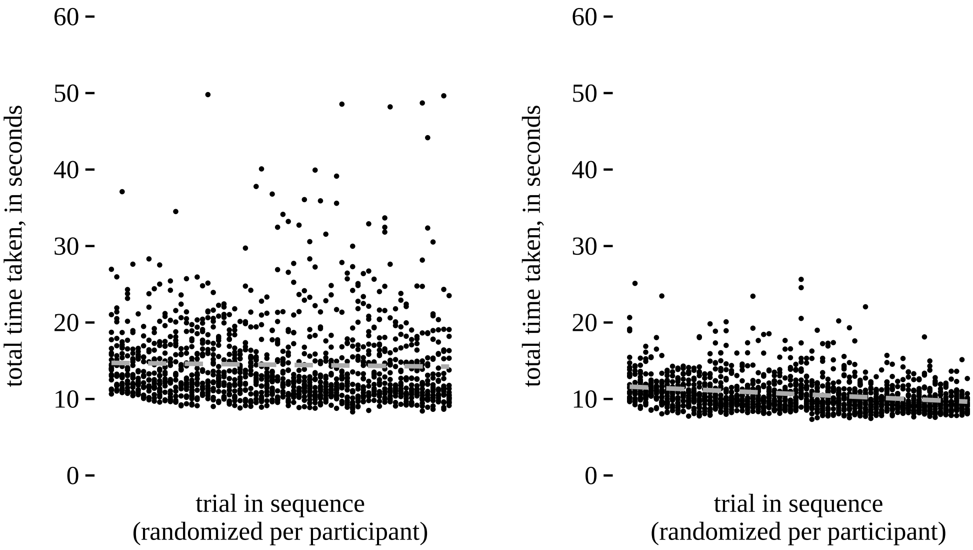
Figure 5: Gazes by animacy of target in theme-choice blocks (solid lines) and averaged models thereof (dashed lines with ribbons)

a time of more than 60 seconds each.

The largest part of the touchscreen input for each participant in each

	estimate	standard error	t	p
(Intercept)	0.12	0.02	5.03	<0.0001
first-order time polynomial	0.07	0.08	0.89	0.37
second-order time polynomial	-0.02	0.07	-0.37	0.71
third-order time polynomial	-0.01	0.06	-0.27	0.79
image = animate	0.03	0.01	2.91	<0.0001
image = recipient	-0.05	0.01	-4.46	<0.0001
$time^1$ * animate	-0.11	0.08	-1.38	0.17
$time^1$ * recipient	-0.35	0.08	-4.48	<0.0001
$time^2$ * animate	-0.13	0.08	-1.68	0.09
$time^2$ * recipient	0.14	0.08	1.83	0.07
$time^3$ * animate	0.05	0.08	0.66	0.51
$time^3$ * recipient	-0.04	0.08	-0.54	0.59

Table 1: Coefficients of growth curve analysis model for four-year-olds' eye gaze data



(a) Four-year-old participants (b) Adult participants

Figure 6: Total time per trial by position of trial in the sequence

trial was the path of dragging a theme image to a recipient image. These paths are shown here analyzed in two ways: first, Fig. 7 shows histograms of the integrals of each path over the straight line between its start- and endpoint. The perfect straight line itself would have a value of zero, and

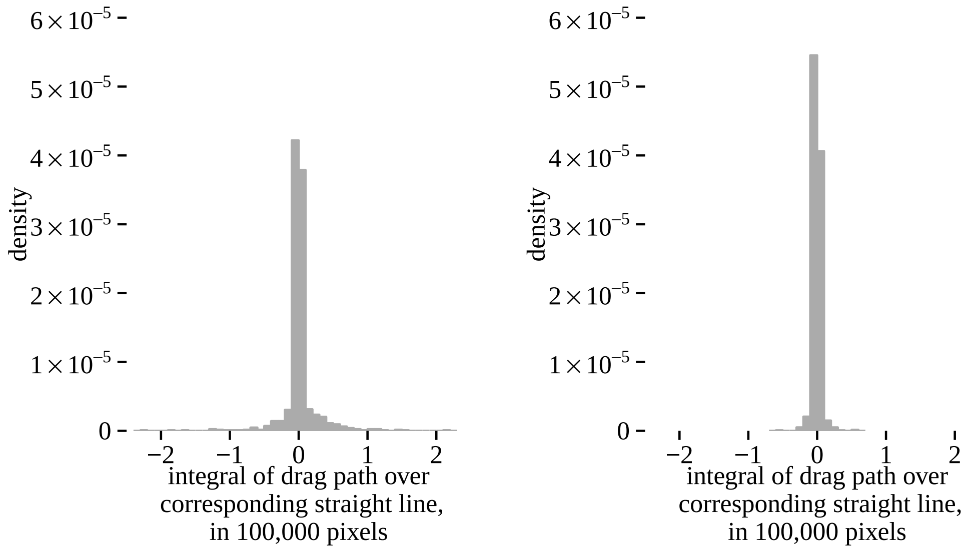
	estimate	standard error	t	p
(Intercept)	0.18	0.03	6.69	<0.0001
first-order time polynomial	0.12	0.06	1.98	0.05
second-order time polynomial	0.09	0.05	1.77	0.08
third-order time polynomial	-0.05	0.05	-0.97	0.33
image = animate	0.04	0.01	4.80	<0.0001
image = recipient	-0.12	0.01	-12.99	<0.0001
$time^1$ * animate	-0.16	0.07	-2.38	0.02
$time^1$ * recipient	-0.16	0.07	-2.30	0.02
$time^2$ * animate	0.00	0.07	0.05	0.96
$time^2$ * recipient	-0.21	0.07	-3.09	<0.0001
$time^3$ * animate	0.11	0.07	1.68	0.09
$time^3$ * recipient	0.07	0.07	1.09	0.28

Table 2: Coefficients of growth curve analysis model for adults' eye gaze data

these integrals are also very much clustered around zero for both four-year-olds (excess kurtosis: 24.306, skewness: 0.004) and adults (excess kurtosis: 31.686, skewness: 1.030). Second, Fig. 8 shows histograms of the difference between the length of each drag path (measured in pixels) and the length of the straight line between its start- and endpoints. Again, the straight line itself would have a value of zero here, and the the actual values are clustered near zero for both four-year-olds (excess kurtosis: 183.783) and adults (excess kurtosis: 54.239).

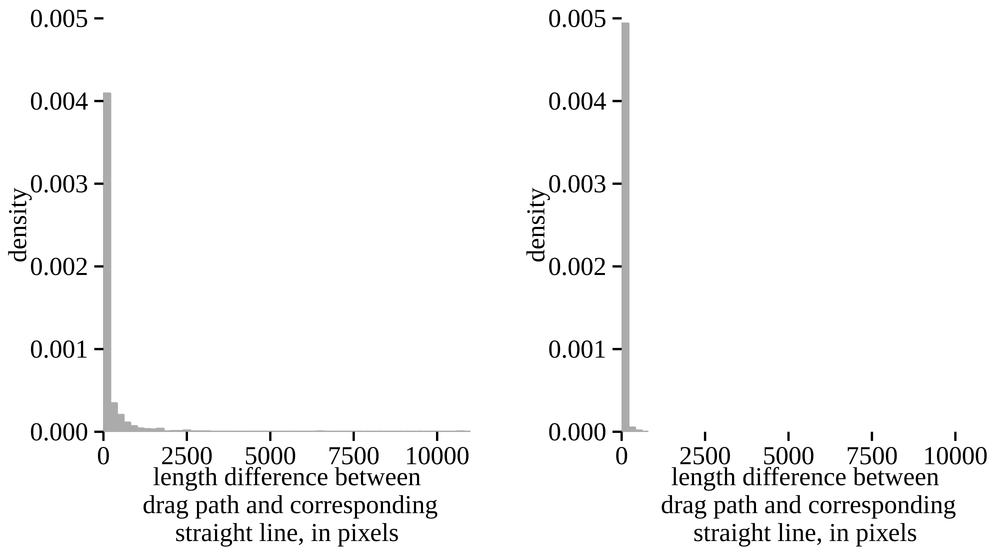
3 Discussion

The expected effects of the position of the gap on the choice made in filling that gap did not materialize. However, adult participants were much more likely than chance to pick an inanimate theme when the given recipient was also inanimate (regardless of the order of gap and recipient in the instruction sentence). It is likely that this reflects semantic expectations: *give* prototypically takes an inanimate theme and and animate recipient. In the animate-recipient condition, two of the three theme options were inanimate, and it was easy to conform to this prototype (although the difference to the two-to-one ratio of inanimate to animate choices that random chance would predict is not significant). In the inanimate-recipient condition, there was only one inanimate theme option, but adult participants chose it much more often than chance would predict in order to satisfy at least the animacy



(a) Four-year-old participants (b) Adult participants

Figure 7: Histograms of integrals of drag paths over straight lines between their individual start- and endpoints



(a) Four-year-old participants (b) Adult participants

Figure 8: Histograms of length differences between drag paths and straight lines, in pixels

prototype for the theme. Four-year-old children, on the other hand, seem insensitive to these animacy prototypes, since their choices in either condition are not different from the random two-to-one ratio.

However, both four-year-old children and adults appear to be sensitive to animacy as such: in the theme-gap conditions, participants tended to look at the animate theme option or options first after the instruction sentence. Since all eye gaze samples following the first touchscreen dragging input of each trial were excluded from this analysis, this attraction cannot be due to the motion of an image, but has to be conditioned on the features of the static images themselves.

The paths of dragging a theme to a goal were very straight for both 4-year-olds and adults. Taken together with the fact that participants took much longer on all trials than necessary for just their touchscreen input), this suggests that touchscreen input in this task was deliberate and planned. The dragging paths therefore cannot reveal any systematic deviations like those found in mouse-tracking studies (see for example Spivey et al. 2005).

4 Conclusion

We were not able to find any ordering effect that would be predicted by the literature discussed in Section 1.2, but this may well be a feature of the novel task used here and therefore does not cast doubt on that point of view yet. The present animacy-related findings are consistent with previous findings in that ordering-related literature, however: perhaps unsurprisingly, both four-year-old children and adults appear to be aware of the animacy of referents, but only the adults are affected by it as well. This might go some way towards explaining why previous work on the dative alternation in children did not find an animacy effect: there really may not be one. Extending the present experiment to older children will reveal whether this effect does arise over developmental time, and if so, at what age.

Touchscreens and eyetrackers can be used together with no apparent problems. However, to approach the usefulness of eyetracking data as an online measure, experiments must be designed carefully to avoid participants' deliberately planning their touchscreen input (as is evident in the present results) and thus taking this input off-line, as it were. If touchscreen use is constrained, for example by asking participants to keep a finger on the screen at all times or to use their non-dominant hand, effects of on-line processing can be expected to manifest themselves in the touchscreen input data.

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