Diachronic change in verb usage statistics predicts differences in sentence processing across the lifespan

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Abstract

Diachronic corpus analyses reveal that syntactic usage patterns change over time. Are these changes reflected in differences in language processing across the human lifespan? We use the attachment of *with-* prepositional phrases (PPs) as a case study for investigating this question: a *with*-PP can attach to a verb, describing an *instrument* with which to perform the action (e.g., Slice the cake [with a knife]), or to a direct object (DO), *modifying* the noun (e.g., Slice the cake [with the pink frosting]). The relative frequencies of the instrument and modifier constructions differ depending on the verb in the sentence — the 'verb bias'. Using two diachronic corpora, Syntgram and CCOHA, we analyzed the co-occurrence statistics of 27 verbs and instrument vs. modifier *with*-PPs. Between the 1940s and the 2000s, some verbs were more instrument-biased (i.e., more likely to co-occur with *with*-PPs that attach to the verb than the DO) than others and co-occurrence patterns were more similar for temporally close decades, suggesting subtle diachronic changes in usage patterns. We collected sentence interpretation data probing *with*-PP attachment preferences in participants ranging in age from 25 to 75. Interpretations of globally ambiguous sentences (e.g., Pet the rabbit with the towel) differed depending on the verb (i.e., some verbs elicit more instrument than modifier interpretations of the PP than others and vice versa) and on the age of the participant. In particular, verbs which became less instrument-biased over time elicited more instrument interpretations among older adults than young adults, suggesting that variation in language comprehension can be in part predicted from the corpus statistics of the time periods that an individual experienced.

1 Introduction

Language is constantly changing and evolving over time (Beckner et al., 2009; Chater and Christiansen, 2010). Each generation inherits the form-meaning mappings that previous generations have developed. New words and usages may arise due to colexification or word-sense extension as new generations need to fill a communicative gap (Brochhagen et al., 2023; Srinivasan and Rabagliati, 2015). Similarly, some syntactic forms can proliferate while others disappear (i.e., Josserand et al., 2021; Thompson et al., 2016). Given that the language changes, the usage patterns that are experienced by an individual over their lifetime differ across generations. Here, we investigate whether syntactic change over time, at the level of the language, is reflected in different patterns of online language processing across generations within the same time period.

1.1 Syntactic Change

Corpus studies have demonstrated shifts over time in the usage patterns of certain grammatical structure. Using the Google books corpus, Michel et al. (2011) showed that many verbs became more regular over the course of two centuries (i.e., from chide/chode to chided; from burnt to burned) while a few verbs reverted to being irregular in more recent decades (light/lit, wake/woke). Additionally, the rate of change varies by geographical region, with the US having a much faster rate of regularization than the UK, for example.

Wolk et al. (2013) conducted a corpus analysis comparing the diachronic trends in genitive and dative alternations. The genitive alternation consists of the *Of-genitive* (e.g., "the fall of Rome") and *S-genitive* (e.g., "Rome's fall") constructions. The dative alternation consists of *PP-dative* (e.g., "Flann gave the book to Max") and *NP-dative* (e.g., "Flann gave Max the book"). Replicating previous studies, they found stable factors (i.e., word length of the constituents, animacy) that predicted usage of particular constructions (e.g., as the length of the constituents increases, the proportion of *PP-datives* decreases). Critically, both the usage proportions of each alternation and those factors

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exhibited diachronic changes. For instance, the frequency of the *Of-genitive* construction peaked around the 1800s, but declined afterwards, with the *S-genitive* construction increasing in frequency after the 1800s. Likewise, the influence of word length on construction choice increased over time, whereas the effect of animacy on choice decreased in weight over time for both constructions (likely corresponding to increased frequency of reference to inanimate or collective entities).

Syntactic change is reflected in real-time language processing measures as well. Bornkessel-Schlesewsky et al. (2020) explored whether changes in language processing or production drive language change using the case of Icelandic, which is currently in a transitional period that parallels the evolution of English. It has fixed subject position (like modern English) and morphological case marking (similar to earlier stages of English). In present-day Icelandic, use of linear order is becoming more frequent while case marking is decreasing in frequency. Bornkessel-Schlesewsky et al. (2020) found that, in explicit judgments of acceptability, Icelandic speakers preferred the standard case-marked forms, but event-related potentials (ERP) revealed that the emerging non-case-marked forms elicited less real-time processing difficulty. It is noteworthy that the participants were young adults. Whether older adults would have less difficulty processing the standard case-marked form (and perhaps more difficulty processing the linear order form) is an open question.

1.2 Language Change and Aging

Older and younger adults differ systematically in the structure of their lexical-semantic networks (Cosgrove et al., 2023; Wulff et al., 2021). Using word association data, Dubossarsky et al. (2017) constructed semantic networks for different age groups. They found that networks were sparse during early language acquisition, peaked in density during middle adulthood, and were largest but somewhat less dense during late adulthood due to continued language acquisition and increased vocabulary size (Baayen et al., 2017; Ramscar et al., 2014).

However, it remains unknown whether these age-related differences are related to different experiences with a language that is changing. Cain and Ryskin (2023) collected relatedness judgments from young and older adults for word pairs that have and have not changed in meaning over time (between 1950 and 2000). They found that these word relatedness judgments were quite similar between the age groups, in that the ratings from both age groups most closely matched the similarities derived from the most recent decade of historical word embeddings (Hamilton et al., 2016). In contrast, Li and Siew (2022) used response time data from a semantic decision task to show that words that had undergone meaning change elicited greater processing difficulty in middle-aged adults compared to younger adults, perhaps because the middle-aged adults were familiar with a greater number of competitors (i.e., meanings that were no longer prevalent). In sum, lexico-semantic change over time, at the level of the language, may result in differences in online processing across generations within the same time period.

1.3 Current Study

In the current work, we investigate syntactic change and its consequences for online processing across different age groups who may have experienced distinct usage patterns over their lifetime. We use the attachment of *with-* prepositional phrases (PPs) as a case study for investigating this question: a *with*-PP can attach to a verb, describing an *instrument* with which to perform an action (e.g., Slice the cake [with a knife]), or to a direct object (DO), *modifying* the noun (e.g., Slice the cake [with the pink frosting]). The relative frequencies of the instrument and modifier constructions differ depending on the verb in the sentence — the 'verb bias' (Gahl et al., 2004; Ryskin et al., 2017; Snedeker and Trueswell, 2004). For example, "strike" is biased to appear in instrument structures, whereas "pet" is biased toward modifier structures.

Previous psycholinguistic work indicates that these verb biases guide online processing. For instance, when the *with*-PP attachment is globally ambiguous (e.g., "Pet the rabbit [with the towel]" when there is both a rabbit wrapped in a towel and a separate towel available as an instrument in the visual environment), listeners rely on verb bias to guide their interpretation. They are more likely to look at and reach for (or click on) the instrument towel for instrument-biased verbs than for modifier-biased verbs (Ryskin et al., 2017; Snedeker and Trueswell, 2004). Further, these biases are shaped by language experience. Participants were more likely to interpret ambiguous sentences with an (initially) equi-biased verb like "spot' as having a modifier structure when they were repeatedly exposed to "spot" in unambiguous modifier constructions relative to when they were repeatedly exposed to "spot" in unambiguous instrument constructions (Ryskin et al., 2017).

In the present work, we first tested whether verb biases change over time. Using two diachronic corpora, Syntgram (Goldberg and Orwant, 2013), a corpus of verb-specific syntactic annotations based on the Google N-grams corpus, and the (cleaned) Corpus of Historical American English (CCOHA; Alatrash et al., 2020; Davies, 2012), we analyzed the co-occurrence statistics of 27 verbs (from Ryskin et al., 2017) and instrument vs. modifier *with*-PPs.

Second, we probed differences in verb biases between individuals of different ages. Participants (25–75 years old) clicked on images in a 4-picture display in response to sentences with ambiguous *with*-PP attachment (e.g., Pet the rabbit with the towel). The locations of their clicks indicated which interpretation they had chosen (e.g., instrument vs. modifier).

Third, we used a Bayesian multilevel logistic regression model to examine the relationship between diachronic changes in verb bias and age-related differences in interpretation.

2 Quantifying Diachronic Changes in Verb Biases

Our first aim was to quantify how much the verb-specific usage of the instrument and modifier constructions changes over time. We specifically focused on the 27 verbs (see Table 1) from Ryskin et al. (2017) and on the construction frequencies from the 1940s to the 2000s, since the participants from our behavioral experiment would have potentially experienced those decades (Section 3).

2.1 Methods and Data

In Syntgram, we identified relevant instances of verb appearances as ones where the target verb was the root of the dependency tree fragment, and the word "with" appeared in the fragment. Next, using the dependency tree fragments, we categorized these instances as instrument if the *with*-PP attaches to the verb, modifier if it attaches to the DO of the verb, or neither. We were able to find relevant instances for 24 of the original 27 verbs, three verbs were not found in any relevant constructions in the corpus ("bop", "scuff", "pet"). Overall, there were 1,761,679 total instances, with an average of 67,757 instances per verb, and an average of 251,668 instances per decade. For each of the 24 verbs included in the analysis, we computed the average instrument bias, for each decade, to get stable estimates of how often they participate in instrument constructions.

Instrument	**equi-biased**	**Modifier**
Strike	Feed	Pet
Whack	Scuff	Look at
Hit	Pinch	Squeeze
Rub	Knock on	Pick out
Poke	Pat	Cuddle
Bop	Locate	Find
Smack	Feel	Hug
Clean	Spot	Select
Tease	Point to	Choose

Table 1: Verbs from Ryskin et al., 2017 grouped according to sentence completion norming data.

In CCOHA, we first filtered the corpus to instances where the target verbs were used with "with," and then used the `spaCy` dependency parser to annotate the sentences (Honnibal and Montani, 2017). Using this dependency tree structure, we then identified whether the construction was instrument, modifier, or neither based on the attachment of the *with*-PP. We then filtered the verbs to those where every decade had at least one instrument and one modifier construction, which resulted in eleven verbs. Overall, there were 5,691 total instances, with an average of 517 instances per verb, and an average of 813 instance per decade.

In both of these corpora, the majority of relevant instances are unambiguous in terms of which construction is being used. Most of the *instrument* constructions do not have a direct object (i.e., "He was hit with the bat."), and most of the *with*-PPs in *modifier* instances describe the noun phrase (i.e., "...pick out the gym bag with black plastic handles..."). Therefore, we expect the dependency parser to accurately identify which construction is being used.

2.2 Results

As seen in Figure 1, analysis of the Syntgram corpus reveals a variety of diachronic trends in the verb biases: some had a consistent, strong instrument bias (e.g., "cuddle" or "pick"), others had weak instrument bias (e.g., "hit" or "point"), and some did indeed change over time (e.g.,, "clean", "poke"). To identify patterns of change over time,

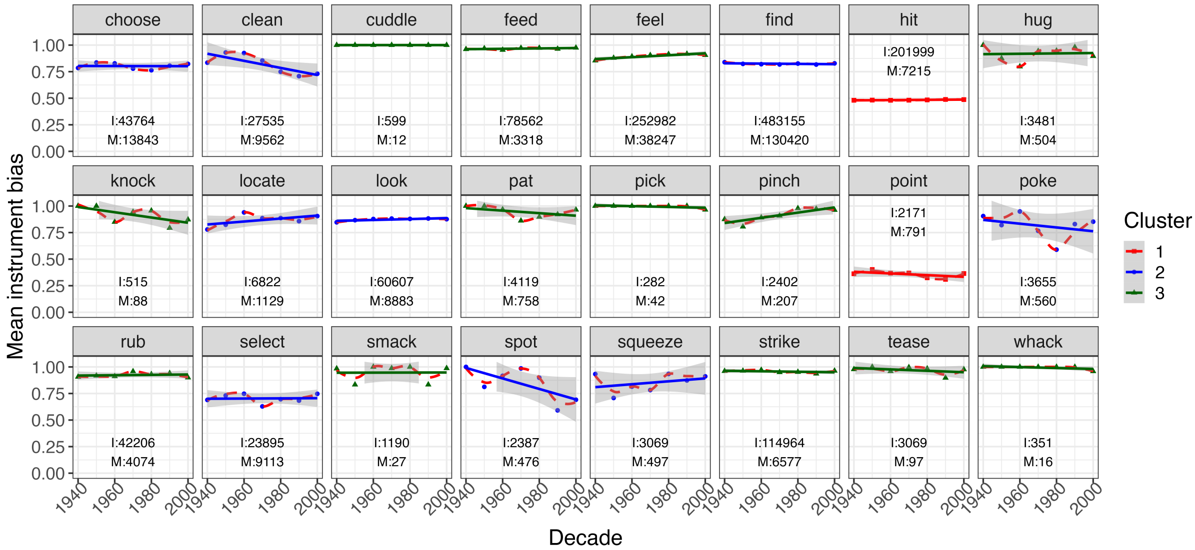

Figure 1: Average instrument bias per decade, as derived from the Google Syntgram corpus. Cluster is indicated by the color (k = 3). The frequency of each construction type is included.

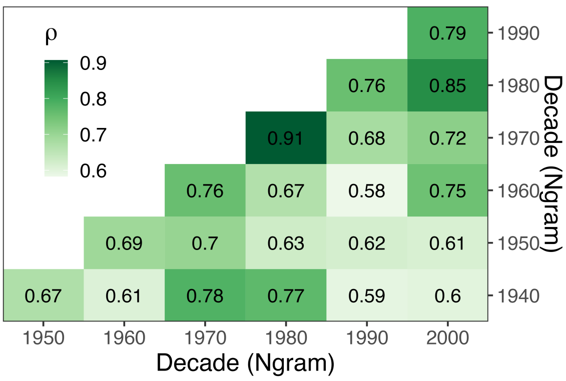

Figure 2: Spearman rank correlation of average instrument biases between different decades in the Google Syntgram corpus. The diagonal has been excluded since it would be a perfect correlation.

we used K-means clustering. The clustering was performed on verb-specific instrument biases for each decade. Three clusters were identified (we set $k = 3$) and can be seen in Figure. 1). The clustering results suggest that there are three types of patterns: low instrument bias (i.e., "hit" and "point"), high instrument bias (i.e., "feed" and "pick"), and a moderate-decreasing instrument bias (i.e., "clean" and "spot").

In order to quantify the amount of change over time across all verbs, we calculated the pairwise Spearman rank correlations between the verb-specific instrument biases of each decade (Figure 2). While there were changes in instrument biases for some verbs, overall, the decade-level instrument biases had relatively high correlations ($0.58 \leq \rho \leq 0.91$). Yet, as the temporal distance between the decades increases, the correlation tends to decrease (with the exception of $\rho_{1940,1970}$ and $\rho_{1940,1980}$).

Figure 3 shows the average instrument bias for the CCOHA subset. Relative to the previous analysis (Fig. 1), these diachronic trends seem to have more variation, likely due to the decreased corpus size. Due to the lower number of verbs (11) that were available for analysis from the CCOHA dataset, we did not perform clustering. The verb biases across decades were moderately correlated (Fig. 4), though not as highly as the verb biases derived from Syntgram ($0.05 \leq \rho_{ccoha} \leq 0.79$ vs $0.58 \leq \rho_{Syntgram} \leq 0.91$). The exception seem to be the 1940s, which had low correlations with several of the other decades.

Comparing the instrument bias proportions between the two corpora, the correlation between the decade-level average instrument biases of the two corpora are widely varied ($-0.42 \leq \rho \leq 0.53$), with the 1980_{CCOHA} having the highest correlation with every decade from Syntgram, and 1940_{CCOHA} having the lowest. This variability may reflect the smaller size of the CCOHA dataset or differences in composition (e.g., genre balance) between the two corpora.

Across the two datasets, these analyses demonstrates that verb biases do appear to change over time, even within a limited time frame (60 years). There does not appear to be a unitary trend across this set of verbs, as some remain quite consistent,

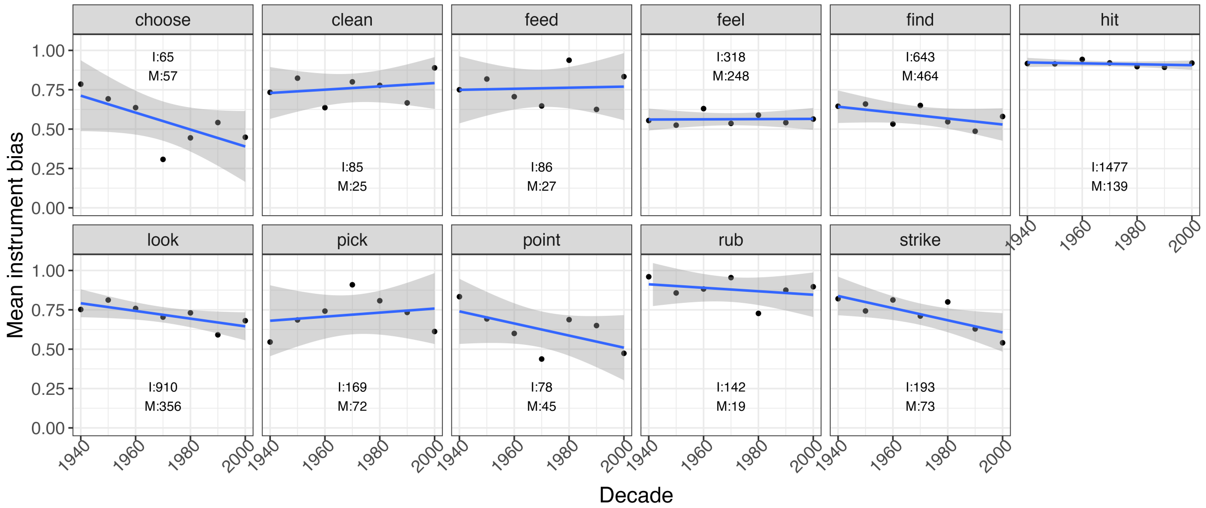

Figure 3: Average instrument bias per decade, as derived from CCOHA. The frequency of each construction type is included.

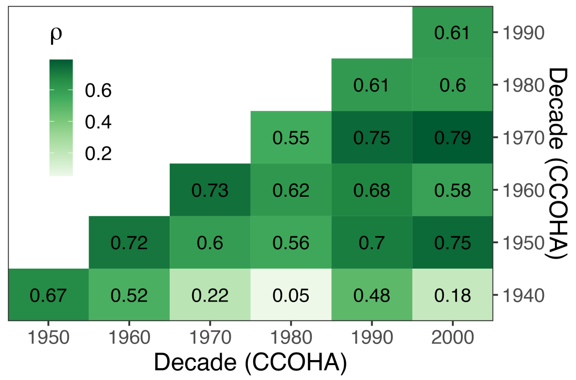

Figure 4: Spearman rank correlation of average instrument biases between different decades in CCOHA. The diagonal has been excluded since it would be a perfect correlation.

while others change in bias across the time frame.

3 Verb Biases across the Lifespan

Next, we conducted a web-based replication of Experiment 1 from Ryskin et al. (2017), but intentionally collected data from participants across the lifespan (ages 25–75).

3.1 Methods and Data

209 participants were recruited through Amazon Mechanical Turk. Participants heard instructions while looking at a computer display with four pictures (e.g., a feather, a frog holding a feather, a dolphin, and a sponge). The location of their first click was recorded. Participants heard instructions containing each of the 27 critical verbs, each time paired with different pictures. There were 81 trials total, consisting of three practice trials at the start, 24 filler trials, and 54 critical trials (each verb appeared twice). On the critical trials, the instructions ended with an ambiguous *with*-PP (e.g., "Pet the frog with the feather"). On the filler trials, the instructions did not have an ambiguous *with*-PP and was not related to the instrument or modifier constructions (e.g., "Make the animals wrestle."). The critical and filler trials were intermixed and the order was randomized for each participant.

Interpretations were coded as *instrument* if participants clicked on the 'instrument' and used that to carry out the action (e.g., clicked on the feather), or as *modifier* if they clicked on the animal that had the instrument with it (e.g., clicked on the frog holding the feather). Figure 5 shows the age distribution grouped by decade. There were not enough participants in the 70 y.o. cohort to be a separate group ($n = 8$), so they were included in the 60 y.o. cohort.

3.2 Results

Figure 6 shows the proportion of instrument interpretations across the lifespan. Each verb is colored according to the norm-based verb bias categories from Ryskin et al. (2017). We used a Bayesian multilevel logistic regression model to test the relationship between interpretations and age, based on the verb bias categories[1] (fitted using the brms package in R, Bürkner, 2017). The equi-biased verbs coded as the reference for the norm-based

[1]Formula: $instrument = bias\,norm * age + (1 \mid verb + (1 \mid participant)$

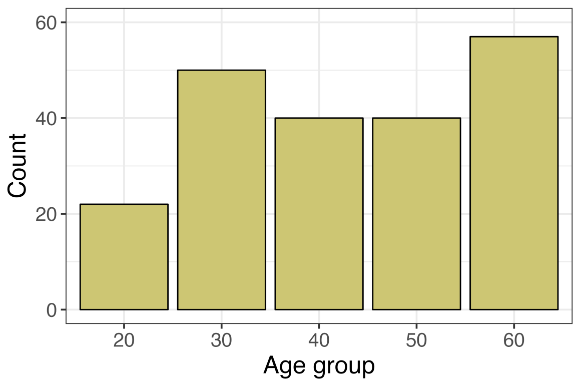

Figure 5: Participant age distribution, grouped by age decade.

verb bias category, and age was scaled and centered. Replicating Ryskin et al. (2017), overall, participants were more likely to first click on the target instrument in response to verbs that have an instrument bias relative to equi-biased verbs ($\beta_{Instr.\ norm} = 0.85$, $95\%CrI = [0.20, 1.49]$), and modifier biased verbs were the least likely to elicit instrument interpretations ($\beta_{Mod.\ norm} = -0.91$, $95\%CrI = [-1.55, -0.26]$).

Additionally, the interpretations of older adults appear to become more equi-biased relative to the youngest age group: the equi-biased verbs seem to be consistent over the lifespan ($\beta_{Age} = -0.07$, $95\%CrI = [-0.24, 0.11]$), while the difference between the verb bias categories becomes smaller ($\beta_{Instr.\ norm\ *\ Age} = -0.07$, $95\%CrI = [-0.17, 0.04]$, $\beta_{Mod.\ norm\ *\ Age} = 0.13$, $95\%CrI = [0.02, 0.25]$).

In sum, this analysis indicates that verb biases do differ subtly between age groups. One possibility is that younger adults may have stronger biases (toward instrument or modifier), whereas older adults appear to be more equi-biased in general. Alternatively, it may be that the norms used to categorize the verbs, which were collected from young adults, may reflect the biases of young adults better than older adults. Older adults may have systematically different verb biases as a result of different language experience over their lifetime.

4 Predicting Differences in Interpretations from Diachronic Change

The results from Section 2 indicate that, based on corpus frequencies, verb biases change over time (Fig. 1). The results from Section 3 indicate that, verb biases appear to change across the lifespan

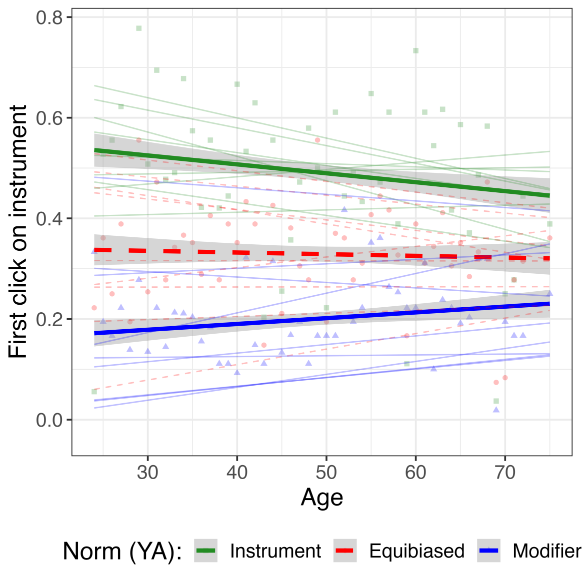

Figure 6: Proportion of instrument interpretations across the lifespan, colored by by verb bias category as determined by norms from young adults (Ryskin et al., 2017). Opaque lines indicate lines of best-fit across all verbs in a verb bias category. The transparent points represent individual participants' average interpretations for each verb, and the transparent lines indicate the per-verb lines of best-fit.

(Fig. 6). In this section, we aimed to test whether age-related differences in interpretation are related to diachronic changes in verb biases.

4.1 Analysis & Results

Instead of using the young adult norms from previous research to separate verbs into bias categories, we used the corpus-based clusters from Syntgram to categorize the verbs. Based on this new grouping (Figure 7), for the two out of the three clusters that changed minimally over time (stable low and high instrument biases), older participants appear to become slightly less likely to use an instrument interpretation. For the cluster that does change over time (decreasing instrument bias cluster), this age trend reverses, such that older participants are more likely to give an instrument interpretation than the younger participants.

We used a Bayesian multilevel logistic regression model to predict whether participants clicked on the instrument (i.e., used an instrument interpretation). We used the Syntgram-based verb bias clusters as a predictor along with age and their interaction. We included random intercepts for verb and participant, along with random slopes for age

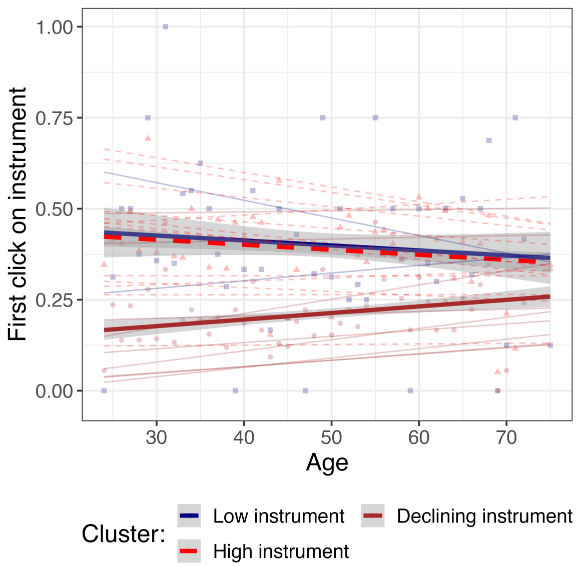

Figure 7: Proportion of instrument interpretations across the lifespan, grouped by the corpus-based clusters, as indicated by the three opaque lines. The transparent points represent individual participants' average interpretations for each verb, and the transparent lines indicate the per-verb averages. Note that the low instrument cluster only contains 2 verbs.

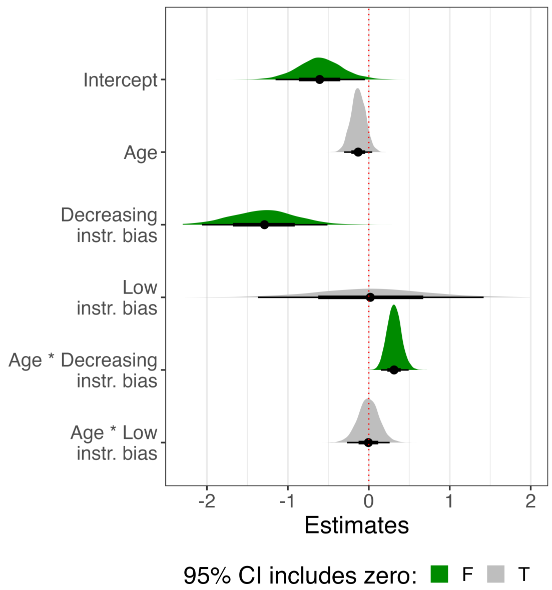

Figure 8: Model estimates for the Syntgram model. Color indicates whether the 95% CI includes zero.

by verb, and cluster by participant[2]. The high instrument bias cluster was coded as the reference level for cluster, and age was scaled and centered.

The model estimates can be seen in Figure 8. Based on the credible intervals, there were three significant effects. First, participants on average were less likely to click on the instrument than on one of the other pictures ($\beta_{Intercept} = -0.61, 95\%CI = [-1.15, -0.05]$). Second, relative to the high instrument bias cluster, the decreasing instrument bias cluster verbs were less likely to be interpreted with an instrument construction on average ($\beta_{Decreasing\ cluster} = -1.31$, $95\%CI = [-2.16, -0.51]$; Estimated marginal means: $Est_{Decreasing\ cluster} = 0.129$, 95% CI = [0.07, 0.21] vs $Est_{High\ cluster} = 0.353$, 95% CI = [0.24, 0.21]). Lastly, the decreasing bias cluster interacted with age such that older adults were more likely to give an instrument response for the verbs in that cluster ($\beta_{Age*Decreasing\ cluster} = 0.31, 95\%CI = [0.15, 0.49]$).

While there are a variety of different ways that experience and language learning may accumulate over the lifespan, this pattern matches the direction of change in the corpora, going from a strong instrument bias early on to a lower instrument bias more recently. In other words, older adults would have experienced a stronger instrument bias early on, while younger adults would have experienced the decades with a lower bias.

We then performed an analogous analysis with diachronic verb bias data from the CCOHA corpus. Since there were not enough relevant verbs in the CCOHA corpus to use K-means clustering, we directly compared the decade-level biases to the behavioral data.

We used another Bayesian binomial model to explore the relationship between the individual verbs and instrument interpretations[3]. "Hit" was coded as the reference verb, since it had a consistent high instrument bias over time (see Fig. 3, top right), and age was scaled and centered.

Figure 9 shows the posterior estimates for age and the interactions across the eleven verbs (simple effects of each verb are not included for clarity). For the verb 'hit,' participants appear to be less likely to use an instrument interpretation as age increases ($\beta_{Age} = -0.34, 95\%CrI = [-0.60, -0.09]$).

For the six verbs that interact with age (the 95% CrI of the interaction effect doesn't include zero), the direction of the estimate indicates that older adults are more likely to use an instrument interpretation, relative to 'hit.' This matches the direction

[2]Formula: $instrument = age_{scaled} * cluster_{ngram} + (1 + age_{scaled} \mid verb) + (1 + cluster_{ngram} \mid participant)$

[3]Formula: $instrument = age_{scaled} * verb + (1 + verb \mid participant)$

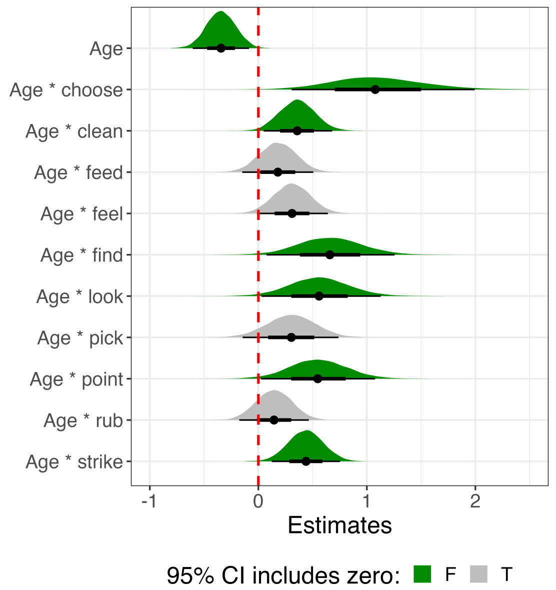

Figure 9: Model posteriors for age and the interactions between verb and age for CCOHA. Color indicates whether the 95% CrI includes zero.

of verb bias change in CCOHA, as those verbs have a decreasing instrument bias (see Figure 3). One exception was the verb 'clean' which did not have a decreasing instrument bias according to the analysis of CCOHA in Section 2, yet it also appears to elicit more instrument interpretations among older adults relative to 'hit.' However, this interaction effect ($\beta_{age*clean} = 0.36$, $95\%CrI = [0.05, 0.68]$) was smaller than for the other verbs ($\beta_{age*choose} = 1.10$, $95\%CrI = [0.31, 2.03]$; $\beta_{age*find} = 0.66$, $95\%CrI = [0.08, 1.26]$;$\beta_{age*look} = 0.56$, $95\%CrI = [0.03, 1.13]$; $\beta_{age*point} = 0.55$, $95\%CrI = [0.02, 1.08]$; $\beta_{age*strike} = 0.44$, $95\%CrI = [0.12, 0.75]$).

In summary, this last analysis demonstrated that verbs that underwent syntactic change over time predicted differences in interpretations across the lifespan.

5 Discussion

Through two corpus analyses (Section 2), we found that verb biases (whether a verb co-occurs more frequently with instrument or modifier constructions) often change over time. While many verbs have largely stable biases, the most frequent type of diachronic change between 1940 and 2000 is a decrease in instrument bias.

Our behavioral experiment (Section 3) replicated prior findings that the interpretations of sentences with globally ambiguous *with*-PP attachment were predicted by a verb's bias. These verb bias effects appeared stronger for younger adults than older adults. This may be in part due to the fact that verbs' biases were categorized using norms from a previous study, which were collected from a sample of young adults.

Finally, we used two Bayesian models to test the relationship between the corpus-based verb bias trends over time and the lifespan data (Section 4). While there were some discrepancies in the verb-specific trends between the two corpora, the model results were consistent. When the instrument bias of a verb decreased between 1940 and 2000, the verb was more likely to elicit instrument interpretations among older adults than young adults. This suggests that the experience with verb biases of past decades (greater instrument bias for some verbs in the past), unique to the older adults, impacted their in-the-moment sentence processing.

Our results extend previous findings that language users update their syntactic representations based on experience with the statistics of the environment (Ryskin et al., 2017) and indicate that, at least for the alternation studied here, this updating unfolds over many decades (perhaps due to infrequent encounters of some verbs in the key constructions).

5.1 Limitations and future studies

In the present work, we only used one syntactic alternation as a case study for the relationship between diachronic syntactic change and lifespan differences in language processing. Other syntactic alternations are known to have undergone syntactic change (e.g, genitive and dative, Wolk et al., 2013). Future studies could investigate the relationship between diachronic change and processing across the lifespan for these syntactic alternations .

Additionally, while the diachronic changes in verb biases found in the analysis of CCOHA were more pronounced than in Syntgram, the reduced corpus size should still be taken into account: the amount of relevant instances for each verb was greatly reduced ($range_{ccoha} = 110 - 1,616$ vs $range_{Syntgram} = 324 - 613,575$), and the number of valid verbs was also lower in CCOHA ($n_{ccoha} = 11/27$ vs $n_{Syntgram} = 24/27$). Future studies could examine syntactic structures that occur more frequently in diachronic corpora.

Moreover, the dependency parsers used in the corpora analyses may not be sensitive to the contextual, fine-grained semantics of the constituents, such as the plausibility of using the *with*-PP prepositional object to carry out the action. Certain objects may be viewed as canonical instruments and therefore strongly favor instrument constructions for certain verbs, but are incompatible with other verbs. A 'sponge' may be used to 'rub' or 'clean' but is very unlikely to be used with 'feed' or 'hug.' Therefore, future studies could use context-sensitive models, such as BERT, to augment or replace the dependency parsers. For example, Manning et al. (2020) used the self-attention heads in BERT to parse different types of syntactic relationships.

Lastly, future studies should take age-related differences into account when comparing behavioral data to norms generated by one age group. Therefore we plan to collect production data from across the lifespan.

6 Conclusion

Language is continually changing over time, due to a variety of factors. Previous studies have highlighted the relationship between online sentence processing and recent linguistic experience. Our findings additionally suggest that previous linguistic experience continues to influence online sentence processing on the timescale of decades.

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