How long does a quick kiss take?

Studying event duration of Light Verb Constructions using explicit word embeddings

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Durative events in Light Verb Constructions* are perceived differently than their full verb counterparts (Wittenberg & Levy, 2017)

Light Verb Construction

Alice **gave** the paper **a read**.

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Full Verb Construction

Alice **read** the paper.

perceived as taking less time

*Other names for Light Verb Construction (LVC) include support verb construction, stretched verb construction, complex predicate, expanded predicate and verbonominal construction (Gilquin, 2019; Ronan and Schneider, 2015).

Durative events in Light Verb Constructions are perceived differently than their full verb counterparts (Wittenberg & Levy, 2017)

Human experiments

(Wittenberg & Levy, 2017)

By asking participants

- to estimate the duration of events in terms of hours, minutes and seconds
- to categorise the duration of events using multiple choice options

Computational experiments

(Liu & Chersoni 2023)

By semantically projecting (Grand et al., 2022) contextualised BERT embeddings (Devlin et al., 2019) onto a Duration scale

Durative events in Light Verb Constructions are perceived differently than their full verb counterparts (Wittenberg & Levy, 2017)

RQ: Can we find the same effect in a fully transparent word embedding space?

Scope:

- LVCs and FVCs in isolation (without context words)
- LVCs and FVCs in context (sentences that contain the constructions)

Durative events in Light Verb Constructions are perceived differently than their full verb counterparts (Wittenberg & Levy, 2017)

RQ: Can we find the same effect in a fully transparent word embedding space?

Our approach:

- We used the same semantic projection technique (Grand et al., 2022) as Liu & Chersoni (2023).
- However, we built our own transparent co-occurrence count-based vector space and constructed our own Duration scale.
- We built a dataset of 242 LVC-FVC pairs based on 12 academic literature sources on LVCs.

We use a broad definition of Light Verb Constructions (Gilquin, 2019)

1. Delexical verb

- high frequency verbs:
  give, make, take, have, do
- general verbs:
  run
- other verbs:
  commit

+

2. Eventative deverbal noun

- identical to a verb:
  *do **research***
- derived from a verb:
  *take a **decision** (decide)*
- semantically related to a verb:
  *make an **effort** (try)*

We used the Spoken BNC 1994 and Spoken BNC 2014 as underlying corpora

- because LVCs occur more frequently in spoken informal contexts (Wierzbicka, 1982)
- We removed from each sentence all metadata, punctuation, interjections, unidentified words, articles and truncated expressions
- We keep the lemmatised tokens

$$\text{lemma}_1\text{\_pos}_1\text{␣lemma}_2\text{\_pos}_2\text{␣...␣lemma}_N\text{\_pos}_N\text{\textbackslash n}$$

$$\text{pos} \in \{\text{ADJ, ADV, SUBST, VERB, PREP, PRON}\}$$

shall_VERB we_PRON have_VERB little_ADJ swim_SUBST

Spoken BNC 1994 and Spoken BNC 2014 contain anonymised tokens

- for male/female and neuter names respectively
  `--anonname`**`m`**`_SUBST --anonname`**`f`**`_SUBST --anonname`**`n`**`_SUBST`

- for social media and places
  `--anon`**`socialmedianame`**`_SUBST --anon`**`place`**`_SUBST`

- We added anonymised tokens for numbers written in digits
  `--anon`**`numeral`**`_POS where POS ∈ {ADJ, SUBST, VERB, ADV, PRON}`

From the Spoken BNC 1994 and Spoken BNC 2014
we extracted 7.205 sentences containing LVCs

- We used the dependency parser of Stanza, a Python library (Qi et al., 2020)
- We identified sentences with LVCs by looking for a target light verb (e.g., `give_VERB`) with as object a nominal belonging to an LVC (e.g., `kiss_SUBST`)

`give_VERB` `he_PRON` **`kiss_SUBST`** `on_PREP face_SUBST`

Light Verb

Nominal

Object

We built our co-occurrence count-based vector space as follows

- a basis of 2000 content tokens:
  - excluding prepositions, pronouns, tokens of the form `[a-z]_POS` , e.g., `p_SUBST`
  - excluding the 50 most frequently occurring lemmas
- a 5x5 tokens context window, minimum sentence length of 5
- Positive Pointwise Mutual Information (PPMI) as a weighting scheme

$$PPMI = \max\left(\log_2\left(\frac{p(T,C)}{p(T)p(C)}\right), 0\right)$$

When studying the verbs in isolation,

we found that Light Verb Constructions were modelled as

taking less time than Full Verb Constructions.

We semantically project our vectors onto a Duration scale

(Grand et al., 2022) (Liu & Chersoni, 2023)

$$Proj = \frac{\overrightarrow{target} \cdot \overrightarrow{DURATION}}{||\overrightarrow{DURATION}||}$$

short

(adjectives)
brief, short-term
short, immediate

(nouns)
minute, moment,
second

long

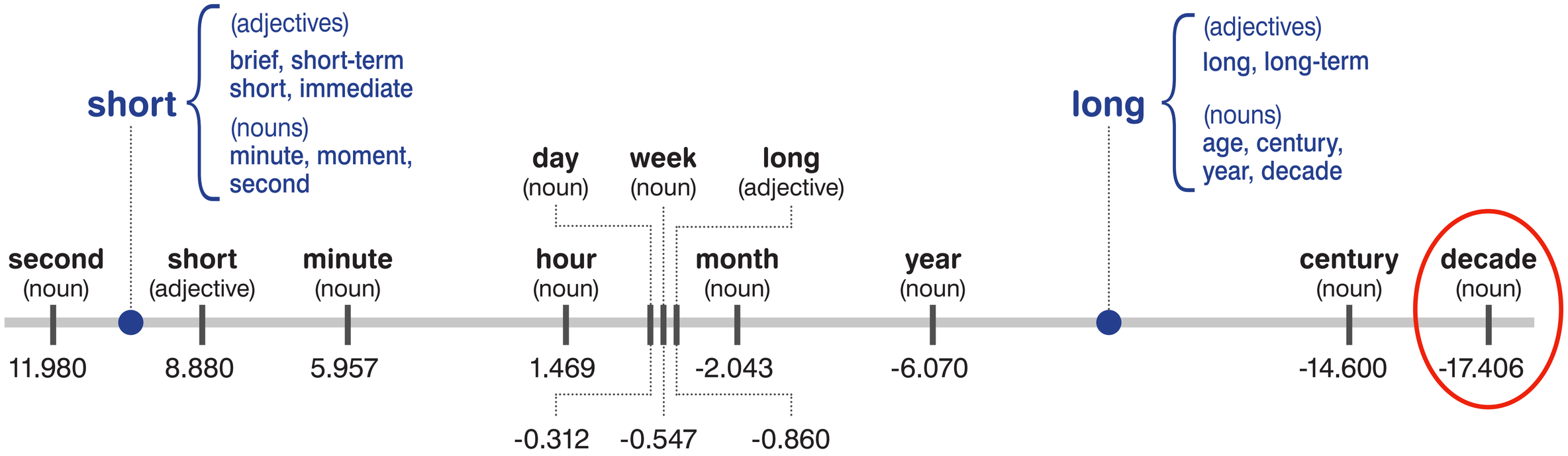
(adjectives)
long, long-term

(nouns)
age, century,
year, decade

We semantically project our vectors onto a Duration scale

(Grand et al., 2022) (Liu & Chersoni, 2023)

$$Proj = \frac{\overrightarrow{target} \cdot \overrightarrow{DURATION}}{||\overrightarrow{DURATION}||}$$



We semantically project our vectors onto a Duration scale

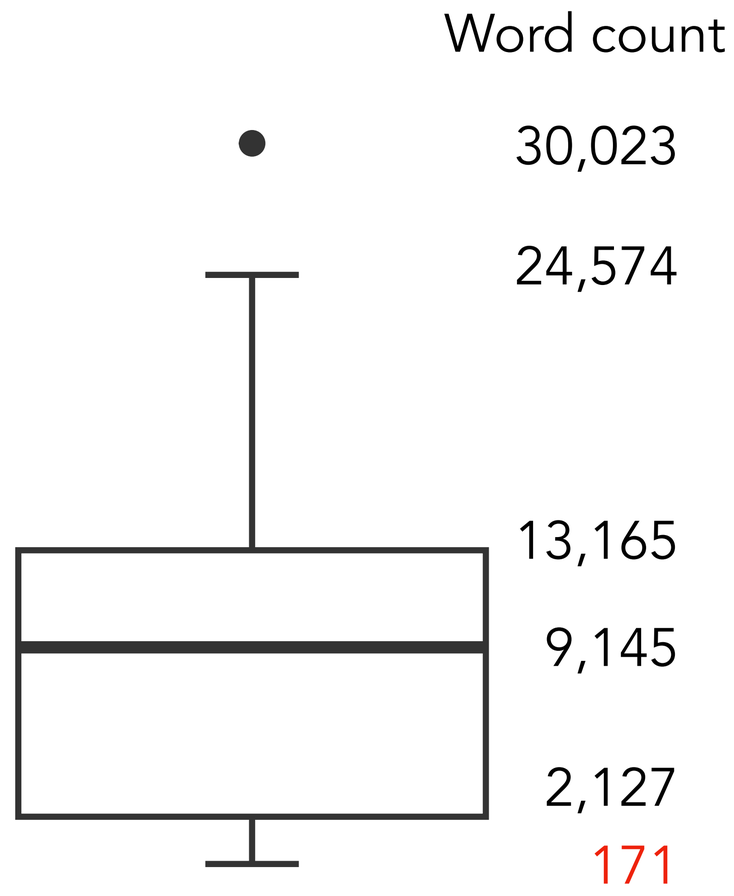
(Grand et al., 2022)

(Liu & Chersoni, 2023)

longer duration

shorter duration

Lemma	POS	Projection	Word count
decade		−17.406	**171**
century	noun	−14.600	602
year		−6.070	30,023
month		−2.043	7,780
long	adjective	−0.860	9,505
week	noun	−0.547	16,825
day		−0.312	24,574
hour		1.469	9,177
minute		5.957	9,145
short	adjective	8.880	2,491
second	noun	11.980	1,763



We semantically project 158 LVC-FVC pairs in isolation
onto our Duration scale and find a statistically significant difference

LVC = Light Verb + nominal

additive
compositionality

<

modelled as
taking less time

FVC = Full Verb

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additive compositionality

modelled as taking less time

	LVC projection	FVC projection
Min.	−0.485	−2.387
Q1	2.399	0.665
Median	4.133	1.369
Mean	4.186	1.535
Std.	2.208	1.230
Q3	5.744	2.264
Max.	9.342	4.843

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Paired T-test where $\alpha = 0.05$

p-value < 2.2×10^{-16}

t(157) = 16.58, CI [2.39,+∞)

Cohen's d of 1.40, 95% CI [1.17, 1.64]

When semantically projecting sentences containing 132 LVC-FVC pairs
onto our Duration scale, we do not find an **overall** statistically significant difference

one-sided Brunner-Munzel test, where $\alpha = 0.05$

$$H_0 : P(FVC < LVC) + \frac{1}{2}P(FVC = LVC) = 0.5$$

$$H_A : P(FVC < LVC) + \frac{1}{2}P(FVC = LVC) > 0.5$$ (Brunner & Munzel, 2000)

$p < \alpha$ for 6 LVC-FVC pairs

Including all outliers								
LVC-FVC	#LVC	#FVC	BM	p	BF p	BH p	Rel.eff. p	Rel.eff. CI
make appearance-appear	3	369	15.106	0.002	0.264	0.198	0.939	[0.792,1.096]
have try-try	13	8,359	3.422	0.005	0.660	0.198	0.733	[0.579,0.883]
have bite-bite	14	160	3.103	0.006	0.792	0.198	0.719	[0.566,0.868]
give address-address	31	255	2.706	0.006	0.792	0.198	0.637	[0.535,0.740]
have rest-rest	40	97	2.187	0.016	1.000	0.422	0.631	[0.511,0.747]
make move-move	35	4,787	1.746	0.044	1.000	0.968	0.583	[0.487,0.679]

When correcting for multiple testing (132 tests),
we do not find a statistically significant difference (Shaffer, 1995)

- Bonferroni correction: more false negatives (Bonferroni, 1936)
- Benjamini-Hochberg correction: more false positives (Benjamini & Hochberg, 1995)

No p-value < α
when correcting for
multiple testing (132 tests)

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Bonferroni correction (BF)

Benjamini-Hochberg correction (BH)

When semantically projecting sentences containing 132 LVC-FVC pairs
onto our Duration scale, we do not find an **overall** statistically significant difference

Contributing factors:

- Spoken BNC 1994 & Spoken BNC 2014 as underlying corpora
  - Conjunctions of sentences
  - Maximum sentence length is 331 tokens

Group	Count	Min.	Q1	Median	Mean	Std.	Q3	Max.
combined	172,766	1	8	15	20.503	19.012	26	331
LVCs	7,205	2	9	16	21.423	18.917	27	331
FVCs	165,561	1	8	15	20.463	19.015	26	331

When semantically projecting sentences containing 132 LVC-FVC pairs
onto our Duration scale, we do not find an **overall** statistically significant difference

Contributing factors:

- All vectors are weighted equally due to additive compositionality
- In the current setup, it is not feasible to apply more complex compositional methods

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LVCs	7,205	2	9	16	21.423	18.917	27	331
FVCs	165,561	1	8	15	20.463	19.015	26	331

In our work we find

- For LVC-FVC pairs **in isolation**, we find events in LVC are modelled as taking less time than events in FVC.
- For LVC-FVC pairs **in context**, we do not find an overall statistically significant difference in duration between events in LVC and events in FVC.

Future work includes

- making the distinction between event types, by including articles: durative/punctive events in mass/count syntax
- using different representations for different parts of speech: matrices for adjectives and verbs (Baroni & Zamparelli, 2010; Grefenstette & Sadrzadeh, 2011)
- optimising the sentence extraction method to better isolate the target expression and its relevant context

Studying event duration of Light Verb Constructions using explicit word embeddings

- For LVC-FVC pairs in isolation, we find events in LVC are modelled as taking less time than events in FVC.
- We demonstrate semantic nuance can be studied using a fully transparent language representation.
- Studying LVC-FVC pairs in context demands for more precise methods for sentence extraction and more complex compositional methods.

If this ***sparks an interest***,

then ***give*** this QR code ***a scan***

so we can ***have a chat***!