The detrimental effect of semantic similarity on immediate serial recall

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Introduction

Detrimental effects of similarity on STM
Similarity of stimulus properties, in general, impairs short-term memory (STM) performance. For example, phonological similarity (Baddeley et al., 1984) and visual similarity (Avons & Masson, 1999) have detrimental effects on STM.

Facilitative effect of semantic similarity (?)
Nevertheless, previous studies have suggested that semantic similarity has a facilitative effect on STM (e.g., Saint-Aubin & Poirier, 1999).

Critical review on the semantic similarity effect
Ishiguro and Saito (2020a) pointed out that semantic association, which enhances STM performance, was possibly confounded with semantic similarity in previous studies. Further, results of their meta analysis showed that semantic similarity indeed had a detrimental effect, by statistically separating semantic similarity from semantic association.

Purpose of the current study
Test a possible detrimental effect of semantic similarity by conducting the immediate serial recall task
Specifically, we investigated whether and how semantic similarity impairs STM.

Method

Participants: 120 participants recruited via Prolific Ltd. (data for 114 participants were included in the analysis)

Task: a Web-based immediate serial recall task

Stimuli: 25 lists of 6 unrelated words (25 lists were randomly sampled from a pool of 100 lists for each participants)

Dependent variables: (1) correct-in-position, (2) item correct, and (3) order errors

Independent variables: (1) position (1-6), (2) semantic distance as semantic dissimilarity index (see Ishiguro & Saito, 2020a), (3) word length, (4) imageability, (5) frequency, and (6) age-of-acquisition

Analysis: We used logistic models (e.g., whether an item was recalled at the correct position (“1”) or not (“0”) for correct-in-position scoring)

Results

Logistic model for correct-in-position

	Estimate	*SE*	*z* value	*p* value	
Intercept	1.13	0.31	3.63	< .001	***
Position 2	-0.85	0.06	-13.09	< .001	***
Position 3	-1.21	0.06	-18.81	< .001	***
Position 4	-1.92	0.07	-29.24	< .001	***
Position 5	-2.72	0.07	-38.77	< .001	***
Position 6	-2.36	0.07	-34.83	< .001	***
Semantic distance	0.07	0.03	2.02	.044	*
Word length	-0.14	0.02	-6.32	< .001	***
Imageability	0.09	0.02	4.01	< .001	***
Frequency	0.28	0.05	5.95	< .001	***
Age-of-acquisition	0.00	0.01	0.28	.780	

Note. Intercept partly reflects the effect of the first position.

As semantic distance of an item increased (semantic similarity decreased), the probability of recalling that item increased.

Logistic model for item correct

	Estimate	*SE*	*z* value	*p* value	
Intercept	1.28	0.30	4.35	< .001	***
Position 2	-0.52	0.07	-7.79	< .001	***
Position 3	-0.80	0.07	-12.19	< .001	***
Position 4	-1.54	0.07	-23.58	< .001	***
Position 5	-2.40	0.07	-35.33	< .001	***
Position 6	-2.22	0.07	-33.22	< .001	***
Semantic distance	0.03	0.03	0.88	.380	
Word length	-0.13	0.02	-5.93	< .001	***
Imageability	0.08	0.02	3.70	< .001	***
Frequency	0.28	0.04	6.34	< .001	***
Age-of-acquisition	0.00	0.01	0.16	.872	

Note. Intercept partly reflects the effect of the first position.

Semantic distance’s effect disappeared in item correct scores.

By contrast, other semantic-lexical variables had effects.

Logistic model for order errors

	Estimate	*SE*	*z* value	*p* value	
Intercept	-3.86	0.41	-9.33	< .001	***
Position 2	1.37	0.13	10.17	< .001	***
Position 3	1.62	0.13	12.23	< .001	***
Position 4	1.55	0.13	11.67	< .001	***
Position 5	1.16	0.14	8.44	< .001	***
Position 6	0.65	0.15	4.43	< .001	***
Semantic distance	-0.11	0.04	-2.41	0.0161	*
Word length	0.04	0.03	1.21	.228	
Imageability	-0.03	0.03	-0.98	.328	
Frequency	0.03	0.06	0.51	.610	
Age-of-acquisition	0.00	0.02	-0.27	.788	

Note. Intercept partly reflects the effect of the first position.

Semantic distance’s effect were evident in order errors.

By contrast, other semantic-lexical variables’ effects were not confirmed.

Discussion

Interpretations of Results
Semantic similarity, indexed by semantic distance, impaired STM (i.e., correct-in-position scores). Furthermore, absence and presence of semantic distance’s effect on item correct and order errors would imply that semantic similarity selectively impaired order memory, consistent with Ishiguro and Saito (2020a).

Implications
As the detrimental effect of semantic similarity is comparable to phonological and visual similarity effects in its direction, we suggest semantics-based processes or mechanisms in STM.

References

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