Predicting the Age of Acquisition of Concepts from Sensorimotor Experience

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Theories of embodied cognition have highlighted the important role that sensorimotor experience plays during language production and processing. Yet, there is relatively little research on the way sensorimotor experience can influence the development of language. Explanations for how concepts are acquired has previously been assessed through linguistic (e.g. frequency, length) and semantic factors (e.g. concreteness, valence), but such findings have been limited in their scope, relying on a relatively small sample of concepts acquired during development. Moreover, the use of suboptimal and unidimensional semantic variables often provides a shallow picture of how these variables actually influence the acquisition of language, leaving important subtleties unexplained.

With an increasing availability of megastudy datasets, where thousands of participants are recruited for large scale data collection, it is now possible to explore various psycholinguistic properties of thousands of concepts (e.g. Brysbaert et al., 2014; Warriner et al. 2013). Lynott et al. (in prep) have applied this approach to collect norming data based on sensorimotor experience, where thousands of words are rated by participants across 11 sensorimotor dimensions (sensory: auditory, gustatory, olfactory, haptic, interoceptive; motor: hand/arm, foot/leg, head, mouth/throat, torso), providing a detailed profile of how we experience different concepts through our sensorimotor modalities.

Here, I present a comprehensive set of analyses which demonstrates how sensorimotor experience reliably predicts age of acquisition (AoA) ratings for over 13,000 concepts. The results demonstrate that when sensorimotor ratings are added to hierarchical regression models predicting AoA, even when controlling for various other factors, significantly more variance is explained. Furthermore, the analyses demonstrate the important, or even dominant, roles that haptic and interoceptive experience plays in predicting the AoA of concrete and abstract concepts respectively (see Tables 1 & 2). Whereby the more haptic or interoceptive a concept is, the more likely it will be acquired earlier in life. These results can help to further our understanding of language development through the lens of embodied cognition, and provides important insights into how experiences with the environment around us contribute to the development and acquisition of both concrete and abstract concepts.

References

Brysbaert, M., Warriner, A. B., & Kuperman, V. (2014). Concreteness ratings for 40 thousand generally known English word lemmas. *Behavior research methods*, *46*(3), 904-911.

Lynott D, Connell L, Brysbaert M, Carney J, Brand J. (In prep). Sensorimotor norms of modality-specific perceptual strength and effector-specific action strength for 40,000 concepts.

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Table 1. Hierarchical regression analysis predicting AoA of concrete concepts, known predictors are entered at stage 1, with sensory modality predictors entered at stage 2

Stage	Predictor	Estimate	Std. error	*t*	*p*	R^2	ΔR^2
1	intercept	17.53	0.22	78.72	.001***	.40	
	frequency	-0.76	0.02	-44.51	.001***		
	length	0.16	0.01	13.56	.001***		
	concreteness	-1.05	0.04	-26.04	.001***		
	valence	-0.38	0.02	-18.07	.001***		
2	vision	-0.26	0.03	-7.75	.001***	.43	.03
	haptic	-0.39	0.03	-14.59	.001***		
	audition	-0.21	0.02	-9.23	.001***		
	olfaction	0.01	0.04	0.34	.73		
	gustation	-0.04	0.03	-1.33	.18		
	interoception	-0.05	0.03	-1.61	.11		

Table 2. Hierarchical regression analysis predicting AoA of abstract concepts, known predictors are entered at stage 1, with sensory modality predictors entered at stage 2

Stage	Predictor	Estimate	Std. error	*t*	*p*	R^2	ΔR^2
1	intercept	15.06	0.21	70.05	.001***	.40	
	frequency	-0.87	0.02	-51.99	.001***		
	length	0.08	0.01	7.81	.001***		
	concreteness	-0.42	0.06	-7.01	.001***		
	valence	-0.08	0.02	-4.74	.001***		
2	vision	-0.26	0.03	-7.57	.001***	.43	.03
	haptic	0.00	0.05	0.01	.99		
	audition	-0.03	0.03	-0.94	.35		
	olfaction	-0.06	0.10	-0.63	.53		
	gustation	-0.11	0.09	-1.21	.23		
	interoception	-0.28	0.03	-10.76	.001***		