It's Alive
Instantiating The Referent Model of Lexical Decision

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Abstract

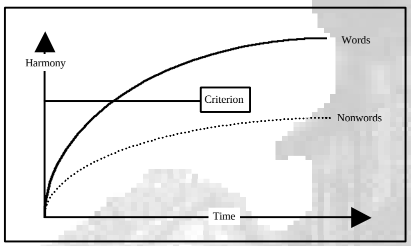
Joordens & Piercey (1996) highlighted data supporting a referent model of lexical decision. This model assumes that the basic process of word recognition is the pattern completion process typical of attractor models of memory. As patterns are retrieved from such models, they increasingly fit with the weight matrix, which can be viewed as a global representation of the contents of memory. This fit can be quantified as a entity called harmony (Smolensky, 1986). Within the referent model, successive comparisons are made between the current item's harmony and an average (i.e., referent) harmony level. The difference between these levels over time drives a random-walk process, allowing continuous harmony values to be mapped on to word versus nonword decisions. In the current work we instantiate this model within the context of the Hopfield network model proposed by Masson (1991; 1995). A comparison of the simulation and human data support the referent model.

Masson's (1995) Distributed Model of Memory

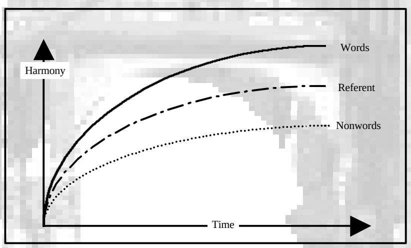
The word recognition process occurs as a gradual forming of orthographic, phonological, and semantic representations for the presented stimulus.

The different levels of representation are compiled in the order suggested above. First orthography, then phenology, and lastly semantics.

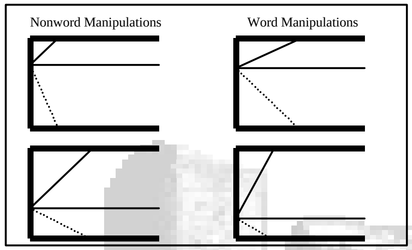
Decision Criterion



Referent Model



Referent Model Predictions



Network Structure

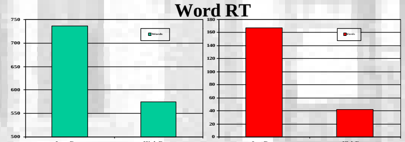
Experiment #1 & Simulation #1

High frequency words are assumed to have a higher drift rate than low frequency words. Thus, when the high frequency words are introduced, they should initially result in fast and highly accurate word responses. However, as a function of the efficiency principle, the boundaries should migrate upwards upwards such that the nonword boundary were moved closer to the referent, and the word boundary further away. This should show through as faster and less error prone nonword responses.

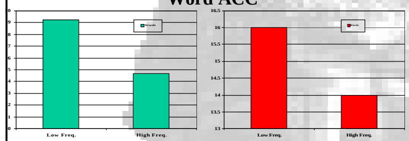
Low frequency items were presented for the first half of the Experiment #1 and Simulation #1 followed by high frequency items for the second half. Both words and nonword decisions become faster and more accurate when high frequency words are presented.

Experiment #1 | **Simulation #1**

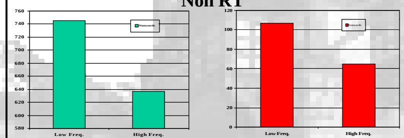
Word RT



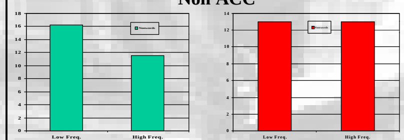
Word ACC



Non RT



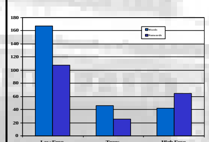
Non ACC



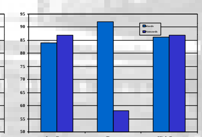
Transition Stage

During the transition the high frequency words become faster and highly accurate. The initial shift in the referent, or average harmony, causes the nonwords to become less accurate and faster.

Word & Nonword RT



Word & Nonword ACC

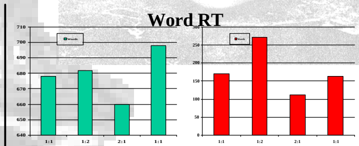


Experiment #2a, 2b & Simulation #2a, 2b

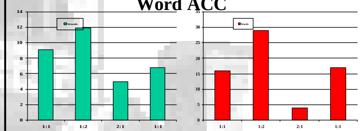
Word and nonword ratio are manipulated. If we compare a context containing more words than nonwords to the baseline, we would expect the starting position to shift slightly towards the word boundary which should lead to; (1) faster word responses, (2) slower nonword responses, (3) less word errors, and (4) more nonword errors. In contrast, if we compare a situation with less words than nonwords, we would expect a shift of towards the nonword boundary which should lead to; (1) slower word responses, (2) faster nonword responses, (3) more word errors, and (4) less nonword errors.

Experiment #2A & 2B | Simulation #2A & 2B

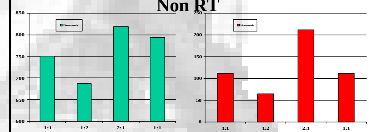
Word RT



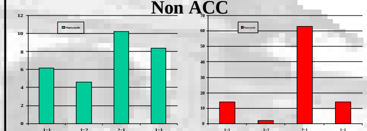
Word ACC



Non RT



Non ACC



Conclusions

The referent models predictions fit nicely with the human data.

There is evidence of an intimate relationship between word and nonword decisions and the criterion used to create these decisions.

Computer simulations support the notion of using a referent which overlays a distributed representation of memory to produce lexical decisions.

References

Borowsky, R., & Masson, E. J. (1996). Semantic ambiguity effects in word identification. Journal of Experimental Psychology: Learning, Memory, and Cognition. 22, 63-85.

Grainger, J. & Jacobs, A. M. (1996). Orthographic processing in visual word recognition: A multiple read-out model. Psychological Review, 103, 518-565.

James, C. T. (1975). The role of semantic information in lexical decisions. Journal of Experimental Psychology: Human Perception and Performance, 1, 130-136.

Joordens, S., & Becker, S. (1997). The long and short of semantic priming effects in lexical decision. Journal of Experimental Psychology: Learning, Memory, and Cognition, 23, 1083-1105.

Masson, M. E. J. (1995). A distributed memory model of semantic priming. Journal of Experimental Psychology: Learning, Memory, and Cognition, 21, 3-23.

Piercey, C. D. & Joordens, S. (In Press). Turning an advantage into a disadvantage: Ambiguity effects in lexical decision versus reading tasks. Memory & Cognition

Stone, G. O., & Van Orden, G. C. (1993). Strategic control of processing in word recognition. Journal of Experimental Psychology: Human Perception and Performance, 19, 744-774.