The Effects of Feature Type on Semantic Priming of Picture Naming in Normal Speakers

Although semantic feature treatments have had positive treatment effects, generalization to untrained items and maintenance effects long after therapy concludes can be improved (Nickels, 2002). Therefore, it is necessary to refine semantic feature treatments. One approach is to gain a better understanding about the relationship of the feature units on the activation of conceptual representations, so that this relationship can be exploited in word retrieval therapies. One theory that provides further specificity regarding feature types and their connections in the semantic system is called the Conceptual Structure Account (CSA; Tyler & Moss, 2001; Taylor et al., 2007).

The CSA proposes that semantic memory is comprised of shared and distinctive features. Shared features are defined as those features that are common to related concepts, while distinctive features are unique to each concept. That is, most living things share features of *eyes, ears, breathes, legs;* thus, these features are only indicative of category membership. Conversely, fewer living things have *stripes, trunk, mane,* or an *udder* making these distinctive features*.* Distinctive features belong to fewer concepts and provide more information about a specific concept. An example given by Taylor and colleagues is tiger. To activate the concept of tiger, the shared features which define animals and, specifically cats, such as four legs, teeth, and tail, will be activated but, until stripes is activated, the concept of tiger will not be complete and therefore, not activated above other types of cats. Thus, shared features reflect category membership and are not helpful in identification, and distinctive features provide more information about a particular concept and are critical to identification (Tyler & Moss, 2001; Taylor et al., 2007).

In living things, shared features are highly correlated to each other (e.g. things which breathe typically have eyes and ears) while distinctive features, on the other hand, are weakly correlated to other features (e.g. most things with eyes and ears don't have pouches, udders, or eight legs. Nonliving things on the other hand, have distinctive features which are highly correlated (things that have a blade also cut) and fewer shared features with lower correlations (most tools have a handle but could be made of wood, plastic, or metal; be used for hitting, cutting, or turning) (Tyler & Moss, 2001; Taylor et al., 2007).

The distribution of shared and distinctive features in living and nonliving concepts could be used to further specify the stimuli used in anomia treatments; however, it is unknown if shared and distinctive features can be used to activate concepts because previous studies have used concept-to-concept activation and not feature-to-concept activation. Thus, the aim of the current study was to test the roles of shared and distinctive features, as proposed by the CSA, in feature-to-concept activation. The current experiment entailed a priming paradigm with multiple primes. Processing time may be an important factor in order to allow for consolidation of the meanings of each prime (Milberg, Blumstein, Giovanello, & Misiurski, 2003). Therefore, to determine if there is a benefit to presenting multiple features prior to naming a picture the paradigm was administered at two inter-stimulus intervals. The following research questions were addressed:

1: Is there a significant difference in naming animals, tools, or vehicles as measured by SRT when primed with shared or distinctive features or a combination there of compared to neutral primes?

2. Does SRT for naming animals, tools, or vehicles change linearly as number of shared features changes from 1-2?

3. Does SRT for naming animals, tools, or vehicles change linearly as number of distinctive features changes from 1-2?

4. Is there a significant difference in priming effects over time when comparing an ISI of 200msec to an ISI of 600msec?

Methods

Participants

Forty-six older adults (28 females, 18 males) completed the study. All participants were right-handed, monolingual, English speaking adults without a history of neurologic conditions or disease and/or developmental cognitive disorders as measured by participant report. Participants completed intelligence and language tests prior to participation. Demographic information and average test scores can be found in Table 1.

Design

The dependent variable was speech reaction time (SRT) for picture naming which was measured from the onset of the picture to the initiation of speech. The three independent variables were the prime condition (listed below), semantic category of the target picture (animals, tools, vehicles), and the ISI (200msec or 600msec). ISI was measured from the offset of a stimulus to the onset of the next stimulus.

Trial structure

Trials consisted of two orthographic word primes and a target in the form of a black and white line drawing. Participants were asked to name the target out loud. All picture targets were concepts. Word primes where either semantic features or a neutral prime. The semantic feature primes were either a shared or distinctive feature (defined below) related to the target. The neutral prime was the word *blank.* The combination and order of feature type and neutral primes were randomized across all trials while limiting each target to a single appearance per participant. Thus, in one trial a feature type was presented from 0-2 times. Figure 1 shows an example trial structure with timing. The prime pair conditions were:

Shared-shared
Shared-neutral
Shared-distinctive
Distinctive-distinctive
Distinctive-neutral
Neutral-neutral

Prime type

The word *blank* was used as the neutral prime to compare to the effect of semantic feature primes. Semantic features were selected from the corpus of 541 living and nonliving things created by McRae, Cree, Seidenberg, & McNorgan (2005) based on modified version of the concept production frequency (CPF). Any feature with a CPF greater than two is considered shared and two or less is considered distinctive.

Data Analysis

A linear mixed effects model was employed to measure the effects of prime type on SRT in each semantic category. Distinct analyses were conducted for each category (animals, tools, vehicles). Log-transformed data were used to reduce the effect of outliers. All analyses were conducted with Bonferroni correction for multiple comparisons.

Results

Reliability

Intra-class correlation was calculated for 25% of each participant's responses, resulting in 96% agreement between raters.

Speech Reaction Time

Comparing SRT for naming animals, tools, and vehicles was consistently and significantly ($p<.05$) shortest following distinctive features primes compared to all other prime types (Figure 2). Analyses of SRT following varying number of features did not reveal significant differences between one and two shared features or one and two distinctive features (Figures 3 and 4). Lastly, there was no significant difference in SRT when the ISI was 200msec or 600msec (Figure 5).

Discussion

The most consistent finding was greater priming after distinctive feature primes as compared to shared primes, distinctive and shared primes, or neutral primes. One of the most central hypotheses of the Conceptual Structure Account (Tyler & Moss, 2001; Taylor et al., 2007) is the unique and critical role of distinctive features in semantic space and conceptual activation. The current study supports this claim and validates it in verbal production, a language behavior not previously used in investigations of the CSA. The lack of support for the postulates of the CSA regarding differences in the distribution and correlations of shared and distinctive features in living and nonliving things, suggests further research is required to elucidate these relationships. These findings have future implications for feature-based anomia treatments.

References

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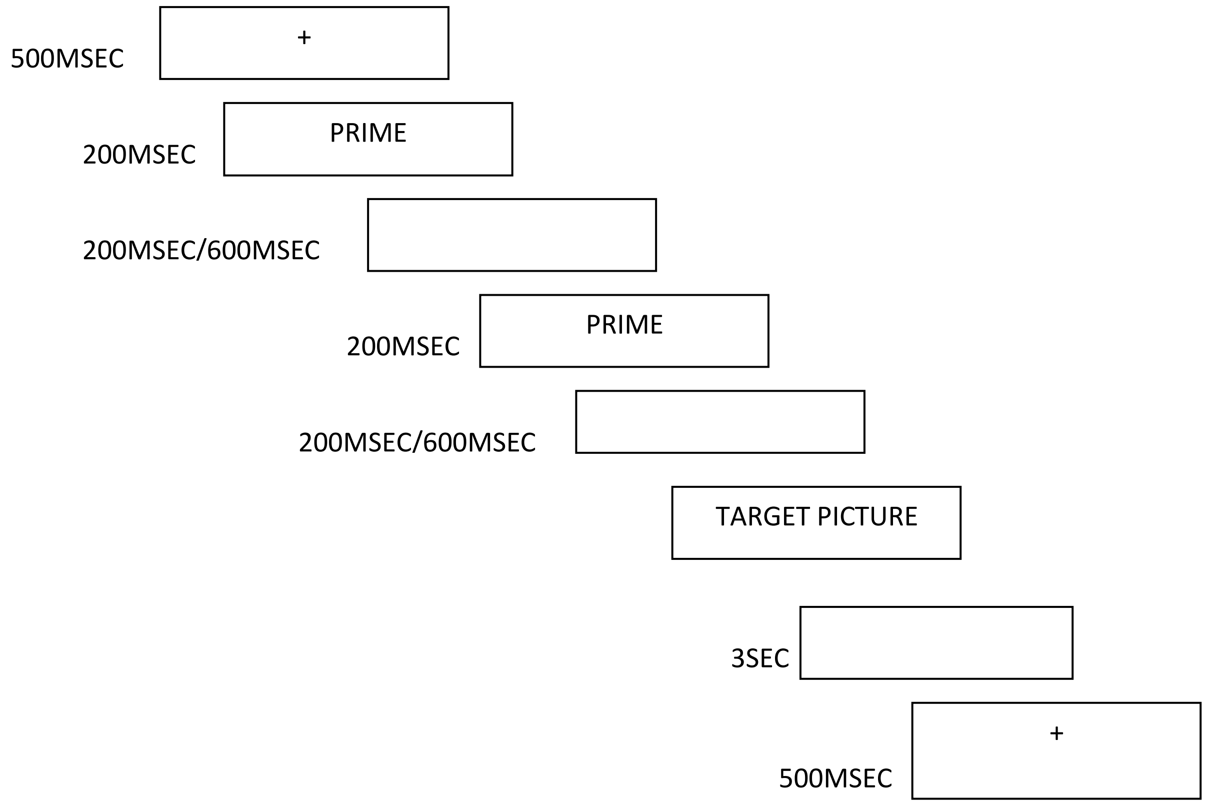
Table 1. Participant Demographics

	Age	Education	MMSE	TOWER	P&P	ANART
AVE	60	16	29	97	51	40
(SD)	(7)	(2)	(1)	(18)	(1)	(8)

AVE = average test scores
SD = standard deviations for average test scores
MMSE= Mini-Mental Status Exam (Folstein, Folstein & McHugh, 1975)
TOWRE = Test of Word Reading Efficiency (Torgesen, Wagner, & Rashotte, 1999),
P&P = Pyramids and Palm Trees Test (Howard & Patterson, 1992),
ANART = American National Adult Reading Test (Nelson, 1982)

Figure 1. Trial Structure with Timing Intervals



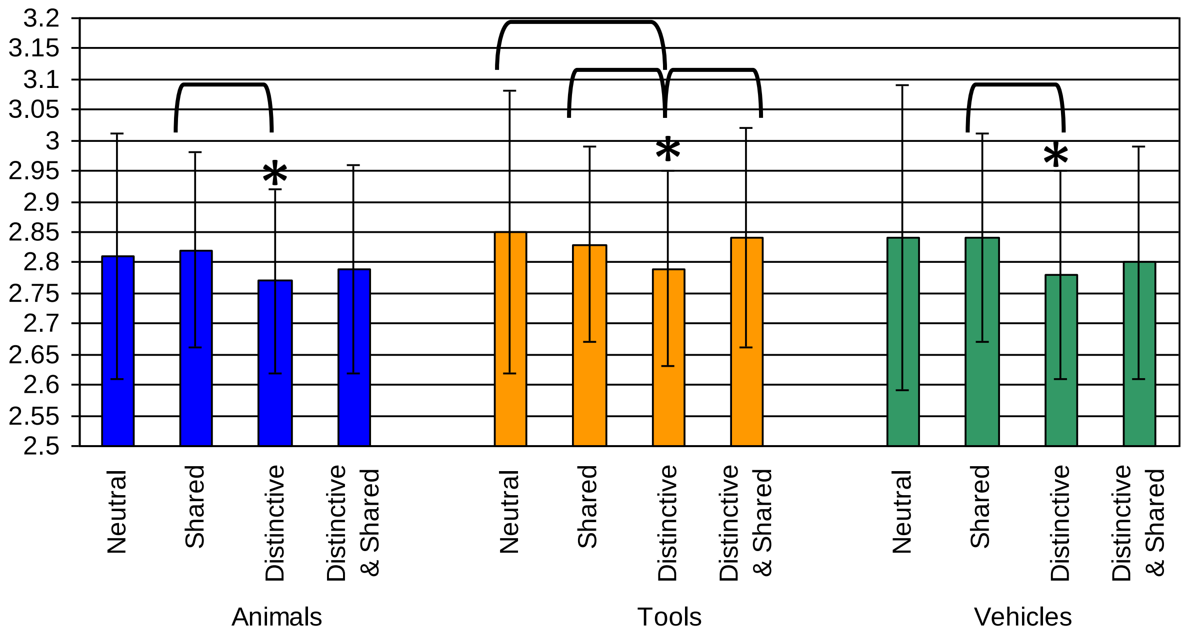


Figure 2. Log-transformed mean SRT from comparison of neutral, shared, distinctive and combined prime conditions. Brackets indicate significant pairwise comparisions (p<.05). Asterisks indicate the prime condition which produced significantly faster SRTs.

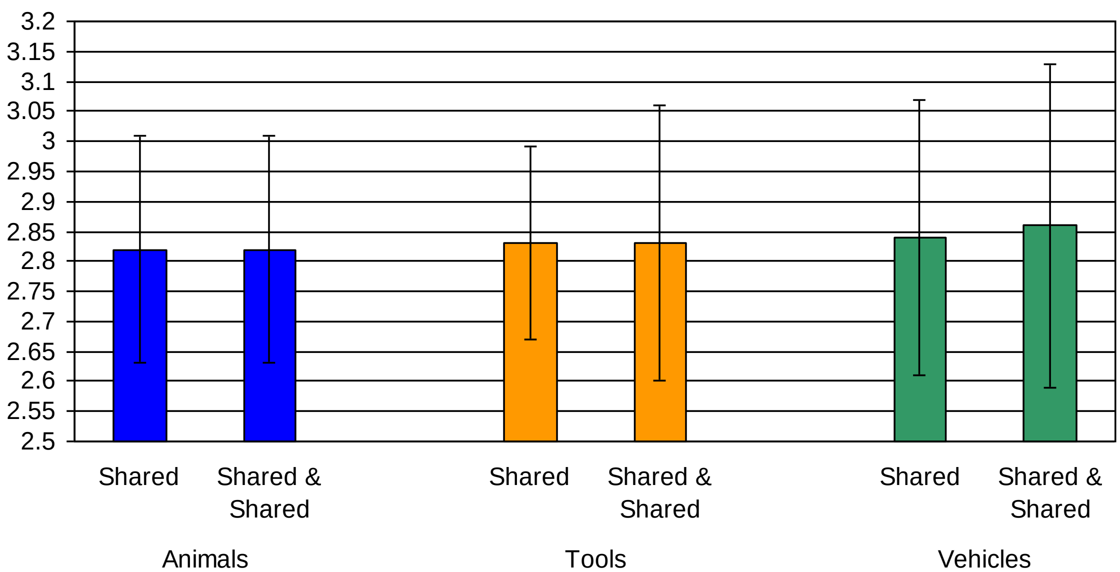


Figure 3. Log-transformed mean SRT from comparison of shared and shared-shared prime conditions. There were no significant effects of prime condition.

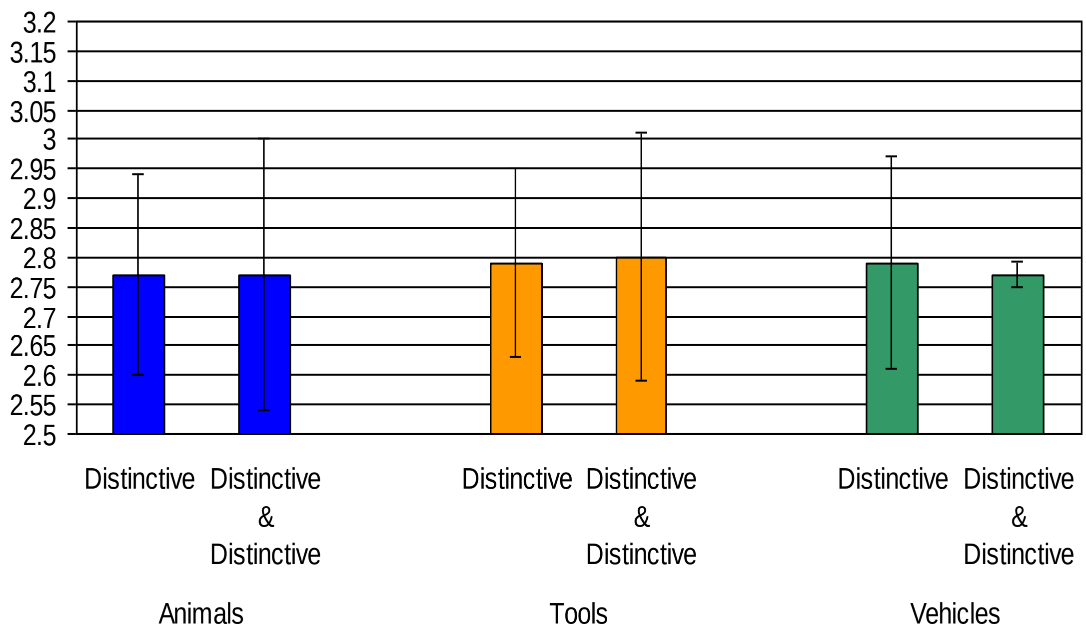


Figure 4. Log-transformed mean SRT of older adult responses from comparison of distinctive and distinctive-distinctive prime conditions. There were no significant effects of prime condition.

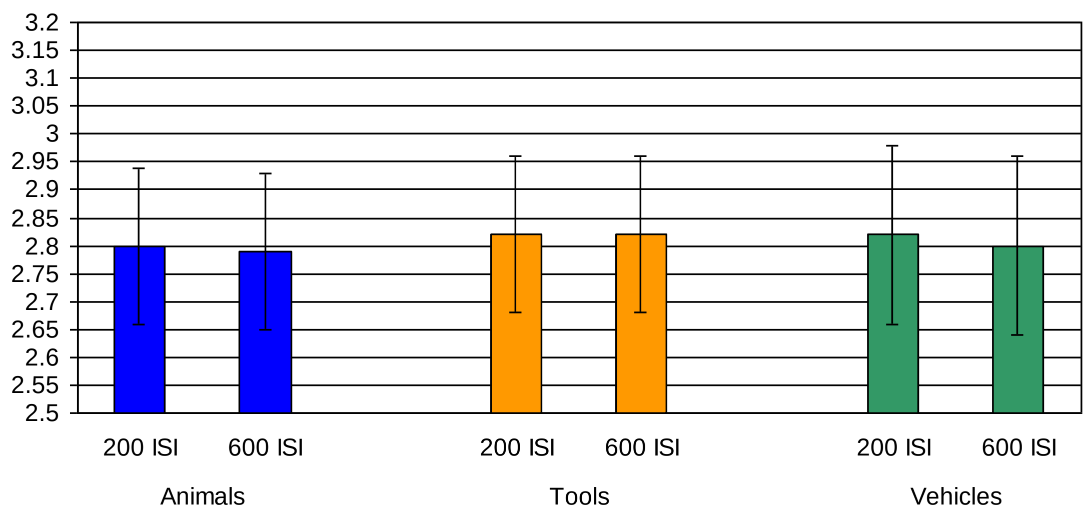


Figure 5. Log-transformed mean SRT of older adult responses to all prime conditions (collapsed across shared, distinctive, combined, and neutral primes) at 200 ISI versus 600 ISI. There was no significant difference in SRT between ISI conditions.