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F-4. Cerebral Hemispheric Mechanisms Linking Ambiguous Word  
Meaning Retrieval with Subjects Varying in Verbal Creativity

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Lexically ambiguous words were used in a divided visual field priming paradigm to determine if both hemispheres or only the right hemisphere are involved with ambiguity resolution, a key aspect of verbal creativity. The Wallach–Kogan similarities subtest was used to divide 84 subjects into three levels of verbal creativity to compare their performance on the Burgess and Simpson (1988) divided visual field task. Both the left and right hemispheres seem to be contributing to the maintenance of multiple word meanings in highly creative subjects, while less creative subjects show sustained subordinate priming only in the right hemisphere or no sustained subordinate priming. These results support a collaborative theory of verbal creativity (Bogen & Bogen, 1969).

The impetus for integrating creativity and psycholinguistic research is provided by both cognitive neuroscience (Bogen and Bogen, 1969; Chiarello, 1991) and by the education and creativity literatures (Al-Sabaty & Davis, 1989; Torrance, 1982). The ability to sustain the representation of multiple pieces of potentially incongruous information is a key component in an operational definition of verbal creativity. The comprehension of lexically ambiguous words involves this ability to maintain activation for multiple incongruous word meanings. Therefore the study of lexical ambiguity is one way to explore an important component of verbal creativity. The divided visual field priming paradigm (Burgess & Simpson, 1988) employs ambiguous words to make its comparison of right and left hemispheric processes. This divided visual field task is particularly well suited for examining the independent ability of the two hemispheres to maintain activation of dominant and subordinate word meanings, an important part of creative verbal processing. Furthermore, the divided visual field priming paradigm provide an excellent means for examining differences in hemispheric lexical processing across subjects with varying levels of measured verbal creativity. If the right hemisphere is making the sole contribution to verbal creativity, then this would lead to the prediction that subjects who score high on the creativity measure

should show greater facilitation for subordinate associates presented in the LVF than subjects scoring low in verbal creativity. Conversely, if both hemispheres make a contribution to verbal creativity in the high creative subjects then both the left and right hemispheres should show sustained priming for both word meanings.

*Methods.* The Wallach–Kogan similarities subtest (1965) was used to divide a group of 84 University of California, Riverside students into three levels of creativity to compare their performance on the Burgess and Simpson (1988) divided visual field task. During the first 1-hr session, 10 similarity phrases preceded by an example (What ways are an apple and an orange are alike?) were presented individually. Two scores were calculated for each trial of each subjectsB creativity measure, these were fluency and uniqueness. Fluency refers to the total number of responses that a subject provided. Uniqueness is measured as the number of responses that a subject made that were completely novel and not provided by any other subject in the sample. These two scores were combined to generate an overall creativity score for each trial using a simple additive equation (total number of responses + number of unique responses = trial total.) In the second session which contained the divided visual field task, subjects were tested individually with a researcher present throughout the procedure to monitor and record all responses.

Subjects were instructed to attend to the prime word and respond to the target word by naming the target as quickly and accurately as possible. Presentation of a trial consisted of a 500 msec fixation point, followed by a centrally presented prime for a duration of 35 msec or 750 msec ending with a flash mask. Lateral presentation of the target subtended a maximum angle of 5.0 degrees, with a foveal eccentricity of 1.5 degrees to the right or left of fixation, and a duration 180 msec followed by a flash mask. A response or time out signal initiated a 1500 msec delay between trials (ISI).

*Results and discussion.* The design was a 2 (SOA: 35 msec and 750 msec)  $\times$  2 (dominance: dominant and subordinate meanings)  $\times$  2 (VF: right and left)  $\times$  2 (relatedness: related, unrelated)  $\times$  3 (creativity: high, medium, low) mixed factorial. Creativity was the sole between-subjects factor. Within subjects factors included SOA, VF, dominance, and relatedness.

Verbal creativity, as measured by the Wallach and Kogan subtest (1965) does affect performance on a divided visual field priming task that uses lexically ambiguous words.

On this task the subjects scoring high in verbal creativity show the fastest reaction times, followed by the medium creative subjects then the low creative subjects. As predicted, the high and medium creative groups showed sustained priming for the subordinate target in the LVF or right hemisphere whereas the low creative subjects did not. However, only the high creative subjects showed sustained subordinate priming in the left hemisphere. The low creativity subjects only show priming for the dominant word meanings. The medium subjects show sustained activation for the subordinate meanings

only in the right hemisphere. While in subjects showing the highest degree of verbal creativity, both the left and right hemispheres seem to be contributing to the creative process. Bogen and Bogen (1969) suggest that through "collaboration" via the corpus callosum and other intercerebral commissures, the asymmetric functions of the hemispheres contribute to the flexibility of thought that fosters creativity. In contrast, many researchers have attributed creativity to solely right-hemisphere processes (Harnard, 1972; Harpaz, 1990; Hassler, Nieschlag & De La Motte, 1990; Martindale, 1978; Osborn, 1963; Torrance, 1982). These results are consistent with the collaborative view of creativity held by Bogen and Bogen (1969) and is consistent much of the recent work in psycholinguistics that suggests that cognitively demanding linguistic processes require the contribution of both hemispheres for the most accurate and swiftest outcome.

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