

## Further evidence for a post-selection inhibitory mechanism in lexical retrieval

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Several studies have reported aphasic patients who are able to name or recognize objects in isolation, but have difficulty when responding to items presented in semantically related blocks (e.g., repeatedly naming items from a semantic category). Some researchers have attributed this difficulty to a disruption in processes underlying retrieval of semantic representations (e.g., Warrington & McCarthy, 1983), whereas others have argued for a deficit in selecting from several highly activated lexical competitors (e.g., Schnur, Schwartz, Brecher, & Hodgson, 2006). One patient, ML, with an exaggerated semantic blocking effect in picture naming, shows evidence of a deficit in inhibiting irrelevant verbal representations (Hamilton & Martin, 2005). We have hypothesized that his exaggerated semantic blocking effect derives from difficulty in inhibiting lexical representations after selection (Biegler, Crowther, & Martin, 2007). Representations not successfully inhibited remain as strong competitors, increasing the semantic blocking effect. In the present study, we aimed to provide further evidence that ML does not have a semantic disruption that could underlie his semantic blocking effect and investigated whether he has difficulty when several lexical representations are concurrently activated but not repeatedly retrieved. We compared his performance to AR, another patient with an exaggerated semantic blocking effect, and to LW, who shows a normal semantic blocking effect.

### Participant information

ML is a 62 year-old right-handed male who suffered a CVA in 1990, resulting in a left frontal and parietal infarction. His speech is nonfluent, but he performs at a high level on tasks involving single items, scoring 98% correct on the Philadelphia Naming Task (PNT).

AR is a 70 year-old right-handed male who suffered a CVA in 1999, resulting in a left hemisphere lesion including frontal, parietal, and temporal regions. His speech is also nonfluent and he performs at a relatively high level on single-item tasks, scoring 93% correct on the PNT.

LW is a 72 year-old right-handed male who suffered a CVA in 2003. The location of his lesion is unknown, as a structural MRI cannot be performed due to a medical condition. His speech is fluent and he likewise performs well on single item tasks, scoring 96% correct on the PNT.

Ten older controls participated in Experiment 1 (mean age = 66.1) and 30 participated in Experiment 2 (mean age = 67).

### Experiment 1: Category fluency

The category fluency task, in which subjects name as many items as possible from a given semantic category, presumably taps similar retrieval and selection processes as semantically blocked naming. Mayr and Kliegl (2000) argued that by calculating a regression equation predicting inter-item response interval from response number, the intercept measures abilities involved in semantic search (i.e., locating the appropriate category) and the slope measures the retrieval process. If ML has no semantic disruption, then we expected an intercept within the normal range, but an above-normal slope and a reduced number of items retrieved, due to difficulty inhibiting previous responses.

### Methods

Subjects were given a category name (13 categories in total) and asked to generate as many category members as possible within one minute.

### Results

In terms of items correct, ML and LW scored just below the worst of the controls and AR scored considerably below. (See Table 1) ML had an intercept value below the mean for controls, indicating fast access to the category, but a slope more than three times the mean for controls, indicating long inter-item retrieval times. AR had substantially higher intercept and slope values than controls, indicating difficulty in both semantic search and retrieval. LW showed intercept and slope values similar to the controls.

### Experiment 2: Sentence completion

Robinson et al. (2005) reported a left frontal patient CH, who had great difficulty providing completions for low-constraint sentences compared to high-constraint sentences. They argued that his difficulty arose from having to select from several simultaneously activated lexical responses. We expected ML would have little difficulty on this task, since it does not require repeated retrieval from a single category.

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Table 1

	ML (%)	AR (%)	LW (%)	Controls (medians)	Range (%)	
Experiment 1: Slopes and intercepts for response number by inter-response interval across subjects						
Items retrieved	8.92	4.92	9.00	15	(9.67–20.33)	
Slope	1.14	1.98	0.36	0.21	(–0.09–0.46)	
Intercept	0.62	5.05	1.64	1.48	(0.44–2.15)	
Lexical constraint	Semantic constraint	ML (%)	AR (%)	LW (%)	Controls (%)	Range (%)
Experiment 2: Proportion of errors for sentence conditions by subjects						
High	High	3.2	6.5	0.0	1.7	(0–9.7)
Low	High	0.0	15.4	5.1	2.3	(0–12.8)
Low	Low	13.9	33.3	5.6	4.3	(0–16.7)

### Methods

Three kinds of sentences were created, varied on lexical and semantic constraint: lexical high (“The pilot landed the \_\_\_\_\_”), lexical low/semantic high (“The repairman fixed the \_\_\_\_\_”), and lexical low/semantic low (“The senator defended the \_\_\_\_\_”). Lexical constraint was determined by proportion of responses provided for the most common response, being either high (>0.70) or low (<0.60). Semantic constraint was determined by whether responses were constrained to a single semantic category (high) or not (low).

### Results

Neither ML nor LW had any difficulty with this task (see Table 1). AR, however, had a substantially greater number of errors than controls for sentences with low lexical and semantic constraint, but was only slightly outside the normal range for low lexical/high semantic sentences, and was within normal range for the high constraint sentences. Thus, his difficulty seemed to be mainly in retrieving weakly activated responses, rather than selecting from many competitors.

### Conclusions

ML’s results are consistent with a selective deficit in a post-selection inhibitory mechanism. AR shows a different pattern that implies difficulty

in searching for and retrieving semantic representations. One hypothesis about AR’s pattern might be that all lexical-semantic links have been weakened for him, slowing semantic access. One successful retrieval, however, results in strengthening of links for that item (through learning), resulting in the learned item becoming a potent competitor for subsequent retrievals within the same category. This competition would negatively affect both category fluency and semantically blocked naming.

### References

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