Feature-based models of semantic processing are predicated on the notion that object concepts are constructed through the co-activation of semantic feature knowledge (e.g., Gainotti, 2006; Tyler et al., 2000; Warrington & Shallice, 1984). For example, for the concept DOG, semantic features include visual-perceptual (has fur, has wet nose), motor/action (walks, wags), and functional (guides the blind) information, along with knowledge of superordinate category membership (animal, mammal, canine), encyclopedic information (Lassie was a famous one, cats are afraid of them), and personal associations/opinions (Dogs are my favorite animal.). In fact, accessing such information is thought to activate retrieval of lexical knowledge for naming and learning the particular patterns of feature co-occurrence among different concepts allows us to categorize similar concepts using shared features (e.g., dogs, cats, mice: all breathe, eat, grow → are animals) distinguish similar concepts using distinctive features (dogs wag their tails, mice do not wag) and recognize concepts that are semantically unrelated (e.g., pencils are utensils used for writing and erasing, which are not activities frequently engaged in by dogs).

As yet unresolved is whether different types of 'core' semantic features may be more salient to identification and differentiation of different concept domains. Is it, as 'sensory/function' or sensorimotor-based hypotheses suggest, that disproportionate deficit to living concepts results from deficient processing of visual-perceptual features (e.g., apple: red, round), considered most salient for their differentiation; whereas disproportionate impairment to nonliving concepts results from deficient processing of functional or action features (pencil: used to write and erase) (e.g., Gainotti, 2006; Warrington and Shallice, 1984)? Or is it the interaction among shared and distinctive features across types that results in disproportionately deficient processing between domains, with shared form-function relations being more robust for living concepts, whereas for nonliving concepts it is more distinctive form-function associations (e.g., Tyler et al., 2000)? Debate is ongoing.

That said, a number of treatments for individuals with lexical retrieval impairment consequent to stroke-aphasia have been developed to take advantage of the relationship between access to semantic feature knowledge and activation of object names (see Boyle, 2010 and Kiran, 2007 for review). The purpose of this report is to add to the relatively small body of evidence regarding the types of semantic feature knowledge most accessible to those with aphasia and how that knowledge is accessed domains (i.e., living vs. nonliving).

Method

Participants

Participants were fifteen right-handed, monolingual native English-speakers (6 female) with aphasia consequent to single left-hemisphere stroke. Following completion of informed consent and prior to beginning the experimental task participants completed several standardized assessments. Table 1 displays participants' demographic information and performance on standardized tests.

Experimental task

Participants verbally-described nine living and nine nonliving object concepts. This task is particularly relevant for examining differences in usefulness of shared versus distinctive information in facilitating understanding a speaker's meaning without access to a lexical label. Instructions were, "Tell me about a(n) ______. Pretend I don't know anything about it.". Scoring for accuracy (i.e., correct versus incorrect) was based on the judgment whether an uninformed listener would be able to identify the described item without knowing its name.

Semantic information was tallied for general information-type categories (see table 2), and then averaged within domain (i.e., living / nonliving). 'Core' features were further analyzed relative to specificity of information provided (see table 2). Feature type analyses for correct and incorrect living and nonliving concepts were completed within group via repeated measure (RM) ANOVAs.

Results and Preliminary Discussion

No difference was observed for accuracy of participants' descriptions of living (mean= 4.07, SD= 3.03) versus nonliving concepts (mean= 4.13, SD= 2.97). It should be noted that, even for those descriptions that were judged inaccurate, participants with aphasia did not, by and large, provide incorrect information.

General semantic feature types: correct and incorrect verbal descriptions

Average amount of semantic information is displayed in figure 1. Planned comparisons followed-up on the significant three-way interaction (RM ANOVA: accuracy x domain x feature type), *F*(1, 28)= 4.27, *p*= .002.

For living concepts, no differences among types of information provided in correct versus incorrect verbal descriptions reached significance at the corrected alpha level (*p*= .007). However, analysis of information provided within correct and incorrect descriptions revealed some potentially interesting patterns (please see table 3). As predicted by sensory/functional-based hypotheses of semantic processing, participants' correct descriptions of living concepts contained more visual-perceptual than either superordinate or action information. Contrary to such hypotheses, however, correct descriptions of living concepts did not contain more visual-perceptual than functional information. In fact, it was descriptions of living items that were judged to be incorrect that contained significantly more visual-perceptual than functional information.

For nonliving concepts, consistent with sensory/functional-based hypotheses, descriptions scored as correct included more functional information than did those scored as incorrect, *t*(70)= 2.871, *p*= .005. However, correct descriptions of nonliving concepts also contained more visual-perceptual information than those scored incorrect, *t*(70)= 5.456, *p*< .001. Furthermore, both correct and incorrect descriptions were characterized by provision of significantly more functional and visual-perceptual information than superordinate, encyclopedic, or action information respectively, with no difference observed between amounts of functional and visual-perceptual information provided (please see table 3).

Specificity of 'core' semantic features: correct and incorrect verbal descriptions

Average amount semantic information is displayed in figure 2. Planned comparisons followed-up on a significant four-way interaction (RM ANOVA: accuracy x domain x feature type x specificity), *F*(2, 28)= 13.5, *p*<.001.

For living concepts, contrary to sensory/functional-based hypotheses, correct descriptions were not characterized by more visual/perceptual information than were incorrect descriptions. The same was true for functional and action information. Regarding distinctive features, there were again no differences within feature type comparing correct versus incorrect responses. Significant findings were noted in comparisons of shared versus distinctive features within feature type, such that more shared than distinctive visual-perceptual information was provided in correct descriptions, *t*(28)= 4.491, *p*< .001, and this pattern was even stronger in incorrect descriptions, *t*(28)= 6.893, *p*< .001. When viewed in light of the findings described above, namely, that provision of visual-perceptual information in general was not as predictive of successful description of living concepts as sensory/functional hypotheses might predict, these data suggest that a preponderance of shared visual-perceptual information, as opposed to distinctive, is insufficient for listeners to distinguish among living concepts since so many category members share the 'shared' visual-perceptual features.

For nonliving concepts, more shared visual-perceptual information was provided in correct than in incorrect descriptions, *t*(28)= 9.348, *p*< .001. No other differences between correct and incorrect descriptions of nonliving concepts were observed. Regarding distinctive features, more distinctive functional information was provided in correct than in incorrect responses, *t*(28)= 3.378, *p*= .002. Significant findings were also observed in comparisons of shared versus distinctive features within feature type. In correct descriptions of nonliving concepts, more shared than distinctive visual-perceptual information was provided in correct descriptions of nonliving concepts, *t*(28)= 10.652, *p*< .001. In incorrect nonliving concept descriptions, more shared functional than distinct functional information was provided, *t*(28)= 3.652, *p*= .001. These findings suggest that provision of distinctive (as opposed to shared) functional information is particularly useful in descriptions of nonliving concepts, and that, consistent with those feature-based theories that propose a salience between distinctive function and form features for nonliving concepts, this information should be provided in combination with sufficient visual-perceptual description.

References

Boyle, M. (2010). Semantic feature analysis treatment for aphasic word retrieval impairments: What's in a name? *Topics in Stroke Rehabilitation, 17*(6), 411-422.

Gainotti, G. (2006). Anatomical functional and cognitive determinants of semantic memory disorders. *Neuroscience & Biobehavioral Reviews, 30*(5), 577-594.

Kiran, S. (2007). Complexity in the treatment of naming deficits. *American Journal of Speech-Language Pathology, 16*, 18-29.

Tyler, L. K., Moss, H. E., Durrant-Peatfield, M. R., & Levy, J. P. (2000). Conceptual structure and the structure of concepts: A distributed account of category-specific deficits. *Brain and Language*, *75*(2), 195-231.

Warrington, E. K., & Shallice, T. (1984). Category specific semantic impairments. *Brain, 107*, 829–854.

Figures:

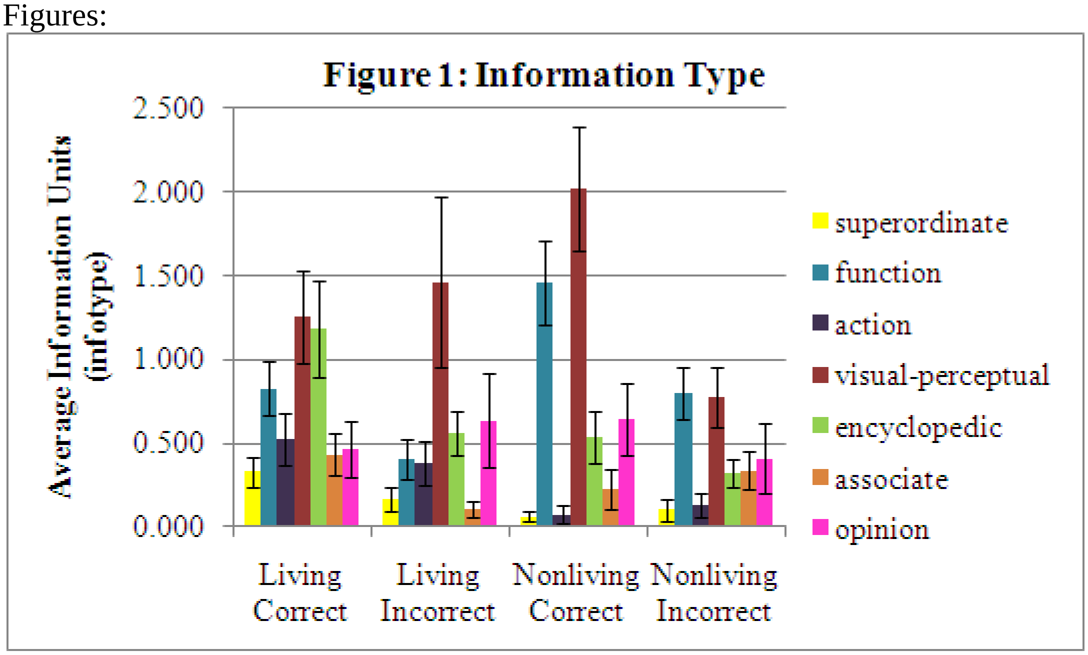

Figure 1: Information Type

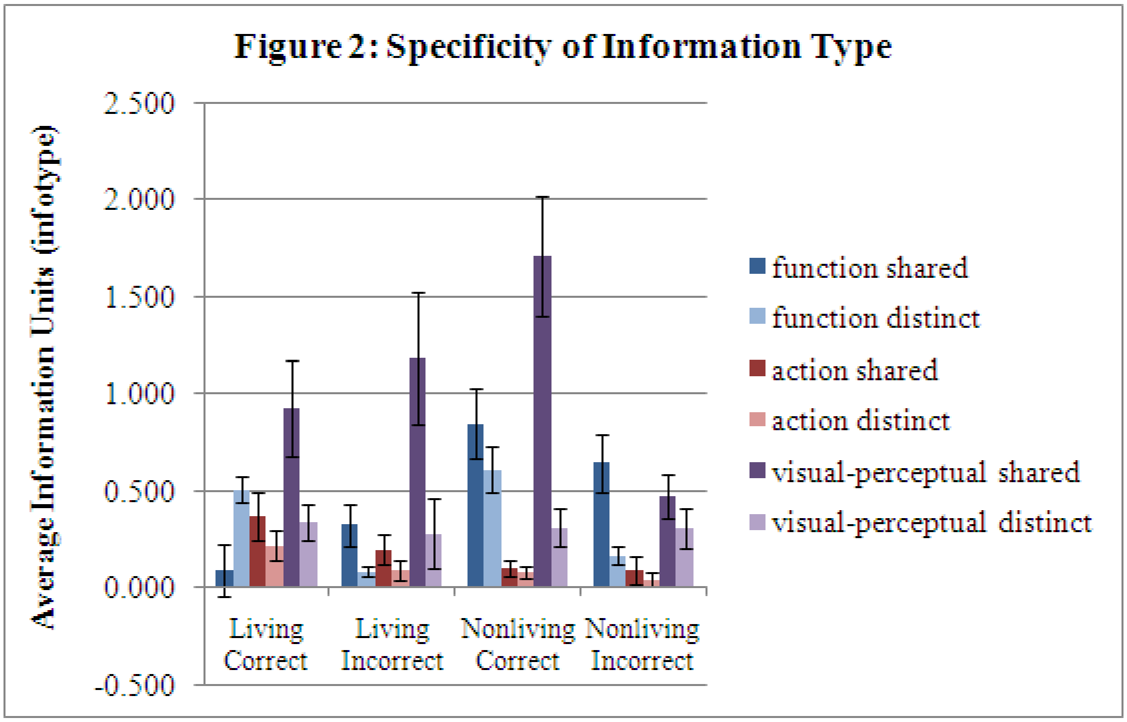

Figure 2: Specificity of Information Type

Tables:

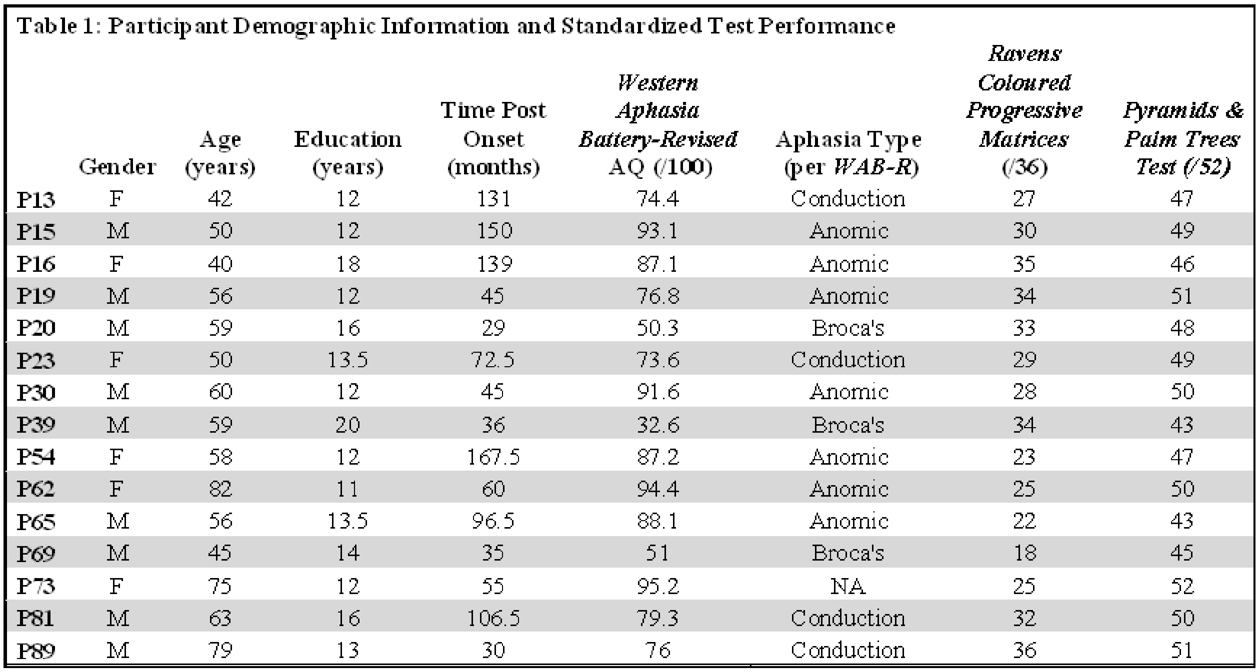

Table 1: Participant Demographic Information and Standardized Test Performance

	Gender	Age (years)	Education (years)	Time Post Onset (months)	*Western Aphasia Battery-Revised* AQ (/100)	Aphasia Type (per *WAB-R*)	*Ravens Coloured Progressive Matrices* (/36)	*Pyramids & Palm Trees Test (/52)*
P13	F	42	12	131	74.4	Conduction	27	47
P15	M	50	12	150	93.1	Anomic	30	49
P16	F	40	18	139	87.1	Anomic	35	46
P19	M	56	12	45	76.8	Anomic	34	51
P20	M	59	16	29	50.3	Broca's	33	48
P23	F	50	13.5	72.5	73.6	Conduction	29	49
P30	M	60	12	45	91.6	Anomic	28	50
P39	M	59	20	36	32.6	Broca's	34	43
P54	F	58	12	167.5	87.2	Anomic	23	47
P62	F	82	11	60	94.4	Anomic	25	50
P65	M	56	13.5	96.5	88.1	Anomic	22	43
P69	M	45	14	35	51	Broca's	18	45
P73	F	75	12	55	95.2	NA	25	52
P81	M	63	16	106.5	79.3	Conduction	32	50
P89	M	79	13	30	76	Conduction	36	51

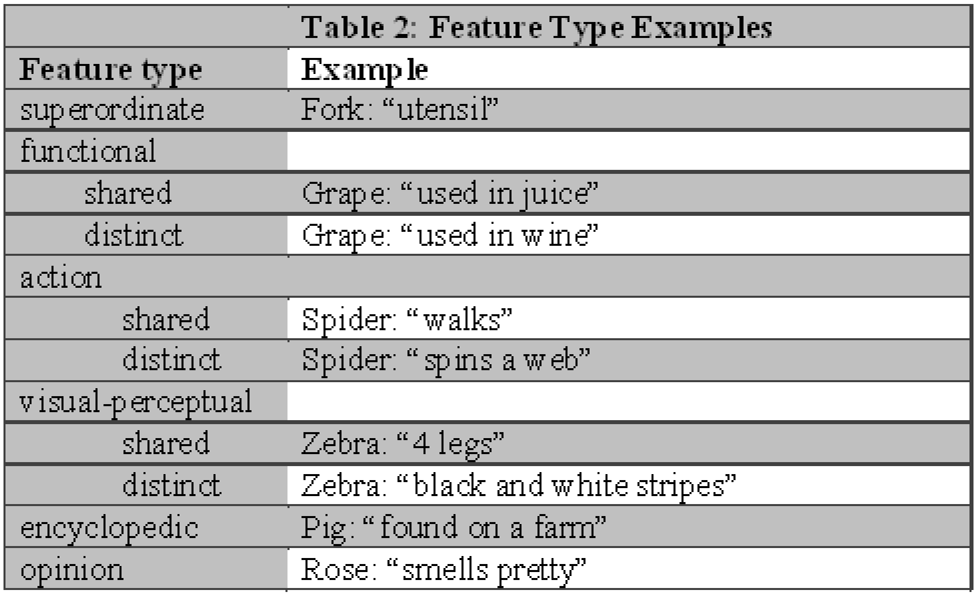

Table 2: Feature Type Examples

Feature type	**Example**
superordinate	Fork: “utensil”
functional	
shared	Grape: “used in juice”
distinct	Grape: “used in wine”
action	
shared	Spider: “walks”
distinct	Spider: “spins a web”
visual-perceptual	
shared	Zebra: “4 legs”
distinct	Zebra: “black and white stripes”
encyclopedic	Pig: “found on a farm”
opinion	Rose: “smells pretty”

Table 3: Post hoc comparison results within domain and accuracy

Information Type	***t*(70)**	***p* <.005 (Bonferroni corrected)**
Living correct:		
Visual-Perceptual > Superordinate	4.027	<.001
Visual-Perceptual > Action	3.205	0.002
Encyclopedic > Superordinate	3.724	<.001
Encyclopedic > Action	2.902	0.005
Living Incorrect:		
Visual-Perceptual > Superordinate	5.658	<.001
Visual-perceptual > Functional	4.621	<.001
Visual-perceptual > Encyclopedic	3.816	<.001
Visual-perceptual > Action	4.726	<.001
Nonliving correct:		
Functional > Superordinate	6.111	<.001
Functional > Encyclopedic	4.032	<.001
Functional > Action	5.636	<.001
Visual-Perceptual > Superordinate	8.595	<.001
Visual-Perceptual > Encyclopedic	6.516	<.001
Visual-Perceptual > Action	8.120	<.001
Nonliving incorrect:		
Functional > Superordinate	3.078	.003
Functional > Action	2.941	.004
Visual-Perceptual > Superordinate	2.976	.004