Supplement Article

Verbal Description of Concrete Objects: A Method for Assessing Semantic Circumlocution in Persons With Aphasia

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Purpose: We investigated from a theoretically motivated perspective what information differentiated sufficient from insufficient descriptions of objects provided by persons with aphasia.

Method: Twenty-one adults with aphasia consequent to single left-hemisphere stroke verbally described 9 living and 9 nonliving objects. Responses were scored for accuracy (i.e., sufficiency) and tallied for type and quantity of semantic feature information provided. Main effects and interactions were identified using repeated measures analyses of variance, with significant findings followed up with planned comparisons.

Results: Differences between correct and incorrect descriptions were identified with respect to both feature

type and feature distinctiveness for living and nonliving items, in particular highlighting the importance of distinctive features in descriptions of both domains.

Conclusions: These findings add to the relatively small body of literature investigating semantic feature processing in adults with aphasia. This is a critical gap to close when considered in light of the preponderance of semantically based treatments for word-retrieval impairment in stroke-aphasia. Our findings provide preliminary support for the notion that semantically guided treatments for word-retrieval impairment in stroke-aphasia may be geared toward increasing specificity of semantic circumlocution to increase semantic self-cueing and to improve communication of information to conversation partners.

Feature-based models of semantic processing are predicated on the notion that object concepts are constructed through the coactivation of semantic feature knowledge (e.g., Gainotti, 2006; Tyler, Moss, Durrant-Peatfield, & Levy, 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.). Accessing such information is an important component of the process of retrieving 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; e.g., Drew & Thompson, 1999; see also Antonucci & Reilly, 2008).

It stands to reason that if there is a link between successful naming and the integrity of semantic knowledge, there might also be a link between anomia and difficulty accessing semantic information. In fact, there is a long history in the cognitive neuropsychological literature of assessing semantic representations in individuals with anomia. One frequently utilized assessment task is to ask participants to verbally define or describe items that are visually or verbally presented to them (De Renzi & Lucchelli, 1994; Hodges, Patterson, Graham, & Dawson, 1996; Hodges, Salmon, & Butters, 1992; Lambon Ralph, Graham, Patterson, & Hodges, 1999; Lambon Ralph, Patterson, & Hodges, 1997; McWilliams & Schmitter-Edgecombe, 2008; Perri, Zannino, Caltagirone, & Carlesimo, 2012). Some of the seminal work in operationalizing the administration and scoring of such tasks has been done by Hodges and colleagues through reports of their work with individuals with Alzheimer's disease and, later, those with semantic dementia (Hodges

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et al., 1992, 1996; Lambon Ralph et al., 1997, 1999). In addition to demonstrating that impaired naming was associated with provision of deficient descriptions of unnamed items, this work also contributed to the development of feature-based theories of semantic organization and impairment to semantically guided lexical retrieval.

Debate continues regarding whether different types of semantic features may be more salient to identification and differentiation of different concept domains (living vs. nonliving). Proponents of “sensory/function” or sensorimotor-based theories have posited that there is a privileged relationship between some types of concepts and the types of features that are most salient for their identification and distinction from other concepts (e.g., Gainotti, 2000, 2006; Warrington & Shallice, 1984). Specifically, the feature types most commonly referenced are those learned through our earliest sensorimotor experiences with concepts: those that pertain to visual-perceptual and function/action characteristics (e.g., Martin, 2007; Martin, Ungerleider, & Haxby, 2000). Some of the strongest evidence of these relationships has come from observations that domain-specific naming deficits may be an emergent property of deficient processing of particular feature types. Warrington and her colleagues were some of the earliest to hypothesize that a disproportionate deficit in naming of living concepts could result from deficient processing of visual-perceptual features, considered most salient for their differentiation, whereas disproportionate impairment in naming nonliving concepts would result from deficient processing of functional or action features (Warrington & McCarthy, 1987; Warrington & Shallice, 1984). Since these early reports, cognitive neuropsychological studies have accumulated, some of which support their proposals (Basso, Capitani, & Laiacina, 1988; De Renzi & Lucchelli, 1994; Forde, Francis, Riddoch, Rumiati, & Humphreys, 1997; Gainotti & Silveri, 1996; Silveri & Gainotti, 1988) and others of which provide counterevidence in the form of documentation of domain-specific naming deficits in the absence of feature-type-specific deficits (e.g., Caramazza & Shelton, 1998) and of feature-type-specific processing deficits in the absence of category-specific impairment (e.g., Lambon Ralph et al., 1999; Lambon Ralph, Patterson, Garrard, & Hodges, 2003).

Partly in response to these discrepancies, it has also been proposed that feature type alone is insufficient to account for lexical-semantic performance. With the proposal of the conceptual structure account, Tyler and her colleagues posited that it is an interaction among shared and distinctive features across feature 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). Feature generation studies done with healthy adults bear out the notion that both feature type and feature distinctiveness are salient to providing a complete description of a concept and that there are differences across both dimensions between living and nonliving concepts; hence, living concepts tend to be described with more shared features, a larger

proportion of visual-perceptual features, and more features in general, whereas nonliving concepts tend to be described with more distinctive features, a larger proportion of function/action features, and fewer features in general (e.g., Cree & McRae, 2003; Garrard, Lambon Ralph, Hodges, & Patterson, 2001; McRae & Cree, 2002; McRae, de Sa, & Seidenberg, 1997; Zannino, Perri, Pasqualetti, Caltagirone, & Carlesimo, 2006).

Whereas much of this work has relied on assessment of individuals with neuropsychological impairment (Alzheimer's disease: Tyler et al., 2000; semantic dementia: Lambon Ralph et al., 1999, 2003; herpes simplex encephalitis: Gainotti & Silveri, 1996; Warrington & Shallice, 1984; see also Capitani, Laiacina, Mahon, & Caramazza, 2003), only a small proportion of studies have examined these factors within the context of the word-retrieval impairments demonstrated by those with stroke-aphasia. A relatively small body of evidence has begun to amass examining performance of persons with aphasia (PWA) in comprehension and production-based semantic feature tasks. One robust finding is that difficulty processing distinctive feature knowledge is linked both to the ability to distinguish among semantically related concepts and to word retrieval (Mason-Baughman & Wallace, 2013, 2014; Wallace & Mason-Baughman, 2012). Work in our own lab with PWA further highlights the importance of distinctive feature cues for accurately verifying concept-feature relationships as well as their importance in sufficiently describing objects such that a communication partner would be likely to identify the item being described in the absence of its label (Antonucci, 2014a, 2014b).

Expanding our understanding of semantic feature processing and how it influences word retrieval in individuals with aphasia is critical given the number of treatments for lexical retrieval impairment consequent to stroke-aphasia that 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). An example with a growing body of evidence is semantic feature analysis (SFA), particularly what Boyle (2010) recently categorized as treatments that facilitate “semantic feature generation” (p. 414). Beginning with Massaro and Tompkins (1994) and continuing through to recent reports (e.g., Wambaugh, Mauszycki, Cameron, Wright, & Nessler, 2013), participants may first be asked to independently generate as much semantic information as they can about an object (or action) they are trying to name, after which the clinician facilitates production of additional feature information through verbal and visual cueing. In essence, one goal of such treatment can be to train participants to semantically circumlocute through practicing the task of verbal description, then receiving feedback and support as needed to increase lexical retrieval success and add to the semantic information independently provided. The purpose of this report is to add to the body of evidence regarding the types of semantic feature knowledge provided by those with aphasia during semantic circumlocution and how that knowledge is accessed for

specific domains (i.e., living vs. nonliving). Specifically, using the verbal description task, well established for assessing semantic knowledge in individuals with cognitive or linguistic impairment, we explored this question: What information differentiates a sufficient (i.e., correct) from an insufficient (i.e., incorrect) description? Theoretically motivated predictions include (a) for living items, a preponderance of visual-perceptual information will be most predictive of success, and (b) for nonliving items, a preponderance of functional information will be most predictive of success. Most extant semantic theories are mute with respect to the relative importance of inclusion of other types of features (e.g., encyclopedic, associate), but we have included some of the most commonly provided in our analyses. We also anticipate that provision of more distinctive, as opposed to shared, feature information will also be predictive of greater success in accurately (i.e., sufficiently) describing objects.

Method

Participants

Participants were 21 right-handed, monolingual, native English-speakers with aphasia consequent to single left-hemisphere stroke. Average participant age was 59.2 years (range = 42–82 years), and participants attained an average of 14.3 years (range = 12–20 years) of education. Participants were required to be in the chronic phase after a single, left hemisphere stroke (i.e., > 6 months postonset) and to be without progressive neurological impairment. Time postonset since participants' strokes averaged 72.81 months (range = 7–167.5 months). Details of participants' demographic information and performance on standardized tests are presented in Table 1. Following completion of informed consent and prior to beginning the experimental task, participants completed standardized tests, which included the Western Aphasia Battery–Revised (WAB-R; Kertesz, 2006), the Raven's Coloured Progressive Matrices (Raven, 1938) as a measure of visual processing and nonlinguistic problem solving, and the picture version of the Pyramids and Palm Trees Test (Howard & Patterson, 1992) as a test of semantic association. WAB-R aphasia quotients ranged from 32.6 to 95.2; the WAB-R-based aphasia types were Broca ($n = 4$), conduction ($n = 7$), anomic ($n = 8$), and nonaphasic ($n = 2$). The two individuals who performed within the normal range on the WAB-R self-identified as experiencing poststroke word-finding difficulties. A minimum subset score of $\geq 4/10$ on the auditory comprehension subtests of the WAB-R was required for participation in the experimental task.

Experimental Verbal Description Task

Stimuli were 36 concrete objects selected from a larger set of 60 (Antonucci, 2014b). To avoid fatigue effects, each participant responded to either set A or set B, each of which comprised half of the selected stimuli (i.e., nine living and nine nonliving). Administration of set A or B was counter-balanced among participants, and administration was divided across two sessions.

Participants verbally described nine living and nine nonliving objects that were presented to them orally. Instructions were "Tell me about a (n) _____. Pretend I don't know anything about it." Participants were encouraged to provide enough information that a naïve listener would know the item they were describing. Descriptions proceeded until the participant indicated he or she had no more to say. No time limit was imposed.

Scoring was completed using orthographic transcriptions of participants' audio-recorded responses. Instances in which the stimulus name was stated during the description were deleted. Consistent with previous work (e.g., Antonucci & Reilly, 2008; De Renzi & Lucchelli, 1994; Hodges et al., 1992, 1996; Lambon Ralph et al., 1999), scoring of accuracy (correct vs. incorrect) was based on the judgment of whether an uninformed listener would be able to name the described item. Evidence of word-finding difficulty (e.g., semantic/phonemic paraphasic errors) was present in verbal descriptions, but participants were not penalized for word-retrieval difficulty when the description was adequate or intelligible within the context of the description as a whole. We noted that overall, PWA did not make substantial errors of fact (a la Hodges et al., 1996, "intrusion errors"); inadequate or incorrect responses were typically either uninformative (no response/empty circumlocution) or insufficiently specific to be scored as correct. A value of 1 was assigned to each description judged to be correct, whereas a value of 0 was assigned to each description judged to be incorrect. Hence, a raw score was obtained for accuracy for each living and nonliving item, the sum of which then represented the total correct for each domain. Regarding the tallying of semantic feature type, a value of 1 was assigned for each unique piece of information within each feature type. Repetitions of information within a single description were not counted, resulting in, as Lambon Ralph et al. (1999) noted, "a type count, not a token count" (p. 318). Table 2 provides definitions and examples for each feature type. Rules for determining feature types and tallies were based on classifications provided in the large normative concept-feature database provided by McRae, Cree, Seidenberg, & McNorgan (2005), which contains the majority of the items represented in this task. Items not represented in the McRae et al. database were examined consistent with the classification schemas represented therein.

Table 3 provides examples of participants' correct or incorrect descriptions of one living and one nonliving item and also demonstrates the associated feature coding tallies for each description. As reflected in Table 3, we note that features were tallied in such a way as to avoid "double-dipping." For example, in the correct description of *pig*, "eat for bacon, ham, pork," the words *bacon*, *ham*, and *pork* were counted as three separate functional distinct features, but *eat* was not then also counted separately as a functional shared feature (i.e., something that is eaten). Another example pertains to the visual-perceptual feature of color. If colors were distinctive to an object, such as red, yellow, and green for a traffic light, each was counted as a separate distinct visual-perceptual feature. In contrast, if

Table 1. Participant demographic information and standardized test performance.

Participant	Gender	Age (years)	Education (years)	TPO (months)	WAB-R AQ (/100)	Aphasia Type (per WAB-R)	RCPM (/36)	PPTT (/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 ^c
P19	M	56	12	45	76.8	Anomic	34	51
P20	M	59	16	29	50.3	Broca	33	48
P21	M	55	16	7	97.4	NA	33	49
P22	M	61	14	14	93.5	Anomic	35	49
P23	F	50	13.5	72.5	73.6	Conduction	29	49
P24	M	52	16	31	72.3	Conduction	33	51
P25	F	39	12	60	56.5	Broca	34	50
P26	M	70	20	75	53.8	Conduction	29 ^b	47
P27	F	72	16	144	53.6	Conduction	26 ^b	45 ^c
P30	M	60	12	45	91.6	Anomic	28	50
P39	M	59	20	36	32.6	Broca	34	43 ^c
P54	F	58	12	167.5	87.2	Anomic	23 ^a	47
P62	F	82	11	60	94.4	Anomic	25	50
P65	M	56	13.5	96.5	88.1	Anomic	22 ^a	43 ^c
P69	M	45	14	35	51	Broca	18 ^a	45 ^c
P73	F	75	12	55	95.2	NA	25	52
P81	M	63	16	106.5	79.3	Conduction	32 ^a	50
P89	M	79	13	30	76	Conduction	36	51

Note. TPO = time postonset; WAB-R = Western Aphasia Battery-Revised; AQ = aphasia quotient; RCPM = Raven's Coloured Progressive Matrices; PPTT = Pyramids and Palm Trees Test.

^aIndicates > 2 SDs below normal performance based on age-, education-, and gender-specific normative data reported by Measso et al. (1993). ^bIndicates norms not included in Measso et al. (1993) for this age-education band. ^cIndicates impaired performance on the PPTT (Howard & Patterson, 1992).

Table 2. Feature-type coding examples.

Category	Example
Superordinate	What broad category does the item belong to? e.g., dog— <i>animal</i> ^a , mammal ^a ; bicycle— <i>vehicle</i>
Coordinate	Belonging to the same category as the target item e.g., dog— <i>fox</i> ; bicycle— <i>skateboard</i>
Subordinate	Subtypes or examples of items that belong to target item's category e.g., dog— <i>collie</i> ; bicycle— <i>10-speed</i> ^a
Functional-shared	What do we use the item for that is common to other items? e.g., dog— <i>used for protection</i> ^a ; bicycle— <i>used for transportation</i> ^a
Functional-distinct	What do we use the item for that is specific to the item? e.g., dog— <i>used as seeing-eye dog</i> ; bicycle— <i>used for exercising</i> ^a
Visual-perceptual-shared	What is a visual description of the item common to other items? e.g., dog— <i>has four legs</i> ^a ; bicycle— <i>has two wheels</i> ^a
Visual-perceptual-distinct	What is a visual description of the item that is distinctive? e.g., dog— <i>has a wet nose</i> ^a ; bicycle— <i>has a chain</i> ^a
Action-shared	What common action does the item do? e.g., dog— <i>walks</i> ; bicycle— <i>none</i>
Action-distinct	What distinguishing action does the item do? e.g., dog— <i>wags</i> ; bicycle— <i>none</i>
Encyclopedic	Explicitly learned knowledge about the item e.g., dog— <i>"[wo]man's best friend"</i> ^a ; bicycle— <i>once you learn how to ride, you never forget</i>
Associative	Entity commonly associated with the target item e.g., dog— <i>bone</i> ; bicycle— <i>Tour de France</i>
Opinion/Empty Circumlocution	Personal view or reference e.g., dog— <i>My favorite creature</i> ; bicycle— <i>My first was a Powder Puff.</i>
Auditory-perceptual (AudP)	What sound does the item make? e.g., dog— <i>bark</i> ^a ; bicycle— <i>squeaks [when ridden]</i>

^aIn McRae et al. (2005) database.

Table 3. Examples of accuracy scoring and feature coding.

Description	Target	±	FS	FD	AD	VPS	VPD	Ency	AudP	O/EC
A [‡] , it f- in the farm, they smell bad (laughs). They eat slop which is all the scraps that people throw—he throws to them, but they're very good to eat for ham and bacon and pork chops.	pig	1	0	3 = <u>eat for ham,</u> <u>bacon,</u> <u>pork chops</u>	1 = eat slop	0	0	1 = in the farm	0	2 = <u>smells bad,</u> <u>good</u> [to eat]
A [‡] is uh no hair um. A [‡] they make squeaky noises. They have four legs. And no trunk, a nose. They um (pause approximately 5 s) they uh squeak uh what's the name of it? They make squeaks. That's about it.	pig	0	0	0	0	4 = <u>no hair,</u> <u>four legs,</u> <u>no trunk,</u> <u>a nose</u>	0	0	1 = make squeaky noises	0
Red, its green, uh go ahead yellow caution, be prepared to stop and green [‡] stop ya son of a b[] slam on everything else it's uh [‡] , keep control, keep people uh (pause) safe alright ... they uh [‡] little stop go if uh turn red everything people walking but uh red, be prepared.	Traffic light	1	2 = <u>keep control,</u> <u>keep people safe</u>	3 = <u>go ahead [green],</u> <u>caution [yellow],</u> <u>be prepared to stop [red]</u>	1 = turn red	0	3 = <u>red,</u> <u>yellow,</u> <u>green</u>	0	0	0
[‡] is three colors, green, yellow, red, Each color stands for a different thing, and uh, mmm, that's it.	Traffic light	0	0	0	0	0	3 = is three colors <u>red,</u> <u>yellow,</u> <u>green</u>	1 = each color stands for a different thing	0	0

Note. The following feature types were excluded from the table because participants did not include that type of information in their description of the target item: superordinate, coordinate, subordinate, action-shared. Underlined text indicates the number of separate items or the item count. FS = functional-shared; FD = functional-distinct; AD = action-distinct; VPS = visual-perceptual-shared; VPD = visual-perceptual-distinct; Ency = encyclopedic; AudP = auditory-perceptual; O/EC = opinion/empty circumlocution.

[‡]Indicates participant stated target name.

a participant listed a series of colors in which an object is available, color was counted as one shared feature “comes in a variety of colors” (e.g., cars or candles come in many colors, but color is not distinctive to the concepts of “car-ness or “candle-ness”). Tallies for each of the information-type categories were averaged across items within each domain (living vs. nonliving) and accuracy category (correct vs. incorrect) to derive the value that was included in statistical analyses for each participant (please see Table 4 for an abbreviated example of a feature tally sheet).

Transcribed descriptions were scored for accuracy and tallied for feature type by the second author. The first and second authors then reviewed each transcript for accuracy judgment and adherence to the classification/tally rubric for each item. Discrepancies were resolved by consensus. Orthographic transcriptions of descriptions provided by all participants were evaluated for the purposes of collecting interrater reliability (IRR) data. IRR data for accuracy were collected via scoring by a research assistant instructed on the scoring procedures but not informed a priori as to the stimulus items. Accurate identifications were scored as correct; inaccurate or uncertain identifications were scored as incorrect. Average point-to-point agreement between the principal scores and the IRR scores was 88.3%.

Results

Feature type analyses for correct and incorrect living and nonliving items were completed within group via repeated measure (RM) analyses of variance (ANOVAs). No difference was observed for accuracy of participants’ descriptions of living ($M = 4.19$, $SD = 3.06$) versus nonliving items ($M = 4.62$, $SD = 3.29$).

General Semantic Feature Types

The average amount of semantic information is displayed in Figure 1. Significant main effects and interactions are displayed in Table 5. Planned comparisons followed up on the significant three-way interaction (RM ANOVA: Accuracy $\times$ Domain $\times$ Feature Type), $F(5, 95) = 2.668$, $p = .027$. Please see Table 6.

With respect to sensory- or functional-based hypotheses, correct descriptions of living items did contain more visual-perceptual information than did incorrect descriptions, though significance was not observed at a Bonferroni-corrected alpha of .008, $t(95) = 2.445$, $p = .016$. Correct descriptions of living items contained significantly more functional, $t(95) = 3.403$, $p < .001$, and more encyclopedic information, $t(95) = 3.299$, $p < .001$, than did incorrect descriptions. Analysis of information provided within correct and incorrect descriptions also revealed some potentially interesting patterns (please see Table 6). As predicted by sensory- or functional-based hypotheses of semantic processing, participants’ correct descriptions of living items contained more visual-perceptual than function or action information. We found it interesting that this pattern in and of itself was not indicative of success because descriptions of living items that were judged to be incorrect also contained significantly more visual-perceptual than functional or action information.

For nonliving items, descriptions scored as correct included more functional information than did those scored as incorrect, $t(95) = 2.258$, $p = .026$, though again not at the corrected alpha level of .008. However, correct descriptions of nonliving items did contain significantly more visual-perceptual information than those scored as incorrect, $t(95) = 6.894$, $p < .001$. Analyses of feature provision

Table 4. Feature tally average examples.

Target	Domain	Correct vs. Incorrect	Sup	Sub	Co	FS	FD	AS	AD	VPS	VPD	Ency	Asstv	AudP	O/EC
rose	L	1	1	0	0	2	1	1	0	1	2	0	0	0	2
snake	L	1	0	0	2	0	0	0	1	1	1	1	0	0	1
			<u>0.5</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>	<u>1</u>	<u>1.5</u>	<u>0.5</u>	<u>0</u>	<u>0</u>	<u>1.5</u>
lion	L	0	1	0	0	0	0	0	1	1	0	1	1	1	2
cactus	L	0	1	0	1	0	0	0	0	1	1	0	0	0	0
			<u>1</u>	<u>0</u>	<u>0.5</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0.5</u>	<u>1</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>	<u>1</u>
pencil	NL	1	0	0	0	1	1	0	0	2	1	0	0	0	0
plane	NL	1	1	0	2	2	1	0	0	1	1	2	1	0	1
			<u>0.5</u>	<u>0</u>	<u>1</u>	<u>1.5</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1.5</u>	<u>1</u>	<u>1</u>	<u>0.5</u>	<u>0</u>	<u>0.5</u>
crown	NL	0	0	0	0	0	1	0	0	2	0	1	1	0	0
bus	NL	0	1	0	1	1	0	0	0	3	1	0	0	0	0
			<u>0.5</u>	<u>0</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>	<u>0</u>	<u>0</u>	<u>2.5</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>	<u>0</u>	<u>0</u>

Note. Underlined averages are examples of the values that would be used for each Accuracy $\times$ Domain $\times$ Feature Type category included in statistical analyses of amount and type of information provided for correct and incorrect living and nonliving descriptions. These values are for illustrative purposes only and do not necessarily exemplify a particular participant’s pattern of responses. Sup = superordinate; Sub = subordinate; Co = coordinate; FS = functional-shared; FD = functional-distinct; AS = action-shared; AD = action-distinct; VPS = visual-perceptual-shared; VPD = visual-perceptual-distinct; Ency = encyclopedic; Asstv = associative; AudP = auditory-perceptual; O/EC = opinion/empty circumlocution.

Figure 1. Feature types.

within correct descriptions of nonliving items demonstrated that these descriptions contained more functional, but also more visual-perceptual, than superordinate or action information; they also contained more functional than encyclopedic information. We were surprised that correct descriptions of nonliving items contained more visual-perceptual than functional information, a pattern not observed in incorrect descriptions.

Specificity of “Sensorimotor-Based” Semantic Features: Shared Versus Distinct

Average amount semantic information is displayed in Figure 2. Significant main effects and interactions are displayed in Table 7. Planned comparisons followed up on a significant four-way interaction (RM ANOVA: Accuracy $\times$ Domain $\times$ Feature Type $\times$ Specificity), $F(2, 38) = 3.798$, $p = .031$.

For living objects, contrary to sensory- or functional-based hypotheses, correct descriptions were not characterized by more visual-perceptual information, either shared or distinctive, than were incorrect descriptions. The same was true for function and action information. 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

Table 5. Main effects and interactions for general feature types provided in verbal descriptions.

Effect and Interactions	<i>F</i> (degrees of freedom)	<i>p</i>
Main effects		
Accuracy	10.367 (1, 19)	.005
Domain	5.121 (1, 19)	.036
Feature type	16.453 (5, 95)	< .001
Interactions		
Accuracy $\times$ Domain	—	ns
Accuracy $\times$ Feature Type	5.414 (5, 95)	< .001
Domain $\times$ Feature Type	5.663 (5, 95)	< .001
Accuracy $\times$ Domain $\times$ Feature Type	2.668 (5, 95)	.027

Note. Em dashes indicate data not reported. ns = not significant.

Table 6. Post hoc comparisons for general feature types provided in verbal descriptions.

Concept/Feature	<i>t</i> (95)	<i>p</i> < .005
Living correct:		
Visual-perceptual > superordinate	6.450	< .001
Visual-perceptual > action	5.195	< .001
Visual-perceptual > functional	3.343	.001
Functional > superordinate	3.107	.002
Encyclopedic > superordinate	4.965	< .001
Encyclopedic > action	3.710	< .001
Living incorrect:		
Visual-perceptual > superordinate	5.135	< .001
Visual-perceptual > functional	4.291	< .001
Visual-perceptual > action	4.324	< .001
Nonliving correct:		
Functional > superordinate	6.433	< .001
Functional > encyclopedic	3.370	.001
Functional > action	6.154	< .001
Encyclopedic > superordinate	3.063	0.003
Visual-perceptual > superordinate	10.171	< .001
Visual-perceptual > functional	3.373	< .001
Visual-perceptual > encyclopedic	7.108	< .001
Visual-perceptual > action	9.891	< .001
Nonliving incorrect:		
Functional > superordinate	4.148	< .001
Functional > action	4.176	< .001
Functional > encyclopedic	3.129	.002
Visual-perceptual > superordinate	3.250	.002
Visual-perceptual > action	3.277	.001

correct descriptions, $t(38) = 5.846$, $p < .001$, and this pattern was stronger in incorrect descriptions, $t(38) = 6.563$, $p < .001$. 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 objects as sensory/functional hypotheses might expect—these data suggest that a preponderance of shared visual-perceptual information, as opposed to distinctive, is insufficient for listeners to distinguish among living objects, perhaps because so many category members share the shared visual-perceptual features.

For nonliving objects, consistent with sensory- or functional-based hypotheses, correct descriptions contained more distinctive functional information, $t(38) = 2.787$, $p = .008$, and also contained more shared visual-perceptual

Figure 2. Specificity of feature types.

Table 7. Main effects and interactions for specificity of “core” features provided in verbal descriptions.

Effect and interactions	<i>F</i> (degrees of freedom)	<i>p</i>
Main effects		
Accuracy	12.103 (1, 19)	.003
Domain	—	ns
Feature Type	23.081 (2, 38)	< .001
Specificity	51.986 (1, 19)	< .001
Interactions		
Accuracy × Domain	—	ns
Accuracy × Feature Type	4.013 (2, 38)	.026
Domain × Feature Type	5.159 (2, 38)	.010
Accuracy × Domain × Feature Type	—	ns
Accuracy × Specificity	—	ns
Domain × Specificity	—	ns
Accuracy × Domain × Specificity	—	ns
Feature Type × Specificity	10.054 (2, 38)	< .001
Accuracy × Feature Type × Specificity	—	ns
Domain × Feature Type × Specificity	—	ns
Accuracy × Domain × Feature Type × Specificity	3.798 (2, 38)	.031

Note. Em dashes indicate data not reported. ns = not significant.

information, $t(38) = 6.222$, $p < .001$, than did incorrect descriptions. Significant findings were also observed in comparisons of shared versus distinctive features within feature type. In correct descriptions of nonliving objects, more shared than distinctive visual-perceptual information was provided, $t(38) = 6.291$, $p < .001$. In incorrect nonliving object descriptions, more shared functional than distinctive functional information was provided, $t(38) = 4.585$, $p < .001$. These findings suggest that provision of distinctive (in addition to shared) functional information is particularly useful in descriptions of nonliving objects and that, consistent with those feature-based theories that propose a salience between distinctive function and form features for nonliving objects, this information should be provided in combination with sufficient visual-perceptual description.

Finally, we note that within domain and accuracy, patterns of feature-type provision confirm patterns observed in the analysis of general feature types (please see Table 8). For living items, more visual-perceptual information, both shared and distinct, was provided than either function or action. For nonliving items, more function and more visual-perceptual information were provided than action information, but there was no difference in the amount of function and visual-perceptual information provided.

Discussion

Twenty-one PWA following single left-hemisphere stroke verbally described nine living and nine nonliving objects. Of particular interest were differences between those descriptions judged to be sufficient versus those judged to be insufficient for a naïve listener to be able to discern the

Table 8. Post hoc comparisons for specificity of “core” features provided in verbal descriptions.

Concept/Feature	<i>t</i> (38)	<i>p</i> ≤ .004
Living correct:		
Functional shared < visual-perceptual shared	−3.971	< .001
Visual-perceptual shared > action shared	5.880	< .001
Living incorrect:		
Functional shared < visual-perceptual shared	−5.428	< .001
Visual-perceptual shared > action shared	5.316	< .001
Nonliving correct:		
Functional shared < visual-perceptual shared	−4.264	< .001
Functional shared > action shared	4.738	< .001
Visual-perceptual shared > action shared	9.002	< .001
Functional distinct > action distinct	3.087	.004
Visual-perceptual distinct > action distinct	3.226	.003
Nonliving incorrect:		
Functional shared > action shared	4.759	< .001
Visual-perceptual shared > action shared	3.170	.003

object being described. Findings were examined with respect to current theories of lexical–semantic organization. Results suggest that provision of visual-perceptual information may not be as predictive as expected of success in describing living objects because the preponderance of the visual-perceptual information provided was shared rather than distinctive. Shared features alone, regardless of type, are likely insufficient for listeners to distinguish among living objects because so many category members share the shared visual-perceptual features. Consistent with the conceptual structure account (Tyler et al., 2000), descriptions judged as accurate also contained more functional (and encyclopedic) information than those judged to be insufficient. Also consistent with predictions, provision of distinctive (in addition to shared) functional information emerged as particularly useful in descriptions of nonliving objects, and it seems that this information should be provided in combination with sufficient visual-perceptual description.

From a theoretical perspective, these findings support the need for elaboration beyond dichotomous sensory/functional hypotheses of lexical–semantic processing and impairment. For PWA, we observed a role for the provision of distinctive features for adequate description of objects, a feature type that may be particularly difficult to access for some individuals with aphasia (e.g., Mason-Baughman & Wallace, 2014). In addition, it may be that we need to examine these relationships from a more finely grained perspective, both with respect to more discrete feature type–concept relationships (e.g., fruit: visual-perceptual color, animal: visual-perceptual form) and across performance of persons with aphasia with different lesion profiles (e.g., Gainotti, 2006; see also Antonucci, 2014a, 2014b).

From a clinical perspective, these findings have implications for semantically based treatment for PWA who exhibit anomia. PWA predominantly produced shared features, less useful in distinguishing among concepts, which may influence their ability to adequately semantically circumlocute to resolve anomic communication breakdown. Semantically based treatments for anomia may be targeted

to increase specificity of circumlocations. In other words, perhaps treatments such as SFA can be modified to focus more exclusively and explicitly on what's special about object concepts, facilitating access to those distinctive features most salient for an individual concept. In a way, this may represent an additional perspective on Kiran and others' complexity account (e.g., Kiran, 2007), emphasizing the importance of distinguishing features themselves, as relevant to both typical and atypical exemplars. Such training could lead to increased access to specific labels through semantic self-cueing and also to enhanced communication of meaning to conversational partners through more specific semantic circumlocation. Work in this area has already begun which demonstrates that more is not always better, with respect both to the efficiency of verbal output provided by PWA (Antonucci, 2009) and to the number and types of features elicited during SFA-type treatment (Hashimoto & Frome, 2011; Wambaugh et al., 2013).

A concern that may arise is whether reducing the number and type of features cued during SFA-type treatment might reduce the generalization to semantically related untrained items frequently observed (e.g., Boyle, 2010), given that shared information would not be explicitly targeted. Preliminary evidence from Kiran and others' work studying the complexity account suggests that such features may be implicitly activated even when not explicitly targeted (e.g., Kiran, 2007), and in fact, recent evidence also suggests that the presence of shared features between trained and untrained items may not be as substantially influential as one might predict (Wallace & Kimelman, 2013). This remains one among many empirical questions to be addressed, including whether we can design treatments more efficiently with respect to what information is likely to be most useful to communication partners. Are there differences in the types of information that should be cued for different types of concepts, and how does this interact with individual profiles of naming impairment?

Conclusion

We have demonstrated one way to utilize verbal-description data from a sample of PWA to contribute to the evidence base regarding the types of semantic information to which PWA have access while completing a task that reflects the process of semantic circumlocation. Critical questions remain concerning how we can use this information to design anomia treatments to be as effective and efficient as possible for PWA and their communication partners. We see at least two implications of the current findings. First, it may be appropriate to use tasks such as verbal description to tailor treatment to individuals, assessing what semantic information each PWA does or does not have access to and training accordingly to maximize use of information he or she can already access and to develop access to additional knowledge. In addition, across PWA and their communication partners, training that increases access to semantic knowledge most salient to distinguishing

a particular concept can support specific lexical retrieval as well as supporting more efficient message transmission in an effort to ease the communication burden for both PWA and communication partners.

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