Continue



EnglishSpLD 16/01/2025 By Sarah Sainty, Assessment ConsultantUpdated 07/05/25. Originally published 16/01/25. The term 'phonological processing' refers to the cognitive aspects of perceiving, storing and retrieving the sounds of spoken language. Phonological processing is essential for the	e development of speech and language, and is also
important for literacy. It is identified within the Delphi definition of dyslexia as being 'the most commonly observed cognitive impairment in dyslexia' (Holden et al, 2025), with three aspects of it being particularly relevant: The awareness of the sound structure of spoken language (phonological)	al awareness). The ability to hold sequences of sounds in
short term memory (phonological memory). Efficiency at retrieving speech-sound related information from long-term memory (phonological processing, speech and language develop alongside each other and are intricately linked. Even young babies have some i sounds in preference to other sounds, particularly the sounds that their own mother makes (DeCasper, 1980). They can also discriminate between different speech sounds. Babbling is not random but draws on the consonant-vowel combinations babies hear around them, so that they are effectively	
later in mature speech. Through babbling, babies build the foundations for the physical articulation skills needed for talking, whilst simultaneously starting to learn the communicative value that speech sounds can have. Receptive language (the understanding of language) begins as children as	
language follows - as they start using these sounds in meaningful ways. An early challenge in phonological processing is to identify individual words as single units, separable from the phrase or sentence in which they are heard. This is a fundamental part of vocabulary development and there	can be trial and error involved in the process. My own
daughter's first word was "heeyar", which she would say if she wanted someone to give something to her. It is debatable whether this really counts as a first word, as in the adult version it was in fact the three words "Here you are!" Also, she would say it when she wanted something, rather the grasped its true meaning. In the first few years of life however, children become more and more adept at identifying, storing and retrieving the specific sequences of sounds that make up individual words, and in combining words effectively to convey meaning. Not to be confused with phonological properties and in the specific sequences of sounds that make up individual words, and in combining words effectively to convey meaning. Not to be confused with phonological properties are the specific sequences of sounds that make up individual words, and in combining words effectively to convey meaning. Not to be confused with phonological properties are the specific sequences of sounds that make up individual words, and in combining words effectively to convey meaning. Not to be confused with phonological properties are the specific sequences of sounds that make up individual words, and in combining words effectively to convey meaning. Not to be confused with phonological properties are the specific sequences of sounds that make up individual words are the specific sequences of sounds.	
patterns of sound errors that typically developing children use in early development to simplify speech. A sound that is usually made at the mouth (e.g. 'dod' for dog), a 'weak syllable' may be dropped (e.g. 'nana' for banana	
'pider' for spider). Children constantly improve the way they say things, not only because the relevant motor skills for speech are developing, but also because they become increasingly sensitive to the sound structure of the words they hear around them, and the way they say things themselves	
errors. At first this is an automatic, unconscious process, but later it may be done with deliberate intent. There was a memorable moment of mixed emotions in our household when my son made his normal request to watch a 'viddydo' and then corrected it to 'video'. As a child's vocabulary exp from other words they already know. The mental models they have of the sound structure of words (phonological representations) become more sophisticated, accompanied by stored information about word meanings (semantic representations), how to physically produce the words (motor representations).	
(grammatical representations). The stronger a child's phonological awareness, the more refined their phonological memory facilitate vocabulary growth, as the child can retain unfamiliar sequences of words more accurately and for longer accompanies of the sound structure of words are likely to be. Strengths in phonological memory facilitate vocabulary growth, as the child can retain unfamiliar sequences of words more accurately and for longer accompanies of the words are likely to be.	
storing them in long-term memory. When phonological memory is weak, many more repetitions of new words may be needed for accurate and secure retention. Strengths in phonological processing speed will mean that sound-based information may be retrieved quickly, accurately and easily to	when talking. When phonological representations are
imprecise or when phonological processing is slow, it may be hard to retrieve specific words accurately in the moment they are needed (word-finding difficulties). As children approach school age, an explicit awareness of the sound structure of words is likely to be emerging, characterised by structure of words accurately in the moment they are needed (word-finding difficulties). As children approach school age, an explicit awareness of the sound structure of words is likely to be emerging, characterised by structure of words accurately in the moment they are needed (word-finding difficulties). As children approach school age, an explicit awareness of the sound structure of words is likely to be emerging, characterised by structure of words accurately in the moment they are needed (word-finding difficulties). As children approach school age, an explicit awareness of the sound structure of words is likely to be emerging, characterised by structure of words accurately in the moment they are needed (word-finding difficulties). As children approach school age, an explicit awareness of the sound structure of words is likely to be emerging, characterised by structure of words accurately in the moment they are needed (word-finding difficulties).	
phonics that determine how those sounds are represented with letters. Through mastery of phonics, children can decode words when reading by systematically mapping letters to sounds ('sounding out' words) and then 'blending' those sounds together. Phonological awareness combined with	
spelling - where words must be broken down or 'segmented' into their component sounds, and the letters that correspond to each sound are written down. 'Orthographic representations' or mental representations of the spellings of words can be added to the other types of information that ch	
awareness is the aspect of phonological processing that has attracted the most attention in the context of literacy, but phonological memory and phonological memory is needed for example to ho to blend them together when reading, and to write down the correct letters when spelling. Phonological information to be retrieved in a timely way in response to the words on the page. People with dyslexia may have difficultie	
affecting the accuracy and/or fluency of their reading and spelling. There are many tests available for assessing different aspects of phonological awareness tasks may require such skills as rhyming, segmenting, blending, and phoneme identification or manipulation. Pl	honological memory is usually tested with nonword
repetition tasks or digit span tests. Phonological processing speed may be assessed with a rapid naming task. DeCasper, A. J., & Fifer, W. P. (1980). Of human bonding: Newborns prefer their mothers' voices. Science, 208(4448), 1174-1176. C., Kirby, P., Snowling, M.J., Thompson, P. A., Carro Findings of a Delphi Study on Assessment and Identification, Dyslexia, 31(1), As a library, NLM provides access to scientific literature. Inclusion in an NLM database does not imply endorsement of, or agreement with, the contents by NLM or the National Institutes of Health. Learn more: PMC	
available in PMC: 2017 Jan 1. Semantic and phonological processing deficits are often present in aphasia. The degree of interdependence between the deficits has been widely studied with variable findings. Semantic variables such as category and typicality have been found to influence semantic variables.	
aphasia but their influence on phonological processing is unknown. This study examined the nature of semantic and phonological access in aphasia by comparing adults with aphasia to healthy control participants. Semantic and phonological tasks were used to assess the difference in processing is unknown.	ing requirements between and within each group as well as
examine the effects of category and typicality on different stages of semantic and phonological processing. Thirty-two persons with aphasia and ten neurologically healthy adults were administered nine tasks: Category Superordinate, Category Coordinate, Semantic Feature, Rhyme Judgment (Verification (No-Name), Rhyme Judgment (Name-Provided), Syllable Judgment (Name-Provided), and Phoneme Verification (Name	
with aphasia performed with significantly lower accuracy than controls on phonological tasks but performed comparably on semantic tasks. Participants with aphasia were significantly slower than controls on all semantic and phonological tasks. Clustering of the nine tasks by accuracy revealed	
with aphasia compared to the control group while clustering by reaction time revealed similar trends in both groups in that phonological (no-name) items required the most processing time. Significant effects of category and typicality were noted in the semantic tasks but not in any of the phonological (no-name) items required the most processing time.	
overall impaired phonological processing with relatively preserved semantic processing as compared to controls. Per accuracy and reaction time measures, distinct trends in processing load for semantic tasks versus phonological tasks were seen in the individuals with aphasia whereas only spending processing load in the control group. The results align most closely with discrete serial processing as category and typicality effects were robust in the semantic tasks but not in any of the phonological tasks. Alternative explanations for these results al	
semantic, phonological, impairment Many two-step models of lexical access propose that semantic and phonological processes are distinct and are activated at different levels during single-word comprehension or production. During picture naming, for example, word production begins at a comprehension or production.	
pictured object, turkey). Conceptual knowledge of the target then activates semantic attributes of the target word from the lexical-semantic system (e.g., 'has wings', 'is food for humans'). Phonological codes of the target word from are then selected from long-term storage within the phonological codes of the target word from the lexical-semantic system (e.g., 'has wings', 'is food for humans').	
maintenance and sequencing of phonological segments occurs in the phonological buffer (e.g., tur-key) prior to articulation (e.g., "turkey"). During spoken word comprehension, comparable stages of processing occur but in the reverse order (i.e., translation of the acoustic signal into phonological segments occurs in the phonological buffer (e.g., tur-key) prior to articulation (e.g., "turkey"). During spoken word comprehension, comparable stages of processing occur but in the reverse order (i.e., translation of the acoustic signal into phonological segments occurs in the phonological buffer (e.g., tur-key) prior to articulation (e.g., "tur-key) prior to articulation (e.g.,	
phonological input buffer and phonological input lexicon) and the systems mediating output phonology for spoken word production (i.e., phonological output buffer) are separate. While many researchers agree that the aforementioned processes are necessary for	or lexical processing (with some modifications to certain
stages), considerable debate exists regarding the level of interaction between semantic and phonological stages during lexical access. On one end of the spectrum, there exists a set of models wherein lexical access proceeds in a discrete, serial fashion, and each stage of processing occurs sequences, and severally serial fashion, and each stage of processing occurs sequences, and severally severally serial fashion, and each stage of processing occurs sequences, and severally severa	
phonological access interact and affect each other resulting in processing occurring in a parallel fashion; connections between semantic, lexical, and phonological nodes are bidirectional and several types of interactivity between nodes (i.e., forward-backward interactivity, lateral interactivity,	
between semantics, word form and phonemes. Support has been found for each type of model within the literature on impaired language processing in persons with aphasia (PWA). For example, evidence that phonological and semantic processing deficits are discrete and independent has been found for each type of model within the literature on impaired language processing in persons with aphasia (PWA).	
distinction between semantic (e.g., plane for helicopter) and phonological errors (e.g., pain for plane) as well as reaction time studies demonstrating the effect of a semantic distractor on naming (Cuetos, Aguado, & Caramazza, 2000; Ellis, Kay, & Frankli Ralph, 2007; Levelt, et al., 1991; Schriefers, 1990). Conversely, other studies with PWA have found that phonological and semantic deficits are interdependent as phonological representations are supported by their corresponding lexical and semantic representations (Kittredge, Dell, Verkuiler	
Schwartz, & Kohen, 2006; Schwartz, et al., 2006). Therefore, within any theoretical model of lexical access, it can be presumed that breakdown can occur at any stage of processing yet the extent to which systems subsequent to the level of impairment are impacted depends on whether these	systems are interactive. Additionally, certain
psycholinguistic factors have been found to differentially impact semantic and phonological stages of lexical processing in both neurologically-intact adults and PWA. For example, previous studies have shown that semantic access is influenced by a variety of factors, including lexical frequency familiarity (e.g., Gernsbacher, 1984; Funnell & Sheridan, 1992), and word length (Ellis, Miller, & Sin, 1983; Howard, 2004; Pate, Saffran, & Martin, 1987). Within the phonological system, frequency, familiarity (e.g., Gernsbacher, 1984; Funnell & Sheridan, 1987).	
impact access to the phonological output lexicon (POL) in PWA (Howard & Gatehouse, 2006), and it has been proposed that word length and phoneme position impacts processing at the level of the phonological output buffer (Romani, Galluzzi, & Olson, 2011). Moreover, select psycholinguistic	
phonological (e.g., phonological neighborhood density) in nature. Pertinent to the present study, there is extensive evidence that the lexical-semantic processing in both healthy individuals (e.g., Ahn, 1998; Barsalou, 1983; Barsalou, 1985; Barton & Komatsu	
Estes, 2003; Hampton, 1998; Keil, Carter Smith, Simons, & Levin, 1998; Silveri et al., 1997; Vanoverberghe & Storms, 2003) and PWA (e.g., Forde & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 1999; Hart, Berndt, & Caramazza, 1985; Laiacona & Capitani, 2001; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 2003; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 2003; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 2003; Lambon Ralph, Lowe, & Rogers, 2007; Sacchett & Humphreys, 2003; Lambon Ralph, Lowe, & Lowe, Lowe, Lowe, & L	
semantic processing between PWA with different deficit profiles and healthy controls (Kiran, Ntourou, Eubanks, & Shamapant, 2005; Kiran & Thompson, 2003; Sandberg, Sebastian, & Kiran, 2012). Within the context of interactive models, it is reasonable to hypothesize that such semantic fac	ctors would impact phonological processing to a certain
degree whereas this expectation would not hold within the framework of discrete serial models. Ultimately, the discussion of whether lexical access is discrete or interactive is important because it facilitates understanding deficit profiles in PWA, and it is well-established that PWA can demonstrate the different state of the control	
method for testing the interactivity between systems is to examine the differential effects certain psycholinguistic factors) have on different stages of semantic and phonological processing. Therefore, the current study aimed to further our u and healthy controls by examining general differences in semantic and phonological processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing within each system within each group. All participants were administered the following three semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups as well as the effects of semantic factors (i.e., category and typicality) on processing between groups are the effects of semantic factors (i.e., category and typicality) on processing between groups are the effects of semantic factors (i.e., category and typicality) on processing between groups are the effects of semantic factors (i.e., category and typicality) on processing between groups are the effects of semantic factors (i.e., category and typicality) on processing the effects of seman	
designed to primarily target semantic processing, (2) three phonological no-name (PhN-N) tasks designed to highly tax processing at the level of the POL, and (3) three phonological name-provided (PhN-P) tasks designed to target processing within the phonological buffer system. Holistic langer than the phonological name-provided (PhN-P) tasks designed to target processing within the phonological buffer system. Holistic langer than the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within the phonological name-provided (PhN-P) tasks designed to target processing within target processing within the phonological name-provide	
explicitly probed in the experimental tasks. Rather, the component processes underlying such language tasks were isolated in order to systematically examine different stages of semantic and phonological processing in healthy individuals versus a large sample of PWA. To do so, we addressed healthy controls and PWA in processing on the nine semantic and phonological tasks according to accuracy and reaction times? We predicted that healthy controls would be significantly faster and more accurate on all tasks than PWA. We also predicted that the difference between groups would be significantly faster and more accurate on all tasks than PWA.	
deficits of PWA is anomia, and these tasks primarily taxed retrieval at the POL. We hypothesized that the differences between tasks would be the smallest for the SEM tasks but the magnitude of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would depend on the amount of semantic impairment in the group of the difference between groups would be the semantic impairment in the group of the difference between groups would be the group of the difference between groups would be the group of the grou	of PWA. How do task demands influence processing
according to accuracy and reaction times within groups? We predicted that PWA would demonstrate a clear delineation in processing requirements according to task type (i.e., SEM versus PhN-P). Unlike the PWA, we believed that processing demands across tasks would be similarly and the second processing demands across tasks would be similarly and the second processing demands across tasks would be similarly and the second processing demands across tasks would be similarly and the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across tasks and the second processing demands across tasks would be similarly across the second processing demands across tasks across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across the second processing demands across tasks would be similarly across tasks which across the second processing demands across tasks would be second processing to the second processing demands across tasks which across the second processing demands across the	
tasks. What are the effects of category and typicality on processing according to accuracy and reaction times within the semantic and phonological tasks in each participant group? We predicted that category and typicality effects would be more robust in semantic relative to phonological tasks in nature. Additionally, if lexical processing is truly interactive, we hypothesized that category and typicality effects would be present in the SEM and PhN-N tasks (since the lexical system is activated in both tasks) but would be least likely in the PhN-P tasks. Conversely, if processing is discretely	
present in the SEM tasks only. Thirty-two participants with aphasia (20 males) as a result of middle cerebral artery stroke(s) were recruited from hospitals and group therapy settings in the Boston area. Two participants had two left-hemisphere CVAs, and one participant had a right hemisphere	ere CVA and presented with crossed aphasia. Additionally,
three PWA had some right-hemisphere involvement in addition to left-hemisphere CVAs; their primary presentation was aphasia. Thirty-one PWA were monolingual English speakers; one participant was bilingual but acquired English at an early age and primarily used English at home. Ten her males) with no reported history of stroke, traumatic brain injury, or other neurological damage also participated in the present study as these participants were expected to perform consistently a	
group of PWA. All participants had normal or corrected-to-normal vision and hearing. PWA and control participant demographic information, including age, gender, handedness, years of education, monolingual status, neurological history, months post-onset and aphasia type (for PWA), was collected in the present study as these participants were expected to perform consistently and group of PWA. All participants had normal or corrected-to-normal vision and hearing. PWA and control participant demographic information, including age, gender, handedness, years of education, monolingual status, neurological history, months post-onset and aphasia type (for PWA), was collected to perform consistently and the present study as these participants were expected to perform consistently and group of PWA.	
tests revealed that PWA and control participants did not significantly differ by age, $t(26.09) = -1.46$ , $p = .16$ , or by education, $t(13.69) = .91$ , $p = .38$ . See Tables 1a/1b for PWA/control demographic information. Demographic information for all PWA. P10 education information is unavailable by the second of the property of t	
data were obtained. W = White, B = Black, A = Asian; NR = No Response Participant Group Age Years of Education Handedness Gender Race/Ethnicity MPO Aphasia Type P1 PWA 56 16 R F W 75 Anomic P2 PWA 51 16 R M W 115 Broca's P3 PWA 65 15 R M NR 50 Broca's P4 PWA 54 16 R M W 28 PWA 66 18 R F W 70 Conduction P7 PWA 70 12 R M W 168 Global P8 PWA 49 12 R M W 156 Broca's P10 PWA 83 N/A R F W 22 N/A P11 PWA 59 12 L M W 36 Anomic P12 PWA 70 12 R M W 24 Wernicke's P13 PWA 63 18 R F B 26 Anomic P14 PWA 86 12 L M	
72 18 R M B 22 Conduction P17 PWA 53 16 R M W 27 Anomic P24 PWA 63 13 R F W 63 CONDUCTION FOR THE PUBLISH FOR	
55 16 R M B 13 Anomic P27 PWA 50 13 L F W 31 Global P28 PWA 26 15 R M W 39 Anomic P29 PWA 49 12 R M B 50 Anomic P30 PWA 79 16 R M W 14 Conduction P31 PWA 68 18 R M A 10 Wernicke's P32 PWA 70 12 R F W 63 Anomic AVERAGE 62.13 15.32 28R, 4L 20M, 12F 54.13 Stdev 13 control participants. W = White, B = Black, A = Asian Participant Group Age Years of Education Handedness Gender Race/Ethnicity C1 Control 54 18 R F W C3 Control 54 18 R F W C4 Control 44 16 R M W C5 Control 55 12 R M B C6 Control 58 12 L M W C7 Control 59 Control 50 Control 5	
W C10 Control 68 20 R M W AVERAGE 56.90 16.20 9 R, 1L 6M, 4F Stdev 8.24 2.74 In addition to the behavioural tasks described below, PWA were administered different language assessments, including the Boston Naming Test (BNT; Kaplan et al., 2001) to assess naming performance, the P	
1992) to assess semantic processing, and the Western Aphasia Battery-Revised (WAB-R; Kertesz, 2007) to obtain Aphasia Quotient (AQ) which indicates overall severity of language deficits in aphasia (see Table 2 for report of individual scores). Of note, AQ was above the criterion cut score for	r mild aphasia for three PWA. However, we were interested
in fully representing the heterogeneity seen in chronic aphasia, and these participants were included in the present study as they demonstrated impaired linguistic skills on other assessments (e.g., P20 scored 39/60 on BNT). Patient performance on WAB-R (Kertesz, 2006), BNT (Kaplan et al., information for P10, P13 and P22 is unavailable because the participants dropped out of the study before the data were obtained. Participant WAB AO BNT score P1 80.2 34 50 P2 48 4 46 P3 49.6 9 50 P4 44.9 24 48 P5 72.5 49 47 P6 70.1 37 47 P7 10.2 0 35 P8 55.5 35 50 P9 58.6 18	
67.7 8 N/A P14 88.1 34 42 P15 93.9 59 51 P16 76.7 51 48 P17 91 28 49 P18 77.9 33 50 P19 92.7 57 50 P20 97.2 39 48 P21 85 51 48 P22 N/A N/A N/A P23 95 46 50 P24 52 10 47 P25 53.4 9 50 P26 87.2 50 50 P27 21.2 1 49 P28 77.6 43 49 P29 85.5 53 50 P30 90 52 49 P31 31.2 4 48 P32 86.6 4	2 38 AVERAGE 69.05 30.97 46.97 Stdev 23.24 19.71 4.59
Several computer-based tasks were developed for this study. Color photographs of real-life objects were used for the visual stimuli. Visually confusing or ambiguous items were avoided. Audio clips of stimuli and tasks instructions were recorded by a native male American English speaker. In a	
three of which were living: vegetables, fruits, and birds and three were nonliving: furniture, transportation, and clothing. Approximately 40 items for each category were submitted to Mturk (, where approximately 500 anonymous workers rated each item's typicality on a scale of 1 to 5. Each item that did not belong to the category were used to identify outlier workers whose answers were discarded in the calculation of typicality. Using the Mturk ratings, the average rating for the category was calculated, and z-scores were calculated by taking the distance from the item's rating to the	
avoid ambiguous typicality, mid-ranking items were not used in development of the tasks. See Appendix A for a list of sample stimuli and Table 3 for stimuli ratings by category. Familiarity and spoken word frequency (Frequency CobSIM; CELEX, 1993) written word frequency (Frequency FK;	Frances & Kucera, 1982). Category Bird Clothing Fruit
Furniture Transportation Vegetable Average typicality rating (1 to 5 scale) 1.86 2.55 2.42 4.06 2.73 2.59 Typical items z-scoreAVERAGE $-1.86$ to $-0.03-0.85-1.59$ to $0.13-0.78-1.63$ to $-0.21-0.91-1.63$ to $-0.11-0.95-1.25$ to $-0.02-0.66$ Atypical items z-scoreAVERAGE $-1.86$ to $-0.19-0.80-1.83$ to $-0.13-0.85-1.83$ to $-0.11-0.95-1.25$ to $-0.02-0.66$ Atypical items z-scoreAVERAGE $-1.86$ to $-0.19-0.80-1.83$ to $-0.13-0.85-1.83$ to $-0.11-0.95-1.25$ to $-0.02-0.66$ Atypical items z-scoreAVERAGE $-1.86$ to $-0.13-0.85-1.83$ to $-0.13-0.85-1.83$ to $-0.13-0.85-1.83$ to $-0.13-0.95-1.83$ to $-0.13-0.95-1.83$ to $-0.13-0.85-1.83$ to $-0.13-0.83$ to $-0.13-0.$	
$26.93  ext{ } 34.31  ext{ } \pm 47.14  ext{ } 27.52  ext{ } \pm 33.52  ext{ } 7.45  ext{ } \pm 9.97  ext{ } Nine experimental tasks were designed to capture abilities within three different systems involved in lexical access: the semantic system, the phonological output lexicon (POL), and the phonological buffer system. The semantic tasks were consistent as the semantic system involved in lexical access: the semantic system involved in lexical access in $	
abilities in PWA such as category generation, category sorting, category superordinate verification, and semantic feature verification (Casey, 1992; Fujihara, Nageishi, Koyama, & Nakajima, 1998; Grober, Perecman, Kellar, & Brown, 1980; Hampton, 1979; Kiran, Ntourou, & Eubanks, 2007; Kiran, Nageishi, Koyama, & Nakajima, 1998; Grober, Perecman, Kellar, & Brown, 1980; Hampton, 1979; Kiran, Ntourou, & Eubanks, 2007; Kiran, Nageishi, Koyama, & Nakajima, 1998; Grober, Perecman, Kellar, & Brown, 1980; Hampton, 1979; Kiran, Ntourou, & Eubanks, 2007; Kiran, Nageishi, N	iran & Thompson, 2003; Rips, Shoben, & Smith, 1973).
Similarly, the phonological tasks were similar to tasks utilized in previous studies examining phonological judgment and manipulation involving rhyme judgments, segmentation, and minimal pairs (Howard & Nickels, 2005; Jefferies & Lambon either a semantic or phonological judgment regarding the target item(s). While certain tasks required both semantic on phonological processes (e.g., PhN-N), the onus for successful completion of the judgment was primarily on one of the aforementioned systems for each task type (i.e., SEM,	
80 items split into two runs. Items/pairs were balanced across category, typicality, and yes/no conditions. Unless otherwise specified, the yes/no responses were given via a keyboard button press with "x" corresponding to a "yes" response and "z" corresponding to a "no" response. A fixation of the yes/no responses were given via a keyboard button press with "x" corresponding to a "yes" response and "z" corresponding to a "no" response. A fixation of the yes/no responses were given via a keyboard button press with "x" corresponding to a "yes" response and "z" corresponding to a "no" response. A fixation of the yes/no responses were given via a keyboard button press with "x" corresponding to a "yes" response and "z" corresponding to a "no" response. A fixation of the yes/no response and "z" corresponding to a "no" response and "z" corresponding to	of 2000ms was displayed between presentations of stimuli
across tasks. The specific tasks and the theoretical motivation for the design of each task type are described in further detail below. Schematic representation of the tasks implemented in the current study and the stage of lexical processing each task primarily taxed, as indicated by matching outlines (B-D). A. Schematic of Lexical Processing, B. Semantic Tasks, C. Phonological No-Name tasks, D. Pho	
make the judgment was presented in both spoken and written form to reduce the effect of reading or auditory comprehension deficits on performance. Participants were presented with a picture of a basic-level item and its spoken name along with a written and spoken superordinate category	name. Participants determined whether the item belonged
to the given category (e.g., chandelier: furniture). Participants were presented with the pictures and the spoken forms of two basic-level items, one item immediately followed by the next. Participants decided whether the items belonged to the same semantic category (e.g., truck: canoe). At the	ne beginning of the task, the six categories were listed as
part of the instructions to minimize category ambiguity. Participants were provided with simultaneous visual and auditory presentation of a basic-level item immediately followed by a written and spoken semantic feature. Participants judged whether the feature applied to the item. Of the 80 transport swims) while the other half were unrelated items and features. Related features consisted of defining type (features shared by .6) indicated by three asterisks; moderate correlations (.5 ≥ .6) indicated by two asteris	
, and the second state of	,