WHAT'S IN A NAME?
PREDICTORS OF PROPER NAME RETRIEVAL DEFICITS IN OLDER AGE

By

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To my parents, for their unwavering love and encouragement, and to my advisor, Lise Abrams, for her invaluable insight throughout this process

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One of older adults' most worrisome cognitive problems is increased incidence of word-finding failures, or tip-of-the-tongue (TOT) states. Relative to other words, proper names seem to elicit more frequent and socially-consequent TOTs, particularly for older adults. The current dissertation aimed to disambiguate phonological and semantic contributions to the disproportionate impairment for proper name retrieval in older age. Young and older adults read general knowledge questions whose target answers were famous names (e.g., *Alfred Hitchcock*) or low-frequency noun non-names (e.g., *arson*). Half of the targets began with a high-frequency (HF) first syllable, and half began with a low-frequency (LF) first syllable. In Experiment 1, target questions were preceded or followed by a "prime" question containing a word with the same first syllable as the target (e.g., *Albert Einstein*, *arbitrary*), or an unrelated question. In Experiment 2, prime questions contained a name or word that was semantically related to the target (e.g., *Steven Spielberg*, *pyromania*). Results confirmed a disproportionate age deficit for names: older adults had more TOTs than young adults, and this age difference was more pronounced for proper names than non-names. However, the age-related impairment for names was moderated by first syllable frequency in that exaggerated

age deficits only occurred for names with HF first syllables. Further, older adults (but not young) showed opposing influences of syllable frequency for non-names and names, experiencing more TOTs for non-names with LF first syllables but fewer TOTs for proper names with LF first syllables. With respect to priming, phonological primes reduced TOTs, increased correct retrievals, and boosted TOT resolution, but only for older adults and for non-names. Conversely, semantic primes did not influence TOTs but did reduce older adults' correct responses, again only for non-names. These findings suggest that age differences in TOTs for non-names and proper names are driven by different characteristics. For non-names, TOTs represent failed activation of LF phonology, whereas for proper names, TOTs result from increased complexity in the structure of names' lexical representations, where first and last names are shared by other people. These results provide clarity and specificity to models of proper name retrieval and cognitive aging.

CHAPTER 1
INTRODUCTION

The act of retrieving a familiar person's name is a common, everyday process to which most people give little notice until they are unable to recall the name of someone they know. These frustrating and embarrassing lapses in memory seem to occur more frequently in late life (e.g., Burke, Locantore, Austin, & Chae, 2004; Cohen & Faulkner, 1986; Cross & Burke, 2004; Evrard, 2002; Fogler & James, 2007; but see James, 2006; Maylor, 1997), with name forgetfulness easily emerging as one of the most prevalent cognitive complaints among the elderly (e.g., Cohen & Burke, 1993; Cohen & Faulkner, 1986; Evrard, 2002; Maylor, 1997). Perhaps due to the social salience of names, cognitive psychologists and neuropsychologists have shown an increasing interest in understanding the mechanisms that underlie the production of proper names and the conditions that promote retrieval failures. Theoretically, the primary question of interest is how the representation of proper names differs from other word classes at the neural and/or cognitive level, and how this divergence influences the ease with which proper names are retrieved compared to other types of words. Extant neuropsychological and behavioral evidence suggests that proper names induce more retrieval failures (e.g., Bredart & Valentine, 1998; MacKay & Burke, 1991; Semenza, 2006; Semenza, 2009), are named more slowly (e.g., Evrard, 2002), and are more difficult to learn (e.g., Brennen, 1993; Cohen & Burke, 1993; Cohen & Faulkner, 1986) than other words (but see Hanley, 2011), although the source of this selective impairment remains unresolved. As such, the global goals of the present research were to: 1) investigate how the representation and retrieval of proper names differ from other categories of words, 2) elucidate why this dissociation makes proper names more difficult to retrieve

and produce, and 3) address why the disproportionate difficulty with names seems to be exacerbated by aging. More specifically, the project examined both phonological and semantic influences on proper name and non-name[1] retrieval among young and older adults.

Aging and Lexical Access

Regardless of word class, the process of retrieving and producing a single word is deceptively complex, providing a number of opportunities for production processes to go wrong. Most cognitive models of speech production assume that semantic (meaning-based), lexical (syntax-based), and phonological (sound-based) representations must be activated during the production of a single word (e.g., Bock & Griffin, 2000; Dell, 1986; Garrett, 1988; Levelt, Roelofs, & Meyer, 1999; MacKay, 1987; Rapp & Goldrick, 2000). For example, production of the word *dog* requires the activation of its semantic and/or perceptual features (e.g., an animal, covered in fur, companion), its lexical representation or *lemma* (e.g., the specific word that best embodies the activated semantic features), and its phonological features (e.g., the individual phonemes within the word). Distinct representations are accessed at each level in the language system, and speech errors result when a speaker fails to activate the correct representations in the correct order. For example, semantic substitution errors occur when top-down activation from the semantic level results in the erroneous selection of a lemma that is semantically similar to an intended target word (e.g., *nun* for *priest*). Sound-based errors or *slips of the tongue* occur when incorrect syllables or phonemes get activated in the

[1] Nouns that are not proper names are often referred to as “common names” within the neuropsychological and psycholinguistic literatures. However, because the nouns selected for this experiment are especially rare, low-frequency nouns, the term common name seemed like an inappropriate and misleading label. From this point forward, the term “non-name” is used to represent any type of word that is not defined as a proper noun.

phonological system (e.g., *dock the loor* for *lock the door*). Finally, word retrieval failures occur when a speaker is unable to access the semantic, lexical, or phonological representation of a known word, thereby obstructing production of an intended target word.

Tip-of-the-tongue (TOT) states represent a unique situation where a speaker is unable to retrieve a word's phonology, despite successful lexical activation (e.g., Burke, MacKay, Worthley, & Wade, 1991; Levelt, 1989; but see Caramazza & Miozzo, 1997, for an alternative view where TOTs result from incomplete access of the lexical representation). The frustration that accompanies TOT states is thought to reflect successful selection of a specific lemma, giving the speaker the sensation that the word is on the verge of being produced. Although all language-users experience the occasional TOT, older adults appear to be more susceptible to these temporary memory lapses, as demonstrated by both diary studies of naturally-occurring TOTs (e.g. Burke et al., 1991; Heine, Ober, & Shenaut, 1999) and laboratory studies comparing TOT incidence rates among young and older adults (e.g., Heine et al., 1999; Vitevitch & Sommers, 2003). Older adults' higher incidence of TOT states has been explained by an age-related reduction in the transmission of activation between various levels of a word's representation, an explanation referred to as the Transmission Deficit Hypothesis (TDH; e.g., MacKay & Burke, 1990). According to TDH, connections between semantic, lexical, and phonological "nodes" in the language system are weakened with age, thereby reducing the transmission of activation between all nodes. Linkage strength may become so weak that the amount of activation transferred throughout nodes in the system may be inadequate to fully activate a targeted node.

The assumptions made by TDH are consistent with neurobiological characteristics of aging in that older adults experience white matter atrophy and truncated myelinated fibers, which in turn constrain neural connectivity (e.g., Burke & Shafto, 2008; Hedden & Gabrieli, 2004). Although declines in connection integrity are diffusely distributed within TDH, the organizational hierarchy of the nodes renders some links more vulnerable to transmission deficits than others. The retrieval of a given phonological node from the phonological network is particularly susceptible to transmission failure because it is subserved by a single, isolated connection between a word's lexical representation and its phonology. In contrast, the semantic system is more resistant to age-related transmission deficits because it is characterized by multiple converging and redundant connections among semantic and lexical nodes. Empirically, TDH's reduction in the transmission of activation in old age also offers a language-specific explanation for why processes that require speeded phonological retrieval, such as picture naming, are more susceptible to age-related declines than processes relying solely on semantic information such as vocabulary (e.g., Mortensen, Meyer, & Humphreys, 2006).

Given the hierarchical architecture of the language system, it seems plausible that certain characteristics of words and their phonological forms may exacerbate age-related retrieval deficits for healthy older adults or those with pathological cognitive deficits (e.g., Balota & Ferraro, 1996; Vitevitch & Sommers, 2003). Indeed, relevant evidence suggests that age differences in language processes may be linked to lexical (structural influences of the whole word) as well as sublexical (structural influences of phonological components contained within a word, e.g., phonemes and syllables) properties of words (e.g., Carreiras, Baquero, & Rodriguez, 2008; Farrell & Abrams,

2011; Spieler & Balota, 2000; Vitevitch & Sommers, 2003). Because of age-related changes in phonological-level processes, a few studies have reported differential effects of sublexical variables, such as syllable frequency (the rate of a syllable's use within a language) and neighborhood density (the number of words in the lexicon that are phonologically similar to a target word) as a function of age (e.g., Carreiras et al., 2008; Farrell & Abrams, 2011; Vitevitch & Sommers, 2003; but see Spieler & Balota, 2000). In examining the incidence of TOTs for non-names, Farrell and Abrams (2011) found that older adults, but not young adults, had more TOTs for words beginning with low-frequency (LF) first syllables (e.g., *ominous*) relative to words with HF first syllables, (e.g., *decanter*). Importantly, age differences in TOT incidence only occurred when participants attempted to retrieve words with LF onset syllables, suggesting that older adults' vulnerability during word retrieval is moderated by the frequency of the phonological components of a word. Assuming that older adults have greater difficulty with words and sounds used infrequently and/or are less connected with other representations in the language system, they might show a particular susceptibility to word types that embody both of these characteristics, i.e., proper names.

Theories of Proper Name Specificity

Some of the earliest research on proper name retrieval stemmed from an attempt to understand why people's names are more difficult to retrieve than other semantic and biographical information about them. To account for this asymmetry, Bruce and Young (1986) proposed a model of face recognition/person identification that has been used to guide a number of empirical investigations into proper name retrieval. According to this perspective, the retrieval of a name is the last step in a sequential series of events required to recognize and name a known person. Upon encountering a face, a person

must activate (in order) long-term perceptual codes for a familiar face (Face Recognition Units; FRUs), then activate Person Identification Units (PINs) which contain biographical and semantic features about the person (age, occupation, nationality), and finally activate the name nodes corresponding to the identified person. Thus, name retrieval relies on prior activation of semantics and is therefore more susceptible to error than the retrieval of biographical facts (see Burton, Bruce, & Johnston, 1990, for later adaptation that allows for semantic activation and name retrieval to occur in parallel).

Indeed, a number of studies have shown that names are harder to access than other types of information about a person (e.g., Johnston & Bruce, 1990; Young, Ellis, & Flude, 1988; Young, McWeeny, Ellis, & Hay, 1986). For example, when asked to make judgments about two pictures of people, participants are faster when the task requires them to compare semantic features of the two targets (e.g., do they have the same occupation, are they both alive?) compared to when they are asked to confirm whether they share the same name (e.g., Johnston & Bruce, 1990; Young et al., 1988). Similarly, a number of studies have shown that names are more difficult to learn than other features about a person (e.g., Cohen, 1990; Cohen & Faulkner, 1986). This effect persists even when the same phonological word form is used; it is easier to remember that a person works as a baker than to remember his name is Mr. Baker (e.g., McWeeny, Young, Hay, & Ellis, 1987), an effect referred to as the Baker-baker paradox (e.g., Cohen & Burke, 1993; Semenza, 2009). All of this evidence is taken to suggest that names are stored separately from other types of person-specific semantic information and that the latter must be successfully activated prior to production of a name.

Beyond the face recognition literature, the “specialness” of proper names extends to more global speech production processes in that the production of names seems to require additional effort relative to other word types. A number of studies have shown that proper names are associated with more TOTs than other classes of words (e.g., Burke et al., 1991; Bredart & Valentine, 1998; Evrard, 2002; MacKay & Burke, 1991; but see Hanley, 2011), and various characteristics of proper names have been proposed to account for this selective deficit. Most of the proposed characteristics relate to the unique semantic properties associated with people’s names, which presumably create a separation between names and other words within the mental lexicon. By nature, names may be more arbitrary (e.g., Semenza, 2006), more specific (e.g., Bredart, Valentine, Calder, & Gassi, 1995; Semenza, 2006; Semenza, 2009), less descriptive (Fogler & James, 2007), less meaningful (e.g., Cohen & Burke, 1986), and less frequent (Cohen & Burke, 1993; Conley, Burgess, & Hage, 1999), all of which may contribute to the isolation of names in the memory system, therefore making them more difficult to access.

Evidence for at least partially distinct neurocognitive systems dedicated to proper name and non-name word retrieval comes from neuropsychological case studies showing selective impairment, and in rarer cases, selective sparing of proper names among aphasics (e.g., Semenza, 2006; 2009). In the most common type of proper name anomia, patients have an inability or profound difficulty when producing the names of people but not when asked to name objects or other types of words. Less commonly, neurological damage can cause the reverse pattern, where a patient is relatively preserved during proper name retrieval but has marked difficulty during the

retrieval of other word types. This double dissociation is taken to suggest that there must be some separation between the brain regions dedicated to the processing of proper names and other nouns. The infrequency of these cases, however, indicates that proper name and non-name retrieval mostly rely on common neural substrates, and only rare and highly-localized lesions selectively target a given word class. Working off existing cognitive and psycholinguistic theories (e.g., Cohen & Burke, 1993), Semenza argues that independent processing pathways are engaged during the retrieval of names versus non-names. The “proper name pathway” is more difficult to employ because of an inherent weakness in the relationship between a proper name (the phonological label) and its reference (the person it corresponds to). Unlike other types of words, a proper name does not designate meaning and refers instead to a single entity, an entirely unique instance. In contrast, the lexical representation of a non-name refers to an interrelated web of attributes that signify and define the reference. In other words, proper names refer to individuals whereas other words refer to categories; one may encounter 500 different pencils but each time call it a pencil, whereas a unique identifier must be stored for each new person. The distinction between the representations of proper names and other words may be theoretically comparable to the dissociation between episodic and semantic memory in that the former refers to the storage of facts about individuals and events, and the latter refers to the storage of shared knowledge that is reused in various different contexts (see also Cohen & Faulkner, 1986). Overall, there seems to be evidence for separate processing streams dedicated to proper name and non-name retrieval; further, some inherent mechanism makes the proper name stream more resource-demanding than the other.

Similar theories about the semantic features of proper names have been used to explain proper name retrieval difficulties among non-aphasic speakers. For example, previous research suggests that names are more difficult to learn (and therefore remember) than other types of information because the phonology of a name does not symbolize semantic information. When a new person is encountered, biographical information about the person is encoded more strongly than the person's name because semantic facts such as occupation (e.g., is a lawyer) can be integrated within one's existing semantic network (e.g., the courtroom, law school, personality characteristics, etc.). The role of semantic meaning (or lack of semantic meaning) in the disproportionate difficulty with proper name memory is supported by a study reviewed by Cohen and Burke (1993), where the experimenters were able to reverse the asymmetry for names relative to semantic descriptors. When pictures of people's faces were used as a memory cues, meaningful information about a person (e.g., is a potter) was more easily retrieved than meaningless names (e.g., Mrs. Ryman), consistent with previous research. However, the opposite effect occurred when the meaningless labels were swapped, so that a name with meaning (e.g., Mrs. Potter) was more easily retrieved than a meaningless occupation (e.g., is a ryman). Thus, the learning of new names may be hindered by the fact that names characteristically lack meaning, and as such, they form less stable connections with other words in the lexicon and are more difficult to access on subsequent retrieval attempts.

Although there may be considerable differences between the semantic representations of proper names compared to other words, recent research has suggested that proper names may form a tight person-specific network within semantic

memory (e.g., Burgess & Conley, 1998; Conley et al., 1999). The hyperspace analogue to language (HAL) is a computational model of semantic memory used to conceptualize the distribution of concepts in semantic space. Using the HAL model, Burgess and Conley (1998) found that proper names draw away from other word classes and form a separate but tight semantic cluster. Relative to non-names, the semantic neighborhood density of proper names is higher, suggesting that the semantic representations of names may form closer connections to each other than do words of other classes. In support of this idea, Conley et al. (1999) found that HAL neighborhood density was a strong predictor of word naming latencies when participants were asked to pronounce first names aloud, suggesting that semantic features also influence *successful* production of names.

Beyond the semantic level, the greater difficulty with proper name retrieval may be linked to a lexical level feature, frequency of use (e.g., Cohen & Burke, 1993). The frequency effect is one of the most well-established findings in the speech production literature, where low-frequency words are produced more slowly and less accurately than high-frequency words (e.g., Besner, Moroz & O'Malley, 2011; Jescheniak & Levelt, 1994; Oldfield & Wingfeild, 1965; Stemberger, 1984), and are also more likely to cause a TOT state (e.g., Burke et al., 1991). Proper names possess an overall lower frequency than other types of words (e.g., Fogler & James, 2007), and even the most common surnames (e.g., *Smith*) are probably used and encountered less frequently than most other words, including biographical information about the person named *Smith* (e.g., lives in an apartment, is a teacher). Conley et al. (1999) compiled two corpora (one based on phone book entries, the other based on internet text usage) to

measure the frequency of first names and its influence on naming times. Name frequency emerged as a significant predictor of pronunciation latencies. However, interpretations from this study are limited by the fact that frequency measures were based on the frequency of first names among all first names, not on the frequency of names among all words in the lexicon. The latter measure would be a more accurate and ecologically-valid indicator of the frequency with which names are produced during everyday speech and would therefore have greater explanatory value in accounting for the difference between proper names and non-names. Additionally, differences between proper nouns and other noun types persist when the exact same phonological forms are retrieved or learned (e.g., McWeeny et al., 1987), suggesting that that frequency of use is not the only reason for the increased difficulty with proper names.

The difficulty with proper name retrieval can also be examined within a general framework of language processing that represents linguistic units as nodes within a complex connectionist network (e.g., MacKay & Burke, 1991). According to Node Structure Theory (NST), proper names' susceptibility to retrieval gaps can be attributed to the relatively weak connection formed between the visual image of a person and his/her name that occurs during learning. Figure 1 depicts the different networks associated with learning the name of a person (*John Baker*) and learning his occupation (*baker).* Upon one's first encounter with a person, a connection is formed between the visual concept node representing the person and the "proper noun phrase" node that represents a person's full name (*John Baker*, Figure 1-1). Solitary connections also form between the proper noun phrase node and the two lexical nodes for the first (*John*) and last (*Baker*) name. In contrast, once biographical information about that person is

learned (i.e., *John is a baker*), a connection is formed between the visual concept node for John (face) and the lexical node representing the occupation (*baker,* Figure 1-1). The noun node for *baker* (in the semantic system) forms connections with an existing network of information about bakers (i.e., makes bread, wears a hat, etc.). As a result, this entire network of nodes also becomes connected to the visual concept node for John. Therefore, the difficulty that arises from attempted retrieval of the name could result from the solitary connection between the visual image of a person to the proper noun phrase node and to the corresponding lexical nodes for the first and last name. Conversely, multiple direct and indirect connections allow for more stable links between the visual concept (face node) and corresponding biographical information about the individual. The discrepancy in connection strength can also account for cueing asymmetry: When we recall or are provided biographical information about an individual (i.e., is a good cook, plays tennis), we do not automatically recall the person's name; however, once given a person's name, we almost invariably recall other information about that person. According to NST, this asymmetry is due to the convergence of activation on nodes that represent biographical information versus the isolated lexical level representation of names (see also Shafto & MacKay, 2000, for expansion of theory to other name phenomena). In sum, the retrieval of proper names might be hindered by multiple isolated links within the lexical system. This effect might be exacerbated if proper names also contain rare and infrequently-accessed phonological units, which have weaker links to the lexical/semantic level (discussed in greater detail below with regards to aging).

However, evidence for a disproportionate difficulty with names is not unequivocal. A primary criticism of extant research is that much of the data showing higher TOT rates for names versus non-names come from diary studies (Burke et al., 1991; Cohen & Faulkner, 1986), which rely on the self-reports of participants and are therefore susceptible to memory biases. TOTs for non-names may be underrepresented in diary studies because people can often supply an alternative word with a similar meaning, making the TOT experience less salient and therefore less memorable than a TOT for someone's name (e.g., Hanley, 2011). For example, a TOT for the word "decanter" can be offset by calling it a carafe or fancy jug, thereby masking the temporary lapse in memory. Similar options are not available when trying to retrieve the name of specific individual because usually there is only one "correct answer". On the other hand, some have argued that laboratory TOT studies underestimate the rate of TOTs for proper names because they cannot use acquaintance names, which are the most common source of retrieval failures.

Only a handful of studies have strategically compared TOTs for names and non-names in an experimentally-controlled design (e.g., Burke et al., 1991; Evrard, 2002; Hanley, 2011), and variability in the methodologies and dependent measures have hindered comparability across studies and challenged strong empirical conclusions. For example, Evrard (2002) elicited TOTs by asking participants to name pictures of celebrities and objects or remain silent if the name of the picture could not be produced. TOTs were identified in a subsequent session by re-presenting the unnamed pictures and querying participants about the depictured person or object. As predicted, pictures of faces elicited more TOTs than pictures of objects. However, TOT rates for object

pictures were remarkably low (< 2%), suggesting that the non-name stimuli may just have been too high frequency to cause TOTs. Because the stimuli were not controlled for pre-experimental familiarity, the increase in TOTs for proper names may have resulted from them being more “difficult” than the objects, as opposed to a proper name effect *per se*. By using general knowledge questions to prompt TOT states as opposed to pictures, Burke et al. (1991) were able to use less frequent and more abstract non-names to compare with proper names in their study. They found that older adults (but not young) had more TOTs for famous names relative to four other types of words (non-object nouns, object noun, adjectives and verbs, and place names), i.e., a proper name effect. However, the proper name effect only occurred when TOTs were computed as the proportion of total trials. When TOT incidence was computed as the proportion unsuccessful retrievals (i.e., # TOT responses / TOT + don’t know responses), the proper name effect disappeared. Computing TOTs as a proportion of unsuccessful retrievals is designed to correct for differences in item familiarity or level of difficulty (e.g., Brown, 1991). Thus, the lack of proper name effects for older adults using this measure may imply that the famous names used as targets may have been less familiar/more difficult than the other word types. However, it is worth noting that *age differences* in TOTs for proper names (where older adults experienced more TOTs than young adults) remained significant when the proportional TOT measure was used as the dependent variable.

Recently, Hanley (2011) conducted two experiments comparing correct response rates and TOT rates for proper names and non-names matched for pre-experimental familiarity. Converging with the evidence presented above, more TOTs occurred for

names relative to objects in Experiment 1, an effect attributed to a failure at phonological retrieval. However, object names produced significantly more incorrect responses, suggesting that participants were more inclined to supply an alternate word (e.g., producing *flower* for a picture of a *corsage*) in the object naming condition relative to the face naming condition. Thus, the rate of TOTs for object names may have been underrepresented by participants' willingness to produce an incorrect response. In support of this idea, Experiment 2 found no difference in TOT incidence between the two types of targets when the number of possible "alternate" words was controlled (i.e., using only words that had elicited no incorrect alternates during pilot testing). He concluded that names are not *more* difficult to retrieve; they merely lack feasible alternates, so proper name TOTs cannot be compensated by circumlocutions. It is worth noting that the two experiments in Hanley (2011) used different methods to induce TOTs (the first via pictures and the second via definition), adding an important additional variable that limits direct comparison between the two studies. As such, it seems premature to make such a strong conclusion about the source of proper name retrieval failures.

In sum, extensive research suggests that representations of proper names and non-names differ at the semantic and/or lexical level, a dissociation that causes increased resource burden during the retrieval of names. However, the specific locus of the distinction remains unclear. The few studies that have directly compared TOT rates for names and non-names have differed in some fundamental ways: the mode of TOT elicitation (pictures or general knowledge questions), the features matched between proper name and non-name stimuli, and the dependent measure used to assess TOT

incidence. The present research developed out of a need to confirm the existence of a name/non-name retrieval disparity and to understand how and why this disparity increases with age. The next section will address how current perspectives on proper name retrieval have been extended to explain why the difference between names and non-names seems to be enhanced among older adults, which may provide further insight into the representation of names in memory.

Aging and Proper Name Retrieval

A common theme inherent to explanations of the proper name/non-name disparity and its interaction with age is that names are stored as more isolated representations within the mental lexicon, making them more sensitive to age-related cognitive changes, brain injury, or disease pathology (e.g., Burke et al., 1991; MacKay & Burke, 1991; Semenza, 2006; 2009). Indeed, the subjective reports of older adults suggest that names are involved in more age-linked retrieval failures than other types of words. Older adults' perception of increased name retrieval failures has been corroborated by diary studies examining real-life TOTs among young and older adults (e.g., Burke et al., 1991; Cohen & Faulkner, 1986) as well as a few laboratory studies comparing proper name versus non-proper name retrieval among young and older participants (e.g., Burke et al., 1991; Cohen & Faulkner, 1986; Evrard, 2002; but see Maylor, 1995; 1997). Taken together, these findings support the idea of a *disproportionate* age impairment during the retrieval of proper names, such that age differences (between young and older adults) are larger for proper names compared to non-names, and/or that word class differences (between proper names and non-names) are more pronounced for older adults than for young.

One possibility is that the independent processing stream dedicated to proper name retrieval is simply more resource-demanding compared to other words, putting older adults (who have reduced cognitive resource capacity) at a distinct disadvantage. In his review, Semenza (2006) described an unusual study where participants were asked to recall supraspan (i.e., exceeding typical short term memory capacity) lists of proper names and non-names at sea level and at high altitudes, the latter representing a condition known to reduce cognitive function by causing hypoxia, deprived oxygen levels in the brain (Pelamatti, Pascatto, & Semenza, 2003). Proper name recall was significantly impaired by the exposure to high altitude, whereas non-name recall was relatively resistant to the effects of hypoxia. Specifically, there was a significant reduction in the primacy effect during proper name recall under conditions of high altitude (memory for names at the beginning of the list), suggesting that semantic encoding of proper names into long-term memory was most affected by the deficit in oxygen. Because proper name recall was particularly impaired by hypoxia, it suggests that the retrieval of names may be a more metabolically-demanding task than word recall (Semenza, 2006).

Declines in general cognitive resources may contribute to age-related changes in language function, including proper name retrieval. These ‘resource-reduction’ theories operate on the principle that the human capacity for processing information is limited because a finite pool of resources is shared by competing mental processes that occur simultaneously or in close succession (e.g., Burke & Shafto, 2008). Because older adults have fewer baseline “resources” compared to young adults, they more consistently reach a point where available resources are insufficient to complete the

task. Specific resources implicated in age-related language processes include processing speed, working memory, and inhibitory control. Evidence for a processing speed or “general slowing” account for age-related changes to language (e.g., Salthouse, 1996) comes from older adults’ particular responsiveness to manipulations in the speed with which language processes are being performed relative to manipulations of other variables designed to increase task difficulty. Older adults also exhibit robust impairments in their ability to produce and comprehend syntactically-complex language (e.g., Burke & Shafto, 2008; Kemper, 2006). Working memory declines provide the most intuitive explanation for changes in syntactic processing associated with aging. A shrinking working memory capacity limits older adults’ ability to process complex syntactic structures, and as a result older adults produce sentences with lower syntactic complexity and propositional density (e.g., Kemper, 2006). Finally, the inhibitory deficit (ID) hypothesis (e.g., Hasher & Zacks, 1988; Zacks & Hasher, 1994) suggests that older adults are less adept at suppressing irrelevant information from entering attentional awareness, causing increased word use and off-topic verbosity during discourse production (e.g., Mortensen et al., 2006), and greater distraction from interfering stimuli during reading or listening (Burke & Shafto, 2008). In general, declines in processing speed, working memory, and inhibitory control effectively account for aging-induced limitations on language processes that rely heavily on general cognitive resources. If proper name retrieval is particularly resource-intensive, then it should show larger declines with age than non-name word retrieval.

What characteristics about the representation, organization, and processing of proper names demand more resources? The peculiar semantic qualities of names

described above (arbitrariness, specificity, lack of meaning, and infrequency) may all contribute to why proper names are afforded less stable connections in the lexical-semantic system and thus why proper names increase age differences in retrieval failures. In support of this idea, Fogler and James (2007) examined age differences in TOT states for “descriptive” (or meaningful) and non-descriptive proper names. Older adults, but not young adults, recalled significantly more descriptive names (e.g., *Pink Panther*) than nondescriptive names (e.g., *Charlie Brown*) and were significantly faster in producing the descriptive names. Further, age differences in retrieval failures were larger for nondescriptive targets compared to descriptive targets. The authors argue that when a person views the picture of a character with descriptive name (e.g., *Pink Panther*), it automatically activates characteristics of the referent (e.g., being pink and a panther); if these characteristics are those that are also contained in the name, then the phonology of the name itself also becomes primed. So in a sense, a “lexical” level name representation can be skipped. Additionally, the single connection constraint that is inherent for most proper names may not exist for descriptive names because they have additional connections between the node representing the name phrase and other semantic items, and the multiple connections could reduce age declines in retrieval. Overall, these findings suggest that name descriptiveness is one factor that influences age differences in proper name retrieval.

According to NST and its corollary TDH, the particular difficulty with proper name retrieval among older adults is believed to be caused by the combination of two factors: 1) in the memory system, the lexical representations of proper names receive less activation than those of non-names because proper names are not directly connected to

the semantic properties of the referent, and (2) with age, the cognitive system functions less well, and the units representing memory information receive less activation (e.g., Burke et al., 1991). As discussed in the section on aging and lexical access, older adults' transmission deficits are most obvious when the retrieval of a representation relies on a single connection. Because the retrieval of proper names seems to involve multiple isolated links (e.g., between the semantic system and name phrase node, the name phrase node and the individual first and last name nodes, and the name nodes to their corresponding phonological units), there is a greater likelihood that an age-related transmission failure will result in a retrieval blockage.

Although the subjective experiences of older adults and some empirical data lend support for the notion that aging exacerbates differences between proper name and non-name retrieval, not all studies have found evidence for selective age impairments for proper names relative to other words. The interaction between aging and proper name/non-name status seems to be contingent on the dependent measure used to assess word retrieval (e.g., James, 2006; Maylor, 1995; 1997). For example, James (2006) presented pictures of famous faces and asked young and older participants to name them as well as supply specific semantic information about the depicted targets. An analysis of TOT incidence (the proportion of TOT responses in each condition) revealed an increase in age differences for proper names relative to the biographical information. However, age differences in non-TOT retrieval errors (incorrect responses, unknown responses) were comparable for names and biographical information. Similarly, Maylor and Valentine (1992) asked participants aged 54-84 to complete a series of five tasks in response to picture of faces: structural decisions, familiarity

decisions, semantic decisions, first name decisions, and name retrieval. Regression analyses revealed linear age declines in all tasks except naming, which showed an exponential decline with age. Thus, the difference between proper names and other words may not emerge until the last stage of production, i.e., phonological retrieval, the stage of production wherein older adults have consistently shown exacerbated declines. However, Maylor (1997) reported data from a similar task where participants' responses to pictures of famous faces were categorized as follows: unfamiliar, familiar (but no semantic information available), semantic information (knowledge of biographic facts but no name), and name (proper name given with semantic information). She then computed conditional probabilities that were used to assess the likelihood of retrieving a particular piece of information contingent upon having gotten to the previous stage (e.g., accessing semantics after recognizing the face, accessing the name after activating semantics). Using these conditional probabilities, she reported no exceptional age deficit at the level of name retrieval relative to the earlier stages of face recognition and semantic retrieval. However, participants in these analyses were in their 50s, 60s, and 70s, making it difficult to make comparisons to other studies that use college students as their young adult group. Nonetheless, the mixed results across studies highlight the importance of considering the type of dependent measures used to assess retrieval success prior to making global claim about age-related declines.

So far, the majority of research on proper name retrieval and its decline with age has focused on the semantics of name retrieval, a non-intuitive fact considering that the naming failure stems from a problem during phonological retrieval. Additionally, it is well-established that older adults have greater difficulty with phonological-level

processes compared to semantic-level processes, suggesting that a selective age deficit for names may be caused by characteristics of names that emerge at the phonological level, or the links to it. One possibility is that names consist of lower-frequency phonological components relative to other words, hindering phonological encoding. According to the phonological plausibility hypothesis, names are less restricted by the phonological constraints imposed by a language, so there are a greater number of plausible phonological combinations used in names compared to other words (e.g., Brennen, 1993). Due to the relaxed phonological constraints, names would be more likely to possess very low-frequency phonological units. According to Brennan (1993), we are much more likely to encounter rare or novel syllables when we learn a new name compared to when we learn new words, therefore making it more difficult to encode the new name and integrate it with existing items in the phonological lexicon. Nearly 80% of English words contain the 500 most frequent syllables (e.g., Levelt et al., 1999), so phonological encoding and motor planning procedures are better practiced for high-frequency (HF) syllables compared to low-frequency (LF) syllables (e.g., Cholin, Dell, & Levelt, 2011; Farrell & Abrams, 2011). According to interactive activation models of speech production, words with HF syllables have stronger and more stable connections between the lexical and phonological levels due to the repeated activation of regularly-accessed phonological representations. Each time a syllable is activated, it spreads bottom-up activation to all lemmas sharing that syllables. Over time, HF syllables acquire stronger connections to the lexical layer due to the repeated spreading of activation between the lemmas that contain that syllable. If proper names contain LF phonological forms, they may have weaker lexical-to-phonological connections because

this bottom-up strengthening activity does not occur very often. This assumption would explain why proper names induce more TOTs than other words and why this difference increases with age. Older adults have a greater vulnerability to connections that are “out of practice”, an effect that is particularly noticeable during phonological retrieval of proper names. Conversely, the difficulty with names may be caused the opposite phenomenon: too much sharing of phonology among names. While an individual’s full name is typically unique, most people possess a first or last name that is common among many others, which may cause inhibition during retrieval (e.g., Maylor, 1997; Valentine et al., 1996).

This dissertation aimed to disambiguate the unique contributions of phonological and semantic factors in the disproportionate impairment for proper name retrieval in aging. To elucidate structural differences in the semantic and phonological representations of proper names and non-names, phonological and semantic primes were introduced during different stages of the TOT experience, an implicit way of measuring interactivity between words and names.

Priming and Tip-of-the-Tongue (TOT) States

The application of priming methods to the TOT phenomenon has provided invaluable insight into the time course of lexical access and the level at which retrieval failures occur. Both phonological and semantic primes have been investigated within the TOT literature, with the logic being that each type of prime should be differentially useful depending on when they are encountered during the production process and where the blockage has occurred. Beyond TOTs, research on phonological priming using a variety of speech production tasks has shown that the presentation of a phonologically-related prime word facilitates production, an effect attributed to the level

of phonological encoding (e.g., Abrams, White, & Eitel, 2003; Cutting & Ferreira, 1999; Damian & Martin, 1999; James & Burke, 2000; Meyer & Schriefers, 1991; Schriefers, Meyer, & Levelt, 1990; White & Abrams, 2002). Prior exposure to a prime word (*idol*) activates the phonology it shares with the target (*island*), therefore speeding the time required to retrieve the first syllable of the target for production. Specific to the TOT literature, the implicit presentation of a phonologically-related prime has been shown to reduce the incidence of TOT states as well has increase resolution once a TOT state has occurred (e.g., Abrams & Rodriguez, 2005; Abrams et al., 2003; James & Burke, 2000; Meyer & Bock, 1992; White & Abrams, 2002). Because TOTs occur when some or all of the phonological components of an intended word are temporarily inaccessible, the presentation of phonological prime is presumed to send activation to the blocked phonology through an alternate route, thereby attenuating the occurrence of TOTs and facilitating increased retrievals after TOTs have occurred. Despite weakened links to phonological forms, older adults in their 60s and early 70s (i.e., young-old adults) experience reduced TOT incidence and boosts in TOT resolution due to phonological priming (e.g., Abrams, Trunk, & Merrill, 2007; James & Burke, 2000; White & Abrams, 2002). Differences in the size of priming effects between young and young-old adults have been inconsistent and unreliable, with young adults experiencing more priming in some studies (e.g., Abrams et al., 2007) but not in others (e.g., James & Burke, 2000; White & Abrams, 2002). However, there seems to be a limit on the extent to which transmission deficits can be offset by priming. TOT resolution in older adults in their mid-70s and older (those with the most extensive declines in connection strength) is not

affected by priming, at least with a single initial syllable (Abrams et al., 2007; White & Abrams, 2002).

Phonological priming has recently been shown to influence the incidence (e.g., Burke et al., 2004) and resolution (e.g., White, Abrams, & Frame, in press) of proper name TOTs. Burke et al. (2004) found that participants experienced fewer TOTs for proper name target pictures (e.g., *Brad Pitt*) when they had recently produced a homophone of the target's name (e.g., *pit*) in response to a definition compared to an unrelated word (e.g., *cane*). Similarly, White et al. (in press) reported phonological priming of TOT resolution when TOTs for famous proper names were elicited via general knowledge questions (e.g., *What actor-screenwriter directed and starred in the film Annie Hall?*" Target = *Woody Allen).* Participants were more likely to resolve their TOTs when the subsequent question contained a prime with the same first name as the target (e.g., *Woody Harrelson*).

Although TOTs for both proper names and non-names benefit from phonological priming, priming effects are moderated by specific characteristics of the prime, including grammatical class and first-syllable frequency (for non-names), and semantic category (for names). Among non-names, phonological primes facilitate TOT resolution only when the prime is a part of speech different from the target (Abrams & Rodriguez, 2005; Abrams et al., 2007). At the level of phonology, Farrell and Abrams (2011) found that the size of phonological priming effects was contingent on the frequency of the first syllable shared between target and prime. Larger priming effects on TOT resolution were observed when the target had a LF first syllable compared to a HF first syllable, a pattern that was constant across age groups. Both effects have been attributed to

interference from phonological competitors, even after initial lexical selection has been completed. Because similar-sounding words from the same grammatical class might be viable candidates for selection, they compete with the TOT target and forestall target retrieval. Similarly, syllable frequency moderates the size of priming effects by determining the number of partially-activated lexical candidates. Because HF syllables occur in many other words, priming is diffusely distributed among more alternate words, therefore reducing the priming effect for targets with HF syllables compared to LF syllables.

At present, it remains unclear whether phonological primes exert analogous effects on proper names, although recent research suggests that names are also susceptible to competition from similar-sounding names when they are viable candidates for selection. White et al. (in press) found that TOT resolution for a famous target (*Elton John, a singer*) was marginally higher following the presentation of a prime with the same first-syllable as the target's first name compared to an unrelated word, but only when the prime was from a different semantic category (*Elmer Fudd, a cartoon character*). First syllable primes had no effect on TOT resolution when the prime was from the same semantic category (*Elvis Presley, a singer*). In contrast, primes that shared an entire first name as the target (described above) universally boosted TOT resolution, regardless of semantic category. These results were taken to suggest that the phonological input from a single syllable is insufficient to prime target retrieval when there is also competition at the semantic level. It is interesting to note that priming effects from first-syllable primes were only marginal, even for different semantic category primes. Relative to non-names, it may be more difficult for a single syllable to

send enough activation to a proper name target to facilitate its retrieval due to the sheer number of connections engaged during proper name retrieval. As shown in Figure 1, there are connections between the name phrase and the individual first and last name nodes, then numerous connections between the first/last name nodes and their phonological subcomponents. In contrast, TOTs for a word would only involve the connections between the lemma and its phonological subcomponents.

Alternatively, if names contain lower-frequency phonological units compared to other words, they may show larger priming effects because priming will spread to fewer phonologically-related candidates. In support of this idea, one of the case studies described in Semenza's (2006) review involved a patient that could retrieve proper names when given the first phoneme of a proper name, but not when given the first phoneme of non-proper nouns. Semenza argued that proper names are better able to benefit from the phoneme cueing because of the one-to-one connection between the proper name representation and its phonology, i.e., less opportunity for competition. In sum, there is evidence to suggest that proper names may require more phonology to show priming effects due to increased competition from similar-sounding names and the greater number of steps involved during retrieval, which may weaken priming over time. Conversely, names may benefit more from priming due their possession of infrequent phonology, which would allow for priming to be distributed among fewer lexical candidates.

Research investigating semantic priming effects on TOTs and correct word retrieval is less consistent, in that semantic primes can be facilitative or inhibitory depending on the type of task. Among non-names, some production tasks, such as

word naming, have shown facilitation from semantic priming presumed to be caused by spreading activation between conceptually-related words, allowing for heightened semantic activation of a target (see Farrell, Abrams, & White, 2012, for a review). In contrast, semantic interference has been reported in other production paradigms, such as picture-word interference, where naming a target picture (e.g., *lion*) is slowed by the presence of a semantic associate word (e.g., *tiger*) presented prior to or simultaneously with the target picture (Cutting & Ferreira, 1999; Sailor, Brooks, Bruening, Seiger-Gardner, & Guterman, 2008; Schriefers et al., 1990; Starreveld & La Heij, 1995, 1996). Theoretically, interference from a semantically-related alternate word would occur if it initiates competition at lexical selection, thereby slowing or preventing the selection of the correct target, while semantic facilitation would occur when there is spreading activation within the semantic system that does not result in the activation of lexical competitors. Because TOTs are thought to be caused by failed phonological retrieval following successful lexical activation, semantic primes should not impact TOT states but might exert an influence on correct target retrieval.

In support of this idea, a few studies have shown that semantically-related cues presented prior to, or concurrently with a TOT question, did not affect the incidence of TOTs relative to unrelated words (e.g., Jones, 1989; Meyer & Bock, 1992, Experiment 1) but increased the proportion of correct responses (Meyer & Bock, 1992, Experiment 1 and Experiment 2). However, one study (Meyer & Bock, 1992, Experiment 2) found that semantically-related cues increased TOT responses compared to unrelated words when presented *after* an initial response failure. It is important to note that in this methodology participants were told that the cues might provide some information about

the target word, so the results represent explicit search strategies as opposed to implicit spreading activation from semantically-related words. Therefore, it is unclear whether increased TOTs in the semantic cue condition resulted from participants becoming fixated on the cue itself (therefore hindering target retrieval) or from automatic processes like spreading activation. Nonetheless, evidence for increased TOTs from semantic cues necessitates the need for further research on the role of semantic competitors in causing TOTs and in preventing TOT resolution. Finding semantic interference from implicitly-presented semantic primes would suggest that there may multiple sources of retrieval failures that result in TOTs, such as incomplete activation of a target's lexical representation (e.g., Caramazza & Miozzo, 1997).

An interesting empirical question is whether proper name retrieval is similarly susceptible to semantic interference and/or facilitation as is non-name retrieval. Because of the semantic irregularities associated with proper names, there is reason to suspect that proper names may behave differently when presented with a semantic prime than do non-names. For example, Vitkovitch, Potton, Bakogianni, and Kinch (2006) found that participants produced fewer naming errors and time-out responses when naming pictures of famous faces (e.g., *Nicole Kidman, an actress*) if they had named a semantically-related face three trials previously (e.g., *Julia Roberts, an actress*). In Experiment 1, primes and targets were from the same occupational category but were not often linked to one another. However, the facilitation effect held in Experiment 2 when the prime and targets were also semantic associates (e.g., *Jamie Oliver-Gordon Ramsey, celebrity chefs with television shows*) and in Experiment 3 when the prime was presented in word form instead of a picture. Thus, the authors concluded

that semantic-lexical processing of proper names differs from non-names in that it involves little or no competition at the lexical level.

Only one published study has investigated the influence of purely-semantic primes on proper name TOTs specifically. Cross and Burke (2004) found that the incidence of TOTs for famous names (e.g., *Audrey Hepburn*) was not affected by prior production of a famous character that the target has played (e.g., *Eliza Doolittle*). However, the character priming manipulation did reduce the proportion of incorrect responses. This pattern suggests that spreading activation within the semantic network allowed for the prior production of the character to trigger activation of the target's lexical representation, thereby enabling more correct responses. However, because TOTs are caused by a breakdown in the lemma-to-phonology link, semantic priming had no effect on this later stage in the production process.

In sum, semantic and phonological primes exert differential influences on word retrieval depending on when they are encountered during production. As yet, no studies have directly compared the effectiveness of priming on proper names and non-names, which may serve as a useful tool in establishing how these word types differ in terms of their representations at the semantic and phonological levels.

The Current Research

How names are differentially represented from non-names and whether this separation renders name retrieval more difficult compared to other words remains a subject of empirical and theoretical contention. Moreover, the question of whether older adults have disproportionate difficulty during name retrieval is even more complex and inconsistent. This dissertation aimed to clarify these issues by directly comparing the two word types within a single paradigm and by controlling as many features of the

stimuli as possible. The first phase of the project consisted of a pilot study to assess young and older adults' perceived familiarity with potential proper name and non-name stimuli and to assess semantic similarity among target-prime pairs. The ultimate goals of the project were to examine the extent to which the disproportionate age deficit for names is caused by semantic-level factors (as proposed by many theoretical perspectives), phonological-level factors (as proposed by the current author), or a combination of the two. To accomplish this end, two TOT experiments were conducted to compare the influence of phonological (Experiment 1) and semantic (Experiment 2) primes on the incidence and resolution of TOT states for names and non-names. The influence of both types of primes differed as a function of age and target type, revealing structural differences in the retrieval pathways dedicated to proper name and non-name retrieval and links that are most vulnerable to aging. Further, the retrieval of both types of targets were strongly linked to first syllable frequency, providing novel insights into the lexical-to-phonological connections of proper names and other words and how these connections change throughout the lifespan.

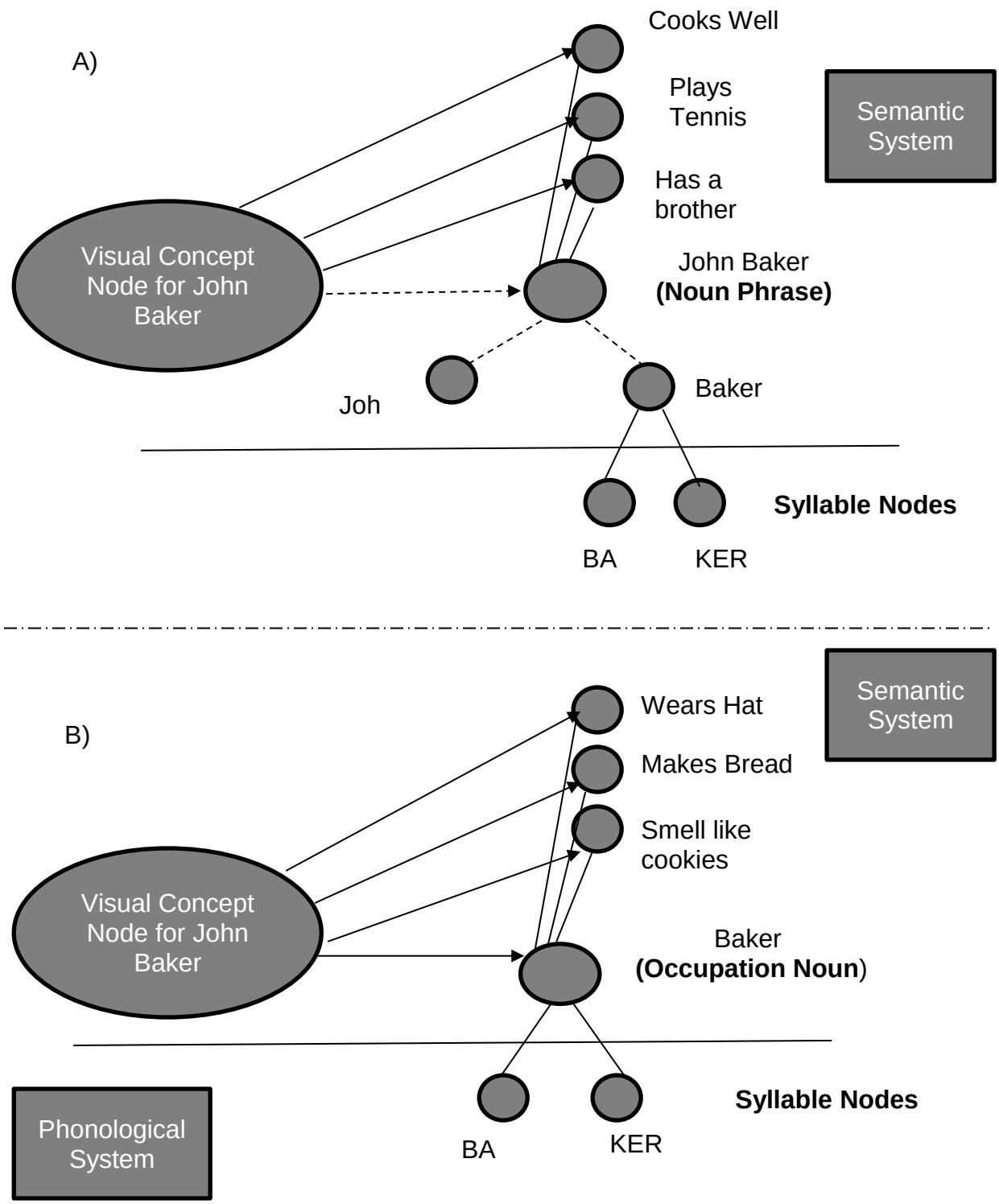


Figure 1-1. Representation of Proper Names and Non-Names according to NST (adapted from MacKay & Burke, 1991).

CHAPTER 2
PILOT STUDY

Method

Data Collection and Participants

Participants consisted of 18 young adults (*M* = 19.32, *SD*= 1.25, range = 18–22 years) and 18 older adults (*M* = 77.4, *SD* = 8.8, range = 60-92 years). Young adults were recruited from the Psychology Research Participation pool at the University of Florida. Older adults were primarily recruited from the Cognition and Aging Lab Older Adult Pool, a database of community-dwelling volunteers living in Gainesville and surrounding areas.

Materials

One-hundred fifty non-names and 150 famous proper names were developed for the pilot study. Because the ability to conduct TOT resolution analyses is reliant upon the number of TOTs participants experience during an experimental testing session, 47 proper names and 72 non-names known to induce high rates of TOTs, based on previous research in our laboratory, were selected. One hundred three new proper names and 78 non-names were also developed in an attempt to find more items that were potentially susceptible to TOTs and were reasonably familiar to each age group. Non-name and proper name targets were selected from a variety of semantic categories, described in greater detail in the experimental methods.

Each target was paired with (1) a phonological prime word/name, (2) a semantic prime word/name, and (3) an unrelated word/name. For the non-name targets, the phonological prime word contained the same phonological first syllable as the target, as determined by an online dictionary (http://www.merriam-webster.com/), and was

unrelated to the target in meaning. Previous TOT research has demonstrated that phonological priming is only effective when the prime is from a different part of speech as the target (Abrams & Rodriguez, 2005; Abrams et al., 2007). Therefore, I selected phonological primes that were from a different grammatical class as the target (e.g., a verb, adjective, adverb, interjection) in order to maximize phonological priming effectiveness. Semantic primes were synonyms for the target word, superordinate/subordinate members of the same semantic category, or words that share defining semantic features with the target. To maximize the semantic similarity between targets and primes, semantic primes were the same part of speech as the target (both were nouns). The unrelated words, half of which were nouns and half of which were non-nouns, were semantically and phonologically unrelated to the target.

For proper name targets, the phonological prime's first name began with the same first syllable as the target's first name (e.g*., **Al**bert Einstein* for ***Al**fred Hitchock*). Phonological prime names and the unrelated names were the same gender as the target but differed in terms of occupational category and visual similarity in order to eliminate any semantic relation to the target. The semantic primes came from the same occupational category as the target and were the same gender. Semantic primes for non-fictional targets were also the same race/ethnicity as the target with the exception of three targets. Target names that are fictional characters were paired with semantic primes that are also fictional characters within the same modality. More details and examples for both types of targets and their phonological, semantic, and unrelated primes are provided in the experimental method.

Procedure

The pilot study consisted of two major subsections. In the first subsection, participants were asked to rate their knowledge and familiarity with half (75) of the non-name target words and half (75) of the proper name targets. In the second subsection, participants were asked to make semantic similarity judgments between the remaining 75 non-names targets and either their semantic, phonological, or unrelated prime and between the remaining 75 proper name targets and either their semantic, phonological, or unrelated prime. As such, participants saw each target only once and either rated their familiarity with the target or rated the target's semantic similarity to one of its primes.

The pilot study began with the non-name familiarity rating task. Participants were told that they were going to be asked to rate their familiarity with famous names and uncommon words. To discourage the inflation of familiarity ratings due to participant response bias, the participants were told that the names and words were developed for a variety of age groups and were not expected to know them all. They were then presented the following instructions: "First, you will be presented uncommon words one at a time. Your task is to think about how familiar you are with each word. For each item, decide how well you know the word on a scale of 1 (completely unfamiliar) to 5 (very familiar). Use the following scale to guide your responses." A 5-point Likert scale with descriptions for each numeric option was presented below the instructions (Figure 2-1). Once participants indicated that they understood the task and scale, the experimenter pressed the Space Bar key to begin the study. Each trial was preceded by a fixation cross displayed in the center of the screen, and the experimenter pressed Enter to begin the trial. Targets were displayed one at a time and were centered in the

upper one-third of the screen. The Likert scale was displayed below the target during each trial. Participants were asked to make their selections out loud, and the experimenter recorded their responses via key press (i.e., 1, 2, 3, 4, or 5).

After going through all non-name targets, participants were then presented with the following instructions: “Instead of words, you will now see names of famous people. For each name, decide how familiar you are with that person. When determining familiarity, think about how many facts you know about each person and how regularly you encounter the name. Use the following scale to guide your responses.” A unique scale was developed for the proper name targets to assist participants in assessing their familiarity with famous names (Figure 2-2). The same procedure used for non-name familiarity ratings was used for the 75 proper name targets, with proper name targets displayed above the scale.

After participants completed the familiarity ratings, they were then asked to make judgments about the semantic similarities between the non-name targets and their primes. Each target that was not rated for familiarity during the first subsection was presented in conjunction with its semantic, phonological, or unrelated prime word. Using a 3-point Likert scale, participants were asked to assess how closely the target and primes were related to each other in meaning (Figure 2-3). Participants were given the following instructions for the non-name targets: “In this next task, you will be shown pairs of words. For each pair, think about how similar in meaning the two words are to one another, and then rate their similarity using the scale below. It may help to think about how many 'features' the two words have in common. For example, the words 'dog' and 'cat' are STRONGLY RELATED because they are both animals, mammals

with fur, and domestic pets, and you would say 3. 'Dog' is SOMEWHAT RELATED to 'snake' because they are both animals (you would say 2), but COMPLETELY UNRELATED to the word 'boat' because they share no common features (you would say 1). Although some of the words may sound similar, only consider the words' meanings when determining your rating. If you do not know the meanings of one or both words, select 9 (unknown)." Once the experimenter was confident that the participant understood the similarity ratings task, the experimenter pressed Enter to begin the next subsection. As with the familiarity ratings, each trial began with a fixation cross to ready the participants. The target words were displayed directly above the prime words, and the word pairs were centered approximately one third of the way down from the top of the screen. The scale appeared below the word pairs on each trial, and the experimenter recorded the participants' verbal responses (1, 2, 3, or 9).

After going through all 75 non-name targets, participants performed the same task for the remaining 75 proper name targets. They were given the following instructions "In this section, you will see pairs of famous names. Your task is to decide how similar the two people are to one another in terms of their biographical characteristics (e.g., age, era, occupation), personality features (funny, mysterious), and public personas (e.g., political enemy, villain). For example, Robert DeNiro and Al Pacino are STRONGLY RELATED because they are both actors, of Italian descent and have played tough guys in Mobster movies, so you would say 3. DeNiro would be SOMEWHAT RELATED to Brad Pitt because they are both actors (you would say 2), but COMPLETELY UNRELATED to Benjamin Franklin because they lived in different eras, held different occupations, and have dissimilar personas (you would say 1). If you don't know one or

both names, select 9 (unknown). Note that all pairs contain to two people from the same gender, so gender should not be used as a criteria to judge similarity. Although some of the names may sound similar to one another, think about the characteristics of the people and not their names when making your judgments." Because the nature of semantic relatedness is thought to differ for names, a modified scale was developed for the proper name similarity ratings task (Figure 2-4).

Results

The pilot test had the following specific aims: (1) to find a subset of targets that were sufficiently familiar to both young and older adults, (2) to address potential age differences in participants' familiarity with each type of target, and (3) to confirm that the semantic primes were more closely related to their targets than either the phonological or unrelated prime words. To address the first goal, a 2 (Age Group: Young, Older) X 2 (Target Type: Non-Name, Name) mixed factorial ANOVA was conducted by items on the mean familiarity ratings. Results revealed that older adults (M = 4.1) rated the targets as more familiar overall than young adults (M = 2.9), F (1, 298) = 430.2, MSE = .528, $p < .001$, and that non-names (M = 3.95) were rated as more familiar than names (M = 3.0), F (1, 298) = 178.44, MSE = .752, $p < .001$. The Age Group X Target Type interaction was not significant, $F < 1$, p = .528. Although the lack of interaction revealed that both age groups were less familiar with the proper name targets, the primary point of concern was that young adults' ratings of familiarity with the proper names was especially low, identifying the targets as "Somewhat Unfamiliar". Because the most important objective was to identify a subset of items that would be moderately familiar to each age group (Aim 1), the first step was to remove the proper names targets with the lowest familiarity ratings as well as those that elicited high rates of 'Unknown"

responses during the semantic similarity ratings task. The primary focus was to remove items that were especially unfamiliar to young adults, in an attempt to reduce age differences in familiarity (Aim 2). Finally, I removed items where the semantic similarity ratings were not sufficiently higher in the semantic prime condition relative to the phonological or unrelated prime, thereby indicating a weak semantic relation to the semantic prime and/or low familiarity with the targets and primes (Aim 3).

The removal of these items resulted in 76 non-name targets and 76 proper name targets (Table 2-1 for descriptive statistics on the familiarity and similarity ratings for each age group). Half of these items were “matched” on first syllable in that the non-name target has a corresponding proper name target with the same first syllable. A 2 (Age Group: Young, Older) X 2 (Target Type: Proper Name, Non-Name) mixed-factorial ANOVA by items was used compare the mean familiarity ratings for proper name and non-name targets among young and older adults. Results revealed a significant main effect of target type, F (1, 150) = 83.2, MSE = .338, $p < .001$, where non-name targets (M = 4.0) were rated as more familiar than proper name targets (M = 3.5). There was also a significant main effect of age group, F (1, 150) = 215.09, MSE = .469, $p < .001$, where older adults (M= 4.35) were significantly more familiar with targets than young (M = 3.2). The Age Group X Target Type interaction was not significant, $F < 1$, $p > .457$. Although the pattern was similar to the analysis on all stimuli, the removal of items resulted in a meaningful increase in familiarity with each target type, such that now both categories of targets were rated as “Vaguely Familiar” or higher by both age groups. The lack of an interaction between age and target type is especially important for this study because any disproportionate age differences in TOTs for names versus non-

names cannot be attributed to familiarity discrepancies; in other words, older adults are more familiar with both word types than young adults, and to the same extent.

To assess whether the semantic primes were given higher semantic similarity ratings than the phonological and unrelated primes for young and older adults, a 2 (Age Group) X 3 (Prime Type: Semantic, Phonological, Unrelated) mixed factorial ANOVA was conducted by items on the mean semantic similarity ratings for each item. Results revealed a significant main effect of prime type, F (2, 240) = 1131.29, MSE = .14, p < .001, where semantic primes (M = 2.57) were rated as more similar to the target than either the phonological (M = 1.16) or unrelated primes (M = 1.17), which did not differ. There was also a significant main effect of age group, F (1, 120) = 5.18, MSE = .105, p = .025, where young adults (M = 1.66) rated the primes as more semantically similar to the target than did older adults (M = 1.6). There was a significant Age Group X Prime Type interaction, F (2, 240) = 13.624, MSE = .099, p < .001, such that young adults provided higher ratings of similarity than older adults for the phonological and unrelated primes (ps <.001), but lower ratings of similarity for the semantic primes (p = .042). This may reflect the fact that young adults were less certain of the meanings of the phonological and unrelated primes so were more liberal with their ratings of similarity to avoid “unknown” responses. Nonetheless, both young and older adults rated the semantic primes as more similar than either the phonological or unrelated primes (ps < .001), which did not differ from one another (ps> .264).

Table 2-1. Means and standard deviations for familiarity ratings and semantic similarity ratings in the pilot study

	Age Group	
	Young	Older
Non-Name Targets		
Familiarity Rating	3.5 (.65)	4.6 (.32)
Phonological Prime's Semantic Rating	1.2 (.36)	1.1 (.19)
Semantic Prime's Semantic Rating	2.6 (.41)	2.7 (.35)
Unrelated Prime's Semantic Rating	1.2 (.3)	1.1 (.17)
Proper Name Targets		
Familiarity Rating	2.8 (.78)	4.1 (.69)
Phonological Prime's Semantic Rating	1.2 (.34)	1.1 (.25)
Semantic Prime's Semantic Rating	2.4 (.58)	2.5 (.47)
Unrelated Prime's Semantic Rating	1.4 (.46)	1.1 (.19)

*Note: Familiarity Ratings are based on a 5 point scale (1= Completely Unfamiliar, 5= Very Familiar). Semantic similarity ratings are based on a 3 point scale (1= Completely Unrelated, 3= Strongly Related).

1	2	3	4	5
Completely Unfamiliar	**Somewhat Unfamiliar**	**Vaguely Familiar**	**Familiar**	**Very Familiar**
I have never heard this word and could not define it or describe anything about it	I have heard the word but could not define it or use it in a sentence	I have heard the word and produced it before. I could not give a definition or use it in a sentence, but I may be able to select the correct definition if given choices	I hear and use the word occasionally. I could use the word correctly in a sentence and could easily define it	I hear and use the word regularly and could provide a clear definition of the word

Figure 2-1. Familiarity rating scale for non-name targets

1	2	3	4	5
Completely Unfamiliar	**Somewhat Unfamiliar**	**Vaguely Familiar**	**Familiar**	**Very Familiar**
I have never heard of this person and could not tell you a single fact about him or her	I think I have heard this name before, but I am fairly sure that I have never talked about this person. I could not tell you anything about him/her with any confidence	I have heard or talked about this person before, but it would be difficult to tell you more than a single fact about him or her	I hear and talk about this person occasionally. I could probably tell you a couple of facts about him or her	I talk about this person often and could tell you many facts about him or her

Figure 2-2. Familiarity rating scale for proper name targets

1	2	3	9
Completely Unrelated	**Somewhat Related**	**Strongly Related**	**Unknown**
The two words share no common features and are not similar in meaning	The words' meanings share at least one common characteristic. For example, they are from the same basic category: animal, object, tool, abstract concept, food, plant, etc.	The words come from the same specific category, are united by a common concept, have multiple shared characteristics, or are synonyms	I do not know the meaning of one or both words

Figure 2-3. Semantic similarity rating scale for non-name targets

1	2	3	9
Completely Unrelated	**Somewhat Related**	**Strongly Related**	**Unknown**
Besides gender, the two people do not have a single feature in common	The two people have the same occupation, and I could probably name 1 or 2 additional features the two people have in common	The two people have the same occupation and age range, and I could name 3 or more additional features they have in common	I am unfamiliar with one or both names

Figure 2-4. Semantic similarity rating scale for proper name targets

CHAPTER 3
EXPERIMENT 1: PHONOLOGICAL INFLUENCES ON NON-NAME AND PROPER NAME TOTS

Specific Aims

Specific Aim 1

- To examine the role of phonological frequency in the disproportionate impairment for proper name retrieval and its interaction with age.

Only a handful of studies have directly compared the retrieval of names and non-names in single laboratory study, and the heterogeneity of methods and dependent measures have made it difficult to draw strong conclusions about the presumed disparity between name and non-name retrieval. As such, the fundamental goals of the study were to confirm the distinction between proper names and non-names in terms of retrieval difficulty and to investigate how differences between word types are affected by aging. Assuming that names induce more TOTs than non-names, especially for older adults, the second goal of this project was to clarify the characteristics of names that make them more susceptible to retrieval failures. Of particular interest was how phonological frequency (i.e., first-syllable frequency) would moderate the relationship between target type and age group. One possibility was that names' possession of low-frequency phonological forms might make them particularly vulnerable to age-related retrieval failures, accounting for the disproportionate age-related deficit for proper names. An alternative possibility was that similar-sounding names might interfere with name retrieval due to the sharing of first names and surnames, which would cause names with many first-syllable neighbors (HF first syllables) to be more susceptible to TOTs.

Specific Aim 2

- To investigate how phonological *priming* may attenuate the proper name/non-name retrieval disparity and its increase with age.

Because TOTs are thought to be caused by insufficient activation of an intended word's phonology, presenting some the phonology of a target through priming should reduce the proportion of TOTs overall. Previous exposure to the full phonology of a target has been shown to reduce TOTs and increase correct responses for both names (Burke et al., 2004) and non-name targets (James & Burke, 2000). However, the present study was the first to directly compare the effectiveness of phonological priming for proper names versus non-names using identical methods. It was also the first to assess phonological priming effects on TOT incidence for proper names using *only* the target's first syllable (but see Meyer & Bock, 1992, which used a cueing methodology). There were *a priori* reasons to suspect that proper names would benefit more from priming due to the solitary connections between semantic/lexical and phonological representations. Conversely, proper names may require more phonological input than a single syllable to show robust priming effects (e.g., White et al., in press). Priming was expected to reduce age differences in TOT rates by compensating for age-related transmission deficits to phonological forms.

It was unclear how phonological priming from only a single syllable would influence the proportion of correct responses, a less direct indicator of phonological activation than the proportion of TOT states. Theoretically, the rate of correct responding would be linked more strongly to successful spreading activation from the semantic level to the lexical representation of the correct target, and as such should be less influenced by phonological priming than TOTs. Although previous research has

shown that phonological priming can increase the proportion of correct responses (Burke et al., 2004; James & Burke, 2000), both studies presented the entire phonology of a target either through the use of homophones, in the former case, or multiple prime words, in the latter case. Thus, providing the first syllable of the target through implicit priming may or may not provide enough bottom-up activation to exert an influence on lexical selection and the proportion of correct responses. It was predicted that phonological primes presented before the target question would reduce TOTs (for which the activation of the first syllable is critical) but would have minimal influences on the proportion of correct responses (which is more dependent on earlier processes such as lexical selection).

Specific Aim 3

- To evaluate the effectiveness of phonological priming on successful TOT *resolution* as a function of the speaker's age, the target type, and the target's first syllable frequency.

Previous research has demonstrated that encountering the phonology of a forgotten word is more helpful at facilitating TOT resolution when the word begins with a LF first syllable compared to a HF first syllable (Farrell & Abrams, 2011). Presumably, priming is less beneficial for words with HF phonological forms because there are many alternate words to compete with the target at the lexical level, therefore reducing the facilitation effects occurring at the phonological level. If this effect should hold, priming of TOT resolution should be more effective for proper names than non-names because there are fewer individual words sharing phonology (e.g., Brennen, 1993) and thus less opportunity for lexical competition. Conversely, because the lexical-phonological representations of proper names require the activation of multiple isolated links, phonological priming from a single syllable may be less useful in facilitating TOT

resolution for names compared to non-names. The influence of priming on phonological and lexical level processes was not expected to differ as a function of age, as the prime word should effectively offset the age-related decline in phonological activation.

Method

Participants

Young adults (Range = 18-28 years) were recruited from various sources in the Gainesville area, including University of Florida courses, local fliers, and advertisements placed on internet classifieds. Participants from the University of Florida Undergraduate Psychology Participant pool or the Undergraduate Linguistics Participant pool received partial course credit for participation, and individuals recruited via outside sources received $10 compensation for their time. Older adults (Range = 60-75 years) were also recruited using a variety of methods, including the existing Cognition and Aging Laboratory participant pool database, email solicitations to University of Florida alumni, and advertisements at retirement communities and senior centers in Gainesville, Florida, and Fort Myers, Florida. Older adults were compensated at a rate of $8/hour. All participants were native English speakers with normal or corrected-to-normal vision and hearing and no diagnosis of a learning disability or cognitive impairment. Prior to completing the experiment, both age groups were asked to complete a brief demographic questionnaire to collect information about their health and educational history. This step was particularly important for older adults in order to rule out any existing conditions (e.g., stroke) that may impact cognitive performance. Older adults then completed the Mini Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975) as a cursory screen for dementia and were required to score 25 or above to be included in the study.

One older adult participant was removed from analyses because of a low MMSE score, resulting in 62 young adults (*M*= 19.4, *SD* =1.6) and 43 older adult (*M* =68.2, *SD*= 4.7) participants. Young adults were evenly represented by males and females. Older adults consisted of 35% males and 65% females. Full descriptive statistics regarding participants ’age, health, education, and cognitive performance are displayed in Table 3-1. Independent samples t-tests were used to compare the two age groups on the following dimensions: perceived health rating relative to others at same age (on a 10 point scale), years of education, vocabulary (25-item multiple choice test requiring participants to select the nearest synonym to an uncommon word), forward digit span (the number of digits that could be recited back to the experimenter in the same order), and backward digit span (the number of digits that could be recited back to the experimenter in reverse order). Relative to the young adult group, older adults had more years of education, higher vocabulary scores, and shorter forward digit spans (*p*s <.001). The age groups did not differ on their ratings of health or backward digit span (*p*s > .261).

Materials

Seventy six proper names and 76 uncommon non-name nouns were selected from the pilot study to serve as targets during the TOT elicitation task. Each target’s first syllable frequency was provided by the CELEX database (Baayen, Piepenbrock, & Gulikers, 1995), the only normative corpus that provides syllable frequency measures in English. First-syllable frequency was defined as the summed frequency of words containing a particular syllable in the onset position. For the proper name targets, first syllable frequency was based on the first syllable of the first name. Although the corpus includes few proper names, it was used to ascertain the frequency of each proper name

target's phonological first syllable by finding the syllable's frequency of use among existing non-names within the database. If the syllable did not appear in the CELEX database, it was assigned a frequency value of 0. Half of the targets were categorized as having a HF first syllable and half were categorized as having a LF first syllable, as determined by a median split within each target type (*median* = 498 for non-names, 361 for names). Example non-name and proper name targets with HF and LF first syllables are shown in Table 3-2 and Table 3-3, along with the mean syllable frequency for each category. Importantly, there was a subset of stimuli for which syllable frequency did not differ between non-names and proper names because they possessed the same first syllable: Half of the non-name targets had a proper name counterpart with the same first syllable (e.g., *Audiologist/Audrey Hepburn*; *Diameter/Diane Sawyer*).

Non-name targets were nouns from a variety of semantic categories, including objects (*kaleidoscope*), abstract words (*nostalgia*), procedures/processes (*photosynthesis*), people (*equestrian*), literary terms (*acronym*), and actions (*arson*). Proper name targets were also selected from a variety of occupational categories, including actors (*Eddie Murphy*), living politicians and world leaders (*Rudy Giuliani*), historical figures/presidents (*Herbert Hoover*), artists/writers/directors/musicians (*Andy Warhol*), athletes (*Michael Phelps*), fictional characters (*Betty Boop*), entrepreneurs and name brands (*Orville Redenbacher*), and miscellaneous celebrities and "news-makers" (*Monica Lewinsky*). Among the 76 proper name targets, 52 were male and 24 were female. Targets were also selected from a variety of time periods, although the distribution favored historical figures and celebrities born prior to the young adult age range. Nineteen targets were born prior to 1900, 11 were born between 1900 and 1919,

15 were born in the 1920s and 1930s, 13 were born in the 1940s and 1950s, 12 were born in the 1960s and 1970s, and 6 were born in 1980 or later.

Each target was paired with a phonological prime word and an unrelated word. For non-names, the phonological prime had the same first syllable as the target but was from a different grammatical class (26 verbs, 49 adjectives, and 1 adverb). The unrelated words were a mix of nouns (39) and non-nouns (12 verbs, 25 adjectives) and were used in both Experiment 1 and Experiment 2. The unrelated words had no phonological or semantic relation to the target. For proper names, the phonological prime's first name had the same first syllable as the target's first name. Both the phonological prime name and the unrelated name were the same gender as the target but came from a different occupational category in order to minimize the semantic relation to the target (Table 3-2 and Table 3-3 for example targets and primes).

A trivia-style question was developed for each target that was designed to elicit the target as the answer. For non-name targets, the question asked the participants to provide the specific word that embodies a definition (e.g., *What do you call a word or abbreviation, such as CEO, that is formed by taking the first letter or letters from each word in a phrase?* Target = acronym). Target questions were written to include enough specific details so that there was only one correct answer to the question (i.e., the target). This task proved very difficult for some of the non-names targets that had very close synonyms or semantic associates (e.g., tyrant, christening). In these cases, we inserted a phrase to discourage the production of an alternate word (e.g., *"not dictator", "another word for baptism"*). For proper name targets, the questions asked the participant to supply the name of a famous person based on biographical information

(e.g., *Which English filmmaker was the master of suspense, making films such as Psycho and Vertigo?* Target= Alfred Hitchcock). At least two to three biographic details were embedded in the proper name target questions to account for the fact that young and older participants may have been exposed to the famous names in different contexts. The non-name and proper name target questions were controlled for word length so that differences in comprehension difficulty could not account for effects of target type (refer to Table 3-4 for mean word length of all questions). A one-way ANOVA confirmed that non-name target questions and proper name target questions did not differ in word length, F (1, 150) = 1.37, MSE = 35.61, p = .244. Importantly, target questions were carefully written so that none of the target's phonology was contained within the words in the questions.

The phonological prime and unrelated words were embedded in questions that were presented before or after the target questions. The answers to the prime/unrelated questions were phonologically and semantically unrelated to the target. Outside the phonological prime, none of the other words in the questions contained the target's phonology. None of the prime questions (phonological, semantic, unrelated questions for non-name and proper name targets) differed from one another in terms of word length, *p*s >.17. All target, phonological prime, semantic prime and unrelated questions can be found in the Appendix.

Procedure

After providing consent and completing the background questionnaire and MMSE (older adults only), participants took part in the TOT elicitation task, which was presented on PC-compatible computers via a program written in Visual Basic 5.0. Participants were informed that would be answering general knowledge questions

whose answers were famous names, uncommon words, or biographical facts about a person or event. For each question, participants were asked to indicate whether they knew the answer (and could provide target word or a proper name's first and last name), did not know the answer (not familiar with the word or name), or were having a TOT (currently unable to retrieve the word or name but certain that the answer is known and on the verge of being produced). Participants were told to respond quickly in order to reduce age differences in response times, avoid excessively long testing sessions, and minimize circumstances where participants experienced a TOT but waited long enough to resolve it before moving the next question. The experimenter began the TOT elicitation task once it was clear that the participant was familiar with the procedure and understood the definition of a TOT.

Questions were displayed in the center of the screen, approximately one-third from the top of the screen. Each trial consisted of a pre-target question, the target question, and a post-target question, although the post-target question was only presented when the participant had a TOT for the target (Figure 3-1 for a flowchart of procedure). The target question was then re-presented after the post-target question in order to give the participants an opportunity to resolve their TOT. The pre-target question contained the phonological prime on half of the trials and the unrelated word/name on the remaining half of trials. Two counterbalanced versions of the experiment were developed so that an equal number of participants received a given target's phonological prime/unrelated word as the pre-target question. Then, if the participant had a TOT for the target question, the post-target question was either the phonological prime or unrelated question, whichever one was not used as the pre-target

question. For example, in Version 1 the Alfred Hitchcock target question was preceded by its unrelated question (*Celebrity chef Bobby Flay has a show on the Food Network that focuses on using what cooking method?*). If the participant had a TOT for the Alfred Hitchcock question, the next question would contain its phonological prime (*Which famous equation relevant to mass and energy did Albert Einstein discover?*). In Version 2, Albert Einstein would be the pre-target question and Bobby Flay would be post-target question. Targets alternated between non-name and proper name trials, each of which was selected randomly. For each question, the experimenter recorded via keypress whether the participant said Known, Unknown, or TOT (pressing the letter k, u, or t, respectively). If the participant took too long to respond or was noticeably stalling, the experimenter was able to press the m key to move on to the next question. For all target questions (both the first presentation and the second presentation if there was a TOT), the program also recorded the time interval between when the question first appeared on screen and when the experimenter pressed a key.

After completing the TOT elicitation task, participants were given a multiple-choice recognition test for all TOT questions that remained unresolved. The multiple-choice test was used as a cursory measure of the correctness of TOT responses by confirming that participants could at least recognize the correct answer to the target question. Participants were re-presented the TOT target question with four multiple choice options displayed below the question, one of which was the target. The other multiple choice options were selected as semantic associates with the target. For example, the alternate choices for the Alfred Hitchcock question were *Cecil B. Demille*, *Martin Scorsese*, and *M. Night Shyamalan,* all film directors. “Correct” TOT responses were

only included in statistical analyses if participants subsequently resolved their TOTs or answered the multiple choice question correctly. Following the recognition test the participants were asked a series of questions to detect their awareness of the priming manipulation (e.g., *"Did you notice a relationship between the words or names in any of the questions?"*). They were then asked to rate the semantic similarity between all TOT targets and their phonological and unrelated primes (Pilot study section for details on the semantic similarity ratings task). Although the semantic relationship between targets and primes had been measured in the pilot, the procedure was repeated in actual experiment to confirm that the participants used in the experiment perceived a close semantic relationship between the semantic prime and target, but no semantic relationship between the target and either the phonological or unrelated prime. This task was more relevant for Experiment 2 but was done in both experiments in order to keep the entire procedure consistent across experiments. Participants then completed the digit span task and vocabulary test and were debriefed and compensated (when relevant).

Results

For all analyses, estimates of effect size (*r)* are reported for main effects and focused contrasts. The Pearson's correlation coefficient, *r*, is a standardized measure of the strength of an experimental effect that can be used for ANOVA when there is one degree of freedom (e.g., Field, 2005). By convention, an *r* value of 0.10 represents a small effect (the effect explains 1% of total variance), an *r* value of .3 represents a medium effect (the effect explains 9% of total variance), and an *r* value of .5 represents a large effect (the effect explains 25% of the total variance). In analyses that were

conducted by participants and by items, greater credence was given to the participant analyses due to extensive variability among items.

Initial Responses

Participants' first response to the target questions were classified into five categories: correct known (where they provided the correct target name or word), incorrect known (where they said that the answer was known but provided a name or word other than the target), correct TOT (where they said TOT and subsequently resolved the TOT or correctly answered the TOT question during the recognition test), incorrect TOT (where they said TOT on the first question and then failed to resolve the TOT or get the correct answer on the recognition test, or provided an incorrect answer during the second presentation of the target question), and unknown (where they said that the answer was unknown at the first presentation of the target question). Experimenters were instructed to skip trials where the participant was taking an excessive amount of time to respond to the question (> 10 seconds after reading the question), which made up a small percentage of trials (0.4% for young and 0.7% for older adults).

Means for each response type as a function of age group and target type are shown in Table 3-5. Separate 2 (Age Group: Young, Older) X 2 (Target Type: Non-Name, Name) ANOVAs were conducted on the percentage of incorrect knowns, incorrect TOTs, and unknown responses. Analyses for correct TOTs and correct Knowns are explored in depth with additional variables in the next sections. For incorrect known responses, only the effect of target type was significant, F (1, 103) = 157.4, MSE = .002, p < .001, r =.78, where non-name questions were given more incorrect known answers relative to proper name questions. Neither the effect of age

group nor the age group X target type interaction was significant, *p*s >.151. The proportion of incorrect TOTs did not show main effects of age group or target type, *ps* > .124, although there was a marginally significant age group x target type interaction, F (1, 103) = 2.86, MSE = .0002, p = .094. Older adults had more incorrect TOTs for names than non-names (p = .037, r =.2), while young adults had equivalent rates of incorrect TOTs for names and non-names. Finally, unknown response rates showed significant main effects of age group, F (1, 103) = 45.75, MSE = .045, p < .001, r = .55 (young having more unknowns than older adults), and target type, F (1, 103) = 109.32, MSE = .008, p < .001, r =.72 (proper names having more unknown responses than non-names), which were qualified by a significant interaction between the two variables, F (1, 103) = 12.0, MSE = .008, p < .001. This interaction reflects the fact that the higher rate of unknown responses for proper names relative to non-names was more pronounced for young adults (r =.73) than for older adults (r =.41), and age group differences in unknown responses (young having more than older) were more pronounced for proper names (r =.6) compared to non-names (r =.45), all *p*s < .001.

TOT Incidence

Main analyses

To identify outlier items, I first calculated the mean TOT incidence rate separately for non-name and proper name targets. Due to extreme item variability in TOT incidence, items that were greater than 2.5 SDs from the mean within a target category were excluded from analyses, resulting in the loss of one non-name target

(*kaleidoscope*) and one proper name target (*Anthony Hopkins*)[1]. Prime condition in this analysis refers to whether a phonological prime or an unrelated word/name was presented in the question *preceding* the target question. A 2 (Age Group: Young, Older) X 2 (Target Type: Non-name, Name) X 2 (Prime Condition: Phonological Prime, Unrelated) X 2 (Target First Syllable Frequency: High, Low) mixed-effects ANOVA was conducted by participants (F_1) and items (F_2) on the mean proportion of TOT responses to target questions (# of correct TOTs/total trials). Descriptive statistics for this analysis are reported in Table 3-6. Results revealed significant main effects of age group, F_1 (1, 103) = 50.19, MSE = .023, p_1 < .001, r_1 = .57, F_2 (1, 141) = 105.2, MSE = .007, p_2 < .001, r_2 =.65, target type, F_1 (1, 103) = 43.91, MSE = .007, p_1 < .001, r_1 = .55, F_2 (1, 141) = 16.24, MSE = .012, p_2 < .001, r_2 =.32, and prime condition, F_1 (1, 103) = 10.28, MSE = .004, p_1 = .002, r_1 = .3, F_2 (1, 141) = 8.44, MSE = .004, p_2 =.004, r_2 =.24, where more TOTs occurred for older adults, proper names, and in the unrelated condition. There was a marginal (by participants) effect of syllable frequency, F_1 (1, 103) = 3.74, MSE = .005, p_1 = .056, r_1 = .19, F_2 (1, 141) = 1.22, MSE = .012, p_2 =.272, r_2 =.09, where more TOTs occurred for targets with HF first syllables relative to LF first syllables, an inhibitory syllable frequency effect. Main effects were qualified by significant two-way interactions between age group and target type, F_1 (1, 103) = 14.33, MSE = .007, p_1 < .001, F_2 (1, 141) = 7.73, MSE = .007, p_2 =.006, target type and syllable frequency (by participants only), F_1 (1, 103) = 7.94, MSE = .004, p_1 = .006, F_2 (1, 141) = 2.14, MSE = .012, p_2 =.15, and marginally significant interactions between prime condition and age

[1] Outliers were calculated within target type because proper name targets elicited significantly more TOTs relative to non-name targets. The removal of these items did not qualitatively change the results of analyses.

group, F_1 (1, 103) = 3.08, *MSE* = .004, p_1 = .082, F_2 (1, 141) = 2.9, *MSE* = .003, p_2 =.004, and prime condition and syllable frequency, F_1 (1, 103) = 2.97, *MSE* = .005, p_1 = .088, F_2 (1, 141) = 2.88, *MSE* = .004, p_2 =.091. All two-way interactions were moderated by significant three-way interactions (described below) with the exception of the prime condition X syllable frequency interaction (which did not co-occur in any of the three-way interactions). Planned comparisons revealed that priming effects were significant in reducing TOTs for targets with LF first syllables (p_1 =.003, r_1 = .29; p_2 =.001, r_2 =.26), but not for targets with HF first syllables (*p*s > .373). Further, the inhibitory syllable frequency effect was significant in the phonological prime condition (p_1 = .006, r_1 = .26, p_2 =.063, r_2 =.15) but not in the unrelated condition (*p*s >.694). Hence, there seems to be interactivity between the influence of the prime and the number of first-syllable neighbors.

The primary question of interest was whether age differences in TOT incidence were exacerbated for proper names relative to non-names. As predicted, the age group X target type interaction revealed a disproportionate impairment for proper names with age: while both age groups had more TOTs for proper names, the effect was more pronounced for older adults (*ps* < .001, r_1 =.56, r_2 =.33) than young adults (p_1= .029, r_1 =.23, p_2 = .041, r_2 =.17). Further, age differences were larger for names (r_1 =.61, r_2 =.61) relative to non-names (r_1 =.41, r_2 =.41, all *p*s <.001). However, the magnitude of this disproportionate impairment was moderated by target first-syllable frequency, as shown by a significant (by participants) age group X target type X syllable frequency interaction F_1 (1, 103) = 5.1, *MSE* = .004, p_1 = .026, F_2 (1, 141) = 1.87, MSE = .007, p_2 =.17. Upon further investigation, the age group X target type interaction was significant for targets

with HF first syllables (p_1 <.001) but not for targets with LF first syllables (p_1 =.119), shown in Figure 3-2. For HF first syllable targets, the age group X target type interaction is identical to the two-way presented above: more pronounced effects of target type for older adults (p_1 <.001, r_1 = .58) relative to young adults (p_1 = .053, r_1=.19), and more pronounced age differences for proper names (p_1 <.001, r_1 = .59) relative to non-names (p_1 =.005, r_1 = .27). In contrast, for LF syllable targets, age differences were comparable for proper names (r_1 =.53) and non-names (r_1= .45, *p*s <.001). To examine the unique role of syllable frequency in explaining age differences in TOTs for names versus non-names, the age group X syllable frequency interaction was examined within each level of target type. Age differences in TOT incidence for non-names was moderated by first syllable frequency, with larger older adult deficits for non-names with LF first syllables (p_1 <.001, r_1 =.45) relative to HF first syllables (p_1 =.005, r_1 =.27). In contrast, age differences in TOT incidence for proper names was equivalent for names with HF (r_1=.59) and LF first syllables (r_1=.53), *p*s <.001.

Finally, to see how each age group's TOT incidence was influenced by target characteristics, the target type X syllable frequency interaction was examined separately for young and older adults. The target type X syllable frequency interaction was only significant for older adults (p_1 <.001), who demonstrated opposing influences of syllable frequency for non-names and proper names: more TOTs occurred for non-names with LF first syllables versus HF first syllables (p_1 =.049, r_1=.19), and more TOTs occurred for proper names with HF first syllables versus LF first syllables (p_1 = .015, r_1=.24). In contrast, the target type X syllable frequency interaction was not significant for younger adults (p_1 = .662), for which none of the contrasts were fully significant but

trended toward an inhibitory syllable frequency effect for both non-names and names (*p*s >.069).

Overall, results from this analysis indicate that age differences in TOTs are more pronounced for proper names but only relative to non-names targets with HF first syllables. Due to older adults' particularly susceptibility to LF phonology during non-names retrieval, age differences in TOTs were similar for names and non-names with LF first syllables. Finally, only older adults' TOTs were reliably impacted by syllable frequency, which exerted an opposing influence on TOTs for names and non-names.

There was also a marginal interaction between age group, target type, and prime condition, F_1 (1, 103) = 3.38, *MSE* = .004, p_1 = .069, F_2 (1, 141) = 3.46, *MSE* = .003, p_2 =.065, displayed in Figure 3-3. The three-way interaction was explained by a significant target type X prime condition for older adults (p_s = .025, p_2 =.062) but not for young adults (p_1 = .89, p_2 =.076). For older adults, presentation of a phonological prime prior to the question reduced TOTs for non-names relative to an unrelated word (*ps* <.001, r_1 = .38, r_2=.26), but priming had no effect on TOTs for proper names (p_1 =.53, p_2 =.59). For young adults, presentation of a phonological prime had no effect on their rate of TOT incidence, for either target type, *p*s > .18. No other interactions involving TOT incidence as the dependent variable were significant (*p*s >.101).

The disparate ranges of syllable frequencies for non-name and proper name targets made it necessary to use different criteria to define HF and LF first syllables within each target type. To rule out the possibility that the observed effects of syllable frequency on proper name and non-name TOTs were confounded by the use of different cutoffs to establish syllable frequency category, I repeated the Age Group X

Target Type X Prime Condition X Syllable Frequency analysis on the incidence of TOTs among those items that were matched on first-syllable frequency (i.e., 34 pairs of non-name and proper name targets with the same first syllable). The main effects and interactions reported in the previous analysis remained stable when only the matched stimuli were included in the ANOVA.

Other proportional measures of TOT incidence

A primary goal of this research was to directly test the hypothesis that aging exacerbates differences between proper name and non-name retrieval**.** While the above analyses lend evidence in favor of selective age impairment for names, previous research has shown that the name/non-name retrieval disparity may fail to emerge when the two word classes are equated for familiarity and/or name agreement (Hanley, 2011). Young adults were less familiar with the targets (as measured by the pilot study as well as the rates of unknown responses in the current experiment), and age differences in familiarity were especially pronounced for proper names (according to the rates of unknown responses reported above). As such, young adults' lack of familiarity with the proper name targets might reduce their opportunities for TOTs and inflate age differences in proper name TOTs.

Two additional measures of TOT incidence were calculated in order to adjust for age differences in familiarity and target type: 1) #TOTs/TOTs+ Knowns +Incorrect Knowns+ Incorrect TOTs (i.e., all trials for which a retrieval attempt was made), and 2) #TOTs/ TOTs + Knowns (all trials for which the participants knew the correct answer). In the first measure, unknowns were excluded in order to remove trials where participants lacked any knowledge of the answers (which disproportionately affected young adults and proper name trials), therefore calculating a proportional measure for which the

opportunities for TOTs was more similar across age groups and target types. The second measure was also used because it represents all trials for which there was confirmation of knowledge, either by producing the correct answer or getting the correct answer on the multiple choice (i.e., all trials for which a TOT was possible). Because the disproportionate age impairment for names was moderated by syllable frequency, 2 (Age Group) X 2 (Target Type) X 2 (Syllable Frequency) mixed-effect ANOVAs were conducted on these two proportional measures. Both measures replicated the age group X target type X first syllable frequency interaction from the overall analysis (reported above): the Age Group X Target Type interaction was significant for targets with HF first syllables (*p*s <.01) but not for targets with LF first syllables (*p*s >.859). For HF syllable targets, older adults had more TOTs than young adults for proper names (*p*s <.001), but not for non-names (*p*s >.123), and difficulty with proper names relative to non-names was more prominent among older adults (*p*s <.001) than young adults (*p*s <.01). While these data do not rule out the possibility that empirical evidence for a disproportionate age-related impairment for names may be influenced by age differences in familiarity with the target stimuli, it is not the primary factor driving the age group X target type interaction reported in the current study, which seems to be contingent on first syllable frequency.

Correct response rates

To examine whether the effects of priming and syllable frequency were specific to TOTs states or could also influence other stages of lexical access, an Age Group X Target Type X Prime Condition X Syllable Frequency mixed ANOVA was conducted on the proportion of target questions that were answered correctly on the first presentation (# correct/total trials). Descriptive statistics for this analysis are shown in Table 3-7.

There were significant main effects of all variables (by participants). Older adults correctly answered more questions than young, F_1 (1, 103) = 13.2, *MSE* = .21, $p_1 <$ .001, r_1 = .34, F_2 (1, 141) = 25.59, *MSE* = .0813, $p_2 <$ .001, r_2 = .39. Non-name questions were answered correctly more often than proper name questions, F_1 (1, 103) = 39.09, *MSE* = .032, $p_1 <$ .001, F_2 (1, 141) = 5.32, *MSE* = .151, p_2 = .022. Presenting a phonological prime resulted in higher correct answers relative to the unrelated condition, F_1 (1, 103) = 15.7, *MSE* = .009, $p_1 <$ .001, r_1 =.52, F_2 (1, 141) = 11.6, *MSE* = .007, $p_2 <$ .001, r_2 = .19. Finally, questions about targets with LF first syllables were answered correctly more than targets with HF first syllables (by participants only), F_1 (1, 103) = 18.29, *MSE* = .009, $p_1 <$ .001, r_1 =.39, F_2 (1, 141) = 1.16, *MSE* = .036, p_2 = .28, r_2 =.09. There was also a significant interaction between age group and prime condition, F_1 (1, 103) = 4.54, *MSE* = .009, p_1 =.017, F_2 (1, 141) = 3.97, *MSE* = .009, p_2 = .048. Planned comparisons showed that only older adults demonstrated phonological priming effects on the proportion of known answers (*p*s <.001, r_1 =.38, r_2 =.3); phonological primes did not influence young adults' correct response rate (p_1 =.235, r_1 =.12, p_2 =.434, r_2 = .06).

The prime's influence on correct response rate can be attributed to multiple mechanisms. One possibility is that activation spreads from the phonology of the prime to the lexical representation of the target, hence strengthening baseline activation of the target's lemma (boosting the rate of Correct Known responses), and strengthening the target's lemma-to-phonology link (reducing the rate of TOT responses). However, phonological priming should not influence semantic level activation and therefore should not be able to activate a target's lemma if it was otherwise unfamiliar to the participant (affecting the rate of Unknowns), nor should it be able influence the activation level of

other lemmas that were semantically-related to the target (affecting the rate of Incorrect Knowns). To confirm that phonological priming specifically influences lexical-to-phonological processes but not semantic-lexical processes, I compared the effect of prime condition on older adults' rate of unknown responses and incorrect response rate (i.e., the age group that demonstrated priming effects on correct knowns). Phonological priming had no influence on older adults' unknown responses, F (1, 42) = 1.88, MSE = .002, p = .177 (priming difference score = 1.1%), or incorrect known responses, F (1, 42) < 1, p = .997 (priming difference score = 0%). Therefore, phonological primes increase older adults' correct known responses and reduce TOTs (for non-names) but do not influence the rates of unknown or incorrect known responses.

Independent of priming, young and older adults' correct known rates were differentially affected by target type and syllable frequency. A two-way interaction between age group and syllable frequency (by participants), F_1 (1, 103) = 5.4, MSE = .009, p_1 = .022, F_2 < 1, p_2 = .57, was qualified by a three-way interaction between age group X target type X syllable frequency (by participants), F_1 (1, 103) = 11.54, MSE = .007, p_1 < .001, F_2 < 1, p_2 = .32. Unlike TOT incidence, the target type X syllable frequency interaction was significant for both young (p=.032) and older adults (p = .011), although the age groups differed on when syllable frequency effects emerged. For young adults, the inhibitory effect of syllable frequency was significant for non-names (p = .01, r =.25) but not for names (p = .815, r =.02). For older adults, the effect of syllable frequency was inhibitory for names (p < .001, r =.43) but not for non-names (p =.125, r =.15). Inhibitory syllable frequency effects were most pronounced for older adults' correct known rate for proper names. As such, the age group X syllable

frequency interaction was significant for proper names, ($p < .001$) but not for non-names ($p = .644$), as shown in Figure 3-4. Larger age differences occurred for LF syllable names ($p < .001$, $r = .42$) compared to HF syllable names ($p = .017$, $r = .23$), due to older adults' reduction in correct responses for names with HF first syllables. In contrast, age differences in correct known rates for non-names were unaffected by syllable frequency (both *p*s =.003, *r*s = .29). In sum, these analyses suggest that syllable frequency moderates age differences in correct known rates for proper names but not for non-names. This contrasts with the TOT incidence analyses, where syllable frequency accounted for age differences in TOT incidence rates for non-names but not for names. No other main effects or interactions were significant for correct known rates, *p*s > .322.

TOT Resolution

In order to examine the effect of all within-subjects variables (target type, prime condition, and syllable frequency) on TOT resolution, it requires that a participant have at least one TOT in each condition (a minimum of 8 TOTs, distributed across the conditions). Because young adults had relatively low TOT rates, especially for non-names, it was impossible to include all the variables of interest in a single ANOVA without losing over 80% of the young adult participants. As such, separately analyses were conducted to examine (1) the effect of phonological priming on non-name and proper name TOT resolution among young and older adults, and (2) the effect of syllable frequency on primed TOT resolution in young and older adults. The same procedure was used to exclude outlier items as was used for TOT incidence, resulting in the loss of two non-name items (*torpedo*, *crucifix*). For resolution analyses, there was greater variability and data loss among the items. As such, interactions that were only significant in the items analyses were not further explored.

Phonological priming effects on TOT resolution

For TOT resolution, prime condition is defined by the type of question (phonological prime, unrelated) presented immediately after a TOT. A 2 (Age Group) X 2 (Target Type) X 2 (Prime Condition) mixed-effect ANOVA was conducted by participants and items on the proportion of TOTs that were successfully resolved (# resolved TOTs/Total TOTs). Young and older adults' mean resolution rates as a function of target type and prime condition are displayed in Table 3-8. Only prime condition had a significant main effect on TOT resolution, F_1 (1, 73) = 4.03, *MSE* = .091, p_1 = .049, r_1 =.23, F_2 (1, 86) = 4.14, *MSE* = .121, p_2 = .045, r_2=.21, where TOTs were resolved more often when the post-target question contained a phonological prime (36.3%) compared to an unrelated word/name (29.3%). No other effects or interactions were significant in the participant analyses, *p*s >.116.

Because the significant loss of power makes it difficult to detect higher-order interactions, I compared the magnitude of priming effects separately for non-name and proper name targets, which had shown differential effects of priming on TOT incidence. Separate 2 (Age Group) X 2 (Prime Condition) ANOVAs were conducted on the mean TOT resolution rate for non-name and proper name targets. Results revealed a significant priming effect for non-names, with higher resolution in the prime condition compared to the unrelated condition (priming difference score = 11.2%), F_1 (1, 77) = 4.84, *MSE* = .1, p_1 =.031, r_1 =.24, F_2 (1, 38) = 3.4, *MSE* = .15, p_2 =.07, r_2=.29. In contrast, TOT resolution rates for proper names did not show a priming effect (priming difference score = 3.2%), *Fs* < .1, *ps* > .359. No other effects were significant, p_1s > .188.

To examine this relationship the other way, I also conducted separate Age Group X Target Type ANOVAs within each level of prime condition. In the unrelated condition, there was a marginal effect of age group by participants, F_1 (1, 80) = 3.08, *MSE* = .115, p_1 =.083, r_1 =.19, F_2 < 1, p_2 =.334, where younger adults resolved more TOTs than older adults. No other effects or interactions were significant in the unrelated condition, *p*s >.611. In the primed condition, there was a significant main effect of target type, F_1 (1, 85) = 3.71, *MSE* = .077, p_1 =.057, r_1 =.2, F_2 (1, 112) = 4.73, *MSE* = .125, p_2 =.032, r_2 =.2, where TOTs for non-names were resolved more frequently than TOTs for names, but no other effects or interactions were found, p_1s >.586.

Finally, the target type X prime condition relationship was explored within each level of age group. For young adults, none of the main effects or interactions were significant, *p*s > .205, suggesting no phonological priming for either target type. For older adults, there was a main effect of prime condition, F_1 (1, 40) = 4.72, *MSE* = .086, p_1 =.036, r_1=.32, F_2 (1, 124) = 5.63, *MSE* = .094, p_2 =.019, r_2 =.21, reflecting the increase in resolution following a prime word versus an unrelated word, and to the same degree for both names and non-names. None of the other effects were significant, p_1s > .1.

Effects of syllable frequency on primed TOT resolution

To investigate how syllable frequency might interface with phonological priming during resolution of proper name and non-name TOTs, a 2 (Age Group) X 2 (Target Type) X 2 (Syllable Frequency) ANOVA was conducted on mean TOT resolution rates in the primed condition. Syllable frequency effects were not examined in the unrelated condition because there were too few cases (only 32% of participants could be included in the analysis). Operating on the assumption that primes influence TOT resolution via

activation of the target's first syllable, the syllable frequency variable is more relevant in the primed condition relative to the unrelated condition. Results revealed a marginally significant interaction (by participants only) between target type and syllable frequency F_1 (1, 47) = 3.22, *MSE* = .085, p_1 = .079, F_2 < 1, p_2 = .85 (shown in Figure 3-5, collapsed across Age Group). Focused coontrast revealed than names with HF first syllables were resolved less often than names with LF first syllables (p_1 = .06, r_1=.27). There was no effect of syllable frequency on non-name TOT resolution (p_1 = .69, r_2=.06), Examined the other way, non-names were resolved more often than proper name targets when the targets had HF first syllables (p_1 < .001, r_1=.47); proper names with LF first syllables were resolved as often as non-names with LF first syllables (p_1 =.317, r_2= .14). No other effects or interactions involving syllable frequency were significant, *p*s >.442.

Partial name retrievals

To be coded as a correct response or a correctly-resolved TOT, we required that participants produce the proper name target's first and last name. It is possible that the added level of difficulty of retrieving two separate lexical entries (for the first and last name) is the source of the disproportionate impairment for names, as opposed to differences in the representation of names or the processes engaged during their retrieval. To investigate this possibility, I counted each time a proper name target's first or last name was correctly provided during the first presentation of the target question, the second presentation of the target question, or when participants were asked to give any available information about the TOT name following the second presentation of the target questions. Overall, participants very rarely had access to one of the names but not the other (1.8% of proper name trials for young, 2.5% of proper name trials for older). When these partial answers were coded as correct responses, it did not change

the pattern of proper name versus non-name retrieval described in the previous analyses.

Discussion

Results from this experiment lend further empirical support in favor a disproportionate age-related impairment for proper names, but more importantly, they clarify the conditions in which selective deficits occur. Fundamentally, age differences in TOTs for proper names and non-names were differentially affected by two constructs that were designed to tap into phonological-level processes during TOT states: first-syllable frequency and phonological priming. Consistent with previous research (Burke et al., 1991; Cohen & Faulkner, 1986; Evrard, 2002; James, 2006; but see Maylor, 1995; 1997), age differences in TOT incidence were exacerbated for proper names. However, the unique finding of the present experiment was that this particular age-impairment for names *only* occurred when the targets contained HF first syllables. Age differences were comparable for names and non-names when they began with a LF first syllable, suggesting that phonological frequency is a critical determinant of older (but not young) adults' TOTs. The effectiveness of phonological priming also differed as a function of age group and target type. Phonological primes reduced TOTs, increased correct knowns, and bolstered TOT resolution, but only for older adults and only for non-names. The specificity of priming effects observed in this experiment suggests that priming is only effective when it is able to activate the precise link that triggered the TOT, which may be more difficult to access for proper names and young adults. Taken together, these results imply the type of phonological retrieval failures that result in a TOT may differ for non-names and proper names and may also differ for young and

older adults, providing insight into how these word classes are represented in the phonological lexicon and how they are processed throughout the lifespan.

A primary first goal of this project was to assess whether there is a particular age-related deficit during the retrieval of proper names relative to other types of words, which has been challenged by a few studies that reported comparable age deficits during the retrieval of proper names and other types of information (e.g., Maylor, 1997). As a novel finding, these data confirm older adults' particularly vulnerability to proper names, but only when proper names are being compared to non-names with HF first syllables. Age differences in TOT incidence for non-names with LF first syllables were similar to that of proper names, suggesting that different factors may account for age-related declines in the retrieval of names versus non-names. To my knowledge, this is the first study to report an opposing influence of the same variable (first-syllable frequency) on the processing of proper names and non-names. Older adults had more TOTs for non-names with LF first syllables relative to HF first syllables, replicating previous research (Farrell & Abrams, 2011), but showed the opposite effect for names, having more TOTs for names with HF first syllables relative to LF first syllables. Older adults' retrieval of proper names is uniquely hindered by interference from phonologically-related names, which may be caused by confusability or competition among alternative name options (is it Jennifer, Jessica, Jenna?), an interference that does not occur for non-names.

Interference from similar-sounding first names may also explain why phonological priming of proper names has been elusive, at least when the primes contain only a single syllable (e.g., White et al., in press). At a structural level, there is an additional

level of lexical-phonological selection that is demanded by names but not by non-names, which enhances the opportunity for competition: first name selection. Once a specific person's lemma, or "name phrase" is activated by the semantic information presented in the question (e.g., the Julie Andrews node), the speaker then has to then select the first name (Julie) and last name (Andrews) label that corresponds to that person, followed by the phonological subcomponents contained within the names. Theoretically, primes reduce TOTs and/or promote TOT resolution by activating the weakened link that caused the TOT in the first place, i.e., the link between the target's lemma and its first syllable. However, if the lemma-to-first syllable link was NOT the one that caused the original transmission failure, then a first syllable prime would not be helpful and may in fact introduce competitors by spreading activation to other first names. The lack of phonological priming of proper names implies that proper name TOTs are not consistently caused by a breakdown in the retrieval of a target's first syllable but may be caused by an inability to access the first or last name.

Phonological primes did facilitate retrieval of non-names, but only for older adults. We know from the syllable frequency findings that older adults' TOTs for non-names are specifically driven by weakened connections to LF first syllables. As such, the presentation of a word with the same first syllable is able to activate this weakened connection, thereby preventing TOTs and bolstering TOT resolution. Conversely, phonological primes had no effect on young adults' TOTs incidence and did not significantly increase young adults' TOT resolution (although resolution was qualitatively higher in the primed, M = 44.1, versus unprimed condition, M = 34.9). The ~10% priming effect for young adults' TOT resolution is comparable to older adults'

(significant) priming effect (≈12%), so the lack of significance may represent the substantial loss of power in the young adults' TOT resolution analysis. However, young adults showed no evidence of priming for TOT incidence, which cannot be attributed to inadequate statistical power. This is the first study to report significant phonological priming effects for older adults but not for young, at least within the context of TOTs. Methodologically, this study is unique in that it is the first to attempt priming of TOT incidence using only a single syllable (and embedded within a question), so it may have uncovered a unique age-related discrepancy in the amount of phonology that is necessary to prevent TOTs. Overall, the results of this experiment suggest that spreading activation from a single syllable does not provide enough information to prevent young adults' TOTs from occurring, but may help young participants resolve their TOTs once lexical selection has occurred (as has been shown in previous studies).

In sum, results from Experiment 1 suggest that age differences in TOTs for non-names and names stem from different sources of failure during lexical access. Older adults' TOTs for non-names are specific to phonological retrieval failures, as evidenced by facilitatory syllable frequency effects and significant priming from first-syllable neighbors. TOTs for proper names may arise from breakdowns at multiple locations in the lexical-phonological system, as evidenced by inhibitory syllable frequency effects (competition from similar-sounding names) and null phonological priming effects (due to indirect links between the lemma associated with the target and its first syllable). These findings expand on and clarify existing theoretical accounts of the specialness of proper names by adding greater specificity to where and how proper names diverge from other word classes. In Experiment 2, I attempted to gain insight into structural differences

between names and non-names at the level of semantic activation and lexical selection. In the General Discussion, the implications of these results will be discussed in greater detail in conjunction with findings from Experiment 2 to develop a more comprehensive model of how proper names are represented and accessed.

Table 3-1. Descriptive characteristics for young and older participants in Experiment 1

	Age Group			
	Young		Older	
	M	*SD*	*M*	*SD*
Age*	19.4	1.6	68.2	4.7
Health Rating (out of 10)	8.3	1.2	7.9	2.3
Education (in years)*	13.3	1.2	16.4	2.8
Vocabulary (out of 25)*	14.2	4.3	18.6	5.4
Forward Digit Span*	7.5	1.2	6.4	2.1
Backward Digit Span	5.1	1.2	5.0	1.2
MMSE	--	--	28.5	1.7

Note: * indicates significant age group differences ($p < .001$).

Table 3-2. Sample non-name targets with phonological, semantic, and unrelated primes

Sample Non-Names with HF First Syllables (*M* = 2023.4)			
Target	Phonological Prime	Semantic Prime	Unrelated
Acronym	Accurate	Initials	Surprising
Arson	Arbitrary	Pyromania	Ridiculous
Marsupial	Marginal	Kangaroo	Telephone
Obituary	Obey	Eulogy	Ignore
Sample Non-Names with LF First Syllables (*M* = 230.7)			
Target	Phonological Prime	Semantic Prime	Unrelated
Barnacle	Barter	Oyster	Cookie
Beaker	Beaten	Flask	Pleasant
Embryo	Empathize	Fetus	Revisit
Haiku	Hygienic	Limerick	Cabinet

Table 3-3. Sample proper name targets with phonological, semantic, and unrelated primes

Sample Non-Names with HF First Syllables (*M* = 1722.8)			
Target	Phonological Prime	Semantic Prime	Unrelated
Alexander Hamilton	Alec Baldwin	John Adams	Bob Dylan
Arthur Miller	Arnold Palmer	Neil Simon	Ryan Reynolds
Leonardo da Vinci	Lee Harvey Oswald	Michelangelo	Paul Michael Glaser
Monica Lewinsky	Molly Ringwald	Paula Jones	Kelly Clarkson
Sample Non-Names with LF First Syllables (*M* = 150.8)			
Target	Phonological Prime	Semantic Prime	Unrelated
Julia Child	Judy Blume	Martha Stewart	Katharine Hepburn
Lucille Ball	Louisa May Alcott	Carol Burnette	Erin Andrews
Rosa Parks	Rosie O'Donnell	Coretta Scott King	Marie Antoinette
Rudy Giuliani	Rupert Murdoch	Michael Bloomberg	Conrad Hilton

Table 3-4. Mean word length of each type of target and prime question

Target Type	Target Question	Phonological Prime Question	Semantic Prime Question	Unrelated Question
Non-Name	23.5	21.7	21.7	21.0
Proper Name	24.7	20.8	22.2	21.1

Table 3-5. Percentage of each response type as a function of age group and target type.

	Age Group	
	Young	Older
Non-Names		
Correct Known	41.9	52.3
Incorrect Known	15.3	14.6
Correct TOT	5.9	11.6
Incorrect TOT	1.9	1.6
Unknown	34.5	18.8
Proper Names		
Correct Known	32.3	45.0
Incorrect Known	6.0	7.2
Correct TOT	7.3	17.6
Incorrect TOT	1.8	2.3
Unknown	52.4	27.8

Table 3-6. Young and older adults' mean TOT incidence (in %) as a function of target type, prime condition, and first syllable frequency.

	Age Group			
	Young		Older	
	M	*SE*	*M*	*SE*
Non-Names				
Primed				
HF First Syllable	6.2	1.0	9.4	1.2
LF First Syllable	4.5	1.0	8.8	1.1
Unrelated				
HF First Syllable	6.3	1.0	10.8	1.1
LF First Syllable	5.6	1.1	15.3	1.3
Proper Names				
Primed				
HF First Syllable	7.9	1.1	18.0	1.3
LF First Syllable	5.9	1.2	15.3	1.4
Unrelated				
HF First Syllable	8.4	1.1	18.8	1.4
LF First Syllable	6.9	1.1	16	1.3

Table 3-7. Young and older adults' percentage of correct known responses as a function of target type and prime condition.

	Age Group			
	Young		Older	
	M	*SE*	*M*	*SE*
Non-Names				
Primed				
HF First Syllable	40.3	2.6	52.0	3.1
LF First Syllable	43.0	2.5	56.2	3.0
Unrelated				
HF First Syllable	39.0	2.5	50.4	3.0
LF First Syllable	42.2	2.4	50.4	2.8
Proper Names				
Primed				
HF First Syllable	33.2	2.3	43.9	2.8
LF First Syllable	33.1	2.4	50.6	2.9
Unrelated				
HF First Syllable	32.4	2.5	39.2	3.0
LF First Syllable	32.0	2.2	45.9	2.7

Table 3-8. Young and older adults' mean TOT resolution (in %) as a function of target type and prime condition.

	Age Group			
	Young		Older	
	M	*SE*	*M*	*SE*
Non-Names				
Primed	44.1	5.7	37.9	5.2
Unrelated	34.9	6.1	25.7	5.6
Proper Names				
Primed	30.9	4.3	32.3	3.9
Unrelated	31.8	4.8	24.7	4.4

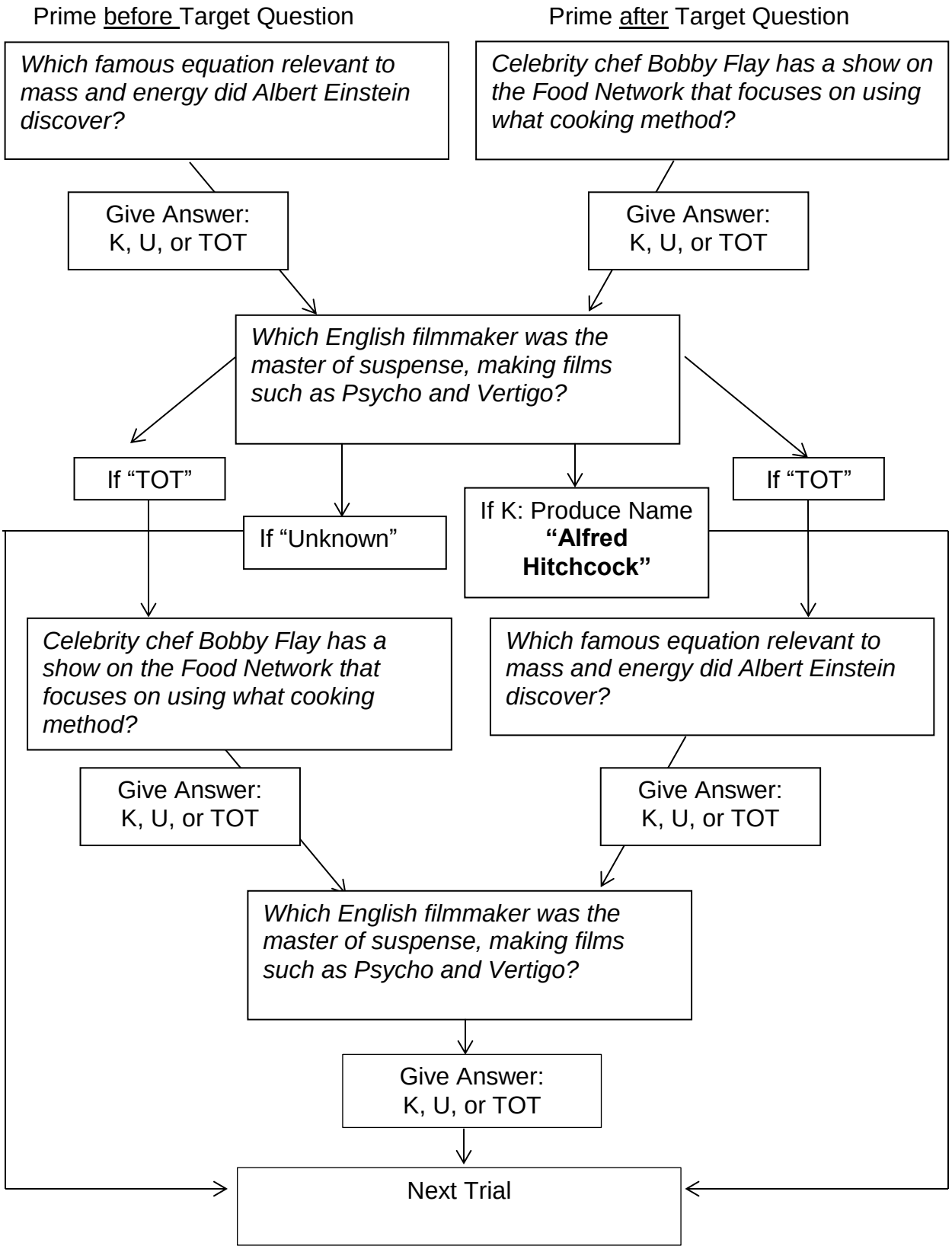
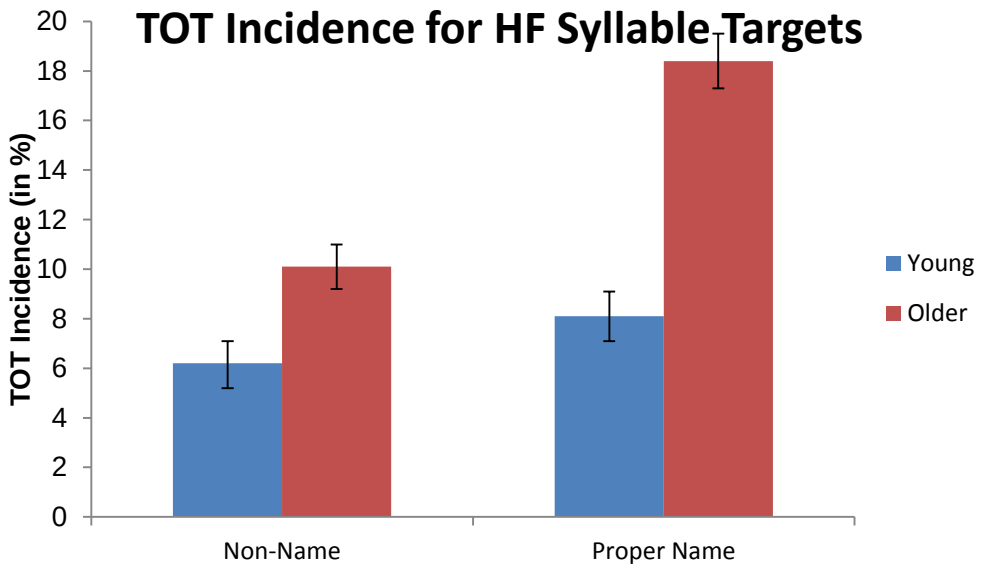


Figure 3-1. Trial structure for Experiment 1



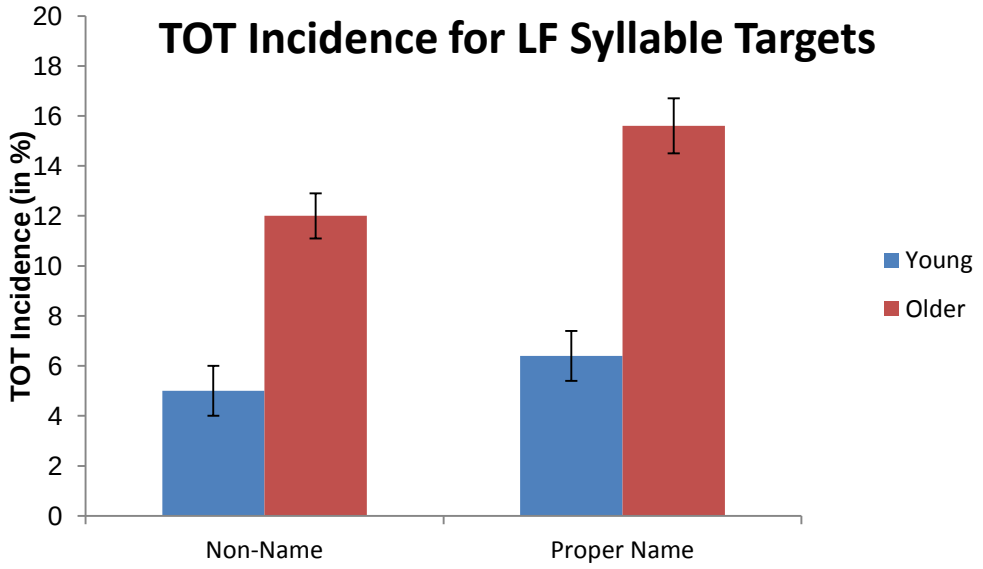
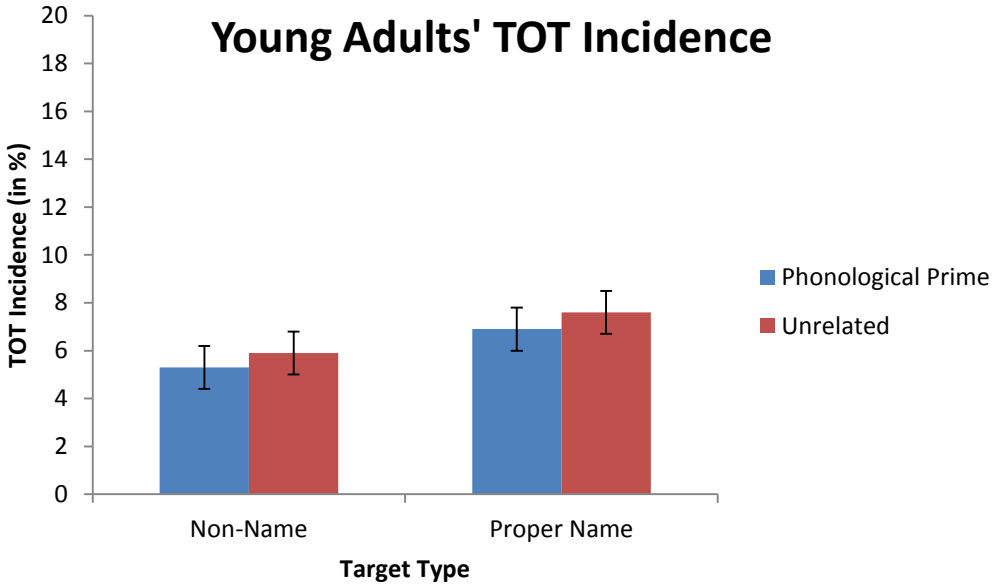


Figure 3-2. Age differences in TOT incidence as a function of target type and first syllable frequency.



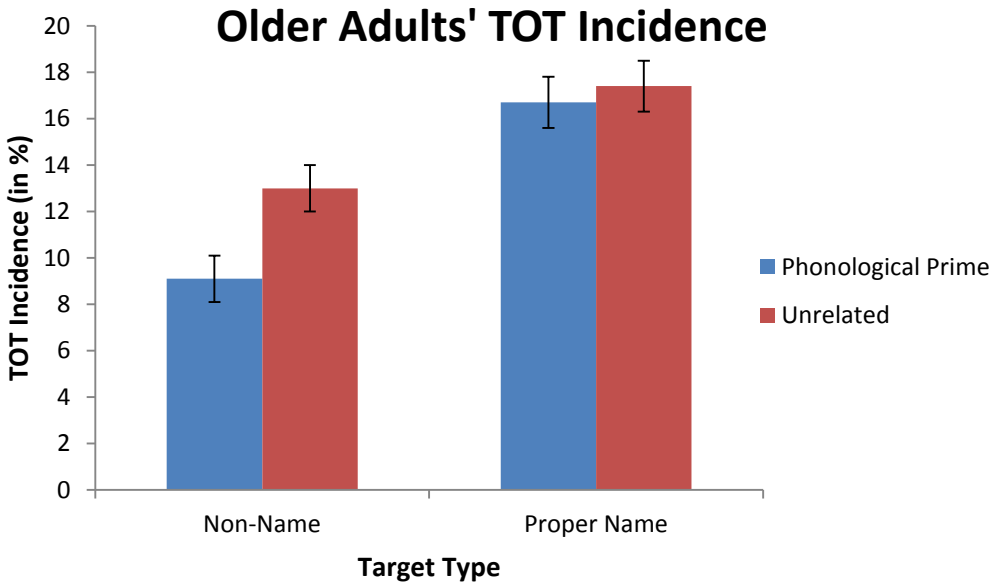
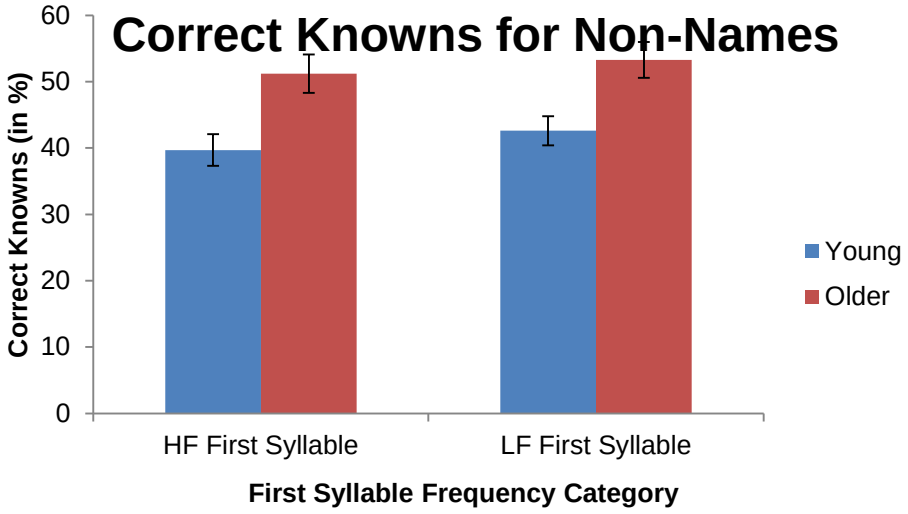


Figure 3-3. Age differences in phonological priming of TOT incidence.



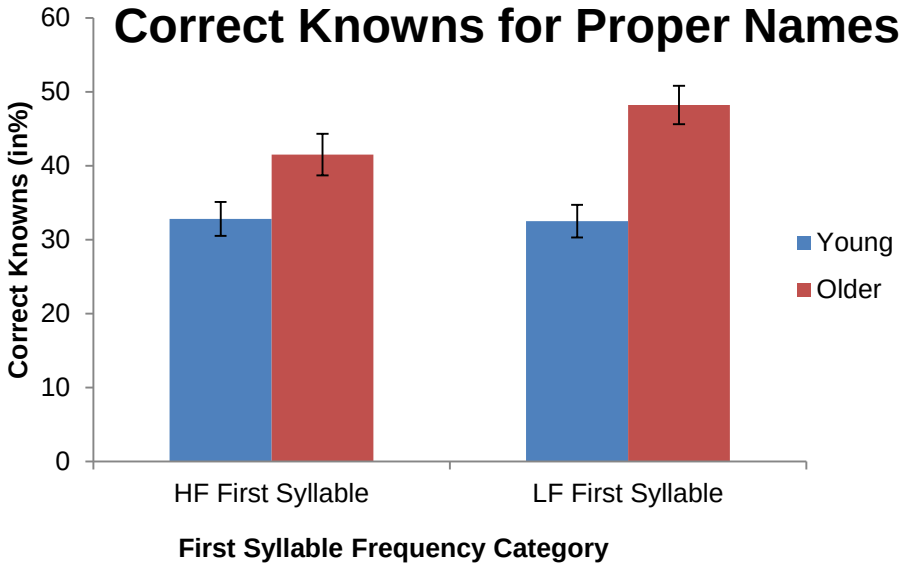


Figure 3-4. Age differences in correct known responses as a function of target type and first-syllable frequency.

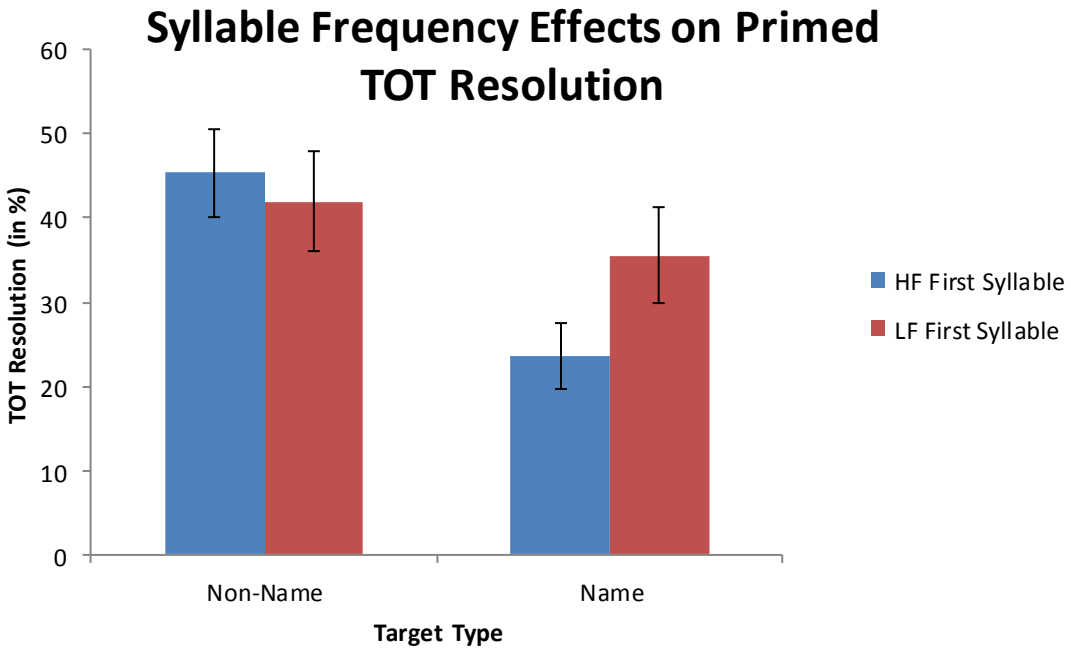


Figure 3-5. Effects of syllable frequency on primed TOT resolution of non-name and proper name targets (collapsed across age group).

CHAPTER 4
EXPERIMENT 2: SEMANTIC INFLUENCES ON NON-NAME AND PROPER NAME TOTS

In Experiment 2, a semantic prime (or competitor) was introduced to the TOT task, a manipulation that should theoretically influence lexical activation but not phonological level processes. Previous research is equivocal regarding the influence of semantic primes on successful word retrieval, and especially TOTs. While some studies report null effects of semantic priming on TOT incidence for proper names (Cross & Burke, 2004) and non-names (Meyer & Bock, 1992, Experiment 1), interference has been reported in some contexts (Meyer & Bock, 1992, Experiment 2). In other methodologies, picture naming of objects is generally slowed by the presence of a semantically-related distractor word, an interference effect ascribed to competition from the distractor at lexical selection (e.g., Schriefers et al., 1990). In contrast, pictures of famous faces are named more accurately when they are preceded by a picture of a semantically-related person relative to an unrelated person (Vitkovitch et al., 2006), suggesting that the selection of proper names does not occur in competition, as does lemma selection of non-proper names.

While semantic priming effects have never been directly compared for proper names and non-names, there are theoretical reasons to suspect that the presence of a semantic prime may exert differential influences on the two word types during lexical selection as well as divergent effects on TOT incidence and the proportion of correct responses. Of critical interest is how semantic primes will bolster (or inhibit) correct responding relative to the phonological priming effects found in Experiment 1. Unlike phonological priming which is designed to offset age declines in phonological retrieval,

semantic priming is not a compensatory tool for older adults, who typically have intact or superior semantic knowledge relative to younger adults. Due to the vastness and richness of semantic knowledge, they could potentially benefit more from semantic priming than young adults, as they have more converging connections from the semantic level. Finally, whether semantic priming interfaces with syllable frequency will provide an interesting test of the limits of spreading activation and parallel activity within the production network. If more or less semantic priming occurs as a function of syllable frequency, it would challenge the notion of fully distinct semantic, lexical, and phonological systems.

Specific Aims

Specific Aim 4

- To examine the interaction between semantic and phonological factors on TOT incidence and correct retrieval of proper names in young and older adults.

As discussed in the introduction, the disproportionate deficit for name retrieval in older age may occur as a function of semantic, lexical, and phonological factors. As Experiment 1 was designed to tap into the phonological characteristics of names and non-names and their interactions with lexical competition, Experiment 2 attempted to illustrate differences between the two word classes at earlier stages in the production process, semantic activation through lexical selection. Semantic priming was used as an indirect indicator of semantic organization. There is evidence to support predictions that semantic priming of word retrieval may be enhanced (e.g., Burgess & Conley, 1998) or reduced (e.g., Bredart et al.,1995; Schweinberger, Burton, & Kelly, 2001) in proper names relative to non-names. According to Burgess and Conley (1998), proper names form a close semantic network specific to individual people. As a result,

semantic activation may spread more efficiently between nodes representing semantically-related persons, resulting in more pronounced semantic priming effects for proper names versus non-names, which have more diffusely distributed semantic representations. In contrast, proper name retrieval may show reduced semantic priming if biographical information about people is stored in a separate module than names (e.g., Bredart et al., 1995; Schweinberger et al., 2001) and is not automatically accessed during name retrieval. In support of the latter idea, Schweinberger failed to find semantic context priming when participants were asked to make syllabic judgments about proper names.

Importantly, semantic primes were expected to influence correct responses rates but not TOTs, the opposite pattern than was projected for phonological primes. Older adults were predicted to show more pronounced semantic priming effects relative to young due to their possession of a larger, more complex semantic network. An interaction between semantic priming and phonological frequency was not expected but would imply greater parallel activity among levels in the network than is assumed by existing models of speech production and face recognition.

Specific Aim 5

- To check for semantic priming of TOT *resolution* among proper names and non-names, an effect that would challenge the purely phonological locus of TOT states.

To my knowledge, no previous study has assessed the influence of a semantic prime on the retrieval of a target word once already in a TOT state. Presenting a semantic prime *after* a TOT has occurred will provide an interesting test of theoretical explanations of TOTs. If current assumptions hold true, the presentation of a semantic prime should not be able to activate the blocked lemma-to-phonology connection that

phonological primes influenced in Experiment 1. As such, semantic primes were also not expected to interact with the effects of age, target type, or target first syllable frequency on TOT resolution. However, if semantic priming effects do emerge, they would imply that TOTs can result from blockages at multiple levels in the production system, such as the link between the semantic system and the lexical level. Other studies have referred to these types of errors as “Stage 1 failures,” when the speaker is unable to activate the correct lexical representation following semantic activation (e.g., Gollan & Brown, 2006; Hanley, 2011). Stage 1 failures were assumed to be represented by a “don’t know” response as opposed to a “TOT”, so it will be interesting to see if the feeling of pending retrieval associated with TOTs can occur at the semantic-to-lemma link in addition to the lemma-to-phonology link. Notwithstanding, the consistency of phonological priming effects across TOT studies (lending support to the phonological locus of TOT states) leads to the hypothesis that semantic primes will not influence the rate of TOT resolution or interact with phonological-level variables during resolution.

Method

Participants

The same inclusion criteria were used in Experiment 2: native English speakers, normal or corrected-to-normal vision and hearing, no diagnosis of a learning disability or cognitive impairment, and a score of 25 or above on the MMSE (for older adults). Participants were recruited through the same methods described in Experiment 1. Young adults were either given credit toward course requirements or $10 compensation, and all older adults were paid $8/hour for their time. Data from one young adult were removed from analysis due to English being the second language.

Data from three older adults were removed from analysis for scoring below 25 on the MMSE. The removal of these participants resulted in 59 young adults (*M* = 19.4, *SD* = 1.6, range = 18-25 years), of which 40% male and 60% were female, and 40 older adults (*M* = 69, *SD* = 4.4, range = 60-75), of which 35% were male and 65% were female. Descriptive statistics on background characteristics (years of education, health rating) and cognitive measures (forward digit span, backward digit span, vocabulary, MMSE) are shown in Table 4-1. Independent samples t-tests revealed that older adults had more years of education and higher vocabularies than young adults (*p*s <.001), but the age groups did not differ on the other dimensions (*p*s > .356).

Materials

The same 76 proper names and 76 non-name nouns from Experiment 1 were used as targets in this experiment (Experiment 1 method for details). Each target was also paired with a semantic prime word/name and an unrelated word/name, the same unrelated items that were used in Experiment 1. Semantic non-name primes were also nouns and were close semantic associates with the target (e.g., *flask* for the target *beaker*), a subordinate/superordinate member of the same semantic category as the target (e.g., *kangaroo* for *marsupial*), closely related in meaning to the target (e.g., *metaphor* for *simile*), or shared a common semantic concept (e.g., *eulogy* for *obituary*). Semantic proper name primes came from the same occupational or conceptual category as the target, which included actors, musicians, authors, politicians, athletes, historical figures, fictional characters, brand names, and general “news-makers” (refer to Table 3-2 for examples). In order to enhance the semantic overlap between targets and primes, efforts were made to find the closest semantic alternative to a given target

by selecting an individual from the same specific genre of work or artistry, i.e., the same literary genre (*Mark Twain* for *Ernest Hemingway*), played the same sport or position (*Ryan Lochte* for *Michael Phelps*), held the same office (*Hillary Clinton* for *Condaleeza Rice*), and/or was involved in a common project or film (*Tommy Lee Jones* for *Harrison Ford*). Target names that are fictional characters were paired with semantic primes that are also fictional characters within the same modality (e.g., *Olive Oyl* for *Betty Boop*). If the target is still living, the semantic prime's date of birth was within ten years of the target's date of birth. Semantic primes were mostly individuals with the same gender and ethnicity as the target, with the exception of two targets (*Condaleeza Rice*, *Mahatma Ghandi*). All unrelated words and names shared no phonological or semantic features with the target.

The same target questions and unrelated questions described in Experiment 1 were used in this study. The semantic prime questions were designed to activate semantic commonalities between the target and prime by making specific mention of shared semantic features. For example, the semantic prime question for the target Harrison Ford included the shared film *The Fugitive* within the question: "*One of Tommy Lee Jones' most notable roles was a federal marshal in which movie about an on-the-run doctor wrongfully accused of murder?"* The semantic prime questions were matched on word length with both the unrelated questions and the phonological prime questions (Table 3-4).

Procedure

The procedure was identical to Experiment 1 except that semantic primes were used instead of phonological primes during the TOT elicitation task. During the TOT

elicitation task, target questions were preceded by either the semantic prime question or the unrelated question. If the participant had a TOT for the target, the post-target question was either the semantic prime or unrelated question, whichever one had not been used prior to the target (Figure 4-1 for an example of the procedure with a non-name target and semantic prime). Participants were randomly assigned to one of two versions of the experiment to ensure that equal numbers of participants received the semantic prime and unrelated question as the pre-target question for a given target. As with the first experiment, the TOT elicitation task was followed by a multiple choice recognition test, and then a questionnaire to assess their awareness of the priming manipulation and any explicit strategies they may have invoked. They then rated the semantic similarity between each TOT target and its semantic prime and unrelated prime on a 3-point scale (1= completely unrelated, 2= somewhat related, 3= strongly related; Pilot section for details). Following the computer program, the participants completed the digit span and vocabulary tests and were then debriefed and given compensation.

Results

Initial Responses

Experimenters were again instructed to skip trials where the participant took too long to respond (> 10 seconds after reading the question), accounting for 0.6% of trials for young adults and 1.3% of trials for older adults. Initial responses were classified into the same 5 categories described in Experiment 1: correct known, incorrect known, correct TOT, incorrect TOT, and unknown. Means for each response type as a function of age group and target type are shown in Table 4-2. Two (Age Group: Young, Older) X

2 (Target Type: Non-Name, Name) ANOVAs were conducted on the percentage of incorrect knowns, incorrect TOTs, and unknowns (as the proportions of TOTs and correct knowns are explored in depth with other variables). For incorrect known responses, the main effect of target type, F (1, 96) = 158.48, MSE = .002, p < .001, r =.79, and marginal effect of age group, F (1, 96) = 3.34, MSE = .004, p = .071, r =.18, were moderated by a significant age group X target type interaction, F (1, 96) = 5.86, MSE = .002, p = .017. Planned comparisons revealed that older adults had more incorrect knowns for proper name targets (p <.001, r =.39) but did not differ from young adults for non-name targets (p = .951). The proportion of incorrect TOTs did not show any main effects or interactions, ps > 2.66. Finally, unknown response rates showed significant main effects of target type, F (1, 96) = 125.79, MSE = .008, p < .001, r =.75, and age group, F (1, 96) = 81.62, MSE = .038, p < .001, r =.68, which were qualified by a significant interaction between the two variables F (1, 96) = 11.62, MSE = .008, p < .001. This interaction reflects the fact that the higher rate of unknown responses for proper names relative to non-names was more pronounced for young adults (r=.76) than for older adults (r =.46, both ps < .001), and age differences (young having more unknowns than older) were larger for proper names (r =.67) relative to non-names (r=.6, both ps <.001).

Semantic Similarity Ratings

To assess participants' perceptions about the semantic similarity between targets and primes and to see whether this relationship differed as a function of age, mean similarity ratings for all TOT targets and their semantic and unrelated primes were compiled. Items for which the participant responded that they were unfamiliar with either

the prime or target (and could not assess their similarity) were excluded (19.6% for young, 5.5% for older). A 2 (Age Group) X 2 (Prime Type: Semantic Prime, Unrelated) ANOVA revealed that semantic primes were rated as more similar to their targets than the unrelated primes, F_1 (1, 78) = 3107.45, *MSE* = .058, p_1 <.001, an important check on the semantic priming manipulation that did not differ as a function of age group F_1 (1, 78) = 2.03, *MSE* = .058, p_1 =.157.

TOT Incidence

The same procedure was used to exclude outlier items as was done in Experiment 1, i.e., items that were +/- 2.5 SDs from the mean TOT incidence rate for a given target type. This resulted in the loss of one non-name target (*acronym*), which was excluded from all TOT incidence analyses.

Main analyses

A 2 (Age Group: Young, Older) X 2 (Target Type: Non-Name, Proper Name) X 2 (Prime Condition: Semantic Prime, Unrelated) X 2 (First Syllable Frequency: HF, LF) mixed-effect ANOVA was conducted on mean TOT incidence rate by participants (F_1) and items (F_2). Means from this analysis are shown in Table 4-3. Unlike Experiment 1, prime condition had no influence on TOT incidence, F_1 < 1, p_1 = .337, F_2 (1, 142) = 1.54, *MSE* = .004, p_2 =.217. Independent of prime condition, the results from Experiment 1 were largely replicated in Experiment 2. There were significant main effects of target type, F_1 (1, 96) = 51.48, *MSE* = .007, p_1 < .001, r_1=.59, F_2 (1, 142) = 20.39, *MSE* = .013, p_2 <.001, r_2 = .35,and age group, F_1 (1, 96) = 16.35, *MSE* = .034, p_1 < .001, r_1= .38, F_2 (1, 142) = 45.56, *MSE* = .009, p_2 <.001, r_2 =.49, where more TOTs occurred for proper names and older adults. There were also significant two-way interactions between age

group and target type, F_1 (1, 96) = 11.44, *MSE* = .007, p_1 < .001, F_2 (1, 142) = 5.88, *MSE* = .009, p_2 =.017, and target type and first syllable frequency (by participants), F_1 (1, 96) = 5.19, *MSE* = .005, p_1 = .025, F_2 (1, 142) = 1.42, *MSE* = .013, p_2 =.235.

As in Experiment 1, there was a significant age group X target type X syllable frequency interaction (by participants), F_1 (1, 96) = 5.93, *MSE* = .005, p_1 = .017, F_2 (1, 142) = 1.9, MSE = .009, p_2 =.17, depicted in Figure 4-2. Age differences in TOT incidence were contingent on target type and syllable frequency category. The age group X target type interaction was significant for items with HF first syllables (p_1 <.001) but not LF first syllables (p_1 =.301), replicating Experiment 1. When targets possessed HF first syllables, older adults had more TOTs relative to young for proper names (p_1 <.001, r_1=.38), but equivalent TOT rates as young for non-names (p_1 =.388, r_1=.09). This pattern deviated slightly from Experiment 1, where older adults had more TOTs than young in all conditions, but the size of age differences were smaller for non-names with HF first syllables compared to proper names with HF first syllables. In contrast, the magnitude of age differences were similar for names (r_1=.38) and non-names (r_1=.4) when they possessed a LF first syllable (*p*s < .001), which occurred across both experiments.

For non-names, age differences in TOT incidence was dependent on syllable frequency category, where older adults *only* had more TOTs than young for non-names with LF first syllables (p_1 <.001, r_1=.4); young and older adults had similar TOT rates for non-names with HF first syllables. In contrast, for names, age differences in TOT incidence did not differ as a function of syllable frequency (*p*s <.001), with older adults having more TOTs than young adults for both LF and HF syllable names (consistent

with Experiment 1). The target type X syllable frequency interaction was only significant for older adults (p_1 =.003), because they exhibited opposing effects of syllable frequency as a function of target type: more TOTs for non-names with LF first syllables relative to HF first syllables (p_1 =.039, r_1=.21), and more TOTs for names with HF first syllables relative to LF first syllables (p_1 =.056, r_1=.19). Young adults trended toward an inhibitory syllable frequency effect for both target types (*p*s >.062). No other effects or interactions were significant, *p*s >.112.

Correct response rates

As expected, semantic priming did not influence the occurrence of TOT states, which is linked more strongly to activation of a word's phonology. To examine how semantic priming might affect other aspects of lexical access, the Age Group X Target Type X Prime Condition X Syllable Frequency ANOVA was also conducted on the proportion of correctly-answered target questions (# Correct Knowns/Total Trials). Means from this analysis are shown in Table 4-4. There were significant main effects of age group, F_1 (1, 96) = 33.89, *MSE* = .165, p_1 < .001, r_1 =.51, F_2 (1, 142) = 63.01, *MSE* = .07, p_2 <.001, r_2 =.55, target type, F_1 (1, 96) = 34.25, *MSE* = .037, p_1 < .001, r_1 =.51, F_2 (1, 142) = 8.11, *MSE* = .143, p_2 =.005, r_2 =.23, and syllable frequency (by participants), F_1 (1, 96) = 5.57, *MSE* = .06, p_1 = .02, r_1 =.24, F_2 <1, p_2 =.497, where more correct answers occurred for older adults, non-names, and LF first syllable targets. Although the main effect of prime condition was not significant, F_1 (1, 96) = 1.78, *MSE* = .006, p_1 = .185, F_2 (1, 142) = 1.99, MSE = .009, p_2 =.161, there was a significant interaction between prime condition and age group, F_1 (1, 96) = 12.48, *MSE* = .006, p_1 < .001, F_2 (1, 1492) = 8.91, MSE = .006, p_2 =.003. Planned comparisons

within the age group X prime condition interaction revealed that older adults had a significant reduction in correct response rates following semantic primes (p_1 = .002, r_1 =.3, p_2 = .01, r_2=.21); younger adults trended in the same direction, though the effect was not significant (p_1 =.1, r_1= .17, p_2 =.338, r_2 =.08).

These effects were qualified by a significant age group X target type X syllable frequency interaction (by participants), F_1 (1, 96) = 7.28, *MSE* = .009, p_1 = .008, F_2 <1, p_2 =.36, and a marginally significant four-way interaction F_1 (1, 96) = 3.15, *MSE* = .01, p_1 = .079, F_2 (1, 142) = 5.48, MSE = .0067, p_2 =.021. Because the primary question of interest was how the semantic primes would influence correct response rates, I examined the effect of prime condition within each target/syllable frequency combination as a function of age. The target type X prime condition X syllable frequency interaction was significant for older adults, p_1 =.053, p_2 =.073, in that older adults' correct response rate was reduced by semantic primes, but only for non-names with HF first syllables (p_1 =.006, r_1 =.28, p_2 =.011, r_2 = .21). There was no influence of semantic primes for non-names with LF first syllables (p_1 = .245, p_2 =.11), or for proper names from either syllable frequency category (p_1s > .139). In contrast, the target type X prime condition X syllable frequency interaction was not significant for young adults, p_1 = .680, p_2 =.231, reflecting the fact that semantic primes had no influence on young adults' correct response rate in any target type/syllable frequency condition (*p*s >.19).

I also examined the age group X target type X syllable frequency interaction separately in the semantic prime and unrelated conditions. The three-way interaction was only significant in the unrelated condition (by participants), p_1 =.003, p_2 =.11. As in Experiment 1, the target X syllable frequency interaction was significant for older adults

(p_1=.009), reflecting an inhibitory syllable frequency effect for names (p_1 =.004, r_1 =.29) but not for non-names (p_1 =.471). Unlike Experiment 1, the target X syllable frequency interaction was not significant for young (p_1 =.119), but the comparisons trended in the same direction, with young showing a marginal inhibitory syllable frequency effect for non-names, p_1 = .075, r_1 =.18, and no effect of syllable frequency for names, p_1 = .743. As in Experiment 1, the significant age X syllable frequency interaction for proper names (p =.014), revealed that age differences were larger for proper names with LF first syllables (r_1= .56) compared to proper names with HF first syllables (r_1=.39. both ps <.001). The age group X syllable frequency interaction was also marginal for non-names (p = .091) where age differences were larger for non-names with HF (r_1 =.53) first syllables compared to non-names with LF first syllables (r_1 =.39, both ps <.001). Overall, patterns in the unrelated condition were similar to Experiment 1, with the exception of syllable frequency moderating age differences in both target types here (though marginally for non-names), and only proper names in Experiment 1. The semantic prime altered these patterns by reducing older adults' correct knowns for non-name targets with HF first syllables (the condition where age differences were most pronounced in the unrelated condition and Experiment 1), therefore making age differences more similar across conditions (Figure 4-3). As such, the three way interaction was not significant in the semantic condition, p_1 = .532, p_2 = .843. No other effects or interactions involving correct known rates were significant, p >.136.

Theoretically, the semantic prime would influence correct response rates by interfering with lexical selection of the target. There are two methods by which lexical selection of the target would be hindered by the prime: (1) by activating the semantics of

several associated words and concepts, it prevents or delays the activation of the target's lemma (resulting in fewer correct knowns and more 'unknown' responses), or (2) by bolstering activation of alternate lemma(s) (resulting in fewer correct knowns and more 'incorrect known' answers). Older, but not young, adults exhibited a reduction in correct knowns following a semantic prime, so further analysis on the older adults can help to dissociate these two possibilities. A target type X prime condition ANOVA was conducted (by participants) on older adults' proportion of unknown answers (to test the first hypothesis) and on proportion of incorrect known responses (to test the second hypothesis). Older adults' rate of unknown responses showed only a significant main effect of target type, F (1, 39) = 31.87, MSE = .014, p <.001, r = .67, with fewer unknowns for non-names (M = 17.4%) relative to proper names (M= 27.9%). Neither the effect of prime condition, F < 1, p = .774, nor the prime condition X target type interaction, F (1, 39) = 1.22, MSE = .004, p =.28, had a significant impact on older adults' rate of unknown responses, contrary to the delayed activation hypothesis. However, in support of the alternative lemma hypothesis, the semantic prime increased the rate of incorrect known responses (M = 13.4%) relative to the unrelated condition (M = 11.6%), F (1, 39) = 4.4, MSE = .003, p = .043, r = .32. Older adults' rate of incorrect known responses was also affected by target type, F (1, 39) = 64.78, MSE = .012, p <.001, r = .79, with more incorrect knowns for non-names (M =16.2%) than names (M = 8.9%). The prime condition X target type interaction was not significant, F < 1, p = .801, suggesting equivalent semantic priming effects on incorrect knowns for names and non-names among older adults.

One relevant question is whether the increase in incorrect knowns following semantic priming resulted from the prime word itself being produced in lieu of the target. Overall, if an incorrect response was given to a target question in the semantic prime condition, 31% of the time it was the semantic prime itself. In contrast, the semantic prime was never offered as an incorrect response in the unrelated condition. To further examine the likelihood of producing the semantic prime instead of the target, an Age Group X Target Type ANOVA was conducted on the proportion of times a semantic prime was given as the answer in the semantic prime condition (# of times semantic time produced/total semantic prime trials). Non-name semantic primes (M = 5.3%) were more likely to be given as the answer relative to proper name semantic primes (M = 1.9%), F (1, 96) = 64.67, MSE = .001, p <.001, r = 63. An interaction between age group and target type, F (1, 96) = 4.49, MSE = .001, p =.037, revealed that older adults (M = 2.4%) were more likely than young adults (M = 1.4%) to give the semantic prime as the answer for proper name questions (p =.053, r =.2), but that the age groups were equally likely to produce the semantic primes for non-name questions (M_{Older} = 4.9%, M_{Young} = 5.7%, p = .307).

TOT Resolution

Targets whose mean TOT resolution rate was more than 2.5 SDs from the target type mean were excluded from analysis, which included three non-names (*diameter, lentil, allegory*) and one proper name (*Carmen Electra*). As with Experiment 1, extreme data loss prevented the ability to look at all variables of interest within a single analysis. Because semantic primes were not expected to interface with syllable frequency (and did not interact with syllable frequency on TOT incidence), I examined the Age Group X

Target Type X Prime Condition relationship (collapsed across syllable frequency category, shown in Table 4-5), and Age Group X Target Type X Syllable Frequency interaction (collapsed across prime condition). Because the items were associated with high variability in TOT resolution, greater explanatory value was attributed to the participant analyses.

Semantic priming effects on TOT resolution

The 2 (Age Group) X 2 (Target Type) X 2 (Prime Condition) ANOVA revealed a marginal main effect of target type (by participants), F_1 (1, 65) = 3.73, *MSE* = .048, p_1 = .058, r_1 = .23, F_2 < 1, p_2 =.491, where non-names (34.4%) were resolved more frequently than proper names (29.2%). There was also a significant interaction between target type and age group (participants only), F_1 (1, 65) = 4.13, *MSE* = .048, p_1 = .046, F_2 < 1, p_2 = .838. Focused contrasts showed that older adults (p_1 = .008, r_1 =.32) had a higher resolution rate for non-names compared to names, whereas young adults' resolution rates did not differ as a function of target type (p_1 = .942).The age group effect was not significant for either target type, *p*s > .242. Semantic primes did not influence TOT resolution, evidenced by no main effect, F_1 < 1, p_1 = .91, F_2 < p_2 =.391, nor any interactions with prime condition, *p*s > .136.

Effects of syllable frequency on TOT resolution

To see how first syllable frequency influences TOT resolution independent of priming, an Age Group X Target Type X Syllable Frequency ANOVA was conducted on the mean TOT resolution rate. Only results relevant to the new variable, syllable frequency, are discussed. Syllable frequency had no effect on TOT resolution rate, F_1

(1, 64) = 1.19, *MSE* = .079, p_1 = .280, F_2 < 1, p_2 =.531, and no other interactions involving syllable frequency were significant, *p*s > .289.

Discussion

Results of Experiment 2 replicated some of the key findings reported in Experiment 1, confirmed a long-standing hypothesis regarding the source of TOT states, and offered some new information about the top-down processing of names and non-names from the point of semantic activation through lexical selection. By presenting semantic primes prior to the target question and after TOT states, my goal was to examine how semantic associates enable or interfere with lexical selection of proper names and non-names. While semantic primes had no influence on TOTs, for either target type or either age group, they reduced older adults' correct responses, but only for non-names with HF first syllables. As with Experiment 1, the specificity of priming effects are useful in identifying structural differences in the representation of names and non-names, and how they are uniquely affected by aging. Because person semantics are associated with increased specificity (each person has a unique semantic profile), lexical selection of proper names is unaffected by competition from semantically-related primes. In contrast, semantic associates repressed older adults' selection of non-name targets by increasing activation of alternate lemmas, which suggests that there may be age-related changes to either the semantic organization of words or the ability to inhibit semantic competitors.

The lack of semantic priming effects on TOT incidence lends additional empirical support in favor of models that attribute TOTs to a breakdown in lexical-to-phonological communication. The TOT experience represents a situation where lemma selection has

occurred (granting the speaker the strong feeling of knowing the word to be produced), but the retrieval of the phonological word form is unattainable. As such, it serves as a real world demonstration of the rift between semantic-level processing and phonological-level processing. Because semantic associates should influence the activation of the target's semantic features, but not phonological features, the semantic prime was not expected to reduce TOTs or facilitate TOT resolution, as observed in the current data. As such, these results suggest that there is a tangible separation between semantic and phonological processing of words, and it is in this rift that TOT states reside. The division between semantic and phonological systems (and its influence on TOTs) appears to be one commonality between the representations of non-name and proper names.

However, semantic primes did influence lexical selection but only for older adults, as evidenced by the reduction in older adults' correct responses to non-name target questions. Further investigation of the semantic priming effect revealed that the reduction in older adults' correct response rate was due to their production of more incorrect known responses following a semantic prime, as opposed to having more unknown responses. By increasing the likelihood of incorrect alternate answers, the semantic prime (or distractor) exerted its influence by encouraging lexical "mis-selection" (Ferriera & Griffin, 2003). These findings parallel results from the picture-word interference paradigm, where pictures of objects are named more slowly when a semantically-related distractor word is visually or auditorily presented with the to-be-named picture (e.g., Abdel Rahman & Melinger, 2007; Damian, Vigliocco, & Levelt, 2001; Kroll & Stewart; 1994; Sailor et al., 2008; Schriefers, Meyer, & Levelt, 1990;

Starreveld & La Heij, 1995, 1996). However, semantic interference effects in the picture-word interference paradigm have been observed in both young and older adults, whereas in the current study, only older adults exhibited lexical mis-selection following semantic primes and only for non-name targets with HF first syllables. Whereas in the picture-word interference paradigm responses are slowed due to competition from competitors, semantic interference in our TOT elicitation task represents a non-speeded decision to select an alternative lemma, a longer-lasting interference effect. The specificity of semantic interference effects observed here suggests that there needs to be two sources of competition in order for an incorrect lemma to be selected in lieu of the target lemma (e.g., bottom-up competition from similar sounding words, and top-down competition from semantically-related words), and that only older adults are vulnerable to this long-lasting interference effect.

While proper name retrieval is assumed to involve the same generic stages as non-name word retrieval (semantic activation → lexical selection → phonological encoding), the current findings challenge the extent to which the semantic organization and lexical retrieval of proper names is really comparable to other word classes. Semantic priming (or interference) effects were not found for proper names, for either age group, which suggests that 1) the semantics affiliated with a given person are relatively isolated in semantic space, in contrast to the network of overlapping semantic features that exists among words, and/or 2) that compared to non-names, the selection of a specific proper name's lemma is less affected by the relative activation levels of alternate lemmas.

Overall, results from two experiments introduce several ways in which the representations and processes dedicated to proper names are distinct from other types of words, thereby exacerbating age-related declines in retrieval. While the selection of a specific proper name lemma seems to be less affected by interference from semantic associates, the selection of a first or last name is vulnerable to competition from similar-sounding names once the full name phrase lemma has been activated for production. In the general discussion, I will interpret these findings in conjunction with existing theories and evidence to clarify the mechanisms that account for proper names' special status in the lexicon.

Table 4-1. Descriptive characteristics for young and older participants in Experiment 2

	Age Group			
	Young		Older	
	M	*SD*	*M*	*SD*
Age*	19.4	1.6	69.0	4.4
Health Rating (out of 10)	8.3	1.4	8.0	1.5
Education (in years)*	13.4	1.2	17.0	3.1
Vocabulary (out of 25)*	13.1	3.8	19.5	4.3
Forward Digit Span	7.4	1.1	7.2	1.3
Backward Digit Span	5.2	1.3	5.2	1.4
MMSE	--	--	28.5	1.1

Note: * indicates significant age group differences ($p < .001$).

Table 4-2. Percentage of each response type as a function of age group and target type.

	Age Group	
	Young	Older
Non-Names		
Correct Known	35.5	51.5
Incorrect Known	16.1	16.0
Correct TOT	6.9	10.4
Incorrect TOT	2.1	2.9
Unknown	38.6	17.4
Proper Names		
Correct Known	25.0	43.4
Incorrect Known	5.5	8.9
Correct TOT	9.0	16.3
Incorrect TOT	1.8	2.5
Unknown	58.3	27.9

Table 4-3. Young and older adults' mean TOT incidence (in %) as a function of target type, prime condition, and first syllable frequency.

	Age Group			
	Young		Older	
	M	*SE*	*M*	*SE*
Non-Names				
Primed				
HF First Syllable	7.7	1.2	10.3	1.4
LF First Syllable	4.9	1.0	11.4	1.2
Unrelated				
HF First Syllable	7.2	1.2	7.5	1.5
LF First Syllable	6.6	1.1	11.1	1.3
Proper Names				
Primed				
HF First Syllable	9.8	1.5	18.1	1.9
LF First Syllable	8.4	1.3	15.1	1.6
Unrelated				
HF First Syllable	9.5	1.4	17.0	1.7
LF First Syllable	7.8	1.3	15.2	1.6

Table 4-4. Young and older adults' correct response rate (in %) as a function of target type, prime condition, and first syllable frequency.

	Age Group			
	Young		Older	
	M	*SE*	*M*	*SE*
Non-Names				
Semantic Prime				
HF First Syllable	33.9	2.3	47.2	2.8
LF First Syllable	35.9	2.4	49.6	2.9
Unrelated				
HF First Syllable	32.1	2.3	53.9	2.8
LF First Syllable	35.7	2.5	52.2	3.1
Proper Names				
Semantic Prime				
HF First Syllable	26.3	2.4	42.0	2.9
LF First Syllable	25.7	2.5	44.2	3.0
Unrelated				
HF First Syllable	24.8	2.4	40.4	2.9
LF First Syllable	24.1	2.2	47.4	2.7

Table 4-5. Young and older adults' mean TOT resolution (in %) as a function of target type and prime condition.

	Age Group			
	Young		Older	
	M	*SE*	*M*	*SE*
Non-Names				
Primed	30.4	4.7	38.0	4.9
Unrelated	31.4	5.7	37.6	5.9
Proper Names				
Primed	30.6	4.1	27.3	4.3
Unrelated	31.8	4.5	27.0	4.7

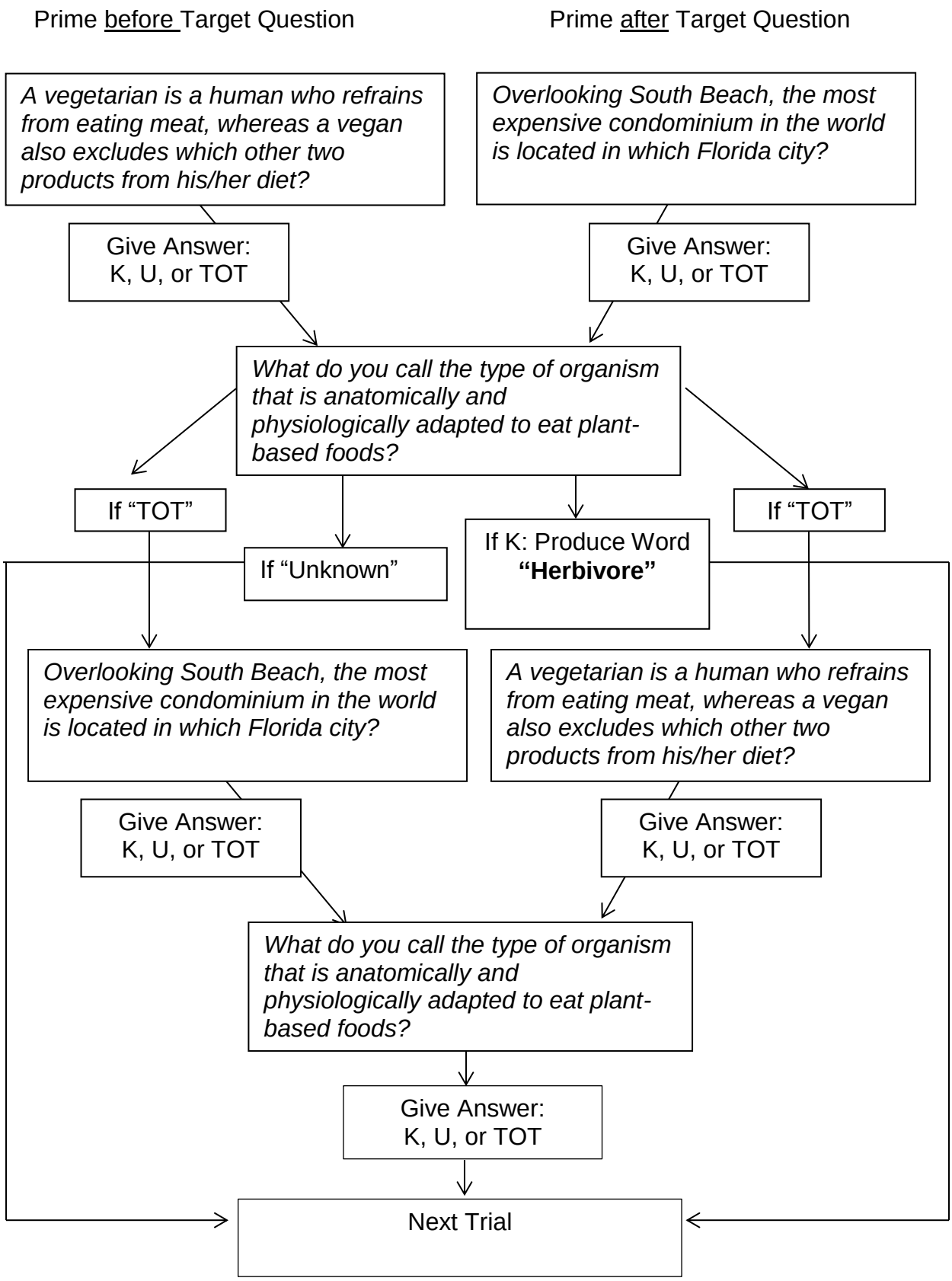
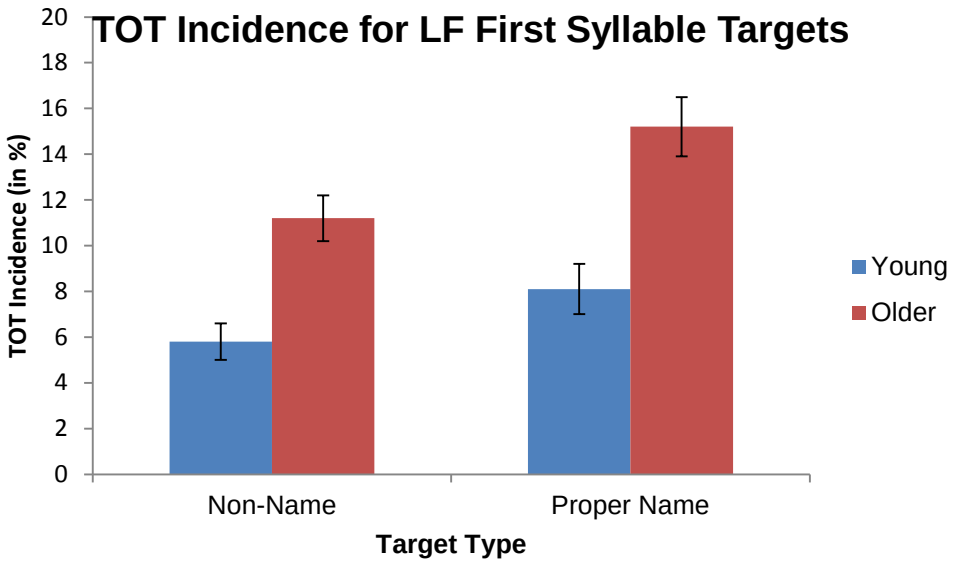


Figure 4-1. Trial structure for Experiment 2



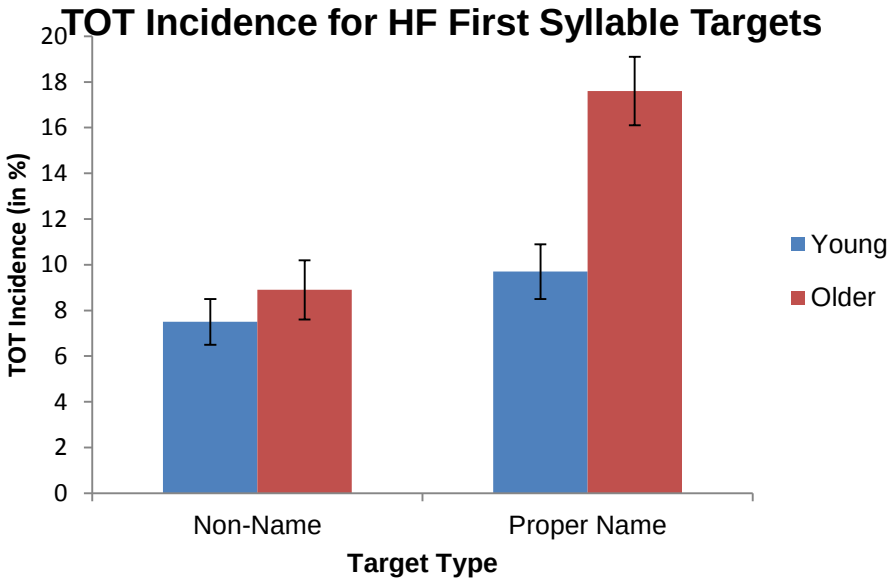
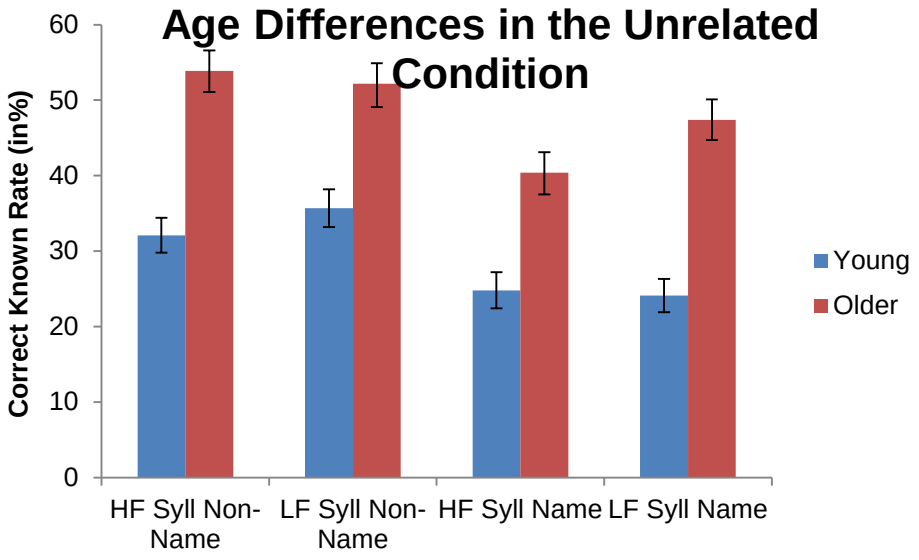


Figure 4-2. Age differences in TOT incidence as a function of target type and first syllable frequency.



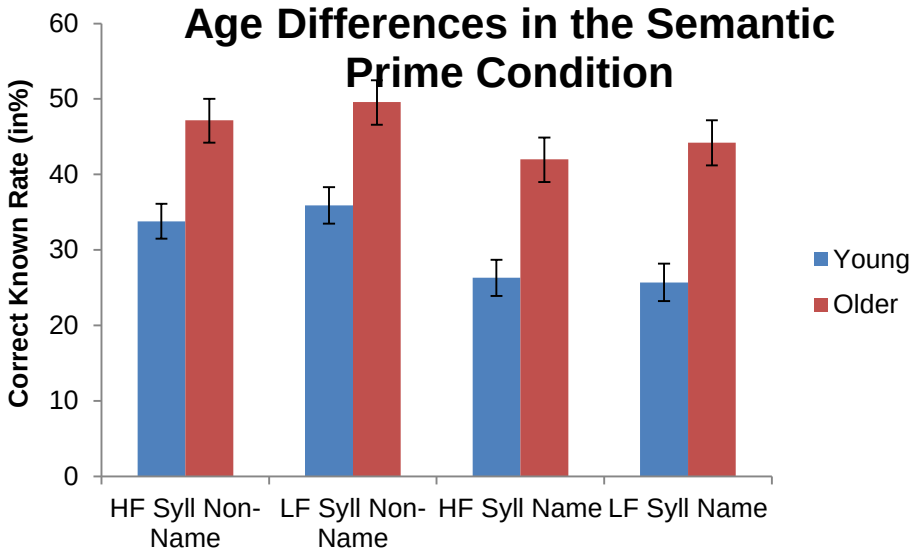


Figure 4-3. Age differences in correct response rates as a function of prime condition, target type, and syllable frequency.

CHAPTER 5
GENERAL DISCUSSION

The goal of this dissertation was to uncover differences between proper names and non-names at the levels of semantic activation, lexical selection, and phonological encoding, with the greater goal of understanding of why proper names are particularly susceptible to retrieval failures in older age. Previous theoretical and empirical efforts at understanding the specialness of proper names has largely focused on semantic characteristics. Relative to other words, proper names are inherently more arbitrary and more specific (e.g., Bredart et al., 1995; Semenza, 2006; Semenza, 2009), less descriptive and less meaningful (e.g., Cohen & Burke, 1986, Fogler & James, 2007), and are generally encountered less often (Cohen & Burke, 1993; Conley et al., 1999). However, very few studies have directly compared proper name retrieval to non-name retrieval using a paradigm that enables manipulation of specific features that may differ between the word classes. The introduction of semantic and phonological primes at different stages in the retrieval process revealed divergent processing streams associated with names and non-names from the moment of lexical selection (when the person has activated the word or name he/she wants to produce) through phonological encoding (when the individual sounds are assembled for production). Importantly, the retrieval of non-names and names was differentially affected by priming and first syllable frequency, suggesting distinct mechanisms to account for age-related declines in each word class. In two experiments, the following key differences between proper names and non-names emerged: 1) while age differences in TOTs for non-names are isolated at the level of phonological encoding, TOTs for proper names may be caused by retrieval failures at multiple stages of lexical-phonological processing, including first

or last name retrieval, 2) because proper name TOTs have multiple sources of transmission failures, proper name retrieval is less responsive to phonological priming and is inhibited by phonological neighborhood size, and 3) due to increased semantic specificity, lexical selection of proper names is a non-competitive process.

Results from both experiments confirmed a critical role of syllable frequency in the disproportionate age impairment during the retrieval of known names. As expected, there were exaggerated age differences for proper names but only relative to non-names with HF first syllables. Words with LF first syllables were as difficult for older adults as proper names, suggesting that age differences in retrieval of non-names and names may be caused by different features. For non-names, syllable frequency accounted for nearly all of the age-related increase in TOTs, as evidenced by the age group X syllable frequency interaction among non-names. In Experiment 1, age differences in TOTs for non-names were significantly larger for words with LF first syllables compared to words with HF first syllables. In Experiment 2, age differences in TOTs for non-names *only* occurred for words with LF first syllables, consistent with previous research (Farrell & Abrams, 2011). These findings imply that older adults' increase in TOTs for non-names can be almost exclusively attributed to a breakdown during phonological retrieval, specifically, the retrieval of LF phonological components. Older adults' susceptibility to retrieval failures among words with LF first syllables has been attributed to a long-term practice effect: links to sounds that are not used regularly and/or occur in few words grow weaker with disuse, therefore encouraging transmission failures that cause TOTs. In contrast, age differences in TOT incidence for proper names were not dependent on syllable frequency, with older adults universally having

more TOTs than young adults for names with HF and LF first syllables. Thus, there must be other factors accounting for age-related declines during proper name retrieval. In support of this idea, phonological primes reduced age differences in TOTs for non-names but had no effect on age differences for proper name TOTs.

One possibility is that there is increased complexity associated with proper name retrieval due to the demands of completing lexical selection (identifying the specific person) and then retrieving the first and last names associated with that lemma. As depicted in Figure 1-1, there are multiple places wherein a person could fail to activate part of a name's representation: 1) from the person's lemma (name phrase) to the first name label, 2) from the lemma to the last name label, 3) from the first name to its phonological subcomponents, and 4) from the last name to its phonological subcomponents. Thus, there are at least four locations where activation spreading can fail during proper name retrieval, therefore increasing the likelihood of TOTs. The idea that name retrieval is associated with increased complexity, and therefore increased cognitive resource burden, supports previous research indicating more neural resources are involved during proper name recall relative to other words (e.g., Pelamatti et al., 2006; Semenza, 2006; 2009). The cognitive burden of retrieving proper names would be especially taxing on older adults, who have reduced cognitive resources relative to their younger counterparts.

Multiple potential loci for proper name TOTs would also explain why first-syllable primes were not beneficial for reducing TOTs or bolstering TOT resolution of names, for either age group. Because the breakdown that caused the TOT could have occurred at multiple links during the retrieval process, it is less certain that the activation from the

prime will be able to reach the temporarily disabled link. For example, if the retrieval breakdown occurred in the link between a target lemma and its first name, then activation from a prime sharing only a single syllable would have to traverse the distance between the first syllable node and the first name node, and then from the first name to the lemma node. Activation from the prime would diminish over time and distance, so a single syllable may not provide enough information to fully reactivate the link between the name phrase lemma and the first name node. For non-names, if the retrieval breakdown occurred in the chasm between the lemma and first syllable, then activation from the prime would only have to spread from the first syllable to the target lemma. This might be why priming was helpful for older adults, whose TOTs for non-names appear to be exclusively linked to a breakdown during the retrieval of phonological subcomponents.

Deactivated links between a proper name lemma and either the first or last name might be the most common source of proper name TOTs, which is why primes containing the full phonology of either the first or last name have been able to reduce TOTs (Burke et al, 2004) and increase TOT resolution for proper names (White et al., in press). It might also explain why people are less likely to have partial phonological information available (e.g., a phoneme or syllable) when having a TOT for a proper name, because they have not yet retrieved the first name's lexical representation and have not reach the level of phonological subcomponents. For example, Cohen and Burke (1993) reported that proper name TOTs were associated with complete memory gaps, whereas non-name TOTs were more likely to be accompanied by some partial phonological knowledge of the missing word. An interesting question is whether priming

of proper names is dependent on the amount of phonology provided or demands an entire name (first or last) to facilitate retrieval. For example, if participants are given partial phonology of both the first and last name would that be enough to offset TOTs, or is an entire first or last name needed?

The lack of phonological priming for younger adults' TOTs for non-names was surprising, given the fact that a number of previous studies have shown significant priming effects for young adults' resolution of non-names TOTs using only a single syllable (e.g., Abrams & Rodriguez, 2005; Abrams et al., 2003; White & Abrams, 2002). In the current study, young adults' TOT resolution for non-names was numerically higher in the phonological prime condition compared to the unrelated condition, with an almost 10% difference between the two conditions, which is similar to significant priming effect sizes found in previous research. In this study, young adults had far fewer TOTs than older adults, so a substantial proportion of young adults were excluded from the resolution analyses for failing to have a TOT in each condition. Therefore, the loss of power among analysis for young adults may partially account for the non-significant priming effect for TOT resolution. However, young adults also failed to show any priming of TOT incidence or correct knowns, which cannot be explained by reduced power, as there were more young adults included in the analysis than older adults. Hence, there must be some fundamental difference in the factors that induce TOTs among young and older adults. This was the first study to examine phonological priming effects on TOT incidence using only a single syllable, as previous studies had used homophones and/or the entire target's phonology embedded within word lists (e.g., Burke et al., 2004; James & Burke, 2000). One possibility is that younger adults were

less familiar with the non-name targets, so providing partial phonology prior to the question was not enough to forestall TOTs or boost successful selection of the targets. However, once a TOT state occurs (and the lexical representation of a word was fully activated), activating a single syllable may provide enough information to overcome the TOT, which is why young adults have been able to benefit from single syllable primes in previous research and trended in that direction in the current study.

The increased complexity of name retrieval might also explain why older adults showed opposing syllable frequency effects for names and non-names. The differential influence of syllable frequency on older adults' non-name and proper name TOTs can be explained if the effect is assigned to different levels in the retrieval process: facilitation from HF first syllables at the level of phonological encoding of non-names, and inhibition from HF first syllables at the level of first name selection of proper names. If a person successfully selects a specific person’s lemma but is unable to retrieve his/her first name, then it is not helpful to have multiple other name options that sound like the target’s first name and are all equally viable as a name option (because names themselves do not denote meaning and are not directly linked to the semantics of a person). The parallel effect for non-names is unlikely to occur because words that share phonological properties do not typically share semantic properties, so are not viable candidates for production.

However, inhibitory syllable frequency effects were not limited to older adults' TOTs for proper names. A relatively unexpected finding was that older adults’ correct response rate for names and young adults’ correct response rate for non-names both showed inhibitory syllable frequency effects, with fewer correct responses for items with

HF first syllables compared to LF first syllables. These findings are intriguing because they imply that phonological characteristics can influence how strongly a word or name is stored in memory. In this case, the possession of a large first-syllable cohort reduced the likelihood of completing lexical selection of the target. These results are contrary to previous research showing facilitation from high syllable frequency during phonologically-driven tasks, such as word and pseudoword naming (e.g., Cholin et al., 2011; Macizo & Van Petten, 2007). The current data suggest that having many first syllable neighbors can be counterproductive during all stages of lexical access prior to phonological encoding, at least when there is uncertainty of the word to be produced. As demonstrated by their lower rates of correct responses, young adults' knowledge of the non-name targets was significantly weaker than that of older adults. If young adults' knowledge of the non-names was characterized by familiarity with the target concept but uncertainty with the word itself (i.e., before lemma selection), then it might create a situation wherein having a number of similar-sounding words hinders access to a specific word. For older adults, interference from similar-sounding proper names may have occurred during the retrieval of the first name, after successful selection of the lemma associated with the person.

Overall, it appears that facilitation from HF syllables only occurs when it is at the level of phonological encoding, when the person is certain of the word to be produced, such as older adults' TOT incidence for non-names, and previous studies on word or pseudoword naming tasks, which do not demand lexical selection. In other cases, when a person is less certain of a word (i.e., young adults' retrieval of non-names), or when there are multiple places for transmission failures occur (i.e., older adults' retrieval of

proper names), it becomes more problematic to have similar-sounding words and names. Although these assumptions are speculative, it might be a useful future research endeavor to see if the beneficial effects of phonological frequency on word production reported in previous research can be reversed when participants are asked to retrieve words from memory when uncertain of correctness of their response. For example, would high syllable frequency interfere with naming latencies when participants are asked to name pictures of uncommon objects whose names are known but not produced often? Or, would syllable frequency negatively influence recall of newly-learned words that have just entered the lexicon because they sound like other existing (better known) words?

It is important to note that the disproportionate age impairment for names and its interaction with syllable frequency is 1) specific to TOT incidence, and 2) cannot be explained by age differences in familiarity with the targets or the number of opportunities to have TOTs. First, older adults' difficulty with proper names was only expressed in the TOT incidence analyses; older adults knew more correct responses and had fewer unknown responses for proper name questions relative to young adults. Thus, the particular age impairment for proper names is isolated to the level of phonological retrieval, i.e. influencing only TOTs, when older adults are attempting to retrieve names that they know well. One potential argument is that young adults' lack of familiarity with the proper name targets granted them fewer opportunities to have TOTs; one can only have a retrieval failure if there is an existing representation that is trying to be accessed. However, identical patterns emerged when unknown answers were excluded (including all trials for which a retrieval attempt was made) and when TOTs were calculated as a

proportion of known answers (including all trials for which the correct answer was known), suggesting that age difference discrepancies as a function of target type cannot be explained by familiarity. Further, the interaction between age group, target type, and syllable frequency remained unchanged when the analysis was conducted using only targets matched on first syllable frequency. Thus, even when looking at the identical set of syllables, high syllable frequency reduces older adults' TOTs for non-names but increases their TOTs for proper names.

Beyond the organization of lexical-phonological links, Experiment 2 revealed intriguing differences between names and non-names in terms of the flow of activation between the semantic and lexical layers. A critical question was whether lexical selection of proper names is a competitive process, as is assumed by most models of non-name word production. Based on previous research, there were *a priori* reasons to suspect that proper name selection would be more vulnerable to competition from semantic competitors due to a close-knit distribution of proper names within semantic space (e.g., Burgess & Conley, 1998; Conley et al., 1999).There were also reasons to suspect that proper names would be less vulnerable to lexical competition due to the individualized nature of a person's semantics (e.g., Semenza, 2006; 2009). Because semantic primes reduced older adults' correct response rates for non-names but not for names, results from the current research confirm the latter perspective and suggest that the semantic representations of names are characterized by less semantic overlap among semantic associates, resulting in a non-competitive lexical selection process.

Older adults' reduction in correct responses was attributed to lexical mis-selection in that they showed an increase in incorrect responses following a semantic prime but

not a change in unknown responses. The incorrect selection effect can be explained by differences in the relative activation levels of viable lemmas in the primed versus unrelated condition. In the unrelated condition, each question is read as its own entity, triggering activation of the semantic features described in the question and allowing the participant to select the specific lemma that best embodies the set of activated semantic features. However, when the prime is presented in the pre-target question, participants are forced to engage in deep semantic processing of the prime word and its meaning, allowing for strong activation of the prime's lexical representation as well as the lexical representations of other semantically-related lemmas. The subsequent target question then activates a set of semantic features that overlap closely with the prime but are not identical. Because of the proximity between the prime and target questions, there is not enough time for the activation of competing lemmas to completely subside. Hence, the activation of shared semantic features (provided in the target question), coupled with the heightened baseline activation of the prime's lemma and/or related lemmas (provided by the prime question), allows for an incorrect word to be chosen for production. Participants are only susceptible to this interference effect prior to the point of lexical selection of the target (TOT incidence), which is why semantic primes do not influence TOT resolution, where they have already chosen a particular lexical entry for production.

However, the semantic interference effect was not ubiquitous. Only older adults experienced the lexical mis-selection effect and only for non-names with HF first syllables. Although young adults have shown semantic interference in other research methodologies, the type of semantic interference reported here differs from other

paradigms in that it is relatively long-lasting; activation of alternate lemmas must be maintained at least several seconds in order to prevent selection of the target. Semantic interference effects in the picture-word interference paradigm, for example, are much more ephemeral, so much so that they disappear when the timing of the distractor/picture presentation is changed by mere milliseconds. Further, semantic distractors in those studies generally slow production latencies but rarely cause the participants to produce the wrong picture name. Hence, there is something methodologically unique about the type of distraction provided by the semantic primes in this study that allows for the wrong name to be chosen. Based on the selectivity of when interference occurs, it seems that competition must come from two sources in order for lexical mis-selection to occur: semantic interference from activated competitors, and phonological ambiguity from HF first syllables. It was not activation of the prime itself that caused older adults but not young adults to produce more incorrect responses following prime questions, as both age groups were equally likely to give non-name primes as the answer to non-name target questions. Therefore, semantic primes must be encouraging older adults to produce alternate words that had been activated in the prime question. Words with HF phonology might also have more semantically-related words relative to words with LF phonology, rendering them more vulnerable to the mis-selection effect.

Older adults' vulnerability to this long-lasting semantic interference effect can be explained by two different sources of age-related change in the cognitive and language profiles of older adults, declines in inhibitory control (e.g., Hasher & Zacks, 1988; Zacks & Hasher, 1994), and gains in semantic word knowledge (see Burke & Shafto, 2008 for

review). The ID hypothesis is a resource-reduction theory of cognitive aging that explains age-related deficits across multiple cognitive domains to a common agent: reduced ability to ignore or suppress irrelevant stimuli from entering attentional awareness. The ID hypothesis has been used to account for a number of documented age-related changes to language processing, including increased word length and tangential speech during discourse production, and increased interference from distracting material during comprehension (see Abrams & Farrell, 2011; Burke & Shafto, 2008; Mortensen et al., 2006). In light of this idea, older adults' propensity toward semantic interference observed in the current study could be caused by an inability to inhibit or suppress previously activated lemmas while reading the target question. Because of this sustained activation of the alternate (incorrect) lemmas, they are unable to fully process the target question and fail to detect the introduction of a new concept that they would have otherwise known (in the unrelated condition). Alternatively, older adults may be more inclined to semantic interference because they have superior semantic networks relative to young, as measured by vocabulary scores and general knowledge tests (e.g., Verhaeghen, 2003; Ackerman & Rolfhus, 1999). In order to see semantic priming or interference, the semantic networks dedicated to the target and prime must include shared semantic representations. If older adults have better knowledge about the meanings of both the prime word and the target, they would be more likely to activate the semantic features shared between the words, allowing for lexical selection of the prime and/or related lemma to supersede selection of the target. For this same reason, older adults might activate *more* competing lemmas while reading the prime question relative to young adults, making target selection more difficult.

Neither age group experienced semantic interference effects during the retrieval of proper names, suggesting that proper names are either less likely to share semantic features (therefore preventing the spread of activation between proper names at the semantic level) or that the selection of a proper name's lemma occurs independent of the relative activation levels of other names. The former point is somewhat counterintuitive because obviously people do possess overlapping semantic features; they share common occupations, hobbies, acquaintances, events, and projects. And, both types of target questions were designed to engage those features that were shared between target and prime. So, why then would activation from the semantic prime influence lexical selection for non-names but not for names? One obvious concept is that the representation of a person demands increased specificity, both at the level of semantics (each person that we know has a completely unique constellation of semantic features) and at the level of name retrieval (there is always only one name lemma that matches those semantic features). There is less competition during the selection of name because there is no other word or label to communicate the same level of specificity. In contrast, words often have synonyms or very closely-related alternate word options that can be produced in place of a given target word, making lexical selection a more 'selective' process.

In sum, data from two experiments unveil differences in the representation and processing of proper names at multiple levels in the language network. Some of these differences seem to exacerbate the negative effects of age on the retrieval of proper names compared to other words. The lexical-phonological representation of names is characterized by added complexity due to the necessity of retrieving first and last

names, many of which are shared by other people that are known. Because of this additional level of complexity, there are multiple places where transmission failures can occur, which increases the likelihood of TOTs, especially for older adults. The specificity demanded by proper names (both in the semantic profiles associated with a given person, and the specificity of the name label used to describe that person) causes lexical selection of proper names to be less dependent on competition. While the focus of this research was to understand how names and non-names are differentially portrayed in the lexicon, these data also revealed some insight abut general language processing, including the opposing influence of syllable frequency during lexical selection versus phonological encoding, and the extent of interactivity between semantic, lexical, and phonological characteristics during word retrieval and production.

Conclusions from this research are limited by the fact that the proper name and non-name stimuli were not perfectly matched on familiarity, so we cannot completely rule out the possibility that lack of familiarity with the proper name targets contributed to the increase in retrieval failures for names (independent of age). Additionally, the measure of syllable frequency used here represents the combined frequency of words that contain that syllable in the onset position, as reported by the CELEX database. While CELEX does contain a few proper names within the database, many of the names used in this study were not found in the database, so their syllable frequencies came from a corresponding non-name with the same first syllable. At any rate, it is not known whether a HF syllable in language is necessarily a HF syllable among names. In future research, I hope to disentangle this issue to see whether inhibitory effects of high syllable frequency among proper names stem from a name sounding like many other

words (non-names) in the lexicon or from names sounding like many other names. Using a measure of a syllable's use among names would more accurately capture how spreading activation among similar-sounding names influences retrieval. The finding that older adults' semantic inference effect was moderated by syllable frequency was an unexpected and theoretically valuable contribution to models of speech production, which have generally assumed distinct semantic and phonological systems. One unexplored possibility is that HF first syllables are more likely to be morpheme units that denote some level of semantic meaning. As such, there may be more semantic commonalities among words with HF first syllables than words with LF first syllables, allowing two sources of interference (semantic, phonological) in the former case. Because I did not control for morpheme usage in the current stimuli, it might be a useful future research endeavor to see whether the relationship between syllable frequency and semantic interference is driven by the morpheme status of the syllable.

Finally, it must be pointed out that the conclusions I have drawn about age-related changes to proper name retrieval refer only to their retrieval of famous names. While I have generally used the term "proper name" to refer to the names of people, there are of course many other types of proper names (place names, event names) that may enable different storage and processing mechanisms than that of people's names. At this point it is largely unknown whether these other types of proper names are equally vulnerable to retrieval failures as people names and whether they are differentially represented at the semantic and phonological levels. It would be particularly useful to contrast proper names that have to share lexical nodes with other names (i.e., other Julies, other Smiths) to those that do not involve this particular constraint (Afghanistan,

Paris). Comparing age differences for words, completely unique proper names, and shared proper names would reveal the importance of name sharing (and phonological interference) in older adults' particular impairment during name retrieval.

To the same end, diary studies have suggested that acquaintance names (not famous names) are the most common source of TOTs among older adults, although the retrieval of acquaintance names has yet to be examined within the context of a laboratory study. There are reasons to suspect that acquaintance names would behave differently than proper names due in part to the specific features that were uncovered in the current study. First, acquaintance names may be more common than famous names, so there may be increased sharing of first/last names and hence increased interference during retrieval. Further, many of the famous names used in TOT studies represent the most iconic version of a specific first or last name, so they may be less vulnerable to phonological interference than would acquaintance names. Globally, I plan to expand on this line of research by investigating how the fragility of proper names' representation is linked to breakdowns during the encoding and/or learning of new names. Are unique names better learned because they do not compete with existing proper names that are already associated with other people? Are distinct names more memorable because there is consistency in the mapping of phonology and semantics, whereas non-names refer to many different semantic instances? For example, when most people hear the name *Barack* they think of one semantic instance of that name (the first African American president of the United States) whereas *Betty* might refer to any number of famous women with that name. Further, how do metacognitive factors contribute to difficulty with learning names? Answering these question may lead to a

better understanding of how names are differentially represented in semantic knowledge and how they achieved their “special” status in the mental lexicon.

APPENDIX A
NON-NAME TARGET, PRIME AND UNRELATED QUESTIONS

Non-Name Target	**Target Question**	**Phonological Prime Question**	**Semantic Prime Question**	**Unrelated Prime Question**
Acronym	What do you call a word or abbreviation, such as CEO, that is formed by taking the first letter or letters from each word in a phrase?	Which two variables are used to calculate body mass index to get a relatively **accurate** measure of one's body fat?	In public transportation, what do the **initials** ETA stand for?	Increased incidence of forest fires is a **surprising** result of _____ _____, the rise in the temperature of Earth due to Greenhouse gases?
Alchemy	What medieval 'science' was concerned with the conversion of the base metals into gold and the creation of elixirs for youth and immortality?	What does it mean to dine **alfresco**?	Despite its negative connotation, practitioners of **witchcraft** describe themselves as healers, similar to which type of spiritual leader thought to treat illness by contacting the spirit world in trance-like rituals?	**Seaweed** is often used in wrapping which kind of Japanese food consisting of cooked rice, raw fish, and various other edible ingredients ?
Allegory	What is the term for an artistic device used to express an idea through symbolic images or words, such as the grim reaper to represent death?	Mother Theresa is thought to be one of the most **altruistic** humans in the 20th century, and in 1979 was awarded which Swedish prize for peace?	Which classic **fable** tells the story of a race between a slow, steady creature and a fast, lazy creature, warning the listener about the dangers of overconfidence?	What is the term for a drug, such as marijuana or tobacco, that is thought to create the behavioral **doorway** into the use of more serious drugs?

Anagram	What type of word play involves rearranging the letters in a word to create a new word or phrase, using all letters exactly once?	In the NFL, how many yards' penalty would a player receive if the referee sees him **antagonize** or taunt the opponent?	What is the name of the word **puzzle** where the goal is to fill in white squares with letters that form words by solving clues which lead to the solutions?	The **'Speaker'** is the title given to the presiding leader of which legislative body?
Anarchy	What is the term for a society without any form of organized government, also used to describe political disorder or lawlessness?	The phrase **anecdotal** _____ refers to testimony or data based on the personal stories or reports of a few individuals?	**Nihilism,** the philosophy that negates the idea that life has meaning and challenges the existence of morality, is often associated with which German thinker?	What do you call the style of jeans or trousers that become wider from the knees downward and were **fashionable** in the 1960s and 70s?
Annulment	What is the term for a legal or judicial procedure that declares a marriage invalid or void from its beginning, as if the marriage had never occurred?	Which tune played during the famous Disney World musical boat ride has been voted the most **annoying** song in the world?	In 2010, which country had the highest **divorce** rate in the world and is also geographically the largest country in the world?	What do you call the **person** who deals directly with customers at the bank, and whose responsibilities include check cashing, deposits, and cash withdrawals?
Anthrax	What is the word for the infectious disease that is transmitted by handling contaminated materials, that caused a crisis in the United States in 2001 when it was sent to multiple public figures in envelopes?	What is the most **anterior** lobe in the human brain?	In 2003, U.S. intelligence uncovered a terrorist plot to release **cyanide** gas into the New York City subway system, organized by which militant Islamist group?	What plant-eating insect is the larval form of a butterfly in its **undeveloped** early stages?

Arson	What is the crime of intentionally or maliciously setting fire to structures, wild land, or other property?	What is the name of the film review wesbite that uses the ripeness of tomatoes for its **arbitrary** rating scale?	Less than ____% of people have **pyromania,** the impulse control disorder characterized by the need to start fires to relieve tension or for gratification.	Which 2006 'mockumentary' is about a spoof reporter from Kazakhstan and his **ridiculous** capers in the United States?
Audiologist	What type of health practitioner specializes in evaluating and treating individuals with hearing loss or dysfunction in the vestibular system?	What is the Earth's highest mountain, luring many **audacious** climbers and mountaineers to the Himalayas each year?	**Optometry** is a health care profession whose practitioners are trained to treat symptoms and diseases of which sensory organ?	In the 1960s, protest **demonstrations** became highly popular in the U.S. for a variety of social groups trying to voice their disapproval of which war?
Barnacle	What do you call a small, hard-shelled marine animal that attaches itself in clusters to submerged surfaces in shallow tidal waters, and resembles a small crater once attached?	In a **barter** system, goods or services are directly exchanged for other goods or services, without the use of what intermediary medium?	What is the term for a substance or food that increases sexual desire, such as the edible shell-covered mollusk called an **oyster?**	Which youth organization for girls places an emphasis on practical outdoor activities, including camping, woodcraft, aquatics, hiking, backpacking, and sports, and is known for its annual **cookie** fundraiser?

Beaker	What type of laboratory glassware is used to stir, mix, and heat liquids, and is generally shaped like a cylinder with a flat bottom and small lip to aid pouring?	One of the most famous upsets in sports history occurred in the 1980 Winter Olympics when the Soviet hockey team was **beaten** by which underdog nation?	What do you call the narrow tubular section at the top of a laboratory **flask,** also a word for a human body part?	What type of alternative medicine involves the manipulation of very thin needles inserted into the skin, a painful-sounding treatment that most actually find quite **pleasant?**
Boomerang	What is a flat, curved, wooden flying tool used as a weapon or for sport, that is designed to return to the thrower once it's in the air?	The tradition of **booing** a performance has its roots in which ancient culture's annual festival where playwrights would compete to determine the best tragedy?	The **Frisbee** was trademarked by which U.S. toy company that also owns the rights to the Hula Hoop, Slip-N-Slide, and Hacky Sack?	The **panda** is an endangered bear species, with fewer than 3,000 animals living in which Asian country?
Cadaver	What do you call a dead human body that is used for dissection and medical research?	What is the name of the social networking site where users **connect** with one another through 'tweets'?	What is the largest bone in the human **skeleton,** located in the upper leg?	Around which body part are you supposed to tie a string in order to remind yourself of a task you **intend** on doing in the future?
Calligraphy	What is the art of elegant, decorative lettering, that is often used for wedding and event invitations, inscriptions, and formal documents?	Traditionally, volunteers in the Peace Corps have to **commit** to how many years of service abroad?	According to popular belief, which type of professional is notorious for having sloppy, unclear **handwriting?**	Certain plants rely on the **scatter** of their seeds though wind or animal transport to accomplish which process?

Capillary	What is the smallest of the body's blood vessels that receives blood from the arteries and arterioles and transports blood to venules?	The Saffir-Simpson scale is a 5-level **categorical** system used to rank the strength of what weather event, whose peak Atlantic season occurs in August and September?	In the circulatory system, do **veins** transport blood towards or away from the heart?	Which species of freshwater **fish** resides in South American rivers and has the reputation for an insatiable appetite for meat?
Caravan	What is the word for a group of travelers on a journey, typically through the desert or on a trade mission, also used to describe a covered vehicle used as traveling living quarters?	What is the legal term for the killing of a human being without intent, such as when a patient dies due to the **careless** negligence of a doctor?	What type of **nomad,** like the first modern human, relies exclusively on wild plants and animals for food as opposed to domesticated species?	The most famous use of the **diamond** gemstone is to adorn which piece of jewelry that symbolizes a future union?
Carcinogen	What is the name for a substance or agent that directly produces cancer, such as tobacco?	**Carving** a pumpkin creates which type of Halloween ornament?	The inhalation of **asbestos** can lead to which type of cancer?	How does one describe a very bright hue or shade, such as those used in a **highlighter,** that is also used in high-visibility clothing so that the wearer is easily distinguishable from the background?

Christening	What is the religious ceremony (another word for baptism), that involves 'naming' an infant within the religion and a water ritual that symbolizes an infant's admission into the faith?	Which form of precipitation occurs when water begins to **crystallize** within the Earth's atmosphere and most often occurs during winter months?	In the Jewish faith, what is the female equivalent of a **Bar Mitzvah**, the ceremony that symbolizes when a person becomes responsible for his own actions from a religious perspective?	Traditionally, an **overcoat** is made of a heavy, warm fabric intended to serve as the outermost garment, and is designed to extend below which body part?
Contraband	What is the term for items that are illegal to be possessed or sold, typically associated with goods that are smuggled or traded illicitly?	What famous North American landmark is **constantly** moving backwards because of the millions of gallons of water that move over it every minute?	The term **bootlegger** started when horsemen would use their tall boots to hide pints of alcohol and became popular during which reform period in United States history when the manufacture and sale of alcohol was made illegal?	Which **glorious** event occurred in Berlin in 1989, symbolizing the reunification of East and West Germany?
Contraception	What one-word term refers to the prevention of pregnancy through various natural and intentional techniques, such as breast feeding, hormone pills, or barrier methods?	What is the term for the **concise** written records of a meeting that summarize the events of the meeting and any decisions that were made?	A **vasectomy** is a surgical procedure that prevents the release of _____ when a man ejaculates.	In which famous play do both lead characters, star-crossed lovers from opposing social groups in Verona, Italy, tragically die after a series of **hasty** decisions?

Coroner	What is the name of the public officer whose primary functions are to investigate the origin of human deaths, issue death certificates, and maintain death records?	What is the method of transmitting information through a series of on-off tones, lights, or clicks that allows people to efficiently **correspond** over radio?	What procedure involves slicing open and separating body parts to investigate a body's internal structure, often used for scientific investigation or **autopsy?**	What is the term for a survey of public opinion from a particular sample that measures things like the percentage of people that **disapprove** of a president or certain policies?
Crucifix	What do you call the image of Jesus's body hung on a T-shaped wooden structure, often used in religious jewelry and artwork, that is distinct from the image of the structure with no body?	What is the largest organ in the human body, **crucial** for protecting the body from most physical and environmental factors?	The **resurrection** of Jesus is honored on which holiday, marking the end of Lent?	Despite media reports, job **satisfaction** is not strongly correlated to which outcome, a measure that reflects the efficiency of production output?
Demographics	What is the word for the statistical characteristics of a population, that typically include information about a region's gender, age, ethnic, or financial profile, often used in sociology and marketing?	What is the name of the **delicate** fabric, not silk, that has a glossy surface and is often used in women's lingerie and evening gowns?	The Unites States Constitution mandates that a **census** be taken every _____ years to track changes in the size of the population as well as its social and ethnic makeup.	The phrase **'slippery** ____' is used to describe the idea that a relatively minor first step can lead to a chain of events that result in something significant.

Diameter	In geometry, what word represents a straight line through the center of a circle?	What is the name of the most common form of traumatic brain injury, whose symptoms include temporary memory loss, nausea, headache, and **dilated** pupils?	**Circumference** refers to the length of the perimeter of which geometric shape?	Which basic mechanical device is shaped like a helix and made of elastic material, and is used to absorb shock, such as in mattresses and **upholstery?**
Diaphragm	What sheet of muscle extends along the bottom of the rib cage separating the chest and abdominal cavities, that singers use to control their breathing in a performance, and also causes hiccups when it spasms?	What is the name of the medical removal of tissue from a living subject to **diagnose** the presence of an infection or pathology?	What do you call inflammation of the **larynx,** which causes hoarseness or a loss of voice and is often associated with singers?	Aside from the **treadmill,** what is one of the most popular aerobic machines used in gyms, designed to simulate stair climbing, walking, or running without causing excessive pressure to the joints?
Dowry	What is the term for the money, goods, or property that a bride brings to her husband at marriage?	Considered **dowdy** by previous generations, which length/style of skirt has become a hot fashion trend in recent years?	What is the legal contract that names who will manage an estate and receive **inheritance** of property at death?	A **playful** piano tune by Chopin is nicknamed the _____ *Waltz,* although it typically lasts between one and a half to two and a half minutes.

Ecosystem	What is the term for a contained biological community (not habitat) consisting of living organisms and their nonliving surroundings, such as a coral reef or tundra?	What is the term for the type of motor vehicle that uses two or more power sources, such as a Prius, that has grown in popularity due to the need to **economize** on fuel prices?	The planet's **biosphere** is thought to have evolved with a process that began approximately 3.5 _____ years ago.	What do you call wood from a variety of species that is suitable to be used by a **carpenter,** often supplied to hardware stores or directly to construction sites?
Embryo	What do you call an animal in the earliest stages of its development in the uterus, specifically in humans from conception to about the eighth week?	Which developmental disorder typically diagnosed in childhood is characterized by impaired social interaction, an inability to **empathize** with others, and/or restricted or repetitive behaviors?	Skipping meals during pregnancy may harm the development of a human **fetus** and increases the risk of which condition, when a baby is born before 37 weeks of gestation?	Due to serious budget shortfalls, in 2010, President Obama halted NASA's plans to **revisit** what celestial body, the Earth's only satellite?
Equestrian	What is the term for a person who skillfully rides on horseback, typically for recreation, cultural display, or for competition in horse shows?	Although one should not **equate** the test with intelligence, which test taken at the end of high school has been shown to predict academic achievement in college?	What is the average weight for a **jockey,** the small athlete that rides horses during horse races?	Which measure used in psychology research is used to assess how quickly humans **react** and respond to a stimulus?
Euphemism	What is a word or phrase that is substituted as a less distasteful term for one considered offensive, such as 'passed away' for 'died'?	What is the second most popular illegal drug in the U.S., an inhaled stimulant that produces a feeling of alertness, **euphoric** mood, and increased sexuality?	What is the French-inspired term for a figure of speech that is designed to be interpreted in multiple ways, such as a sexual **innuendo?**	What term describes the **celebration** of a 100 year anniversary, usually held for a place or organization?

Genealogy	What is the study of family histories that involves tracing a family's descent from ancestors?	Which *'Opposites Attract*' singer was also the most **genial** of the original American Idol judges?	What is the name of the NBC documentary series where a celebrity goes on a journey each week to trace his or her ancestral **lineage?**	Most pencil **erasers** are made from a synthetic version of which material?
Genocide	What do you call the deliberate and systematic destruction of a particular ethnic, political, religious, or cultural group?	What type of shark is the largest living fish species, a **'gentle** giant' that mainly feeds on plankton?	What was the term used to describe the **massacre** of approximately six million European Jews during World War II, a program of destruction ordered by the Nazi leader Adolf Hitler?	What adjective is used to describe a **creepy** foreboding of an upcoming harmful event, such as dark clouds hovering in the distance?
Haiku	What is the name of the unrhymed Japanese poem having 3 lines containing a set number of syllables, usually on some subject in nature?	Which **hygienic** practice is cited as the second best way to prevent flu, after the vaccine?	What European island nation is credited with developing the **limerick,** a witty and humorous poem with a strict rhyme structure?	The office furniture used to organize and store paper documents in labeled folders is called a _____ **cabinet.**
Harem	What word refers to a group of women that belong to one man, typically associated with Eastern and Middle Eastern cultures?	What do you call the top-ranking employee of the White House Office, a **harried,** stressful position as the President's closest advisor?	In which holy Islamic text is a man's possession of a **concubine** permitted under strict circumstances?	In a newly popular winter celebration, party-goers are required to wear which type of **'ugly'** garment?

Herbivore	What do you call the type of organism that is anatomically and physiologically adapted to eat plant-based foods?	**Hurried** woman syndrome is a new term used to describe the weight gain, low sex drive, moodiness, and fatigue symptoms that accompany a busy stressful lifestyle, and over time can lead to long-term _____.	A **vegetarian** is a human who refrains from eating meat, whereas a vegan also excludes which other two products from his/her diet?	Overlooking South Beach, the most expensive **condominium** in the world is located in which Florida city?
Hermaphrodite	What do you call an organism that has both male and female reproductive organs?	What term is used to describe a condition where a body part continues **hurting** for a long time, maybe even years?	Known for her boyish figure and short pixie cut, which English supermodel made **androgyny** fashionable in the 1960s?	According to the common **superstition,** breaking a mirror will cause how many years of bad luck?
Hieroglyphics	What is the name of a well-known ancient Egyptian picture-writing system?	What cartoon starred a **hyperactive,** freckle-faced boy with a cowlick and a penchant for mischief?	How many vowels are there in the modern English **alphabet?**	A **delirious** mental state and tingling of the limbs is a sign of which medical condition, caused by loss of body fluid?
Hypochondria	What term describes the condition of being unnecessarily anxious about one's health, or the state of suffering imaginary illnesses?	What popular sports drink was developed by University of Florida researchers to **hydrate** athletes?	What do you call the type of **neurosis** or anxiety disorder defined by a persistent and often irrational fear of an object or situation that is generally disproportionate to the actual danger posed?	A **stiletto** is which type of weapon with a long, slender blade?

Incubator	What is the term for a device designed to maintain optimal temperature, humidity, and air conditions used within science to grow cell cultures, or for medicine to care for premature babies?	Named after the winged bug, what 'effect' refers to the phenomenon whereby a series of seemingly **inconsequential** events snowball to create a large result?	A **thermostat** is used to maintain a system's _____ at a specific set point.	What is the lowest **satisfactory** letter grade according to most American schools?
Iota	Originally a Greek letter written in subscript, what word is now used to mean a very small amount?	Common table salt is formed by an **ionic** bond between which two chemical elements?	In cooking, what is the term for the very small amount of a substance that can be taken between the thumb and forefinger, or the equivalent of two **smidgens** according to some modern cooking companies?	What is another name for **table** tennis, a sport where players hit a lightweight, hollow ball back and forth across a net ?
Javelin	What is the name of the slender metal shaft that was once thrown as a weapon of war and is now thrown for distance in a field event?	Which U.S. city is known for its **jazzy** music scene, unique cuisine, and its annual Mardi Gras festival?	In Florida, what type of reptilian game is hunted with a **spear** during nighttime hours when firearms are prohibited?	In bowling, a **perfect** game is achieved when the bowler reaches the highest possible score of 300 points by rolling a _____ on every frame.
Juniper	What is the name of the evergreen plant with needle-like leaves, whose blue-colored berries are used to flavor foods, such as the popular liquor that is often served with tonic?	Although technically different strands of the same fruit, the peach is thought of as the **juicier,** fuzzier version of which fruit?	Aside from its popularity in Christmas songs, **holly** is used to make which type of caffeine-rich herbal tea from South America that is served with a metal straw?	A **regional** airport is one that lacks customs or immigration facilities, so it cannot offer which kind of flight?

Kaleidoscope	What is the name of the tubular viewing toy that produces symmetrical designs through an arrangement of mirrors and chips of various hues?	One of the most **collegial** ways to decide on a topic or select a leader is through _____ ballot, where each vote is anonymous.	Which mnemonic aid is used to remember the sequence of hues in a **rainbow?**	Which lightweight but strong metallic element is often used to make the head of a **hammer?**
Lentil	What is the name of the edible plant that comes from the bean family and originated on the Indian subcontinent, whose seeds can be cooked and eaten and form the base of a popular vegetarian soup?	_____ **lending** refers to the practice of granting loans to individuals who may have difficulty making the repayment schedule, a major factor in our recent economic recession.	Which type of Middle Eastern spread is made from ground **chickpeas** blended with tahini, olive oil, salt, and pepper?	What do you call the form of communication designed to **persuade** the attitude of a community toward some cause or position, often seen as a form of political warfare?
Luminaria	What do you call a small torch placed inside a paper bag that is usually arranged with others to form a display during holidays?	What is the name brand of the popular spray that is used to **lubricate** hinges and locks and unbind stuck bolts?	Although most are made of paraffin, a **candle** can be made with which natural product, procured from the hive of a flying insect?	The distance of lightning can be calculated by the interval between when the lightning is seen and when the **thunder** is _____.
Malevolence	What noun describes the quality of having or showing vicious ill will or hostility towards someone, or the desire to do evil to others?	The opposite of **malignant,** what do you call the type of tumor that lacks the ability to spread?	What is the term for an unlawful act that is motivated by the perpetrator's **hatred** for a specific social group?	Which Ivy League university near Boston is considered one of the world's most **exclusive,** with the second lowest acceptance rate in the country?

Marinade	What do you call a savory sauce in which meat, fish, or a vegetable is soaked before cooking to enhance the flavor?	You are legally required to report a change in **marital** status to which government agency responsible for administering retirement and disability benefits?	Which type of salad **dressing** is a mixture of olive oil and vinegar, usually flavored with herbs and spices or other ingredients?	According to a British research team, which sound do people find most **repulsive,** a noise made by humans and is typically preceded by nausea?
Marsupial	What is the name of the order of warm-blooded animals including koalas and opossums which carry their young in an abdominal pouch?	Which 2010 film about an English folk legend known for 'robbing from the rich' saw only **marginal** success at the box office?	What do you call a baby **kangaroo?**	Who is credited for inventing the first working **telephone,** receiving the first patent in 1876?
Martyr	What do you call a person who suffers persecution, offers a great sacrifice, or voluntarily dies for refusing to renounce, or accept, a belief or cause?	Which 2006 film about the Irish-American organized crime scene won Best Picture and featured a **marvelous** ensemble cast including Leonardo DiCaprio as the undercover cop Billy Costigan?	Who is the patron **saint** of Ireland, whose legacy is celebrated around the world every year with green beer and parades?	What is the name of the **impressive** wave of protests throughout the Arab world in 2010, noted for its use of social media to spread the word?
Mercenary	What do you call a professional combatant that takes part in armed conflict strictly for financial gain as opposed to having a direct interest in the war itself?	What do you call the **murky** water that results from the mixing of sea water with fresh water?	Which type of **soldier** in the U.S. Navy is a principal part of the special operations force and has a reputation for enduring one of the toughest training regimens in the world?	What do you call a **wistful,** visionary fanta sy, especially one of hopes or ambitions imagined as coming to pass, that occurs while awake?

Meteorology	What do you call the scientific study of weather and the atmosphere, whose practitioners are often employed by television news programs?	What Indian salutation has been given a more **meaningful** association in western yoga, where it is exchanged between the teacher and students?	What is the scientific instrument used to gauge atmospheric pressure and **forecast** the weather?	Which original **action** figure of a 'real American hero' is now a collector's item and is one of the most expensive toys in the world?
Migration	What is the term for the annual seasonal journey made by many bird species in response to changes in food availability, habitat, or weather?	What is another nickname given to the **Minor** League Baseball league that started with a joke that players were being grown like corn?	What is the smallest known bird species who has the ability to hover in the air when in **flight** by rapidly flapping its wings?	Which term is used to describe an abandoned village, town or city that was once populated but is now eerily **empty,** as if occupied by spirits?
Misdemeanor	What is the name of a 'lesser' criminal offense, such as petty theft or trespassing, with a relatively easy punishment, but is still more serious than an infraction such as speeding?	In current popular culture, what do you call someone who looks so similar to a person that they could be **mistaken** as twins?	What is the most prevalent type of **felony** conviction in the United States?	What is the name of the Scottish **apparel** worn by warriors that resembles a knee-length plaid skirt?
Mitochondria	In cell biology, what is the 'powerhouse of the cell', the structure that produces energy?	What do you call the **mighty** group of Norse warriors who raided wide areas of Europe and Asia and are often depicted as wearing helmets with two horns?	The **nucleus** of the cell is home to which helical structure that contains the cell's genetic material?	How many keys are on the average **piano,** 88 or 22?

Molasses	What is the name of the thick, brown substance that resembles honey and is produced during the refining of sugar or by boiling down sweet fruit juice?	What type of **malicious** computer program can replicate itself and spread from one computer to another?	Which state in the Northeast is the largest producer of **syrup** in the U.S., making 5.5% of the global supply of the sugary substance used to adorn pancakes?	Which Seattle native that died at the age of 27 is widely regarded as the greatest electric guitar **talent** of all time?
Monastery	What is the name of a building or group of buildings that houses individuals who have taken a religious vow and includes a room dedicated to prayer?	Which dinosaur with a **monstrous** head and long tail was one of the largest known land predators and has become the best recognized dinosaur species in popular culture?	Although the term can be applied to the residence of any religious order, a **convent** is generally taken to describe the living quarters of which type of spiritual person?	Which measure of typing speed is used as an indicator of how **adept** a professional secretary is at his/her trade?
Monogamy	What term refers to the practice of having one sexual partner or spouse at a time?	What is the term used to describe political ads that are designed to **malign** the other candidate by exaggerating or bending the truth?	What do you call a gentleman above the age of legal adulthood who has never taken nuptial vows, and if past a certain age is often attributed to having a fear of **commitment?**	The **violin** comes from which class of musical instruments, which also includes the guitar, bass, cello, and harp?

Monogram	What is a symbol or logo that is made by combining the initials of an individual or company and is often used to adorn stationary, luggage, or clothing?	What does GDP stand for, the **monetary** value of all the finished goods and services produced within a country's borders in a specific time period?	Which French fashion label is known for the **embroidery** of its initials, LV, sewn into its luxury trunks, bags, totes, and apparel?	What is the name of the **incredible** waterfall located in southern Africa on the Zambezi river?
Mutiny	What is the term for a conspiratorial revolt (not a coup) against authority, such as the crew overthrowing the captain of a ship?	On which continent is it a common practice to **mutilate** a female's genitals for non-medical reasons?	What Caribbean nation was formerly a French colony before starting the most successful slave **rebellion** known to history?	Which *Oliver Twist* author, considered the greatest novelist of the Victorian era, was known for including passages in his writings that were designed to subtly **satirize** British aristocratic snobbery?
Nostalgia	What word is used to describe the sentimental yearning for a past experience or time period, often in an idealized form?	A recent survey found that _____, individuals who reject the idea of a God, are actually among the most **knowledgeable** about world religions.	What style of book is dedicated to an author's **reminiscence** about his or her own life and experiences?	What do you call the **harmonious** ensemble of string, brass, woodwind, and percussion sections, sometimes consisting of over 80 musicians?
Obituary	What section of the newspaper reports the recent death of a person, typically along with an account of the person's life and information about the upcoming funeral?	What is the well-known list of biblical principles that believers in Judaism and many forms of Christianity are expected to **obey?**	A **eulogy** is a tribute speech that praises a person's life and accomplishments and is usually a part of what type of service?	What sleep disorder characterized by abnormal pauses in breathing during sleep often goes undiagnosed because people **ignore** the symptoms?

Parasite	What is the term for an organism that lives on or in another, obtaining nourishment from it?	What is the common name of the substance that is injected into the skin to **paralyze** facial muscles, thereby reducing the appearance of wrinkles?	What is the common name of the infection characterized by fever, sore throat, and enlarged lymph nodes that is caused by the Streptococcus **bacteria?**	Which supplement is presumed to **influence** heart health due to its concentration of omega-3 fatty acids?
Philanthropy	What term describes the active effort to enhance human potential and promote public welfare, either through deeds or charitable donations?	Which actor won an Oscar for his role as a **finicky,** obsessive-compulsive novelist in *As Good as it Gets*?	Which Irish lead singer of U2 is now known for his **humanitarianism** as well as his music?	An **electroencephalogram** is used to measure electrical activity in which organ?
Photosynthesis	What do you call the chemical process performed by plants, algae, and bacteria by which carbon dioxide is converted into food through the use of energy from the sun, releasing oxygen as a byproduct?	In what famous Dutch painting does a pearl earring serve as the **focal** point of the work?	What do you call a material, such as **chlorophyll,** that changes color by selectively absorbing certain wavelengths of light, and in humans is found in the skin?	A **Bloody** Mary is a drink made of tomato juice and which liquor?
Planetarium	What is the name of the building where one can view projected images of celestial bodies on the inner surface of a dome?	What type of engineer is responsible for **planning,** designing, constructing, maintaining, and operating infrastructures while safeguarding the interests of society and the environment?	The invention of which instrument was a necessary requirement for the development of **astronomy** into a modern science?	What is the process that determines which biological traits **survive** in a population as a function of reproductive advantage?

Poinsettia	What is the name of the flower indigenous to Central America that has large bright red leaves and is especially trendy at Christmas?	In one of the most **poignant** movie moments of time, Rhett Butler bids farewell to Scarlett O'Hara by saying 'Frankly my dear, I don't give a damn' in which 1939 film?	At Christmas time, what activity are two people supposed to do if they find themselves under a **mistletoe?**	Which Aerosmith rocker and reality show host became a **grandfather** in 2004?
Reincarnation	What do you call the spiritual belief that the soul of a person is born again in another body after death?	The bank is likely to **repossess** a house if which type of payment is not made after several months?	The oldest living denomination, **Hinduism's** basic tenets include a belief in a cyclical pattern of spiritual birth that is determined by a person's _____, where beneficial consequences are the direct product of past moral actions.	The successful passage of food from **esophagus** to the stomach begins with which activity that is initiated in the mouth?
Rosary	In the Catholic faith, what do you call the string of beads that is used to count a series of prayers that make up a devotion?	What unit of time is determined by the rate at which the Earth **rotates** on its axis?	What do you call a devotional offering of food, objects, or the lives of animals or people, usually left on an **altar?**	How many miles do participants **complete** in a marathon, a commemoration of the fabled distance that the Greek messenger soldier traveled to Athens to announce victory after the Battle of Marathon?

Simile	What is the figure of speech that is used to compare one thing to another, unlike thing by the use of 'like' or 'as' ?	**Simmering** is a food preparation technique that involves cooking food in hot liquid kept at or just below which point?	Which popular hit from the 1980s uses a **metaphor** to liken the experience of love to war?	Which website debuted in 1997, and is now the most visited website on the **Internet?**
Sovereignty	What is the state of having absolute governing authority over a geographic area?	At many weddings, the husband and wife make the **solemn** vow to love one another for 'better for worse', for 'richer for poorer', and in which other opposing conditions?	On what day do Americans celebrate their **independence** from Britain, the same day that the Founding Fathers signed the Declaration?	What is the little boy's name in the classic tale about magic beans that grow into a **giant** beanstalk?
Suspenders	What do you call the fabric or leather straps worn over the shoulders to hold up trousers?	What is the most commonly diagnosed behavioral disorder in children, characterized by an inability to **sustain** attention, hyperactivity, and/or impulsivity?	Because of its utility as a protective garment that covers the torso and legs, **overalls** were required for workers manufacturing which reactive material?	What is the world's best known and most prestigious **bicycle** race?
Toga	What is the term for a loose outer garment worn by citizens of ancient Rome?	Which best-selling home exercise system promises unrivaled results in 90 days through the use of **total** body cross training that prevents the body from adapting to the workout?	What country is associated with the **sari,** a piece of cloth worn by women that is usually wrapped around the waist, with one end then draped over the shoulder baring the midriff?	A **clever** strategy in the game of hangman is to start by guessing the most frequently occurring letters, which include all the letters of which type?

Torpedo	What do you call a large, cigar-shaped, self-propelled projectile that is launched above or below the water's surface?	In which Shakespearean play does the lead female character become so **tormented** with guilt that she tries to wash imaginary blood from her hands?	What kind of radiation is often used to guide a **missile** to its destination using the thermal (heat) energy emitted by an object?	What kind of funding is **provided** by the government to help cover college expenses on the basis of need?
Tyrant	What do you call an oppressive and cruel ruler (not dictator) that is unrestrained by the law and puts his or her own interests above the interests of the population?	The **Tidy** Towns Awards were started in which country (that is also a continent) in order to reduce littering and bolster civic pride?	What is the name of the 'Red **Emperor'** or 'Chairman', who was the leader of the Chinese Revolution in 1949 and established the country now known as the People's Republic of China?	In the U.S. army, what do you call the person responsible for the **instruction** of new recruits about the customs and practices of military life, and is especially important during Basic Training?
Venison	What do you call the edible meat of a game animal, most commonly deer?	It is important to **ventilate** the air in occupied buildings in order to limit the amount of which chemical compound that can be toxic at high concentrations?	**Buffalo** meat has increased in popularity among health enthusiasts because it has significantly less ____ relative to beef.	What do you call the form of transportation, usually a boat, used to carry **passengers** and sometimes automobiles and cargo across a body of water?
Vernacular	What do you call a nonstandard language or dialect (not slang), such as ebonics, that is specific to an area or population and is used in place of a more established foreign language?	Which NFL wide receiver plays for the Tennessee Titans, holds the record for single-season touchdown receptions, and has one of the highest recorded **vertical** leaps in sports?	What **colloquialism** is commonly used throughout the South as a contraction of 'you' and 'all'?	According to a theory of developmental psychology, children raised by an **authoritarian** parent are likely to have _____ self-esteem.

APPENDIX B
PROPER NAME TARGET, PRIME, AND UNRELATED QUESTIONS

Proper Name Target	**Target Question**	**Phonological Prime Question**	**Semantic Prime Question**	**Unrelated Question**
Alan Greenspan	Which U.S. economist served as Chairman of the Federal Reserve from 1987 to 2006?	Since 1984, **Alex Trebek** has been the host of which trivia game show?	**Donald Rumsfeld** was Director of the Office of Economic Recovery from 1969-1971, before holding which Cabinet office under two different presidents?	In 1998, **Sammy Sosa** was in pursuit of breaking the Major League Baseball record for the number of _____.
Alexander Hamilton	Which founding father of the United States was the first Secretary of the Treasury and was killed in a duel with political opponent Aaron Burr in 1804?	Which TV sitcom currently stars **Alec Baldwin** as a TV network mogul working at a famous New York address?	**John Adams** was a Founding Father, Federalist, lawyer, and diplomat before becoming the _____ president of the U.S..	In one of his most popular songs, singer-songwriter **Bob Dylan** advises that the answer is *'Blowin' in the _____'.*
Alfred Hitchcock	Which English filmmaker was the master of suspense, making films such as *Psycho* and *Vertigo*?	Which famous equation relevant to mass and energy did **Albert Einstein** discover?	What **Stephen King** novel about an author nursed back to health by an obsessed fan became a movie thriller in which Kathy Bates won a Best Actress Oscar?	Celebrity chef **Bobby Flay** has a show on the Food Network that focuses on using what cooking method?

Amelia Earhart	Who was the first female aviator to fly solo across the Atlantic Ocean, later disappearing in 1937 after attempting a circumnavigation al flight of the globe?	Twenty-six year old star **Amanda Bynes** got her big break working for which children's TV network?	**Molly Brown** was nicknamed the 'Unsinkable' after her survival and heroism during the sinking of which famous ship?	**Lucy Liu** costarred in which 2000 film adaptation of a popular 1970s TV series about sexy female private investigators?
Andy Griffith	Which actor had a self-titled TV comedy show in the 1960s and then played the lead character in the legal drama *Matlock* in the 1980s and 90s?	Journalist **Anderson Cooper** is the host of the news show *AC 360°*, which is shown on what cable channel?	Actor **Leslie Nielsen** became known for his spoof films, including the popular comedy movie series, *The* ____ *Gun*.	In which Nebraska city is **Warren Buffett's** company Berkshire Hathaway located, the largest city in the state that resides on the Missouri River?
Andy Warhol	Which controversial artist of the 1950's-1980's was a leading figure in the 'pop art' movement, best known for his paintings of iconic American products and celebrities?	Aside from his Travel Channel show that documents his exotic travels and culinary quests, **Anthony Bordain** is also a frequent guest judge on Bravo's Top _____.	Known for his unique drip-style paintings, **Jackson Pollock** was given a memorial exhibition in what New York City museum the same year as his death?	English writer **Rudyard Kipling** is best known for penning which book of fables about Mowgli's adventures with exotic creatures in the Indian jungle?
Annie Oakley	What is the stage name of the sharp-shooting female star in *Buffalo Bill's Wild West* show, best known for her tricks with a .22 caliber rifle?	**Annabel Lee** is the last completed poem by which three-named American author known for his gothic, macabre style?	**Calamity Jane** was a frontierswoman and scout in the late 19th Century known for fighting what indigenous group in the American West?	American author **Emily Post** was famous for writing about which topic, a guide for social behavior?

Anthony Hopkins	Which actor is best known for his portrayal of Hannibal Lector in the movie *Silence of the Lambs*?	Photographer **Ansel Adams** is best known for his black-and-white photographs of the American West, especially which national park?	Starring in seven films as this character, what is **Sean Connery's** most famous role?	American football coach **Vince Lombardi** is best known for winning the first two Super Bowls coaching which NFL team?
Arthur Miller	Who wrote the classics *Death of a Salesman* and *The Crucible* and was once married to Marilyn Monroe?	The combination of which two beverages creates an '**Arnold Palmer**', a drink named after the famous golfer?	**Neil Simon's** plays were made famous on what world-renowned New York theater district?	Canadian actor **Ryan Reynolds** was once married to which curvaceous *Lost in Translation* actress?
Atticus Finch	Which literary character was the heroic protagonist lawyer in the Pulitzer Prize-winning novel *To Kill a Mockingbird*?	**Adam Smith**, the Father of Economics, developed which economic principle that espouses private ownership, competitive markets, and a government-free market system?	**Holden Caulfield** was the narrator of what 1951 J.D. Salinger novel about a teenager coming of age, struggling with his sexuality, and battling mental health?	A famous explorer, **Marco Polo** is also the name of a game of tag played in a _____.
Audrey Hepburn	Who was a Belgian ballet dancer before starring as the lead actress in *Breakfast at Tiffany's* and the movie adaptation of the musical *My Fair Lady*?	Singer **Aubrey O'Day**, the MTV reality star, was also a contestant on which TV show that is famous for the catch phrase 'You're Fired!'?	Before her untimely death at age 43, **Natalie Wood** was a successful Hollywood actress, starring in which movie musical about warring gangs in New York City?	Athlete and model **Gabrielle Reece** is known for playing which professional sport on the sand?

Austin Powers	Who is the title character in the comedic film series of the late 1990s about a British spy's heroic quest to bring the villain Doctor Evil to justice?	**Oscar De La Hoya** won 10 world titles in six different classes competing in which sport?	**Clark Griswold** is the fictional patriarch in the comedy series about a family continuously experiencing minor disasters while trying to enjoy what type of annual event?	**Bruce Jenner** is a former track and field athlete and gold-medalist who is now better known for his role in the reality TV show *Keeping up with the* _____.
Barney Rubble	In the animated TV show *The Flintstones*, who is the main character's best friend?	***Barnaby Jones*** was a 1970s TV series about a private detective firm owned by a father and his _____ -in-law.	What is the name of **Fred Flintstone'**s wife?	On *Saturday Night Live*, **Will Ferrell** became famous for his impersonation of which U.S. President?
Benedict Arnold	Which American Revolutionary War general's name is now synonymous with treason due to the fact that he secretly plotted to surrender West Point to the British and eventually changed sides after getting caught?	***Bennie and the Jets*** was a 1974 hit about a fictional band that was performed by which iconic British singer-song writer?	**Paul Revere** was a famous patriot of the American Revolution, most famous for alerting the colonial militia of what approaching danger?	**Johnny Depp** found major box office success playing the role of Captain Jack Sparrow in which movie series based on a ride at Disney theme parks?
Bette Davis	Which actress was the first person to accrue 10 Academy Award nominations, including the movies *All About Eve*, *What Ever Happened to Baby Jane*, and *Jezebel*?	**Beverly Cleary** is an American children's author, whose best known characters include the Quimby sisters, Beezus and _____.	**Joan Crawford** was a Hollywood star who played the lead in *Mildred Pierce* and co-starred in *What Ever Happened to Baby Jane*, before her reputation was tarnished by a tell-all book written by which member of her family?	Rap and R&B artist **Faith Evans** is known as the widow of which New York rapper, famously killed in a drive-by shooting in Los Angeles?

Betty Boop	Which buxom cartoon character first appeared in 1930 and is considered the first and most famous sex symbol in the world of animation?	Despite the lack of historical evidence, **Betsy Ross** is widely credited as having made the first American _____.	**Olive Oyl** was the cute cartoon love interest of Popeye the Sailor Man, who advocated eating which food item to stay strong?	Actress **Amy Smart** currently plays a recurring role on which Showtime series about a dysfunctional family in Southside Chicago?
Beyoncé Knowles	What is the name of the singer who was a lead member of the musical group, Destiny's Child, starred in the film *Dreamgirls*, and is married to the rapper, Jay-Z?	English children's author **Beatrix Potter** is most recognized for which story about a mischievous young rabbit in a garden?	**Mary J. Blige** is the only artist to have won which type of award in the categories of Pop, Rap, Gospel, and R&B?	Actress and sex symbol **Jessica Alba** has how many children with her husband Cash Warren?
Calvin Klein	Which American fashion brand known for its minimalist style in sportswear, underwear, and fragrance, has also been made famous by the overt sexuality of its print ads, including a controversial feature of 15 year-old Brooke Shields?	The 'Iron Man' **Cal Ripken** was inducted into which sport's Hall of Fame in 2007?	**Tommy Hilfiger** is an American fashion brand that gained the interest of artists from which music genre, who popularized wearing the apparel several sizes too large?	Singer **Josh Groban** performed *'The Prayer'* as a duet for the ending ceremonies of the 2002 Winter Olympics, hosted in which Utah city?
Carmen Electra	What is the stage name of the actress/ model who gained fame for her appearances in Playboy and Baywatch, for her highly-public relationships with athletes and rock stars, and for her popular 'striptease' workout videos?	What was the first name of **Carmela Soprano's** husband on HBO's *The Soprano's*, the show's lead character?	Baywatch actress **Pamela Anderson** was previously married to Tommy Lee, who is the drummer of which heavy metal band?	What is the name of the first book that became a bestselling series of novels written by **Diana Gabaldon**?

Christopher Reeve	Which actor known for playing Superman in multiple movies in the late 1970s and 80s became a quadriplegic after being thrown from a horse?	What is the American name of the sport that **Cristiano Ronaldo** plays for the Portuguese national team as well as professionally for a club in Madrid?	Actor **Michael Keaton** is best known for playing the roles in two Tim Burton films, the title role in *Beetlejuice* and Bruce Wayne in what superhero flick?	Serial killer **Jeffrey Dahmer** made his murders particularly gruesome by eating some of the flesh of his victims, a practice known as _____.
Condaleeza Rice	Who was the first female African-American secretary of state serving under George W. Bush for his second term?	American news anchor and reporter **Connie Chung** has been married to which TV talk show host since 1984?	Before joining the Obama administration, **Hillary Clinton** served in which upper house of the United States legislative branch?	Actress **Linda Blair** is best known for playing the possessed child Regan in which 1973 horror film?
Davy Crockett	Which American folk hero died at the Battle of the Alamo and is referred to in popular culture as the 'King of the Wild Frontier'?	**Dale Earnhardt** was a dominant force in which sport prior to his death in 2001?	**Paul Bunyan**, a giant lumberjack of North American folklore, is often depicted with what type of animal companion?	Winning 14 Grand Slam titles, **Pete Sampras** was once ranked #1 in the world before retiring from what sport?
Demi Moore	What is the name of the actress whose film credits include *St. Elmo's Fire*, *Ghost*, and *Indecent Proposal*, and who recently ended her marriage to the much younger Ashton Kutcher?	**Debbie Harry**, pop-punk star of the early 1980s, was the front woman of which band whose name reflects the lead singer's platinum hair?	**Ally Sheedy** is best known for her roles in 1980s brat pack films, including *St. Elmo's Fire* and which film about a group of high school students serving a punishment on the weekend?	**Eva Peron**, the First Lady of Argentina from 1946 to 1952, was a powerful spiritual and political leader in the country, whose life inspired which musical?

Diane Sawyer	What is the name of the current anchor of *ABC World News* who previously held the position of co-anchor for ABC's *Good Morning America*?	**Diana Ross's** first number 1 hit was the motown favorite *'Ain't No _____ High Enough'.*	Journalist **Katie Couric** has previously anchored *CBS Evening News* as well as which morning news/talk show?	Before acting on Broadway, **Cathy Rigby** won a silver medal in which event at the 1970 Gymnastics World Championships?
Dolly Parton	Which American singer-songwriter is one of the most successful female country artists of all time and is famous for her role in movies like *Steel Magnolias* and *Straight Talk*?	**Dominique Dawes** was a member of the Magnificent Seven in 1996, a team that brought the United States its first ever Olympic team gold-medal in which sport?	**Emmylou Harris** is a 12-time Grammy winning folk and country musician who has collaborated with numerous other artists, including Willie Nelson and which *'Heart of Gold'* singer?	Seattle native **Amanda Knox** served four years in jail after being charged with murder when she was studying abroad in which European country?
Donald Trump	Which American business magnate gained public notoriety in the 2000s after launching the reality TV show *Celebrity Apprentice*, and through becoming increasingly involved with American politics, most recently in the Republican primaries?	Currently a free agent, Syracuse-grad **Donovan McNabb** plays which football position?	Millionaire **Bill Gates** is the former CEO and current chairman of which computer software company?	Twenty-five year old **Shaun White** is a two-time Olympic gold medalist in which winter sport?

Eddie Murphy	Which comedian went on to acting fame in the movie *Beverly Hills Cop* in the 1980s, *The Nutty Professor* in the 1990s, and most recently in *Shrek* as the voice of Donkey?	Artist **Edgar Degas**, perhaps best known for his paintings of dancers, was born in which French city?	African-American actor and comedian **Martin Lawrence** is widely known for playing which 'large' female character in a movie series?	The 17-year old pop sensation **Justin Bieber** was discovered after posting some of his videos on which video-sharing website?
Eli Manning	Who is the quarterback for the NY Giants, leading them to win the 2012 Super Bowl, and who has a brother who is the former quarterback of the Indianapolis Colts?	Actor **Elijah Wood** is best known for his portrayal of Frodo Baggins in which fantasy adventure trilogy?	At the age of 23, **Ben Roethlisberger** became the youngest Super Bowl winning quarterback playing for which NFL team?	**Nicolas Cage** won the Academy Award for his performance as a suicidal alcoholic in which 1995 film based on a novel by the same name?
Elizabeth Taylor	Which iconic film actress, known for her lavish lifestyle and long-term love affair with Richard Burton, starred in *Cleopatra* and *Suddenly, Last Summer*, and recently died in 2011?	**Elaine Benes** was the friend and former girlfriend of the main character on which NBC sitcom that also featured George Costanza and Cosmo Kramer?	Feisty Irish actress **Maureen O'Hara** starred opposite which famously rugged American movie star in *The Quiet Man*?	American pop singer **Colbie Caillat** won a Grammy in 2010 for the song Lucky, a duet she performed with which male singer-songwriter?
Ernest Hemingway	Who is the author of *A Farewell to Arms* and *The Sun Also Rises*?	Gator football coach **Urban Meyer** won how many national titles in his tenure from 2005 to 2010?	What was the name of **Mark Twain's** most esteemed novel, often referred to as the Great American Novel?	After the success of his initial feature film, director **Spike Lee** was offered a job directing commercials for which sports company?

Eva Longoria	What is the name of the Latina actress that plays the character of Gabrielle Solis on the television series *Desperate Housewives* and was once married to NBA star Tony Parker?	**Yves Saint Laurent** is a luxury fashion brand that goes by which self-titled three letter label?	Actress **Salma Hayek** was born in which Latin American country?	British singer **Susan Boyle** received international attention singing *'I Dreamed a Dream*' on which reality competition show?
Fidel Castro	A former hero of the Cuban Revolution, who was the highly controversial communist president of Cuba from 1976 to 2008?	In 2005, **Philip Seymour Hoffman** won the Best Actor Academy Award for which biographical film about an American author?	Marxist revolutionary **Che Guevara** began forming his socialist ideology on a 9-month journey through South America on what type of vehicle?	**Tom Wilkinson** won a Golden Globe for his portrayal of Benjamin Franklin in the popular miniseries about the Founding Fathers on which premium TV network?
Franklin D. Roosevelt	Highly regarded as one of the best presidents in United States history, which man was elected to four terms in office and navigated the country through the Great Depression and most of World War II?	**Frankie Valli** and the Four Seasons is one of the best-selling vocal groups of all time, reaching peak fame in the 1960s with hits like *'Sherry'* and *'Big Girls Don't* _____ ____'.	**Harry Truman** became the 33rd president at the advent of the Cold War and created the Truman Doctrine to contain which spreading political movement in Europe?	What is the English title of **Victor Hugo's** novel about Quasimodo and Esmeralda?
Freddy Krueger	What is the name of the fictional villain in the *A Nightmare on Elm Street* film series, a disfigured monster who kills victims in their dreams with a glove armed with razors?	Former slave turned statesman **Frederick Douglass** was a leader in the abolitionist movement during the Civil War and gave the keynote address at which president's funeral service?	In the 1988 horror film *Child's Play*, the main villain **Chucky** is not a person but rather which type of toy?	Early on, American artist and illustrator **Norman Rockwell** was the art director for *Boys' Life*, the publication produced by which major youth organization?

Gerald Ford	Who was the only US president never elected as president or vice-president by the electoral college, and became the 38th president after the resignation of Richard Nixon?	English actor **Jeremy Irons** starred opposite Helen Mirren in the historical miniseries about the reign of which queen?	The 40th president of the United States, **Ronald Reagan** was a darling of the Republican party due to his policy of supply-side economics, now known by which nickname?	**Richard Pryor** was regarded as one of the most influential stand-up comedians of his era, whose comedy acts often confronted what serious social issue in America?
Harley Davidson	What is the name of the American motorcycle company that is known for its emphasis on freeway cruising and motorcycle customization?	In 1977, **Harvey Milk** became the first openly gay person be elected to public office in what U.S. state?	Luxury automobile manufacturer **Mercedes-Benz** has its roots in which European country?	In the 1980s, **Willard Scott** was the weatherman for *The Today Show* and began the practice of sending birthday wishes to people starting at which age?
Harrison Ford	Which actor is best known for his performances as Indiana Jones, as Dr. Richard Kimble in *The Fugitive*, and as a pilot in the original *Star Wars* trilogy?	One of the most famous escapes demonstrated by magician **Harry Houdini** involved him being suspended upside-down in a locked glass-and-steel cabinet full of _____.	One of **Tommy Lee Jones'** most notable roles was a federal marshal in which movie about an on-the-run doctor wrongfully accused of murder?	In 2009, baseball player **Alex Rodriguez** admitted to using _____ from 2001 to 2003.

Herbert Hoover	Which president tried to combat the Great Depression by increasing corporate taxes and initiating massive public works projects, such as a dam on the border of Arizona and Nevada that is named after him?	Author **Herman Melville** is best known for writing which Great American Novel about Ishmael, Captain Ahab, and a white whale?	**William Taft** was the only U.S. president to also be appointed to which highest office in the federal judicial branch?	**Michael Crichton** was an author, producer, and screenwriter most often associated with the Sci-Fi genre, including which book-turned-movie about a theme park dedicated to genetically recreated dinosaurs?
Herman Cain	Which African-American Tea Party activist sought the 2012 Republican Party presidential nomination but withdrew after repeated allegations of sexual misconduct?	**Herbie Hancock** is an American musician of which music genre that features blue notes, improvisation and syncopation?	African-American civil rights activist **Al Sharpton** was a candidate for the 2004 Democratic presidential nomination, and now makes regular appearances on which cable news channel with a reputation for promoting conservative political positions?	What nickname was bestowed upon **Reggie Jackson** due to his clutch hitting in the postseason playing for the New York Yankees?
Hugo Chavez	Who is the current president of Venezuela whose platform is known as the 'Bolivarian Revolution' and has been implementing socialist reforms in the country since 1999?	The band **Huey Lewis** and the News contributed to the soundtrack of which 1985 film about a time-traveling teen?	Controversial socialist politician **Daniel Ortega** is the current president of which Central American country, located north of Costa Rica?	**David Letterman** recently surpassed which television icon for hosting the longest-running late night TV show in America?

Isaac Newton	One of the most influential scientists in history, who is known for developing the three laws of motion and is fabled to have discovered gravity when an apple hit him on the head?	**Isaiah Mustafa** became famous in 2010 after starring as the hunky 'Man Your Man Could Smell Like' in commercials for which deodorant brand?	French philosopher and mathematician **René Descartes** was a key figure in the _____ Revolution, the historical era characterized by an expansion in knowledge of physics, astronomy, biology, medicine, and chemistry.	The most famous song by **Woody Guthrie** is *'This _____ is Your Land'.*
Jackie Robinson	Who was the first African-American man to play Major League Baseball in the modern era, joining the Brooklyn Dodgers in 1947 and bringing an end to racial segregation in professional baseball?	Singer-songwriter **Jackson Browne** wrote many of the hits for which American band, best known for the songs *Hotel California* and *Take it Easy*?	**Willie Mays** began his professional baseball career in the 'Negro Leagues,' before getting picked up by the New York _____, a franchise now in San Francisco.	Fearing that his creativity would be stifled by new standards passed by the Federal Communications Commission, outspoken host **Howard Stern** moved his famously crude radio show to which satellite radio company in 2006?
Janet Reno	Who was the first female Attorney General of the U.S., nominated by then-President Bill Clinton?	Nicknamed the Queen of Rock and Roll, **Janis Joplin** was one of the biggest attractions at which legendary 1969 music festival held at a dairy farm in upstate New York?	**Madeleine Albrigh**t was the first woman to be appointed to which position in the United States Cabinet, the office primarily concerned with foreign affairs and diplomacy?	Actress **Kristen Davis** is most famous for playing the role of Charlotte on which comedy-drama series about a group of four women living in New York City?

Jefferson Davis	Who was president of the Confederacy during the Civil War, criticized by historians as an ineffective wartime leader?	Motorcycle customizer and TV personality **Jesse James** created a huge media scandal in 2010 when he was caught having multiple affairs during his marriage to which famous actress?	Confederate commander **Robert E. Lee** first established himself as an exceptional tactician and officer in which war between neighboring countries?	Before being fired in 2011, **Charlie Sheen** was the highest paid actor in television working on which show?
Jerry Springer	Who was the host of the self-titled TV show about dysfunctional families and relationships, which frequently resulted in fights between guests?	In which HBO TV series about a movie star and his friends from Queens does **Jeremy Piven** play a Hollywood agent?	**Phil Donahue's** talk show had a 26-year run on national TV and often focused on social issues that divided which 2 political factions?	Notorious Wild West train robber, bank robber, and gang leader **Butch Cassidy** was forced to flee the country with his accomplice, who was known by what nickname?
Julia Child	What is the name of the American chef who introduced French cuisine through her cookbook *Mastering the Art of French Cooking* and her television show *The French Chef*?	American actress and vaudevillian **Judy Garland** is perhaps best known for playing a Kansas farm girl named Dorothy in which 1939 film?	**Martha Stewart**, who gained fame through the success of her TV show which focused on entertaining, decorating, and cooking, also had a line of home décor at which discount store?	Hollywood's top female legend **Katharine Hepburn** holds the record for winning how many Academy Awards for Best Actress?
Julie Andrews	Which singing actress is best known for her lead roles in *Mary Poppins* and *The Sound of Music*?	Author **Judy Blume** has written many novels, such as *Are You There God? It's Me, Margaret*, for which age group?	**Barbra Streisand**, who began her acting career in movie musicals such as *Funny Girl* and *Hello, Dolly!*, is widely known to suffer from extreme _____ during live performances.	**Rachael Ray** hosts a cooking show on the Food Network based on the premise that a delicious meal can be prepared in how many minutes?

Keanu Reeves	What Canadian actor is best known for his roles in *Point Break*, *Speed*, and *The Matrix* series?	Comedian **Kenan Thompson** got his start as a teen star on Nickelodeon, and was a cast member on which NBC sketch comedy show that airs every weekend?	**Val Kilmer** rose to fame in the mid-1980s starring in comedies and then blockbuster action films, including which film about young Naval aviators in Fighter Weapons School?	**Larry Birkhead** is known for having a child with which former Playmate who died of an overdose of prescription drugs in 2007?
Laura Bush	What former Texas librarian is married to the 43rd president of the United States and is the mother to twin daughters?	Actress and model **Lauren Bacall**, known for her husky voice and sultry looks, was married to which Casablanca leading man?	**Elizabeth Dole**, whose husband ran for president in 1996, represented which southern state in the U.S. Senate?	One of the most successful models of the 1990s, **Cindy Crawford's** trademark is a small _____ above her lip.
Leonardo da Vinci	The original 'Renaissance Man,' which Italian artist painted the Mona Lisa and The Last Supper, and is also revered for his design ingenuity?	According to multiple government agencies, **Lee Harvey Oswald** assassinated which U.S. president in Dallas, Texas in 1963?	On which chapel's wall did Renaissance artist **Michelangelo** paint one of the most famous frescos in Western history?	**Paul Michael Glaser** is best known for playing one of the protagonists in which 1970s cop thriller that ran for four seasons?
Louis Armstrong	Who was the jazz musician and singer famous for his trumpet playing and scat singing, as well as his hits such as *'What a Wonderful World'* and '*Dream a Little Dream of Me*'?	**Lewis Carroll** is most famous for writing which children's story about a girl who falls down a rabbit hole into a fantastical land ?	Because of his exceptional writing and improvisation, jazz legend **John Coltrane** was awarded which prize in 2007, typically associated with journalists and writers?	In which movie did **Tom Hanks** say the quote 'Mama always said life is like a box of chocolates: You never know what you're gonna get'?

Lucille Ball	Which red-headed comedienne had one of Hollywood's longest careers and reached peak fame in a 1950s sitcom about a zany housewife that co-starred her then-husband Desi Arnaz?	Which sister is considered the 'beauty' of the family in **Louisa May Alcott's** best-known novel about Jo, Meg, Beth, and Amy March?	What was the name of **Carol Burnette's** popular variety show that ran from 1967-1978, that included comedy sketches, song, and dance?	University of Florida grad **Erin Andrews** is a co-host on which ESPN college preview show?
Mahatma Ghandi	Who was the prominent leader in the struggle for Indian independence in the first half of the 20th century, who was a staunch advocate for non-violence?	Before a fight, boxer **Mohammed Ali** famously told reporters that he was going to 'float like a butterfly, and sting like a _____'.	The **Dalai Lama** is the title given to the highest 'lama' or teacher in the Tibetan branch of which Eastern-based religion?	English philosopher **Francis Bacon** popularized the use of which 'method' that stresses the importance of forming falsifiable hypotheses and collecting evidence through experiments and observation?
Maria Shriver	Which journalist came from a highly famous American family and was the wife of the 'Governator', serving as First Lady of California from 2003-2011?	In 1992, **Marisa Tomei** won the best supporting actress Oscar for her performance in the comedy, *My Cousin* _____.	Author and attorney **Caroline Kennedy**, the last surviving child of John and Jackie, endorsed which nominee in the 2008 democratic primary?	In 2008, People magazine reported that **Christina Applegate** had been diagnosed with what disease?
Marie Curie	What is the name of the female scientist who laid the foundation for the study of radioactivity and won Nobel prizes in physics and chemistry?	Rock singer **Melissa Etheridge** is known for her raspy vocals and her advocacy of _____ rights.	Known as the 'lady with the lamp,' **Florence Nightingale** tended to wounded British soldiers during the Crimean war and laid the foundation for which health profession?	In which futuristic film series did **Linda Hamilton** play the role of Sarah Connor?

Marlon Brando	Which award-winning actor is known for his performances in *A Streetcar Named Desire*, *Apocalypse Now*, and his portrayal of Vito Corleone in *The Godfather*?	In the 16th century, **Martin Luther** was a key figure in the Protestant Reformation, forming what sect of Western Christianity?	Iconic bad-boy **James Dean** cemented his legendary status in American movie history, acting in only three films before dying of which cause at age 24?	In his famous 1995 trial, **O.J. Simpson** was acquitted of killing his ex-wife and her friend after he was famously unable to put on what type of garment found at the crime scene?
Marty McFly	What was the name of the character played by Michael J. Fox in the *Back to the Future* trilogy?	Singer **Marvin Gaye's** song *'I Heard It Through the Grapevine'* became the signature tune of which clay-animated singing group in the 1980s?	In the 1986 comedy film ***Ferris Bueller's*** *Day Off*, Ferris and his friends skip school to spend the day having adventures in what U.S. city?	**David Schwimmer** is best known for playing Ross on what 10-season sitcom about a group of young people living in New York City?
Mary Magdalene	Which controversial biblical figure is regarded as one of the most important female disciples but is referred to as a prostitute in some texts?	In 1962, American sex symbol **Marilyn Monroe** famously serenaded a U.S. president with what song at a celebration of his 45th birthday?	**Joan of Arc** is considered a heroine of the Catholic Church after leading which army to several important victories in the 100 Years War before being captured and burned at the stake?	In 2009, **Vanessa Redgrave's** daughter Natasha Richardson died after a head injury sustained during which activity?
Michael Dukakis	Which Democratic presidential nominee of Greek heritage ran against George H. W. Bush in 1988 and lost?	One of the most influential musicians of the 20th century, **Miles Davis** was a jazz music pioneer and was best known for his prowess with what horn instrument?	Businessman **Ross Perot** ran in the 1992 presidential elections as an unusually successful _____ candidate, and then in 1996 as a Reform Party candidate?	In the fantasy novel series about young wizards coming of age, what is the name of the school that **Harry Potter** and his friends attend?

Michael Phelps	Which American Olympic Swimmer won 16 gold medals combined in the 2004 and 2008 Olympics but received negative fame when pictures of him holding a bong appeared on the internet?	**Mighty Mouse** was an animated mouse superhero created by which major movie studio, also known for the popular animated series *The Simpsons*?	American swimmer and Olympic medalist **Ryan Lochte** specializes in the individual medley and what kind of swimming stroke?	Which neighborhood in New York City has been a dominant African-American residential, cultural and business center since the 1920s, and is often cited as the inspiration for **Langston Hughes**' poetry?
Mikhail Gorbachev	Who was the last General Secretary of the Communist Party of the Soviet Union whose attempts at reform and reorientation of Soviet strategic aims contributed to the end of the Cold War?	Actor **Mickey Rooney** did the voice of which 'jolly, old elf' character in four different Christmas TV animated specials?	**Boris Yeltsin** became the first president of the Russian Federation in 1991 after the formal dissolution of which Single-Party Communist State?	Which 1984 film stars **Kevin Bacon** as a teen who moves to a small town where dancing and rock music have been banned?
Monica Lewinsky	What is the name of the woman involved in an affair with President Bill Clinton in 1995 and 1996 that caused his impeachment?	**Molly Ringwald** was a member of the 'brat pack' of teen stars in the 1980s films, whose film credits include *Pretty in Pink* and _____ *Candles*.	**Paula Jones**, who sued Bill Clinton for sexual harassment prior to his impeachment, was an employee of which U.S. state where Clinton had previously been governor?	Now a two-time Grammy winner, **Kelly Clarkson** got her first break after winning the inaugural season of which reality competition show?
Monty Python	What is the name of the British comedy troupe that created a sketch comedy show called _____ _____*'s Flying Circus*, which later developed into films, books, albums, and stage productions?	After his diagnosis in the late 1990s, talk show host **Montel Williams** is now actively involved in a nonprofit foundation dedicated to which disease?	The comedy duo that consisted of **Cheech Marin** and his partner Chong gained success in the 1970s and 80s with an act that focused on their love of which drug?	Canadian rock singer **Bryan Adams** had a huge hit with which song about a certain season in the late 1960s?

Nathaniel Hawthorne	Which American writer composed the classics *The Scarlet Letter* and *The House of Seven Gables*?	One of the most successful military commanders in history, the French ruler **Napoleon Bonaparte** is cited as having an inferiority complex because of what physical 'flaw'?	American essayist **Ralph Waldo Emerson** gave a now-famous speech entitled the 'American Scholar' to which academic honor society, one of the oldest in the United States?	French film actor **Olivier Martinez** recently announced his engagement to which *Catwoman* actress, whom he has been dating since 2010?
Orville Redenbacher	Which American businessman started a self-titled popcorn brand in 1970?	**Orson Welles** was best known for his Broadway production *Caesar*, adapted from which best-known English playwright's work?	**H.J. Heinz** founded a food manufacturing company in the 1860s, which is now best known for producing which product?	On what fictional island do **Peter Pan**, Tinker Bell, and the Lost Boys live?
Peter Parker	Which fictional teenage superhero is the alter-ego of Spider Man in the Marvel comic book series?	**P.T. Barnum** was an American showman and businessman, associated with what type of travelling entertainment troupe, featuring clowns, acrobats, and animals?	**Clark Kent** is the secret civilian identity of which DC Comics superhero?	**Will Smith** starred in which 1997 sci-fi comedy about a secret agency dedicated to keeping Earth a 'neutral zone' for extraterrestrial aliens?
Rosa Parks	What African-American hero of the Civil Rights Movement refused to give up her bus seat in 1955, and whose arrest sparked the Montgomery Bus Boycott?	After hosting her own talk show for 6 seasons, in 2006 **Rosie O'Donnell** joined the cast of which ABC daytime show featuring a council of diverse women?	Civil rights leader **Coretta Scott King** initiated the movement to make the anniversary of her husband's assassination a national holiday on the 15th of which month?	Despite the lack of historical evidence, an oft-repeated legend holds that when **Marie Antoinette** was told the peasants had no bread to eat, she answered with what famous quote?

Rudy Giuliani	What is the name of the former New York City mayor who was a supportive leader during the 9/11 attacks?	In 2011, **Rupert Murdoch** faced allegations that his companies, including *News of the World* and other tabloids, had been using which tactic to illegally acquire information about celebrities and politicians?	The 12th richest man in the United States, **Michael Bloomberg** is currently the mayor of which city?	**Conrad Hilton** was an American business man and inventor best noted for starting which chain?
Salvador Dalí	What Spanish surrealist painter of the 20th century has a museum dedicated to his work in St. Petersburg, Florida, and whose paintings were noted for their extensive use of symbolism?	Actor **Sal Mineo** is best known for his performance as John 'Plato' Crawford in *A Rebel without a* _____.	One of the most influential artists of the 20th century, **Pablo Picasso** split his time between Paris and which Spanish city during the early part of his career?	Before his independent career, **Justin Timberlake** was a member of which popular boy band of the late 1990s and early 2000s?
Sherlock Holmes	What fictional detective created by Arthur Conan Doyle is known for his logical reasoning and is often aided by his sidekick Dr. John Watson?	**Sherman Hemsley** played George Jefferson on both *The Jeffersons*, and its parent sitcom, *All in the* _____.	The comic strip **Dick Tracy** featured a quick-witted and fast-shooting detective who was depicted wearing a hat and trench coat of which color?	**Dan Aykroyd** is a founder of which blues and soul revivalist band that was created as part of a comedy sketch on *Saturday Night Live*?
Sigmund Freud	Who is the father of psychoanalysis, known for his controversial theories about repression, the unconscious mind, dream analyses, and the Oedipus Complex?	**Siegfried Fischbacher** and his partner Roy had one of the most-visited shows in Las Vegas involving daring tricks with lions and tigers, which were which exotic color?	**Ivan Pavlov** was a famous Russian psychologist who accidentally discovered classical conditioning while researching the salivary gland in which species?	Meaning 'let do' or 'leave it alone', what is the term for an economic policy based on markets without government intervention, an ideal advocated by small-government conservatives such as **Calvin Coolidge**?

Tony Bennett	Which Italian-American crooner has enjoyed a prolific career crossing pop, classics, show tunes, and jazz and whose signature song is 'I Left My Heart in San Francisco'?	Actor **Tobey Maguire** starred in what 2003 film about an overlooked racing horse who had unexpected success?	Crooner **Frank Sinatra** is famous for singing about *'New York, New York',* a city that never _____.	On which two South Eastern Conference (SEC) football teams has **Steve Spurrier** acted as head coach?
Tony Hawk	Which retired skateboarder was a pioneer athlete in the sport, made famous by completing the first '900' and for the video game series bearing his name?	American country singer **Toby Keith** had a long-lasting number one hit with the song '_____ *for My Horses*'.	Before his tragic death in 2010, **Andy Irons** was a world-class professional surfer, inspiring a line of surfboards produced by which iconic surf brand?	**Matthew Fox** is best known for his role as Jack on which supernatural drama series that started with a plane crash and ended in 2010?
Tyler Perry	Which African-American actor, director, and producer was the highest paid man in entertainment in 2011, largely due to the success of the *Madea* series?	In which sport has **Tiger Woods** won 14 professional major championships and was the youngest man to achieve a career Grand Slam?	African-American comedian **Bernie Mac** had his most notable film role in which movie about a band of 11 criminals attempting to pull off a heist on a Las Vegas casino?	Philosopher **David Hume** is known for empiricism, which relies on the idea that the mind is a _____ _____, or tabula rasa.
Virginia Woolf	Which feminist author of *Mrs. Dalloway* is praised for her inclusion of stream-of-consciousness and psychologically-rich characters and committed suicide in March 1941?	What is the term used to describe the type of model, such as Betty Grable or **Veronica Lake**, whose images were mass produced so that they could be informally displayed in men's rooms?	American poet **Emily Dickinson** explored which recurring theme in her writing?	**Jennifer Aniston** divorced which Hollywood actor in 2005, amidst allegations that he had an affair with his *Mr. and Mrs. Smith* co-star?

Woody Allen	Which Jewish screenwriter is noted for quirky comedies, such as *Hannah and her Sisters* and *Midnight in Paris*, and is also notorious for marrying his Korean stepdaughter, who was 34 years younger?	**Woodrow Wilson**, the 28th U.S. President, was known for creating the League of Nations and signing the Treaty of Versailles after which war?	Director **Roman Polansk**i, who fled the U.S. after pleading guilty to having unlawful sex with a minor, won three Oscars for which WWII drama?	Former NBA star **Shaquille O'Neal** is over ___ feet tall and weighed 325 lbs., making him one of the heaviest players to ever play in the league.

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BIOGRAPHICAL SKETCH

Meagan Farrell was born on March 15th in Fort Myers, Fl. She grew up on Fort Myers Beach with her two siblings, Liam and Caitlin. At Appalachian State University Meagan was starting athlete on the women's soccer team, and received accolades in 2005 as a Division I Academic All-American. In May 2006 she graduated *summa cum laude* with a B.A. in Psychology.

Prior to starting graduate school, Meagan worked as a psychometrist in Southwest Florida, conducting testing batteries for patients with a variety of other neuropsychological conditions. After receiving a College of Liberal Arts and Sciences Alumni Fellowship, she began her graduate career at UF in the fall of 2007, working closely with her research mentor Lise Abrams. Her research interests are focused on language and memory processes in young and older adults, with an emphasis on age-related changes to speech production and the retrieval of words from memory. Specific areas of investigation include (i) semantic, lexical, and phonological predictors of word retrieval failures in older age, (ii) the temporal dynamics of lexical access and speech production, and (iii) the neurocognitive basis of language. Her dissertation research was funded by a Jacquelin Goldman Dissertation Fellowship in Developmental Psychology, and the William Orr Dingwall Neurolinguistics Dissertation Fellowship. In December 2012 she will be awarded a Ph.D. in psychology with a graduate specialist certificate in Gerontology. Upon completion of her Ph.D, Meagan will continue investigating neurocognitive change associated with normal aging and age-related neuropathology as a post-doctoral research fellow at Columbia University College of Physicians and Surgeons.