Word class effects on representation and processing in non-brain-damaged speakers and people with aphasia

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Declaration

The work in this thesis is my own original work. It has not been submitted for a higher degree in any other university of institution. All of the work reported in this thesis was undertaken during the time I was enrolled as a PhD student at Macquarie University, under the supervision of Prof Lyndsey Nickels and Prof. David Howard. Ethics approval for the studies reported in this thesis was obtained from Macquarie University's Human Research Ethics Committee, Reference No. 5201200905.

Signed: 

Anastasiia Romanova

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General Abstract

This thesis focuses on processing of proper nouns (e.g., Hugh Grant) and common nouns (e.g., actor). Empirical studies have shown poorer retrieval and slower learning for proper nouns in comparison to common nouns in non-brain-damaged individuals, and poorer retrieval for proper nouns relative to common nouns in people with aphasia. However, no consensus has been reached regarding the underlying cause(s) of these discrepancies.

Differences in production of proper and common nouns have generally been attributed to the existence of separate processing mechanisms for these two noun classes. However, different statistical properties (such as frequency) and the effects they may have on retrieval of proper relative to common nouns have also been discussed. A stumbling block for making any firm conclusions regarding differences in proper versus common noun processing based on previous experimental designs is that matching proper and common nouns on statistical properties is very hard, if not impossible. This thesis attempted to address this methodological problem with five experiments to inform our understanding of word class effects (proper versus common nouns) on representation and processing.

Chapters Two, Three and Four explore learning mechanisms for novel proper and common nouns in younger and older non-brain-damaged speakers as well as in people with aphasia. By using novel word forms paired with novel meanings, we held statistical properties of words equal. Therefore, the design allowed us to more directly address the possibility that proper and common nouns are processed by two separate mechanisms. Younger and older individuals showed the same pattern in retrieval: Proper nouns were not more vulnerable than common nouns. In learning, proper nouns were, however, more demanding (possibly due fine visual discrimination required). People with aphasia did not demonstrate greater impairment on newly learned proper nouns than on common nouns relative to their age-matched controls.

Chapter Five focuses on proper versus common noun production in category fluency tasks in non-brain-damaged speakers as well as in people with aphasia. Category fluency tasks were argued to reduce the influence of frequency on word retrieval and thus, represent a more objective tool (in comparison to picture naming, for example) to assess differences in proper versus common noun retrieval. The study found no evidence for proper nouns being harder to retrieve.

Finally, in Chapter Six, repetition of a word in the presence of a picture was used to facilitate naming of proper and common nouns in people with aphasia. Proper and common nouns were found to benefit equally from facilitation.

Overall, convergent evidence from the studies in this thesis shows that when statistical properties are held equal or affect performance on the task less, proper nouns are no longer more vulnerable in retrieval than common nouns. Consequently, statistical properties of proper and common nouns should be given more consideration in accounting for retrieval patterns and should be incorporated into explanatory theoretical models.

Chapter One

Introduction

Everybody will have most probably experienced multiple times the problem of not being able to remember the name of a familiar actor, singer, politician, or acquaintance. Arguably, these problems occur more often than problems with recalling a word for a particular animal, tool, vegetable or object. Numerous studies have provided empirical illustrations for this casual observation: Proper nouns (usually personal names, e.g., Hugh Grant, Bono, Tony Abbott) cause more retrieval blocks (*tip-of-the-tongue* states) than common nouns (e.g., an actor, a singer, a politician, a stethoscope, a colander) (see, for example, Burke, MacKay, Worthley, & Wade, 1991; Cohen & Faulkner, 1986; Hanley, 2011; Hanley & Cowell, 1988; Hay, Young, & Ellis, 1991; Reason & Lucas, 1984). Moreover, proper nouns have been found to be more prone to naming errors (e.g., Burke et al., 1991; Evrard, 2002; McKenna & Warrington, 1980), take more time to be retrieved (e.g., Evrard, 2002; Marful, Paolieri, & Bajo, 2014) and be slower to make semantic judgements upon (e.g., Johnston & Bruce, 1990; Young, Ellis, & Flude, 1988) than common nouns. A rational question to ask is why proper and common nouns show different patterns in word production. There has been an extensive discussion in literature elaborating on the possible answer to this question (see reviews by Cohen & Burke, 1993; Hanley, 2011a; Hanley, 2011b; Semenza, 1997, 2006; Valentine, Brennen, & Brédart, 1996; Yasuda, Beckmann, & Nakamura, 2000).

How are proper and common nouns different? Logical properties account

The logical properties account (a term used by Kay, Hanley, & Miles, 2001) focuses on the different representation and processing of proper and common nouns when explaining differences found in their retrieval. This account encompasses various theories and ideas put forward in an attempt to shed light on differences between these two noun classes. The basic and uncontroversial difference between common and proper nouns is that common nouns have *type* reference, whereas most proper nouns carry *token* reference (Jackendoff, 1983). Hence, any person whose profession is acting can be called *an actor* (thus, this common noun refers to the type of beings), but there is only one actor whose name is *Hugh Grant* (thus, this proper noun is related to a single token).

Another relevant argument that is often made to explain proper versus common noun differences is that proper nouns are arbitrary labels, or *pure referring expressions*, as opposed to common nouns that are sometimes called descriptions (e.g., Brédart & Valentine, 1998; Cohen, 1990; Kripke, 1980; Semenza 1997, 2006). Proper nouns are thought to be arbitrary in the sense that they do not convey any meaning about their bearers but are simply tags that facilitate identification. Indeed, a person who does acting is traditionally called *an actor* but the British actor *Hugh Grant* could have easily been given another name - his name does not itself convey any meaning as to what kind of person he is.

Another factor that could contribute to the greater prevalence of retrieval blocks for proper nouns is the fact that they usually require retrieval of one particular label whereas common nouns often can be substituted by synonyms or words from different levels of object categorisation (superordinates or subordinates). Thus, Brédart (1993) notes that only few peoples' names have alternatives (usually these are artists' names: e.g., 'Marilyn Monroe' and 'Norma Jean Baker'), while one can easily refer to an object in different ways (e.g., a *car* may be called by its type/brand - 'Volkswagen' or 'Golf' or 'hatchback'). Thus, in retrieval, one may replace a target common noun with an adequate alternative possibly without even conscious awareness, but any failure to recall a target proper noun would result in a block. Empirical investigation has confirmed that when the number of alternatives (e.g., synonyms) were controlled, there was no difference in the number of retrieval blocks for proper and common nouns (e.g., Brédart, 1993; Hanley, 2011a).

A different explanation was proposed by Brennen (1993, 2000). He suggested that, proper nouns are disadvantaged in retrieval because their set of plausible phonologies is much larger than that for common nouns. Indeed, we keep acquiring proper nouns throughout our lives whereas few new common nouns are added to our vocabulary after adolescence. Therefore, Brennen suggests that we are more open to new proper noun exemplars than we are to common nouns. For example, it would be easier for us to believe that ‘dreaner’ is the name of a person than the name of an occupation (Brennen, 1993). Consequently, provided partial phonology for a word is available, the whole phonology of a common noun can be retrieved more easily than that of a proper noun.

Most probably, all the factors listed above play a role in processing of proper and common nouns. Unfortunately, it is not feasible to control for all of them within the framework of one experiment and thus, it is hard to determine the relative contribution to the differences that have been found between these two noun classes in spoken production.

At what point in the process of word retrieval do differences between proper and common nouns occur?

Semenza (2006, 2009) argued that differences in common and proper noun retrieval could arise from a combination of differences at both the semantic level (different connections between attributes) and at the lexical level (different mechanisms in the activation of the phonological form; see also Hanley (2011a, 2011b) for discussion). Figure 1 (from Semenza, 2009) represents the separate systems of individual (proper noun) and general (common noun) semantics. The main distinction between the two systems is in the structure of the semantic feature network: Semantic features of common nouns comprise an overlapping and interactive set with high-probability connections (see also Semenza, Zettin, & Borgo, 1998), whereas semantic features associated with proper nouns are united only by belonging to the same unique entity. Consequently, the activation from individual and general semantics to proper and common noun word forms, respectively, follows different pathways.

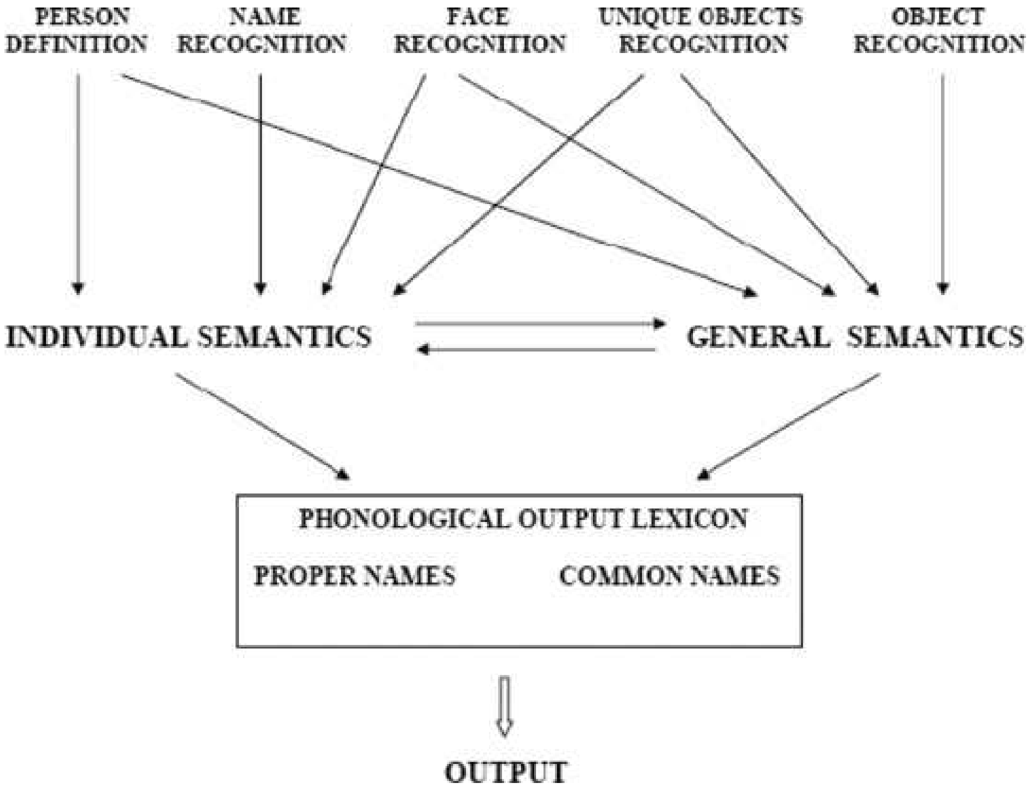


Figure 1. Information processing model for proper and common noun production (from Semenza, 2006, pp. 350).

a) Semantic level

As this thesis does not discuss the issue of *general* (common) versus *individual* (proper) semantics and any possible differences in the semantic memory structure of common and proper nouns, we will touch upon the topic only briefly here.

Studies on common nouns have shown that there are subcategories within this noun class that are processed differently: living/non-living objects, biological/non-biological, animate/inanimate objects (e.g., Capitani, Laiacona, Mahon, & Caramazza, 2003; Caramazza &

Shelton, 1998; Riddoch & Humphreys, 1987; Warrington & McCarthy, 1987; Warrington & Shallice, 1984). Semantic organisation of the category of living things was argued to rely more on the sensory properties while functional properties were more important for non-living (man-made) objects (e.g., McCarthy & Warrington, 2015). An alternative view suggested that living things are more visually similar and share a lot of perceptual and semantic features, whereas objects (even with the same name and/or function) are more heterogeneous and more distinctive (e.g., Humphreys & Forde, 2001; Moss & Tyler, 2000). Although it has been suggested that attributes shared by more members of a category are less vulnerable to damage than those specific to few individuals, the pattern is quite the opposite for identification and discrimination tasks. Thus, the relatively non-distinctive features of living things make the task of differentiating between individual stimuli hard and susceptible to category-specific impairments in patients with brain damage, although the general class of items are likely to be available. On the other hand, highly distinctive features of objects are less vulnerable to the effects of impairment and thus, identification of individual exemplars of objects often stays preserved (see discussion in McCarthy & Warrington, 2015).

Based on the vast discussion about specific semantic organisation of subcategories within the class of common nouns, it is logical to expect differences in how the semantics of proper nouns in general, and subcategories within them in particular, is organised in comparison to common nouns. Indeed, proper noun referents can be compared with ‘living things’ in the discussion above, while common noun referents – to ‘objects’. Thus, different individuals (proper nouns) are more visually similar than different types of objects (common nouns). By definition, different ‘individuals’ within a class share more features and are less distinct than different ‘types’ of objects are to each other. Consequently, following the logic from above, one could perhaps expect proper noun semantic features to be more stable and withstand damage but to be more vulnerable to decay when it comes to distinguishing between individual stimuli.

Additionally, research on semantic distance effects has demonstrated that there are differences in semantic organisation within the proper noun class. For example, Crutch & Warrington (2003) demonstrated that physical distance is important in the representation of geographical names. Moreover, Crutch & Warrington (2011) suggested that even items within the same subcategory may be organised differently depending on certain variables. For example, the semantic organisation principle for people's names may be determined by the level of familiarity with the name bearers: Less familiar names were suggested to be organised by occupation, while for more familiar people the organisation may be based on associative/thematic relationships (Crutch & Warrington, 2011).

Neuropsychological data from people with aphasia also support the possible differential organisation of proper noun and common noun semantics. Thus, cases reported by Miceli et al. (2000; case APA) and Lyons, Hanley, and Kay (2002; case FH) present contrasting patterns. Both studies presented people with aphasia, whose naming impairment was at the semantic rather than lexical level, but their pattern of impairments was opposite: APA presented with a selective proper noun retrieval deficit while FH revealed a selective retrieval deficit for common nouns.

Although suggesting that there are differences in semantic organisation of proper and common nouns seems reasonable, most theoretical models that account for proper versus common noun processing have focused on possible differences in the mechanisms of activation of the phonological form. Thus, this thesis focuses on proper and common noun processing in respect to a potential difference in their access to the phonological form (over and above whether there are differences in semantic representation that may lead to potential dissociations in performance).

b) Lexical level

In general people (without aphasia) can report semantic information about the proper nouns that they cannot retrieve, for example, saying "he is a British actor, with dark hair, often plays disorganised upper class types in comedies" while not being able to name the picture of Hugh Grant. This kind of 'tip of the tongue' behaviour is considered characteristic of impaired access to the phonological form of the word[1], and this is the level at which difficulties with proper noun retrieval are commonly considered to arise. Although there are several models that attempt to explain why different retrieval patterns are seen for proper and common nouns, most of them rely on a difference in connectivity between the entity and its phonological form. Thus, it has been suggested that the access from word semantics to its phonological form is realised via separate structurally different pathways (e.g., Semenza & Zettin, 1988; Burke et al., 1991; Burton & Bruce, 1992; Brédart, Valentine, Calder, & Gassi, 1995). The specifics of the different models are not relevant in the context of the experiments in this thesis and thus, the models will not be described in further detail here (see reviews in Cohen & Burke, 1993; Hanley, 2011b; Hanley, 2014; Hanley & Cohen, 2007; the model by Burke et al., 1991 is discussed in Chapter Three).

Neuropsychological evidence: Double dissociations at the level of access to the lexicon

If it is true that common and proper nouns are indeed processed by two separate lexical mechanisms, these mechanisms could be independently affected by brain damage and if so we

[1] Throughout this thesis the terms 'lexical form' and 'phonological form' are used interchangeably to refer to the stored phonological representation of a word, at a level prior to phonetic encoding.

should also be able to see examples of double dissociations in people with aphasia. A double dissociation at the lexical level would be reflected in people with aphasia whose common noun retrieval is relatively intact while proper nouns are impaired, along with other cases with the opposite pattern: relatively spared proper nouns and impaired common nouns. In both cases, (for a lexical level dissociation) the semantic system has to be intact so that semantic information about both common and proper nouns is available but only access to word forms is impaired (Brédart, Brennen, & Valentine, 1997).

Neuropsychological data indeed demonstrate a substantial number of cases of people with aphasia with relatively preserved ability to recall common nouns but impaired retrieval of proper nouns (e.g., Cohen, Bolgert, Timsit, & Cherman, 1994; Fery, Vincent, & Brédart, 1995; Hanley & Kay, 1998; Harris & Kay, 1995; Hittmair-Delazer, Denes, Semenza, Mantovan, 1994; Lucchelli & De Renzi, 1992; Martins & Farrajota, 2007; McKenna & Warrington, 1980; Otsuka et al., 2005; Semenza & Zettin, 1988, 1989;). For example, the Italian patients reported in Semenza and Zettin (1988, 1989) and in Hittmair-Delazer et al. (1994), when asked to name to definition, could retrieve ‘colombo’ (pigeon) but not ‘Colombo’ (Columbus).

The situation is less clear-cut when it comes to cases where proper nouns are selectively spared in oral word production. The reported cases are rare and involve heterogeneous levels of impairment with often severe impairment in word production in general. One such case was reported by Semenza and Sgaramella (1993). Their patient (RI) could only spontaneously produce monosyllables, but his naming of people’s names improved significantly upon presentation of a phonemic cue, while his naming of even very high frequency objects did not benefit from cueing.

Martins and Farrajota (2007) argue that the two people with aphasia (JFJ and ACB) from their study form a double dissociation. To our knowledge, this is the first and only study that directly compares two people with aphasia on common and proper noun production using the same experimental stimuli – the appropriate methodology to be able to demonstrate a double dissociation. Martins and Farrajota (2007) suggest that JFJ and ACB presented with a complementary pattern of impairment at the lexical access level: JFJ had normal common noun production and impaired proper noun production, whereas ACB suffered from impaired common noun naming with spared proper nouns. However, the pattern may not be quite as clear as they suggest. For example, while ACB was argued to have impaired common noun naming, in common noun category fluency he scored below controls only on one common noun category, which was a similar pattern to JFJ (who was argued to have intact common noun naming). Indeed, if we compare performance of the two participants on individual common noun categories in the picture naming task, for many of them the difference between the scores of the two patients was just a matter of 1 to 3 points, with the scores being equal for the category 'animals'. Furthermore, JFJ, the patient with a proper noun impairment, seemed to have a relative preservation of geographical names (he was within normal limits). This could reflect a finer gradation within the proper noun class, but nevertheless weakens the claim of a general proper noun impairment. In sum, although Martins & Farrajota (2007) provide a detailed report, it remains hard to conclude with certainty that there was a clear double dissociation.

Overall, we argue that the cases of proper noun sparing that have been reported so far are not strong enough to comprise, together with cases of proper noun anomia, a clear double dissociation. Moreover, Kay, Hanley, and Miles (2001) argued that more thorough in-depth investigation of common noun production in previously reported proper name anomia cases could potentially reveal additional impairments in common noun retrieval. Kay et al. systematically investigated the ability to retrieve common nouns of BG, a woman with proper name anomia (described in Harris & Kay, 1995). As a result, impairment for common nouns was also revealed: Items that were acquired later in life, had lower word familiarity, and lower name agreement (a large number of correct alternative names for the word), were more likely not to be retrieved. Kay et al. (2001) interpreted BG's difficulties in spoken word production with a continuum of word retrieval difficulty: Words that were less familiar and acquired later in life (mostly proper nouns but also some common nouns) were affected more by impaired word retrieval than more familiar items that were acquired earlier in life. Moreover, BG was severely impaired in naming people but was able to name unique biographical facts. Therefore, Kay et al. (2001) concluded that in BG's case the deficit for proper nouns would be hard to explain as due to proper nouns being pure referring expressions, unless BG suffered from two separate impairments for proper and common nouns. While the hypothesis of two separate impairments could not be refuted, it is a less parsimonious explanation.

Overall, the majority of cases reported in the literature are mostly of people who have selective proper noun anomia with common nouns being relatively intact, as well as more sparse and less convincing reports of cases where people have proper nouns spared in the presence of pronounced common noun retrieval disorders. In the absence of clear double dissociations, the neuropsychological data cannot provide strong evidence for separate processing mechanisms for proper and common nouns at the level of access to the lexical form.

Although double dissociations remain undoubtedly a useful tool when studying cognitive mechanisms (Baddeley, 1986), there is discussion in the literature whether they actually can support the claims that they are meant to (e.g., Juola & Plunkett, 2000; Plaut, 1995). Shallice (1988) pointed out that "if modules exist, then … double dissociations are a relatively reliable way of uncovering them". The opposite, he said, cannot be affirmed: The existence of double dissociations does not presuppose the existence of the modules. Baddeley

(2003) notes that a good alternative to double dissociations is a “less spectacular but more practicable doctrine of converging operation”: ample evidence coming from a wide range of data will put enough constraints on theory and will facilitate its development. Hence, in this thesis, when examining the performance of people with aphasia we did not try to find (double) dissociations but rather explored common versus proper word retrieval patterns in people with aphasia with no previously detected selective deficit for either common or proper nouns, nor semantic deficits.

How are proper and common nouns different? Statistical properties account

As noted above, an alternative view to the logical properties account is that, irrespective of possible processing differences between the noun classes, distinct retrieval patterns are mostly driven by differences in such statistical properties of words as frequency, familiarity, age of acquisition, and recency of use (e.g., Kay et al., 2001). Thus, according to this account, there is one single mechanism that is responsible for processing of both proper and common nouns. However, differences seen in production are due to the fact that nouns within and across the two classes hold different positions on ‘a continuum of word retrieval difficulty’. This account will be covered in more detail later in the thesis.

Thesis outline

This thesis aims to contribute to the discussion on proper versus common noun processing. In particular, we use different methods to test which noun properties (logical or statistical) play a crucial role in differences between proper and common nouns seen in production in non-brain-damaged speakers and in people with aphasia.

Chapter Two reports data from the experiment on learning of novel proper and common nouns in young non-brain-damaged adults. The aim of the experiment was to assess how logical properties of proper and common nouns affect learning when statistical properties are held equal.

Chapters Three and Four present data from older non-brain-damaged adults and for people with aphasia on a learning experiment with a design similar to that reported in Chapter Two. The aim of the study in Chapter Three was to examine whether older adults would show a disproportionate age-related impairment on proper nouns relative to younger adults. Chapter Four reports data for people with aphasia[2].

Chapter Five explores production of proper and common nouns elicited with category fluency tasks in non-brain-damaged speakers and in people with aphasia. The aim of this study was to see whether proper nouns are harder to retrieve/more susceptible to damage than common nouns using a task where statistical properties have a reduced effect on success.

The study described in **Chapter Six** used a repetition task to facilitate retrieval of proper and common noun items that were successfully recognised but not named by people with aphasia. The aim of the study was to compare facilitation effects for the two noun classes and relate them to predictions from the single versus dual processing mechanism accounts for proper and common nouns.

Finally, **Chapter Seven**, the general discussion, provides summary of all the experiments in the thesis and discusses their contribution to our understanding of proper and common noun processing.

[2] This chapter is the only data chapter in the thesis that is not written in the form of a journal article. Consequently, the introduction and methods are more concise and refer to the earlier chapters rather than being written to 'stand alone'.

References

Baddeley, A. D. (1986). *Working Memory*. Oxford: Clarendon Press.

Baddeley, A. D. (2003) Double dissociations: Not magic, but still useful. *Cortex*, 39, 129-131.

Brédart, S., Brennen, T., & Valentine, T. (1997). Dissociations between the processing of proper and common names. *Cognitive Neuropsychology, 14*, 209-217.

Brédart, S., & Valentine, T. (1998). Descriptiveness and Proper Name Retrieval. *Memory, 6*, 199-206

Brédart, S., Valentine, T., Calder, A., & Gassi, L. (1995). An interactive activation model of face naming. *Quarterly Journal of Experimental Psychology, 48A*, 466–486.

Brennen, T. (1993). The difficulty with recalling people's names: The plausible phonology hypothesis. *Memory, 1*, 409–431.

Brennen, T. (2000). On the meaning of personal names: A view from cognitive psychology. *Names, 48*, 139-146.

Burke, D. M., MacKay, D. G., Worthley, J. S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language*, *30*, 542-579.

Burton, A. M., & Bruce, V. (1992). I recognise your face but I can't remember your name: A simple explanation? *British Journal of Psychology, 83*, 45–60.

Capitani, E., Laiacona, M., Mahon, B., & Caramazza, A. (2003). What are the facts of semantic category- specific deficits? A critical review of the clinical evidence. *Cognitive Neuropsychology, 20*, 213–261.

Caramazza, A., & Shelton, J. R. (1998). Domain-specific knowledge systems in the brain: The animate-inani mate distinction. *Journal of Cognitive Neuroscience, 10,* 1–34.

Cohen, G. (1990). Why is it difficult to put names to faces? *British Journal of Psychology, 81*, 297-297.

Cohen, L., Bolgert, F., Timsit, S., & Chermann J. F. (1994). Anomia for proper names after left thalamic infarct. *Journal of Neurology, Neurosurgery and Psychiatry, 57*, 1283–1284.

Cohen, G., & Burke, D. M. (1993). Memory for proper names: A review. *Memory, 1,* 249-263.

Cohen, G., & Faulkner, D. (1986). Memory for proper names: Age differences in retrieval. *British Journal of Developmental Psychology, 4,* 187-197.

Crutch, S. J., & Warrington, E. K. (2003). Spatial coding of semantic information: Knowledge of country and city names depends on their geographical proximity. *Brain*, *126*, 1821–1829.

Crutch, S. J., & Warrington, E. K. (2011). Taxonomic and thematic organisation of proper name conceptual knowledge. *Behavioural Neurology*, *24,* 265–276.

Evrard, M. (2002). Ageing and lexical access to common and proper names in picture naming. *Brain and Language, 81*, 174–179.

Fery, P., Vincent, E., & Brédart, S. (1995). Personal name anomia: A single case study. *Cortex, 31,* 191-198. Hanley, J. R., & Cowell, E. S. (1988). The effects of different types of retrieval cues on the recall of names of famous faces. *Memory and Cognition*, *16*, 545–555.

Hanley, J. R. (2011a). Why are names of people associated with so many phonological retrieval failures? *Psychonomic Bulletin & Review*. Advance online publication. doi:10.3758/s13423- 011-0082-0

Hanley, J. R. (2011b). An appreciation of Bruce and Young's (1986) serial stage model of face naming after 25 years. British Journal of Psychology, 102, 915-930.

Hanley, J. R. (2014). Retrieval failures for the names of familiar people. In B. L. Schwartz, & A. S. Brown (Eds.) *Tip-of-the-Tongue States and Related Phenomena*. New York: Cambridge University Press.

Hanley, J. R., & Cohen, G. (2007). Memory for people: Face, names, and voices. In G. Cohen, & M. A. Conway (Eds.) *Memory in Real World.* (3rd edition). Hove: Psychology Press.

Hanley, J. R., & Kay, J. (1998). Proper name anomia and anomia for the names of people: Functionally dissociable impairments? *Cortex*, *34,* 155–158.

Hay, D. C., Young, A. W., & Ellis, A. W. (1991). Routes through the face recognition system. *Quarterly Journal of Experimental Psychology*, *43A*, 761–791.

Harris, D.M., & Kay, J. (1995). Selective impairment of the retrieval of people's names: A case of category specificity. *Cortex*, *31*, 575-582.

Hittmair-Delazer, M., Denes, G., Semenza, C., & Mantovan, M.C. (1994). Anomia for people's names. *Neuropsychologia, 86,* 345-358.

Humphreys, G. W., & Forde, E. M. (2001). Hierarchies, similarity, and interactivity in object recognition: Category-specific neuropsychological deficits. *Behavioural and Brain Sciences, 24*, 453–509.

Jackendoff, R. (1983). Semantics and cognition. Cambridge, MA: MIT Press.

Johnston, R. A., & Bruce, V. (1990). Lost properties? Retrieval differences between name codes and semantic codes for familiar people. *Psychological Research, 51*, 62-67.

Juola, P., & Plunkett, K. (2000). Why double dissocia tions don't mean much. In Cohen, G., Johnston, R. A., and Plunkett, K (Eds.), *Exploring Cognition : Damaged Brains and Neural Networks*. Psychology Press/Taylor and Francis, Philadelphia, PA.

Kay J., Hanley, J. R., & Miles, R. (2001). Exploring the relationship between proper name anomia and spoken word retrieval: A single case study. *Cortex*, *37*, 501-517.

Kripke, S. (1980). *Naming and necessity*. Oxford: Blackwell.

Lucchelli, F., & De Renzi, E. (1992). Proper name anomia. *Cortex, 28*, 221-230.

Lyons, F., Hanley, J. R., & Kay, J. (2002). Anomia for common names and geographical names with preserved retrieval of names of people: A semantic memory disorder. Cortex, *38*, 23-35.

McCarthy, A., & Warrington, E. K. (2015). Past, present, and prospects: Reflections 40 years on from the selective impairment of semantic memory (Warrington, 1975). *The Quarterly Journal of Experimental Psychology*, 1-28.

Marful, A., Paolieri, D., & Bajo, T. (2014). Is naming faces different from naming objects? Semantic interference in a face- and object-naming task. *Memory & Cognition*, *42*, 525-537.

Martins, I. P., & Farrajota, L. (2007). Proper and common names: a double dissociation. *Neuropsychologia*, *45*, 1744-1756.

McKenna, P., & Warrington, E. K. (1980). Testing for nominal dysphasia. *Journal of Neurology, Neurosurgery, and Psychiatry, 43*, 781-788.

Miceli, G., Capasso, R., Daniele, A., Esposito, T., Magarelli, M. &, Tomaiulo, F. (2000). Selective deficit for people names following left temporal damage: An impairment of domain-specific conceptual knowledge. *Cognitive Neuropsychology, 17,* 489- 516.

Moss, H. E., & Tyler, L. K. (2000). A progressive category-specific semantic deficit for non-living things. *Neuropsychologia, 38*, 60–82.

Otsuka, Y., Suzuki, K., Fujii, T., Miura, R., Endo, K., Kondo, H., & Yamadori, A. (2005). Proper name anomia after left temporal subcortical haemorrhage. *Cortex*, *41,* 39-47.

Plaut, D. C. (1995). Double dissociation without modularity: Evidence from connectionist neuropsychology. *Journal of Clinical and Experimental Neuropsychology*, *17*, 291-321.

Reason, J. T., & Lucas, D. (1984). Using cognitive diaries to investigate naturally occurring memory blocks. In J.E. Harris & P.E. Morris (Eds.), *Everyday memory actions and absent-mindedness* (pp. 53-70). London: Academic Press.

Riddoch, M. J., & Humphreys, G. W. (1987). A case of integrative visual agnosia. *Brain, 110*, 1431–1462.

Semenza, C. (1997). Proper-name-specific aphasias. In Goodglass, H., & Wingfield, A. (Eds), *Anomia*: *Neuroanatomical and Cognitive Correlates.* San Diego: Academic Press.

Semenza, C. (2006). Retrieval pathways for common and proper names. *Cortex, 42*, 884–891.

Semenza, C. (2009). The neuropsychology of proper names. *Mind and Language, 24*, 347–369.

Semenza, C., & Sgaramella, T.M. (1993). Production of proper names: a clinical case study of the effects of phonemic cueing. *Memory*, *1*, 265-280.

Semenza, C., Zettin, M., & Borgo, F. (1998). Names and identification: An access problem. *Neurocase: The Neural Basis of Cognition, 4,* 45-53.

Shallice, T. (1988). *From neuropsychology to mental structure.* Cambridge: Cambridge University Press.

Valentine, T., Brennen, T., & Brédart, S. (1996). The cognitive psychology of proper names. London: Routledge.

Warrington, E. K., & McCarthy, R. A. (1987). Categories of knowledge: Further fractionations and an attempted integration. *Brain, 110*, 1273–1296.

Warrington, E. K., & Shallice, T. (1984). Category specific semantic impairments. *Brain, 107*, 829– 853.

Yasuda, K., Beckmann, B., & Nakamura, T. (2000). Brain processing of proper names. *Aphasiology*, *14*, 1067-1089.

Young, A. W., Ellis, A. W., & Flude, B. M. (1988). Accessing stored information about familiar people. *Psychological Research*, *50*, 111–115.

Chapter Two

Investigating Differences in Learning of Novel Proper and Common Nouns in Young Adults

Abstract

Proper nouns are often reported to be harder to retrieve and to learn than common nouns. Differences in logical properties (nature of proper and common nouns as word classes) have been commonly used to explain the retrieval patterns. However, statistical properties (e.g., frequency) for more or less familiar proper and common nouns are very hard to match, and thus, it is impossible to directly compare the relative retrieval difficulty between these noun classes using real words. The aim of this study was to dissociate the effects of logical and statistical properties by using novel words with consequently equal statistical properties (e.g., zero frequency) paired with novel meanings. Thus, if logical properties played a dominant role in retrieval, proper nouns should still have been harder to retrieve. Results showed that young healthy adults did not have any disadvantage for proper nouns in word retrieval, supporting the role of statistical properties such as frequency in the relatively poor retrieval and learning of proper nouns in the literature. However, associations between proper noun labels and their depictions were harder to learn than equivalent associations for common nouns. We suggest this could have been due to fine visual discrimination required in the task that assessed the learning outcomes.

Introduction

Proper and common nouns form two different lexical semantic categories characterised by distinct features. Common nouns refer to a category or class of beings or objects (e.g., a dog, a bank), as well as abstract nouns (e.g., love, science), while proper nouns designate a specific individual being or object with its unique features (e.g., Snoopy, Heinz). These two noun categories have long been contrasted in research in order to determine whether they engage similar or distinct processing mechanisms.

In word retrieval, both diary (e.g., Burke, MacKay, Worthley, & Wade, 1991; Reason & Lucas, 1984) and laboratory studies (e.g., Cohen & Faulkner, 1986; Hanley, 2011; Hanley & Cowell, 1988; Hay, Young, & Ellis, 1991) have revealed that proper nouns are subject to tip-of-the-tongue states more frequently than common nouns. Data from reaction time studies also support discrepancies between the two noun categories. Namely, latencies for face naming (e.g., Brédart, Valentine, Calder, & Gassi, 1995, 1986; Evrard, 2002; Marful, Paolieri, & Bajo, 2014; Young, McWeeny, Ellis, & Hay) have been reported to be longer than those for object naming (e.g., Evrard. 2002; Humphreys, Riddoch, & Quinlan, 1988; Levelt, Schriefers, Meyer, Pechmann, Vorberg, & Havinga, 1991; Marful et al., 2014). Decision times in categorisation tasks with presentation of familiar faces have also been found to be longer for making judgements about names (proper nouns) than about occupations and nationalities (common nouns) (Johnston & Bruce, 1990; Young, Ellis, & Flude, 1988).

As illustrated by the research outlined above, the data from studies on unimpaired speakers (as well as studies on people with brain damage which are beyond the scope of this paper; see, for example, Cohen & Burke, 1993; Semenza, 1997, 2009) show that proper nouns may be harder to retrieve than common nouns. To account for the existing empirical data, Kay, Hanley, and Miles (2001) suggested that proper and common nouns could be on a single “continuum of word retrieval difficulty”. This essentially means that proper nouns are more vulnerable to tip-of-the-tongue states because they have features that make them more demanding in terms of word retrieval than most common nouns. These features are thought to be statistical properties such as frequency, familiarity, and age of acquisition. This view predicts that discrepancies in processing should not be unique to proper versus common nouns, but differences might be seen within and across these lexical-semantic categories. Namely, some common nouns may be more difficult than some proper nouns, just as, within the categories, some proper/common nouns are easier to retrieve than others. Nevertheless, other authors suggest that over and above any differences in statistical properties, proper and common nouns have different logical properties that lead to separate word processing and learning mechanisms.

This second, logical property, account rests on the proposal that proper nouns are “pure referring expressions” (e.g., Kripke, 1980) in that they refer us to an individual entity but do not convey any meaning. While common nouns have *type* reference denoting a category of beings or objects, proper nouns are characterised with *token* reference as they denote an individual within a category (Jackendoff, 1983). Consequently, common nouns, in comparison to proper nouns, form stronger and/or more elaborated links with their associated semantic information (e.g., Cohen & Burke, 1993; Semenza, 1997, 2009). Theories that further specify the differences in the retrieval mechanisms come mostly from the face perception field, with name retrieval being the final step of face recognition (e.g., Brédart et al., 1995; Bruce & Young, 1986; Burton & Bruce, 1992), but also from language production (e.g., Burke et al., 1991). For most of these theories the crucial concept regarding proper noun retrieval and the source of the difficulties in face naming (proper nouns) compared to object naming (common nouns) is differences in connectivity. In particular, some of the theories hypothesise that, for common nouns, multiple connections from their many semantic features contribute to activation of the lexical form and thus, guarantee more stable retrieval. In contrast, for the names of people, there is no convergence of connections nor multiple sources of activation, as there is only a single connection to the lexical form from a proper noun token node (e.g., Node Structure Theory: Burke et al. 1991; Interactive Activation and Competition Model: Brédart et al., 1995).

In the attempt to determine what characteristics of proper and common nouns lead to differences in performance for these two noun classes, learning has also been used as a research tool. Learning studies have commonly used a paired associate method: Learning of a mapping between a new face and a personal name (a proper noun) paired with a piece of biographical information about this person such as occupation, possession, etc. (a common noun) was followed by recall of the personal name and the biographical information upon presentation of the face. Most such studies have shown that the subsequent recall of a learned personal name is poorer than recall of a learned occupation (e.g., Stanhope & Cohen, 1993; Terry, 1994). One of the first, and most influential, learning studies was by McWeeny, Young, Hay, and Ellis (1987). They paired unfamiliar faces with existing people's names and occupations, some of which were ambiguous as they could refer either to an individual or an occupation (such as Mr Baker, the baker; Mr Cook, the cook; Mr Potter, the potter, etc.). The same word was presented as a proper noun (a personal name) to some subjects and as a common noun (an occupation) to others: *"Mr Baker is a lawyer"* versus *"Mr Higgins is a baker."* The results showed that participants recalled nouns presented as occupations (*a baker*) better than the same nouns presented as proper nouns (*Mr Baker*). This phenomenon is called *the Baker-baker paradox*. The logical properties of the noun classes were used to explain the results. In particular, following the model proposed by Bruce and Young (1986), it was concluded that *Mr Baker*, although a meaningful proper noun, was harder to retrieve than *a baker* because retrieval of people's names is contingent upon access to the semantic information about the individuals (in this case, their occupation)[3].

Cohen (1990) followed up on the results obtained by McWeeny et al. (1987) by introducing two more conditions which did not have ambiguous (*a baker*) and unambiguous (*a lawyer*) occupations in the same sentence. Instead, Cohen (1990) used non-words for a name/occupation: e.g., *"This is Mr Baker. He is a ryman"* versus *"This is Mr Ryman. He is a baker"* versus *"This is Mr Baker. He is a lawyer"* (the latter condition being similar to that in McWeeny et al., 1987, where both ambiguous and unambiguous occupations were present). Surprisingly, *the Baker-baker paradox* disappeared in the two new conditions, so that ambiguous meaningful names (e.g., Baker) were recalled as well as meaningful occupations (e.g., a baker), while meaningless personal names (e.g., Ryman) were recalled to the same degree as meaningless occupations (e.g., a ryman; see also Milders, 1998). The only condition in which the results from McWeeny et al. (1987) were replicated was identical to the one used in the original study (*"This is Mr Baker. He is a lawyer"*). Cohen (1990) argued that this inconsistency of results in the different conditions was due to the conflicting meanings in the deviant condition: Both 'Baker' and 'lawyer' denote professions, which contradicts contextual sense. Thus, she argued that participants ignored meaningfulness of 'Baker' and ascribed profession semantics to 'a lawyer'. In contexts, however, where semantics of proper nouns did not contradict the semantics of other phrase constituents, the meaningfulness of proper nouns contributed to their retrieval success. Thus, in her explanation of proper noun retrieval difficulties in general, Cohen (1990) focuses on the necessity of encoding the meaning of a word to be able to retrieve it. As proper noun word forms lack direct links to the semantic network (Bruce & Young, 1986), they are inherently harder to retrieve. However, there is

[3] Note that the serial model of Bruce and Young (1986) is derived from face recognition theories and, thus, is only compatible with word production models to a limited extent. Moreover, Bruce and Young's model (1986) does not make any direct claims about differences in common versus proper noun processing.

evidence against such a point of view: Fery, Vincent, and Brédart (1995) demonstrated that their patient (OV) with a selective deficit for personal names had comparable problems with retrieving completely arbitrary names (e.g., Mowgli) and more descriptive names (e.g., Snow White).

The studies described above attempted to control for differences between the statistical properties (e.g., frequency) of proper and common nouns by using the same word forms for both noun classes (homophones; e.g., '(Mr.) Baker' versus '(a) baker'). However, although *Baker* and *baker* have the same word forms, there is debate whether homophones share one lexical representation (Biedermann & Nickels, 2008; Levelt, Roelofs, & Meyer, 1999) or have separate representations (Caramazza, Costa, Miozzo, & Bi, 2001; Caramazza & Miozzo, 1998). If *Baker* and *baker* have different lexical representations, then they have different frequency counts – in other words we cannot be sure that using homophones controls for statistical properties. In general, matching proper and common nouns for frequency is far from straightforward. While frequency counts for any linguistic item are only an approximation of the true frequency for an individual, frequency counts for proper nouns are particularly variable between individuals (e.g., Brédart, 1993). Thus, Valentine, Brédart, Lawson, and Ward (1991) suggest that to obtain "a word-frequency like measure" for a proper noun, frequency and familiarity counts for this item should be combined. However, it is unclear how to achieve this.

To summarise, previous research on learning of proper versus common nouns has usually involved learning associations between unfamiliar faces and ambiguous/unambiguous real words or non-words. To our knowledge, there have been no experiments looking at learning of associations between novel meanings and novel words representing proper and common nouns. Studying these associations would, however, allow one to have a better control over such statistical word properties as frequency, familiarity, and age of acquisition. This would in turn enable one to contribute to our knowledge of the role of logical properties and their relative dominance in proper versus common noun processing. In other words, such an approach would address the differences between proper and common nouns more directly.

The goal of the present study was to determine whether the relative difficulty reported for retrieval of familiar proper nouns compared to familiar common nouns paired with unfamiliar faces (e.g., Stanhope & Cohen, 1993; Terry, 1994) would persist in learning and subsequent retrieval of novel proper and common nouns paired with novel meanings. Due to the novelty of both phonological word forms and semantic information related to the items, the statistical properties of experimental items were thus held equal. Indeed, in our study both noun classes were novel words of equal frequency and familiarity, and were acquired by participants during the experiment. Such a design allowed us to examine the potential role of logical properties in proper and common noun processing. If an inherent difference in the logical properties of proper and common nouns plays a crucial role in their retrieval, then, as in previous research, participants should find proper nouns harder to retrieve than common nouns. If, on the other hand, logical properties do not play a dominant role in the differences in retrieval and, instead, statistical properties are usually responsible for such disparities, then retrieval success should be comparable for proper and common nouns.

It is worth noting that the processes of novel word learning and those of retrieval of familiar words are two separate mechanisms. Thus, findings made about one of those two mechanisms cannot be automatically and unequivocally transferred to the other. This experiment allowed us to examine both processes: In the first, *learning stage* of the experiment (sessions 1-4) we expected that gradually, over sessions, representations of novel meanings and novel word forms and associations between them would become established, enabling examination of effects of proper versus common noun status on learning. By the second, *testing stage* (sessions 5-8), mappings between novel word forms and novel meanings would have been learned, and the learned word forms should have the status of familiar proper and common nouns. We argue that logical properties may not only affect retrieval but could also affect the learning curve for proper and common nouns. Namely, proper nouns may be learned at a slower rate than common nouns as more time would be required to establish strong mappings between novel word forms and their meanings (due to an assumed inherently weak connection between the lexical form and the semantics of proper nouns).

Method

The experiment comprised a learning task where novel creatures (inspired by Gupta et al., 2004) were paired with novel words that were presented in either proper or common noun conditions.

Participants

Sixteen English native speakers (7 males) aged 22-42 years (*Mean* = 28.69, *Standard Deviation* = 5.35), with under-graduate/postgraduate University degrees, who fulfilled the inclusion criteria participated in the study. Participants were included if they had normal or corrected to normal vision and hearing, no history of brain damage, mental illnesses or other neuropsychological impairments affecting their current mental state, and no history of drug or alcohol abuse. In addition, as verbal learning and verbal short-term memory have been found to be related (e.g., Gathercole & Baddeley, 1989; Gupta, 2003; Papagno & Vallar, 1995), immediate serial recall abilities were tested: We used standard forward, backward, and sequence digit spans, as well as spatial span tasks (Wechsler, 2008a, 2008b). All participants had immediate serial recall within the normal range. They also performed within the norm on repetition of two-syllable non-words (Kay, Lesser, & Coltheart, 1992).

Materials: Verbal stimuli

For the purposes of the experiment we created 22 bisyllabic phonologically plausible non-words (20 experimental and 2 practice trial stimuli), 5-8 letters and 4-7 phonemes in length (e.g., blaggit, maston, thorbit; see *Appendix A*). Five English native speakers rated a set of 53 candidate stimuli for the extent to which they sounded like possible English words (using a scale from 1 to 5) and read the non-words aloud. Those items that received a rating of 4 or 5 and where at least four speakers gave an identical pronunciation were included in the final stimulus set. Additionally, we excluded items that were reminiscent of real words, as judged by the same raters.

The final 20 experimental stimuli were divided into two lists matched for number of phonemes, number of letters, (written) bigram frequency, orthographic and phonological neighbourhood size, and phonotactic probability. These two lists were then assigned to Set A or Set B. The sets were randomly assigned to either proper noun or common noun conditions. The assignment of sets to conditions was counterbalanced across participants. Throughout the experiment participants were provided with the stimuli in both written (upper case) and auditory form. Auditory stimuli were recorded by a native English speaker and played to participants simultaneously with the written forms being displayed on the screen.

Materials: Pictorial stimuli

A set of colour vector images was purchased from the graphic website iStock (n. d.), and modified to fit the requirements of the experiment. The final set of 176 colour pictures comprised novel creatures that lacked any pre-existing name and varied along a number of dimensions such as colour, shape, posture, and facial expression. These pictures formed 20 subsets of experimental items, 2 practice subsets and 22 extra creatures (distractors for the verification task).

Each subset consisted of 7 exemplars. Four of these 7 exemplars depicted creatures of the same ‘species’: They resembled each other in body shape, but differed in body structure (e.g., fatter/thinner, bigger/smaller), colour tint (e.g., brighter or darker blue) as well as facial expression and posture (see Figure 2). Three of these 4 pictures were paired with a verbal stimulus presented as a common noun (the name of a species) in the experiment. For 1 of these 4 exemplars (we will call it the “neutral” exemplar) three additional depictions of that same individual creature were generated: These only varied in facial expression and posture (see Figure 3). These three exemplars were paired with a verbal stimulus presented as a proper noun (the name of an individual) in the study.

In addition, 22 unrelated pictures of different creatures of different species, that were not part of the 20 experimental or 2 practice sets, were employed in the word-picture verification and picture recognition tasks (see below).

Conditions

All verbal and pictorial stimuli were organised into two conditions: a common noun condition and a proper noun condition.

In the common noun condition, stimuli were presented as members of a species and were accompanied with the following instructions: “During this experiment you will be presented with different creatures that you have never seen before. In this part of the experiment you will see creatures that come from a number of different species. You will see different representatives of each species. For example, there may be pictures of a slim creature, a fatter creature of the same species, an older creature of that species, a creature of a lighter/darker colour, etc.”

In the proper noun condition, stimuli were presented as individuals with the following instructions: “During this part of the experiment you will be presented with different individual creatures that you have never seen before. You will see different pictures of the same individual creature. For example, there may be pictures of this creature when it is happy, sad, angry, jumping, rotated, etc.”

Assignment of conditions was counterbalanced across subjects. Half of the participants saw pictures depicting members of 10 different species paired with non-word Set A (common noun condition), and had depictions of 10 different individuals paired with non-word Set B (proper noun condition). The assignment was reverse for the other half of participants.

Procedure

The experiment consisted of 4 learning sessions held over 2 weeks (learning stage) and 4 follow-up sessions one day, one week, four weeks and two months post-training (testing stage)[4]. Each learning session included a presentation phase and a testing phase. Testing sessions only had a testing phase. See Figure 1.

Learning stage (sessions 1-4): Presentation phase

During the presentation phase participants were asked to learn 20 associated pairs of pictures and non-words. Stimuli were presented on the computer screen using SuperLab presentation software (Cedrus Corp., version 2.00 for PC, Phoenix, AZ). Visual images (pictures) of novel creatures and auditory and written verbal stimuli (sound recordings and written non-words) associated with them were presented in two separate blocks of 10: one block of common nouns and one of proper nouns. The order in which blocks were presented was counterbalanced across participants and across sessions.

[4] The procedure was adapted from that of Tuomiranta et al. (2011).

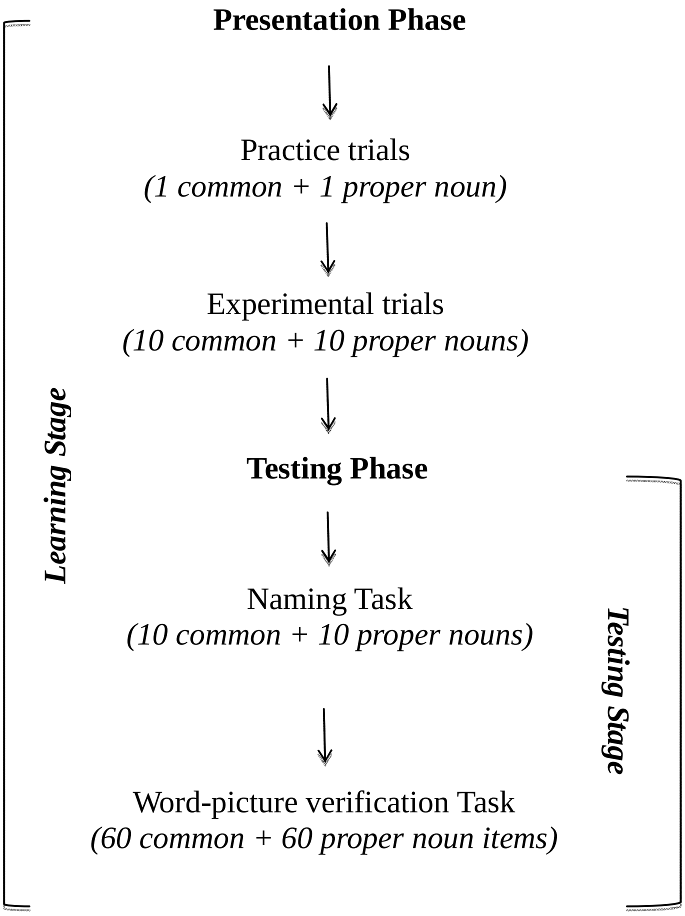


Figure 1. Summary of the experimental procedure: Learning and testing phases.

Each trial involved 3 consecutive depictions of either a species (in case of the common noun condition) or an individual (in case of the proper noun condition). Thus, in the common noun condition, participants saw three different members of the same species (e.g., Figure 2), whereas in the proper noun condition, they saw three different depictions of the same individual (e.g., Figure 3). In both conditions, while seeing a picture of a species member/individual, subjects also heard and saw its name (e.g., they heard “blaggit” and saw BLAGGIT, no article was provided in the common noun condition, and the use of upper case removed cues from capitalisation of initial letters for proper nouns). They were asked to repeat the non-word immediately after hearing the recording. The consecutive presentation of all three items (in a randomised order) was followed by the presentation of all these three items simultaneously, where participants were asked to again repeat the name for the items presented. In total, participants heard and repeated the name for each item 4 times per block. Each block was presented twice per session.

Figure 2. Example of members of the same species. Common noun condition.

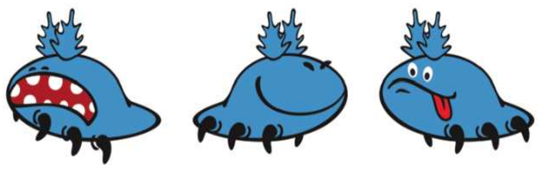


Figure 3. Example of depictions of the same individual. Proper noun condition.

Each block of each condition within the presentation phase started with a practice trial, during which a novel creature was shown to participants in the manner described above. After all the 20 experimental items (10 novel creatures per condition), as well as 2 creatures from practice trials, had been presented to the participants twice, the testing phase of a learning session began.

Learning stage (sessions 1-4): Testing phase

The testing phase consisted of a picture naming task and a receptive word-picture verification task.

During the *picture naming task* participants were asked to recall names of species (for the common noun condition) or names of individual creatures (for the proper noun condition) upon picture presentation on the screen. The task was comprised of 20 experimental items (10 per condition) and 2 practice trials (one per condition). The experimental items were represented by one of the three pictures of a species/individual introduced in the presentation phase. The particular picture was assigned to the naming task of each session in a predetermined random order to ensure that every depiction appeared at least twice throughout 8 sessions. The items from both proper and common conditions were presented, intermixed, in a random order. Participants were not instructed which of the items presented had been learned with proper noun labels and which with common noun labels.

After the first attempt to name the picture (irrespective of whether successful or not), participants were given a cue (the first consonant phoneme/letter or onset consonant cluster) of the item in both written and auditory forms. Subsequently, regardless of naming accuracy, participants saw and heard the correct response and were asked to repeat it.

In the *word-picture verification task* participants were presented with a picture and an auditory and written verbal stimulus. Participants needed to decide whether the word was the correct label for the picture by pressing “yes” or “no” buttons. Prior to proceeding to the experimental items, participants were given practice trials where the experimenter pointed out whether the response was correct or not, and in the case of an incorrect response, clarifications were given as to why. Each of the 20 learned labels (10 common and 10 proper) was presented in 6 different condition types resulting in 120 experimental items in total. Below we consider each verification type separately (see Table 1):

Type 1 - Trained pictures: Participants were presented with one of the three pictures of a species/individual that they had encountered in the presentation phase (which of the three pictures was used was pseudorandomised across the testing sessions) paired with the correct verbal label. The correct response to the Type 1 trials was “yes”.

Type 2 - Untrained pictures within noun class: An untrained picture (the “neutral” picture) of a species/individual trained during the presentation phase was paired with the correct verbal label. The correct response to the Type 2 trials was “yes”. This type examined generalisation of learning beyond the trained exemplars (the same untrained exemplar was presented across the sessions).

Type 3 - Untrained picture across noun class: This type provided the participants with another exemplar of the same species as the trained items. This resulted in conceptually different conditions for common and proper nouns. This type was crucial for the experiment as it enabled verification of whether participants had learned items as proper nouns.

For common nouns, another exemplar (untrained member) from the trained species presented as the verbal label was provided (as for Type 2), once again examining generalisation across exemplars within species. The correct response for common nouns was “yes”.

In trials with proper nouns, participants were also presented with a picture of a different member of the species to which the trained individual creature belonged. However, this should be rejected: While a member of the same species, it was not a depiction of the trained individual to whom the name (proper noun) applied. In the practice trials, the experimenter took particular care that participants understood why their response was wrong for this verification type (if this was the case). The correct response for proper nouns was “no”.

Depictions of untrained species members for this verification type were three pictures that were used to train items from the opposite condition for other participants: Pictures trained as proper noun items for other participants were used for common noun items in Type 3, and vice versa. These three pictures were given in a predetermined order across sessions.

Type 4 - Trained non-target within noun class: Participants were presented with trained pictures from other (non-target) creatures trained in the same (common or proper) noun block. The order of the pictures presented was predetermined across the sessions. Non-target trained creatures of a dissimilar colour to the target creatures were selected. The correct response to the type 4 trials was “no”.

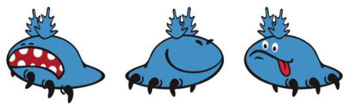
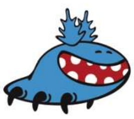
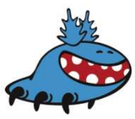
Type 5 - Untrained non-target across noun class: Participants were presented with untrained pictures of other (non-target) creatures trained in the opposite (common or proper) noun block, given in a predetermined order. The correct response was “no”.

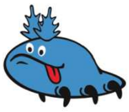
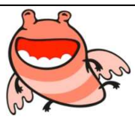
Type 6 - Unseen species: The distractors in these trials comprised creatures of species not used in the presentation phase of the experiment. The pairings were different at each testing session but the set of ‘unseen’ creatures stayed constant across the sessions. The correct response was “no”.

Table 1

Word-picture Verification Matching Types and Required Responses

NB: No participants were exposed to the proper and common noun conditions for the same creature as depicted here. The same creatures are provided here for both conditions to facilitate comparison.

	Common Nouns		*Proper Nouns*	
Trained items				
Type 1 Trained target pictures	Trained pictures of trained target species		Trained pictures of trained target individuals	
		YES		YES
Type 2 Untrained target pictures within noun class	Untrained picture of trained target species		Untrained picture of trained target individuals	
		YES		YES

Type 3 Untrained (non-)target pictures across noun class	Untrained pictures of trained target species	Untrained pictures of untrained individuals of the species to which the target individual belongs
	 YES	 NO
Type 4 Trained non-target pictures within noun class”	Trained pictures of trained non-target species	Trained pictures of trained non-target individuals
	 NO	 NO
Type 5 Untrained non-target pictures across noun class	Untrained pictures of untrained individual from trained non-target species	Untrained pictures of untrained member of untrained species (another non-target individual from the species that was learned as a proper noun)
	 NO	 NO
Type 6 Unseen species	Untrained pictures of unrelated untrained creatures	Untrained pictures of unrelated untrained creatures
	 NO	 NO

After the participants had responded yes/no with a button press for each verification trial, they received feedback as to whether their response was right or wrong (they saw a green tick or a red cross on the screen).

Testing sessions: Testing phase

The 4 follow-up sessions of the experiment consisted of the *picture naming* and *word-picture verification tasks* described above. In these sessions, no feedback was provided in either task, except for practice trials.

In addition, three further tasks were performed: auditory lexical decision, written lexical decision, and picture recognition. The aim of these three tasks was to examine the extent to which the pictures and words had been learned, while the picture naming and word-picture verification tasks tapped the knowledge of the mapping between a picture and a verbal label.

Lexical decision tasks: Both auditory and written versions of the task included 60 items, the 20 trained non-words (e.g., purmill), 20 untrained non-words that were different by one phoneme from the target non-words (e.g., purtill), and 20 two-syllable real words that shared the first phoneme with the target non-words (e.g., pendant). Participants were asked to press "yes" if they heard a real word or a word that they had learned throughout the experiment (the target non-word), and "no" – if they heard a non-word (non-target non-word). To control effects of presentation order, split halves design was used within one session so that participants saw the same items both spoken and written but half of the items were first tested spoken and the other half were first tested written, with the order of the modality of presentation balanced for the two subsets across the sessions.

Picture recognition task: This task was performed after the lexical decision task and included 20 trained pictures and 20 untrained pictures of untrained unrelated creatures (the same pictures that were used in the word-picture verification task Type 6). Participants were asked to press "yes" if they saw a picture of a creature that they had been trying to learn throughout the experiment, and "no" – if it was not.

Results

Picture verification and lexical decision tasks

Participants performed well on the picture verification and auditory and written lexical decision tasks throughout the 4 follow-up sessions (testing stage): 95%, 94%, and 98% correct on average across the 4 sessions, respectively. This is evidence that participants had learned both novel word forms and pictures throughout the experiment.

Naming and Verification

We first address the question of whether learning occurred and whether there were differences in learning as measured by retrieval of proper and common nouns. A 2 (noun class) x 8 (session) mixed design ANOVA with assignment group (which picture set was assigned to which condition) as a between-subject factor was employed and performed in SPSS (IBM SPSS Statistics for Macintosh, Version 22.0) for both picture naming and word-picture verification tasks.

Naming

Accuracy on the naming task is shown in Figure 4. As participants performed close to ceiling on both proper and common nouns from Session 3 onwards in the cued naming condition, statistical analysis was only performed on the uncued naming data.

The ANOVA for uncued naming (see Table 2) showed a significant main effect of session, reflecting the improvement in naming accuracy across sessions (see Figure 4). In addition, significant linear trends were found when analysis was performed on the learning stage sessions (1-4), which indicated a significant learning effect ($F(1,14) = 334.12$, $r = .96$, $p < .001$), with no significant interaction for the linear trend between session and noun class. Thus, participants improved to a similar extent on proper and common nouns throughout the learning stage. A significant decrease in naming rates during the testing stage (5-8) was demonstrated with significant linear trend across the testing sessions (5-8: $F(1,14) = 11.48$, $r = .45$, $p = .004$). A signification interaction for the trend between session and noun class ($F(1,14) = 5.26$, $r = .27$, $p = .038$) indicated a relative higher performance on proper nouns at the last testing session.

Table 2

Mixed-effect ANOVA Results for Uncued Naming Accuracy and Word-picture Verification Task, with Session, Noun Class, and Assignment Group as Predictors (Combined Across Verification Types for the Verification Task)

	df (effect, error)	*F*	*p*	*r*
Uncued Naming. Between-Subject Effects				
Assignment Group	1, 14	1.72	.211	.11
Uncued Naming. Within-Subject Effects				
Session	**7, 8**	**63.48**	**< .001***	**.98**
Noun Class	**1, 14**	**7.32**	**.017***	**.34**
Session*Noun Class	7, 8	1.27	.370	.53
Verification accuracy. Between-Subject Effects				
Assignment Group	1, 14	1.34	.266	.09
Verification Accuracy. Within-Subject Effects				
Session	**7, 8**	**15.91**	**< .001***	**.93**
Noun Class	**1, 14**	**6.23**	**.026***	**.31**
Session*Noun Class	7, 8	1.17	.411	.51
Verification RTs. Between-Subject Effects				
Assignment Group	1, 14	0.32	.580	.02
Verification RTs. Within-Subject Effects				
Session	**7, 8**	**18.37**	**< .001***	**.94**
Noun Class	**1, 14**	**11.09**	**.005***	**.44**
Session*Noun Class	7, 8	0.28	.944	.20

Note. Two-way and three-way interactions with assignment group as one of the predictors were not significant ($p > .05$). * significant at $p < .05$.

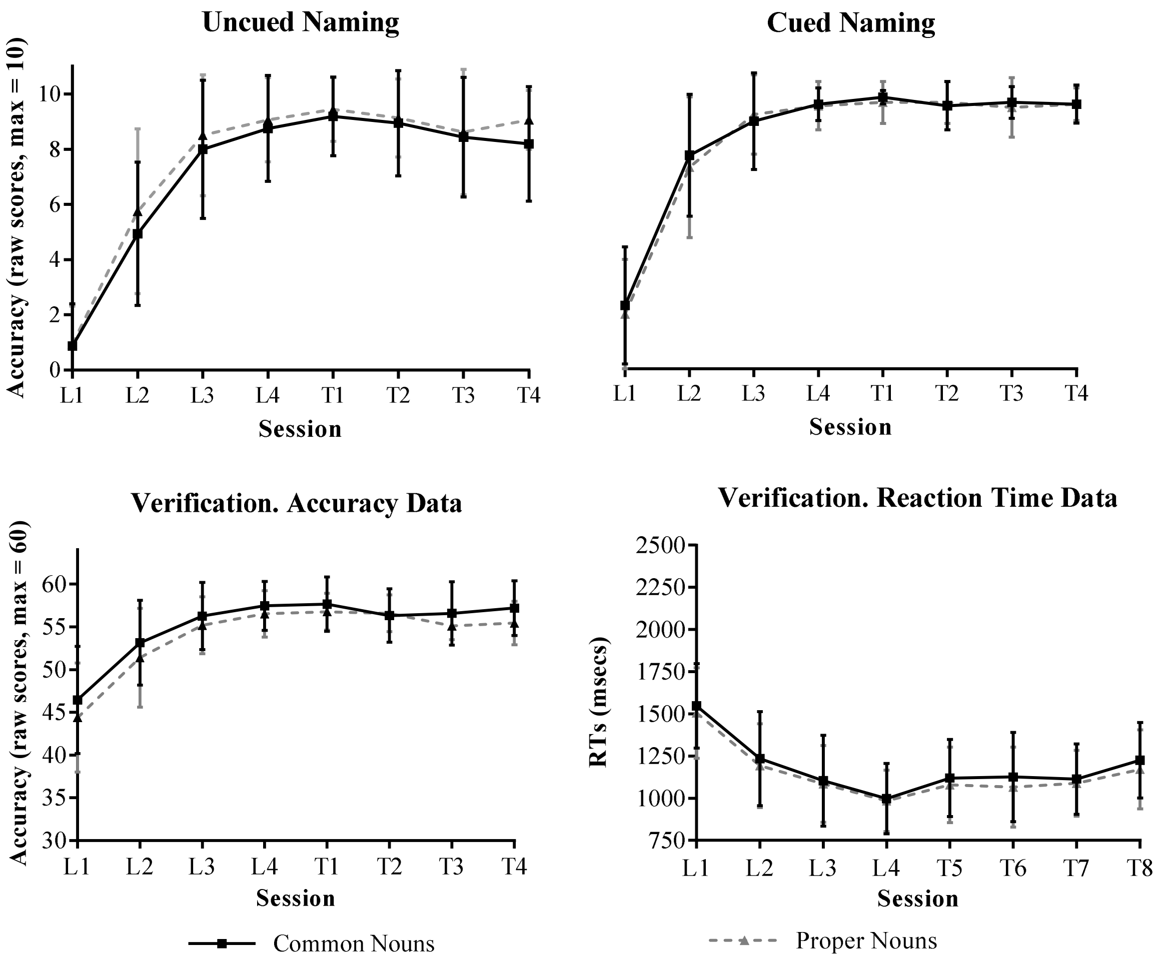


Figure 4. Uncued and cued naming accuracy, word-picture verification accuracy and reaction time data (RTs) combined across all verification types.

There was also a relatively small but significant main effect of noun class on accuracy of naming: Proper noun items were significantly more accurately named than common nouns. There was no significant interaction between session and noun class indicating that proper noun items tended to be more accurately named across all 8 sessions.

Verification task analysis (combined across verification types)

The design of the study resulted in unequal numbers of yes/no trials in the proper and common noun conditions. Namely, the proper noun condition contained 4 sets requiring "no" responses (verification types 3, 4, 5 and 6), whereas the common noun condition contained 3 "no" response sets (verification types 4, 5 and 6). Such disproportionate distribution of the trials may have theoretically led to differences in the level of chance depending on response bias, where, for example, participants who had a strategy giving "yes" responses to all questions would be more successful in the common noun condition, and participants who used a "no" response strategy would have higher scores for proper nouns. We used signal-detection research methods (Macmillan & Creelman, 1991) to determine if any patterns found in the data were due to the effects of the variables of interest or simply to chance level performance. Namely, hit rates and false alarm rates were calculated and transformed to *z*-scores, which were then used to calculate the *d*-prime statistic. Zero value of the *d*-prime would signal that our participants' performance was at the chance level (the effective ceiling of *d'* score being 4.65). All 16 participants of the study had $d' > 0$ (*Mean* = 2.81*; Standard Deviation* = 0.51).

Figure 4 shows accuracy and reaction times for verification for proper and common nouns combined across verification types (6 for each noun class). Reaction times (RTs) ranged from 486.1 to 3438 msecs and no data trimming was applied.

Both accuracy and reaction time data analyses showed the same pattern: There was a main effect of session (Table 2) indicating improved performance on the items across sessions. A significant linear trend was found across the learning stage confirming that there was steady learning through the learning stage (accuracy: sessions 1-4: $F(1,14) = 83.76$, $r = .86$, $p < .001$; RTs: sessions 1-4: $F(1,14) = 10.86$, $p < .001$, $r = .88$). In the testing stage there was no significant trend for accuracy but reaction times did show a relatively small but significant increase flagging the weakening of the learning effect (accuracy: sessions 5-8: $F(1,14) = 2.92$, $r = .17$, $p = .109$; RTs: sessions 5-8: $F(1,14) = 5.12$, $p = .040$, $r = .27$). Both accuracy and reaction times showed a main effect of noun class. However, while common nouns elicited slightly higher accuracy than proper nouns, proper nouns were responded to faster than common nouns. There was no significant interaction between session and noun class for either reaction times or accuracy.

Summary

Participants showed clear learning for both proper and common nouns and the learning outcomes were maintained over a period of 2 months.

The question arises, however, as to why proper nouns were easier to retrieve in the naming task and, although faster, were less accurate in the verification task than common nouns. We will return to this below, but first will examine performance on the verification task in more detail.

Verification task: further analysis

To see whether participants performed differently on the 6 verification types, we ran a 12 (verification type) x 8 (session) mixed design ANOVA with assignment group as a between-subject factor. See Table 3 for raw data. This analysis included all 6 verification types (each type encompassed a proper and a common noun version, hence, 12 in total). Due to the similar nature of Types 2 and 3 for common nouns, average scores across these two common noun types were used in all the subsequent analyses.

Table 3

Mean and Standard Deviation Values for Accuracy and Reaction Times (RTs) of all the Verification Types across Sessions

Type	Distractor	Common Nouns				Proper Nouns			
		Accuracy		RTs		Accuracy		RTs	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Trained target pictures	8.72	0.16	1236.57	46.11	9.55	0.10	1054.68	42.47
2	Untrained target pictures	9.22	0.14	1182.59	59.52	9.55	0.09	1082.40	50.19
3	Untrained (non-)target pictures (cross class)	9.22	0.14	1182.59	59.52	6.41	0.29	1421.29	67.74
4	Trained non-target pictures	9.04	0.21	1223.97	57.36	9.09	0.21	1123.95	51.64
5	Untrained non-target pictures (cross class)	9.20	0.16	1204.10	58.52	9.54	0.12	1141.82	49.73
6	Unseen species	9.69	0.06	1068.93	52.04	9.72	0.70	1058.20	46.25

The results showed a main effect of session and verification type for both accuracy and reaction times (see Table 4). The interaction between verification type and session observed on accuracy showed that the effect of verification type varied over the sessions (and thus, the learning curve).

Table 4

Mixed-effect ANOVA Results on Verification Subtype Accuracy and Reaction Times (RTs) with Session, Noun Class, and Assignment Group as Predictors

	df (effect, error)	*F*	*p*	*r*
Accuracy (individual subtypes). Between-Subject Effects				
Assignment Group	1, 14	1.34	.266	.09
Accuracy (individual subtypes). Within-Subject Effects				
Session	**7, 35**	**46.11**	**< .001***	**.77**
Verification Type	**11, 50**	**51.15**	**< .001***	**.79**
Session*Verification Type	**8, 114**	**2.75**	**< .001***	**.16**
Accuracy. Within-Subject Contrasts (Verification Type) comparing common versus proper				
Type 1: trained targets	**1, 14**	**37.28**	**< .001***	**.73**
Type 2: untrained targets	**1, 14**	**11.28**	**.001***	**.45**
Type 3: untrained (non-)targets across noun class	**1, 14**	**98.94**	**< .001***	**.88**
Type 4: trained non-targets within noun class	1, 14	0.10	.760	.01
Type 5: untrained non-targets across noun class	**1, 14**	**8.23**	**.012***	**.37**
Type 6: unseen non-targets	1, 14	0.41	.533	.03
RTs (individual subtypes). Between-Subject Effects				
Assignment Group	1, 14	0.32	.580	.02
RTs (individual subtypes). Within-Subject Effects				
Session	**3, 48**	**21.81**	**< .001***	**.61**
Noun Class	**3, 44**	**18.60**	**< .001***	**.57**
Session*Noun Class	8, 108	1.80	$.087^{+}$	.11
RTs. Within-Subject Contrasts (Verification Type) comparing common versus proper				
Type 1: trained targets	**1, 14**	**80.34**	**< .001***	**.85**
Type 2: untrained targets	**1, 14**	**19.37**	**.001***	**.58**
Type 3: untrained (non-)targets across noun class	**1, 14**	**49.99**	**< .001***	**.78**
Type 4: trained non-targets within noun class	**1, 14**	**17.57**	**.001***	**.56**
Type 5: untrained non-targets across noun class	**1, 14**	**6.59**	**.022***	**.32**
Type 6: unseen non-targets	1, 14	0.53	.479	.04

Note. Two-way and three-way interactions with assignment group as one of the predictors were not significant ($p > .05$). * significant at $p < .05$; $^{+}$ $p < .1$.

To determine which of the verification types were responsible for the noun class effect in the ANOVA across verification types and for the verification type effect in the analysis on individual verification subtypes, planned contrasts were performed (with the significance level adjusted for multiple comparisons with Bonferroni correction). The contrasts performed revealed that significant noun class differences were present in the verification Type 1 (Trained target pictures), Type 2 (Untrained target pictures within noun class), Type 3 (Untrained (non-)target pictures across noun class), and Type 5 (Untrained non-target pictures across noun class) for both accuracy and reaction time data. For Types 1, 2, and 5 responses to proper noun items were more accurate and faster than to common nouns, whereas for Type 3 the results were in the opposite direction: Proper nouns were slower and less accurate (see Table 3, earlier, and Figure 5) when another individual from the trained species was provided for verification and thus required a “no” response. In addition, reaction time data analysis showed that responses to Type 4 (Trained non-target pictures) proper nouns were significantly faster than those to common nouns. Contrasts performed on proper and common noun items for other verification types did not reach significance.

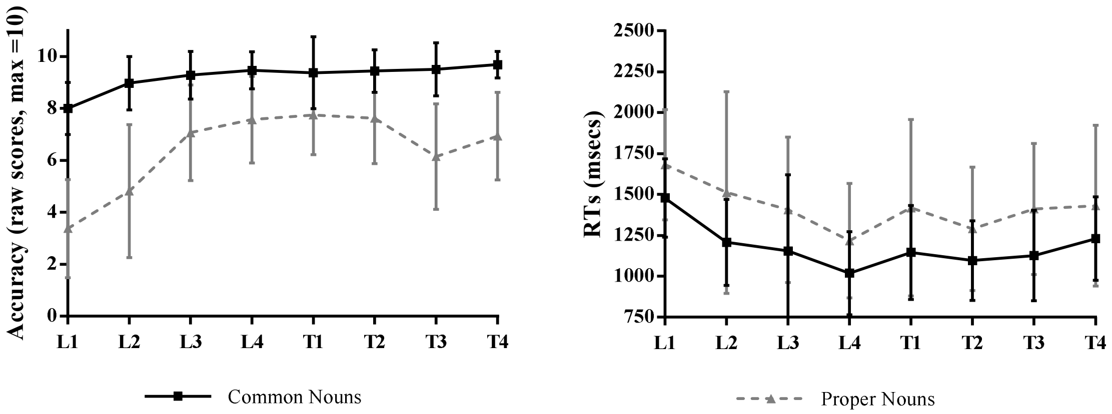


Figure 5. Accuracy and reaction times for the verification Type 3.

Type 3 was the only subtype where common nouns were more accurate than proper nouns, and the difference between the noun classes was far larger than the difference in accuracy on any other subtypes. It is, therefore, clear that this particular verification type may have caused the overall benefit for common nouns in the verification accuracy analysis across verification types (see Table 2). Why is Type 3 different from other verification types? Type 3 tested whether participants had learned the names of novel species as common nouns and names of novel individual creatures as proper nouns. To respond correctly to this verification type for common noun items, participants had to accept a previously unseen individual of a trained species (as it was just another exemplar of the trained species) – which they were able to do well. However, in the case of proper nouns, they had to reject a picture of a new individual (as it was a different individual of the same species as a trained individual and the name of the species was unknown to participants) – and they found this a challenging task.

As Type 3 was crucial for determining whether participants had indeed learned proper and common nouns as proper and common, we conducted further mixed design ANOVA analyses (2 (noun class) x 8 (session) with assignment group as a between-subject factor) on accuracy and reaction time data for this verification type. The analyses showed a main effect of session (accuracy: $F(7, 8) = 98.94$, $p < .001$, $r = .88$; RTs: $F(7, 8) = 17.25$, $p < .001$, $r = .94$) and noun class (accuracy: $F(1, 14) = 25.27$, $p < .001$, $r = 96$; RTs: $F(1, 14) = 49.99$, $p < .001$, $r = .78$), as well as a significant interaction between the two for accuracy but not for reaction times (accuracy: $F(7, 8) = 4.01$, $p = .035$, $r = .78$; RTs: $F(7, 8) = 0.39$, $p = .887$, $r = .25$). These results indicate gradual improvement in performance on both proper and common nouns across sessions, with higher accuracy and faster responses for common nouns in comparison to proper nouns. In addition, the interaction tells us that participants' learning curve for proper nouns was different from that for common nouns. Proper nouns showed much lower accuracy after the first learning session but improved significantly throughout the experiment with a slight drop in scores at the later sessions (around session 7), whereas the learning curve for common nouns was less steep due to less room for improvement. The presence of a significant linear trend for Type 3 items for the effect of session across the learning stage (1-4), as shown with a linear contrast ($F(1, 14) = 81.75$, $p < .001$, $r = .85$), provided yet further statistical support for learning taking place. A significant interaction for the trend between session and noun class ($F(1, 14) = 22.91$, $p < .001$, $r = .62$) confirms that the learning curve was different for proper and common noun items. No linear trend was present for the testing stage (5-8) ($F(1, 14) = 3.82$, $p = .071$, $r = .22$) but an interaction between session and noun class was significant ($F(1, 14) = 9.27$, $p = .009$, $r = .40$) meaning that although learning effects were retained for common nouns, there was a slight drop (particularly, at the third testing session) in accuracy for proper nouns.

Overall, verification task results confirmed the pattern obtained for the naming task: Proper nouns demonstrated higher accuracy rates and correct responses were provided faster than for common noun items. Type 3 in the verification task was the only verification type that evoked the opposite pattern: It was harder to learn the mapping between an individual creature and a word form (proper noun) than between a family of creatures and a word form (common noun). It can be concluded, therefore, that it was verification type 3 items that caused the superiority for common nouns in the combined verification analysis (reported in Table 2)[5].

Discussion

Our study investigated processing of proper and common nouns using a learning task. We taught participants proper and common nouns that were novel in terms of both their meaning and form – new words were associated with new creatures. We explored differences through both the learning stage of the experiment, when items were in the process of establishing semantic and lexical representations, and at the testing stage, when the items were assumed to have a lexical representation. This allowed us to observe any possible noun class processing differences during the whole learning continuum.

The study aimed to contribute to the discussion on the nature of differences underlying proper and common noun processing that have been reported previously (e.g., Kay et al., 2011; Semenza, 2006, 2009, 2011). In particular, the design of the experiment provided the opportunity to hold equal the statistical properties of proper and common nouns. Thus, if proper and common noun items demonstrated distinct patterns in our experiment, these disparities could be due to differences in their logical properties.

First, both picture naming and word-picture verification tasks showed significant learning for both proper and common noun items (sessions 1-4). A significant decline in naming accuracy and increase in reaction times in the verification task was seen during the testing stage (sessions 5-8), while verification accuracy was retained. Second, participants showed higher

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[5] When Type 3 items were eliminated from the analysis of the verification task, main effects of session ($F(7, 8) = 12.49$, $p = .001$, $r = .92$) and noun class ($F(1, 14) = 25.16$, $p < .001$, $r = .64$) were observed. Performance on proper nouns was shown to be better than on common nouns. The lack of significant interaction between session and noun class ($F(7, 8) = 3.10$, $p = .068$, $r = .73$) also indicates that the learning curves for the two noun classes are comparable.

naming accuracy for proper noun items in comparison to common noun items across all 8 sessions. Moreover, it took less time for participants to respond to proper nouns than to common nouns in the verification task. Proper nouns were also, in general, more accurate than common nouns across sessions in the verification task (with the exception of Type 3). Thus, the picture naming task, as well as both accuracy (except for Type 3) and RT data on the word-picture verification task showed the same pattern: If anything, proper nouns seemed to be easier than common nouns – quite the reverse of the pattern that has been generally reported in learning experiments in the literature (e.g., McWeeny et al., 1987; Stanhope & Cohen, 1993; Terry, 1994).

Nonetheless, it is important to establish whether participants actually learned items as proper and common nouns as opposed to simple labels associated with individual pictures? To be able to address this question, a particular verification matching type was included in the experiment (Type 3). Participants could only perform correctly on this condition if they had learned proper nouns as labels for individuals and common nouns as labels for species. However, accuracy was significantly better for common than proper noun items: In this condition they tended to overgeneralise individual creatures' names to the whole species. Thus, it seemed that participants found it harder to learn that a name belonged to an individual creature than to learn that a name referred to a whole species. Moreover, the learning curve for proper nouns was qualitatively different from that for common nouns: Performance on proper nouns was significantly lower in the beginning, improved throughout the learning stage but was still significantly below that of common nouns at the testing stage. Reaction time data for correct responses supported these findings: Common nouns were responded to faster than proper nouns in this condition. Nevertheless, although participants struggled to learn word forms as proper nouns, they significantly improved throughout the experiment, indicating that by the testing sessions there had been learning of this noun class.

There are similarities here to the first language acquisition domain. Research has shown that interpretation of a proper noun strikingly depends on the familiarity of the object this noun refers to (e.g., Hall, 2008). It was observed that if children do not yet know the name for an object/living being, they tend to learn the first word form that they hear in relation to the referent as a common noun. If, however, they already have the common noun in their vocabulary, they interpret the newly heard word as a proper noun. Thus, if a child saw a poodle for the first time and was told that its name was *Barbos*, the child would be inclined to name every other poodle *Barbos* until s/he learned otherwise. Such a pattern may shed light on the results of our experiment, where participants tended to interpret novel word forms for newly learned objects (novel creatures) as common nouns and found it hard to learn the correct mapping, despite being given explicit instructions which made it clear whether a label was a proper or common noun.

The fact that our study did not show any advantage for common nouns in word retrieval suggests that a large contributory factor to previous findings that proper nouns are more vulnerable is that they tend to be of lower frequency, familiarity, and later age of acquisition in comparison to common nouns.

We would, however, be unwilling to conclude, based on our results, that proper nouns are actually retrieved more easily than common nouns. It is important to consider the visual characteristics of the stimuli (see also Bruce & Young, 1986 for differences between face and object recognition). Visual information could be treated as a part of the overall semantic representation for a word (e.g., Quinn, Eimas, & Rosenkrantz, 1993), and proper nouns in this experiment were visually more homogenous (individual creatures differed in facial expression and posture from each other) than common nouns that had more heterogeneous visual representations (members of a species varied on colour, shape, as well facial expression and posture). Consequently, common nouns develop broader visual-semantic representations (with 'fuzzy' boundaries) in comparison to proper nouns. Proper nouns, on the other hand, may have a more tightly defined visual-semantic specification. Thus, when provided with a proper noun exemplar in the naming task, the mapping from semantics to the lexical form of the word may have occurred faster and with higher accuracy due to the speed of visual recognition. This would also benefit performance in the verification task, and indeed proper nouns were generally faster and more accurate.

There was one condition of the verification task, however, where proper nouns were less accurate (although they still responded fast). Verification Type 3 presented another exemplar from the same species as the learned individual, which had to be rejected. This Type required a far finer visual discrimination than any other in the verification task, and, early in learning, participants were inclined to incorrectly accept these as representations of the individual. Earlier we suggested that this could represent a failure to learn that the label was the name of an individual (proper noun). However, this response pattern may also have been a failure to determine that the visual image presented was not an example of that individual. In many ways these both reflect proper nouns being harder to learn.

Although the difficulty in assigning items to a noun class demonstrated in the word-picture verification task could be derived solely from the experiment design (e.g., the semantic features of species' representatives possibly not being sufficiently distinct, experimental learning context not being natural), we would like to suggest that it does in fact reflect processing in the real world. Namely, in the context of unfamiliar objects, if we were shown two similar looking objects, we would most likely struggle to decide whether they were depictions of the same object or different representatives of one kind. For example, if we saw a sequence of pictures depicting two poodles and were asked whether these were the same dog or two different dogs, it is quite likely that some hesitation would occur (which of course would not be the case if we compared pictures of our own beloved poodle and of a complete “dog-stranger”).

To summarise, our study showed that, when proper nouns (and specifically personal names) and common nouns have the same statistical properties, proper nouns are not more vulnerable in retrieval than common nouns. Hence, differences in statistical properties are likely to play a dominant role in the inferior retrieval of familiar proper nouns that has been observed in the literature. In learning, however, proper nouns seem to be more demanding than common nouns, at least in tasks requiring fine visual discrimination.

References

Biedermann, B., & Nickels, L. (2008). The representation of homophones: More evidence from remediation of anomia. *Cortex, 44*, 276-293.

Brédart, S. (1993). Retrieval failures in face naming. *Memory*, *1,* 351-366.

Brédart, S., Valentine, T., Calder, A., & Gassi, L. (1995). An interactive activation model of face naming. *Quarterly Journal of Experimental Psychology*, *48A*, 466–486.

Bruce, V., & Young, A. W. (1986). Understanding face recognition. *British Journal of Psychology*, *77*, 305-327.

Burke, D. M., MacKay, D. G., Worthley, J. S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language, 30,* 542-579.

Burton, A. M., & Bruce, V. (1992). I recognise your face but I can't remember your name: A simple explanation? *British Journal of Psychology, 83*, 45–60.

Caramazza, A., Costa, A., Miozzo, M., & Bi, Y. (2001). The specific-word frequency effect: Implications for the representation of homophones. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27,* 1430–1450.

Caramazza, A., & Miozzo, M. (1998). More is not always better. A response to Roelofs, Meyer, & Levelt. *Cognition*, *69*, 231-241.

Cohen, G. (1990) Why is it difficult to put names to faces? *British Journal of Psychology*, *81*, 297-297.

Cohen, G., & Burke, D. M. (1993). Memory for proper names: A review. *Memory, 1,* 249-263.

Cohen, G., & Faulkner, D. (1986). Memory for proper names: Age differences in retrieval. *British Journal of Developmental Psychology, 4,* 187-197.

Evrard, M. (2002). Ageing and lexical access to common and proper names in picture naming.

Brain and Language, 81, 174–179.

Fery, P., Vincent, E., & Brédart, S. (1995). Personal name anomia: A single case study. *Cortex, 31,* 191-198.

Gathercole, S. E., & Baddeley, A. D. (1989). Evaluation of the role of phonological STM in the development of vocabulary in children: A longitudinal study. *Journal of Memory and Language*, *28*, 200-213.

Gupta, P. (2003). Examining the relationship between word learning, nonword repetition, and immediate serial recall in adults. *The Quarterly Journal of Experimental Psychology, 56A*, 1213-1236.

Hall, D. G. (2008). Acquiring proper nouns for familiar and unfamiliar animate objects: Two-year-olds' word-learning biases. *Child Development*, *62*, 1142-1154.

Hanley, J. R. (2011). Why are names of people associated with so many phonological retrieval failures? *Psychonomic Bulletin & Review*. Advance online publication. doi:10.3758/s13423- 011-0082-0

Hanley, J. R., & Cowell, E. S. (1988). The effects of different types of retrieval cues on the recall of names of famous faces. *Memory and Cognition*, *16*, 545–555.

Hay, D. C., Young, A. W., & Ellis, A. W. (1991). Routes through the face recognition system. *Quarterly Journal of Experimental Psychology, 43A,* 761–791.

Humphreys, G. W., Riddoch, M. J., & Quinlan, P. T. (1988). Cascade processes in picture identification. *Cognitive Neuropsychology, 5*, 67-104.

iStock (n. d.). Retrieved July, 2012 from http://www.istockphoto.com

Jackendoff, R. (1983). *Semantics and cognition.* Cambridge, MA: MIT Press.

Johnston, R. A., & Bruce, V. (1990). Lost properties? Retrieval differences between name codes and semantic codes for familiar people. *Psychological Research*, *52*, 62-67.

Kay J., Hanley, J. R., & Miles, R. (2001). Exploring the relationship between proper name anomia and spoken word retrieval: A single case study. *Cortex, 37*, 501-517.

Kay, J., Lesser, R., & Coltheart, M. (1992). *Psycholinguistic Assessments of Language Processing in Aphasia (PALPA)*. Hove: Lawrence Erlbaum Associates.

Kripke, S. (1980). *Naming and necessity*. Oxford: Blackwell.

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioural Brain Sciences*, *22*, 1-38.

Levelt, W. J. M., Schriefers, R., Vorberg, D., Meyer, A. S., Pechmann, T., & Havinga, J. (1991). The time course of lexical access in speech production: A study of picture naming. *Psychological Review*, *98*, 122-142.

Macmillan, N. A., & Creelman, C. D. (1991). *Signal detection theory: A user's guide.* New York, NY: Cambridge University Press.

Marful, A., Paolieri, D., & Bajo, T. (2014). Is naming faces different from naming objects? Semantic interference in a face- and object-naming task. *Memory & Cognition*, *42*, 525-537.

McWeeny, K. H., Young, A. W., Hay, D. C., & Ellis, A. W. (1987). Putting names to faces. *British Journal of Psychology*, *78*, 143-149.

Milders, M. (1998). Learning people's names following severe closed-head injury. *Journal of Clinical and Experimental Neuropsychology*, *20*, 237-244.

Papagno, C., & Vallar, G. (1995). Verbal short-term memory and vocabulary learning in polyglots. *Quarterly Journal of Experimental Psychology, 48A*, 98-107.

Reason, J. T., & Lucas, D. (1984). Using cognitive diaries to investigate naturally occurring memory blocks. In J.E. Harris & P.E. Morris (Eds.), *Everyday memory actions and absent-mindedness* (pp. 53-70). London: Academic Press.

Quinn, P., P. Eimas, & S. Rosenkrantz (1993). Evidence for representations of perceptually similar natural categories by 3-month and 4-month old infants. *Perception*, 22, 463–375.

Semenza, C. (1997). Proper-name-specific aphasias. In Goodglass, H., & Wingfield, A. (Eds), *Anomia*: *Neuroanatomical and Cognitive Correlates.* San Diego: Academic Press.

Semenza, C. (2006). Retrieval pathways for common and proper names. *Cortex, 42*, 884–891.

Semenza, C. (2009). The neuropsychology of proper names. *Mind and Language, 24*, 347–369.

Semenza, C. (2011). Naming with proper names: The left temporal pole theory. *Behavioural Neurology, 24*, 277–284.

Stanhope, N., & Cohen, G. (1993). Retrieval of proper names: Testing the models. *British Journal of Psychology, 84*, 51-65.

Terry, W.S. (1994). On the relative difficulty in recalling names and occupations. *The American Journal of Psychology*, *107*, 85-94.

Tuomiranta, L., Groenholm-Nyman, P., Kohen, F., Rautakoski, P., Laine, M., & Martin, N. (2011). Learning and maintaining new vocabulary in persons with aphasia: Two controlled case studies. *Aphasiology, 29*, 1030-1052.

Valentine, T., Brédart, S., Lawson, R., & Ward, G. (1991). What’s in a name? Access to information from people's names. *European Journal of Cognitive Psychology*, *3*, 147-176.

Wechsler, D. (2008a). *Wechsler adult intelligence scale - fourth edition.* San Antonio, TX: Pearson Assessment.

Wechsler, D. (2008b). *Wechsler adult intelligence scale - fourth edition: Technical and interpretive manual*. San Antonio, TX: Pearson Assessment.

Young, A. W., Ellis, A. W., & Flude, B. M. (1988). Accessing stored information about familiar people. *Psychological Research*, *50*, 111-115.

Young, A. W., McWeeny, K. H., Ellis, A. W., & Hay, D. C. (1986). Naming and categorizing faces and written names. *The Quarterly Journal of Experimental Psychology Section A: Human Experimental Psychology*, *38*, 297-318.

Appendix A

Verbal Stimuli (20 experimental and 2 practice items)

blaggit	krevid
bodrech	lartog
chalten	maston
cheskel	mirplet
crennet	purmill
dockim	seldent
dunsel	shimelt
gurnatch	storlick
fabbor	timpel
jiddet	thorbit
kertix	zeedon

Chapter Three

Effects of Ageing on the Learning of Novel Proper and Common Nouns

Abstract

This paper investigated retrieval and learning for novel proper (names of individuals) and common (names of species) nouns in a group of older adult speakers relative to the performance of younger individuals. Older participants were predicted to perform more poorly than younger adults in general. Moreover, under the account where proper and common nouns have distinct processing mechanisms and the proper noun mechanism is more vulnerable to the effects of ageing, older participants were predicted to demonstrate an age-related disproportionate decline in retrieval and, possibly, learning of proper nouns.

Contrary to the predictions of this account, the results showed that proper and common nouns were subject to equal retrieval deficits in older adults. However, older adults had difficulties in a word-picture verification task tapping the learning of associations between names of individuals and depictions of individual creatures. It was suggested that this could reflect older participants' difficulties in learning the 'scope' visual characteristics of individual creatures.

Introduction

Recalling personal names (e.g., Steven, Helen), both highly familiar and newly learned, is often regarded as one of the foremost problems in ageing (see, for example, Cohen & Faulkner, 1984). Indeed, questionnaire studies have shown that older adults express major concern regarding their frequent inability to retrieve personal names (see, for example, Maylor, 1997). Diary studies with older adults have also provided support for these observations (e.g., Burke, MacKay, Worthley, & Wade, 1991). This research has reported more tip-of-the-tongue-states (TOTs; retrieval blocks for words that are familiar but temporarily inaccessible for recall) for personal names than for common nouns.

This study aims to examine this phenomenon further by examining the learning of proper and common nouns in older adults and comparing these patterns to the performance of young adults reported in our earlier study (Romanova, Nickels, & Renvall, 2015). We will first review the empirical evidence regarding proper and common noun processing and the differences that have been observed with ageing, before briefly considering theoretical accounts of these differences.

Experimental studies examining differences between proper and common noun processing in general, and effects of ageing on proper noun retrieval in particular, are of two types. The first have explored retrieval of familiar (famous) people's names compared to everyday and/or uncommon objects through picture-naming and naming to definition (e.g., Burke et al., 1991; Evrard, 2002; Rendell, Castel, & Craik, 2005) and found poorer retrieval for personal names for both young and older adults. Experiments of a second type have involved learning of unfamiliar personal names: Pictures of fictitious people have been paired with personal names and occupations or possessions. These experiments generally revealed that the superiority of common noun retrieval over that for personal names persists even when items from the two noun classes have identical phonological forms (e.g., *Mr Baker* versus *a baker*) in both younger (e.g., Cohen, 1990; McWeeny, Young, Hay, & Ellis, 1987; Stanhope & Cohen, 1993; Terry, 1994) and older participants (e.g., James, 2004; Rendell et al., 2005).

Although the patterns of retrieval of familiar and unfamiliar personal names in comparison to common nouns have been found to be similar for younger and older people, there has been discussion in the literature about whether older people have a larger age-related difficulty for personal names than for common nouns. We will now review the evidence for this alleged disproportionate deficit for personal names demonstrated by older participants in the two types of study mentioned above.

Retrieval of familiar personal names versus common nouns

The majority of studies in this category have used picture-naming (e.g., Evrard, 2002; James, 2006; Maylor, 1995, 1997; Rendell et al., 2005) or naming to definition (e.g., Burke et al., 1991). Naming of famous people has usually been compared with naming of either everyday or uncommon and low frequency objects, with the exception of James (2006) who compared retrieval of famous people's names with retrieval of biographical information about those people. Personal names have generally been found to be retrieved worse than common nouns by all age groups, however, some, but not all, studies reported clear age-related deficits for personal names in comparison to common nouns (e.g., Burke et al., 1991; Evrard, 2002; James, 2006; Rendell et al., 2005). Other studies found that ageing resulted in equal impairment for both noun classes (e.g., Maylor, 1995, 1997). Some, however, noted that there were potentially confounding factors which may have led to the finding of a disproportionate personal name deficit. In particular, in Rendell et al. (2005), the disproportionate deficit for older participants could have been at least partly due to famous people being rated as particularly low familiarity. In Burke et al. (1991), the disproportionate impairment was only seen on absolute TOT scores but not when TOTs were looked at as proportions of all unsuccessful trails. This emphasises the importance of selecting a sensitive and appropriate measure of analysis in general and particularly when studying personal name production.

Maylor (1997) considered the question of whether the later stage of proper noun production (word form retrieval) is more affected by ageing than earlier stages of naming (face recognition, retrieval of semantic information) in two studies. In the first study (Maylor, 1990), younger and older participants were given pictures of famous and non-famous people and asked to perform familiarity judgements, provide semantic information, and name the people if they could. Responses to famous people were then studied using regression analysis to compare age-related effects on the tasks. In the second study, to avoid ceiling effects on familiarity judgements and semantic information tasks in the younger group, recordings of famous and non-famous people's voices were presented (instead of pictures of faces) for participants to judge whether they were familiar (Maylor, 1997). The converging evidence from the two studies showed that elderly participants experienced comparable problems with both retrieving the word form and recognition and semantic information retrieval. Thus, the experiments did not support the presence of disproportionate deficit for proper nouns restricted to the retrieval stage in older people.

Retrieval of unfamiliar personal names versus biographical information

The possibility of a disproportionate deficit for personal names in ageing has also been studied in associative learning experiments. These have tested retrieval of newly learned unfamiliar personal names and biographical information paired with pictures of previously unknown people (e.g., Barresi, Obler, & Goodglass, 1995; James, 2004; Rendell et al., 2005). Across experiments, personal names and occupations/possessions comprised either unambiguous words (e.g., *Mr Smith* versus *a doctor*), ambiguous words (e.g., *Mr Baker* versus *a baker*), or non-words (*Mr Ryman* versus *a ryman*). Although, as mentioned above, the usual pattern was that personal names were recalled more poorly than biographical information, when the experiments included non-words young participants' performance was similar for non-word items presented as names or as biographical information (Cohen, 1990; Milders, 1998). For example, in Cohen (1990) participants remembered that the person's was '*Ryman*' as well as they recalled that his/her possession was a '*ryman*'. The authors explained the lack of the usual pattern of personal name disadvantage as being because both 'Ryman' and 'ryman' were meaningless for participants. However, it could be also argued that it was because non-word personal names and non-word common nouns were inherently of equal (zero) frequency, contrary to the experiments with real words.

As with the studies on retrieval of familiar personal names, no consistent results have been obtained in learning studies regarding increased relative difficulty for proper nouns with ageing. Thus, some studies, comparing learning of personal names versus common nouns that represent biographical information about the name bearers (e.g., their occupations, possessions), found that recall of personal names was harder for both younger and older participants, and age-related deficits were of equal magnitude for both noun classes (e.g., Bruyer et al., 1992; Cohen & Faulkner, 1986; Rendell et al., 2005). Other studies with a similar design did find that personal names were of particular difficulty for older people in relation to common nouns when compared to younger participants (e.g., Barresi et al., 1995; James, 2004).

Theoretical framework: Personal names versus common nouns

General explanations of the differences in retrieval of personal names versus common nouns can be grouped into two major accounts. On the one hand, personal names in particular, proper nouns in general (i.e., including names of places, brands, etc.), and common nouns are suggested to be part of one "continuum of word retrieval difficulty" (Kay, Hanley, & Miles, 2001). This means that words within and across these two noun classes vary in statistical (distributional) features such as frequency, familiarity, and age of acquisition. This hypothesis suggests that retrieval of proper nouns is often inferior to that of common nouns because the majority of proper nouns are of lower frequency and familiarity, and acquired later than common nouns. It is also possible that these properties affect retrieval in older people to a larger extent than in younger speakers (in line with *the transmission deficit hypothesis* described below).

The other account is based on the possible different processing nature of these two noun classes. This account rests on the view that proper nouns are “pure referring expressions” (e.g., Kripke, 1980) in that they refer us to an individual entity but do not convey any meaning. Personal names in particular and proper nouns in general designate specific individual beings or objects with their unique combinations of semantic features. On the contrary, common nouns refer to a category of beings or objects. Consequently, proper nouns are often called *tokens* (having only one referent), whereas common nouns are *types* (having multiple referents; Jackendoff, 1983). What follows is that common nouns, as opposed to proper nouns, form stronger and/or more elaborated links with semantic information associated with them (e.g., Cohen & Burke, 1993; Semenza, 1997, 2009). Note that proponents of this view in general do not deny that there is also a “continuum of difficulty”, but rather suggest that differences in frequency, for example, are not sufficient to account for the phenomena.

One of the most widely cited models that is designed to account for the distinction between personal names (proper nouns) and common nouns is Node Structure Theory (Cohen & Burke, 1993; MacKay, 1987) and, within this, the transmission deficit hypothesis (MacKay & Burke, 1990). This interactive activation model is able to predict the more frequent occurrence of TOTs for personal names in comparison to common nouns for all speakers, and also their greater prevalence for older people in comparison to younger speakers.

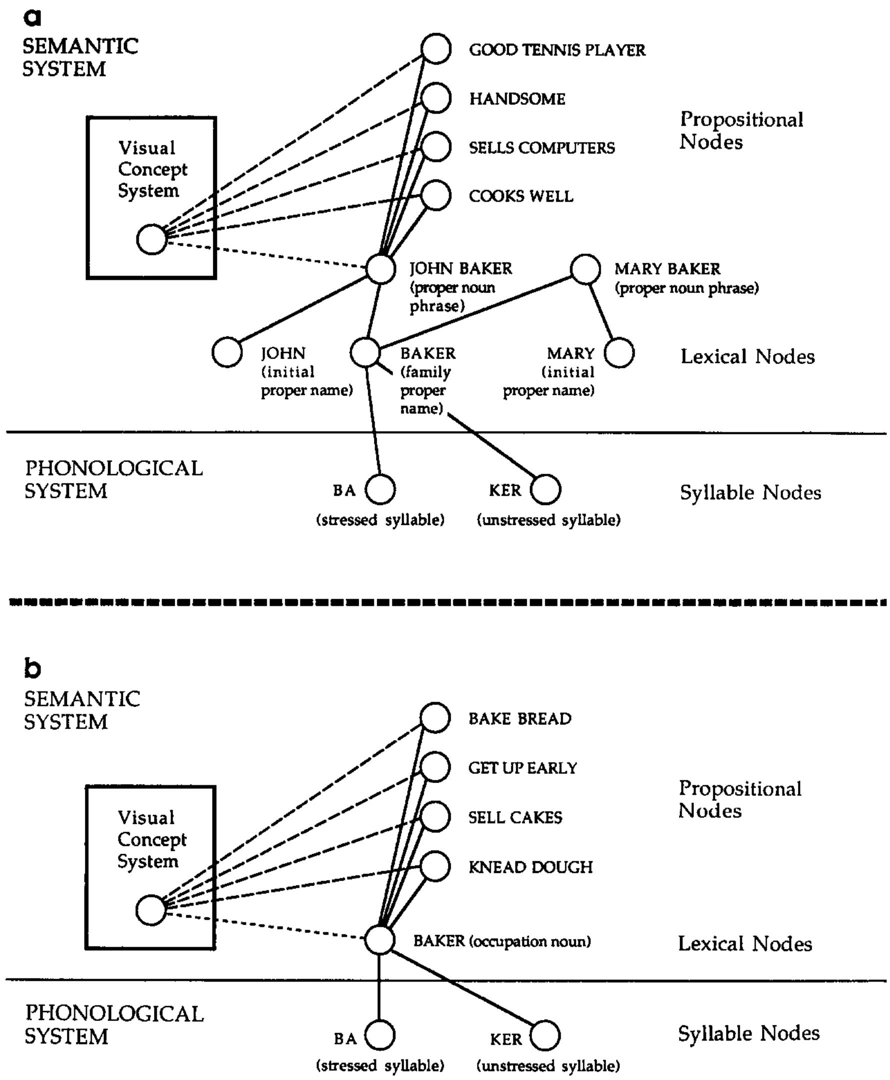


Figure 1. A partial representation of the personal names *John* and *Mary Baker* and the common noun *a baker* in Node Structure Theory (from Burke et al., 1991, pp. 571).

According to Node Structure Theory, successful retrieval of a word depends on adequate priming that spreads through the connections among the processing network (semantic system, including propositional and lexical nodes, phonological and muscle movement systems). If connections between the nodes are weak, priming becomes insufficient and retrieval of the word is more difficult. The weakening of connections can occur if a word is used infrequently or has not been recently used. Moreover, transmission of priming becomes less efficient with ageing (Burke et al., 1991).

Figure 1 (taken from Burke et al., 1991, pp. 571) demonstrates the steps for retrieval of the personal names *John* and *Mary Baker* (Figure 1a) in comparison to the common noun *a baker* (Figure 1b; the muscle movement system is disregarded here). First, whether the production target is a personal name or a common noun, propositional nodes for the concept are activated: for example, “good tennis player” for *John Baker* and “bake bread” for *a baker*. The next step in the speech production process is crucial in terms of differences between personal names and common nouns. Common nouns (e.g., *a baker*) receive summation of priming from all their propositional nodes to their lexical node (e.g., occupation noun *baker*). In the case of personal names (e.g., *John Baker*), however, propositional nodes representing all the semantic information known about the person in question converge onto the proper name phrase node (*John Baker*) that represents the person’s identity. The proper name phrase node, in its turn, spreads priming to separate lexical nodes for the name constituents (*John* and *Baker*) through single divergent connections[6]. Due to this one extra step in production of personal names, the lexical node (*Baker*) and its connected phonological nodes do not receive convergent priming, which renders them particularly vulnerable to retrieval blocks. Indeed, as priming is needed for a node to be activated, the lack of convergent connections from the propositional nodes to the lexical nodes of a personal name could hinder the transmission of sufficient priming to the name’s phonological nodes. As a result, semantic information about the person in question can be accessed but the phonological

[6] It is important that, in the model, personal names and common nouns that have identical phonological forms (*Baker* versus *a baker*) have separate lexical nodes, and these lexical nodes represent types, not tokens. Thus, the lexical node *Baker* is connected to proper name phrases of all the people with this family name, while *a baker* has links to all the people with this occupation. It is for this reason that semantic information about concrete individuals stored in the propositional nodes cannot be directly connected with the lexical nodes of a personal name.

form may be unavailable – a TOT occurs. Additionally, connections between lexical and phonological nodes become stronger the more frequently a word is used, and weaken if a word has not been used recently. Thus the fact that personal names are often of lower frequency than everyday common nouns also increases the likelihood for transmission deficits to occur. This model therefore incorporates elements of both the theoretical perspectives (the continuum of difficulty and the representational differences). For elderly people, the inherent vulnerability of personal names combined with the independent predisposition to transmission deficits in ageing, may result in personal names being a particular challenge for retrieval (and learning – see below).

Node Structure Theory can also explain why learning unfamiliar personal names (proper nouns) is harder than learning occupations of unfamiliar people (common nouns; e.g., *Mr Baker* versus *a baker* in the study by McWeeny et al., 1987). Burke et al. (1991) argue that the occupation name *baker* has a number of preexisting connections from the lexical form to the propositional nodes, while the family name *Baker* is unlikely to have any. As a result, there is less transmission of priming and, consequently, less activation flows through the personal name's processing network. As with retrieval of familiar personal names, the authors suggest that in older people, age-linked transmission deficits would add to the existing insufficient priming for unfamiliar personal names and cause a disproportionate learning deficit for personal names.

Overall, the general pattern found in studies on retrieval of familiar and unfamiliar personal names in comparison to common nouns is that personal names are harder for both younger and older speakers. However, there is no consensus regarding whether personal names are disproportionately harder for elderly people. Consequently, the present research explores this issue further in a learning study. It is well known that matching of proper and common nouns on statistical variables such as frequency is problematic (Valentine, Brédart, Lawson, & Ward, 1991), and becomes even more tricky for studies looking at learning of unfamiliar personal names. Indeed, contrary to retrieval studies that use different stimuli to induce production of personal names and common nouns (except for James, 2006), learning studies have generally employed pictures of unfamiliar people to evoke both types of items. Although James (2006) points out that such a design may avoid potential differences in familiarity of the evoking stimuli across item sets, in our opinion, this exacerbates possible frequency differences between the items from the two noun types (unfamiliar people are even lower in frequency than famous people). Thus, the fact that older participants in James (2006) had more TOTs for personal names than for biographical information in comparison to the younger groups seems unsurprising: The very low occurrence of TOTs for biographical information in both groups may have been caused by relatively high frequency of familiar occupation nouns.

Consequently, to circumvent the matching problem we used learning of associations between novel meanings and novel words (Romanova et al., 2015). We argue that such an approach allows us to address the differences between proper and common nouns more directly. Hence, any differences in retrieval of newly learned unfamiliar proper and common noun items in our experiment could be attributed to the different nature of the noun classes they belong to - their logical properties.

Although there have been at least two previous studies (Cohen, 1990; Milders, 1998) that incorporated novel words into their design, neither of these used older adults. Moreover, in these studies, the authors attributed the similar performance on personal names and common nouns to the relative lack of meaning. However, these were one-session experiments and thus, did not allow for consolidation of the meaning associated with newly learned proper and common nouns. Therefore, in Romanova et al. (2015), we extended the learning process to several sessions to ensure that participants associated the labels they learned with either a particular proper or common noun referent. Moreover, in Cohen (1990) and Milders (1998), the nature of associations with novel meanings differed across personal names (faces of unfamiliar people) and common nouns (unspecified possessions of these unfamiliar people). In our opinion, the conditions would have been more comparable if common nouns were represented by pictures of unfamiliar objects, instead. Therefore, Romanova et al. (2015) also attempted to balance the proper and common noun conditions in terms of the nature of the stimuli: Pictures of novel individual creatures were presented for proper nouns, and pictures of novel species of creature were presented as common nouns.

In Romanova et al. (2015), we also did not find any advantage for common nouns in word retrieval for young participants: Newly learned proper nouns were not harder to name than newly learned common nouns. Proper noun items also received more accurate and faster responses in the word-picture verification task. However, in a verification task which enabled us to track more specifically the extent to which proper nouns were learned, young participants were shown to struggle more with learning that a name belonged to an individual creature (proper noun) than to a whole species (common noun). It was concluded that although in retrieval, statistical properties of proper and common nouns may play a dominant role (and thus, when matched on frequency, etc. items from the two noun classes show equal chances of successful retrieval), in learning proper nouns seem to be more demanding than common nouns, possibly due to their special representational/logical properties.

Here, we compare the data on young adults to the performance of older speakers. We predicted that older individuals would perform more poorly on both proper and common nouns than younger adults. Furthermore, if differences usually found in retrieval of proper and common nouns are due to distinct statistical properties of the noun classes (as suggested in Romanova et al., 2015), older participants would be expected to have equal deficits for proper and common nouns (as by virtue of being novel items their statistical properties are identical). If we assume, however, that logical properties may drive differences in learning of associations between novel words and meanings for the two types (proper and common), an age-related disproportionate deficit for proper nouns may be predicted.

Method

The design of the experiment and materials used were identical to those employed in Romanova et al. (2015). The only difference was in the number of testing sessions (see below). Hence, while we include key elements of the design here, for further details the reader is referred to Romanova et al. (2015).

Participants

Twelve older adults (5 males) took part in the study. We compared their data with that obtained for 16 (7 males) younger adults in Romanova et al. (2015). Participants from both groups were English native speakers. The age range of the older group was 55-74 years (*Mean* = 61.83, *Standard Deviation* = 5.44), and the younger group – 22-42 years (*Mean* = 28.69, *Standard Deviation* = 5.35). The level of education of the older group was overall lower than for the younger group: only 6 of 12 older participants had higher education (Bachelor’s degree or equivalent or higher), whereas all 16 younger participants had a Bachelor’s degree or higher. All the participants met the same inclusion/exclusion criteria: no history of brain damage, drug or alcohol abuse, and normal or corrected to normal vision and hearing. Their immediate serial recall abilities (verbal short-term memory) were tested using forward and backward digit span tasks (Wechsler, 2008a, 2008b), and all the participants performed within the normal range for their age group (normative data taken from Gregoire & Van Der Linden, 1997). They also had a normal performance on a non-word repetition task (Kay, Lesser, & Coltheart, 1992).

Materials: Verbal stimuli

Twenty-two bisyllabic phonologically plausible English non-words of 5-8 letters/ 4-7 phonemes long were used as novel words in the experiment (20 experimental and 2 practice items; see Romanova et al., 2015). The list was divided into two sets of 10 items (Set A and Set B) that were matched for the number of phonemes and letters, phonotactic probability, written bigram frequency, as well as orthographic and phonological neighbourhood. Each set was randomly assigned to either the proper or common noun condition, counterbalanced across participants within the groups of older and younger speakers. Auditory stimuli were recorded by a native English speaker.

Materials: Pictorial stimuli

Pictures for the experiment depicted novel creatures that varied on a range of parameters: colour, shape, facial expression, and posture. Pictures included unchanged original images purchased from the graphic website iStock (n.d.) as well as original images modified to fit the requirements of the design. There were 176 colour images in total and they were grouped into 20 subsets of experimental and 2 subsets of practice items.

Each subset comprised 7 exemplars. Four of the exemplars were different representatives of the same species: They were similar in body shape but varied in body structure (e.g., some were thinner and some – fatter), tints of colour (e.g., some were dark blue and some lighter blue), as well as facial expression and posture (see Figure 2). Three of the four exemplars were paired with a non-word presented as a common noun (the name of a species).

The fourth exemplar (we will call it ‘neutral’ for the sake of future reference) was further modified into three more exemplars. The latter represented different depictions of the same individual: They were similar in body shape, body structure, and colour but varied in facial expression and posture (see Figure 3). These three exemplars were paired with a non-word presented as a proper noun (the name of an individual).

Additionally, 22 pictures that were unrelated to the 20 experimental and 2 practice subsets were used in word-picture verification and picture recognition tasks (see details on the tasks below).

Figure 2. Example of members of the same species, including (last on the right) the 'neutral' exemplar. Common noun condition.

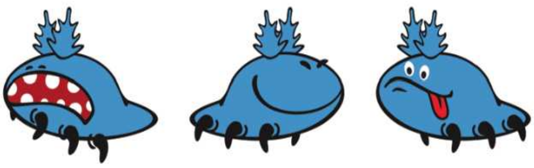


Figure 3. Example of depictions of the same individual. Proper noun condition.

Conditions

The experiment included common and proper noun conditions. In the common noun condition, participants were presented stimuli as members of the same species (10 different species), and the following instructions were given: "During this experiment you will be presented with different creatures that you have never seen before. In this part of the experiment you will see creatures that come from a number of different species. You will see different representatives of each species. For example, there may be pictures of a slim creature, a fatter creature of the same species, an older creature of that species, a creature of a lighter/darker colour, etc."

In the proper noun condition, participants saw individual creatures (10 different individuals), and the instructions for this condition were: "During this part of the experiment you will be presented with different individual creatures that you have never seen before. You will see different pictures of the same individual creature. For example, there may be pictures of this creature when it is happy, sad, angry, jumping, rotated, etc."

For half of the participants non-word Set A was matched with pictorial exemplars depicting members of the same species (thus, Set A was assigned to the common noun condition), whereas non-word Set B was matched with pictorial exemplars depicting individual creatures (thus, Set B was assigned to the proper noun condition). For the other half of the participants the assignment was reverse.

Importantly, individual creatures from the proper noun condition were from different species to those presented in the common noun condition.

Procedure

The experiment included 5 sessions: 4 learning sessions held over the period of 2 weeks (learning stage) and 1 testing session one week after the last learning session (testing stage). As reported in Romanova et al. (2015), the group of younger adults had 4 follow-up sessions: 1 day, 1 week, 4 weeks, and 2 months after the last learning session (following the procedure in Tuomiranta et al., 2011). However, in order to compare their performance to that of the older speakers in this experiment, only the follow-up session one week post-training was used in the analysis in the present paper.

Each learning session comprised a presentation and testing phase, whereas the testing session had only the testing phase. We will now consider the structure of learning and testing stages in more details. See Figure 4.

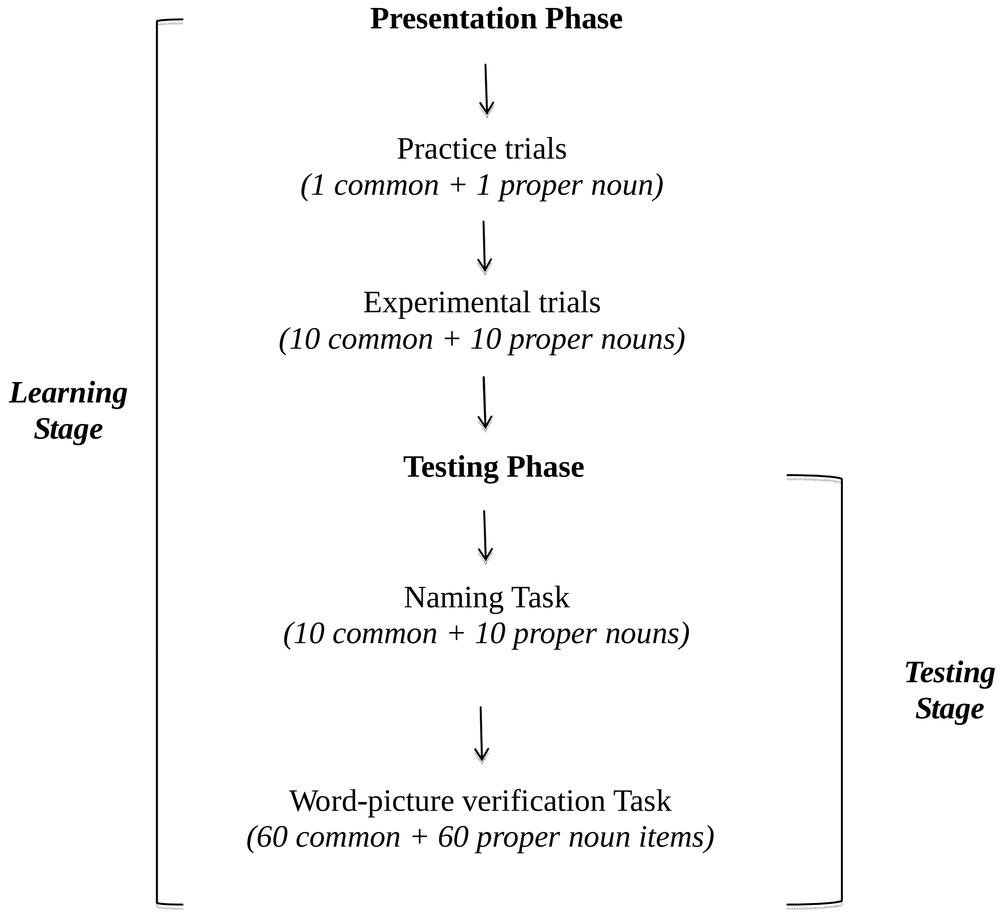


Figure 4. Experimental procedure: presentation and testing phases.

Learning stage (sessions 1-4): Presentation phase

During the presentation phase participants were asked to learn associations between non-words and pictures presented as either different species (common nouns) or different individuals (proper nouns). All stimuli were displayed on a computer screen using DMDX software (Foster & Foster, 2003).

Common and proper noun items were presented in two separate blocks of 10 trials. The order of the blocks was counterbalanced both across sessions and participants. Each trial included consecutive randomized presentation of three members of a species (in the common noun condition) or of three different depictions of an individual creature (in the proper noun condition). Each time participants saw a picture of a creature paired with a non-word presented both auditorily (e.g., "blaggit') and in a written form (e.g., BLAGGIT). The items were written in block letters to avoid additional cues from articles for common nouns and from capitalisation of proper nouns. Immediately after participants heard the word, they were required to repeat it. After all three depictions of a species/individual had been presented consecutively, all three items appeared simultaneously on the screen again and participants were asked to repeat the name of the species/individual for the fourth time.

Each condition block was preceded by a practice trial that followed the procedure described above. After participants had completed both common and proper noun blocks once, the same blocks were repeated once more. After the trials for all 20 novel creatures (10 per condition) had been seen twice, the testing phase of the session started.

Learning stage (sessions 1-4): Testing phase

The testing phase of a learning session consisted of a *picture naming task* as well as a *word-picture verification task.* The aim of these tasks was to facilitate learning of meaning-form mapping by giving appropriate feedback and also to monitor learning of these mappings.

In the picture naming task, each common and proper noun item was represented with one of the three depictions used in the presentation phase. Particular pictures were pre-assigned to the task for each session to ensure that each of the three depictions would be seen at least once in the picture-naming task throughout the sessions. The items from the common (n = 10) and proper noun (n = 10) conditions were intermixed and presented in a random order. One practice item was given for each condition. In the testing phase, participants were not told whether the item they saw had been presented as a member of a species or as an individual creature in the presentation phase.

After the first attempt to name the creature in the picture, irrespective of the outcome, participants received a cue (the first consonant phoneme/letter or the cluster of consonant phonemes/letters) presented both auditorily and in written form and again attempted to name the picture. After these two naming attempts, participants heard and saw the correct name for the item in the presence of the picture and were asked to repeat it.

In the word-picture verification task, participants were shown a picture of a creature paired with a verbal label (presented both auditorily and in written form). Participants were asked to decide whether the stimulus that they were given was the correct label for the picture by pressing a ‘yes’ or ‘no’ button. After each button press, participants received feedback: A green tick appeared on the screen upon the correct response, and a red cross – in the case of the wrong response. The presentation of experimental trials was preceded by two practice trials (one for each condition). All 20 verbal labels (10 from the common and 10 from the proper conditions) were presented in 6 different verification matching types (see Table 1). Thus, participants had 120 pairings to respond to. The 6 verification types comprised:

Type 1. Trained pictures. Participants saw one of the three depictions of a species/individual that they had encountered in the presentation phase paired with the correct verbal label. These three depictions were presented in a pseudorandomised order across the sessions to ensure that each appeared at least once. The correct response was ‘yes’.

Type 2. Untrained pictures within noun class. The untrained ‘neutral’ picture of a trained species/individual was presented. Participants were supposed to generalise the learned common/proper noun item beyond the trained exemplars. The correct response was ‘yes’.

Type 3. Untrained picture across noun class. This verification type was crucial for the analysis as it was designed to verify whether participants learned the items as common and proper nouns. Here, another exemplar (member) of the same species as the trained common/proper item was presented. This, however, led to conceptually different responses for common and proper noun items.

In the common noun condition, participants saw another untrained exemplar of the target species. As in Type 2, this verification type tested whether participants could generalise across exemplars (member) within species. The correct response here was ‘yes’.

In the proper noun condition, participants were shown a picture of a different member of the species to which the target individual creature belonged to. Unlike in the common noun condition of Type 3, here participants were expected to reject such a match: Although the creature presented belonged to the same species, it was a different individual, and thus, the trained proper noun label could not be applied to it. Therefore, the correct response was ‘no’.

To ensure participants understood the logic behind this verification type, the experimenter gave extended feedback on participants’ responses to the corresponding practice trials.

Type 4. Trained non-target within noun class. Participants were presented with trained depictions of other non-target creatures within the same condition (representatives from other trained species for the common noun condition and depictions of other individuals for the proper noun condition), given in a predetermined order across sessions. The correct response was ‘no’.

Type 5. Untrained non-target across noun class. As for Type 4, this verification type included pictures from non-target creatures. However, this time these were untrained creatures: one of the three untrained individual exemplars from trained non-target species for the common noun condition, and one of the three untrained members of the species to which the trained non-target creature belonged to in the proper noun condition. The pictures were presented in a predetermined order across the sessions. The correct response was ‘no’.

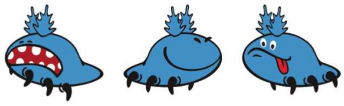
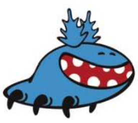
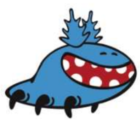
Type 6. Unseen species. Participants were presented with pictures of untrained creatures that were unrelated to any of the creatures shown during the presentation phase. The correct response was ‘no’.

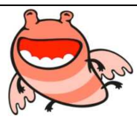
Table 1

Word-picture Verification Types and Required Responses

NB: No participants were exposed to the proper and common noun conditions for the same creature as depicted here.

The same creatures are provided here for both conditions to facilitate comparison.

	Common Nouns		*Proper Nouns*	
Trained items				
	trained pictures of trained target species		trained pictures of trained target individuals	
Type 1 “Trained target pictures”		YES		YES
	untrained picture of trained target species		untrained picture of trained target individuals	
Type 2 “Untrained target pictures within noun class”		YES		YES
	untrained pictures of trained target species		untrained pictures of untrained individuals of the species to which the target individual belongs	
Type 3 “Untrained (non-) target pictures across noun class”		YES		NO
	trained pictures of trained non-target species		trained pictures of trained non-target individuals	
Type 4 “Trained non-target pictures within noun class”		NO		NO

Type 5 “Untrained non-target pictures across noun class”	untrained pictures of untrained individual from trained non-target species		untrained pictures of untrained member of untrained species (another non-target individual from the species that was learnt as a proper noun)	
		NO		NO
Type 6 “Unseen species”	untrained pictures of unrelated untrained creatures		untrained pictures of unrelated untrained creatures	
		NO		NO

Testing stage (session 5): Testing phase

The last session of the experiment included only the picture naming and word-picture verification tasks. The procedure for both of these tasks at the testing stage was identical to those described above for learning sessions, except that no feedback was given throughout the tasks (except for the practice trials).

Additionally, lexical decision and picture-verification tasks were conducted. The aim of these was to determine whether participants had learned the pictures and verbal labels irrespective of learning the mapping between them. Both auditory and written versions of lexical decision tasks were given, in split halves design to control for the presentation order across the versions. Both modality versions of the task comprised 60 items: 20 target non-words learned throughout the experiment (e.g., purmill), 20 non-target non-words different from target non-words by one phoneme (e.g., purtill), and 20 real words sharing the first phoneme with target non-words (e.g., pendant). The task was to press ‘yes’ if participants heard or saw real words or the creature names that they had learned in the experiment, and to press ‘no’ if they heard unknown non-words.

The picture verification task included 40 items: 20 pictures that were trained in the experiment as targets and 20 untrained pictures of untrained creatures that were not in any way related to trained creatures. The 20 untrained pictures were identical to those presented in Type 6 of the word-picture verification task. The task was to press ‘yes’ if participants saw a picture of a creature they had learned throughout the presentation phases of the experiment, and to press ‘no’ if it was not the case.

Results

Picture verification and lexical decision tasks

Older participants’ performance on auditory and written lexical decision, as well as picture verification tasks at the testing session was high: 91%, 96% and 88% correct, respectively, indicating that older participants learned and recognised the verbal and pictorial stimuli presented throughout the study. Nevertheless, they performed significantly more poorly than the younger adults on the auditory lexical decision ($t(26) = 1.80$, $p = .042$; one-tailed) and picture verification tasks ($t(26) = 3.85$, $p < .001$), while scores on the written lexical decision task were comparable across the groups ($t(26) = 1.52$, $p = .070$).

Naming and Verification tasks

To answer the question of whether the group of older participants learned associations between novel words and meanings and whether the learning patterns were different for older and younger participants, we analysed the picture-naming and word-picture verification tasks with a 2 (proper versus common) x 5 (session) mixed design ANOVA with participant group (older versus younger) as well as assignment group (which picture set was assigned to which condition) as between-subject factors (IBM SPSS Statistics for Macintosh, Version 22.0).

Naming

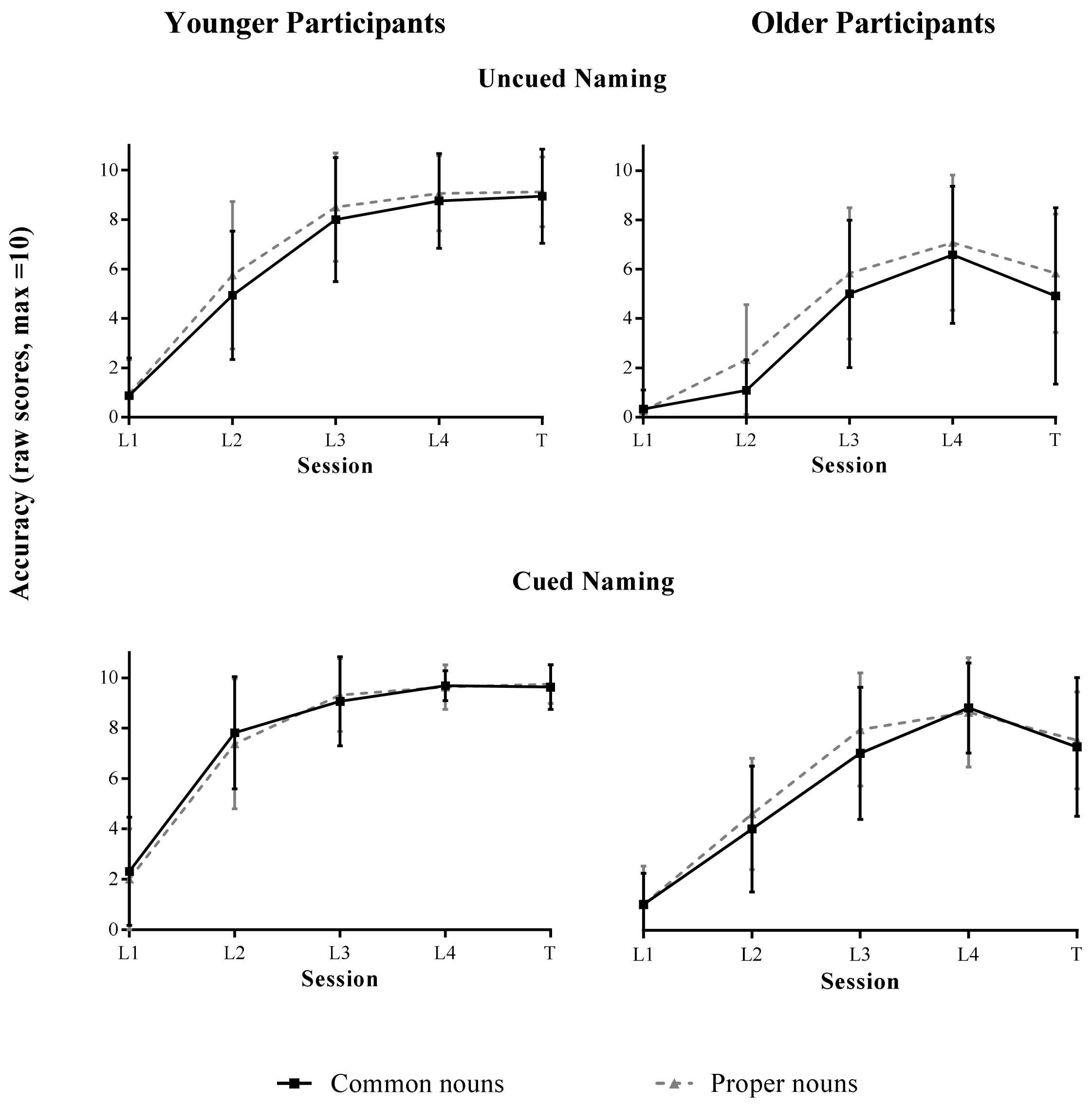


Figure 5. Uncued and cued naming accuracy.

Naming accuracy in both uncued and cued conditions for older and younger participants is shown in Figure 5 (see also *Appendix A* for graphs on performance of individual older participants for cued naming). In *uncued naming*, there was a main effect of session in the main ANOVA analysis across all sessions (see Table 2), combined with a significant linear trend for the learning stage alone (sessions 1-4: $F(1,24) = 342.33$, $r = .93$, $p < .001$) in the absence of significant two- or three-way interactions for the trend between session, participant group, and noun class. This indicates that both older and younger participants improved on naming accuracy across the sessions and the learning effects were of a similar extent across the two groups of participants and across proper and common nouns.

The main ANOVA analysis for uncued naming across all sessions showed a significant main effect of noun class, with no interaction between session and noun class: Proper nouns were retrieved significantly better than common nouns across sessions. There was a significant effect of participant group as well as a session by participant group interaction, reflecting generally lower naming accuracy on proper and common nouns for the older participants and the slight drop in accuracy at the testing stage. Assignment group (whether set A or set B were assigned to proper nouns) also was significant: Participants from who were assigned non-word Set B scored higher in the naming task than the others. There were, however, no significant two- or three-way interactions with assignment group.

Analysis of *cued naming* (see Table 2) revealed essentially similar results to the uncued condition: Across the whole experiment (sessions 1-5), a significant main effect of session on naming accuracy overall was observed. In addition, a significant linear trend for session across the learning stage (sessions 1-4: $F(1,24) = 517.55$, $r = .97$, $p < .001$) with no significant two- or three-way interactions for the linear trend between session, participant group, and noun class was detected. As in the uncued naming analysis, the main ANOVA showed a main effect of participant group and session, and a session by participant group interaction. The only major difference from the uncued condition was the lack of a noun class effect on naming accuracy: Participants from both groups performed comparably on proper and common noun items.

Table 2

Mixed-effect ANOVA Results for Uncued and Cued Naming Accuracy with Session, Noun Class, Participant and Assignment Groups as Predictors

	df (effect, error)	*F*	*p*	*r*
Uncued Naming. Between-Subject Effects				
Participant Group	**1, 24**	**17.49**	**< .001***	**.42**
Assignment Group	**1, 24**	**4.84**	**.038***	**.17**
Uncued Naming. Within-Subject Effects				
Session	**4, 21**	**94.81**	**< .001***	**.95**
Noun Class	**1, 24**	**10.92**	**.003***	**.31**
Session*Noun Class	4, 21	2.54	.070	.33
Session*Participant Group	**4, 21**	**11.04**	**< .001***	**.68**
Noun Class*Participant Group	1, 24	0.90	.352	.04
Session*Noun Class*Participant Group	4, 21	0.78	.550	.13
Cued Naming. Between-Subject Effects				
Participant Group	**1, 24**	**16.38**	**< .001***	**.41**
Assignment Group	1, 24	3.37	.079	.12
Cued Naming. Within-Subject Effects				
Session	**4, 21**	**133.78**	**< .001***	**.96**
Noun Class	1, 24	0.36	.553	.015
Session*Noun Class	4, 21	1.83	.161	.26
Session*Participant Group	**4, 21**	**5.60**	**.003***	**.52**
Noun Class*Participant Group	1, 24	1.34	.259	.05
Session*Noun Class*Participant Group	4, 21	1.08	.391	.17

Note. Two-way and three-way interactions with assignment group as one of the predictors were not significant ($p > .05$).

* significant at $p < .05$.

Overall (across both cued and uncued naming), although older people were generally worse in naming of both proper and common nouns than the group of younger participants, both groups improved their performance across the sessions, with a slight drop in accuracy for the older group at the testing stage. In uncued naming, proper nouns received higher accuracy scores than common nouns, whereas in cued naming, performance on proper and common noun items was comparable. Therefore, it is possible that additional activation due to cueing facilitates retrieval of common nouns.

Verification

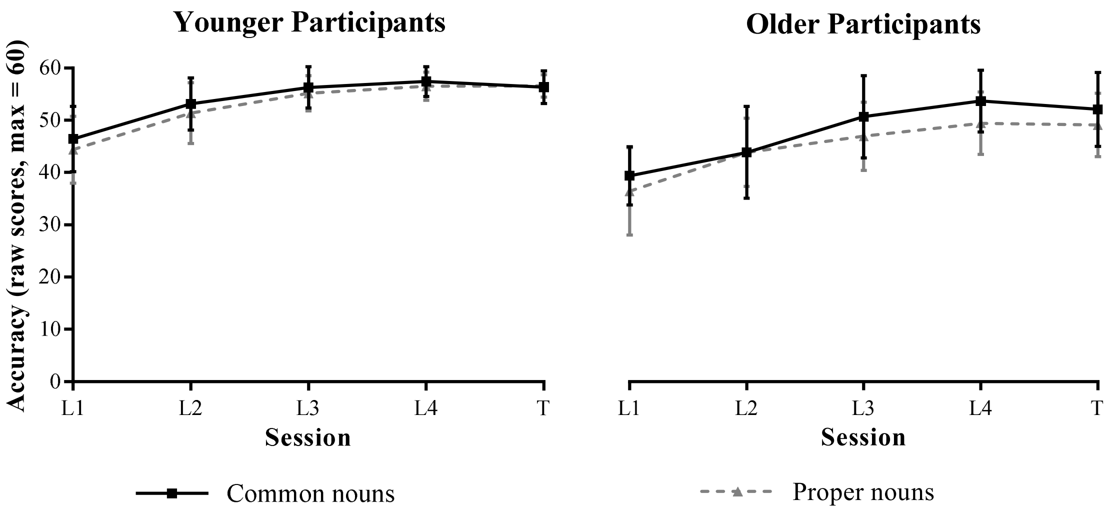


Figure 6. Word-picture verification accuracy across verification types.

We first evaluated performance on the verification task in both of our participant groups (see Figure 6) using signal-detection research methods (Macmillan & Creelman, 1991). The *d*-prime statistic was calculated on the basis of *z*-scores obtained from hit and false alarm rates on the task. Performance of both older and younger participants was found to be above chance level as scores from both groups exceeded zero (the *d*-prime of zero signalling the chance level, with an effective ceiling score of 4.65; older participants: *Mean* = 1.92, *Standard Deviation* = 0.83; younger participants: *Mean* = 2.60, *Standard Deviation* = 0.53).

In the initial analysis of the word-picture verification task we explored accuracy rates on proper and common nouns collapsed across all 6 verification types. There was a main overall effect of session across the whole experiment (see Table 3), combined with a significant linear effect for session across the learning stage (sessions 1-4: $F(1,24) = 178.97$, $r = .88$, $p < .001$) with no two- or three-way interactions for the linear trend between session, noun class and participant group, indicating that both age groups had comparable improvement of their verification accuracy on both proper and common noun items across the sessions. In the ANOVA including all sessions (see Table 3), noun class once again had a significant effect on verification accuracy. However, in contrast to the naming task, verification accuracy on proper nouns was lower than on common nouns. Finally, there was an overall significant effect of participant group: Older people performed more poorly on both noun classes across the sessions. There were no significant interactions.

Table 3

Mixed-effect ANOVA Results for Word-Picture Verification Task with Session, Noun Class/Verification Type, Participant and Assignment Groups as Predictors

	df (effect, error)	*F*	*p*	*r*
Word-Picture Verification (combined across types). Between-Subject Effects				
Participant Group	**1, 24**	**16.08**	**.001***	**.40**
Assignment Group	1, 24	3.72	.066⁺	.17
Word-Picture Verification (combined across types). Within-Subject Effects				
Session	**4, 21**	**39.75**	**< .001***	**.88**
Noun Class	**1, 24**	**16.71**	**<.001***	**.41**
Session*Noun Class	4, 21	1.90	.149	.27
Session*Participant Group	4, 21	1.18	.347	.18
Noun Class*Participant Group	1, 24	3.18	.087⁺	.12
Session*Noun Class*Participant Group	4, 21	1.36	.282	.21
Word-Picture Verification (individual subtypes). Between-Subject Effects				
Participant Group	**1, 24**	**16.55**	**< .001***	**.41**
Assignment Group	1, 24	3.83	.062⁺	.14
Word-Picture Verification (individual subtypes). Within-Subject Effects				
Session	**2, 54**	**107.46**	**< .001***	**.82**
Verification Type	**4, 98**	**84.79**	**< .001***	**.78**
Session*Verification Type	**10, 248**	**2.82**	**.003***	**.11**
Session*Participant Group	2, 54	1.69	.191	.07
Verification Type*Participant Group	**4, 98**	**10.70**	**< .001***	**.31**
Session*Verification Type*Group	**10, 248**	**4.17**	**< .001***	**.15**
Word-Picture Verification (individual subtypes). Within-Subject Contrasts (Verification Type) comparing common versus proper				
Type 1: trained targets	**1, 24**	**39.72**	**< .001***	**.62**
Type 2: untrained targets	**1, 24**	**31.17**	**< .001***	**.57**
Type 3: untrained (non-)targets across noun class	**1, 24**	**229.09**	**< .001***	**.91**
Type 4: trained non-targets within noun class	1, 24	0.42	.525	.02
Type 5: untrained non-targets across noun class	**1, 24**	**14.89**	**.001***	**.38**
Type 6: unseen non-targets	1, 24	1.84	.188	.07

Note. Two-way and three-way interactions with assignment group as one of the predictors were not significant ($p > .05$).

* significant at $p < .05$.

We conducted further analysis on the word-picture verification task to see if performance on different verification types within the task varied across the noun class and participant groups. A 12 (verification type: 6 types x 2 noun classes) x 5 (session) mixed design ANOVA with participant and assignment groups as between-subject factors was performed (see Table 3). Throughout the analysis, we used an average score for Type 2 and 3 for common noun items as they required identical judgements. The ANOVA revealed significant main effects of session and verification type, as well as session by verification type interaction. These results indicate that participants' accuracy and their learning curves varied across different verification types. Moreover, a two-way interaction between participant group and verification type, as well as a three-way interaction between participant group, verification type, and session were significant. Thus, the difference in the performance of older and younger participants varied depending on the verification type and session number. To understand which verification types caused noun class effects in the initial verification analysis (with scores combined across verification types), planned contrasts were performed (with Bonferroni corrections) on performance on proper and common noun sets for all 6 verification types. As a result, significant noun class differences were found in the verification Type 1 ('Trained target pictures'), Type 2 ('Untrained target pictures within noun class'), Type 3 ('Untrained (non-)target pictures across noun class'), and Type 5 ('Untrained non-target pictures across noun class'). In the case of Types 1, 2, and 5 proper nouns were more accurate, for Type 3 however, common nouns were more accurately judged (See Table 4 for descriptive statistics on the verification types). However, only Type 3 ('Untrained (non-)target pictures across noun class') showed a significant interaction with participant group ($F(1,24) = 20.05$, $r = .46$, $p < .001$).

Table 4

Descriptive Statistics for Accuracy for Individual Verification Types

Type		Proper nouns		Common nouns	
		Mean	SD	Mean	SD
1	Trained target pictures	9.30	0.12	8.42	0.15
2	Untrained target pictures	9.37	0.09	8.83	0.14
3	Untrained (non-)target pictures (cross class)	4.65	0.29	8.83	0.14
4	Trained non-target pictures	8.04	0.27	7.94	0.23
5	Untrained non-target pictures (cross class)	8.51	0.21	8.01	0.22
6	Unseen species	9.00	0.15	8.82	0.21

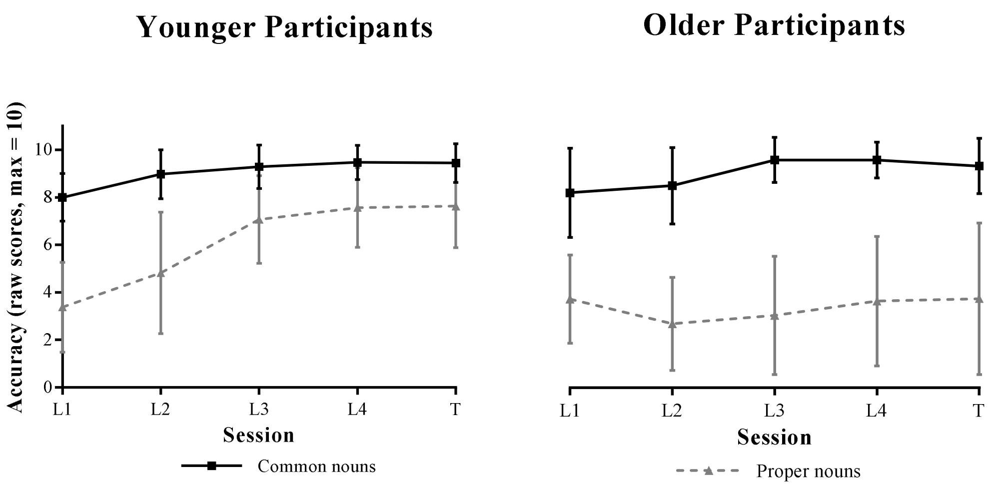


Figure 7. Accuracy on verification Type 3.

To further explore the nature of noun class differences in performance of older versus younger participants for Type 3 (‘trained (non-)targets across noun class’), we carried out an ANOVA. This showed main effects of session ($F(4,21) = 23.62$, $r = .82$, $p < .001$), noun class ($F(1,24) = 229.09$, $r = .91$, $p < .001$), and participant group effect ($F(1,24) = 21.88$, $r = .47$, $p < .001$), as well as a significant interaction between noun class and participant group ($F(1,24) = 20.05$, $r = .46$, $p < .001$), session and participant group ($F(4,21) = 6.91$, $r = .57$, $p < .001$), and session, noun class, and participant group ($F(4,21) = 5.05$, $r = .49$, $p < .001$). These results indicate that although participants had similar stable high performance on common noun items, their performance on proper nouns was poorer. Moreover, whereas younger adults gradually improved their performance on proper noun items, older people stayed at a low level throughout the sessions. It is worth mentioning, however, that variability within the group of older participants was high (see Figure 7 and *Appendix B* for individual graphs).

Overall, relative performance on proper and common noun items was comparable across the older and younger adults. Both groups performed better on proper nouns than on common nouns from verification Types 1 (‘trained targets’), 2 (‘untrained targets’), and 5 (‘untrained non-targets across noun class’), and had identical accuracy across the two noun classes in Types 4 (‘trained non-targets within noun class’) and 6 (‘unseen non-targets’). The only verification type where both older and younger participants performed on proper nouns more poorly than on common nouns, was Type 3 (‘untrained (non-)targets across noun class’). Moreover, older adults performed significantly worse on this type than the younger group: The former overgeneralized names of target individuals to pictures of different individuals from the same species. Interestingly, verification accuracy on proper nouns from Type 3 at session 4 correlated with participants’ naming accuracy at session 4 (the one at which highest accuracy was expected) at a level of only marginal significance (uncued: $r(10) = .56$, $p = .059$; cued: $r(10) = .51$, $p = .093$). No correlation between verification accuracy on proper noun items in Type 3 and digit span was found ($r(10) = .49$, $p = .107$; Wechsler, 2008a, 2008b).

Discussion

This study investigated older adults' learning and retrieval of proper and common nouns. To be able to match proper and common nouns on statistical properties, we used stimuli that were completely novel to participants: Associations between novel meanings (individuals or species of unknown creatures) and novel words were introduced. Moreover, to ensure that participants attached the corresponding meanings to verbal stimuli, we repeatedly presented the new items over 4 learning sessions and facilitated their learning through providing feedback on the picture naming and word-picture verification tasks. Hence, our study controlled statistical properties more tightly than previous studies where, although associations between a referent and proper and common nouns were novel, the word forms themselves were not (e.g., Barresi et al., 1995; Cohen & Faulkner, 1986; James, 2004; Rendell et al., 2005): Such studies enabled control of familiarity of experimental items, but could not match for frequency, age of acquisition, or recency of use.

As was predicted, older participants had generally lower performance than younger speakers: Their accuracy was lower on all the experimental items in the picture naming and overall in the word-picture verification task. Their learning was also slower (learning curve less steep) in the picture naming task. Such results are consistent with a general decline in word retrieval in ageing (e.g., Burke et al., 1991; Maylor, 1997).

One subset of word-picture verification stimuli comprised a critical control in this study. The Type 3 verification task was crucial in determining whether novel words were learned as proper and common nouns. In this type, a trained label was presented with a creature from the same species as the trained item. For common nouns, the participant should accept this creature as an example of the trained species, however for proper nouns the creature should be rejected (it is the same species but not the same individual). However, for the older participants in this study this was not the case: There was a disproportionate age-related deficit in learning of new associations between novel proper nouns and their meanings as reflected in verification Type 3 scores.

Thus, based on the results of this Type 3 verification task, it can be concluded that although participants had no problem in generalising a species name (common noun) to an untrained member of this species, when presented with the name of an individual, they struggled in saying that it could not be applied to another member of the species to which this individual belonged. Both older and younger adults tended to overgeneralise the name of an individual to the whole species. However, although younger adults performed more poorly on proper nouns than on common nouns on verification Type 3 throughout all 5 sessions, they slowly improved on proper nouns and retained a relatively high performance throughout the testing stage. In other words, there was clear evidence that they learned to correctly associate a proper noun label with an individual rather than a species. Older participants, on the other hand, never learned that it was incorrect to generalise the name of an individual to the whole species – thus, never fully learned the correct association between novel words and proper noun meanings. Instead, they responded as though they had learned all items as common nouns.

This is consistent with studies on language acquisition that find that children tend to learn novel words as common nouns if they do not yet have a label for the referent (e.g., Hall, 2008). In other words, a new creature without a name would be learned as a common noun. Only when the object in question already has a label (a common noun) would they learn a new word as a proper noun. In our study, despite overt instructions regarding the labels being common or proper nouns (names of species or individuals), it is possible that older participants also associated the label with the name of a species (common noun) rather than a name of an individual (proper noun).

However, it is also possible that the names were indeed learned correctly as names of individuals and species but that this particular manipulation in the verification task was simply very hard. Literature on ageing shows that older adults sometimes demonstrate deficiencies in tasks requiring visual discrimination (for example, between distorted and undistorted geometrical figure, judgement of adequacy of drawings, etc.; e.g., see for review, Albert, 1994). Note that older participants' performance on the picture verification task in our experiment, although high, was poorer than that of the younger group, which could have indicated problems with visual discrimination or visual memory. Some authors have also suggested that inefficient inhibition in older people could result in ineffective selective attention: Performance on a task could be inhibited by the presence of task irrelevant information in the working memory (e.g., Kramer, Humphrey, Larish, Logan, & Streayer, 1994). As the verification Type 3 task for proper nouns was the only verification type where participants were supposed to reject a picture of a creature that looked very similar to the target (because it was a different member of the same species as a target individual), this particular task could have put additional cognitive load on older participants. Indeed, participants had to discriminate between an untrained member of a target species presented and the visual memory of another member of the same species. Successfully rejecting Type 3 mapping for proper nouns may have been impeded by both problems in discriminating between similarly looking items and with visual working memory or visual attention. Perhaps then, the older adults needed further training, not so that they learned that the items are proper nouns, but rather to assist in learning the visual features of the proper noun - learning exactly the limits of what this individual could look like and still be the same individual.

With further learning the visual discrimination task may become more automatic and less cognitively demanding.

These two possibilities have different implications for the interpretation of the remainder of the data. If the poor Type 3 verification results reflect proper nouns being learned as common nouns, then we can draw no conclusions regarding proper noun learning and retrieval in older adults from the naming data. If on the other hand, they reflect a problem determining which exemplars should be included as a depiction of an individual, then the naming results can indeed inform our understanding of proper noun learning and retrieval. As we have no way to discriminate between these possibilities, we will discuss the implications of the data if the latter scenario were true.

In the picture naming task, older participants did not show any disproportionate impairment for proper nouns (names of individuals): The patterns of performance on proper and common noun items were comparable across the age groups. Specifically, both older and younger participants had lower accuracy for common nouns in the uncued condition of the picture-naming task, whereas when presented with a phonological cue, performance on proper and common nouns did not differ for either age group (possibly, due to an additional boost of activation for common nouns due to cueing). The lack of a difference between proper and common nouns supports a dominant role for statistical properties (frequency, familiarity, age of acquisition, etc.) in explaining the differences between the noun classes and an age-related disproportionate deficit for personal names often seen in retrieval studies (e.g., Burke et al., 1991; James, 2006): The design of this study ensured that statistical properties were equal.

It is harder to explain why both older and younger adults actually found proper nouns easier than common nouns to retrieve (as was shown in the uncued naming condition) and to respond to in the word picture verification task (in all verification types except Type 3). In

Romanova et al. (2015), we speculated that such patterns could be explained by differences in the visual characteristics of our proper and common noun stimuli. In our experiment, representatives of an individual creature (proper noun condition) were highly visually similar to each other. Members of a species (common noun condition) were more visually heterogeneous than individual creatures but may still have been hard for participants to distinguish between due to the novelty of the whole concept. Members within a species were designed to be as distinct as possible while still sharing sufficient features to clearly be members of the same species. It is probable that this was more successful for some sets than the others (which is also supported by effects of assignment group in the verification task). As a result of our experimental manipulation, visual representations for proper nouns (being unambiguously similar to one another) could be clearer and, thus, stronger in comparison to those for common nouns. This could affect both naming and verification. In the latter, boundaries within the common noun condition (between members of species) may seem less clear than within the proper noun condition, and this could be reflected in fewer accurate responses.

In summary, this study found no evidence for a disproportionate impairment for proper nouns in retrieval following learning. While older subjects were more impaired overall in learning and retrieval, both young and older subjects showed the same pattern – slightly better performance with proper than common nouns. However, the older adults showed poor performance on a verification task where they had to reject a member of the same species as a learned individual. It is possible that this reflects difficulties in learning the 'scope' of the visual characteristics that define an individual.

We suggest that, overall, using novel items (with novel meaning and novel word forms) in a learning task is a promising tool for studying processing differences in proper and common nouns. More studies are required however, perhaps including further training distinguishing within and between individuals in a species. Perhaps also, making depictions of different exemplars of the same common nouns even more dissimilar would help avoid confusion in interpreting items as proper or common (particularly, in the verification task). Introducing more semantic knowledge about the items (for example, where they live, what they do, what they eat, like, etc.) could also facilitate learning proper and common noun items as more meaningful words with stronger semantic representations. Consequently, this could lead to more straightforward conclusions about differences in learning and retrieval of proper nouns (personal names) relative to common nouns in groups of older and younger adults, and determine weightings that statistical and logical properties have in processing of these two noun classes.

References

Albert, M. S. (1994). Age-related changes in cognitive function. In M. L. Albert & J. E. Knoefel (Eds.), *Clinical Neurology of Aging* (pp. 314–328). New York: Oxford University Press.

Barresi, B. A., Obler, L. K., & Goodglass, H. (1995). Dissociation between proper name and common noun learning. *Brain and Cognition*, *37*, 10-78.

Bruyer, R., Van der Linden, M., Lodewijck, M., Nelles, B., Schils, J., Schweich, M., & Brédart, S. (1992). Age differences in putting names and occupations to faces? *Archives de Psychologie*, *60,* 243–257.

Burke, D. M., MacKay, D. G., Worthley, J. S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language*, *30,* 542-579.

Cohen, G. (1990) Why is it difficult to put names to faces? *British Journal of Psychology, 81*, 297-297.

Cohen, G., & Burke, D. M. (1993). Memory for proper names: A review. *Memory, 1,* 249-263.

Cohen, G., & Faulkner, D. (1984). Memory in old age: “Good in parts.” *New Scientist, 11*, 49-51.

Cohen, G., & Faulkner, D. (1986). Memory for proper names: Age differences in retrieval. *British Journal of Developmental Psychology, 4,* 187-197.

Evrard, M. (2002). Ageing and lexical access to common and proper names in picture naming. *Brain and Language*, *81*, 174–179.

Foster, K. I., & Foster, J. C. (2003) DMDX: A window display program with millisecond accuracy. *Behavior Research Methods, Instruments & Computers*, *35*, 116-124.

Gregoire, J., & Van Der Linden, M. (1997). Effect of age on forward and backward digit spans. *Aging, Neuropsychology, and Cognition: A Journal on Normal and Dysfunctional Development*, *4*, 140-149.

Hall, D. G. (2008). Acquiring proper nouns for familiar and unfamiliar animate objects: Two-year-olds' word-learning biases. *Child Development*, *62*, 1142-1154.

iStock (n. d.). Retrieved July, 2012 from http://www.istockphoto.com

Jackendoff, R. (1983). *Semantics and cognition.* Cambridge, MA: MIT Press.

James, L. (2004). Mr. Farmer versus meeting a farmer: Specific effects of aging on learning proper names. *Psychology and Aging*, *19*, 515-522.

James, L. (2006). Specific effects of aging on proper name retrieval: Now you see them, now you don't. *Journal of Gerontology: Psychological sciences, 61B*, 180-183.

Kay J., Hanley, J. R., & Miles, R. (2001). Exploring the relationship between proper name anomia and spoken word retrieval: A single case study. *Cortex*, *37*, 501-517.

Kay, J., Lesser, R., & Coltheart, M. (1992). *Psycholinguistic Assessments of Language Processing in Aphasia (PALPA)*. Hove: Lawrence Erlbaum Associates.

Kramer, A. F., Humphrey, D. G., Larish, J. F., Logan, G. D., & Strayer, D. L. (1994). Aging and inhibition: beyond a unitary view of inhibitory processing in attention. *Psychology and Aging*, *9*, 491–512.

Kripke, S. (1980). *Naming and necessity*. Oxford: Blackwell.

MacKay, D. G. (1987). *The organisation of perception and action: A theory for language and other cognitive skills*. New York: Springer-Verlag.

MacKay, D. G., & Burke, D. M. (1990). Cognition and aging: A theory of new learning and the use of old connections. In T. Hess (Ed.), *Aging and cognition: Knowledge organization and utilization* (pp. 213-263). Amsterdam: North Holland.

Macmillan, N. A., & Creelman, C. D. (1991). *Signal detection theory: A user's guide.* New York, NY: Cambridge University Press.

Maylor, E. A. (1990). Recognizing and naming faces: Aging, memory retrieval, and the tip of the tongue state. *Journal of Gerontology: Psychological Sciences*, *45*, 215–226.

Maylor, E. A. (1995). Effects of aging on the retrieval of common and proper names. Facts and *Research in Gerontology, Supplement*, 55–73.

Maylor, E. A. (1997). Proper name retrieval in old age: Converging evidence against disproportionate impairment. *Aging, Neuropsychology, and Cognition*, *4*, 211–226.

McWeeny, K. H., Young, A. W., Hay, D. C., & Ellis, A. W. (1987). Putting names to faces. *British Journal of Psychology, 78*, 143-149.

Milders, M. (1998). Learning people's names following severe closed-head injury. *Journal of Clinical and Experimental Neuropsychology*, *20*, 237-244.

Rendell, P. G., Castel, A. D., & Craik, F. I. M. (2005). Memory for proper names in old age: A disproportionate impairment? *Quarterly Journal of Experimental Psychology, 58A*, 54–71.

Romanova, A., Nickels, L., & Renvall, K. (2015). Investigating differences in learning of novel proper and common nouns in young adults. *Manuscript in preparation*.

Semenza, C. (1997). Proper-name-specific aphasias. In Goodglass, H., & Wingfield, A. (Eds), *Anomia*: *Neuroanatomical and Cognitive Correlates.* San Diego: Academic Press.

Semenza, C. (2009). The neuropsychology of proper names. *Mind and Language, 24,* 347–369.

Stanhope, N., & Cohen, G. (1993). Retrieval of proper names: Testing the models. *British Journal of Psychology, 84*, 51-65.

Terry, W.S. (1994). On the relative difficulty in recalling names and occupations. *The American Journal of Psychology*, *107*, 85-94.

Tuomiranta, L., Groenholm-Nyman, P., Kohen, F., Rautakoski, P., Laine, M., & Martin, N. (2011). Learning and maintaining new vocabulary in persons with aphasia: Two controlled case studies. *Aphasiology*, *29*, 1030-1052.

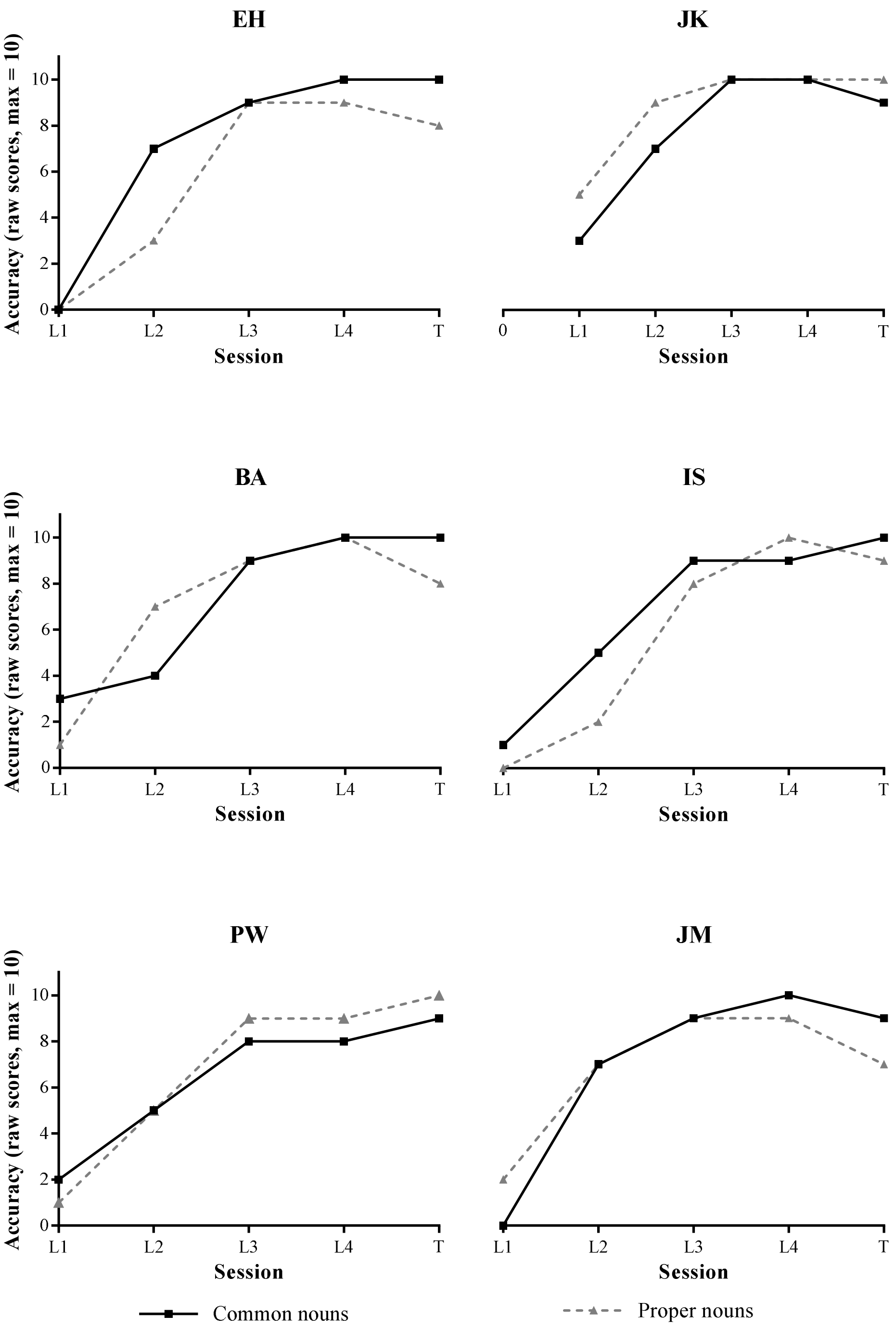
Valentine, T., Brédart, S., Lawson, R., & Ward, G. (1991). What's in a name? Access to information from people's names. *European Journal of Cognitive Psychology, 3*, 147-176.

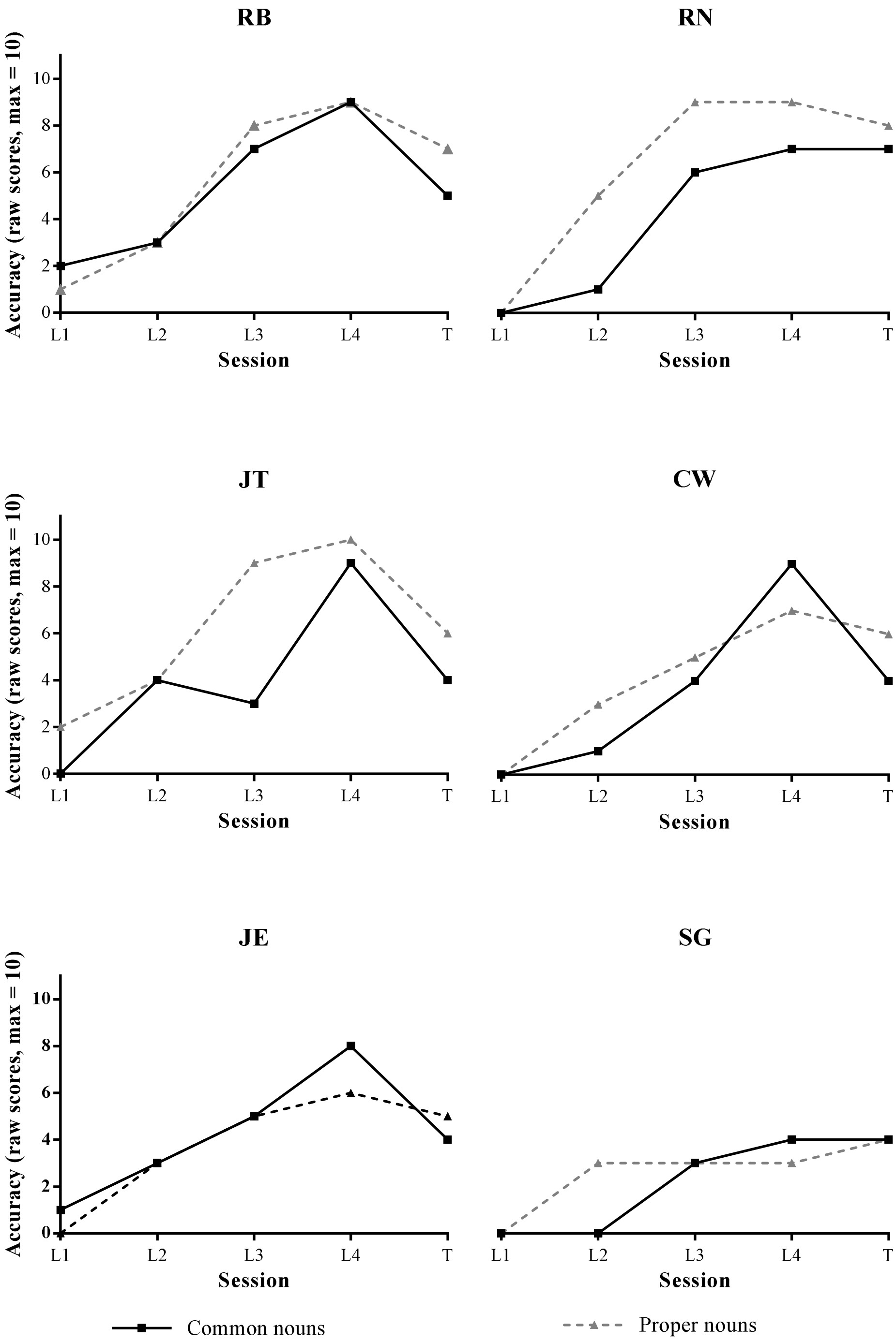
Wechsler, D. (2008a). *Wechsler adult intelligence scale - fourth edition.* San Antonio, TX: Pearson Assessment.

Wechsler, D. (2008b). *Wechsler adult intelligence scale - fourth edition: Technical and interpretive manual.* San Antonio, TX: Pearson Assessment.

Appendix A

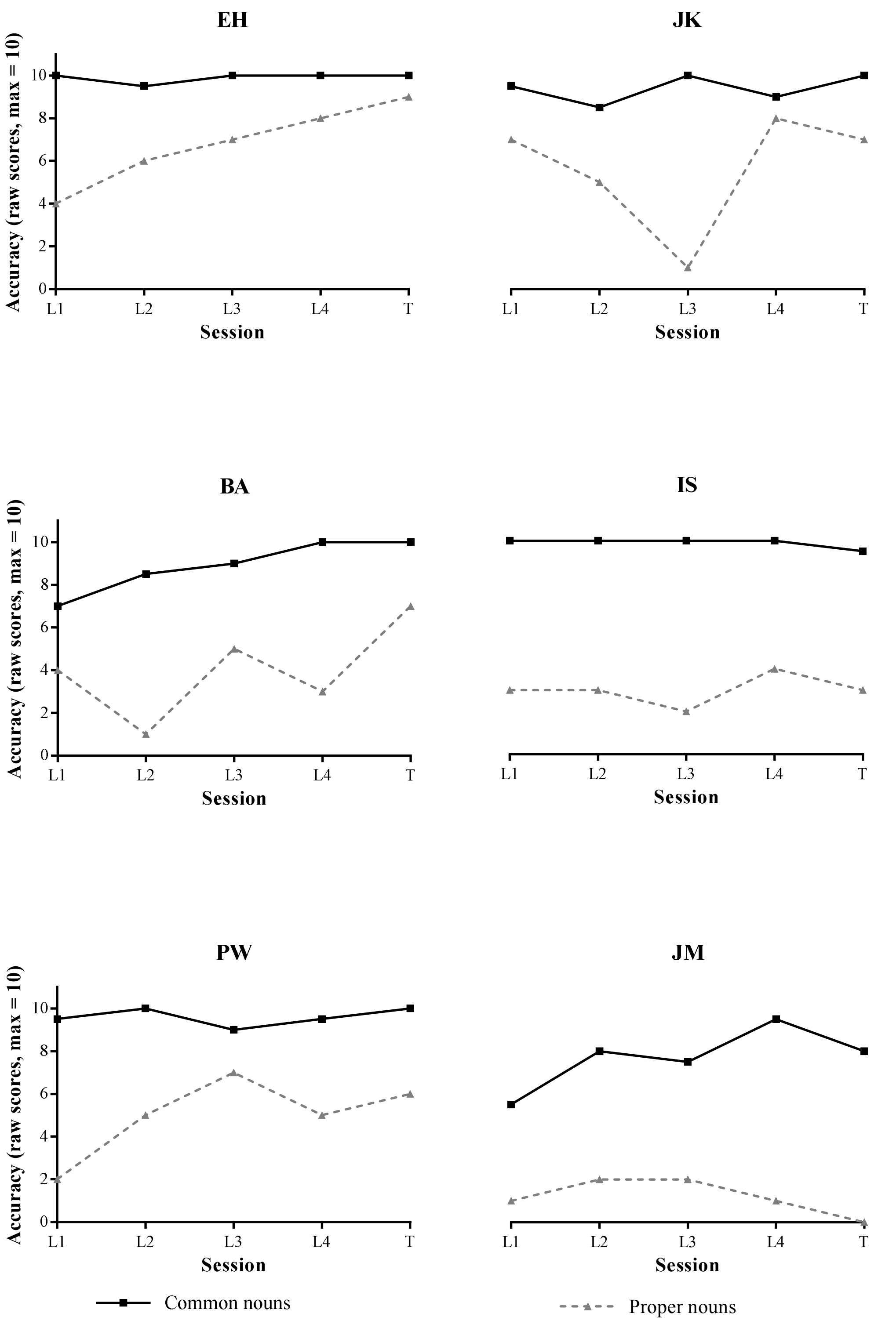
Cued Naming Accuracy: Older Individuals

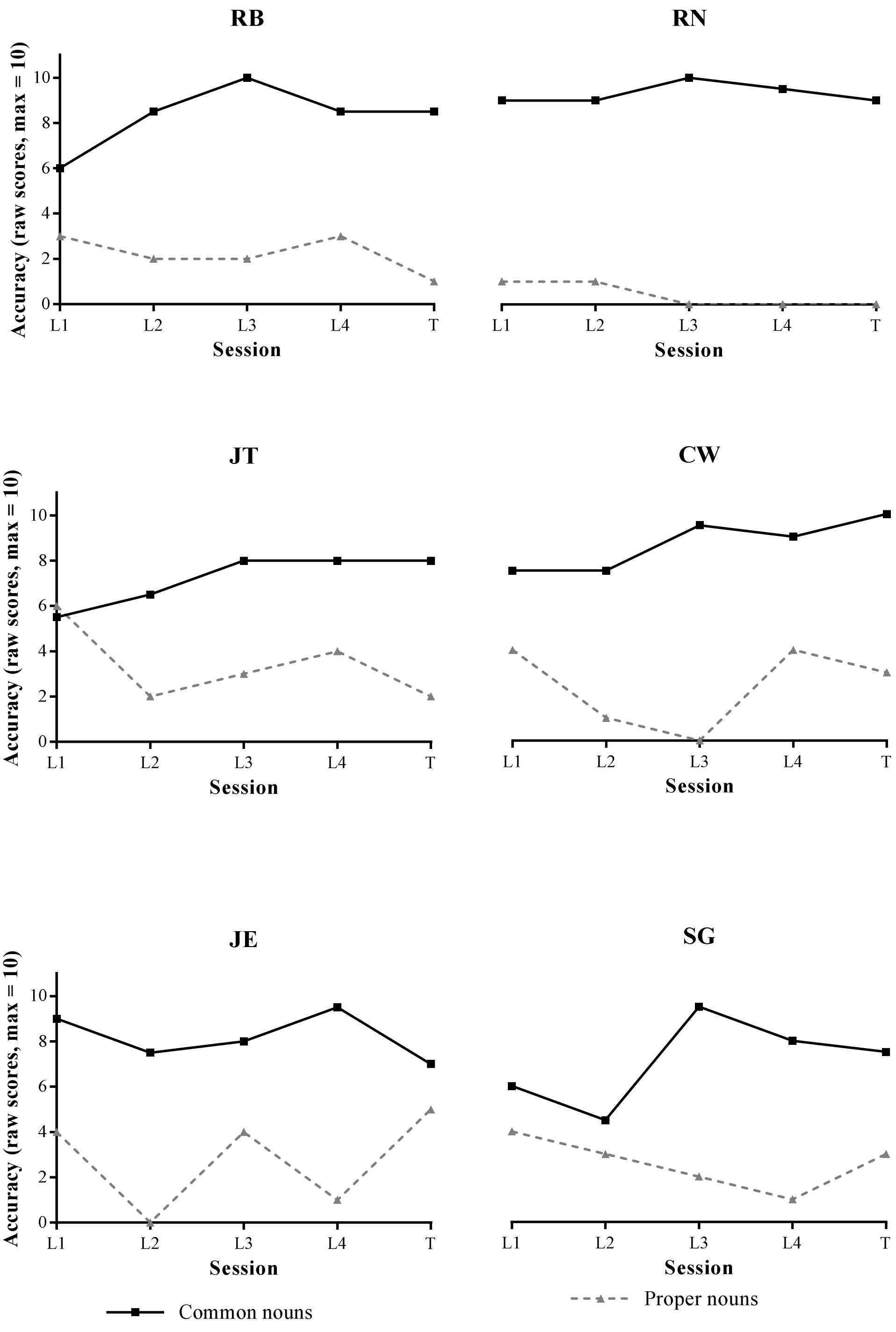



RB
RN
JT
CW
JE
SG
Accuracy (raw scores, max = 10)
0
2
4
6
8
10
L1
L2
L3
L4
T
Session
Common nouns
Proper nouns

Appendix B

Accuracy on Verification Type 3: Older Individuals





RB
RN
JT
CW
JE
SG
Accuracy (raw scores, max = 10)
0
2
4
6
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L1
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L3
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Session
Common nouns
Proper nouns

Chapter Four

Learning of Novel Proper and Common Nouns in People with Aphasia

Abstract

Cases have been reported of people with aphasia who have selective proper noun deficits in word retrieval. If these cases reflect the fact that proper nouns are processed using a mechanism that is inherently vulnerable to the effects of brain damage, it would be expected that similar disproportionate impairments would also be found for learning and retrieval of novel proper nouns relative to novel common nouns. This study compared performance of two people with aphasia (JG and JF) on learning of novel proper (names of individuals) and common (names of species) nouns with a group of age-matched controls. Using novel items controlled the statistical properties of items within and across noun classes (e.g., frequency). JG and JF demonstrated some learning for items from both noun classes, and did not show any disproportionate deficits for proper nouns. However, high variability in performance on proper nouns within the control group, as well as the fact that it could not be clearly established that either controls or people with aphasia had learned associations between proper noun semantics and proper noun labels makes it hard to unequivocally interpret the results.

Introduction

This chapter examines the learning of proper and common nouns in people with aphasia. It compares the performance of two people with aphasia with the performance of age-matched non-brain-damaged speakers on the learning task reported in Romanova, Nickels, and Howard (2015).

Although some people with aphasia show impaired retrieval of common nouns with proper nouns relatively preserved (e.g., Cipolotti, McNeil, & Warrington, 1993; Lyons, Hanley, & Kay, 2002; Martins & Farrajota, 2007; Semenza & Sgaramella, 1993), reports of the relatively greater impairment to proper nouns have been more prevalent (e.g., Cohen, Bolgert, Timsit, & Cherman, 1994; Fery, Vincent, & Brédart, 1995; Harris & Kay, 1995; Hittmair-Delazer, Denes, Semenza, Mantovan, 1994; Lucchelli & De Renzi, 1992; Martins & Farrajota, 2007; McKenna & Warrington, 1980; Otsuka et al., 2005; Semenza & Zettin, 1988, 1989). This could be an indication of proper nouns either being inherently harder and hence, more susceptible to the effects of brain damage (possibly, due to their lower frequency, familiarity, and later age of acquisition relative to common nouns; Kay, Hanley, & Miles, 2001). Alternatively, it could be that proper and common nouns have distinct processing mechanisms with the proper noun mechanism being more vulnerable (e.g., Cohen & Burke, 1993; Semenza, 1997, 2009). Several face and word processing models have also incorporated different processing pathways for these two noun classes (e.g., Brédart et al., 1995; Bruce & Young, 1986; Burke, MacKay, Worthley, & Wade, 1991; Burton & Bruce, 1992). For example, Node Structure Theory (Burke et al., 1991) postulates that lexical forms of a proper noun may be more vulnerable to deficits in transmission of priming (required for activation within the processing network). This is due to the fact that, compared to common nouns, proper nouns have a single connection to an additional node that receives converging priming from multiple semantic features to its lexical form. Moreover, Burke et al. (1991) suggest that older people experience particular difficulty with proper nouns due to a combination of a general age-related transmission deficit and the overall vulnerability of proper nouns (MacKay & Burke, 1990).

Just as age is proposed to affect the transmission of priming, brain damage has also been suggested to decrease transmission of activation between processing levels (e.g., Dell, Schwartz, Martin, Saffran, & Gagnon, 1997). Therefore, considering the vulnerability of proper nouns to transmission deficits, people with aphasia may show disproportionate deficits for proper nouns relative to common nouns in comparison to age-matched controls (in the same way as older people are predicted to have a disproportionate deficit for proper nouns in comparison to younger adults).

Although, as noted above, a number of case studies have revealed selective deficits in people with aphasia in retrieval of personal names in particular, and proper nouns in general, no studies have been conducted comparing learning of personal names and common nouns in this group of speakers. The only relevant study, to our knowledge, is by Milders (1998) who explored personal name learning in 12 people with closed-head injuries (but without aphasia). People with closed-head injuries often suffer from memory problems (e.g., Van Zomeren & Saan, 1990) and have poor verbal learning (e.g., Richardson, 1990). Based on this knowledge, as well as the fact that personal names were found to be harder to retrieve and learn than common nouns (e.g., Cohen, 1990; McWeeny, Young, Hay, & Ellis, 1987; Stanhope & Cohen, 1993; Terry, 1994), Milders (1998) predicted that people with closed-head injuries would remember associations between unfamiliar faces and their personal names worse than associations between the faces and biographical information related to them (in this case, possessions). As expected, the brain-damaged subjects showed retrieval of people’s names that was poorer than retrieval of their possessions, when both names and possessions were real words in Dutch. For example, participants were better in recalling that the person in the picture had 'ketel' (a kettle) than that his name was 'Ketel'. However, like the control group, their performance on names and possessions was identical if the items were labelled with non-words. Although people with closed-head injuries showed inferior recall of proper nouns in the study, we argue that it is impossible to ascertain that the pattern found is not due to lower frequency of proper nouns relative to common nouns. Indeed, even same word forms (e.g., 'ketel' as a kettle and 'Ketel' as a name) can have different lexical representations and thus, different frequency counts (e.g., Caramazza, Costa, Miozzo, & Bi (2001).

Despite the lack of experimental studies on personal name versus common noun learning in aphasia, there has been some research on people with aphasia that has used an associative learning technique pairing pictorial stimuli with novel meanings and novel labels (Gupta, Martin, Abbs, Schwartz, & Lipinski, 2006; Kelly & Armstrong, 2009; Tuomiranta et al., 2011; Wang, Howard, & Morris, 2012). All four studies conclude that at least some people with aphasia (partly) retain the ability to learn new verbal material, even when presented with completely novel items and challenged with a demanding task like picture naming (see Tuomiranta et al., 2011 for a review of the learning studies).

To summarise, although, to our knowledge, no learning studies comparing unfamiliar proper and common nouns have been carried out with people with aphasia, the often reported pattern of poorer retrieval of familiar proper nouns relative to common nouns in people with aphasia (for review, see, for example, Semenza, 2006) indicates that a similar pattern might be expected in learning as well. Thus, people with aphasia would be expected to perform more poorly than their age-matched controls on retrieval and learning of both proper and common novel nouns but, proper nouns may be more impaired than common nouns.

Research aim

The aim of this chapter is to contribute to the discussion on the relative difficulty of proper nouns (personal names) and common nouns by considering learning of novel words in people with aphasia. By pairing novel meanings with novel word forms we avoid the problem of matching proper and common noun stimuli on such statistical properties as frequency, familiarity, age of acquisition, and recency of use (see, for example, Valentine, Brédart, Lawson, & Ward, 1991; Brédart, 1993; Kay et al., 2001).

Using this novel word learning task, older participants in Romanova, Nickels, and Howard (2015) did not show poorer retrieval of novel proper noun items (names of individual creatures) in comparison to common noun items (names of species). In a word-picture verification task, however, they failed to reliably discriminate between depictions of same versus different individuals within a species in the crucial verification type that was designed to determine whether associations had been learned between word forms and their noun class (proper or common). In this study, we suggested that older adults had successfully learned whether the words applied to proper or common noun concepts but had failed to master the scope of the visual characteristics of the proper nouns. Although the older participants were not poorer in retrieving proper nouns in the naming task, it may be that the vulnerability of this noun class appears only when there is larger (than age-related) weakening in connections between the processing levels – for example, in people with aphasia (e.g., Semenza, 2006).

If proper nouns are processed via a separate more vulnerable mechanism (e.g., Burke et al., 1991; Burton & Bruce, 1992; Brédart, Valentine, Calder, & Gassi, 1995), we would predict a disproportionate deficit for learning and retrieval of novel proper nouns in the people with aphasia studied here. If, however, proper nouns are generally learned and retrieved more poorly than common nouns due to differences in statistical properties (e.g., frequency, age of acquisition) between proper and common nouns, we would predict people with aphasia to show an equal impairment for learning and retrieval of novel stimuli in our experiment. We would, however, expect people with aphasia to demonstrate similar visual discrimination abilities as compared to their age-matched controls. Therefore, they are also predicted to perform poorly on the word-picture verification type that was problematic for older adults.

Method

Participants

Two people with aphasia, native English speakers, were tested. Both were assessed with the Comprehensive Aphasia Test (CAT; Swinburn, Porter, & Howard, 2004) and Boston Naming Test (BNT; Kaplan, Goodglass, & Weintraub, 1983). See Table 1. One, JG, was a woman who was 12 years post-stroke, with good semantic processing and a mild word retrieval impairment (as revealed in CAT and BNT picture naming). The other, JF, was a man with a history of multiple cerebrovascular events (more than 3 months post-onset at the time of testing). JF's performance on semantic and word retrieval tasks was within the normal range on CAT and BNT (normative data taken from Nicholas, Brookshire, Maclennan, Schumacker, & Porrazzo, 1989). However, the neuropsychologist's report noted that JF had focal naming deficits that were most obvious for spices, plants, and famous people's names, and generally worse for living than non-living things, but that he did not have any impairment in general cognitive processing.

Table 1

Participants' Background Information and Raw Scores on Selected Tasks from CAT (Swinburn, et al., 2004), as well as BNT (Kaplan et al., 1983)

	JG	JF	*Max score (where relevant)*
Gender	female	male	
Age (in years)	64	70	
Previous Occupation	child-care worker	real estate agent	
Articulation	intact	intact	
CAT			
Semantic memory	10	10	*10*
Recognition memory	10	9	*10*
Spoken word comprehension	29	29	*30*
Written word comprehension	30	28	*30*
Word Fluency	**12***	16	
Repetition of words	32	**28***	*32*
Repetition of non-words	6	8	*10*
Naming objects	44	46	*48*
Boston Naming Test	**42***	52	60

Note. * below performance of non-brain-damaged individuals.

The data from JG and JF were compared with that of 12 native English-speaking age-matched control subjects. The age range of the control group was 55-74 years (*Mean* = 61.83, *Standard Deviation* = 5.44). These were the same people who comprised the older group in Romanova, Nickels, and Howard (2015).

Materials and Design

All the materials for the experiment, as well as the experimental procedure, were those described in Romanova, Nickels, and Howard (2015).

Analysis and Results

Picture verification and lexical decision tasks

Picture verification and lexical decision tasks were included into the study to assess whether participants could recognise verbal and pictorial stimuli learned throughout the experiment. We used modified t-tests (one-tailed; Crawford & Howell, 1998) to compared performance of the people with aphasia with that of the controls. Although both people with aphasia performed relatively well on most of the tasks, they performed significantly more poorly than the controls on the written lexical decision task (JG: 80 % correct, $t(11) = -4.14$, $p = .001$; JF: 89 % correct, $t(11) = -1.88$, $p = .044$) and JG also was worse on the auditory lexical decision (JG: 70 % correct, $t(11) = -3.40$, $p = .003$; JF: 83 % correct, $t(11) = -1.25$, $p = .118$). Both participants were not significantly different from the controls on the picture verification (JG: 83 % correct, $t(11) = -0.63$, $p = .271$; JF: 75 % correct, $t(11) = -1.54$, $p = .076$).

Additionally, to determine whether performance of JG and JF was above chance level, we evaluated their scores on all 3 tasks using signal-detection research methods (Macmillan & Creelman, 1991). The *d*-prime statistic was calculated on the basis of *z*-scores obtained from hit and false alarm rates on the task. The *d*-prime of zero signals the chance level, with an effective ceiling score being 4.65. Performance on all 3 tasks by both participants was shown to be above chance level: auditory lexical decision (JG: $d' = 0.80$, the only score that approached chance; JF: $d' = 2.31$), written lexical decision (JG: $d' = 1.99$; JF: $d' = 2.34$), and picture verification (JG: $d' = 2.12$; JF: $d' = 1.96$).

In sum, JG and JF showed clear abilities to learn the visual forms (at the level of age-matched controls). JF also learned the lexical forms (as evidenced by auditory lexical decision), but JG was impaired on learning of the lexical forms (both auditory and written lexical decision was impaired).

Experimental Tasks

We compared performance of the people with aphasia with the controls on the experimental tasks (picture naming and word-picture verification) using modified t-tests (one-tailed; Crawford & Howell, 1998). Revised standardized difference tests (RSDT, two-tailed; Crawford & Garthwaite, 2005) were used to compare the size of the difference in performance between common and proper in the people with aphasia relative to the controls. See Romanova, Nickels, and Howard (2015) for detailed analysis of the control group's performance.

Picture naming

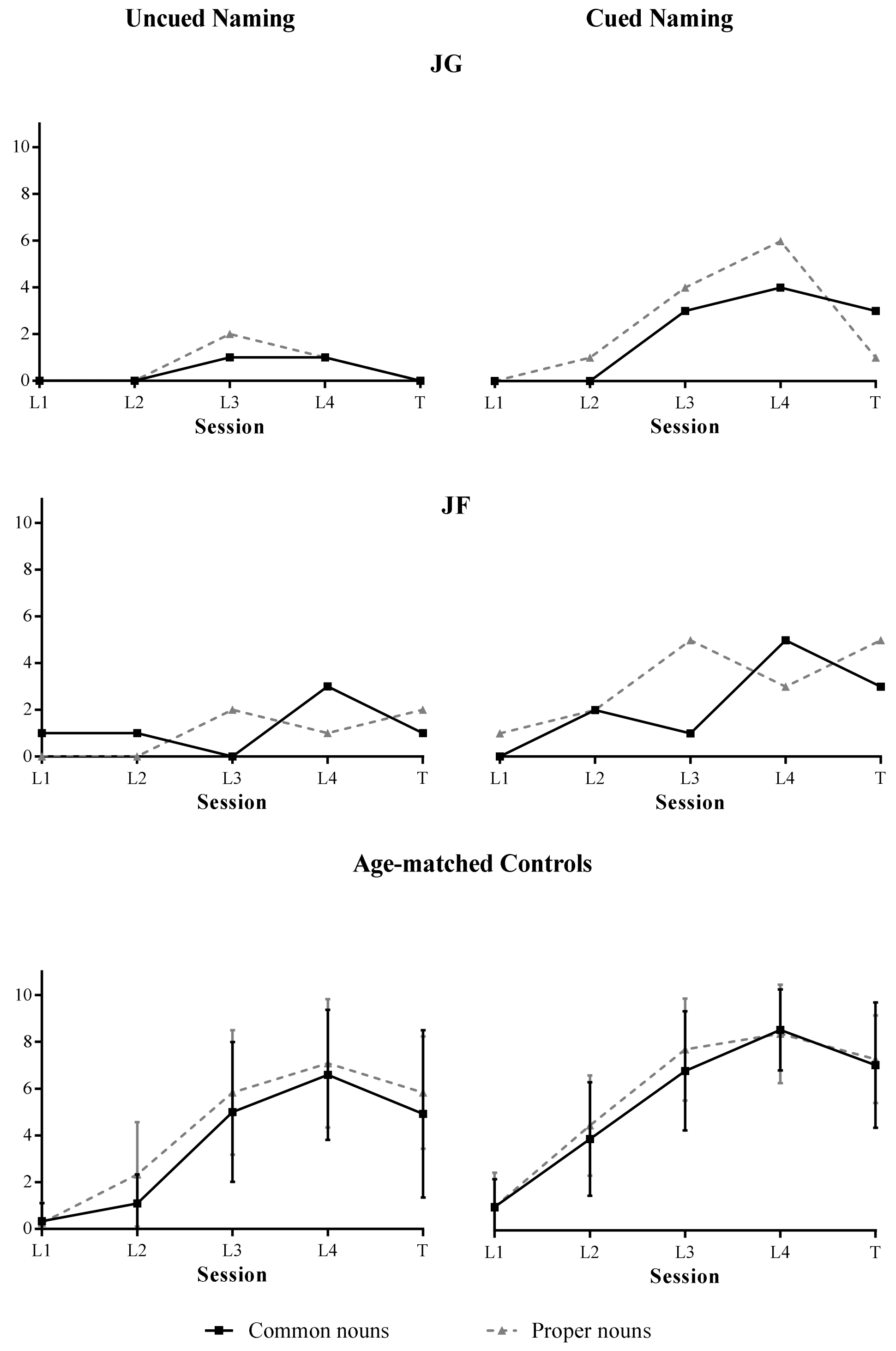

Figure 1. Uncued and cued naming accuracy.

Due to performance close to floor on the uncued condition in the picture naming task for the people with aphasia, statistical analysis comparing their performance in naming accuracy to that of the controls was performed on the cued naming data only (see Figure 1 for both uncued and cued naming accuracy). First, we evaluated whether JG and JF improved on common and proper nouns across the learning sessions by looking at the linear trend using Weighted Statistics (WEST-Trend) method (one-tailed; Howard, Best & Nickels, 2015). Both participants showed significant improvement on items from both noun classes across the learning stage (common: JG $t(9) = 2.42$, $p = .019$; JF $t(9) = 2.94$, $p = .008$; proper: JG $t(9) = 3.19$, $p = .005$; JF $t(9) = 1.96$, $p = .04$).

We then compared the *learning slopes* for both proper and common nouns across the learning stage with that of controls (i.e., how naming accuracy changed across sessions 1-4; see Table 2). Neither JG nor JF showed a significant difference compared to controls in the learning slope for proper nouns. However, JG's slope was significantly different from that of the controls for common nouns – she improved on common noun items less than the controls over the learning sessions. JF showed a trend to the same pattern. The age-matched controls showed a pattern where improvement (slope) over the learning phase was equal for proper and common nouns (see Romanova, Nickels, & Howard, 2015) and JF showed a pattern that was not significantly different (as measured by RSDT). However, JG came close to a significantly different pattern – reflecting a difference between proper and common noun learning compared to the controls - her learning was relatively poorer for common nouns.

We then compared naming accuracy of the people with aphasia relative to the age-matched controls across the four learning sessions (total number of items successfully retrieved summed across all learning sessions). Although, the only significant difference obtained was that JG named significantly fewer common nouns than the controls, all other comparisons were close to significant (p < .1) showing a trend for JG and JF to learn fewer items overall. However, RSDT showed no significant difference in the size of the decrement compared to controls for either participant. Hence, the people with aphasia tended to be worse than the controls, but did not show a difference in the size of the impairment for either common or proper.

Finally, we compared the people with aphasia and controls on their naming accuracy at the testing session (session 5). JF did not perform significantly differently from the controls (although common nouns were close to significantly poorer). However, JG's naming accuracy was significantly poorer than control's on proper nouns and close to significant for common nouns due to her large drop in accuracy at this testing session. Consequently, JG's performance on proper nouns was considerably lower than that on common nouns. This was reflected in RSDT results: JG showed a disproportionate deficit for proper nouns in comparison to the control participants.

Table 2

Comparison of Performance of the People with Aphasia on Proper and Common Nouns in the Naming Task

	Proper nouns			Common nouns			Proper vs. Common	
				Slope: Learning sessions				
Controls	*M* = 0.37 (*SD* = 0.12)			*M* = 0.36 (*SD* = 0.09)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(11)	*p (1-tailed)*		*t*(11)	*p (1-tailed)*	*t*(11)	*p (2-tailed)*
JG	0.46	0.72	.244	0.59	**2.43**	**.017***	2.20	.050+
JF	0.51	1.15	.138	0.50	1.48	.084+	0.43	.674
				Accuracy: Learning sessions				
Controls	*M* = 21.67 (*SD* = 6.71)			*M* = 20.33 (*SD* = 6.73)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(7)	*p*		*t*(7)	*p*	*t*(7)	*p*
JG	11	-1.53	.077+	7	**-1.90**	**.042***	0.52	.611
JF	11	-1.53	.077+	8	-1.76	.053+	0.32	.752
				Accuracy: Testing session				
Controls	*M* = 7.33 (*SD* = 1.87)			*M* = 7.08 (*SD* = 2.68)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(7)	*p*		*t*(7)	*p*	*t*(7)	*p*
JG	1	**-3.25**	**.004***	3	-1.47	.086+	**2.59**	**.025***
JF	5	-1.20	.128	3	-1.47	.086+	0.40	.698

Word-picture verification

Both participants' scores were above chance on the word-picture verification task (JG: *d'* = 0.99; JF: *d'* = 0.88). In analysis, we repeated the procedure reported for naming. We first compared the learning slopes for the learning sessions, followed by accuracy across the learning sessions and, finally, accuracy at the testing session (see Figure 2 and Table 3).

Both JG and JF showed evidence of learning across the sessions. Their performance was not statistically different from that of their age-matched controls on any of the analyses of learning slopes (for the learning sessions) or of accuracy combined across the learning sessions. At the testing stage, for JF, performance on common nouns dropped and was lower than that of the controls (the difference was close to significance). Due to this drop, he showed a disproportionate deficit for common nouns relative to controls who tended to perform slightly better on common nouns in the verification task. While JG was not significantly different from controls in the learning stage, at the testing stage of the experiment she differed from the controls on proper nouns: She did not retain the level of accuracy attained during the learning sessions and her performance dropped. However, her overall pattern was not significantly different to the controls.

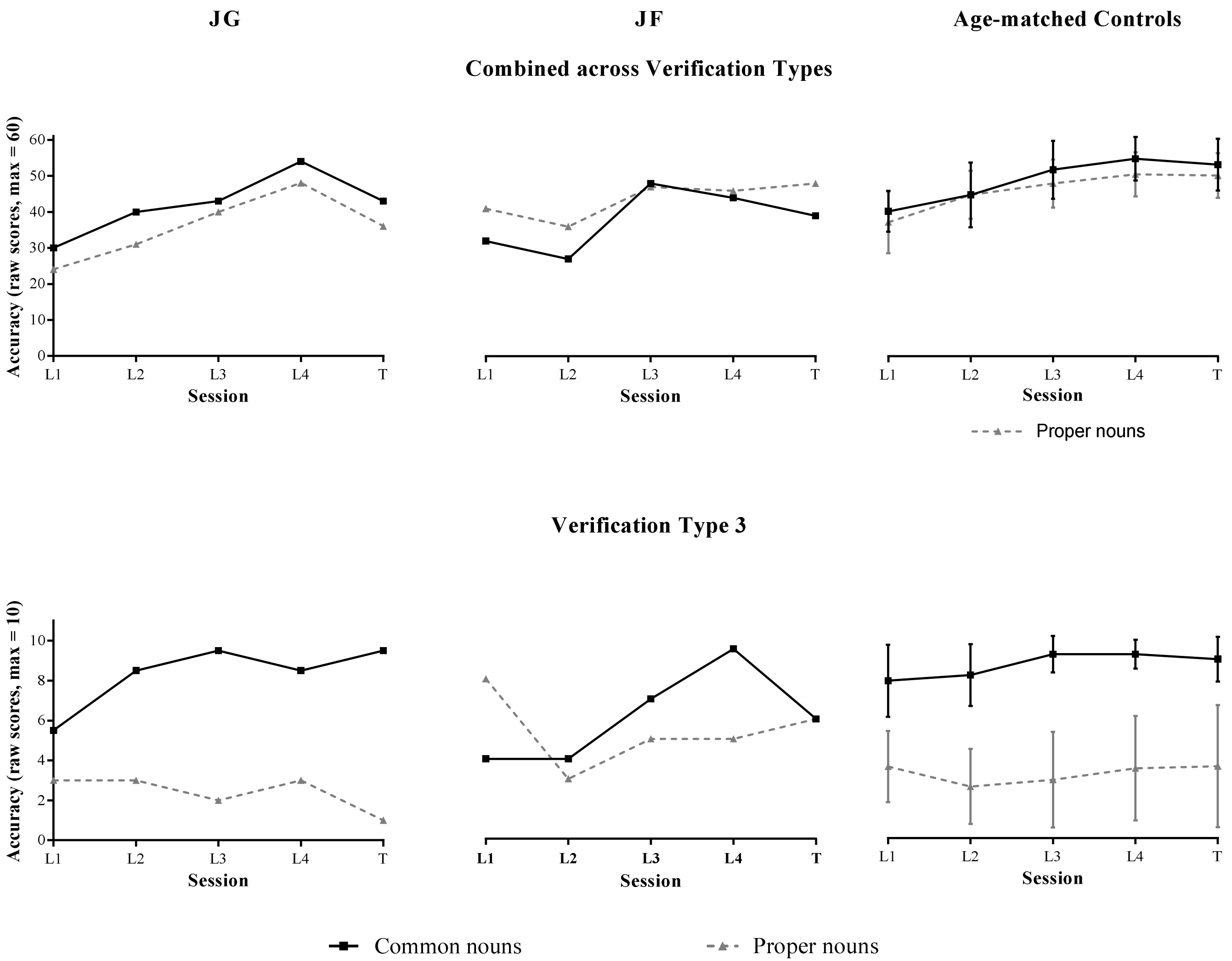

Figure 2. Accuracy on the word-picture verification task.

Table 3

Comparison of Performance of the People with Aphasia on Common and Proper Nouns in the Word-Picture Verification Task (Combined across Verification Types)

	Proper nouns			Common nouns			Proper vs. Common	
				Slope: Learning sessions				
Controls	*M* = 0.17 (*SD* = 0.06)			*M* = 0.17 (*SD* = 0.06)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(11)	*p*		*t*(11)	*p*	*t*(11)	*p*
JG	0.12	-0.73	.239	0.13	-0.79	.222	0.04	.971
JF	0.17	-0.04	.483	0.10	-1.32	.108	0.82	.431
				Accuracy: Learning sessions				
Controls	*M* = 174.17 (*SD* = 23.78)			*M* = 188.50 (*SD* = 25.09)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(7)	*p*		*t*(7)	*p*	*t*(7)	*p*
JG	143	-1.26	.117	167	-0.82	.214	0.64	.534
JF	170	-0.17	.435	151	-1.44	.089^{+}	1.85	.091^{+}
				Accuracy: Testing session				
Controls	*M* = 49.33 (*SD* = 6.12)			*M* = 52.67 (*SD* = 7.33)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(7)	*p*		*t*(7)	*p*	*t*(7)	*p*
JG	36	**-2.09**	**.030***	43	-1.27	.116	1.45	.176
JF	48	-0.21	.419	39	-1.79	.050^{+}	**2.73**	**.019***

We also looked at how the people with aphasia performed in comparison to the age-matched controls on the crucial verification condition: Type 3. This was the experimental condition where accurate performance would indicate that participants had learned items as proper and common nouns (see Romanova, Nickels, & Howard, 2015 for details). Participants saw an untrained exemplar of the same species as the trained common/proper noun item paired with the name of a target species (common) or individual (proper). In the common noun condition, they should accept the exemplar as correct (as it was another untrained member of the target species). In the proper noun condition, on the other hand, the correct response would be to reject the exemplar (as the individual presented was different from the target individual, although of the same species). It is important to bear in mind that, as a group, the age-matched controls performed poorly on this task for proper noun items.

As in the previous analyses, we explored the learning slopes (for learning sessions), as well as accuracy combined across the learning sessions and accuracy at the testing session (see Figure 2 and Table 4). JG's performance was not statistically different from that of the control group on any of the three comparisons for Type 3 verification judgements – like the controls there was no evidence that she had learned proper nouns as proper nouns. JF, however, performed more poorly than controls on common noun items for both accuracy combined across the learning sessions and accuracy at the testing session.

Table 4

Comparison of Performance of the People with Aphasia on Common and Proper Nouns in the Word-Picture Verification Task (Type 3)

	Proper nouns			Common nouns			Proper vs. Common	
				Slope: Learning sessions				
Controls	*M* = -0.15 (*SD* = 0.73)			*M* = 0.66 (*SD* = 0.74)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(11)	*p*		*t*(11)	*p*	*t*(11)	*p*
JG	-0.67	-0.68	.255	0.56	-0.13	.450	0.32	.757
JF	-0.27	-0.16	.437	0.46	-0.25	.403	0.05	.960
				Accuracy: Learning sessions				
Controls	*M* = 12.58 (*SD* = 6.52)			*M* = 34.46 (*SD* = 4.12)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(7)	*p*		*t*(7)	*p*	*t*(7)	*p*
JG	11	-0.23	.410	32	-0.57	.289	0.28	.783
JF	21	1.24	.120	24.5	**-2.32**	**.020***	**2.92**	**.014***
				Accuracy: Testing session				
Controls	*M* = 3.83 (*SD* = 2.95)			*M* = 8.96 (*SD* = 1.12)				
	Score	Comparison with controls		Score	Comparison with controls		RSDT	
		t(7)	*p*		*t*(7)	*p*	*t*(7)	*p*
JG	1	-0.92	.188	9.5	0.47	.325	1.30	.221
JF	6	0.71	.247	6	**-2.54**	**.014***	**3.00**	**.012***

Discussion

This study examined learning and retrieval of novel proper and common nouns in two people with aphasia (JG and JF) and compared it to that of a group of age-matched controls. Performance of the age-matched control group on the same set of novel proper and common nouns had been investigated in Romanova, Nickels, and Howard (2015; the group of older adults) but we will briefly review their performance here.

Age-matched controls

Here we compared the performance of people with aphasia to the control cued naming. In this condition the controls showed results consistent with one-session learning experiments that used novel items (e.g., Cohen, 1990; Milders, 1998): The older adults performed comparably on proper and common noun items. However, in the uncued naming condition, the older adults did not show inferiority of proper nouns in retrieval. Indeed, proper nouns were recalled more successfully than common nouns Romanova, Nickels, and Howard (2015). However, the older participants found it much harder to learn items as proper nouns: They failed to reject stimuli in a verification task when the name of an individual was paired with a picture of another individual within this species (a Type 3 'no' response trial). Poor performance on proper nouns in the verification Type 3 indicated that the older participants either failed to learn adequate meaningful associations between pictures and proper noun labels, or learned associations and formed adequate lexical representations but were unable to specify the boundaries between visual representations between individuals within a species. This was in contrast to younger participants in Romanova, Nickels, and Renvall (2015) who showed clear learning in this discrimination over the course of the study. Overall, in learning, but not in retrieval, proper nouns seemed to be more demanding than common noun, especially in tasks involving fine visual discrimination (such as the Type 3 verification).

It has to be also noted that when comparing the data from the older participants with the data of JG and JF, there was very high variability within the older group (see graphs with performance of individual participants on naming and verification in Romanova, Nickels, & Howard, 2015). Indeed, both the picture naming and word-picture verification tasks showed that while some older participants (e.g., EH, PW) received high scores in naming for both noun classes and demonstrated good learning in verification (including Type 3), others (e.g., SG, JE), did poorly on naming and verification (with lack of learning for proper nouns in Type 3).

People with aphasia

JG's accuracy in naming and verification for proper nouns was comparable with that of the control group. However, her performance in both tasks dropped for proper nouns at the testing session more than that of controls. She also showed significantly poorer naming performance for common nouns, with slower learning and less accurate recall than the controls. However, JG only showed a disproportionate difference compared to the controls in naming at the testing point after one week where proper nouns were relatively more impaired.

JF's performance on proper noun items did not significantly differ from that of the control group on any task or measure. However, common nouns were close to significantly different on the majority of measures, he could not retain learning effects for common nouns in the word-picture verification task and thus, demonstrated a disproportionate deficit for common nouns at the testing session relative to controls.

Overall, common nouns presented a bigger challenge for the people with aphasia than proper nouns, which was demonstrated both in retrieval and learning. Thus, JG and JF's performance in cued naming, like the controls performance in uncued naming, was better for items with more homogeneous visual representations (proper nouns as names of individuals),

For JG, proper nouns were also found harder to retain in the naming task than common nouns. The latter is interesting finding and may suggest that the recency of use (e.g., Burke et al., 1991) affects proper nouns to a larger extent in retrieval. Proper nouns have been suggested to have a vulnerable link between the proper noun token and its lexical form (due to only a single connection, less priming is transmitted through through to the lexical form relative to common nouns). Possibly, for people with aphasia, whose connections between the processing levels are weakened (e.g., Dell et al., 1997) this vulnerable link combined with low recency of use, renders a disproportionate impairment in naming for proper nouns. Of course, this speculative account needs, as a minimum, support from replication of this pattern (which was not evident in JF).

This study suffers from a number of limitations of the data which restrict the extent to which we can draw strong conclusions or generalisations from the verification task. First, JG and JF's performance on the verification task was close to chance. Second, the variability within the control data (particularly, for the verification Type 3) undermines the reliability of the claim that JG and JG did not show any disproportionate deficit for proper nouns. The reasons for such a high rate of variability in older adults are yet unclear. Although we did not have extensive cognitive testing, scores on verification Type 3 task correlated with naming rates across common and proper nouns at a level approaching significance, whereas digit span demonstrated that the performance on verbal memory was within the norm and had no significant correlation with verification Type 3 accuracy. Thus, it is possible that older people's ability to learn a novel item as a proper noun depends on how successful they are in retrieval of those items, and how well they learned the word forms. As JG and JF's performance in naming was lower than that of the controls on both noun classes, their poor performance on the verification task, and Type 3, in particular, is not surprising.

These claims also relate to research on child language acquisition (e.g., Hall, 2008) showing that children to do not learn words as proper nouns unless the common noun for the type of item has been already established. Therefore, it is possible that participants in our study (both older adults and people with aphasia) would benefit from more training on common noun items to be able to make correct judgements for proper nouns in the verification Type 3 in particular. Hence, it would be interesting to compare the results of our experiment with one where target individuals (proper nouns) are from target species (common nouns).

To summarise, in line with previous learning studies with people with aphasia (Gupta et al., 2006; Kelly & Armstrong, 2009; Tuomiranta et al., 2011; Wang et al., 2012), our study demonstrated that people with aphasia were able to learn associations between novel meanings and their labels to some extent, and also retained some of the learned associations one week after training. The study did not provide evidence for proper nouns being particularly susceptible to impairment in novel word learning in aphasia, when statistical properties of items from the two noun classes are controlled for. However, one has to be cautious interpreting the results as high levels of variability within the control group, as well as the failure to demonstrate that both controls and people with aphasia had learned associations between proper noun semantics and proper noun items may have masked real patterns.

References

Brédart, S. (1993). Retrieval failures in face naming. *Memory, 1,* 351-366.

Brédart, S., Valentine, T., Calder, A., & Gassi, L. (1995). An interactive activation model of face naming. *Quarterly Journal of Experimental Psychology*, *48A*, 466–486.

Bruce, V., & Young, A. W. (1986). Understanding face recognition. *British Journal of Psychology*, *77*, 305-327.

Burke, D. M., MacKay, D. G., Worthley, J. S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language*, *30*, 542-579.

Burton, A. M., & Bruce, V. (1992). I recognise your face but I can't remember your name: A simple explanation? *British Journal of Psychology, 83*, 45–60.

Caramazza, A., Costa, A., Miozzo, M., & Bi, Y. (2001). The specific-word frequency effect: Implications for the representation of homophones in speech production. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *27*, 1430–1450.

Cipolotti, L., McNeil, J. E., & Warrington, E. K. (1993). Spared written naming of proper nouns: A case report. *Memory, 1*, 289-311.

Cohen, G. (1990) Why is it difficult to put names to faces? *British Journal of Psychology*, *81*, 297-297.

Cohen, L., Bolgert, F., Timsit, S., & Chermann J. F. (1994). Anomia for proper names after left thalamic infarct. *Journal of Neurology, Neurosurgery and Psychiatry*, *57*, 1283–1284.

Cohen, G., & Burke, D. M. (1993). Memory for proper names: A review. *Memory, 1,* 249-263.

Crawford, J. R., & Garthwaite, P. H. (2005). Testing for suspected impairments and dissociations in single-case studies in neuropsychology: Evaluation of alternatives using Monte Carlo simulations and revised tests for dissociations. *Neuropsychology*, *19*, 318-331.

Crawford, J. R., & Howell, D. C. (1998). Comparing an individual's test score against norms derived from small samples. *The Clinical Neuropsychologist*, *12*, 482-486.

Dell, G. S., Schwartz, M. F., Martin, N., Saffran, E. M., & Gagnon, D. A. (1997). Lexical access in aphasic and nonaphasic speakers. *Psychological Review*, *104*, 801-838.

Fery, P., Vincent, E., & Brédart, S. (1995). Personal name anomia: A single case study. *Cortex*, *31*, 191-198.

Gupta, P., Martin, N., Abbs, B., Schwartz, M., & Lipinski, J. (2006). New word learning in aphasic patients: Dissociating phonological and semantic components. *Brain and Language*, *99*, 218-219.

Hall, D. G. (2008). Acquiring proper nouns for familiar and unfamiliar animate objects: Two-year-olds' word-learning biases. *Child Development*, *62*, 1142-1154.

Harris, D.M., & Kay, J. (1995). Selective impairment of the retrieval of people's names: A case of category specificity. *Cortex*, *31*, 575-582.

Hittmair-Delazer, M., Denes, G., Semenza, C., & Mantovan, M.C. (1994). Anomia for people's names. *Neuropsychologia*, *86*, 345-358.

Howard, D., Best, W., & Nickels, L. (2014). Optimising the design of intervention studies: Critiques and ways forward. *Aphasiology*. Advance online publication. doi:10.1080/02687038.2014.985884

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). *Boston Naming Test*. Philadelphia: Lea & Febiger.

Kay J., Hanley, J. R., & Miles, R. (2001). Exploring the relationship between proper name anomia and spoken word retrieval: A single case study. *Cortex, 37*, 501-517.

Kelly, H., & Armstrong, L. (2009). New word learning in people with aphasia. *Aphasiology*, *13*, 1398-1417.

Lucchelli, F., & De Renzi, E. (1992). Proper name anomia. *Cortex*, *28*, 221-230.

Lyons, F., Hanley, J. R., & Kay, J. (2002). Anomia for common names and geographical names with preserved retrieval of names of people: A semantic memory disorder. Cortex, *38*, 23-35.

MacKay, D. G., & Burke, D. M. (1990). Cognition and aging: A theory of new learning and the use of old connections. In T. Hess (Ed.), *Aging and cognition: Knowledge organization and utilization* (pp. 213-263). Amsterdam: North Holland.

Macmillan, N. A., & Creelman, C. D. (1991). *Signal detection theory: A user's guide.* New York, NY: Cambridge University Press.

Martins, I. P., & Farrajota, L. (2007). Proper and common names: a double dissociation. *Neuropsychologia*, *45*, 1744-1756.

McKenna, P., & Warrington, E. K. (1980). Testing for nominal dysphasia. *Journal of Neurology, Neurosurgery, and Psychiatry, 43*, 781-788.

McWeeny, K. H., Young, A. W., Hay, D. C., & Ellis, A. W. (1987). Putting names to faces. *British Journal of Psychology*, *78*, 143-149.

Milders, M. (1998). Learning people's names following severe closed-head injury. *Journal of Clinical and Experimental Neuropsychology*, *20*, 237-244.

Nicholas, L. E., Brookshire, R. H., Maclennan, D. L., Schumacher, J. G., & Porrazzo, S. A. (1989). Revised administration and scoring procedures for the Boston Naming test and norms for non-brain-damaged adults. *Aphasiology*, *3*, 569-580.

Otsuka, Y., Suzuki, K., Fujii, T., Miura, R., Endo, K., Kondo, H., & Yamadori, A. (2005). Proper name anomia after left temporal subcortical haemorrhage. *Cortex*, *41*, 39-47.

Richardson, J. T. E. (1990). *Clinical and neuropsychological aspects of closed-head injury*. London: Taylor & Francis.

Romanova, A., Nickels, L., & Renvall, K. (2015). Investigating differences in learning of novel proper and common nouns in young adults. *Manuscript in preparation*.

Romanova, A., Nickels, L., & Howard, D. (2015). Effects of ageing on the learning of novel proper and common nouns. *Manuscript in preparation*.

Semenza, C. (2006). Retrieval pathways for common and proper names. *Cortex, 42*, 884–891.

Semenza, C. (2009). The neuropsychology of proper names. *Mind and Language, 24,* 347–369.

Semenza, C., & Sgaramella, T.M. (1993). Production of proper names: a clinical case study of the effects of phonemic cueing. *Memory, 1*, 265-280.

Semenza, C., & Zettin, M. (1988). Generating proper names: a case of selective inability. *Cognitive Neuropsychology, 5,* 711-721.

Semenza, C., & Zettin, M. (1989). Evidence from aphasia for proper names as pure referring expressions. *Nature*, *342,* 678–679.

Stanhope, N., & Cohen, G. (1993). Retrieval of proper names: Testing the models. *British Journal of Psychology*, *84*, 51-65.

Swinburn, K., Porter, G., & Howard, D. (2004). *The Comprehensive Aphasia Test*. Hove: Psychology Press.

Terry, W.S. (1994). On the relative difficulty in recalling names and occupations. *The American Journal of Psychology*, *107*, 85-94.

Tuomiranta, L., Groenholm-Nyman, P., Kohen, F., Rautakoski, P., Laine, M., & Martin, N. (2011). Learning and maintaining new vocabulary in persons with aphasia: Two controlled case studies. *Aphasiology*, *29*, 1030-1052.

Valentine, T., Brédart, S., Lawson, R., & Ward, G. (1991). What's in a name? Access to information from people's names. *European Journal of Cognitive Psychology*, *3*, 147-176.

Van Zomeren, A. H., & Saan, R. J. (1990). Psychological and social sequelae of severe head injury. In R. Braakman (Ed.), *Handbook of clinical neurology* (Vol. 13, pp. 397-420). Amsterdam: Elsevier Science Publishers.

Wang, N., Howard, D., & Morris, J. (2012). Learning in people with aphasia: The impact of linguistic load and memory. [Abstract]. *Stem-*, *Spraak- en Taalpathologie*, *17*, 114-146.

Chapter Five

Category Fluency Tasks as a Method for Investigating Common and Proper Noun Retrieval

Abstract

This paper investigates performance of people with aphasia and their age-matched controls on production of words from a broad range of common and proper noun categories. We used category fluency tasks to avoid the methodological problem of matching proper and common noun stimuli on their statistical properties (e.g., frequency). In this task, which reduced the potential effects of statistical properties on word retrieval, contrary to what has been reported in the literature for picture naming of familiar people, proper nouns were not found harder to retrieve than common noun in non-brain-damaged controls. Moreover, people with aphasia did not show any disproportionate deficit in proper nouns compared to the controls nor did they show selective deficits for any of the proper noun categories. Hence, the results of this study suggest that different nature of proper and common noun classes (e.g., number of referents associated with the word, strength of connections within the semantic network) does not make retrieval of proper nouns more difficult, and, consequently, differences in statistical properties (e.g., lower frequency of proper nouns relative to common nouns) are likely to be the major cause for poorer proper noun retrieval prevalent in the literature.

Introduction

Everybody can relate to the situation when they meet someone they have seen once or twice before, and struggle to remember this person's name, while such information as where, and when they last met, what this person does, etc. instantly comes to mind. The quest to discover why these situations occur – why we often find proper nouns (names of individual people, places, brands, etc.) harder to recall than common nouns (names of types of objects or beings) has given rise to a great deal of research using several different methodologies and several explanatory theories. This paper focuses on the difficulties the researcher encounters when investigating common and proper noun processing and the limitations of the different methodologies. We suggest that category fluency tasks can help overcome some of these difficulties and present a study of common and proper noun processing in unimpaired adults and people with aphasia using category fluency. We first provide an overview of the relevant issues. Although the intricacies of the theoretical debate on differences between common and proper nouns are beyond the scope of this paper, we will briefly outline some important claims that are particularly relevant for the current study before moving on to methodological concerns.

Kay, Hanley, and Miles (2001) point out that explanations of why proper nouns have been found more vulnerable in word retrieval are of two types. The first type focuses on differences in so-called logical properties of common and proper nouns, while the second appeals to their distinct statistical, or distributional, properties. Under the *logical properties account*, the basic distinction between common and proper nouns is that common nouns have multiple referents while most proper nouns have one unique referent, and this distinction is reflected in how these two noun classes are processed in word production. Namely, while common noun word forms receive the sum of activation from an elaborated network of semantic attributes, word forms of proper nouns receive activation from the unique connection from a single token marker (e.g., Semenza & Zettin, 1988; Node Structure Theory; Burke, Mackay, Worthley, & Wade, 1991; Interactive Activation and Competition Model: Brédart, Valentine, Calder, & Gassi, 1995). The alternative view has been labelled the *statistical properties account* (Kay et al., 2001): The same mechanisms are responsible for processing of common and proper nouns but there is a continuum of word retrieval difficulty and retrieval success of a word (irrespective of whether it is a common or a proper noun) depends on where on this continuum this word is placed. The statistical properties that are well established as influencing word retrieval include frequency, familiarity, and age of acquisition. For example, Burke et al. (1991) suggest that connections between nodes within the speech production system become stronger the more frequently they are used. As proper nouns are of lower frequency and familiarity than common nouns this is hypothesised to be one of the major reasons why they are hard to retrieve. There is also empirical evidence that suggests that items that are acquired later in life are harder to name than those acquired earlier (e.g., Hodgson & Ellis, 1998). As common nouns tend to be acquired early in life (with relatively few new items added to our vocabulary later), while proper nouns tend to be learned throughout the lifespan, consequently proper nouns may be more susceptible to word retrieval failures. Consistent with this account, Saetti, Marangolo, Renzi, Rinaldi, and Lattanizi (1999) described anomic people with aphasia who struggled more with retrieving the names of contemporary celebrities than historical figures.

Researchers have used different methodologies in order to explore differences in common and proper noun retrieval and processing mechanisms. These have included self-rating questionnaires (e.g., Rabbitt, Maylor, McInnes, Bent, & Moore, 1995), diary studies (e.g., Burke et al., 1991; Reason & Lucas, 1984), and experiments examining retrieval (e.g., Burke et al., 1991; Evrard, 2002; James, 2006; Maylor, 1995; McKenna & Warrington, 1980; Rendel, Castel, & Craik, 2005) and learning (e.g., Cohen, 1990; Cohen & Faulkner, 1986; James, 2004;

McWeeny, Young, Hay, & Ellis, 1987; Rendel et al., 2005; Stanhope & Cohen, 1993; Terry, 1994;) of familiar and unfamiliar common and proper nouns conducted with groups of young and elderly adults. The converging evidence from these tasks has led to a consensus that proper nouns are harder to retrieve and learn than common nouns for the majority of younger adult participants. Moreover, elderly adults demonstrate disproportionate impairments in retrieval and learning of proper nouns in comparison to common nouns relative to younger participants (e.g., James, 2004). The majority of these studies use accounts based on the differences in logical properties to explain the differential retrieval patterns for common and proper nouns.

However, we would like to suggest that some of these methodologies may have inherent flaws for inferences about differences in processing of the two noun classes. The main and most evident difficulty, which is almost impossible to circumvent, is the issue of matching common and proper nouns for psycholinguistic variables, and for frequency in particular. Although any frequency counts are just an approximation of the real frequency of lexical items for a particular person, they are likely to be even less accurate for proper nouns: Proper noun frequencies are highly individual as they are dependent on person’s preferences, interests, sources of information, geographical location, etc. and can be highly variable over time as, for example, the popularity of a famous person varies immensely with time. Valentine, Brédart, Lawson, and Ward (1991) suggested that the true frequency of a person’s name is a composite of its frequency (how many people with this name that the respondent knows) and familiarity counts (how familiar known people with this name are to the respondent). In addition, Hollis and Valentine (2001) note that some proper nouns are lexical compounds (such as Colin Firth, Eiffel Tower, etc.). Therefore, frequency of these items should be a compound of individual frequencies of its members. Many studies do not attempt such matching, however, even when they do, for the reasons noted above, matching based on frequency counts may not result in sets that are truly of comparable frequency for all (or any) of the participants (e.g., Brédart, 1993; Kay et al., 2001). Thus, it is impossible to state with absolute certainty that differences obtained for common versus proper nouns in the literature are not due to the lower frequency of proper nouns. In addition, recency of use has also been shown to affect the prevalence of lexical retrieval blocks (Burke et al., 1991), a factor which, once again, may be more of a confound for proper nouns than common nouns. Burke et al., for example, note that elderly participants had most problems with names of acquaintances that were highly familiar to them but whom they had not seen for a very long time.

Apart from these general concerns that are an issue for many of the methods that are traditionally used to study production of common and proper nouns, there are also specific design-related concerns. Below we briefly consider some of these.

Self-rated questionnaires have been used to support the hypothesis of a disproportionate impairment for proper nouns for elderly participants (e.g., Cohen & Faulkner, 1984). Maylor (1997) reviews the literature and suggests that there is evidence that elderly people (Rabbitt et al., 1995) had a significantly larger problem with forgetting people's names than young participants (Matthews, Coyle, & Craig, 1990), based on self-ratings in the Cognitive Failures Questionnaire (Broadbent, Cooper, FitzGerald, & Parkes, 1982). However, arguably, self-rating questionnaires are the least objective tool to evaluate one's abilities, and, in our case, relative difficulties in common versus proper noun production. In particular, Rabbitt et al. (1995) noted that people in general tend to not recognise all their mistakes and base judgements about their own accuracy in a task on those errors that come to their attention which are only a subset of the much larger number of errors that actually take place. As, unlike common nouns, proper nouns do not usually have synonyms or equivalent alternatives and, hence, failure to retrieve them will be more salient for the individual. Moreover, Rabbitt et al. (1995) argue that due to reduced speed of processing and, thus, weaker capacities to monitor their performance adequately, the mismatch between reported and actual errors is especially evident in older adults.

Data from *diary studies*, where participants are asked to record any retrieval blocks they have during a period of several days/weeks, have also indicated that proper nouns tend to predominate over common nouns (e.g., Burke et al., 1991; Reason & Lucas, 1984). Once again, however, these studies could suffer from the same problems of monitoring and awareness noted above for self-ratings. In addition, in diary studies, the experimenter cannot control either the characteristics of the target words or the number of attempts made to retrieve words from different noun classes: Participants may need to recall a name of their acquaintance many more times than names of objects of equally low-frequency, and hence, the same rate of retrieval failure would lead to more diary entries for the proper nouns.

Another factor that could lead to seemingly more retrieval blocks for proper nouns in diary studies is the fact that, as noted above, common nouns often have synonyms or alternative names and, thus, retrieval blocks may stay unnoticed. Proper nouns, on the other hand, normally lack name variations and, consequently, inability to recall a name is perceived as more dramatic. For example, failure to remember that your colleague's name is *Claire* is far more recognisable and potentially embarrassing than a block on the word *'chair'* as you could easily replace the latter with *'seat'*. Overall, the lack of experimental control in diary studies leads to the need for caution regarding the strength of evidence they provide regarding the relative frequency of occurence of retrieval blocks for common and proper nouns.

Picture naming (e.g., Evrard, 2002; James, 2006; Maylor, 1995; McKenna & Warrington, 1980; Rendel et al., 2005) and *naming to definition* (e.g., Burke et al., 1991) tasks have also been used to assess semantic memory and retrieval for common and proper nouns.

They too have found poorer retrieval for *familiar* proper nouns relative to common nouns. Although such experiments are much more controlled in comparison to questionnaires and diary studies, they, nevertheless, are not immune from methodological problems. Specifically, in picture naming experiments in particular, items are traditionally matched, not only for frequency (see above) but also for visual complexity and name agreement across the conditions. Unfortunately, it is very hard, if not impossible to match common and proper nouns on these variables (e.g., Semenza, 2009). Indeed, pictures of objects and faces are, inevitably, of different perceptual difficulty. Another related and non-trivial problem is generating adequate depictions of some proper nouns such as geographical items, such as countries and cities.

Finally, memory for common and proper nouns has been tested in *learning experiments* (e.g., Cohen, 1990; Cohen & Faulkner, 1986; James, 2004; McWeeny et al., 1987; Rendel et al., 2005; Stanhope & Cohen, 1993; Terry, 1994) where participants were usually asked to learn unfamiliar faces paired with unfamiliar names (names mostly not previously associated with a concrete individual) and, more rarely, also learn places (proper nouns) and biographical information (common nouns) associated with these people. In general, names were recalled less successfully than occupations and places, even when word forms for personal names and occupations were identical (e.g., *Mr Baker* versus *a baker*). These results have usually been explained by the fact that the novel personal names lack semantic associations that would feed into the activation of their phonological form, whereas phonological forms of common nouns (and possibly place names) receive summed priming from a whole network of their semantic attributes (e.g., Burke et al., 1991). However, the experimental design of such learning studies does not allow one to fully support or refute this account: According to serial speech production models, activation of the semantic features related to a target word precedes activation of its phonological form (e.g., Butterworth, 1989; Levelt, 1989). Thus, lexicalisation and production of the referent's semantic features (e.g. occupation, nationality) could precede lexicalisation and production of the referent's name. For example, when given a picture of the actor Colin Firth, we would first activate the semantic information about him (e.g., occupation), and hence, likely struggle less with recalling and verbalising his occupation than his name. Critically, however, we would expect a similar pattern if asked to name a picture of, for example, a periscope: We would activate our knowledge of the semantics of the object and hence immediately be able to say that it is some kind of tool, but may hesitate in mapping this semantic information onto its name. Hence, traditional speech production models could easily account for the phenomenon of unfamiliar proper nouns being more difficult to learn and retrieve than common nouns related to those proper nouns.

Moreover, research has demonstrated that words with richer semantic representations (words with more semantic features) evoke better performance in reading tasks (reading aloud, lexical decision; e.g., Pexman, Lupker, & Hino, 2002). In the experiments discussed above, unfamiliar names by definition would have fewer semantic associations than familiar words that refer to biographical information about the referents. For example, in a particular sentence "Mr Baker is a baker"[7], all we know about Mr Baker is that his occupation is baking. Meanwhile, our knowledge about who a baker is much broader ("gets up early", "bakes bread", "kneads dough", etc.). Consequently, the semantic network for the word 'baker' would be a priori richer than for the unfamiliar 'Mr Baker'. Hence, common nouns had, due to the task design, richer semantic networks associated with them and, thus, could be easier to retrieve. Hence, due to these factors, learning tasks using the design discussed above are not able to contribute unequivocal data to the debate regarding differential processing mechanisms for common and proper nouns and different nature of structure/links related to the semantic network associated

[7] A sentence that would never be in an experiment because common and proper nouns with identical word forms would be counterbalanced across participants.

with words from these two noun classes (but see Romanova, Nickels, and Howard (2015) and Romanova, Nickels, and Renvall (2015) for a learning design which aims to overcome these problems).

To summarise, due to the nature of proper nouns and their referents, problems arise when one wishes to match common and proper nouns on classical experimental variables. As a consequence, and due to other concerns with some of the experimental methodologies, it is exceptionally hard to make clear inferences about common versus proper noun processing based on many of the experimental designs.

Another source of data contributing to the discussion of common and proper noun processing comes from cases of people with aphasia with relatively preserved ability to recall common nouns but impaired retrieval of proper nouns (e.g., Cohen, Bolgert, Timsit, & Cherman, 1994; Fery, Vincent, & Brédart, 1995; Harris & Kay, 1995; Hittmair-Delazer, Denes, Semenza, Mantovan, 1994; Lucchelli & De Renzi, 1992; Martins & Farrajota, 2007; McKenna & Warrington, 1980; Otsuka et al., 2005; Semenza & Zettin, 1988, 1989), as well as more rare cases with the opposite pattern of relatively spared proper nouns and impaired common nouns (e.g., Martins & Farrajota, 2007; Semenza & Sgaramella, 1993). Methodologies used in the assessment of the word retrieval abilities of people with these selective deficits, have generally focused on picture naming, naming to definition, and category fluency tasks. In the latter, participants are asked to generate as many exemplars within a particular category (e.g., countries, animals) as they can within a 1-2-minute timeframe. Performance on category fluency tasks is argued to depend on the accessibility of category members. Thus, the task assesses lexical and semantic processing of the category in question (e.g., Diaz, Sailor, Cheung, & Kuslansky, 2004).

This paper focuses on category fluency tasks as we believe they can overcome some of the problems of other methodologies, and picture naming tasks in particular. For example, we suggest that by using a category fluency task, the problem of controlling for stimulus visual complexity and image agreement that are required for picture naming tasks can be avoided. We also argue that the confound of frequency (as well as familiarity, age-of-acquisition, and recency of use) on retrieval scores can be reduced: In a picture naming task, participants are restricted in their retrieval to requested items. Although fluency tasks do not fully eliminate the problem (names of vegetables, for example, can still be more frequent than names of famous people in somebody's lexicon), they allow participants more degrees of freedom in their choice of an item: Apart from the limits of the given category, no constraints are placed - participants are free to retrieve items that are frequent and familiar in their lexicon (be this Roosevelt, Bush, Churchill, Blair, Stalin or Gorbachev; cabbage, chard or bok choi).

Category fluency tasks do, however, have their own restrictions. Thus, category size (the number of potential exemplars within a category) has been found to positively correlate with the number of items participants produce in category fluency tasks (e.g., Wixted & Rohrer, 1994). Indeed, some categories within common and proper noun classes can be inherently broader than others: For example, participants tend to recall more vegetables than fruit (e.g., Azuma et al., 1997). However, common noun categories can be both broader and narrower than some proper noun categories (e.g., the common category 'sports' is likely to be narrower than the proper noun category 'female/male names'; while 'animals' may be broader than 'sports people'). In addition, the internal structure of categories may differ quite substantially both within and across the noun classes. For example, possible groupings for proper noun categories vary: *Countries* and *cities* can be organised by continents or parts of the world, while *female/male names* are likely to be grouped based on personal relations and interests (names of family, friends, favourite actors, etc.). Consequently, different categories may result in distinct recall strategies for exemplars (see discussion in Diaz et al., 2004).

As has been noted before, category fluency tasks have been traditionally used in assessment of people with selective word retrieval disorders. Studies with people with selective proper noun anomia have reported lower retrieval rates for proper noun categories (compared to common nouns). However, often, these studies have not reported the full statistical analysis that is required to be able to claim with certainty that patients show a significant dissociation for proper nouns relative to common nouns (e.g., Fery et al., 1995; Harris & Kay, 1995; Hittmair-Delazer et al., 1994; Martins & Farrajota, 2007; Semenza & Zettin, 1988). To be able to make such a claim one would need to statistically compare performance of people with anomia with a group of controls on generating common versus proper nouns, as well as compare the relative size of any differences found between common and proper nouns for people with aphasia compared to controls (e.g., Crawford & Garthwaite, 2005; Crawford & Howell, 1998).

A second methodological issue relating to proper nouns is the fact that a great deal of the research on proper nouns has focused on personal names. However, the class of proper nouns is far from being homogeneous and goes beyond personal names (names of family, friends, acquaintances, and famous people) to include names of countries, landmarks and brands (to name just a few). Importantly, there has been research to suggest that these subcategories may show different processing characteristics (e.g., Hollis & Valentine, 2001).

Most research on non-brain-damaged people has primarily focused on *personal names* (e.g., Burke et al., 1991; Cohen, 1990; McWeeny et al., 1987; Stanhope & Cohen, 1993; Terry, 1994). Some studies also made a distinction within the subcategory of personal names. Thus, Cohen and Faulkner (1986) found that the majority of retrieval blocks in their diary study occurred with names of friends and acquaintances within the proper noun category, while noting, however, that this could be solely due to the fact that participants made more attempts to retrieve such names relative to names of famous people, places, etc. Nevertheless, they also suggest that names of acquaintances could be harder to retrieve because names of "ordinary people" may lack semantic associations, as opposed to names of famous people and places. However, it seems counterintuitive that names of friends and people one personally knows would have fewer semantic attributes associated with them than names of famous people. In addition, selective anomia for personal names has been the most frequent to be reported (e.g., Fery et al., 1995; Harris & Kay, 1995; Lucchelli & De Renzi, 1992; McKenna & Warrington, 1980; Shallice & Kartsounis, 1993). It is obvious, however, that the category of personal names may not be representative of the whole proper noun class in general.

Geographical names is another proper noun category that has been studied relatively systematically. In some case reports of people with aphasia, this category was impaired (e.g., Harris & Kay, 1995; Semenza & Zettin, 1988, 1989) or spared (Cipolotti, McNeil, & Warrington, 1993), together with personal names, relative to common nouns. In other cases geographical names (countries) were selectively spared in comparison to common nouns and personal names (e.g., Cipolotti, 2000; McKenna & Warrington, 1978; Warrington & Clegg, 1993)[8]. It is possible that other, similar, dissociations could be found if the full range of proper noun subcategories were more frequently studied systematically.

Interestingly, Hollis and Valentine (2001) argued that people's names and landmarks have similar processing characteristics as compared to countries and common nouns. They compared priming effects across these four noun categories looking at the effects of making a familiarity decision to an auditory stimulus on the response to a subsequent familiarity decision to a written presentation of the same word. Priming was found only for people's names

[8] To our knowledge, no cases of selective impairment of geographical names have been reported.

and landmarks and not countries and common nouns. They also found similar cross-modal facilitation when a picture naming task was followed by a familiarity decision (for proper) and lexical decision (for common). No priming effects were observed for countries and common nouns. Hollis and Valentine (2001) suggested that what distinguishes most proper nouns from common nouns is not their uniqueness (as people's names, landmarks, and countries are equally unique) but that some proper nouns are *pure referencing expressions*. Hence, cross-domain and cross-modal priming only occurs with items with pure reference. Hollis and Valentine (2001) used as evidence that people's names and landmarks do not have adjectival form, they do not carry any meaning (one cannot, for example, form adjectives from landmarks' names such as 'Big Ben', 'Kremlin'). On the contrary, countries are different in this respect as they can be formed into adjectives (e.g., Britain – British, Russia – Russian) and are, they claimed, thus, meaningful and processed similarly to common nouns. However, the determination of whether a word has meaning by seeing if an adjective can be formed from this word does not seem to be entirely reliable. For example, Cohen and Faulkner (1986) pointed out that some personal names can form adjectives (e.g,. Machiavelli – Macchiavellian; Churchill - Churchillian) but this is not the case for ordinary names (e.g., John Smith - *John Smithian) nor for all famous people's names (e.g., Colin Firth - *Colin Firthian). However, to extend Hollis and Valentine's logic to suggest that (some) famous people's names are morphologically different from ordinary names - and, thus, can sometimes be adjectivised - seems unwise. What can undoubtedly be concluded, however, is that although not all personal names (at least in English) possess the morphological capability to form adjectives, most personal names can act in the syntactic position of an attribute in a phrase. Indeed, all people's names can take on the possessive case (e.g., Madonna's gym, Eva Longoria's clothing) and other morphological means that can be used to form adjective-like items. For example, if the phrase 'an American singer' (where

‘America’ is a proper adjective derived from the name of a country) refers to a singer from the USA, the phrase ‘Madonna’s gym’ (‘Madonna’s’ being the possessive case) refers to a gym owned/frequented by Madonna, ‘Madonna-like behaviour’ is behaviour characteristic of Madonna, ‘Madonna-style dance’ is a dance of a similar style to Madonna’s, etc. Moreover, whether an adjective may be formed from a noun depends on the language structure: in English, cities can rarely change their morphological form to become an adjective (e.g., ‘Paris’ – ‘Parisian’, but there is no adjectival form for ‘Sydney’), while Russian can routinely form adjectives by adding appropriate inflections (an adjective derived from ‘Sydney’ will be ‘sydneyskiy’). However, in English, Sydney conveys an attributive meaning differently: Sydney Opera House, Sydney lifestyle, etc. Overall, in our opinion, Hollis and Valentine’s (2001) claim that people’s names and landmarks do not have meaning is not fully justified. The main message, however, holds: countries showed different priming effects from people’s names and landmarks. This once again provides support for the idea of subdivisions within the class of proper nouns and encourages further research on different proper noun subcategories.

Research Questions

The aim of this study was to contribute to the existing discussion on the production of common and proper nouns, with a focus on word retrieval in people with aphasia.

As noted above, the variability (across individuals and over time) for proper nouns makes it practically impossible to match common and proper nouns on for many psycholinguistic variables (see Brédart, 1993; Hollis & Valentine, 2001), consequently, any dissociations found in retrieval of common and proper nouns in naming tasks can be due to potential uncontrolled differences in the stimuli. As discussed above, category fluency tasks should help to circumvent the problem of matching by reducing the effect of psycholinguistic variables such as frequency, familiarity, age of acquisition, and recency of use. In addition, category fluency tasks enable the examination of subcategories of common and proper nouns - an area which deserves further attention.

Assessing people with aphasia in their retrieval of common and proper nouns, we were interested whether participants with impaired word retrieval but with no established selective disorders for common or proper nouns, showed significantly poorer performance on proper nouns than on common nouns in category fluency as would be suggested by the generally poorer performance on proper nouns in the literature. Critically, as discussed above, we examined the relative decrement that was shown by people with aphasia relative to performance on the same task.

Despite the fact that category fluency tasks have been routinely used in assessments of patients with selective word retrieval disorders (e.g., Kay et al., 2001; Semenza, Sartori, & D'Andrea, 2003; Semenza & Zettin, 1988, 1989), to our knowledge, no comprehensive studies have been carried out examining performance on this task using a relatively unselected group of people with aphasia.

This study was designed to address three main points:

1. Processing of proper and common nouns in adults without language impairment.

The category fluency task is argued to reduce the effects of statistical properties (e.g., frequency) of items on performance. Consequently, under the statistical properties account, adults without language impairment should not perform more poorly on proper nouns relative to common nouns. If, however, the relatively inferior retrieval of proper nouns that has been found in the past is underpinned by differences in the logical properties of common and proper nouns then the category fluency task should be likely to also show better performance for common nouns.

2. Processing of proper and common nouns in people with anomia.

People with anomia, by definition, are predicted to perform more poorly in word retrieval as measured by category fluency in comparison to controls. However, of particular interest was whether aphasic participants would show greater impairment for proper nouns relative to controls. Assuming there are two processing mechanisms for common and proper nouns (under the logical properties account), and the proper noun processing mechanism is more fragile due to less activation received by a word form through just one single link (e.g., Burke et al., 1991; Brédart et al., 1995; Semenza & Zettin, 1988), we would expect that all people with aphasia, and not only those with selective proper noun anomia reported in the literature, would be likely to experience more difficulties with producing proper nouns, than common nouns. If, however, common and proper nouns are processed similarly at the lexical level and affected by similar factors, deficits for common and proper nouns would be of comparable nature.

3. Differences in processing and representation across proper noun subcategories.

As noted above, the class of proper nouns is heterogeneous and different categories of proper nouns may have distinct processing patterns. Thus, we were interested whether category fluency performance for different subcategories within proper nouns would vary within and across people with aphasia and unimpaired controls.

Method

Participants

Eight people with aphasia (2 females, *Mean age* = 42.88 years, *Standard Deviation* = 12.52, *range* = 26-61; see Table 1) and eight non-brain-damaged control subjects broadly matched for age (7 females, *Mean age* = 53.63 years, *Standard Deviation* = 14.30, *range* = 27-

76; $t(14) = 1.60$, $p = .132$ (two-tailed)), all native speakers of Russian, participated in the study. All people with aphasia were tested at the Federal Center of Speech Pathology and Neurorehabilitation in Moscow. They were all assessed by the hospital's speech therapist and neuropsychologist, and diagnosed according to Luria's Neuropsychological Investigation (Luria, 1962/1966, 1973). In our study, however, we adopted the classification of aphasia into nonfluent and fluent forms of Goodglass, Kaplan, and Barresi (2000). Thus, Luria's *efferent motor* and *dynamic* aphasia were referred to as nonfluent, whereas *sensory (acoustic-gnostic)*, *afferent motor* and *acoustic-amnestic aphasia* were classified as fluent (as noted in Goodglass et al., 2000).

Stimulus Selection

Nine common noun and eight proper noun semantic categories were selected to perform category fluency tasks. Common noun categories were: *vegetables*, *fruit*, *transport*, *professions*, *clothes*, *tools*, *sports*, *musical instruments*, and *birds.* Proper noun categories were *female names*, *male names*, *famous people*, *countries*, *cities*, *landmarks*, *geographical names* (such as rivers, lakes, mountains, districts, etc. - but excluding countries and cities), and *brands*. In choosing the categories, we attempted to select those that were at the superordinate level of categorisation within hierarchical semantic organisation (e.g., Rosch, 1978). That is, we were looking for categories that were able to elicit a fairly high number of diverse responses related to the category in question. Noun categories selected were also consistent with those exploited in other studies (e.g., Kay et al., 2001; Hampton & Gardiner, 1983; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976; Semenza & Zettin, 1988, 1989; Semenza, et al., 2003). We did not attempt to control the size of categories within and across the two noun classes. Consequently, it is clear that, when comparing how our participants perform on the category fluency tasks, we should be cautious and consider that possible differences in category sizes within and across the noun classes, as well as potentially distinct recall strategies for the categories may influence results. It does not mean, however, that our attempts are fully undermined by these considerations. In particular, any influence of category size and category specific recall strategies was inherently controlled in the analysis of people with aphasia through the comparison of their pattern with that shown by the controls.

Table 1

Background Information on the People with Aphasia Participating in the Study

ID	Gender	Age (in years)	Years & months post-onset	Education (level)	Previous Occupation	Aphasia Severity and Type	Naming Impairment	Comprehension Impairment
MS	male	52	1; 9	vocational	milling machine operator	nonfluent (mild-moderate), mild dysarthria	mild: phonological errors	mild-moderate, especially complex syntactic constructions
DS	male	26	0; 6	higher	interpreter /translator	fluent (mild-moderate)	mild: slowed responses semantic errors	almost intact comprehension
VV	male	47	2; 2	vocational	driver	fluent (moderate)	mild: semantic & phonological errors	moderate especially complex syntactic constructions
LG	male	54	0; 10	vocational	construction electrician, security supervisor	nonfluent (moderate); dysarthria	mild: perseverations	mild for complex syntactic constructions
BA	male	34	2; 8	secondary school	loader	nonfluent (mild-moderate)	mild	mild especially complex syntactic constructions
EN	female	61	3; 9	vocational	deputy director of a shop	fluent (mild)	mild: only low frequent words: semantic errors	mild for complex syntactic constructions
BT	female	39	0; 7	incomplete higher	social worker	fluent (mild)	mild: only low frequent words	mild for complex syntactic constructions
TD	male	30	2; 7	higher	engineer, economist	nonfluent (mild); mild apraxia of speech	mild: only low frequent words; semantic errors, slowed responses	mild for spatial syntactic constructions

Procedure

All participants were tested individually. Participants were told that they would be given various categories and their task was to generate as many single words within a category as they could within a 2-minute timeframe. An example category was given: "If I gave you the category 'games', you could say 'hide-and-seek', 'leapfrog', 'chess', etc." At the beginning of each category, participants were given instructions relevant for the category in question, including one or two example responses. The instructions were given both in written form on the computer screen and read aloud by the experimenter. The order in which the categories were presented was randomised across participants. The experimenter allowed 2 minutes for each category. However, if a participant clearly indicated that he/she could not retrieve any more items within a category, the experimenter proceeded to the next category without waiting for the whole 2 minute-time interval to pass (all attempts were 1-2 minutes in duration). All responses were audio recorded.

Analysis

Data preparation

Responses were transcribed and scored by two independent raters. First, any exact repetitions were eliminated from the dataset. Then, a set of inclusion/exclusion criteria was applied to the participants' responses to ensure that items were nouns related to the category (see *Appendix A*).

The final dataset only contained items on which agreement was reached by the two raters. After exclusion of repetitions, 6.28% of responses were eliminated for controls for common noun categories and 1.04% for proper noun categories, resulting in 1551 exemplars generated for common noun categories and 1809 exemplars for proper noun categories. Similarly, 1.92% of common and 0.91% proper noun responses were excluded from items listed by people with aphasia, with the final dataset for common noun categories containing 717 exemplars and 655 exemplars for proper noun categories.

Results

Control participants: Common nouns versus proper nouns

We first analysed whether the control participants performed differently across the common and proper noun categories. A two-sample t-test for related scores (two-tailed) was performed on the summed scores for common and proper noun categories and showed that, contrary to expectations, the control participants generated significantly more proper nouns than common nouns (see Table 2 and Figure 1 for details).

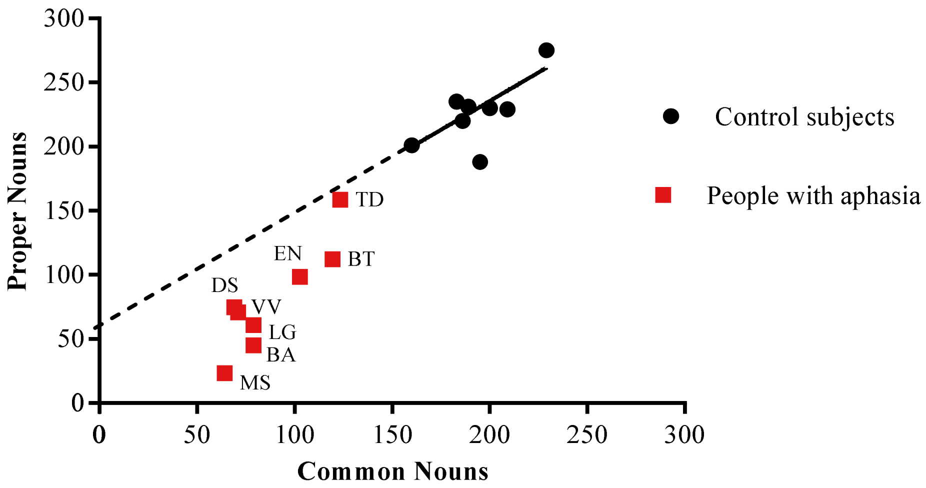

Figure 1. Total number of common and proper nouns generated in the category fluency tasks by the people with aphasia and control participants, with the line of best fit for the control participants (extrapolated downwards with a dotted line).

Table 2

Comparison of Performance of the People with Aphasia and Controls on Common and Proper Noun Fluency Tasks

	Common nouns			Proper nouns			Common vs. Proper	
Control group	M = 193.88 (SD = 20.19)			M = 226.13 (SD = 25.74)			**t(7) = 4.88, p = .002***	
People with Aphasia	*n*	Comparison with controls		*n*	Comparison with controls		RSDT	
		t(7)	*p*		t(7)	*p*	*t*(7)	*p*
MS	65	**-6.02**	**<.001***	24	**-7.40**	**< .001***	1.53	.170
DS	70	**-5.79**	**< .001***	76	**-5.50**	**< .001***	0.32	.759
VV	72	**-5.69**	**< .001***	72	**-5.65**	**< .001***	0.05	.961
LG	80	**-5.32**	**.001***	62	**-6.01**	**< .001***	0.77	.465
BA	80	**-5.32**	**.001***	46	**-6.60**	**< .001***	1.42	.200
EN	104	**-4.20**	**.002***	100	**-4.62**	**.001***	0.47	.651
BT	121	**-3.40**	**.006***	114	**-4.11**	**.002***	0.78	.459
TD	125	**-3.22**	**.007***	161	**-2.39**	**.024***	0.92	.386

* significant at $p < .05$.

There was also a marginally significant strong positive correlation between number of items produced across common and proper noun categories ($r(6) = .69$, $p = .057$): Those individuals who retrieved many common nouns also tended to produce many proper nouns, while those who produced few common nouns also produced fewer proper nouns. Performance on common and proper noun categories did not correlate with the age (common: $r(6) = .09$, $p = .826$; proper: $r(6) = -.11$, $p = .787$) or the level of education (common: $r(6) = -.09$, $p = .830$; proper: $r(6) = .19$, $p = .648$) of the control participants.

In order to see the distribution of individual categories across the common and proper noun sets, we ranked all the categories starting from the one that, on average, generated the highest number of exemplars in the group of controls (see Table 3). As can be seen, the category that generated the highest number of items was 'countries', whereas the categories with lowest scores were 'tools' and 'landmarks'. Although, as discussed above, the size of the categories may have affected the number of items produced for each category, there was a clear tendency for proper noun categories to generate more items than common noun categories: The top of the ranked list of categories was dominated by proper noun categories ('countries', 'cities', 'geographical names', 'unspecified female/male names', and 'famous people').

Table 3

Common and Proper Noun Individual Categories Ranked from Highest to Lowest Based on the Average Number of Exemplars Generated by Control Participants

Category	*Mean*	*SD*
Countries	41.88	6.90
Cities	38.5	7.84
Clothes	33.88	3.04
Geographical names	29	2.93
Female Names	28.63	6.67
Famous People	27.5	7.84
Male Names	26.38	6.48
Professions	26	6.21
Fruit	22.25	4.20
Birds	21.63	5.60
Transport	20.75	5.95
Brands	19.88	4.26
Vegetables	18.5	4.69
Musical Instruments	18.5	3.51
Sports	18	2.83
Tools	14.38	3.42
Landmarks	14.38	3.62

Note. Proper noun categories are italicised.

People with aphasia: Common versus proper nouns

Using modified t-tests (one-tailed; Crawford & Howell, 1998), each of the eight people with aphasia was shown to perform significantly more poorly on both common and proper nouns in comparison to the control participants (see Table 2 and Figure 1). Nevertheless, it was possible that the people with aphasia could be relatively more impaired on one noun category than the other. To evaluate this possibility we used the revised standardised difference test (RSDT, two-tailed; Crawford & Garthwaite, 2005) to examine the size of the difference between common nouns compared to proper nouns in relation to the size of the difference shown by the control subjects: None of the people with aphasia showed a difference that was significantly bigger or smaller in size for common or proper nouns compared to the controls. Thus, there was no evidence for a category specific impairment for either common or proper nouns for any of the participants with aphasia. Moreover, there was a strong positive correlation for scores summed across the categories for common versus proper noun categories ($r(6) = .89$, $p = .003$), indicating that the people with aphasia had comparable performance across the two noun classes: Those participants who scored well on common nouns, also scored well on proper nouns, and those who scored poorly one noun class, also showed poor results on the other. As for the controls, there was no significant correlation between category fluency performance and either age (common: $r(6) = -.15$, $p = .729$; proper: $r(6) = -.32$, $p = .444$) or level of education (common: $r(6) = .23$, $p = .576$; proper: $r(6) = .55$, $p = .160$).

Although the people with aphasia did not show any specific impairment overall for proper noun categories, it was possible that selective deficits could be present for individual categories within the proper noun class. Thus, we conducted additional analyses to determine whether the performance of the people with aphasia varied across the individual proper noun categories. For the purpose of the analyses, the categories of female and male names were combined into one, as there was no reason to suggest that they would be processed or impaired differently. First, we compared the number of responses given for an individual proper noun category by each participant with aphasia with the control subjects' performance. We then examined whether any individual proper noun category revealed a specific deficit relative to common noun performance when compared to the controls. See *Appendix B* for full results.

Perhaps unsurprisingly, the analysis showed that there was variability in the patterns of different people with aphasia. The majority of people with aphasia had a deficit relative to controls on the proper noun categories ‘landmarks’ (7/8), ‘countries’ (7/8), ‘cities’ (7/8), ‘geographical names’ (7/8), ‘famous people’ (7/8), and ‘unspecified female/male names’ (5/8). However, only 3 of the 8 people with aphasia were impaired on the category ‘brands’. The only categories where participants with aphasia showed a difference compared to controls in relative performance on a proper noun subcategory compared to common nouns (all categories combined) were ‘famous people’ (DS, VV, TD, MS, BA), ‘brands’ (DS, VV, TD), and ‘female/male names’ (DS, VV). However, interestingly, in every case they showed a relatively larger impairment for common nouns than for the proper noun subcategory. Thus, no participant was significantly more impaired on any proper noun category compared to the combined set of common nouns (relative to the pattern shown by the controls).

To see whether the distribution of categories ranked by the number of exemplars produced was similar for people with aphasia and controls, we compared the controls’ ranked list of categories (given in Table 3) to that of each person with aphasia. Given the small number of items in some categories for people with aphasia was likely to introduce noise into the analysis and as the primary focus was to evaluate overall relative difficulty of common and proper noun categories, rather than looking at individual categories within the noun classes, we clustered individual proper and common noun subcategories that held consecutive positions in the ranked list created for the group of controls. Seven of the eight people with aphasia showed a category distribution pattern of scores that had a significant positive correlation with the distribution pattern of the controls (see Table 4). These results indicate that the degree of retrieval difficulty across the categories within the two noun class sets was similar for the people with aphasia and control participants. Namely, although the majority of the people with aphasia scored significantly lower on all the individual common and proper noun categories, the overall distribution across categories within common and proper noun sets was comparable. Indeed, for both the control participants and people with aphasia, when the categories were ranked according to how many items had been generated for each category, most proper noun categories tended to be in the top half of the list, while most common nouns had a tendency to take positions in the bottom half of the list. There was only one person with aphasia (MS) who demonstrated the opposite pattern: MS retrieved more items for common noun categories than for proper noun categories (note, however, that the only dissociation found for this participant was between common nouns and 'famous people' with common nouns relatively more impaired).

Table 4

Results of Pearson Correlation Analysis on the Controls' Ranked List of Clusters of Common and Proper Noun Individual Categories and the Scores for the People with Aphasia on these Categories

	Controls	People with aphasia							
		MS	DS	VV	LG	BA	EN	BT	TD
Proper *(Countries + Cities)*	80.38	9	20	20	24	11	40	27	53
Common *(Clothes)*	33.88	13	12	13	11	15	21	18	19
Proper *(Geographical Names + Female Names + Famous People + Male Names)*	111.51	12	42	36	34	27	45	67	77
Common *(Professions + Fruits + Birds + Transport)*	90.63	26	35	32	39	33	52	51	51
Proper *(Brands)*	19.88	1	12	15	4	8	15	18	24
Common *(Vegetables + Musical Instruments + Sports + Tools)*	69.38	26	23	27	30	32	31	52	55
Proper *(Landmarks)*	14.38	2	2	1	0	0	0	2	7
Pearson Correlation Coefficient (*r*)		0.60	**0.95**	**0.92**	**0.95**	**0.77**	**0.94**	**0.90**	**0.96**
p-value (two-tailed)		.156	**.001***	**.004***	**.001***	**.044***	**.002***	**.005***	**.001***

* significant at $p < .05$.

Given the discussion in the literature on the superior retrieval of occupations relative to people's names (e.g., McWeeny et al., 1987), we conducted a separate analysis to compare performance on the common noun category 'professions' and the proper noun categories ‘female names’, ‘male names’ and ‘famous people’ (Poisson two sample binomial tests, see Table 5). None of the comparisons were significant. This indicates that the number of exemplars for ‘professions’ was comparable with the number of exemplars generated for ‘female names’, ‘male names’, and for ‘famous people’ for all eight people with aphasia and the control group.

Table 5

Results of Poisson Two-sample Binomial Tests Comparing Performance on the Common Noun Category ‘Professions’ vs. the Proper Noun Categories ‘Female Names’, ‘Male Names’ and ‘Famous People’ by the Control Participants and People with Aphasia

	Professions	Female Names		Male Names		Famous People	
	n	*n*	*p*	*n*	*p*	*n*	*p*
Controls	26	28.63	.892	26.38	.892	27.5	1.000
MS	5	3	.727	4	1.000	0	.063^{+}
DS	11	16	.442	16	.442	7	.481
VV	4	10	.180	12	.077^{+}	5	1.000
LG	4	7	.549	7	.549	3	1.000
BA	5	9	.424	8	.581	7	.774
EN	10	14	.541	14	.442	3	.092^{+}
BT	15	21	.405	23	.256	11	.557
TD	14	18	.597	22	.243	21	.311

$^{+}$ approaching significance at $p < .1$.

Discussion

The present study aimed to contribute to the debate regarding differences between processing of common and proper nouns. It accomplished this by looking at performance on a set of category fluency tasks of two groups of participants: Adults with unimpaired language (controls) and people with aphasia, with anomia but no previously detected selective deficits in common or proper noun retrieval and with relatively spared semantic processing. Moreover, we examined a broad range of categories within both common and proper noun classes.

We suggested that using category fluency tasks allowed us to reduce effects on retrieval outcomes of such statistical properties of words as frequency, familiarity, age of acquisition, and recency of use. This, arguably, gave us a more objective reflection of participants' retrieval abilities for common versus proper nouns in comparison to questionnaires and diary studies, as well as experiments involving picture naming, naming to definition, and many learning tasks.

Contrary to the predictions, the control participants produced more responses for proper noun categories than common noun categories, and this pattern was similar for all the individual control participants. Although it is possible that differences in category sizes may have obscured the patterns (the proper noun categories used may have higher numbers of exemplars than the common noun categories), these results support suggestions that differences in statistical properties between common and proper nouns are a major factor causing the inferior proper noun retrieval that has been reported in diary and experimental studies on speakers without language impairment (e.g., Burke et al., 1991; Evrard, 2002; James, 2004; Maylor, 1995; McWeeny et al., 1987; Reason & Lucas, 1984; Rendel et al., 2005).

As would be expected, the people with aphasia were impaired on the category fluency tasks compared to the controls and this was true of both common and proper nouns. However, no aphasic participant showed any dissociation between common and proper noun retrieval: Common and proper nouns were equally impaired relative to the control's performance. Like the control group, within the aphasic group there was consistency of performance on common and proper nouns such that people with poorer retrieval abilities were poor on both noun classes, while people with better retrieval abilities produced proportionally higher numbers of both common and proper nouns.

Overall, we did not find that proper nouns were harder to retrieve than common nouns in the category fluency tasks for our participants with aphasia relative to controls. While there is an argument that control performance could be influenced by differences in category size between the subcategories within proper and common nouns, this cannot be a factor when examining the relative impairment of people with aphasia using controls as a baseline. Thus, the lack of a disproportionate deficit for proper nouns for people with aphasia seems a robust finding. Consequently, differences in retrieval for common and proper nouns seen for non-brain-damaged adults seem most likely to be due to *a continuum of word retrieval difficulty* and distinct statistical properties of the two noun classes in question: proper nouns being less frequent, less familiar and acquired later in life in comparison to common nouns (Kay et al., 2001).

Additionally, we considered the patterns obtained for individual proper noun categories taken separately: All the people with aphasia performed worse than the controls on all of the individual proper noun categories but with no stronger impairment for any of the individual proper noun categories in comparison to the common noun set. When we looked at the rank ordering of the average number of responses for each category, the majority of proper noun categories (with the exception of *brands* and *landmarks*) received more responses than the majority of common noun categories. All the participants with aphasia (except for MS) showed similar distribution patterns for individual common and proper noun categories: Proper noun categories, in general, received more responses than common noun categories. This indicates that, if anything, in this task, proper nouns were easier to retrieve than common nouns for both control participants and people with aphasia. Such an observation goes against the account advocating that common and proper nouns are processed by two different lexical mechanisms, with proper noun pathway receiving less activation and thus being more difficult (e.g., Brédart et al., 1995; Burke et al., 1991; Semenza & Zettin, 1988).

Based on the results of our experiment, it is hard to draw any firm conclusions on whether individual categories within the class of proper nouns are processed differently at the lexical level: No selective deficits were revealed for any of the proper noun categories in the performance by participants with aphasia. ‘Countries’ and ‘cities’ received the highest scores of all the proper and common noun categories in the control group and 6 of 8 aphasic participants retrieved more items for these categories than for most common noun categories. Although these patterns give us an indication that word forms for members of these categories may be more readily available for lexical retrieval, particular strategies could also have facilitated retrieval of the items (imagining the world map, cities the person has been to, etc.).

Finally, we compared how our participants performed on the common noun category ‘professions’ in comparison to the proper noun categories of ‘famous people’, ‘female names’, and ‘male names’, as in the literature several studies have made these comparisons in learning studies (e.g., Cohen, 1990; Cohen & Faulkner, 1986; James, 2004; James, 2006; Maylor, 1995; McWeeny et al., 1987; Stanhope & Cohen, 1993; Terry, 1994; Rendel et al., 2005). Our results, however, found no evidence that either control participants or people with aphasia performed differently on ‘professions’ than they did on any of the proper noun categories. Once again, we cannot definitively rule out that a difference in the size of these categories might not be a possible factor affecting the pattern obtained: The proper noun categories may be much broader than the common noun category ‘professions’, which could mask the superior retrieval for common nouns. It is also possible that the poor performance demonstrated by some people with aphasia for all four categories (both common and proper) involved in the analysis may have obscured the test results (i.e., floor effects). Nevertheless, as they stand, our results are not consistent with those from the learning studies which found poorer recall of newly learned personal names than of biographical information about the same novel faces (e.g., Burke et al., 1991; Cohen, 1990; Cohen & Faulkner, 1986; James, 2004; James, 2006; Maylor, 1995; McWeeny et al., 1987; Rendel et al., 2005; Stanhope & Cohen, 1993; Terry, 1994). As suggested above, the reason why people's names have been found harder to recall than their occupations may be attributed, amongst other things, to the fact that, when retrieving a name, semantic information about the person is activated and hence, (as a higher frequency lexical item) may be retrieved faster and easier than the person's name. This difference, however, cannot be used to directly infer a difference between retrieval of common and proper nouns in general.

Overall, the results of this study using data from category fluency tasks found no evidence for proper nouns being harder to retrieve for either people with aphasia or control participants with unimpaired language. This is in stark contrast to previous research. While further research is required to provide accurate estimates of category size and the effects that this may have on category fluency, we believe that our results can be attributed to a reduced influence of statistical properties such as frequency, familiarity, age of acquisition, and recency of use on performance in a category fluency task. Consequently, our findings provide a further incentive to consider statistical properties a driving force in the differences we usually see in retrieval of common and proper nouns, although this is not inconsistent with there being differences in the logical properties of proper and common nouns. Nevertheless, the comparable deficits for common and proper nouns presented by the participants with aphasia, as well as the lack of common noun dominance in the performance of the control participants, suggest that differences in logical properties do not make retrieval of proper nouns inherently more difficult. In sum, this study adds to those calling for more research to investigate the possibility that the frequent observation that proper nouns seem to be more difficult to retrieve than common nouns is due to their different positioning on *a continuum of word retrieval difficulty* (Kay et al., 2001).

References

Azuma, T., Bayles, K. A., Cruz, R. F., Tomoeda, C. K., Wood, J. A., McGeagh, A., & Montgomery, E. B. (1997). Comparing the difficulty of letter, semantic, and name fluency tasks for normal elderly and Parkinson patients. *Neuropsychology*, *11*, 488-497.

Brédart, S. (1993). Retrieval failures in face naming. *Memory*, *1*, 351-366.

Brédart, S., Valentine, T., Calder, A., & Gassi, L. (1995). An interactive activation model of face naming. *Quarterly Journal of Experimental Psychology*, *48A*, 466–486.

Broadbent, D. E., Cooper, P. J., FitzGerald, P. F., & Parkes, K. R. (1982). The Cognitive Failures Questionnaire (CFQ) and its correlates. *British Journal of Clinical Psychology*, *21*, 1-16.

Burke, D. M., MacKay, D. G., Worthley, J. S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language*, *30*, 542-579.

Butterworth, B. (1989). Lexical access in speech production. In W. Marslen-Wilson (Ed.), *Lexical representation and process* (pp. 108–135). Cambridge, MA: MIT Press.

Cipolotti, L. (2000). Sparing of country and nationality names in a case of modality-specific oral output impairment: Implications for theories of speech production. *Cognitive Neuropsychology*, *17*, 709-729.

Cipolotti, L., McNeill, J. E., & Warrington, E.K. (1993). Spared written naming of proper nouns: a case report. *Memory*, *1*, 289-311.

Cohen, G. (1990) Why is it difficult to put names to faces? *British Journal of Psychology*, *81*, 297-297.

Cohen, G., & Burke, D. M. (1993). Memory for proper names: A review. *Memory*, *1*, 249-263.

Cohen, G., & Faulkner, D. (1984). Memory in old age: "Good in parts." *New Scientist*, *11*, 49-51.

Cohen, G., & Faulkner, D. (1986). Memory for proper names: Age differences in retrieval. *British Journal of Developmental Psychology, 4,* 187-197.

Crawford, J. R., & Garthwaite, P. H. (2005). Testing for suspected impairments and dissociations in single-case studies in neuropsychology: Evaluation of alternatives using Monte Carlo simulations and revised tests for dissociations. *Neuropsychology*, *19*, 318-331.

Crawford, J. R., & Howell, D. C. (1998). Comparing an individual's test score against norms derived from small samples. *The Clinical Neuropsychologist*, *12,* 482-486.

Diaz, M., Sailor, K., Cheung, D., & Kuslansky, G. (2004). Category size effects in semantic and letter fluency in Alzheimer's patients. *Brand and Language*, *89,* 108-114.

Evrard, M. (2002). Ageing and lexical access to common and proper names in picture naming. *Brain and Language*, *81,* 174-179.

Fery, P., Vincent, E., & Brédart, S. (1995). Personal name anomia: A single case study. *Cortex*, *31,* 191-198.

Goodglass, H., Kaplan, E., & Barresi, B. (2000). *Boston Diagnostic Aphasia Examination*, 3rd ed. Baltimore: Lippincott Williams & Wilkins.

Hampton, J. A., & Gardiner, M. M. (1983). Measures of internal category structure: A correlational analysis of normative data. *British Journal of Psychology*, *74,* 491–516.

Harris, D. M., & Kay, J. (1995). Selective impairment of the retrieval of people's names: A case of category specificity. *Cortex*, *31*, 575-582.

Hittmair-Delazer, M., Denes, G., Semenza, C., & Mantovan, M.C. (1994). Anomia for people's names. *Neuropsychologia, 86,* 345-358.

Hodgson, C., & Ellis, A. W. (1998). Last in, first to go: Age of acquisition and naming in the elderly. *Brain & Language*, *64*, 146-163.

Hollis, J., & Valentine, T. (2001). Proper-name processing: Are proper names pure referencing expressions? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*, 99-116.

James, L. (2004). Mr. Farmer versus meeting a farmer: Specific effects of aging on learning proper names. *Psychology and Aging*, *19,* 515-522.

James, L. (2006). Specific effects of aging on proper name retrieval: Now you see them, now you don't. *Journal of Gerontology: Psychological sciences*, *61B*, 180-183.

Kay J., Hanley, J. R., & Miles, R. (2001). Exploring the relationship between proper name anomia and spoken word retrieval: A single case study. *Cortex, 37*, 501-517.

Levelt, W. J. M. (1989). Speaking: From intention to articulation. Cambridge, MA: MIT Press.

Lucchelli, F., & De Renzi, E. (1992). Proper name anomia. *Cortex*, *28*, 221-230.

Luria, A. R. (1962/1966). Higher cortical functions in man [in Russian]. Moscow: Moscow University Press. [English version: Basic Books, New York, 1966.].

Luria, A. R. (1973). Outline of the neuropsychological examination [in Russian]. Moscow: Moscow University Press.

Martins, I. P., & Farrajota, L. (2007). Proper and common names: a double dissociation. *Neuropsychologia*, *45*, 1744-1756.

Matthews, G., Coyle, K., & Craig, A. (1990). Multiple factors of cognitive failure and their relationship with stress vulnerability. *Journal of Psycholopathology and Behaviuoral Assessment*, *12*, 49-65.

Maylor, E. A. (1995). Effects of aging on the retrieval of common and proper names. Facts and *Research in Gerontology, Supplement*, 55–73.

Maylor, E. A. (1997). Proper name retrieval in old age: Converging evidence against disproportionate impairment. *Aging, Neuropsychology, and Cognition, 4*, 211–226.

McKenna, P., & Warrington, E. K. (1978). Category-specific naming preservation: A single case study. *Journal of Neurology, Neurosurgery, and Psychiatry, 41*, 571-574.

McKenna, P., & Warrington, E. K. (1980). Testing for nominal dysphasia. *Journal of Neurology, Neurosurgery, and Psychiatry*, *43*, 781-788.

McWeeny, K. H., Young, A. W., Hay, D. C., & Ellis, A. W. (1987). Putting names to faces. *British Journal of Psychology, 78,* 143-149.

Otsuka, Y., Suzuki, K., Fujii, T., Miura, R., Endo, K., Kondo, H., & Yamadori, A. (2005). Proper name anomia after left temporal subcortical haemorrhage. *Cortex*, *41*, 39-47.

Pexman, P. M., Lupker, S. J., & Hino, Y. (2002). The impact of feedback semantics on visual word recognition: Number-of-features effects in lexical decision and naming tasks. *Psychonomic Bulletin & Review, 9,* 542–549.

Rabbitt, P., Maylor, E., McInnes, L., Bent, N., & Moore, B. (1995). What goods can self-assessment questionnaires deliver for cognitive gerontology? *Applied Cognitive Psychology*, *9*, 127-152.

Reason, J. T., & Lucas, D. (1984). Using cognitive diaries to investigate naturally occurring memory blocks. In J.E. Harris & P.E. Morris (Eds.), *Everyday memory actions and absent-mindedness* (pp. 53-70). London: Academic Press.

Rendell, P. G., Castel, A. D., & Craik, F. I. M. (2005). Memory for proper names in old age: A disproportionate impairment? *Quarterly Journal of Experimental Psychology, 58A*, 54–71.

Romanova, A., Nickels, L., & Renvall, K. (2015). Investigating differences in learning of novel proper and common nouns in young adults. *Manuscript in preparation*.

Romanova, A., Nickels, L., & Howard, D. (2015). Effects of ageing on the learning of novel proper and common nouns. *Manuscript in preparation*.

Rosch, E. (1978). Principles of categorization. In E. Rosch & B. B. Lloyed (Eds.), *Cognition and categorization* (pp., 28-48). Hillsdale, NJ: Erlbaum.

Rosch, E. H., Mervis, C. B., Gray, W. D., Johnson, D. M.& Boyes-Braem, P. (1976). Basic objects in natural categories. *Cognitive Psychology*, *8*, 382-439.

Saetti, M. C., Marangolo, P., De Renzi, E., Rinaldi, M. C., & Lattanzi, E. (1999). The nature of the disorder underlying the inability to retrieve proper names. *Cortex*, *35*, 675–685.

Semenza, C., Sartori, G., & D'Andrea, J. (2003). He can tell which master craftsman blew a Venetian vase, but he cannot name the Pope: A patient with a selective difficulty in naming faces. *Neuroscience Letters, 352,* 73-75.

Semenza, C., & Sgaramella, T.M. (1993). Production of proper names: a clinical case study of the effects of phonemic cueing. *Memory*, *1*, 265-280.

Semenza, C., & Zettin, M. (1988). Generating proper names: a case of selective inability. *Cognitive Neuropsychology, 5*, 711-721.

Semenza, C., & Zettin, M. (1989). Evidence from aphasia for proper names as pure referring expressions. *Nature*, *342*, 678–679.

Shallice, T., & Kartsounis, L. D. (1993). Selective impairment of retrieving people's names : A category specific disorder ? *Cortex*, *29*, 281-291.

Stanhope, N., & Cohen, G. (1993). Retrieval of proper names: Testing the models. *British Journal of Psychology*, *84*, 51-65.

Terry, W.S. (1994). On the relative difficulty in recalling names and occupations. *The American Journal of Psychology*, *107*, 85-94.

Valentine, T., Brédart, S., Lawson, R., & Ward, G. (1991). What's in a name? Access to information from people's names. *European Journal of Cognitive Psychology*, *3*, 147-176.

Warrington, E. K., & Clegg, F. (1993). Selective preservation of place names in an aphasic patient: A short report. *Memory*, *1*, 281-287.

Wixted J. T., & Rohrer, D. (1994) Analyzing the dynamics of free recall: An integrative review of the empirical literature. *Psychonomic Bulletin & Review*, *1*, 89–106.

Appendix A

Full set of inclusion/exclusion criteria applied to participant's responses on semantic fluency tasks

1. Items had to be nouns related to a given category as judged by the raters.

2. No discrimination was made between different morphological realization of the same lemma: singular (e.g., apple) and plural (e.g., applies), full (e.g., hood) and diminutive (e.g., hoodie) word forms were counted as correct.

3. If a participant produced synonyms to refer to the same object, only one name was accepted. For example, in the category 'vegetables', we would only accept 'aubergine' or 'eggplant', not both, unless the words meant two different kinds of the same vegetable, in which case they would both be counted (e.g., *apple* – *Antonovka* [a sort of apples]). Similarly, in proper noun categories, if a participant generated more than one version of a name, only the first named version was counted: for example, full and short (diminutive) versions (e.g., *Robert* – *Rob*, *Saint-Petersburg* – *Petersburg*); current and former names (e.g., *Ekaterinburg* – *Sverdlovsk*).

4. We only accepted the first encounter of any given lexical item, even if it was subsequently used in combination with other items to refer to a different object/notion. For example, in the category 'sports', if 'volleyball' has been named, 'beach volleyball' would not be counted. However, if the object/notion was referred to with a phrase containing a repetition of a previously used noun but the object could be appropriately named using a non-repeating element of the phrase then this item was included. For example, if the musical instrument 'guitar' had been named and the person then said 'bass guitar', this would be accepted as a correct response, because 'bass' (the non repeated element of the phrase 'bass guitar') is an appropriate label for the same object.

5. In the category ‘sports’, noun phrase responses that had the construction “adjective + the noun ‘sports’“ were excluded (e.g., ‘ski sports’, ‘ski’ being an adjective in Russian). This was based on the consideration that we were interested in retrieval of diverse nouns within noun categories and ‘sports’ was a repetition of the category name itself.

6. In the category ‘geographical names’, we accepted, amongst other responses, noun phrase responses that consisted of an adjective carrying unique proper noun semantics and a common noun (e.g., Nevskiy prospect [the main avenue in St. Petersburg which is named after the river Neva; ‘Nevskiy’ – an adjective, ‘prospect’ – a common noun].

7. In the categories ‘famous people’ and ‘landmarks’, responses were required to be specific enough for the rater to be sure which person/landmark the participant was referring to. Thus, such responses as ‘Catherine’ (most likely Catherine the Great (II)) and ‘monument to Pushkin’ were not counted on the grounds that there is more than one female famous figure with the name ‘Catherine’ and more than one monument to the Russian famous writer and poet Alexandr Sergeevich Pushkin and, each monument would have a more precise name.

Appendix B

Comparison of Performance of People with Aphasia and the Group of Controls on Common and Individual Proper Noun Categories on Fluency Tasks

	Controls	MS	DS	VV	LG	BA	EN	BT	TD
Female and Male Names (combined)									
Proper nouns									
Score	55 (*SD* = 12.57)	7	32	22	14	17	28	44	40
Comparison with controls	*t*(7)	**-3.60**	-1.73	**-2.48**	**-3.08**	**-2.85**	**-2.03**	-0.83	-1.13
	p	**.004***	064+	**.021***	**.009***	**.012***	**.041***	.218	.149
Common vs. Proper									
RSDT	*t*(7)	2.00	**3.27**	**2.63**	1.86	2.04	1.80	2.13	1.74
	p	.086+	**.014***	**.034***	.106	.081+	.115	.071+	.126
Famous People									
Proper nouns									
Score	27.5 (*SD* = 7.84)	0	7	5	3	7	3	11	21
Comparison with controls	*t*(7)	**-3.31**	**-2.47**	**-2.71**	**-2.95**	**-2.47**	**-2.95**	**-1.98**	-0.78
	p	**.007***	**.022***	**.015***	**.011***	**.022***	**.011***	**.044***	.230
Common vs. Proper									
RSDT	*t*(7)	**2.63**	**3.17**	**2.87**	2.31	**2.75**	1.24	1.41	**2.37**
	p	**.034***	**.016***	**.024***	.054+	**.028***	.254	.202	**.049***

Countries									
Proper nouns									
Score	41.88 (*SD* = 6.90)	3	12	9	10	4	17	15	33
Comparison with controls	*t*(7)	**-7.41**	**-4.08**	**5.65**	**-4.36**	**-5.18**	**3.40**	**-3.67**	-1.21
	p	**< .001***	**.002***	**< .001***	**.002***	**.001***	**.006***	**.004***	.132
Proper vs. Common									
RSDT	*t*(7)	1.53	1.44	0.07	0.82	0.12	0.68	0.23	1.69
	p	.169	.193	.947	.440	.907	.519	.825	.135
Cities									
Proper nouns									
Score	38.5 (*SD* = 7.84)	6	8	11	14	7	23	12	20
Comparison with controls	*t*(7)	**-3.91**	**-3.67**	**-3.31**	**-2.95**	**-3.79**	-1.86	**-3.19**	**-2.23**
	p	**.003***	**.004***	**.007***	**.011***	**.003***	.052$^+$	**.008***	**.031***
Common vs. Proper									
RSDT	*t*(7)	1.51	1.52	1.70	1.69	1.10	1.67	0.16	0.71
	p	.174	.174	.132	.134	.308	.139	.880	.499
Geographical Names									
Proper nouns									
Score	29 (*SD* = 2.93)	5	3	9	17	3	14	12	16
Comparison with controls	*t*(7)	**-7.72**	**-8.37**	**-6.44**	**-3.86**	**-8.37**	**-4.83**	**-5.47**	**-4.18**
	p	**< .001***	**< .001***	**< .001***	**.003***	**< .001***	**.001***	**< .001***	**.002***
Common vs. Proper									
RSDT	*t*(7)	1.25	1.88	0.55	1.07	2.21	0.46	1.51	0.71
	p	.251	.102	.601	.320	.063$^+$	.657	.174	.500

Landmarks									
Proper nouns									
Score	14.38 (*SD* = 3.62)	2	2	1	0	0	0	2	7
Comparison with controls	*t*(7)	**-7.41**	**-3.22**	**-5.65**	**-3.75**	**-3.75**	**-3.75**	**-3.22**	**-1.92**
	p	**< .001***	**.007***	**< .001***	**.004***	**.004***	**.004***	**.007***	**.048***
Common vs. Proper									
RSDT	*t*(7)	1.53	1.97	0.07	1.22	1.22	0.35	0.14	1.01
	p	.169	.090^{+}	.947	.262	.262	.735	.893	.348
Brands									
Proper nouns									
Score	19.88 (*SD* = 4.26)	1	12	15	4	8	15	18	24
Comparison with controls	*t*(7)	**-4.18**	-1.74	-1.08	**-3.52**	**-2.63**	-1.08	-0.42	-0.91
	p	**.002***	.062^{+}	.158	**.005***	**.017***	.158	.345	.196
Common vs. Proper									
RSDT	*t*(7)	1.36	**2.92**	**3.30**	1.33	1.97	2.27	2.18	**2.98**
	p	.217	**.022***	**.013***	.225	.090^{+}	.057^{+}	.065^{+}	**.021***

* significant at $p < .05$; $^{+}$ approaching significance at $p < .01$.

Chapter Six

An Investigation of the Effects of Facilitation on the Naming of Common and Proper Nouns in Aphasia

Abstract

This paper attempts to contribute to discussion about single versus dual processing mechanisms for proper and common nouns. It investigated whether a repetition task facilitates retrieval of proper and common nouns (those that could be recognised but not named) to a similar/different extent in people with aphasia. If proper and common nouns were processed by separate mechanisms, one would expect different facilitation effects for the two noun classes. Contrary to this suggestion, our participants demonstrated facilitation effects for both noun classes and sizes of those effects were statistically comparable, even when familiarity was accounted for. Thus, based on our results, no definitive claims could be made in regards to the single versus dual processing of proper and common nouns: Comparable facilitation effects could be a result of a single processing mechanism responsible for proper and common nouns, as well as of two different mechanisms affected by facilitation in the same way.

Introduction

Theoretical linguistics has long recognised common and proper nouns as different lexical-semantic categories within the word class of nouns. Supporting this theoretical claim, a number of empirical studies have shown that, in non-brain-damaged speakers, common and proper nouns exhibit divergent rates of tip-of-the-tongue (TOT) states and differences in reaction times in word retrieval (e.g., Brédart, Valentine, Calder, & Gassi, 1995; Burke, MacKay, Worthley, & Wade, 1991; Cohen & Faulkner, 1986; Hanley, 2011; Hanley & Cowell, 1988; Hanley & Kay, 1998; Hay, Young, & Ellis, 1991; Levelt, Schriefers, Pechmann, Vorberg, & Havinga, 1991; Marful, Paolieri, & Bajo, 2014; Reason & Lucas, 1984; Young, McWeeny, Ellis, & Hay, 1986). Furthermore, some people with aphasia have shown differences in naming accuracy in word retrieval for common and proper nouns (e.g., Cipolotti, 2000; Cipolotti, McNeil, & Warrington, 1993; Harris & Kay, 1995; Martins & Farrajota, 2007; McKenna & Warrington, 1978; Semenza & Zettin, 1988, 1989). However, the underlying causes of such discrepancies are yet to be confirmed. Thus, the question is still unanswered whether differences in processing of common and proper nouns can be explained by their dissimilar representation and/or processing mechanisms, or whether there are other factors causing discrepancies between these two lexical-semantic categories. This paper first provides a short theoretical overview of possible explanations of empirical findings on common and proper noun retrieval in non-brain-damaged speakers and people with aphasia. This theoretical overview is followed by the description of an experimental study that was employed to explore potential differences between common and proper noun processing in people with aphasia.

As noted above, most studies with non-brain-damaged speakers have shown generally more accurate and faster retrieval, as well as smaller numbers of TOTs, for common nouns in comparison to proper nouns. Some authors propose that these effects are due to differences in

logical properties, that is, differences in the nature of common and proper nouns as different lexical-semantic categories (e.g., Semenza, 2009). Namely, common nouns refer to a category of beings or objects that share certain semantic properties while proper nouns designate specific individual beings or objects with unique features (a type versus token distinction; Jackendoff, 1983). Common noun attributes are sometimes referred to as "essential" (see Yasuda, Beckmann, & Nakamura, 2000 for discussion), meaning that there are a limited number of characteristics that are crucial in linking a common noun to its referents and these characteristics will be identical for each referent of a common noun. For example, Wikipedia gives the following definition for the common noun *city*: "A city is a relatively large and permanent human settlement. … Cities generally have complex systems for sanitation, utilities, land usage, housing, and transportation" (City, 2015). Thus, any settlement that meets these characteristics can be proudly called *a city*. As opposed to "essential", proper nouns are argued to have "accidental" attributes that are endless in number (see Yasuda et al., 2000). The number and quality of characteristics one could give to a proper noun depends substantially on one's personal experience and preferences. Moreover, individual referents of proper nouns are subject to change and thus, their attributes may subsequently alter too. For example, *Sydney* (a proper noun) is the most populous city in Australia and Oceania, it is home to the world famous Harbour Bridge and Opera House, etc. Presumably, there is no other city that would have the same combination of semantic features as Sydney. Furthermore, if another city in Australia outgrows Sydney in its population, then Sydney will lose one of its attributes - the status of "the most populous".

Under the logical properties account, one of the explanations for differences in retrieval between common and proper nouns lies in differences in the way the phonological form is activated. Common nouns are proposed to have multiple connections from semantics to phonological form. In contrast, proper nouns are argued to possess only a single connection between the proper noun concept and its phonological form (see, for example, Cohen & Burke, 1993 for discussion). This single connection makes proper nouns more susceptible to word retrieval failures.

Meanwhile, other authors attribute the distinction in performance between common and proper nouns to be predominantly due to a number of ***statistical properties*** that differ for these two noun categories. The properties in question are traditionally thought to operate at the level of retrieval of the phonological form (e.g., Dell, 1990; Jescheniak & Levelt, 1994). These include, frequency, familiarity, and age of acquisition (Kay, Hanley, & Miles, 2001): Proper nouns tend to be less frequent, less familiar and acquired later in life, in comparison to common nouns. As a result, it is argued that, although processed in a similar way and by the same mechanism, proper nouns are harder to retrieve than common nouns. Thus, under the statistical properties account, we would not expect any difference between common and proper nouns provided we control for statistical properties across the common and proper noun sets. The differences in word retrieval accuracy and reaction times reported in the literature would be then accounted for by different statistical properties of common and proper nouns. However, there are a number of methodological difficulties that unavoidably arise when we want to measure these characteristics for proper nouns.

For example, while frequency counts will always only be an approximation of the true frequency for any individual, the problem is likely to be more extreme in the case of proper nouns. Frequency rates for proper nouns are particularly subjective and vary from individual to individual even for people within the same age range and from the same country, depending on their social economic status, sphere of interests, gender, names frequently used in a family, etc.

Take the proper noun *Simba*. If you are a lover of the Disney cartoon "Lion King" or if you recently saw the musical of the same name, *Simba* will be a very familiar and, possibly, frequent item in your vocabulary. The age of acquisition may vary depending whether you have been a "Lion King" fan since your childhood or just recently got acquainted with the characters. If, however, you are instead a book lover and not a musical goer, this name could be unfamiliar. Hence, obtaining even approximately accurate frequency values for proper nouns simply may not be a feasible task, and hence, matching of common and proper nouns on standard variables such as frequency (Brédart, 1993; Valentine, Brédart, Lawson, & Ward, 1991) and age of acquisition may not be possible. This, in its turn, complicates the task of designing an experiment that could reveal differences underlying common and proper noun retrieval. Therefore, common and proper nouns pose a challenge not only to speakers attempting to retrieve an item, but also to researchers venturing to reveal the underlying causes of the differences in performance.

Turning to neuropsychological data, dissociations have been observed in proper and common noun processing in people with aphasia: Some have been found to have common noun processing spared and proper nouns severely impaired (e.g., McKenna & Warrington, 1980), whereas others have presented with a disproportionate impairment of common nouns with proper nouns staying relatively intact (e.g., Cipolotti et al., 1993). Both selective proper noun impairment and proper noun sparing have been claimed to occur at both the level of access to the phonological output lexicon (e.g., selective proper noun disorders: Lucchelli & De Renzi, 1992; Martins & Farrajota, 2007; Semenza & Zettin, 1988, 1989; selective proper noun sparing: Martins & Farrajota, 2007) and the semantic level (e.g., selective proper noun disorders: Miceli et al., 2000; Vertichel, Cohen, & Crochet, 1996; selective proper noun sparing: Lyons, Hanley,

& Kay, 2002)[9]. It has to be noted, however, that reports of spared proper nouns and impaired common nouns are sparse and quite complex (see Semenza, 2009 for full discussion). In addition, patients who suffer from these dissociations often have very severely impaired word production and only limited testing of comprehension is possible (Semenza, 2006). Thus, the evidence for such dissociations in production is limited.

Treatment studies can also be used to test hypotheses about language processing. Nickels, Kohnen, and Biedermann (2011) argue that treatment studies can discriminate between theories by comparing their predictions about treatment outcomes. Is it the case, therefore, that common and proper nouns respond in the same way to treatment? A review of the literature shows that proper nouns are very often neglected in speech therapy and there are very few studies that compare the influence of treatment (effects on later performance of multiple applications of a technique), facilitation (effects on later performance of a single application of a treatment technique), or cueing (effects at the time of a single application of a technique) on common versus proper nouns. Semenza and Sgaramella (1993) investigated the effects of cueing with a person with aphasia, RI, whose only recognisable words were unconnected sequences of proper nouns. RI was argued to have a deficit "in the mapping from the phonological output lexicon to motor articulatory programmes". Critically, only naming of proper nouns benefited from phonological cueing and not that of common nouns. It is important to note that when performance in one modality is completely at floor, the interpretation of a lack of an effect of cues is not straightforward. Nevertheless, if we take these data to reflect a selective deficit, as Semenza (2006) suggests, there are two possible explanations. First, the lack of cueing effect for common nouns could be due to a deficit in a separate common noun processing mechanism that renders it insensitive to cues. Alternatively, it could be due to

[9] Please note that in his review Semenza (2009) also discusses other possible levels of impairment and selective proper/common noun deficits (such as isolation of semantic information about individual entities and prosopanomia). These are beyond the scope of this paper.

the proposed type/token difference in referencing for common and proper nouns: The single connection between the phonological form of the word and its referent, in the case of proper nouns, creates less competition at the phonological output lexicon level and thus, proper nouns are better cued. As this has only been demonstrated for personal names, the occurrence of stronger cueing effects for other items with individual reference (other types of proper nouns) would support this claim.

Robson, Marshall, Pring, Montagu, and Chiat (2004) report the only full treatment study comparing proper and common nouns that we are aware of. Participants (*n* = 8) had different levels and types of aphasia, but all showed severe word-finding difficulties and no category specific (common or proper noun) impairments were reported. Therapy was individually tailored for each participant and combined semantic and phonological tasks for both common and proper nouns. Analyses were performed at a group level and showed that the treatment improved naming performance and was equally beneficial for common and proper nouns. Moreover, treatment effects were long-lasting and extended up to one month post-treatment. However, stimuli used in the treatment were chosen by participants themselves and contained many personally relevant items. Considering that Robson et al.'s (2004) initial naming assessment showed higher naming rates for personally relevant proper nouns (names of family members, friends, and places associated with a person's life) than for other proper noun categories, treatment effects for proper nouns could have been boosted by the high proportion of personally relevant proper nouns in the treatment set. Robson et al. (2004) suggest that the familiarity of personally relevant items could outweigh the intrinsic disadvantage of proper nouns, which could result in better naming and treatment effects. Nonetheless, the authors hold that the improvements in treatment could not be solely due to the presence of personally relevant proper noun items (such as names of family and friends) as the sets also included the names of famous people, places, and TV programmes. Nevertheless, it could be argued that the names of famous people, places, and TV programmes were also selected by participants themselves and thus, are personally relevant as well.

In sum, while the differential effects of cueing and treatment on proper and common nouns have been studied, there are several reasons why the topic deserves further investigation. Not only are there relatively few studies, but the studies there are do not provide converging or clear pattern: The patient described by Semenza and Sgaramella (1993) benefited from proper noun cueing only, while those investigated by Robson et al. (2004) showed positive treatment effects for both common and proper nouns. In addition, a possible selective impairment for common nouns (Semenza & Sgaramella, 1993) and a mixture of therapy tasks addressing different levels of processing for each participant (Robson et al., 2004) makes it hard to draw conclusions about the mechanisms underlying the effects of a particular treatment on proper nouns in comparison to common nouns. Consequently, it is hard to use these studies to make inferences regarding whether common and proper nouns have similar or different mechanisms in lexical access.

The present study aims to contribute to understanding of common and proper noun processing using data from people with aphasia. Employing a facilitation paradigm, we hope to be able to shed further light on the role of logical and statistical properties in common and proper noun processing, and in particular on whether there is a dual (logical) or single (statistical) processing mechanism.

Repetition facilitation as a tool

Following Howard and Hatfield (1987) and Nickels et al. (2011), we define facilitation as a single application of a certain technique (e.g., repeating a word) carried out to investigate whether this has any effect on the later performance of another task (e.g., picture naming).

The mechanisms underlying the effectiveness of facilitation have been likened to long-lag identity priming effects with non-brain-damaged participants (Nickels, 2002).

In this study we used repetition as the facilitation task: We investigated whether, for a picture that had not be successfully named, repetition of a word (in the presence of a picture) would have any facilitatory effect on later, post-facilitation, picture naming[10]. Relatively long-term effects of this facilitation technique have been previously established (e.g., Best, Herbert, Hickin, Osborne, & Howard, 2002; Davis & Pring, 1991).

Where does the source of repetition facilitation lie? As discussed in Best et al. (2002), the priming effect underlying repetition facilitation occurs neither at the level of phonological output lexicon nor at the semantic (conceptual) level. Instead, it is most likely grounded in the links between semantics and phonology for models with no intermediate representations between these two levels (e.g., Caramazza, 1997) or in the mappings from the lemma level to the phonological output lexicon for two-stage models with the lexical node lemma level (e.g., Levelt, 1989; Levelt, Roelofs, & Meyer, 1999). Wheeldon and Monsell (1992) also argue for this level as the source of identity priming in non-brain-damaged subjects. Findings from Best et al. (2002) provided more evidence for this hypothesis: People with impairments at the level of mappings from semantics to phonology showed greater facilitation effects, compared to participants with relatively more severe impairments of semantics or phonological output processes. In summary, repetition facilitation most likely increases accessibility of the word form. Thus, as Mason et al. (2011) suggest, it is appropriate for people with aphasia where the target word form is not sufficiently activated to be retrieved, whether this is a result

[10] Note, however, the distinction in the use of repetition here to its use in the term "repetition priming" (e.g., Wheeldon & Monsell, 1992), where repetition refers to prior production of the same item, rather than production of an item by saying it in response to an auditory stimulus.

of (mild-moderate) semantic impairments or as a result of lexical impairments (of either the phonological output lexicon or access to it).

As mentioned above, in the logical properties account, differences in processing between common and proper nouns are argued to arise in the mappings from semantics to the phonological output lexicon - exactly the level of processing where repetition facilitation is proposed to have its effects.

In the statistical properties account, the relevant psycholinguistic variables (frequency, familiarity, and age of acquisition) are also proposed to have their effects on accessing the phonological word form (e.g., Barry, Hirsh, Johnston, & Williams, 2001; Jescheniak & Levelt, 1994; Navarrete, Scaltritti, Mulatti, & Peressotti, 2012).

Thus, irrespective of which mechanism (single or dual) or account (built on the differences between logical or statistical properties) is responsible for different performance on common and proper nouns, repetition facilitation should tap the level at which the dissociation between common and proper nouns arises.

Research Questions

In this study we aimed to examine the effects of facilitation on common and proper nouns. Specifically, we examined whether a previous encounter with a target word in a repetition task influenced subsequent word retrieval success rates, and whether these differed for common and proper nouns, both within and across individuals with aphasia.

If common and proper nouns show different patterns of facilitation – for example, one noun category reveals facilitation effects, whereas the other does not, or facilitation effects for one noun category are larger than for the other - we may infer that common and proper nouns are processed by different language processing mechanisms that are unequally affected by facilitation. Such findings would therefore support the logical properties account in favour of two separate mechanisms for processing common and proper nouns.

If, however, common and proper nouns show similar facilitation effects, this pattern would be consistent with a single mechanism that is responsible for processing of both these two noun categories, which would support the statistical properties account. Nonetheless, similar facilitation effects would also be consistent with the hypothesis that common and proper nouns are processed by two distinct mechanisms (logical properties account) but that these mechanisms respond to facilitation in quantitatively and qualitatively similar way.

Method

Participants

Four people with aphasia participated in the experiment. Participants were selected on the basis of being native English speakers with aphasia who reported word retrieval problems and were more than 6 months post-onset. They all were British English speakers from Newcastle upon Tyne area (UK). Participants were assessed with the Comprehensive Aphasia Test (CAT; Swinburn, Porter, & Howard, 2004). See Table 1 for participants' CAT scores.

No major semantic impairments were revealed, as all participants scored within normal limits on at least one word-picture matching task (although MR scored just below the cut-off in the semantic memory task). All the four participants were able to repeat the words and non-words after the experimenter, however, TB and JS had mild to moderate articulatory distortions and cluster reductions. In repetition of words, both TB and JS performed below the cut-off, and a mild length effect was observed for JS (he had no problems in repeating 1-syllable words but failed to repeat two 3-syllable words).

All the participants showed a naming impairment, reflected in performance below the normal cut-off on the action naming task. In the object naming task, however, only JS and TB showed a score that was outside the range of controls, with a length effect present (his naming of 3-syllable words was worse than naming of 1-syllable items). Both JS and TB produced speech sound errors in naming[11]. TB and JG also scored poorly on the word fluency task. Despite the fact that only two participants (TB and JG) showed particularly low performance on word retrieval tasks, all the participants reported word retrieval difficulties in their daily lives. As Swinburn et al. (2004) note, although CAT is a good assessment tool for summarising overall performance of people with aphasia, it does not necessarily detect mild aphasic impairments. Thus, we suggest that CAT naming and word fluency tasks were likely to have been insensitive to word retrieval impairments of our participants. We discuss their word retrieval in further detail below.

[11] We use the term 'speech sound' errors as it is hard to be confident regarding the source of these errors -it seems likely they reflect phonetic/articulatory encoding (apraxia of speech) but we cannot exclude the possibility that they may also be phonological in origin.

Table 1

Participants' Background Information and Raw Scores on Selected Tasks from Comprehensive Aphasia Test (Swinburn, et al., 2004)

	JG	MR	JS	TB	*Max score (where relevant)*
Gender	female	male	male	male	
Age (years)	64	65	78	82	
Time post-onset	12 years	9 years	2 years	14 years	
Education	14 years	21 years	13 years	8 years	
Previous occupation	child-care worker	college head of department	engineer	plumber	
Articulation	intact	mild dysarthria evident in connected speech; mild apraxia of speech	mild-moderate apraxia of speech: distortions, cluster reductions	mild-moderate apraxia of speech: distortions, cluster reductions	
Semantic memory	10	**8***	9	10	*10*
Comprehension					
spoken words	29	28	29	27	*30*
written words	30	**25***	29	**26***	*30*
spoken sentences	28	31	28	**24***	*32*
Written sentences	29	32	30	**17***	*32*
Repetition					
words	32	32	**29***	**26***	*32*
non-words	6	10	10	8	*10*
Naming objects	44	47	**39***	**12***	*48*
Error analysis: first response (%)					
Delayed response	0	0	17	0	
Semantic	0	0	0	5	
Speech sound	0	0	83	58	
No response	100	0	0	37	
Naming actions	**8***	**8***	**7***	**2***	*10*

Word fluency	**12***	17	23	**6***
Spoken picture description	**28.0*** (no complex syntax, occasional missing verbs, prepositions and determiners)	**15.0*** (no complex syntax, incomplete phrases, occasional missing verbs and prepositions)	33.0 (some syntactic variety, correct inflections and usage of prepositions, occasional missing determiners)	**14.5*** (poor syntax, missing verbs and determiners, incorrect inflections)

Note. The scores marked with "*" are below the cut-off for impaired performance based on non-aphasic performance for a particular CAT section. Tasks on comprehension of spoken and written words, repetition of words and non-words, and naming objects and actions are scored 0-2 for each item.

Stimuli

Picturable common and proper nouns were selected for the study and paired with respective colour pictures. The primary inclusion criterion for the items in this experiment was that they should be recognised by the participants but would potentially present difficulty in the naming task, as the facilitation paradigm requires incorrectly named stimuli. Images for all the stimuli were taken from open web resources.

As was discussed in the Introduction, it is not possible to use published counts and ratings to objectively match sets of common and proper nouns on frequency and age of acquisition, due to the individual nature of proper noun frequency. Instead, we collected familiarity ratings for the common and proper nouns, individually for each participant, and used these as a subjective measure of frequency (see Nickels, 1995) in post-hoc statistical analysis.

Proper nouns

Proper nouns were selected from a range of categories: cartoon characters, singers, famous personalities, brands, films, countries, and cities. We excluded items with name variations (e.g., Russia – Russian Federation, Ireland - Eire), and restricted our choice of personalities to those whose names consist of only one element (e.g., Adele, Cher, Cleopatra). However, we made exception for those famous people who are mostly known by one name but do in reality have other names (e.g., Lenin – Vladimir Ilyich Lenin, Rembrandt – Rembrandt Harmenszoon van Rijn). Item images were colour photos in the case of singers, famous personalities, films, and cities; colour pictures for cartoon characters; black and white maps of a continent/region, with the country in question highlighted yellow and displayed with the country's flag, in case of countries; and finally, for brands, a brand logo, with the name erased, paired with a picture of the product associated with this brand.

To check for recognition of potential stimuli we conducted a series of online questionnaires in the target population: 55-80 year-old British English speaking individuals, who had lived most of their lives in the UK and who spoke English as their dominant language. The questionnaires contained pictures of proper nouns presented in blocks by category. Respondents were asked to name the item, after which they were immediately provided with the target name (whether they had answered correctly or not) and asked whether they recognised the item. For example, if the item was a singer, participants had to choose between the following options: 1) "I recognised the singer and I named him/her correctly (disregard spelling mistakes if any)"; 2) "I recognised the singer but I didn't name him/her correctly. I couldn't remember the name"; 3) "I know the name but I couldn't recognise him/her as I didn't know what he/she looks like"; 4) "I recognised the singer but I didn't name him/her correctly. I mixed his/her name up with the name of another singer"; 5) "I don't know this singer." Only the items that received answers (1), (2) or (4) by at least 50% of the respondents were selected for the experiment. As a result of the online questionnaires, we selected 93 one- to four-syllable proper nouns belonging to various categories: cartoon characters (17), singers (7), other famous personalities (8), brands (16), films (10), countries (21), and cities (14). See *Appendix B* for the full list of proper noun stimuli.

Common nouns

In order for the common nouns in the experiment to elicit retrieval difficulties while being familiar to participants, we selected picturable items with relatively low frequencies: We used words with frequencies of less than 80 words per million from the subtitle database (SUBTLEX; $SUBT_{WF} < 80$, Brysbaert, New, & Keuleers, 2012). In addition, some of the items were targets in standardised naming tests, such Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983) and Graded Naming Test (McKenna & Warrington, 1983), but with different pictorial representations.

In summary, the list for the initial naming test included 240 one- to four-syllable low frequency common nouns that were considered to be potentially difficult to name for people with aphasia. They belonged to a range of categories such as animals, household and food items, etc. See *Appendix A* for the full list of common noun stimuli.

Facilitation Procedure

The experimental procedure consisted of the following steps:

1. Stimulus selection

1.1. Naming pre-test. Each participant was presented with pictures depicting common and proper noun referents and asked to name the pictures with a single word. Items were presented in separate blocks of common and proper nouns (7-21 items per block). Proper noun items were blocked by semantic categories (cartoon characters, singers, other famous personalities, brands, films, countries, and cities); blocks were of varying length - from 7 to 17 items. Common nouns were randomly assigned to blocks of 14-15 items, balanced for item length (number of syllables). Blocks of proper nouns were alternated with common noun blocks when presented for naming. The presentation order of the blocks and of items within the blocks was identical for all the participants.

Each block was preceded by direct instructions of what category would have to be named next. Thus, for each block they were instructed that they would have to "Name the [brands/singers/cartoon characters/objects, etc.]." Presentation of items stopped when all the proper noun items had been seen by the participants and they had failed to name at least 40 common nouns, or the whole list of common items had been exhausted.

Each item was presented until a response from a participant, until a participant indicated they could not name the item, or for a maximum of 10 seconds. An item was accepted as correct if it was retrieved within 10-second time frame (whether or not an incorrect response was produced first). As we were interested in word retrieval rather than phonological and/or phonetic encoding, we accepted as correct productions with phonetic distortions and/or attempts that were phonologically related to the targets as correct responses (defined as more than 50% of phonemes in the target being present in the response or vice versa).

1.2. Recognition task. Following completion of the naming pre-test, those items that were not named by the participants on the first attempt were presented again and participants were asked whether each item was someone/something that they recognised. Participants received the following instructions: "You will see some of the pictures again. I want to check if they are things that you know. Can you tell me if you recognise the object/person, etc. in the picture?" This was to ensure that it was not the case that participants were not familiar with, for example, a yoke, or the cartoon character Dumbo, but that their error response reflected impaired name retrieval despite familiarity. The order of the items was identical to that of the naming pre-test with the successfully named items excluded from the list. The participants were not provided with the target name. Those items that had not been named but were recognised comprised the experimental items.

2. Facilitation

2.1. Repetition facilitation. Common and proper nouns from each participant's set of experimental items (words that were not named but were recognised) were randomly assigned to *facilitation* and *no-facilitation* conditions, individually for each participant. Item numbers varied across participants and conditions. Such variation in item numbers was due to unequal numbers of not named but recognised common and proper nouns for each participant, and the need to maximise the number of items retained in the experiment for each participant and condition. Pictures of facilitated nouns were presented together with an auditory recording of the corresponding noun: Participants were asked to repeat the item name after hearing it. The order of the items was the same as in the recognition task with those items that were not recognised and those not facilitated excluded from the list.

3. Post-test

3.1. Post-facilitation naming. At this stage participants were required to attempt naming of all the items that were recognised but not named at the first attempt, whether facilitated or not. The order of the items was identical to the recognition task with those items not recognised being excluded. The lag between the repetition facilitation and post-facilitation naming task was at least five minutes.

3.2. Familiarity judgements. At the end of the experiment, participants were presented with all the experimental items paired with auditory images of the corresponding words and asked to judge how familiar these items were to them by pointing to the scale from 1 (completely unfamiliar) to 7 (very familiar). Individual familiarity judgement ratings were used as subjective individualised frequency measures in further analysis.

Results

Naming pre-test

In order to assess the word retrieval of our participants and to pinpoint any possible dissociations in production of common versus proper nouns, we analysed naming of common and proper nouns at pre-test and compared it to the naming performance of 10 British English speaking age-matched control subjects (*age range* = 65-70 years; *Mean* = 67.10 years, *Standard Deviation* = 1.37).

The number of common noun items attempted at the naming pre-test varied for each person with aphasia, depending on how quickly the experimental criteria were met (see above). Thus, when comparing the naming of the people with aphasia to that of controls, we only used those items that were presented to all participants with aphasia: 149 common and 90 proper nouns.

Figure 1 represents individual naming success rates for common nouns for the four people with aphasia, the naming scores for the corresponding items for 10 control participants and the line of best fit for these control scores. Six of the ten control participants showed a significant difference between conditions such that common nouns were easier to name than proper nouns (Fisher's Exact Test: p (2-tailed) $< .05$). It is clear that there was greater variability in proper noun naming than common noun naming (common nouns ($n = 149$): *Mean* = 133.1, *Standard Deviation* = 6.54; proper nouns ($n = 90$): *Mean* = 68.3, *Standard Deviation* = 9.87). A modified t-test (Crawford & Howell, 1998) was employed to compare each person with aphasia with controls.

Naming accuracy: Common Nouns

Three of the four people with aphasia named common nouns significantly more poorly than the age-matched controls, and the fourth, JS, showed performance comparable to that of control participants (JG: $t(9) = -5.56$, p (one-tailed) $< .001$; MR: $t(9) = -3.22$, $p = .005$; TB: $t(9) = -10.95$, $p < .001$; JS: $t(9) = -1.18$, $p = .134$).

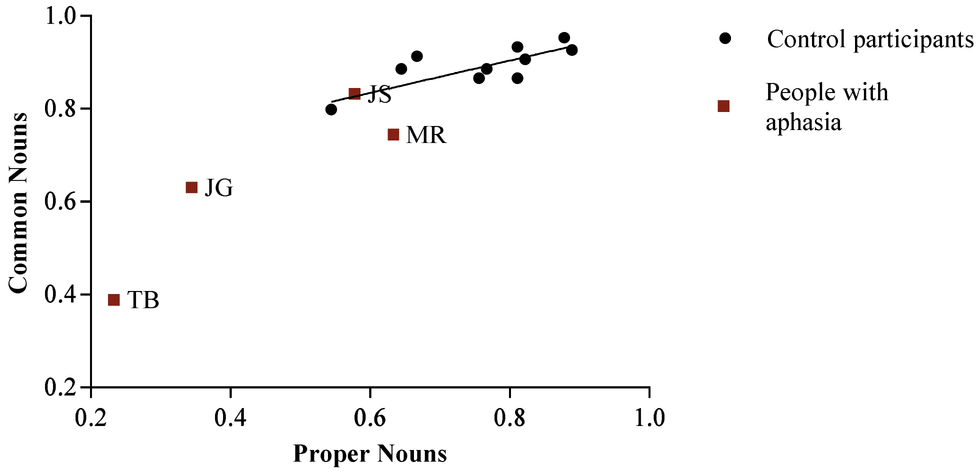

Figure 1. Proportion correct on common and proper nouns in the naming pre-test for people with aphasia and control participants, with a line of best fit for control data points.

Naming accuracy: Proper Nouns

Two of the people with aphasia (JG and TB) showed significantly lower performance than the controls on proper nouns, with another, JS, showing a close to significant difference (See Figure 1; JG: $t(9) = -3.51$, p (one-tailed) $= .003$; TB: $t(9) = -4.47$, $p = .001$; JS: $t(9) = -1.58$, $p = .075$; MR: $t(9) = -0.90$, $p = .196$).

Relative naming accuracy: Common versus Proper Nouns

Like the majority of controls, three of four participants with aphasia scored significantly more poorly on proper nouns than on common nouns and the fourth, MR, showed comparable performance on both noun classes (Fisher's Exact Test; JG: p (two-tailed) $< .001$; JS: $p < .001$; TB: $p = .020$; MR: $p = .093$). The revised standardised difference test (RSDT; Crawford & Garthwaite, 2005) was used to evaluate whether the difference between common and proper noun retrieval was larger for the people with aphasia than the controls. One participant (JS) showed a difference that was of the same magnitude as for the controls ($t(9) = 0.49$, p (two-tailed) = .634). The remaining three participants showed a significantly smaller difference between proper and common nouns than the controls - common nouns were relatively more impaired than proper nouns (Figure 1; JG: $t(9) = 2.51$, $p = .033$; TB: $t(9) = 6.94$, $p < .001$); MR: $t(9) = 2.83$, $p = .020$). Note that this statistical pattern, in part reflects the greater control variability on the proper noun set.

Level of Impairment: Word retrieval

Given that participants' performance on naming tasks of the CAT (Swinburn et al., 2004) was relatively close to ceiling, we conducted additional analyses using the naming pre-test data. Note that, following the experimental scoring, in these analyses, speech sound errors were accepted as correct. The main error types for both common and proper nouns were omissions and circumlocutions (see Table 2 for details). Semantic errors were present in responses of all the participants but were not a dominant error type.

Table 2

Error Patterns: Percentage of Errors of Each Type in Naming Pre-test (Common and Proper Nouns Combined, n = 239)

	Total number of errors (*n*)	Semantic errors (%)	Omissions (%)	Circumlocutions (%)	Other (%)
JG	113	15	71	12	.2
MR	71	22	30	41	7
JS	62	24	56	15	5
TB	159	11	85	2	2

We then used Logistic regression to examine effects of word frequency (SUBTLEX; Brysbaert et al., 2012) on participants' accuracy (on common nouns alone given the lack of frequency counts for proper nouns) while controlling for any confound with length. A test of a full model against a constant only model was statistically significant for all the four participants ($p < .05$). The Wald criterion demonstrated that frequency had a significant effect on naming accuracy for three of the four participants (JG: $p = .001$; MR: $p = .002$; and JS: $p = .031$), but only verged on significant for TB ($p = .076$). Exp (B) values indicated that, when frequency was raised by one unit, JG, MR and JS were 1.20, 1.12 and 1.27 times (respectively) as likely to name the item correctly.

Overall, JG, MR, and JS presented with relatively mild word retrieval problems, while TB's naming was more severely impaired. As participants scored within the normal range on most comprehension tasks, semantic impairments were unlikely to be the primary source of their naming impairments. This suggests that participants' impairment in word retrieval could be localised to the phonological output lexicon or access to it. The presence of frequency effects, semantic and circumlocution errors in naming supports this localisation. JS and TB also produced a high proportion of speech sound errors including groping and articulatory distortions, and length effects (on CAT; Swinburn et al., 2004). Thus, as was suggested above, in addition to the lexical impairment, these two participants may have impairments at *the post-lexical phonological and/or phonetic encoding levels.*

In relation to differences in common and proper noun retrieval, three of the four participants (JG, MR, TB), showed a significantly greater impairment for common nouns than proper nouns in comparison to controls. However, we are reluctant to interpret this as evidence for a dissociation given the relatively greater variability of controls in proper noun naming.

Effects of facilitation on naming

1) Individual Analyses

See Table 3 and Figure 2 for the results of facilitation on naming accuracy for each condition at post-test. First, we investigated whether there was any effect of facilitation on naming for common and proper nouns individually for each of the four participants: facilitated items were named significantly more accurately than unfacilitated items for all participants for both common and proper nouns (Fisher's exact tests: $p < .05$, all comparisons), except that participant TB did not show a significant facilitation effect for proper nouns.

Table 3

Post-test Naming Performance

Participant			JG	MR	JS	TB
Common	Facilitated	Presented *n*	24	16	16	36
		Correctly Named (%)	75%	81%	63%	50%
	Unfacilitated	Presented *n*	22	19	17	28
		Correctly Named (%)	5%	21%	24%	18%
	Facilitated vs. Unfacilitated	*p* (one-tailed)	**< .001***	**< .001***	**.016***	**.004***
Proper	Facilitated	Presented *n*	17	14	11	23
		Correctly Named (%)	65%	93%	73%	22%
	Unfacilitated	Presented *n*	15	17	12	22
		Correctly Named (%)	13%	24%	17%	18%
	Facilitated vs. Unfacilitated	*p* (one-tailed)	**.002***	**< .001***	**.005***	.391
Common vs. Proper	Homogeneity Test	$\chi^2(1)$	2.20	0.06	0.08	2.74
		p (two-tailed)	.138	.799	.779	.098^{+}

Note. * significant at $p < .05$; $^{+}$ approaching significance at $p < .1$.

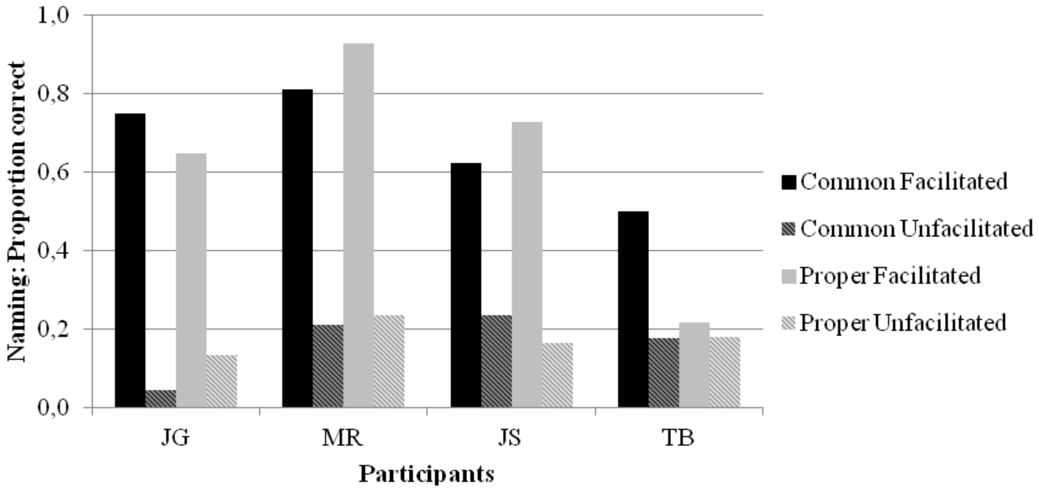

Figure 2. Naming accuracy on facilitated and unfacilitated common and proper nouns in the post-facilitation naming task.

Second, we compared the size of facilitation effects for common and proper nouns, using homogeneity tests. To do so we first converted the *p*-values, obtained as a result of the Fisher's Exact tests, into *z*-scores. There was no statistical difference in the size of facilitation effects between common and proper nouns for any of the participants.

2) Case Series Analyses

We next examined the size of the facilitation effects for common and proper nouns across all the four participants. Combining across the participants there was an overall statistically significant facilitation effect for both common (Combined S test, $z = -6.6$, $p < .0001$, one-tailed; see Leach, 1979) and proper nouns ($z = -4.75$, $p < .0001$).

Homogeneity tests showed no significant differences in the size of the facilitation effects across participants for either common ($\chi^2(3) = 4.53$, $p = .209$, two-tailed), or proper nouns ($\chi^2(3) = 6.77$, $p = .080$): All the participants benefit to the same extent from facilitation. Finally, we examined whether there were any significant differences in the relative size of the facilitation effects between common and proper noun conditions across participants: There were not ($\chi^2(1) = 1.69$, $p = .193$, two-tailed). Thus, although TB's pattern appeared to be different from the others, we did not find statistical support for this, although it is possible that this could be due to insufficient power.

Preliminary Discussion

As both individual and case series analyses showed, facilitation effects were present for both common and proper nouns for all but one participant (TB). Moreover, the size of facilitation effect was statistically comparable across these two noun categories, within and across participants (with a trend for a difference between the classes for TB).

However, there is a possible confounding variable to consider. As was discussed above, our sets of common and proper noun items were not matched on frequency, and while stimuli were randomly allocated to facilitated and unfacilitated sets, they were not matched. It is possible that this could obscure potential differences in facilitation effects for common and proper nouns. As mentioned previously, we collected familiarity ratings from our participants and consequently have used them as a measure of individual subjective frequency in further analyses.

Effects of facilitation on naming controlling for familiarity

1) Evaluating subsets for familiarity

We first examined whether the sets differed in familiarity using Mann Whitney U tests (see Table 4 for more details*).* Despite the random allocation resulting in matched sets under most circumstances, this was not always true. In particular, TB, who showed some indication of a difference between common and proper noun facilitation, showed a significant difference in familiarity for the two sets. Hence, in order to ensure that the effects we observed in the initial analyses were not due to confounds with familiarity, further regression-based analysis was conducted controlling for any effects of familiarity. We first performed the analysis on individual participant's data and then on all four participants combined.

Table 4

Comparison of Item Sets on Familiarity Using Mann-Whitney U Test, Two-tailed

	JG		MR		JS		TB	
	z	*p*	*z*	*p*	*z*	*p*	*z*	*p*
Common vs. proper (facilitated and unfacilitated)	0.31	.756	0.09	.926	1.87	.062	**2.78**	**.005***
Facilitated vs. unfacilitated (common and proper)	0.92	.359	0.13	.899	1.23	.220	0.37	.714
Common facilitated vs. common unfacilitated	1.03	.303	-0.03	1.000	- 0.13	1.000	**2.33**	**.020***
Proper facilitated vs. proper unfacilitated	0.06	.951	0.05	.960	1.50	.135	1.29	.198
Facilitated common vs. proper nouns	0.65	.517	-0.11	1.000	0.15	.880	0.29	.771
Unfacilitated common vs. proper nouns	0.12	.901	0.04	.967	**2.16**	**.015***	**3.71**	**.001***

Note. * significant at $p < .05$.

2) Individual Analyses

Logistic regression was employed to predict the probability of a correct response in the post-facilitation naming task based on a set of predictors: facilitation (facilitated versus unfacilitated items), word class (common versus proper nouns), length (number of phonemes), familiarity (from unfamiliar to very familiar on a 1-7-scale according to self-rating), as well as the interaction between facilitation and word class (the key variable of interest for our experiment). The results are shown in Table 5. For each of the four participants the full model (with the five predictors included) accounted for the data significantly better than a model with a constant only (p < .001, for all the participants). Both facilitation and familiarity proved to be significant predictors of naming accuracy for all the participants. None of the participants showed significant main effects of either word class or length on naming accuracy nor a significant interaction between facilitation and word class (p > .05). However, consistent with the previous analysis, TB showed an interaction that was close to significant. Adding other, two- or three-way, interactions between the predictors into the model did not improve the goodness of fit for any participant (p > .05, for all chi-square tests). Hence, only the models with main effects and one two-way interaction are reported here.

Table 5

Results of Logistic Regressions Examining Effects of Facilitation, Word Class and Length, and Familiarity on Naming Accuracy

Case JG

Model $\chi^2(5) = 47.02^*$.
R^2 = .85 (Hosmer & Lemeshow), .45 (Cox & Snell), .61 (Nagelkerke).

				95 % CI for Odds Ratio		
	B (SE)	Wald (*df* = 1)	Sig.	Lower	Odds Ratio	Upper
Constant	-6.76* (2.60)	6.75	.009			
Facilitation	**4.46* (1.19)**	**14.07**	**.000**	8.41	86.42	888.33
Word Class	1.08 (1.30)	0.69	.405	0.23	2.95	37.43
Familiarity	**0.78* (0.32)**	**6.05**	**.014**	1.17	2.19	4.09
Length	-0.21 (0.19)	1.21	.272	0.56	0.81	1.18
Facilitation * Word Class	-1.31 (1.53)	0.73	.393	0.01	0.27	5.43

Case MR

Model $\chi^2(5) = 58.89^*$.
R^2 = .04 (Hosmer & Lemeshow), .59 (Cox & Snell), .79 (Nagelkerke).

				95 % CI for Odds Ratio		
	B (SE)	Wald (df = 1)	Sig.	Lower	Odds Ratio	Upper
Constant	-20.92* (6.27)	11.14	.001			
Facilitation	**6.16* (1.89)**	**10.66**	**.001**	11.75	475.46	19242.44
Word Class	0.58 (1.14)	0.25	.614	0.19	1.78	16.75
Familiarity	**2.86* (0.84)**	**11.70**	**.001**	3.39	17.38	89.25
Length	0.20 (0.29)	0.46	.498	0.69	1.22	2.17
Facilitation * Word Class	0.64 (2.11)	0.09	.761	0.03	1.90	119.99

Case JS

Model $\chi^2(5) = 32.22^*$.
R^2= .95 (Hosmer & Lemeshow), .44 (Cox & Snell), .59 (Nagelkerke).

				95 % CI for Odds Ratio		
	B (SE)	Wald (df = 1)	Sig.	Lower	Odds Ratio	Upper
Constant	-10.71* (4.36)	6.04	.014			
Facilitation	**2.36* (0.94)**	**6.38**	**.012***	1.70	10.60	66.25
Word Class	0.61 (1.12)	0.30	.585	0.21	1.84	16.52
Familiarity	**1.73* (0.66)**	**6.90**	**.009***	1.55	5.62	20.35
Length	-0.35 (0.26)	1.80	.180	0.42	0.70	1.18
Facilitation* Word Class	0.75 (1.76)	0.18	.671	0.07	2.11	66.14

Case TB

Model $\chi^2(5) = 15.80$*.

R^2= .73 (Hosmer & Lemeshow), .14 (Cox & Snell), .19 (Nagelkerke).

				95 % CI for Odds Ratio		
	B (SE)	Wald (*df* = 1)	Sig.	Lower	Odds Ratio	Upper
Constant	-3.07^{*} (1.29)	5.65	.017			
Facilitation	**1.83^{*} (0.62)**	**8.73**	**.003**	1.85	6.26	21.13
Word Class	-.54 (0.78)	0.47	.492	0.37	1.71	7.86
Familiarity	**0.27^{*} (0.13)**	**4.30**	**.038**	1.02	1.31	1.70
Length	-.06 (0.14)	0.16	.686	0.72	0.94	1.25
Facilitation* Word Class	-1.86^{+} (1.01)	3.39	.065	0.02	0.16	1.13

Note. * significant at $p < .05$, $^{+}$ approaching significance at $p < .1$

3) Combined analysis

Data including all four participants were fitted with a generalised linear mixed-effects regression model for binomially distributed outcomes (Jaeger, 2008). The statistical analyses were run with the statistical software R (R Core Team, 2012), and the generalised linear mixed-effects model was computed with the *lme4* R package (Bates, Maechler, & Bolker, 2012). As in the individual analyses, facilitation, word class, and familiarity were included into the model as potential predictors. Word length was not included as a predictor into the combined analysis as it was not a significant predictor for any of the participants in the individual analyses above. In addition to fixed predictors, linear mixed-effects regression modeling allows random variability induced by subjects and items to be taken into account. Thus, we assessed whether accounting for baseline-differences in naming accuracy scores for different participants and items improved the model: Some participants may have shown better performance in comparison to others and some items may have turned out to be more difficult than others. Furthermore, we assessed whether allowing for participants and items (as random effects) to have different slopes for the effects of our predictor variables (facilitation, word class, and familiarity) made a model a better fit in accounting for data variability.

As our primary interest was to determine whether common and proper nouns react to facilitation differently when familiarity is controlled for, we started with the full model including facilitation, familiarity, word class, and two- and three-way interactions between these predictors as fixed effects. To control for random by-subject variability in the effect of familiarity on naming accuracy, random slopes for familiarity were included into the model. The model with random slopes for participants by familiarity was a significantly better model than the model with random intercepts for participants only ($\chi^2(1) = 6.15$, $p = .013$). Adding random intercepts for items did not improve the model.

See details on the full model in *Appendix C*. In order to identify whether word class was a predictor of naming accuracy and to identify the simplest best-fit model with the least possible predictors, we then progressively subtracted components from the model and performed step-wise comparisons by means of Likelihood Ratio Tests as a way to attain *p*-values. The interaction between facilitation and word class did not improve the model goodness-of-fit ($\chi^2(3) = 4.48$, $p = .215$). Neither did the main effect of word class ($\chi^2(1) = 0.001$, $p = .973$). The interaction between facilitation and familiarity, however, did improve the model goodness-of-fit ($\chi^2(1) = 3.89$, $p = .048$). The results of the model that best fitted the naming accuracy data are displayed in Table 6. The residual deviance for this model is 290 with 304 degrees of freedom indicating there was no problem related to overdispersion.

Table 6

Fixed and Random Effects for the Generalised Linear Mixed-Effects Regression Model that Best-fit the Accuracy Data

Random effects	Variance	SD		
Participant				
Intercept	1.85	1.36		
Familiarity	0.11	0.32		
Number of observations = 309; Participants = 4.				
Fixed effects	Coefficient	*SE*	*z*	*p*
Intercept	-11.71*	3.38	-3.46	.001
Facilitation	**8.22***	**3.45**	**2.38**	**.017**
Familiarity	**1.57***	**0.52**	**3.04**	**.002**
Facilitation by Familiarity	-0.87^{+}	0.51	-1.69	.091

Note. * significant at $p < .05$; $^{+}$ approaching significance at $p < .1$.

In summary, the final model included facilitation and familiarity, as well as facilitation by familiarity interaction terms as fixed effects. The results showed that, as expected, facilitated items are named more accurately scores than unfacilitated items, and more familiar items are named better than less familiar items. Although including the random slope for participants by familiarity reduced contribution of the interaction between facilitation and familiarity, the model that included the interaction was still significantly better than the model with just main effects of facilitation and familiarity included. The presence of the interaction (even if only marginally significant) reflected the fact that facilitation was more beneficial for words of higher familiarity: Items with highest accuracy were facilitated nouns of high familiarity. See Figure 3.

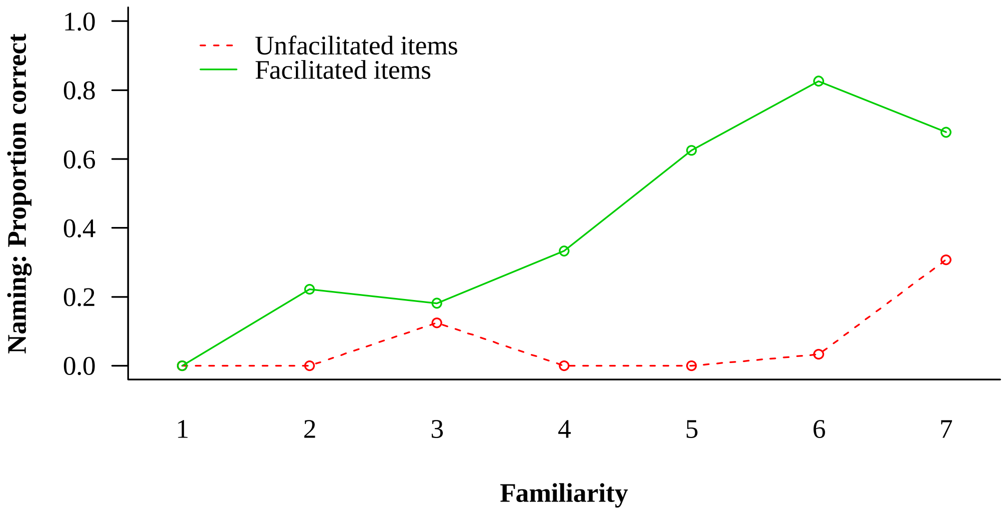

Figure 3. Facilitation by familiarity interaction on naming accuracy in the post-facilitation naming task.

General Discussion

This study investigated whether common and proper nouns respond in similar or different ways to facilitation of word retrieval in aphasia using a repetition task. In doing so it aimed to contribute to the debate regarding the nature of the functional mechanism(s) responsible for processing of common and proper nouns: Whether they are processed by a single mechanism or dual mechanisms. In turn we aimed to inform the related discussion on whether it is logical or statistical properties that dominate in processing of these two lexical-semantic noun categories.

Both individual and group statistical analyses indicated that facilitation improved naming accuracy. Facilitated nouns, both common and proper, were more accurate in the post-facilitation naming task in comparison to unfacilitated items. Critically, however, facilitation effect sizes were statistically indistinguishable for common and proper nouns.

We employed familiarity ratings collected from the participants as a measure of individual word frequency. As expected, familiarity of words was an important predictor of naming accuracy: More familiar common and proper nouns were named more successfully than less familiar items but, in addition, more familiar words showed a tendency to enhanced effects of facilitation. The latter may have implications for proper noun treatment. Namely, given that proper nouns are usually of lower frequency (with the exception of high-frequency personally-relevant items such as relatives' and friends' names), we may expect smaller facilitation effects for proper nouns than for common nouns. However, in our study, analyses controlling for familiarity supported and strengthened the results of the individual and case series analyses that did not account for familiarity: Common and proper nouns were shown to be affected by repetition facilitation to a similar extent.

It has to be noted that although all our participants had word retrieval impairments at the level of the phonological output lexicon and/or access to it (with additional post-lexical deficits for JS and TB), their patterns of common versus proper noun retrieval were not identical. Three of the participants (JG, MR, TB) showed a disproportionately poorer retrieval of common nouns than proper nouns, when compared with the control group. JS, on the other hand, manifested a difference between common and proper noun retrieval that was comparable to controls. However, there was no evidence that these differences affected the impact of facilitation effects on words from these two lexical categories.

TB was the only participant who showed any hint of different facilitation effects for common and proper nouns: He showed no significant facilitation for proper nouns and a close to significant interaction between word class and facilitation effects when familiarity was controlled. We can only speculate about the reason why TB's facilitation pattern seemed different to the others. He was more severely impaired in spoken production than the other cases. This could imply that dissociation in facilitation of common and proper nouns is only seen in more severe cases. This, in turn, would support the logical properties account in saying that proper nouns are (always) more vulnerable than common nouns due to fragile access from semantics to phonology and, thus, may be harder to facilitate. However, clearly more evidence is needed to confirm this hypothesis. However, counter to this argument is that, with our stimuli, there was no evidence that proper nouns were more vulnerable in aphasia - indeed if anything it was common noun naming that was more impaired relative to control naming. Moreover, our analysis controlling for familiarity found no main effect of word class on naming.

Overall, in line with research by Robson et al. (2004) who obtained equivalent treatment effects for common and proper nouns, our findings proved repetition facilitation to be equally beneficial for both common and proper nouns for the majority of the people with aphasia tested here. Thus, the results of this experiment allow us to suggest that repetition in the presence of a picture is potentially an efficient treatment tool that can be used with equal success to improve not only naming of common nouns as has been demonstrated in the past (e.g., Best et al., 2002; Fillingham, Sage, & Lambon Ralph, 2006; Mason et al., 2011) but also proper nouns in people with aphasia with impaired lexical retrieval.

As discussed earlier, similar facilitation effects for common and proper nouns are consistent, under the statistical properties account, with a single processing mechanism for both common and proper nouns. However, the data can also be accommodated by the logical properties account where common and proper nouns are processed by two separate mechanisms, but these mechanisms are affected in the same way by facilitation. Thus, it remains an open question whether common and proper nouns share one processing mechanism or are processed (at least partly) independently by two different processing mechanisms.

In summary, based on our results, repetition facilitation yields similar results on common and proper nouns. While the study did not provide strong evidence in favour of the logical properties account, neither have the results negated it. Thus, the question of which properties play a dominant role in common and proper nouns processing and, consequently, whether there is a single or dual processing mechanism, needs to be further investigated. One potential path for further investigation that is suggested by the results of this study is to employ facilitation to directly compare facilitation of common and proper nouns in individuals with severe and mild word retrieval impairments.

References

Barry, C., Hirsh, K. W., Johnston, R. A., & Williams, C. L. (2001). Age of acquisition, word frequency, and the locus of repetition priming of picture naming. *Journal of Memory and Language, 44,* 350-375.

Bates, D., Maechler, M., & Bolker, B. (2012). *Linear mixed-effects models using S4 classes*. Available from http://lme4.r-forge.r-project.org/

Best, W., Herbert, R., Hickin, J., Osborne, F., & Howard, D. (2002). Phonological and orthographic facilitation of word-retrieval in aphasia: Immediate and delayed effects. *Aphasiology*, *16*, 151-168.

Brédart, S. (1993). Retrieval failures in face naming. *Memory*, *1,* 351-366.

Brédart, S., Valentine, T., Calder, A., & Gassi, L. (1995). An interactive activation model of face naming. *Quarterly Journal of Experimental Psychology*, *48A*, 466–486.

Brysbaert, M., New, B., & Keuleers, E. (2012). Adding part-of-speech information to the SUBTLEX-US word frequencies. *Behavior Research Methods, 44*, 991–997.

Burke, D. M., MacKay, D. G., Worthley, J. S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language*, *30*, 542-579.

Caramazza, A. (1997) How many levels of processing are there in lexical access? *Cognitive Neuropsychology*, *14*, 177-208.

Cipolotti, L. (2000). Sparing of country and nationality names in a case of modality-specific oral output impairment: Implications for theories of speech production. *Cognitive Neuropsychology*, *17*, 709-729.

Cipolotti, L., McNeill, J. E., & Warrington, E.K. (1993). Spared written naming of proper nouns: a case report. *Memory, 1*, 289-311.

City (2015). In Wikipedia The Free Encyclopedia. Retrieved from http://en.wikipedia.org/wiki/City

Cohen, G., & Burke, D. M. (1993). Memory for proper names: A review. *Memory, 1,* 249-263.

Cohen, G., & Faulkner, D. (1986). Memory for proper names: Age differences in retrieval. *British Journal of Developmental Psychology, 4,* 187-197.

Crawford, J. R., & Garthwaite, P. H. (2005). Testing for suspected impairments and dissociations in single-case studies in neuropsychology: Evaluation of alternatives using Monte Carlo simulations and revised tests for dissociations. *Neuropsychology, 19,* 318-331.

Crawford, J. R., & Howell, D. C. (1998). Comparing an individual's test score against norms derived from small samples. *The Clinical Neuropsychologist, 12,* 482-486.

Davis, A., & Pring, T. (1991). Therapy for word finding deficits: More on the effects of semantic and phonological approaches to treatment with dysphasic patients. *Neuropsychological Rehabilitation, 1,* 135-145.

Dell, G.S. (1990). Effects of frequency and vocabulary type on phonological speech errors. *Language and Cognitive Processes, 5,* 313-349.

Fillingham, J. K., Sage, K., & Lambon Ralph, M. A. (2006). The treatment of anomia using errorless learning. *Neuropsychological rehabilitation, 16,* 129-154.

Hanley, J. R. (2011). Why are names of people associated with so many phonological retrieval failures? *Psychonomic Bulletin & Review*. Advance online publication. doi:10.3758/s13423- 011-0082-0

Hanley, J. R., & Cowell, E. S. (1988). The effects of different types of retrieval cues on the recall of names of famous faces. *Memory and Cognition, 16,* 545–555.

Hanley, J. R., & Kay, J. (1998). Proper name anomia and anomia for the names of people: Functionally dissociable impairments? *Cortex, 34*, 93–110.

Harris, D.M., & Kay, J. (1995). Selective impairment of the retrieval of people's names: A case of category specificity. *Cortex*, *31,* 575-582.

Hay, D. C., Young, A. W., & Ellis, A. W. (1991). Routes through the face recognition system. *Quarterly Journal of Experimental Psychology, 43A*, 761–791.

Howard, D., & Hatfield, F. M. (1987). Aphasia therapy: Historical and contemporary issues. Hove, UK: Lawrence Erlbaum Associates.

Jackendoff, R. (1983). Semantics and cognition. Cambridge, MA: MIT Press.

Jaeger, T. F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of Memory and Language*, *59,* 434-446.

Jescheniak, J. D., & Levelt, W. J. M. (1994). Word frequency effects in speech production: Retrieval of syntactic information and of phonological form. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*, 824-843.

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). *Boston Naming Test.* Philadelphia: Lea & Febiger.

Kay J., Hanley, J. R., & Miles, R. (2001). Exploring the relationship between proper name anomia and spoken word retrieval: A single case study. *Cortex, 37,* 501-517.

Levelt, W. J. M. (1989). Speaking: From intention to articulation. Cambridge, MA: MIT Press.

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioural Brain Sciences*, *22*, 1-38.

Levelt, W. J. M., Schriefers, R., Vorberg, D., Meyer, A. S., Pechmann, T., & Havinga J. (1991). The time course of lexical access in speech production: A study of picture naming. *Psychological Review*, *98*, 122-142.

Lucchelli, F., & De Renzi, E. (1992). Proper name anomia. *Cortex*, *28*, 221-230.

Lyons, F., Hanley, J. R., & Kay, J. (2002). Anomia for common names and geographical names with preserved retrieval of names of people: a semantic memory disorder. Cortex, *38*, 23-35.

Marful, A., Paolieri, D., & Bajo, T. (2014). Is naming faces different from naming objects? Semantic interference in a face- and object-naming task. *Memory & Cognition*, *42,* 525-537.

Martins, I. P., & Farrajota, L. (2007). Proper and common names: a double dissociation. *Neuropsychologia*, *45*, 1744-1756.

Mason, C., Nickels, L., McDonald, B., Moses, M., Makin. K., & Taylor, C. (2011). Treatment of word retrieval impairments in aphasia: Evaluation of a self-administered home programme using personally chosen words. *Aphasiology*, *25*, 245-268.

McKenna, P., & Warrington, E. K. (1978). Category-specific naming preservation: A single case study. *Journal of Neurology, Neurosurgery, and Psychiatry, 41*, 571-574.

McKenna, P., & Warrington, E. K. (1980). Testing for nominal dysphasia. *Journal of Neurology, Neurosurgery, and Psychiatry, 43*, 781-788.

McKenna, P., & Warrington, E. K. (1983). *The Graded Naming Test.* Windsor, Berks: NFER-Nelson.

Miceli, G., Capasso, R., Daniele, A., Esposito, T., Magarelli, M., & Tomaiuolo, F. (2000). Selective deficit for people names following left temporal damage: an impairment of domain-specific conceptual knowledge. *Cognitive Neuropsychology*, *17*, 489-516.

Navarrete, E., Scaltritti, M., Mulatti, C., & Peressotti, F. (2012). Age-of-acquisition effects in delayed picture-naming tasks. *Psychonomic Bulletin & Review, 20*, 148-153.

Nickels, L. (1995). Getting it right? Using aphasic naming errors to evaluate theoretical models of spoken word recognition. *Language and Cognitive Processes*, *10*, 13-45.

Nickels, L. (2002) Therapy for naming disorders: Revisiting, revising, and reviewing, *Aphasiology, 16*, 935-979.

Nickels, L., Kohnen, S., & Biedermann, B. (2011). An untapped resource: Treatment as a tool for revealing the nature of cognitive processes. *Cognitive Neuropsychology*, *27*, 539-562.

Reason, J. T., & Lucas, D. (1984). Using cognitive diaries to investigate naturally occurring memory blocks. In J.E. Harris & P.E. Morris (Eds.), *Everyday memory actions and absent-mindedness* (pp. 53-70). London: Academic Press.

Robson, J., Marshall, J., Pring, T., Montagu, A., & Chiat, S. (2004). Processing proper nouns in aphasia: Evidence from assessment and therapy, *Aphasiology*, *18*, 917-935.

Semenza, C. (2006). Retrieval pathways for common and proper names. *Cortex, 42*, 884–891.

Semenza, C. (2009). The neuropsychology of proper names. *Mind and Language*, *24*, 347–369.

Semenza, C., & Sgaramella, T.M. (1993). Production of proper names: a clinical case study of the effects of phonemic cueing. *Memory*, *1*, 265-280.

Semenza, C., & Zettin, M. (1988). Generating proper names: a case of selective inability. *Cognitive Neuropsychology, 5*, 711-721.

Semenza, C., & Zettin, M. (1989). Evidence from aphasia for proper names as pure referring expressions. *Nature*, *342*, 678–679.

Swinburn, K., Porter, G., & Howard, D. (2004). *The Comprehensive Aphasia Test*. Hove: Psychology Press.

Valentine, T., Brédart, S., Lawson, R., & Ward, G. (1991). What's in a name? Access to information from people's names. *European Journal of Cognitive Psychology*, *3*, 147-176.

Verstichel, P., Cohen, L., & Crochet, G. (1996). Associated production and comprehension deficits for people's names following left temporal lesion. *Neurocase*, *2*, 221-234.

Wheeldon, L., & Monsell, S. (1992). The locus of repetition priming in spoken word production. *Quarterly Journal of Experimental Psychology*, *44A*, 723–761.

Yasuda, K., Beckmann, B., & Nakamura, T. (2000). Brain processing of proper names. *Aphasiology*, *14*, 1067-1089.

Young, A. W., McWeeny, K. H., Ellis, A. W., & Hay, D. C. (1986). Naming and categorizing faces and written names. *The Quarterly Journal of Experimental Psychology Section A: Human Experimental Psychology*, *38*, 297-318.

Appendix A

Common Noun Stimuli

abacus	bridge	hammer	mushroom	robot	trumpet
accordion	broccoli	hammock	muzzle	rocket	turkey
acorn	broom	harp	nappy	rug	tutu
almond	bucket	helicopter	needle	ruler	tyre
alphabet	buoy	helmet	noose	saddle	ukulele
ambulance	button	hinge	octagon	sailor	umbrella
anchor	cactus	hoe	octopus	salamander	unicorn
ankle	calculator	hose	orangutan	samurai	veranda
ant	camera	flag	orchestra	sandwich	vest
antelope	candelabra	icicle	ostrich	sarcophagus	violin
antler	candle	igloo	owl	saxophone	volcano
anvil	cannon	iguana	pagoda	scorpion	waffle
apron	canoe	kangaroo	palette	shell	waiter
aquarium	capybara	kite	panda	skeleton	wallet
armadillo	carrot	knight	parachute	skunk	walrus
arrow	cassowary	knot	parrot	slipper	whale
artichoke	caterpillar	kohlrabi	paw	sombrero	whistle
asparagus	celery	labyrinth	peach	spaghetti	wig
avocado	centaur	ladder	pear	spatula	witch
axe	cherry	ladle	pendulum	spider	wrench
bacon	dragon	latch	penguin	sporran	yoke
badge	drawer	leaf	periscope	squirrel	zebra
badger	drill	lemon	piano	stool	
bagel	drum	leopard	pillar	submarine	
baguette	envelope	leotard	pinata	sword	
balcony	escalator	lettuce	pirate	syringe	
balloon	feather	library	platypus	tail	
bandana	flute	lizard	porcupine	tambourine	
banjo	fountain	llama	pretzel	tarantula	
barbecue	funnel	lobster	protractor	tassel	
barrel	ghost	log	pumpkin	thimble	
basket	giraffe	macaroni	purse	thread	
beard	glacier	magazine	puzzle	thumb	
belt	globe	magnet	pyramid	tiger	
bicycle	goat	marmalade	raccoon	toaster	
blanket	gondola	mascara	radio	tobacco	
bomb	gorilla	medal	radish	tractor	
bowl	graffiti	mirror	radius	trampoline	
bracelet	guitar	moose	ravioli	trellis	
bride	gymnast	mosquito	razor	tripod	

Appendix B

Proper Noun Stimuli

Brands	Singers	Countries	Famous Personalities	Cartoon Characters	Cities	Films
Adidas	Adele	Argentina	Cleopatra	Aladdin	Athens	Amadeus
Aldi	Beyonce	Australia	Lenin	Alice	Barcelona	Amelie
Barclays	Bjork	Brazil	Maradonna	Baloo	Berlin	Beethoven
Dolmio	Bono	Canada	Pele	Bambi	Copenhagen	Casablanca
Evian	Cher	Chile	Picasso	Dumbo	Durham	Chicago
Heinz	Madonna	China	Rembrandt	Garfield	Edinburgh	Dracula
Knorr	Sting	Egypt	Stalin	Goofy	London	Hamlet
Lacoste		Finland	Tutankhamun	Mowgli	Moscow	Lassie
Nestle		Germany		Pinocchio	Newcastle	Titanic
Pepsi		India		Pluto	Paris	Zorro
Pringles		Iran		Pocahontas	Rome	
Ribena		Italy		Shrek	Sydney	
Rolex		Japan		Simba	Venice	
Schweppes		Madagascar		Snoopy	York	
Swarovski		Mexico		Tarzan		
Vodafone		Morocco		Tintin		
		Norway				
		Portugal				
		Spain				
		Sweden				
		Yemen				

Appendix C

Fixed and Random Effects for the Full Generalised Linear Mixed-Effects Regression Model on the Accuracy Data (combined across participants)

Random effects	Variance	SD
Participant		
Intercept	1.80	1.34
Familiarity	0.11	0.32

Number of observations = 309; Participants = 4.

Fixed effects	Coefficient	*SE*	*z*	*p*
Intercept	-16.70*	7.12	-2.34	.019
Word Class	6.48	7.95	0.81	.416
Facilitation	12.61[+]	7.19	1.75	.080
Familiarity	**2.26***	**1.04**	**2.18**	**.030**
Facilitation by Familiarity	-1.43	1.04	-1.37	.170
Facilitation by Word Class	-5.10	8.08	-0.63	.528
Familiarity by Word Class	-0.86	1.17	-0.74	.458
Facilitation by Word Class by Familiarity	0.57	1.19	0.48	.630

[*] significant at $p < .05$; [+] approaching significance at $p < .1$.

Chapter Seven

General Discussion and Conclusions

The overall aim of this thesis was to investigate differences in processing and representation of proper and common nouns. Is it easier to recall a name of the tool you use to drain pasta (colander) than the name of an Italian chef you sometimes see on TV (assuming you know one)? Are these two words processed differently or similarly in the language production system? Would it be harder to learn the name of a new kitchen utensil or the name of a new celebrity chef from a cooking show (assuming we are interested in such TV programmes)? Does my mother really have more trouble with remembering her friends' names than she used to? Why do any of these phenomena occur? These were the types of questions that inspired this research project.

There has been a great deal of experimental research on retrieval (e.g., Burke et al., 1991; Evrard, 2002; James, 2006; Maylor, 1995; McKenna & Warrington, 1980; Rendel, Castel, & Craik, 2005;) and learning (e.g., Cohen, 1990; Cohen & Faulkner, 1986; James, 2004; McWeeny, Young, Hay, & Ellis, 1987; Rendel et al., 2005; Stanhope & Cohen, 1993; Terry, 1994) of proper versus common nouns in young and older non-brain-damaged people, as well as case studies on people with aphasia with selective disorders (e.g., Cohen, Bolgert, Timsit, & Cherman, 1994; Hanley & Kay, 1998; Harris & Kay, 1995; Hittmair-Delazer, Denes, Semenza, Mantovan, 1994; Fery, Vincent, & Bredart, 1995; Lucchelli & De Renzi, 1992; Martins & Farrajota, 2007; McKenna & Warrington, 1980; Otsuka et al., 2005; Semenza & Zettin, 1988, 1989) that has shown poorer recall and learning of proper nouns relative to common nouns. Although theories that account for such results vary, most of them attribute proper noun inferiority to a separate processing mechanism for proper nouns which is more vulnerable than that for common nouns due to only a single link connecting the lexical form of a noun and its referent as opposed to multiple links for common nouns (e.g., Semenza & Zettin, 1988; Node Structure Theory; Burke, Mackay, Worthley, & Wade, 1991; Interactive Activation and

Competition Model: Burton & Bruce, 1992; Brédart, Valentine, Calder, & Gassi, 1995). This account is referred to as 'logical properties account' in the thesis. However, to make claims about proper nouns having a separate different processing mechanism from common nouns on the basis of an experiment, one has to match proper and common noun sets on statistical properties (frequency, familiarity, age of acquisition, recency of use). The latter is, however, a challenging, if not unachievable, task (e.g., Hollis & Valentine, 2001; Valentine, Bredart, Lawson, & Ward, 1991; Bredart, 1993). Thus, in this thesis, we tried to circumvent the matching problem, unavoidable in tasks like picture naming and naming to definition, by using other methodologies. Below we focus on the more specific questions addressed by different experiments within the thesis and give a brief outline of their findings.

Are novel proper nouns harder to retrieve and learn than novel common nouns?

Studies reported in Chapters Two, Three, and Four tap into possible differences in learning of proper and common nouns which are novel both in form and in meaning. Existing one-session learning studies that used non-words as stimuli (e.g., Cohen, 1990; Milders, 1998) did not allow enough time for participants to develop adequate lexical representations of novel words, and no long-term studies of proper and common noun processing have explored learning of completely novel nouns. Therefore, the experiments reported in this thesis were, to our knowledge, the first of this kind: Participants were taught associations between novel words (names of individuals in the case of proper nouns and names of species in the case of common nouns) and novel meanings (visual images of creatures participants had never seen before), where participants had four sessions over two weeks to learn the mappings. Such a design was particularly beneficial for controlling statistical properties between the noun class sets as all the items within and across the sets had zero counts on all the measures at the beginning of the experiment. We used a similar design to test participants from three different populations: younger adults (Chapter Two), older adults (Chapter Three), and people with aphasia (Chapter Four). The general results were consistent across all three groups: Novel proper nouns were not found to be more vulnerable than novel common nouns in retrieval. This is in line with previous research on novel proper and common noun learning (e.g., Cohen, 1990; Milders, 1998). Therefore, we concluded that the previously reported inferior recall of proper nouns was possibly due to differences in statistical properties between proper and common noun experimental items that were impossible to control for when stimuli were real words. No disproportionate age-related impairment for proper nouns for the older non-brain-damaged group and the lack of particular susceptibility of novel proper noun retrieval in aphasia were also consistent with this position.

Proper nouns were, however, found to be more demanding in learning. Indeed, in the word-picture verification task, participants tended to incorrectly accept a picture of another individual within the same species as the target individual. The younger adults took longer to learn the correct mapping, while the majority of older individuals and the people with aphasia failed to learn the mapping at all. The failure to respond correctly to this verification type could mean that participants had failed to learn proper nouns as representative of the corresponding word class, and instead had assigned the meaning of a common noun to them. We argue, however, that an alternative explanation was that these results may indicate a failure to determine that the visual image presented was not an example of the target individual. Indeed, the word-picture verification task in general and this particular matching type within the task required fine visual discrimination between highly visually similar stimuli. Bruce and Young (1986) argued that objects within one class (e.g., dogs) may be more visually similar to each other than to members of other object classes (e.g., cats), and when we encounter one exemplar from the class (e.g., a particular dog), our task is to assign it to a class of objects. On the contrary, when identifying a face, our task is to discriminate within visually homogenous representatives of a category (Rosch, 1978 called *faces* a “basic level category”, the same as *dogs* for object recognition). Arguably, this difference between face and object recognition could be enhanced when the homogenous category within which the discrimination has to be performed is relatively new to the individuals tested. We can draw the parallel with our verification task: When required to distinguish between another depiction of the target individual and another member of the same species as the target individual, participants had to discriminate within visually homogenous representatives (a task similar to identifying a face), whereas distinguishing between different species is less visually demanding as representatives of different species look more heterogeneous (a task similar to telling the difference between a dog and a cat).

Is the previously reported disadvantage for proper nouns in retrieval evident in tasks that have reduced effect of statistical properties measures on their outcome? Do different proper noun categories show different patterns?

As it is practically impossible to match proper and common nouns on such statistical properties as frequency, in the study reported in Chapter Five, we attempted to find a task that would have at least reduced effects of statistical properties on its outcome measures. Category fluency tasks seemed to be a suitable choice as participants had no restrictions apart from the category limits as to what items to produce and, thus, could potentially select items that were the most frequent, familiar, recently acquired and used from their individual lexicon. This task also gave us an opportunity to include a broad range of proper noun categories and to see whether there was any difference in retrieval between them.

In addition to testing non-brain-damaged adults, we recruited a group of people with aphasia with no reported selective impairments in retrieval of either proper or common nouns but with general word-finding difficulties. Previously, only data from people with aphasia with selective deficits for mostly proper (e.g., Fery, Vincent, & Bredart, 1995; Harris & Kay, 1995; Lucchelli & De Renzi, 1992; Martins & Farrajota, 2007; Semenza & Zettin, 1988, 1989) and more rarely common nouns (e.g., Martins & Farrajota, 2007; Semenza & Sgaramella, 1993) have been used as evidence for the separate processing of proper and common nouns. However, most people with aphasia with word retrieval problems have reduced transmission of activation between processing levels (e.g., Dell, Schwartz, Martin, Saffran, & Gagnon, 1997). Thus, if we assume that the proper noun processing mechanism is more fragile, this mechanism is more likely to work less efficiently in people with aphasia in general. The results showed no evidence for proper noun vulnerability in retrieval in either the non-brain-damaged participants or people with aphasia (no disproportionate deficit was found for proper nouns in general or any proper noun subcategory in particular). Moreover, contrary to the learning studies that reported poorer retrieval of newly learned unfamiliar personal names relative to occupations of the people in question (e.g., Burke et al., 1991; Cohen, 1990; Cohen & Faulkner, 1986; James, 2004; James, 2006; Maylor, 1995; McWeeny et al., 1987; Rendel et al., 2005; Stanhope & Cohen, 1993; Terry, 1994), our results did not reveal any differences in performance on the proper noun categories ‘famous people’, ‘male names’, and ‘female’ names in comparison to common noun category ‘professions’ in non-brain-damaged individuals or disproportionate impairments for either noun classes in people with aphasia. We, therefore, concluded that previously found differences in retrieval for proper and common nouns could be explained by the lack of experimental control for statistical properties.

Do proper and common nouns benefit equally from treatment in people with aphasia?

Studying treatment effects can both inform language theory and be useful in evaluation of a treatment technique (Nickels, Kohnen, & Biedermann, 2011). Specifically, examining what effects a treatment technique has on proper versus common nouns can assist in tapping into processing mechanisms underlying proper and common noun retrieval. In addition, proper nouns have often been disregarded in speech therapy and very little research has been performed on proper noun treatment (Robson, Marshall, Pring, Montagu, & Chiat, 2004). However, not being able to retrieve a proper noun can have a major communicative and psychological impact as, unlike many common nouns, proper nouns rarely have synonyms or close alternative forms and thus, the failure to retrieve them is obvious. Hence, it is important to know what treatment technique would be successful for proper nouns and if proper and common nouns could be treated similarly.

The technique employed was repetition in the presence of a picture examined in a one-session facilitation study, reported in Chapter Six of this thesis. For four people with aphasia facilitation was beneficial for both proper and common nouns. Moreover, the effect sizes were comparable across the noun classes. While such findings do not provide evidence for separate processing pathways for proper and common nouns nor do they refute them (as these two separate mechanisms could benefit from facilitation through the same mechanisms). Nevertheless, the results of the study indicate that the same treatment (here, repetition in the presence of a picture) can be successfully used for both proper and common nouns.

Limitations and directions for future research

Chapters Two, Three, and Four

As has been mentioned previously, one matching type (Type 3) within the whole word-picture verification task presented a particular difficulty for all subject groups, but specifically for older people and people with aphasia. All the participants found it hard to reject the mapping when proper noun name (name of an individual) was paired with a different individual within the same species as the target individual. It was argued that this difficulty in developing an adequate word-meaning association could be attributed to fine visual discrimination required in this type of task. However, at the moment, it is not possible to distinguish between this explanation and a simple failure to learn names as those of individuals (proper nouns) rather than names of species (common nouns). Although both explanations would still reflect a relative difficulty of proper nouns in learning, it is important to determine what causes this proper noun disadvantage. Difficulties at the level of visual analysis could suggest different processing constraints for proper and common nouns at the level of visual-semantic processing, while inability to learn the association between the label and its meaning could possibly mean distinct processing at the level of the lexical form or connections from semantics to the lexical form (as argued by most of the relevant theoretical models: e.g., Brédart et al., 1995; Burke et al., 1991).

We argue that the task presented in this thesis using learning of novel words paired with novel meanings is an extremely promising tool to examine potential processing differences between proper and common noun classes. Such a design is, quite probably, the only one where exact control of statistical properties for items is possible. However, based on our results, several considerations should be taken into account. First, special attention should be paid to stimulus selection. Thus, in design like ours, ensuring that depictions of members of the same species look dissimilar enough to be assigned to different individuals but share sufficient features to be ascribed to one species is vital for the experimental manipulation. Perhaps, in our study, for some items, different individuals within the same species may have been hard to distinguish for participants, leading to the errors discussed.

Second, we suggest that more training may facilitate learning of visual features of proper noun items and make visual discrimination more automatic.

Third, in our experiment semantics of a word was represented by visual information only. However, introducing more semantic features (e.g., biographical information) may enhance their learning and representation as meaningful words. It is possible that this further elaboration would exacerbate potential differences between proper and common noun items.

Finally, as noted, there is research in the field of child language acquisition (e.g., Hall, 2008) that shows that children tend to learn names of novel items as common nouns, and only if they already know the common noun for a referent, do they learn the new word as a proper noun. To test this theory in adult language learning, it would be interesting to compare learning of the name of an individual with the name of the species this individual belongs to. Such design would also set clearer boundaries for representatives of a common noun (e.g., members of a species) relative to various depictions of a proper noun (e.g., depictions of an individual).

Chapter Five

The methodological concern that arises in regards to using category fluency tasks in investigating proper versus common noun processing is the issue of category size. Indeed, some categories are broader (have more potential exemplars), while some are narrower (have fewer exemplars). It seems inevitable that people would produce more items for broader categories than for narrower categories (albeit the time limit in the task would moderate this effect to some extent). Thus, not controlling for differences in category size in the design or not accounting for it in the analysis could lead to misleading interpretation of the results. However, these category size differences should not affect the relative performance of people with aphasia in comparison to controls. Therefore, in the study presented in Chapter Five, the lack of disproportionate impairment for proper nouns demonstrated by people with aphasia does not lose its reliability.

Future research is needed, however, to provide accurate estimates of sizes of different categories that are typically used in research and to explore the relationship between category size and performance on a fluency task for this category.

Chapter Six

The study on facilitation effects as a result of word repetition reported in Chapter Six of the thesis showed that only one participant with aphasia (TB) revealed a slight (statistically non-significant) indication of distinct facilitation effects for proper and common nouns proper nouns: Retrieval of proper nouns was not improved by facilitation. It was speculated that TB's pattern was different from that of the other three people with aphasia because he was most severely impaired in spoken production. Therefore, we hypothesised that dissociation between proper and common nouns for facilitation perhaps could only be seen in more severe cases. Thus, studies comparing facilitation of proper and common nouns in milder versus more severe cases could verify the hypothesis that differential processing of proper and common noun only affects facilitation mechanisms in people with severely impaired spoken production.

General conclusions

This thesis aimed to contribute to the discussion on proper versus common noun processing and representation. Results from the five experiments converge in the basic idea that, provided that the effects of differences in statistical properties of proper and common nouns are eliminated (Chapters Two, Three, and Four) or do not impact on the task requirements (Chapters Five and Six), logical properties of proper versus common nouns do not seem to come into play in retrieval and learning. This pattern was reflected in similar learning and retrieval for novel proper and common nouns for younger non-brain-damaged adults (Chapter Two) and no disproportionate impairment in older adults or in people with aphasia (Chapters Three and Four). Moreover, proper nouns and common nouns showed similar performance on category fluency tasks in non-brain-damaged speakers, and revealed no disproportionate deficits for proper nouns in people with aphasia (Chapter Five). Last but not least, consistent with findings from the other four studies, no evidence for proper noun disadvantage was shown in the facilitation experiment with people with aphasia (Chapter Six): Facilitation effects for proper and common nouns were equal.

Thus, on the basis of convergent evidence obtained from the experiments conducted as a part of this thesis it can be concluded that differences in statistical properties of proper nouns may play a role in the relatively poorer retrieval patterns recorded previously for proper nouns. Nevertheless, the exact role of logical properties in proper versus common noun retrieval and learning is not clear and, thus, should not be yet underestimated. For example, it is still hard to apply the statistical properties account as an explanation for the occasional reports of people with aphasia who have no problems retrieving abstract and low frequency common nouns but are not able to recall the name of their spouse or a close friend (e.g., Semenza, 2006).

Moreover, although some models that explain differences between proper and common noun processing take some statistical properties into account (e.g., Burke et al., 1991), most do not consider them as a vital part of the processing network. Considering the results of the experiments within this thesis, just as statistical properties of words are considered a central influence on word retrieval in theories of spoken word production that do not explicitly address proper and common noun processing, statistical properties should be incorporated into networks designed to account for the differences in proper and common noun logical properties.

References

Brédart, S. (1993). Retrieval failures in face naming. *Memory*, *1*, 351-366.

Brédart, S., Valentine, T., Calder, A., & Gassi, L. (1995). An interactive activation model of face naming. *Quarterly Journal of Experimental Psychology*, *48A*, 466–486.

Bruce, V., & Young, A. W. (1986). Understanding face recognition. *British Journal of Psychology*, *77*, 305–327.

Burke, D. M., MacKay, D. G., Worthley, J. S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language*, *30*, 542-579.

Burton, A. M., & Bruce, V. (1992). I recognise your face but I can't remember your name: A simple explanation? *British Journal of Psychology, 83,* 45–60.

Cohen, G. (1990) Why is it difficult to put names to faces? *British Journal of Psychology*, *81*, 297-297.

Cohen, L., Bolgert, F., Timsit, S., & Chermann J. F. (1994). Anomia for proper names after left thalamic infarct. *Journal of Neurology, Neurosurgery and Psychiatry*, *57,* 1283–1284.

Cohen, G., & Faulkner, D. (1986). Memory for proper names: Age differences in retrieval. *British Journal of Developmental Psychology, 4,* 187-197.

Dell, G. S., Schwartz, M. F., Martin, N., Saffran, E. M., & Gagnon, D. A. (1997). Lexical access in aphasic and nonaphasic speakers. *Psychological Review*, *104,* 801-838.

Evrard, M. (2002). Ageing and lexical access to common and proper names in picture naming. *Brain and Language*, *81,* 174–179.

Fery, P., Vincent, E., & Brédart, S. (1995). Personal name anomia: A single case study. *Cortex*, *31*, 191-198.

Hall, D. G. (2008). Acquiring proper nouns for familiar and unfamiliar animate objects: Two-year-olds' word-learning biases. *Child Development*, *62*, 1142-1154.

Hanley, J. R., & Kay, J. (1998). Proper name anomia and anomia for the names of people: Functionally dissociable impairments? Cortex, 34, 155–158.

Harris, D.M., & Kay, J. (1995). Selective impairment of the retrieval of people's names: A case of category specificity. *Cortex*, *31*, 575-582.

Hittmair-Delazer, M., Denes, G., Semenza, C., & Mantovan, M.C. (1994). Anomia for people's names. *Neuropsychologia*, *86*, 345-358.

Hollis, J., & Valentine, T. (2001). Proper-name processing: Are proper names pure referencing expressions? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*, 99-116.

James, L. (2004). Mr. Farmer versus meeting a farmer: Specific effects of aging on learning proper names. *Psychology and Aging, 19*, 515-522.

James, L. (2006). Specific effects of aging on proper name retrieval: Now you see them, now you don't. *Journal of Gerontology: Psychological sciences*, *61B*, 180-183.

Lucchelli, F., & De Renzi, E. (1992). Proper name anomia. *Cortex*, *28*, 221-230.

Martins, I. P., & Farrajota, L. (2007). Proper and common names: a double dissociation. *Neuropsychologia*, *45*, 1744-1756.

Maylor, E. A. (1995). Effects of aging on the retrieval of common and proper names. Facts and *Research in Gerontology*, *Supplement*, 55–73.

McKenna, P., & Warrington, E. K. (1980). Testing for nominal dysphasia. *Journal of Neurology, Neurosurgery, and Psychiatry, 43*, 781-788.

McWeeny, K. H., Young, A. W., Hay, D. C., & Ellis, A. W. (1987). Putting names to faces. *British Journal of Psychology, 78*, 143-149.

Milders, M. (1998). Learning people's names following severe closed-head injury. *Journal of Clinical and Experimental Neuropsychology, 20*, 237-244.

Nickels, L., Kohnen, S., & Biedermann, B. (2011). An untapped resource: Treatment as a tool for revealing the nature of cognitive processes. *Cognitive Neuropsychology, 27*, 539-562.

Otsuka, Y., Suzuki, K., Fujii, T., Miura, R., Endo, K., Kondo, H., & Yamadori, A. (2005). Proper name anomia after left temporal subcortical haemorrhage. *Cortex*, *41*, 39-47.

Rendell, P. G., Castel, A. D., & Craik, F. I. M. (2005). Memory for proper names in old age: A disproportionate impairment? *Quarterly Journal of Experimental Psychology, 58A*, 54–71.

Robson, J., Marshall, J., Pring, T., Montagu, A., & Chiat, S. (2004). Processing proper nouns in aphasia: Evidence from assessment and therapy, *Aphasiology*, *18*, 917-935.

Rosh, E. (1978). Principles of categorization. In E. Rosh & B. Lloyd (Eds.), *Cognition and Categorization*, Hillsdale, NJ: Erlbaum.

Semenza, C. (2006). Retrieval pathways for common and proper names. *Cortex, 42*, 884–891.

Semenza, C., & Sgaramella, T.M. (1993). Production of proper names: a clinical case study of the effects of phonemic cueing. *Memory*, *1*, 265-280.

Semenza, C., & Zettin, M. (1988). Generating proper names: a case of selective inability. *Cognitive Neuropsychology, 5*, 711-721.

Semenza, C., & Zettin, M. (1989). Evidence from aphasia for proper names as pure referring expressions. *Nature*, *342*, 678–679.

Stanhope, N., & Cohen, G. (1993). Retrieval of proper names: Testing the models. *British Journal of Psychology*, *84*, 51-65.

Terry, W.S. (1994). On the relative difficulty in recalling names and occupations. *The American Journal of Psychology*, *107*, 85-94.

Valentine, T., Brédart, S., Lawson, R., & Ward, G. (1991). What's in a name? Access to information from people's names. *European Journal of Cognitive Psychology*, *3*, 147-176.

Appendix A

MACQUARIE University

Anastasiia Romanova <anastasiia.romanova@mq.edu.au>

Fwd: Approved- Ethics application- Nickels (Ref No: 5201200905)

Lyndsey Nickels <lyndsey.nickels@mq.edu.au> Wed, Dec 12, 2012 at 6:55 AM
To: Britta Biedermann <britta.biedermann@mq.edu.au>, Kati Renvall <kati.renvall@mq.edu.au>, Saskia Kohnen <saskia.kohnen@mq.edu.au>, Anastasiia Romanova <anastasiia.romanova@mq.edu.au>, Catherine Mason <catherine.mason@mq.edu.au>, Trudy Krajenbrink <trudy.krajenbrink@mq.edu.au>, Belinda McDonald <belinda.mcdonald@mq.edu.au>, Nora Fieder <nora.fieder@mq.edu.au>

This is the generic aphasia and controls ethics.
All the relevant files are now on "aphasia".

---------- Forwarded message ----------
From: **Ethics Secretariat** <ethics.secretariat@mq.edu.au>
Date: 12 December 2012 11:17
Subject: Approved- Ethics application- Nickels (Ref No: 5201200905)
To: Prof Lyndsey Nickels <lyndsey.nickels@mq.edu.au>

Dear Prof Nickels

Re: "Understanding language processing, its breakdown and treatment"
(Ethics Ref: 5201200905)

Thank you for your recent correspondence. Your response has addressed the issues raised by the Human Research Ethics Committee and you may now commence your research.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:

http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel are authorised to conduct this research:

Dr Anna Elisabeth Beyersmann
Dr Antje Lorenz
Dr Britta Biedermann
Dr Karen Croot
Dr Kati Renvall
Dr Samantha Siyambalapitiya
Dr Saskia Kohnen
Miss Anastasiia Romanova
Miss Catherine Mason
Miss Trudy Geertruida Krajenbrink
Ms Belinda McDonald
Ms Emily Church
Ms Fransizka Bachmann
Ms Jennifer Cole-Virtue
Ms Nora Fieder
Polly Barr
Prof Lyndsey Nickels
Prof Niels Schiller
Professor David Howard
Rimke Groenewold
Shiree Heath
Solene Hameau
Tina Marusch

NB. STUDENTS: IT IS YOUR RESPONSIBILITY TO KEEP A COPY OF THIS APPROVAL EMAIL TO SUBMIT WITH YOUR THESIS.

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 12 December 2013
Progress Report 2 Due: 12 December 2014
Progress Report 3 Due: 12 December 2015
Progress Report 4 Due: 12 December 2016
Final Report Due: 12 December 2017

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

http://www.mq.edu.au/policy/

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have final approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

Please retain a copy of this email as this is your official notification of final ethics approval.

Yours sincerely
Dr Karolyn White
Director of Research Ethics
Chair, Human Research Ethics Committee

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Lyndsey Nickels
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***** My usual working days are Mon-Thurs *******