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Alisa M. Maibauer
Cleveland State University

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EXAMINING THE ROLE OF TALKER-SPECIFIC DETAILS IN THE PERCEPTION
OF WORDS SPOKEN BY FAMOUS TALKERS

ALISA M. MAIBAUER

Bachelor of Science in Psychology

John Carroll University

January, 2006

submitted in partial fulfillment of requirements for the degree

MASTER OF ARTS IN PSYCHOLOGY

at the

CLEVELAND STATE UNIVERSITY

May, 2009

This thesis has been approved
for the Department of Psychology
and the College of Graduate Studies by

Thesis Chairperson, Conor T. McLennan

Department/Date

Kimberly Neuendorf

Department/Date

Ernest Park

Department/Date

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ABSTRACT

Previous work demonstrates that talker-specific details tend to affect language perception relatively late in processing. One possible explanation for this time-course effect may be that the listeners in the previous study were presented with unfamiliar talkers. Under conditions where one has been repeatedly exposed to a talker, as is typically the case with famous people, talker-specific details may affect perceptual processing relatively early. The present research sought to explore the potential for relatively early talker effects in the perception of words spoken by famous talkers in a speeded-shadowing task. Words were presented using a long-term repetition priming paradigm where half of the words were spoken by Barack Obama and half were spoken by Hillary Clinton during both the prime and target blocks. During the speeded-shadowing task in the present study reaction times in the target block were longer when the same word was spoken by a different talker in the prime block relative to when the same word was spoken by the same talker in both the prime and target blocks. The results obtained in the present study demonstrate that talker-specific details can affect the perception of spoken words relatively early during processing.

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Variations in the surface information we receive from spoken language, beyond the linguistic content, is referred to as indexical variability. Indexical variability can refer to a change in the person producing language (talker variability), a person's accent, the affective tone of a talker's voice, or speaking rate. Indexical variability can provide the listener with useful information, including the identity of the talker, the talker's current affective state, and the possible originating geographical location of the talker. Moreover, indexical variability can have several consequences for listeners. For example, a person's accent can change a listener's perception of the talker's socioeconomic status (Walker, 2007). When experimenters manipulated the pronunciation of a single letter (e.g., an intrusive /r/ in New Zealand English), participants attributed the speech to someone belonging to a lower social class. Furthermore, hearing an accent can also change how a listener produces language. In a study by Delvaux and Soquet (2007), participants were asked to repeat several sentences. Intermittently the participants would hear a recording of the presented sentence with an accent different from their own. Toward the end of the experiment participants changed their speech production; they began imitating the accent

heard in the recording, and were surprisingly unaware of their imitation. Other areas of language research have sought to discover what role indexical information plays in the underlying language *representations* listeners use to *recognize* spoken words, as well as the effect that indexical variation can have on language *processing*.

In the present research we focused on a specific type of indexical variability, namely talker variability (known as talker change), and its representational and processing implications for spoken word recognition. Specifically, we examined the perceptual consequences created by changing a word's talker on the participants' subsequent processing of the spoken word. Numerous language perception studies have been conducted with unknown talkers (e.g., Bradlow, Nygaard, & Pisoni, 1999; Goldinger, Pisoni, & Logan, 1991; Martin, Mullennix, Pisoni, & Summers, 1989; Mullennix, Pisoni, Martin, 1989; Sommers, Nygaard, & Pisoni, 1994). While these studies have been paramount in developing the fundamentals of language processing and language representations, we know less about how language produced by familiar talkers might be represented. These studies indicate that language produced by familiar talkers may be stored and processed differently than language produced by unknown talkers. Language produced by familiar talkers is processed more quickly and accurately than language produced by unfamiliar talkers (Nygaard & Pisoni, 1998; Nygaard, Sidaras, & Alexander, 2008). The present research is an extension of previous work that has shown that talker change has time-specific effects during spoken word recognition (McLennan & Luce, 2005). In the present study we investigated potential differences in talker change effects (talker effects) when words were spoken by familiar famous talkers. We will begin with an overview of theories regarding how language perception might involve two

distinct forms of lexical representations. We will also provide a review of previous work on talker effects with unfamiliar talkers, and a detailed description of temporal effects of talker change on spoken word recognition.

Indexical variability provides a great deal of information about the talker, but it does not change the linguistic content of the speech. As an example, let us consider the word “refrigerator”. Regardless of how the word is spoken (with urgency, with distain, etc.), the verbal production refers to a large appliance used to cool and store food items. From this example, one can see that two separate types of information are received and interpreted from speech by a listener: 1) talker information and 2) linguistic content information. Accordingly, two types of representational theories have emerged (abstract and episodic) which attempt to provide an account for our ability to process varying language signals. In abstract theories, language is stored in a non-specific linguistic form, void of talker-specific indexical content, (McClelland & Elman, 1986). In a strong form of an abstractionist view, talker information is filtered out and discarded, leaving an idealized form of the word in long-term memory (Joos, 1948; Krulee, Tondo, & Wightman, 1983). Varying language inputs are analyzed through a process of normalization, where they are converted into a common standard non-specific lexical input, and then compared to an abstract form (see Pisoni, 1997).

In episodic theories of language representation, multiple traces of indexical information are stored, which are gathered from our experience, including our experience hearing the same word produced by multiple talkers (Goldinger, 1997). During processing, spoken words are compared and matched to these specific multiple traces. Further support for two distinct forms of lexical representations shows that these two

forms might be located in opposite hemispheres of the brain. Research points to the possibility that talker-specific representations are located in the right hemisphere while abstract representations is stored in the left hemisphere (Van Lancker 1991; Van Lancker, Cummings, Kreiman, & Dobkin, 1988). In a study by González and M^cLennan (2007), the right hemisphere was more sensitive than the left to talker changes. The two types of lexical representation theories have both strong and weak forms (Tenpenny, 1995). In a strong theory of abstract representations, words are stored as abstract talker-independent representations while indexical information might be stored in another cerebral area unassociated with language processing (e.g., general memory). In a strong theory of episodic lexical representations, all phonetically relevant talker-specific lexical information is *stored* in common location and is used during language *processing*. While both theoretical approaches are able to account for some of the findings in language processing studies, a clearer picture emerges when the theories are integrated into a unified or hybrid account of language perception. Previous researchers have demonstrated that each type of representation can affect different aspects of language perception (M^cLennan & Luce, 2005). The specifics of how these forms affect language perception are of primary importance to the present study and will be discussed later in greater detail.

Talker variability has a number of consequences on spoken language processing. Several studies have shown that processing is negatively affected by the presence of multiple talkers as opposed to a single talker. Vowels are more easily identified when produced by a single talker than when presented by multiple talkers (Assmann, Nearey, & Hogan, 1981). General shadowing reaction times (hereafter RTs), where participants

are tasked with verbally repeating a presented word, are longer when words are presented to participants by multiple talker than when those same words are presented by a single talkers (Mullennix, Pisoni, & Martin, 1989; Sommers, 1996). Processing demands increase as the number of talkers is increased, and as a result spoken language produced by a single talker will be processed more rapidly than speech from multiple talkers. While talker variability affects processing, these types of processing experiments do not provide information about the type of mental representation accessed during processing (episodic or abstract), or the point at which the representation affects processing. The strong forms of both the abstract and episodic theories of lexical representations can provide an account for processing demands created by multiple talkers. On one hand, abstract theories of lexical representations would link the processing demands of multiple talkers to normalization. When we encounter varying language inputs, processing is slowed by the increase in normalization demands. On the other hand, episodic theories of lexical representations would link the processing demands of multiple talkers to the increase in indexical-specific activation. With multiple talkers, a higher number of language traces would be activated, which would increase processing demands and create slower RTs.

Talker variability has been shown to affect our ability to maintain lexical information in memory. When participants are presented with word lists, they are more likely to recall words presented by a single talker than words presented by multiple talkers (Goldinger, Pisoni, & Logan, 1991; Martin, Mullennix, Pisoni, & Summers, 1989; Mullennix, Pisoni, & Martin, 1989). People are also able to identify words from a study list repeated by the same talker more accurately than those repeated by a different talker

(Bradlow, Nygaard, & Pisoni 1999; Sommers, Nygaard, & Pisoni, 1994). While these studies show some of the effects talker variability can produce, they generally represent more explicit offline and strategic types of processing rather than implicit online processing. The two types of processing, and the distinction between them, have been discussed throughout language processing literature (see Kempler, Almor, Tyler, Andersen, & MacDonald, 1998). Online language processing is an immediate and automatic analysis with a minimal reliance on other areas of memory. Online processing generally involves the use of more implicit measures such as RT data gathered from a lexical decision or shadowing task. Offline processing is slower, requires the long-term retention of language information, and the reliance on the specific encoding of this information. With slower offline processing it is more difficult to determine whether specific lexical representations or general memory representations are involved in the task.

In the present study we are concerned with discovering the type of lexical representation that dominates the processing of words spoken by familiar famous talkers. An appropriate method for doing so, while at the same time using an online task, can be found with the use of the long-term repetition priming paradigm. In the long-term repetition priming paradigm stimuli are presented in two blocks, a prime and a target block, which are separated by a short distractor task. In priming, information that has been encountered before is generally processed more quickly in subsequent presentations (e.g., Brown, Neblett, Jones, & Mitchell, 1991). There are several varying methods for utilizing this paradigm. The long term repetition priming paradigm can be used to examine the role of indexical variability by changing the talker between the prime and

target block while keeping the lexical content the same (talker change), which provides an opportunity to investigate the type of lexical representation that is affecting processing (i.e., talker-independent or talker-specific). If priming is not affected by a talker change, then a common or talker-independent abstract representation is presumably accessed during processing. If, however, priming is attenuated or reduced by talker changes, then a talker-specific episodic representation is presumably influencing processing. When priming is attenuated by specific properties of a signal, such as a talker's indexical information, this is described as indexical specificity effects, or talker effects. Previous researcher has shown that talker changes will affect the processing in offline repetition priming paradigm tasks (Church & Schacter, 1994; Schacter & Church, 1992), but when a more online task is used, the specifics of how different representations affected processing can be assessed.

In a series of experiments using the long term repetition priming paradigm, abstract and talker information have both been shown to affect the processing of spoken words, albeit at distinct times during language perception (McLennan & Luce, 2005; Luce & Lyons, 1998). These time-specific effects of language information on processing are also known as time-course effects. Abstract information affects processing immediately, while the effects of talker-specific representations on processing follow later. The time-specific effects of the two lexical forms are investigated by manipulating the long term repetition priming paradigm tasks. In tasks where words can be processed more quickly, words rated high on frequency and/or concreteness, talker change does not have consequences on language processing (Luce & Lyons, 1998). In tasks that impose a delay in the participants' response, talker change does affect processing (McLennan &

Luce, 2005). Several different delay methods will create talker effects. A delay in response can be created by increasing the task difficulty, changing stimuli concreteness rating (McLennan, Luce, & Charles-Luce, 2003), or by simply asking the participants to wait before responding. Specifically, McLennan and Luce found that a delay of 150ms was sufficient to produce significant talker effects in their experiment using a shadowing task.

The time-course effects of lexical representations may be linked to the relative strength of the different lexical representations. As listeners, we encounter a large variety of different talkers daily, and there are an infinite number of possible variations in the production of spoken language. Despite this high variability we are able to understand and process language both quickly and accurately. Abstract language representations, void of talker-specific details, would aid in the processing of these highly variable signals. These representations are thought to be formed over time as we continually encounter new variations in speech signals. Lexical representations, in general, which are more frequently activated and processed, are more easily accessed (Balota & Chumbley, 1984). Since abstract representations are frequently activated to interpret spoken language, they too should have a stronger and more easily accessible representation. Episodic information, like abstract information, is explicitly accessible (Bradlow et al., 1999). Over time, however, we will encounter any given word produced by many different talkers more frequently than we will hear it repeated by an individual talker¹. This experience would potentially create talker-specific representations that would be somewhat weaker when compared to abstract representations. If indeed talker-specific episodic representations are relatively weak, then they may be less likely to affect the

immediate processing of spoken language. The present experiment will explore this hypothesis concerning representation frequency. While the talker-specific lexical representations of previous studies may have lacked strength due to participants' relative inexperience with the talkers used in those studies, it may be the case that as we are repeatedly exposed to an individual talker our episodic lexical representation containing talker-specific details might map onto relatively stronger representations than those of unfamiliar talkers.

Unfamiliar talkers have been the primary source of stimuli in previous long-term repetition priming paradigm experiments. During the course of one of these experiments, participants will be exposed to the unfamiliar talker only in the initial prime block before the target block. When words are processed in the target block, by default the stronger, more frequent representation will affect processing first (i.e., abstract non-specific representations). In the present series of experiments we will examine the potential for talker-specific episodic representations that may be more robust (i.e., indexical representations of familiar talkers), to affect processing earlier. Words produced by familiar talkers are recognized more quickly and accurately than words spoken by unfamiliar talkers (Nygaard, Sidaras, & Alexander, 2008; Nygaard, Sommers, & Pisoni, 1994). Furthermore, neural activity is increased significantly when processing input from familiar talkers relative to the processing of unfamiliar talkers (Shah et al., 2001). However, the familiar talker voice stimuli used in previous research are usually unknown to the participants before the experiment. Participants undergo a familiarization process where they learn to identify the talkers that will appear later during the experiment. In the

present research we will investigate the processing of words spoken by talkers familiar to participants *before* they enter into the study.

While it would best to find talkers that participants have had a significant amount of exposure to, such as a family member or close friend, finding these talkers and having them record word stimuli for use in our experiment is impractical (if not impossible). As an alternative, we used the voice recordings of two familiar famous talkers, Barack Obama and Hillary Clinton, as stimuli in the present research. Several studies have shown that adults, and children alike, are able to explicitly recognize and identify famous talker voice stimuli (Spence, Rolings, & Jerger, 2002; Van Lancker, Krieman, & Emmory, 1985). Familiar or famous talker voice stimuli have previously been used in a study with the long-term repetition priming paradigm. The present research will be the first of its kind to investigate the possible representational differences of famous talkers on the perception of spoken words during processing. We hypothesize that the talker-specific details of words spoken by famous talkers will affect spoken word recognition relatively early during processing.

CHAPTER II

METHODS

In the present study the long-term repetition paradigm and a speeded-shadowing task were used in order to examine the role of famous talkers' voice-specific details in the perception of words during processing². In past research this task did not produce talker effects when the stimuli were spoken by unknown talkers. However, we expect to find talker effects in this task with stimulus words spoken by famous talkers. Indexical information associated with the talker is believed to be less frequent than abstract information, and responsible for the relatively later effect on processing. The frequency effect is magnified in cases where a new talker is encountered, such as the unknown talkers in laboratory experiments. On the other hand, the voices of famous talkers have been encountered on a more frequent and regular basis than unknown talkers, which should result in a stronger and more frequent indexical representation of famous talkers' voice details. While it is most likely that famous talker indexical information is not stored at the same frequency as abstract information, its relative frequency may create a situation where it will affect processing earlier than has been demonstrated to date with talkers that are not famous. Consequently, in the current study all stimuli were spoken by

two famous talkers: Barack Obama and Hillary Clinton. Additional measures of the participants' political views and attitudes toward the talkers were taken after the shadowing task to examine a number of potential relationships with talker effects.

2.1 Participants

Forty-two³ participants were recruited from the Cleveland State University community. Students either received credit for their participation as a partial fulfillment of a class requirement, or extra credit. Participants were right handed, native speakers of American English, with no reported history of speech, hearing, or visual disorders.

2.2 Materials

The stimuli consisted of 24 bisyllabic spoken target words and 8 bisyllabic control words (see Appendix B for stimulus list), and were spoken by both Barack Obama (BO) and Hillary Clinton (HC). Stimulus words were extracted from various CSPAN press conference videos (see Appendix A for video list). Press-conference RealMedia (.rm) video files were copied with RealPlayer v.11 from the CSPAN website. The audio was extracted from these files with FFmpeg, an open source multimedia converter. Final stimuli were extracted from the audio files with PeakPro audio editing software, and equated to ensure that all stimuli were presented at consistent volume. Mean word frequency for all stimuli was 313.1 (Kučera & Francis, 1967). Stimuli had a mean duration of 505 ms, and a mean concreteness rating of 340⁴. All stimuli underwent an initial pilot-screening test (n=10) to ensure that participants were able to accurately perceive stimuli extracted from continuous speech. The present study's 32 stimulus words were accurately identified by a minimum of 90% (i.e., 9 out of 10) of the pilot participants. Additionally, participants in the main speeded-shadowing experiment

answered several questions pertaining to their political views and opinions of Barack Obama and Hillary Clinton (see Appendix C). All stimuli in both the pilot- and shadowing-tasks were presented with SuperLab 4.0.7b software for Mac OS X.

2.3 Design

Two blocks (prime and target) of stimuli were presented. The stimuli for these blocks consisted of the words spoken by both BO and HC. In both the prime and target blocks, half the stimuli were spoken by BO and half were spoken by HC. Three stimulus conditions were created between the two blocks: 1) match, where stimuli matched in both word and talker between the prime and target block, 2) mismatch, where stimuli matched in word but differed in talker between the prime and target block, and 3) control, where the stimulus word from the prime block did not appear in the target block (see Table I for an example of one stimulus word in all three conditions). Both the prime and target blocks consisted of 24 stimuli, 8 match words, 8 mismatch words, and 8 control words. Participants heard stimulus words in all three conditions.

Table I

Experimental Conditions and Examples of Primes and Targets		
Condition	Prime	Target
Match		
BO prime → BO target	<i>people</i> _{BO}	<i>people</i> _{BO}
HC prime → HC target	<i>people</i> _{HC}	<i>people</i> _{HC}
Mismatch		
BO prime → HC target	<i>people</i> _{BO}	<i>people</i> _{HC}
HC prime → BO target	<i>people</i> _{HC}	<i>people</i> _{BO}
Control		
Unrelated prime → BO target	<i>behind</i> _{BO}	<i>people</i> _{BO}
Unrelated prime → HC target	<i>nature</i> _{HC}	<i>people</i> _{HC}

2.4 Procedure

Participants were tested individually in a quiet room and were not told at the beginning of the experiment that there would be two blocks of trials. Participants performed a single-word speeded-shadowing task where they were instructed to repeat (or shadow) each stimulus word as quickly and accurately as possible after each stimulus was presented. In both blocks the stimulus words were presented binaurally over a headset. To familiarize the participant with the task, 10 practice trials were presented before the prime block began. Participants' responses were recorded with a microphone located approximately 1 in. from their lips. RTs of the participants' shadowing responses were collected from the onset of the stimulus word. Word shadowing RTs in milliseconds (ms) were recorded using an SV-1 voice key. To ensure that participants were accurately shadowing the individual stimulus words a recording of the participants' full vocal responses was made to check for potential errors. Participants' vocal stimuli shadowing were recorded with Praat recording software, version 5.0.34, and the computer's internal microphone. Between the prime and target blocks, participants were given a math test for approximately 5 minutes as a distractor task. The two blocks consisted of 24 trials. During each trial the participants heard a beep to indicate the beginning of trial followed by presentation of the stimulus word. Participants responded as quickly and accurately as possible following the presentation of each word. After the participant responded, the next trial began.

Following the speeded shadowing task participants were asked to identify both talkers. Participants heard the following recording twice with a change in gender: "In the experiment you just participated in, who do you think the male/female speaker was?"

Participants were asked to speak their answer, and were urged to provide their best guess. After the participants' talker identification, they were asked to rate the confidence of their identification (see Appendix C). The identity of the talkers was then revealed to the participants, followed by three short tasks. First, participants were given approximately two minutes to recall stimulus words spoken in both the prime and target blocks. Second, the participants were given approximately one minute to identify the talker for each word recalled. Finally, the participants were given a series of questions pertaining to their political views and their opinions of Barack Obama and Hillary Clinton (see Appendix C). An overview of the experimental procedures is located in Table II (Tasks appear in order of presentation).

Table II

Procedure Overview			
Task	Format	Content	Response
Informed Consent Form	Paper and Pen	(See Appendix E)	Read and Complete Form
Initial Paperwork	Paper and Pen	(See Appendix F)	Read and Complete Forms
Handedness Inventory	SuperLab	Items in Static Order (See Appendix G)	Response Selection
Race, Gender, and Ethnicity Inventory	SuperLab	Items in Static Order (See Appendix H)	Response Selection
Practice Trials	SuperLab	8 Randomly Ordered Stimuli (half spoken by HC and half by BO) that do not appear in Prime or Target blocks	Speeded Shadowing

Prime Block	SuperLab	24 Randomly Ordered Stimuli (half spoken by HC and half by BO), 8 control stimuli and 16 target stimuli (See Appendix B)	Speeded Shadowing
Math Test	Paper and Pen	(See Appendix C)	Performed for Approximately 5 minutes
Target Block	SuperLab	24 Randomly Ordered Stimuli (half spoken by HC and half by BO), 8 control stimuli, 8 match stimuli, and 8 mismatch stimuli (See Appendix B)	Speeded Shadowing
Talker Identification	SuperLab	2 Audio Questions (See Procedure Section)	Verbal Response
Confidence Rating of Talker Identification	Excel	2 Texted-Based Questions (See Procedure Section)	1-10 Keyboard Response
Talkers' Identity Revealed	Experimenter	Verbal	No Response
Recall	Excel	Recalled Experimental Stimuli Spoken by BO and HC	Keyboard Response
Gender Identification of Recalled words	Excel	Identified Male, Female, or Both for all Recalled Items	Keyboard Response
Post-Shadowing Questionnaire	SuperLab	Items in Static Order (See Appendix D)	Response Selection

CHAPTER III

RESULTS

RTs were excluded if they were less than 200ms or greater than 2000ms⁵ resulting in the exclusion of 26 RTs (2%). RTs less than 200ms do not reflect accurate processing speed. In some cases the voice-key may be inadvertently triggered by a participant's cough or other noise unrelated to their shadowing response. RTs below 200ms where the participant accurately shadowed the stimulus word (which would only happen if the participant's response failed to immediately trigger the microphone) were excluded from the analysis and their correct shadowing remained in the total percent-correct analysis. RTs greater than 2000ms were excluded because they may not reflect online processing. Participants whose priming-effect value (Total-Match-RT minus Total-Control-RT) fell two standard deviations beyond the priming-effect mean were excluded, resulting in the exclusion of one participant.

3.1 Speeded-Shadowing Results

Accuracy was very high; indeed, over 90% of our participants accurately shadowed all (100%) stimulus words. Therefore, no analysis of percentage correct (PC) was conducted. However, a repeated measures Prime (match, mismatch, control) X

Target (talker BO talker HC) participant ANOVA was performed on the RTs for correct responses (see Table III for hypothesized results and Table IV for obtained results). We observed a main effect for talker $F(1, 39) = 27.13, p < .01, \eta^2 = .40$. Participants' shadowing RTs were significantly longer for words produced by HC ($M = 918.16, SD = 137.05$) than words produced by BO ($M = 875.42, SD = 118.03$). However, the stimulus durations of HC and BO were significantly different $t(46) = 2.68, p < .05$. Given that RTs include the duration of the spoken word, the main effect for talker is presumably due to HC's slower speaking rate.

We observed a main effect for prime $F(2, 80) = 3.30, p = .04$, with a medium effect size $\eta^2 = .08$. Planned comparisons showed a significant priming effect; that is, RTs in the match condition were significantly faster than RTs in the control condition, $p < .001$. Planned comparisons also showed a marginally significant talker effect; that is, RTs in the match condition were shorter than RTs in the mismatch condition, $p = .09$. Planned comparisons revealed no difference between the mismatch and control conditions, $p = .63$. While the observed talker effect produced only a marginally significant difference, the pattern of results are in line with our predictions (see Tables 2a and 2b). Moreover, we conducted an additional analysis directly comparing the effectiveness of matched and mismatched targets as primes. We obtained a priming effect for the match (i.e., control minus the match condition [$M = 25.64, SD = 61.01$]) and mismatch (i.e. control minus the mismatch condition [$M = 4.17, SD, 12.48$]) and found significantly greater priming in the match than the mismatch conditions, $t(40) = 1.62, p = .05$.

Table III

Hypothesized RT Results Speeded-Shadowing					
	Match	Mismatch	Control	Priming Effect*	Talker Effect**
		BO (talker target block)			
RT(ms)	750	770	850	100	20
		HC (talker target block)			
RT(ms)	760	780	850	90	20
		Overall (collapsed over talker)			
RT(ms)	755	775	850	95	20

*The control RT minus the match RT
**The mismatch RT minus match RT

Table IV

RT Results Speeded-Shadowing					
	Match	Mismatch	Control	Priming Effect*	Talker Effect**
		BO (talker target block)			
RT(ms)	861	882	883	22	22
		HC (talker target block)			
RT(ms)	898	923	934	11	25
		Overall (collapsed over talker)			
RT(ms)	879	903	908	29	23

*The control RT minus the match RT
**The mismatch RT minus match RT

3.2 Speeded-Shadowing Discussion

Unlike previous research, we found that matched primes were more effective than mismatched primes (talker effects) in a speeded shadowing task. There are two potential sources responsible for our observed talker effects in the current speeded shadowing experiment: 1) Famous talkers' indexical information is stored in more frequent representations and affects processing earlier than the indexical information of unfamiliar talkers processed (i.e., our prediction at the outset of this investigation). 2) Participants' processing of famous-talker stimuli was slower than the processing observed in previous studies. Language processing can be slowed based on the type of words used as stimuli. As stated previously, the stimuli used in the current study were not entirely made up of concrete nouns; thus, processing might have been slowed based on the inclusion of abstract words (see Sheffert, 1998). We hope that any observed talker effects are due to the former rather than later source, but further research is necessary to eliminate this explanation.

Although the mean condition RTs observed in the present study were longer than the mean RTs observed in previous work (see Table V), the differences do not reach 150ms (a duration that has previously been shown to produce talker effects with words spoken by unfamiliar talker). The comparison between McLennan and Luce (2005) and the present study have several limitations. First, we are unable to determine possible significant differences in RTs between the two studies because we are making a comparison between the two studies' means and not a statistical comparison between all of the participants' RTs. Second, the stimuli differed between the two studies in both the precise stimulus words and in the stimulus preparation methods used (i.e., words in the

present study were extracted from continuous speech, while the words in M^cLennan & Luce were recorded in isolation). Future work that includes the identical word stimuli spoken by an unfamiliar talker is necessary eliminate these potential confounds.

Table V

Mean Reaction Times and Stimulus Durations, Previous Research and Present Study

	Match	Mismatch	Control	Overall	Stimulus Durations	
	M ^c Lennan & Luce, (2005)					
RT(ms)	814	808	855	826	569(TA)	560(PL)
	Present Study					
RT(ms)	879.27	902.61	908.48	897	544(HC)	466(BO)

3.3 Post-Shadowing Questionnaire Results

A series of analyses were conducted on the collected post-shadowing data. First, eighteen (43%) of the participants were able to correctly identify at least one of the talkers: (HC) $n = 13$, (BO) $n = 18$. Participants reported a mean confidence rating of the female talker of 4.0, and a mean confidence rating of the male talker of 6.0. Second, an independent samples t-test revealed a significant difference for talker effect (overall match RTs minus overall control RTs) and the participants' ability to identify the talkers, $t(39)$, $p = .01$. Participants who were unable to identify either of the talkers had a significantly larger talker effect ($M = 51.63$, $SD = 97.23$) than participants who identified at least one of the talkers ($M = -13.46$, $SD = 51.71$). Third, a one-way ANOVA revealed no significant differences in talker effect and the participants' political affiliation, $F(3,$

40) = 1.14, $p = .34$ (see Table VI for descriptive statistics). Fourth, descriptive statistics are reported for the mean number of shadowed words recalled after the task, and the mean number of recalled words where participants accurately identified the word's talker (see Table VII). Finally, a series of correlations between the remaining post-shadowing questions and recall data with appropriate talker effect values were performed. None of these correlations reported a significant relationship (see Table VIII).

Table VI

Political Affiliation Descriptive Statistics			
	n	Mean Talker Effect	Standard Deviation
Democrats	27	11	84.46
Republicans	9	22	49.81
Independents	3	1	167.40
Other	2	26	62.40

Table VII

Recall Descriptive Statistics			
	n	Mean	Standard Deviation
Number of words correctly recalled	34	3.15	1.73
Correct talker identification of recalled words	34	1.41	1.18

Table VIII

Correlations: Post-Shadowing Questions and Talker Effects			
Relationship	r	p-value	n
Political Interest and Talker Effect	.06	.70	41
Number of words accurately recalled and Talker Effect	-.04	.82	34
Number of correctly talker identified recall words and Talker Effect	.11	.53	34
HC unique and HC Talker Effect	.10	.52	41
HC listening frequency and HC Talker Effect	-.16	.31	41
Perceive HC voice uniqueness and HC Talker Effect	.05	.75	41
HC like and HC Talker Effect	-.07	.67	41
Perceived HC extremeness and HC Talker Effect	-.08	.64	41
BO unique and BO Talker Effect	.00	.99	41
BO listening frequency and BO Talker Effect	.01	.93	41
Perceive HC voice uniqueness and HC Talker Effect	-.25	.12	41
BO like and BO Talker Effect	-.24	.13	41

Perceived BO extremeness and BO Talker Effect	.00	.99	41
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3.4 Post-Shadowing Questionnaire Discussion

The analysis of the post-shadowing yielded a significant effect of the participants' ability to identify the talkers and overall talker effect. Participants who did not identify either of the talkers had a significantly greater talker effect than participants who identified at least one of the talkers. While this result may seem at odds with the overall hypothesis of the present study, similar results have been found in previous studies with pre-experimental familiar talkers. In a study by Magnuson and colleagues, processing of Japanese moras (consonant-vowel sequences) was slower when the stimuli were produced by familiar adult talkers. The familiar talker stimuli were produced by family members, and it may be the case that participants were surprised to hear their spouse in an experimental setting. Similarly, the participants in the present study able to identify the talkers may have been surprised and distracted by the famous-voice stimuli. This may have caused a more strategic type of processing and a reduction in talker effects. Participants who were unable to identify the talkers may not have been distracted by the famous voices, resulting in a normal stimulus processing speed. Consistent with this interpretation, the mean RT for participants who were able to identify the talkers was longer ($M = 902$) than participants who were unable to identify the talkers ($M = 892$). Regardless of whether the participants were able to identify the talkers, it is highly probable that all participants were exposed to the two talkers before the experiment. This is especially the case with the recent historic democratic primary and general presidential

elections. Furthermore, there was no significant relationship between how much the participants listened to BO or HC and the respective talker effect.

The observed lack of relationship between the participants' responses on the post-shadowing questions and talker effects provides further support for online nature of the present study's shadowing task. A person's biases may play a role in more strategic offline processing tasks where a person is required to make a critical analysis and decision, but they should not influence the ability to hear and repeat a word. For example, you might expect a relationship between someone's rating of how much they like Barack Obama and their subsequent evaluation of the president's economic stimulus plan. Talker effects are traditionally observed when a task requires offline and strategic processing, and one concern with the present study was that the famous talker stimuli would cause a general delay in processing speed. This delay, rather than the familiar nature of the stimuli, would most likely be the cause of any observed talker effect. Given that there were no significant relationships between the post-shadowing questionnaire items and observed talker effects, we can be somewhat more confident that our results were not due to a delay that resulted in offline processing, but rather truly reflect relatively early talker effects.

CHAPTER IV

GENERAL DISCUSSION

The purpose of the present study was to investigate a potential situation where talker-specific representations will affect processing at the same time during processing as abstract representations. To date, researchers have found that talker change attenuates priming only when processing is slowed or delayed. The patterns of results observed in the present study's speeded-shadowing task are consistent with our predictions, and talker-specific representations were observed to affect the perception of spoken words relatively earlier during processing. Furthermore, the results of this study provide support for the hypothesis that indexical information's later effect on processing is due to its relatively weaker representational form. The increased exposure to famous talkers in relation to unknown-talker stimuli (primarily used in experimental methods) should create more robust and easily accessible representations. The results of the present study have several implications for theories of language processing. First, if words spoken by famous talkers have different effects on language processing, then more research should be conducted with familiar rather than unfamiliar voice stimuli. Second, the results of this experiment provide support for a relation between representational strength and time of

processing (i.e. stronger representations affect processing first). No spoken word recognition theory is able to account for time-course effects, and as Luce and McLennan (2005) point out, accounting for variations in language can be difficult for models of spoken word recognition.

There is, however, an alternative account for the observed results in the speeded shadowing task. The word stimuli used in the present experiment consist of words with lower concreteness ratings than those generally used in shadowing tasks. For example, the stimuli in McLennan and Luce (2005) had a mean concreteness rating of 612, while the stimuli in the present study had a rating of 438. Concrete words are processed more quickly than abstract words (Sheffert, 1998), and the stimulus words in the present study may have caused a decrease in the participants' overall processing speed resulting in longer RTs. Additionally, the stimuli in the present study were extracted from continuous speech (an uncommon stimulus production method and potential source of stimulus ambiguity) which may increase processing demands and produce longer RTs. Further studies using the identical extraction method with non-famous talkers are necessary to gain general processing speed information.

The present study's results also showed a potential over-familiarity effect. Participants who were able to identify the talkers showed significantly less talker effects than participants who were unable to identify the talkers. However, as stated previously, participants able to identify the talker were potentially distracted by the stimuli. In a similar vein, Beyer and McLennan (2009) found longer participant shadowing RTs in response to words presented with a picture of the talker (which was done in order to allow listeners to put a face with the voice, and consequently create some degree of

familiarity with the talker) than words presented without a picture. Further investigations are necessary to provide more information about the interaction between a participant's ability to identify a talker and subsequent talker effect. For example, we could inform participants of the talker's identity before the experiment in an attempt to reduce or increase any distraction the famous talkers might create.

The majority of past famous talker research has focused on a participant's ability to recognize and name a famous voice, and research with familiar talkers has primarily required participant training. Few studies have attempted to investigate language processing with pre-experimental familiarity. Language spoken by familiar talkers can produce a difference in cortical activation than language spoken by unfamiliar talkers (Shah et al., 2000), which may indicate that there are differences in language processing. Beyond differences in how language produced by familiar talker is processed, the pattern of results in the present study reveals that talker-specific representations can affect spoken word recognition relatively earlier during processing.

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FOOTNOTES

¹ There may be exceptions to this rule, especially in the media, and individual words may become highly associated with specific talkers. For example, the words “rosebud” and “change” have become strongly associated with specific talkers (i.e., Orson Wells in *Citizen Kane*, and Barack Obama in his 2008 presidential campaign, respectively). In these cases, talker specific details may have a stronger representation than abstract ones. Consequently, several participants in the present study falsely recalled the word *change* and identified it as spoken by BO though this word not appear as an experimental or practice stimulus.

²The methods used in the speeded-shadowing task followed the design and methods of Experiments 3A of McLennan and Luce’s (2005) study.

³In addition to the 42 participants reported in the methods section, data were collected from 23 participants and excluded due to a recording failure of the internal microphone. The data collected from these participants were not used in the final analysis because accurate shadowing could not be determined. Additionally, three participants were excluded due to a high number (greater than five) of no-response errors in their data. These participants were excluded because they had accurately shadowed a stimulus word, but their reaction time was not recorded due to a voice-key failure. To allow all students the ability to participate and receive credit, this experiment was listed on the University’s experiment pool system with no inclusionary criteria. This resulted in the collection and exclusion of seven participants’ data whose first language was not American English, two participants with reported speech disorders, and three left-handed participants.

⁴Concreteness ratings were obtained from the MRC psycholinguistic database, and range from 100 to 700 with a mean of 438. Concreteness ratings were available for only 13 of the present study's 32 stimuli.

⁵RT exclusionary criteria in the speeded-shadowing task followed McLennan and Luce's (2005) exclusionary criteria.

APPENDICES

APPENDIX A

Stimulus Source Information

Barack Obama Video

Title: President-Elect Obama News Conference

Date of speech: Friday, November, 7, 2008

Location: Chicago, Illinois

Duration: 20 minutes

Obtain From C-SPAN Video: <http://www.c-span.org/Watch/watch.aspx?MediaId=HP-A-10890>

Hillary Clinton Video 1

Title: Senator Hillary Clinton (D-NY) at New York Delegation Breakfast in Denver, CO

Date of speech: Monday, August 25, 2008

Location: Denver, Colorado

Duration: 30 minutes

Obtain From C-SPAN Video: <http://www.c-span.org/Watch/watch.aspx?MediaId=HP-A-9785>

Hillary Clinton Video 2

Title: Senator Hillary Clinton (D-NY) Press Conference

Date of speech: Wednesday, May, 7, 2008

Location: Shepherdstown, West Virginia

Duration: 11 minutes

Obtain From C-SPAN Video: <http://www.c-span.org/Watch/watch.aspx?MediaId=HP-A-8994>

APPENDIX B

Stimulus List

Control Words

*behind*_{BO}
*happens*_{BO}
*middle*_{BO}
*several*_{BO}
*making*_{HC}
*million*_{HC}
*nature*_{HC}
*resolve*_{HC}*

Target Words

*about*_{BO/HC}
*because*_{BO/HC}
*before*_{BO/HC}
*between*_{BO/HC}
*careful*_{BO/HC}*
*closely*_{BO/HC}
*forward*_{BO/HC}*
*knowledge*_{BO/HC}
*morning*_{BO/HC}
*moving*_{BO/HC}
*myself*_{BO/HC}*
*paycheck*_{BO/HC}*
*people*_{BO/HC}
*problem*_{BO/HC}
*process*_{BO/HC}
*repeat*_{BO/HC}
*respect*_{BO/HC}
*response*_{BO/HC}
*senior*_{BO/HC}
*something*_{BO/HC}
*statement*_{BO/HC}
*thousand*_{BO/HC}*
*today*_{BO/HC}*
*working*_{BO/HC}

*Hillary Clinton stimulus extracted from Video 2

APPENDIX C

Math Test

**Language Research Laboratory
Mathematical Evaluation Test (MET)**

Welcome to our research laboratory. We are attempting to determine the level of difficulty of certain math problems for another experiment in our laboratory. You can help us by completing the following problems as quickly but as accurately as possible. This is not a test of your intelligence or your math abilities. In fact, we will never associate your name with your answers. We are simply interested in determining which of the following problems are easy and which are difficult.

When the experimenter tells you to begin, turn the page and begin working on the problems. The experimenter will tell you when to stop working.

Thank you for helping us.

MET PART 1

1. $5387 \div 52 =$ _____

2. $585,975 \div 32 =$ _____

3. $7845.55 \times 77.99 =$ _____

4. $\left(\frac{77}{32}\right) \div \left(\frac{895}{84}\right) =$ _____ (express answer as fraction)

5. $945,759 \div 53 =$ _____

6. $\left(\frac{2997}{10,500}\right) \left(\frac{6799}{57}\right) =$ _____ (express answer as fraction)

7. $772,947 \times 48 =$ _____

MET PART 2

1. $4276 \div 41 =$ _____

2. $485,875 \div 22 =$ _____

3. $6835 \times 66 =$ _____

4. $\left(\frac{32}{77}\right) \div \left(\frac{84}{895}\right) =$ _____ (express answer as fraction)

5. $5369 \div 973 =$ _____

6. $\left(\frac{3897}{530}\right) \left(\frac{864,599}{29}\right) =$ _____ (express answer as fraction)

7. $397,947 \times 483 =$ _____

APPENDIX D

Post-Shadowing Questionnaire

On a scale of 1-10, ten being extremely confident and one being extremely unconfident, how confident are you in your identification of female speaker?

On a scale of 1-10, ten being extremely confident and one being extremely unconfident, how confident are you in your identification of male speaker?

With which political party do you consider yourself most affiliated?

(D) Democrat (R) Republican (I) Independent (O) Other

On a scale from 1 to 10, 1 being not unique at all and 10 being very unique, rate how much you feel Barack Obama is unique.

On a scale from 1 to 10, 1 being not unique at all and 10 being very unique, rate how much you feel Hillary Clinton is unique.

On a scale from 1 to 10, 1 being not at all and 10 being very frequently, how often have you listened to Barack Obama speak?

On a scale from 1 to 10, 1 being not at all and 10 being very frequently, how often have you listened to Hillary Clinton speak?

On a scale from 1 to 10, 1 being not unique at all and 10 being very unique, how unique is Barack Obama's voice?

On a scale from 1 to 10, 1 being not unique at all and 10 being very unique, how unique is Hillary Clinton's voice?

On a scale from 1 to 10, 1 being not interested at all and 10 being very interested, how would you rate your interest in politics?

On a scale from 1 to 10, 1 being not at all and 10 being very much, how much do you like Barack Obama?

On a scale from 1 to 10, 1 being not at all and 10 being very much, how much do you like Hillary Clinton?

On a scale from 1 to 10, 1 not extreme at all and 10 being very extreme, how extreme do you think Barack Obama's political views are?

On a scale from 1 to 10, 1 not extreme at all and 10 being very extreme, how extreme do you think Hillary Clinton's political views are?

APPENDIX E

Informed Consent Form

<p>Participant Consent Form LANGUAGE RESEARCH LABORATORY CLEVELAND STATE UNIVERSITY: DEPARTMENT OF PSYCHOLOGY Chester Building 32</p> <p>DR. CONOR T. M^cLENNAN, ASSISTANT PROFESSOR AND DIRECTOR E-MAIL: c.mclennan@csuohio.edu WEBSITE: http://web.mac.com/languageresearch PHONE: (216) 687-3834</p> <p>ALISA MAIBAUER, GRADUATE STUDENT E-MAIL: alisa.maibauer@gmail.com PHONE: (440) 552-0015</p>

This research is being conducted to fulfill the requirements for a Master of Arts degree by Alisa Maibauer under the guidance of Dr. Conor T. M^cLennan. If you would like to learn more about the research being conducted in the Language Research Lab or the results of this experiment, please see the contact information listed above.

There are two copies of this letter. After signing them, please keep one copy for your records and return the other one. Thank you in advance for your cooperation and support.

"I agree to participate in a perceptual experiment in which I will hear spoken words over headphones. I agree to respond to these sounds by repeating the word aloud into a microphone. I furthermore agree to the recording of my voice for acoustic analysis. I understand that confidentiality of my identity will be maintained at all times.

I understand that the procedures to be followed in this experiment have been fully explained to me and that I may ask questions regarding the experiment at the end of the experimental session. I understand the approximate time commitment (30 minutes) involved and that I will receive .5 research credits for my participation. I am also aware that I may refuse to continue the experiment at any time and that I will be excused without loss of credit.

I understand that participation in this experiment involves no risks beyond those of daily living.

I understand that if I have any questions about my rights as a research subject I can contact the Cleveland State University Institutional Review Board at (216) 687-3630.

I understand that the purpose of this research is to add knowledge to the field of spoken word recognition. I understand that although there may be several indirect benefits of this study, its direct benefit is adding to the current body of knowledge on human perception.

I, the undersigned, am 18 years or older and have read and understood this consent form and hereby agree to give my consent to voluntarily participate in this experiment."

Signature of Participant

Date

Name of Participant (PLEASE PRINT)

APPENDIX F

Initial Paperwork

PARTICIPANT INFORMATION FORM
PAGE 1
DR. CONOR T. M^oLENNAN, ASSISTANT PROFESSOR AND DIRECTOR
ALISA MAIBAUER, GRADUATE STUDENT
LANGUAGE RESEARCH LABORATORY
CLEVELAND STATE UNIVERSITY: DEPARTMENT OF PSYCHOLOGY
CHESTER BUILDING 32
(216) 687-3834

FOR LRL USE:

Room # _____
Participant # _____
_____ (credits) OR \$ _____
Experiment _____
Date _____
Experimenter _____

Please fill in the following information:

Name: _____

*Address: _____

E-mail address(es): _____

Telephone Number: _____ Cell Phone Number: _____

Date of Birth: _____ Place of birth (City): _____

Gender: _____ Major: _____

Place of Longest Residence (City): _____

First language spoken: _____

Are you (circle one): right-handed left-handed ambidextrous

What languages do you speak fluently? _____

Would you like to be added to (or remain on) our "Paid Participants Database" so that we can notify you in the future of paid experiments for which you are eligible to participate? _____

PARTICIPANT INFORMATION FORM
PAGE 2
DR. CONOR T. McLENNAN, ASSISTANT PROFESSOR AND DIRECTOR
ALISA MAIBAUER, GRADUATE STUDENT
LANGUAGE RESEARCH LABORATORY
CLEVELAND STATE UNIVERSITY: DEPARTMENT OF PSYCHOLOGY
CHESTER BUILDING 32
(216) 687-3834

FOR LRL USE:

Room # _____
Participant # _____
_____ (credits) OR \$ _____
Experiment _____
Date _____
Experimenter _____

Please note that your responses to the following questions will *not* be directly linked to your name. As with any part of your experience as a research participant in our study, please feel free to ask the experimenter if you have any questions. Thank you.

Have you ever had a hearing or speech disorder?

(circle one) YES NO

If yes, please explain: _____

Have you ever had a visual or reading disorder (other than glasses/contacts)?

(circle one) YES NO

If yes, please explain: _____

Have you ever been diagnosed with Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD)?

(circle one) YES NO

If yes, please explain: _____

APPENDIX G

Handedness Inventory

You can further help us by providing answers to the following questions. There are no right or wrong answers. Please indicate your preferences in the use of hands in the following activities by answering L for Left hand OR R for Right hand. Please answer all of the questions. If you have any questions, please ask the experimenter.

Which hand do you write with?

L) Left R) Right S) Skip

Which hand do you draw with?

L) Left R) Right S) Skip

Which hand do you throw with?

L) Left R) Right S) Skip

Which hand do you use when using scissors?

L) Left R) Right S) Skip

Which hand do you put your toothbrush in?

L) Left R) Right S) Skip

Which hand do you use when using a knife without a fork?

L) Left R) Right S) Skip

Which hand do you use when using a spoon?

L) Left R) Right S) Skip

Which hand is your upper hand when using a broom?

L)Left R) Right S) Skip

Which hand do you use when striking a match?

L) Left R) Right S) Skip

Which hand do you use when opening a lid to a box?

L) Left R) Right S) Skip

APPENDIX H

Race, Gender, and Ethnicity Inventory

You can further help us by providing answers to the following questions. If you have any questions, please ask the experimenter.

Your gender is:

- a.) Male b.) Female x) Skip

Your ethnic background is:

- a.) Hispanic or Latino b.) Not Hispanic or Latino x) Skip

Your racial background is:

- a.) American Indian/Alaska Native
- b.) Native Hawaiian or Other Pacific Islander
- c.) White
- d.) Unknown
- e.) Asian
- f.) Black or African American
- g.) More than One Race
- x.) Skip