Interhemispheric communication and prose processing

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A Thesis
entitled
Interhemispheric Communication and Prose Processing
by
Eric Charles Prichard
Submitted to the Graduate Faculty as partial fulfillment of the requirements for the
Master of Arts Degree in Psychology

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Previous research suggests that those who use their non-dominant hand for at least some tasks ("mixed handers") have better episodic memory than people who use their dominant hand nearly all the time ("strong handers"). Evidence suggests that this is because mixed handers have greater access to the right hemisphere, which is active during the retrieval of episodic memories. Most of this previous research has focused on list learning. The present study extends these findings to memory for prose. Furthermore, this study investigated whether mixed or strong handers would be more susceptible to previously studied effects demonstrating that taking a specific perspective may affect what someone remembers from a story. One hundred fifty UT students were split into three groups of 50. All 150 were given a short story about two boys skipping school. However 1/3 were told to imagine they were burglars, 1/3 were told to imagine they were potential homebuyers, and 1/3 were given no such instructions. After a five minute lag time, during which participants completed a handedness questionnaire, everyone was given five minutes to recall as much as possible from the story. While perspective did affect what was recalled, perspective and handedness did not interact. More importantly, there was a main effect of handedness. As predicted, mixed handers remembered more.
from the story than strong handers. The findings suggest that degree of handedness may be a variable of interest to cognitive and educational psychologists who studying reading the processing of prose material.
I would like to dedicate this work to my grandmother, Dr. Marilyn Reed Spiegel. Who would have guessed that 24 years after having my picture taken in your PhD graduation cap, I would find myself pursuing a PhD at the same university where you did your doctoral work? Life can be funny that way.
Acknowledgements

I would like to acknowledge the intellectual and methodological contributions made by Stephen Christman. I would like to further acknowledge and express my gratitude to the other members of my committee, J.D. Jasper and Jason Rose. All of you have made this project possible. I would also like to acknowledge Peter and Michele Prichard. Their financial and emotional support has been invaluable throughout my academic journey.
# Table of Contents

Abstract iii  
Acknowledgements vi  
Table of Contents vii  
List of Tables viii  
List of Figures ix  
List of Abbreviations x  
I. Introduction 1  
   A. Remembrance of Things Read 3  
   B. Context! Context! Context! 6  
II. Methodology and Procedures 10  
   A. Participants 10  
   B. Material and Procedures 10  
   C. Analytic Plan and Predicted Results 12  
III. Analysis and Results 14  
IV. Discussion 19  
References 22  
Appendices  
   A. Stimulus Materials 26  
   B. Scoring Units 28
List of Tables

Table 1  Sex by Item Type Cell Means. .................................................................16
Table 2  Condition by Item Type Cell Means. ......................................................16
List of Figures

Figure 1  Sex by Item Type Interaction............................................................15
Figure 2  Condition by Item Type Interaction.....................................................16
Figure 3  Mean Percentage Per Item Type by Handedness ..............................17
Figure 4  Sex by Item Type Interaction II ..........................................................18
Figure 5  Condition by Item Type Interaction II. ..............................................18
List of Abbreviations

EHI......................Edinburgh Handedness Inventory
HERA..................Hemispheric encoding/retrieval asymmetry model
LH......................Left Hemisphere
PET...................Positron Emission Tomography
RH.....................Right Hemisphere
WHQ....................Waterloo Handedness Questionnaire
Chapter One

Introduction

Anyone who has ever grappled with Moncrieff’s rambling English translation of Proust’s *A la Recherche du Temps Perdu* (Proust, Moncrieff, & Kilmartin, 1981), the sections of Faulkner’s *The Sound and the Furry* (1929) narrated by mentally handicapped Benjy and mentally deteriorating Quentin, or Marquez’s *One Hundred Years of Solitude* (1970), a magical realist tour de force, is familiar with just how cognitively taxing reading prose can be. However, most fans of literature are relatively unaware of just what processes make an undertaking such as the reading of an innovative novel possible. Readers often have to trudge through semantic ambiguity, experimental syntactic structures, and unfamiliar words in order to make it to the end of a great work. Furthermore, the sheer lengths of some works require one to have memory for events that took place earlier in the story. Without memory for elements presented early in the novel, the reader would eventually lose track of the narrative thread. Reading difficult prose, or even reading at all, is an incredible cognitive feat of which no other species is capable.

The purpose of the review and study which are to be presented on the following pages is to explore one facet of the neuropsychological processes which allow humanity to utilize and enjoy written language. Namely, they explore the possible roles of hemispheric specialization and interhemispheric communication in the processing of prose.

In order to do so, the study presented will be relying on handedness as measure of interhemispheric communication. More specifically, strength of handedness will be measured via the Edinburgh Handedness Inventory (Oldfield, 1971). According to Christman and Propper (2010), there has been a convergence of anatomical and
behavioral evidence suggesting that the tendency to use both hands while performing various tasks (such as writing, opening jars, using a spoon, etc.) is correlated with greater functional access to the right hemisphere. This has made possible the use of strength of handedness as a proxy variable for interhemipsheric connectivity. As will be demonstrated in the following sections, the mixed/strong handed dichotomy has allowed researchers to gain insight into real world behavioral implications of previously theorized hemispheric asymmetries. As such, handedness could ultimately be a powerful tool with which to investigate the potential importance of these asymmetries to the reading and comprehension of prose. It will certainly not replace the approaches neuroscientists already take to the topic, nor should it. However, it may introduce a methodology which complements the existing literature by using larger samples than one can typically afford to use with neuroimaging studies and making it possible to avoid some of the potential problems that may come with attempting to generalize the results of lesion studies to non-clinical populations.

Lofty though the goal of introducing a new methodological tool to the study of hemispheric asymmetries and prose processing is, the study presented here will actually be something of a modest step. It will focus on two cognitive processes which are necessary for comprehension. The first is recall. It is obvious that anterograde amnesia would make reading a novel a fruitless endeavor, but even forgetting only a few early details and characters can make it more difficult to follow a text. The second is the use of contextual information to determine what is important in a text. After reviewing what the literature says about the role of hemispheric asymmetries in these processes, a study will be described which draws on heavily on the stimulus materials
and methods used in a classic study Pitchert and Anderson (1977), that attempts to unify both areas by testing for handedness differences in text recall and the use of contextual information to influence what is recalled. If handedness differences are found, they will serve to further demonstrate the ways in which functional access to the right hemisphere is crucial to processing and understanding prose.

**Remembrance of Things Read**

Early hints that hemispheric communication might play a crucial role in recall emerged in a positron emission tomography (PET) study by Tulving, Kapur, Craik, Moscovitch, and Houle (1994). Their paper, as well as a later review (Tulving, 2002), suggest that they were not interested in laterality *per se*. Rather, they seemed to have been interested in finding a biological basis for Tulving’s distinction between episodic and semantic memory systems. That is, in fact, what they seemed to find. Blood flow increased in the left pre-frontal cortex when subjects encoded semantic and episodic memories and when they retrieved semantic memories. However, when they retrieved episodic memories, there was an increase in right pre-frontal blood flow. This prompted them to propose the hemispheric encoding/retrieval asymmetry (HERA) model of memory.

Tulving et al. (1994) seemed to have their evidence of a biologically meaningful distinction between different memory systems, but they also raised questions for laterality researchers. If the right hemisphere plays a relatively large role in the retrieval of episodic memories, could functional access to the right hemisphere explain some of the within subject variability in memory performance? Christman and Propper (2001) investigated this question by using the presence of familial sinistrality (the presence of
left handed relatives) as a proxy for degree of interhemispheric communication. They split 180 air force recruits into three groups, presented each subject a list of 55 words, and then presented the subjects with either a word fragment test, a recognition test, or a recall test. Subjects with left handed relatives performed significantly better on the recall test, which was the purest test of episodic memory. Subjects without familial sinistrality performed significantly better on the word fragment test, which served as the purest test of semantic memory. There was no significant difference between the two groups’ recognition test scores. The authors noted, however, that recognition tests are not necessarily pure tests of episodic memory. This is because participants may either actually remember seeing an item or they may merely feel that they “know” they have seen an item (Tulving, 1985).

As this new line of research evolved, it became evident that handedness could also serve as a predictive proxy variable for degree of interhemispheric communication. The big breakthrough was the realization that strength of handedness, and not direction of handedness, seemed to be correlated to callosal size (Luders, Cherbuin, Thompson, Gutman, Anstey, Sachdev, & Toga, 2010). Using the EHI (Oldfield, 1971) to divide subjects into mixed and strong handers (as opposed left and right handers), Propper, Christman and Phanuef (2005) found that when subjects were presented with a 36 item word list, there was a significant handedness difference when subjects were given a recall test but not when they were given a word fragment test. Once again, a proxy variable for interhemispheric communication demonstrated better performance on a recall (episodic memory) task for people with more functional access to the right hemisphere. Independent research by Lyle, McCabe, and Roediger (2008) replicated these results when they looked at middle aged adults, but found no significant performance advantage
for mixed handed older adults. This prompted them to suggest that age related degradation of the corpus callosum attenuates the mixed handed recall advantage.

In addition to the findings described above, mixed handedness has been associated with a recall advantage on incidental learning tasks (Christman & Butler, in press), fewer false memories in a verbal converging semantic associates paradigm (Christman, Propper, & Dion, 2004), and a tendency to self-report explicitly remembering items during a recognition memory task when being asked to make remember vs. know judgments (Propper & Christman, 2004). In each case, the findings provide behavioral evidence which supports the HERA model.

While the fact that experimental findings using various measures of handedness (e.g., the EHI and familial sinistrality) alone seem to follow from the HERA model is fairly compelling, other ways have been found to test the model as well. Christman, Garvey, Propper, and Phaneuf (2003) found that saccadic eye movements, known to increase interhemispheric communication, improved episodic memory in laboratory tasks and for everyday events. Furthermore, Lyle, Logan, and Roediger (2008) found that this improvement is driven by strong handers, providing converging evidence that handedness is indeed tapping into the amount interhemispheric communication that takes place and this communication really is essential for recall.

Most of the studies above, however, used list learning. The exceptions have tended to look at memory for past episodes in the lives of participants. Study two of the Chistman et al. (2003) paper on the effects of saccadic eye movements on recall used the ability to recollect everyday events as a DV, while a study by Christman, Propper, and Brown (2006) found that the offset of early childhood amnesia tends to occur at an earlier
date for mixed handers. Although these are important findings, and have done a lot to demonstrate that the effect can be generalized beyond list learning in a lab setting, relatively little has been done looking at handedness and memory for paragraph level learning. A conference paper by Prichard and Christman (2012) reported that mixed handers correctly answered more directed recall questions about a short passage on a fictional Australian author. However, this finding needs to be replicated and done so using different stimulus materials. It is important that an effect is obtained using several samples and different sets of stimuli before building too much on findings pertaining to said effect. For these reasons a key purpose of the proposed research is to see if the handedness effects in episodic memory generalize to more ecologically valid stimulus materials, namely, memory for paragraphs, which contain much greater complexity in terms of syntax, narrative structure, context, etc. Moreover, the proposed research will specifically be looking at the processing of contextual information in paragraph-level materials.

**Context! Context! Context!**

Ornstein (1997), in his book *The Right Mind*, presents the following example of a joke which patients with right hemisphere (RH) damage have difficulty understanding:

“A housekeeper was accused of helping herself to her master’s liquor. She told him, ‘I’ll have you know, sir, I come from honest English parents....’ What might the punch line be? Here are three options. Pick the one you think fits best.

1. He said, ‘I’m not concerned about your English parents. What’s worrying me is your Scotch extraction.’

2. Then the housekeeper saw a mouse and jumped into her master’s lap.
3. He said, “All the same, the next time the liquor disappears you’re fired.”

(Ornstein, 1997, p. 106).

Interestingly, according to Ornstein, patients with RH damage are more likely to pick option three than option one. Understanding the joke and picking the proper punch line requires one to have access to multiple definitions of Scotch and be able to recognize that, in the context of the overall joke, that the word could hold either of these definitions. The humor is derived from the recognition and appreciation of this ambiguity.

Throughout the book, Ornstein goes on to argue that the right hemisphere is responsible for setting context while the left hemisphere sequentially processes information. If correct, this would have important consequences for the respective roles played by the hemispheres during reading.

Since the publication of Ornstein’s book, there has been experimental evidence suggesting that the right hemisphere does indeed handle the processing of context during reading. A recent meta-analysis of 128 neuroimaging studies is particularly relevant (Vigneau, Beaucousin, Herve, Jobard, Petit, Crivello, Mellet, Zago, Mazoyer, & Tzourio-Mazoyer, 2011). Vigneau et al. (2011) found that, during ortholinguistic tasks, in the majority of instances where LH activity increased relative to baseline, there was not a corresponding increase in RH activity. However, most increases in RH activity, relative to baseline, occurred in conjunction with increases in LH activity. When increases in only RH activity were observed, they occurred in the right temporal region during sentence level processing. The authors concluded that this is consistent with the idea that the right hemisphere plays a role in comprehending the meaning of a text by processing context. Furthermore, Jung-Beeman (2005) notes that patients with right temporal damage often
have difficulties understanding the gist of stories. He further notes that there is a relative increase in anterior RH activity when texts without titles are presented and when participants detect changes which are inconsistent with the overall context of the text. This latter finding is consistent with Ramachandran’s (1995) hypothesis that the right hemisphere acts as an anomaly detector, and is crucial for belief updating.

Unfortunately, the participants used in the aforementioned neuroscience studies limit their generalizability. All of the studies reviewed by Vigneau et al. (2011) used only right handers. Furthermore, lesion studies use small N’s and subjects with damaged brains. While both methods have provided much that has been useful, the field could gain from the introduction of a behavioral methodology that includes non-right handers and which addresses how what is learned about brain localization in lesion studies is relevant to understanding the relationship between functional access to the right hemisphere and comprehension in healthy subjects. Because extending the handedness paradigm to research questions about the importance of the RH for comprehension and context processing could fill such a need, the proposed experiment will also contain a simple context manipulation. Tomich, Newman, Carpenter, and Just (2008) found that the RH becomes more active during the processing of topic sentences that the processing of non-topic sentences. Furthermore, as mentioned above, Jung-Beeman (2005) reports that more frontal RH activity is recorded when participants are asked to read passages with titles than when they are presented passages without titles. Both of these findings suggest that a context manipulation can be as simple as presenting a topical title. The present study will take a related approach by asking participants in the experimental to read a passage from a specific perspective.
To recapitulate, the present study has two main purposes. The first is to attempt replicate the Prichard and Christman (2012) finding of a mixed-handed advantage in recalling paragraph level material using different stimulus materials. The second is to introduce a behavioral methodology to the study of context processing in the right hemisphere. It is hypothesized that mixed handed individuals will have better recall for material read. Furthermore, the study will explore the possibility that that mixed handers are more sensitive to contextual manipulations during prose processing.
Chapter Two

Methodology and Procedures

Participants

Participants were 155 (114 female) University of Toledo undergraduates ($M_{\text{Age}} = 19.09, SD = 2.03$). One participant failed to follow instructions and four were non-English speakers. These five participants were replaced before the data were analyzed. Everyone was recruited via the SONA participant pool and received course credit for participation.

Materials and Procedure

Participants were assigned to one of three conditions. There were 50 participants in each condition. One to two participants were tested at a time. They were presented a booklet containing the passage from a Pitchert and Anderson (1977) technical report studying the effect of perspective taking on recall (Appendix A). It is a 370 word story about two boys who decide to skip school. It extensively describes the house where the two boys are hiding and was designed to have three types of idea units, some of which would be relevant to a home buyer’s perspective, some of which would be relevant to a burglar’s perspective, and some of which would be neutral. Since the original technical report did not specifically list all of the idea units, the author of the present report and a second researcher agreed on 15 details relevant to a burglar, 13 details relevant to a homebuyer, and 14 details that would be neutral to a homebuyer or burglar. These 42 details (Appendix B) were the critical items for which each participant’s responses were assessed. In the two experimental conditions, context was provided to participants by instructing them to imagine they were a burglar (the “burglar condition”) or a potential
homebuyer (the “homebuyer condition.”) while they read the story. No such instructions were given to participants in the control condition. All participants were told that they “may be asked questions about the story” later on in the experimental session. All participants had two minutes to read the story. After two minutes, all participants were given five minutes to fill out the EHI and the Waterloo Handedness Questionnaire (1977). The EHI is a ten item scale that presents motor tasks which can be performed with one hand (e.g., drawing, combing one’s hair). The items are five point scales that range from “I always use my left hand for this task” to “I always use my right hand for this task.” When one always uses their right hand for a task, that item is assigned a score of 10. When one sometimes uses their right hand for a task, that item is assigned a score of five. Tasks for which one uses the left hand receive either a -5 or -10. The scores are summed across the 10 items for each participant. A median split of the absolute values of the scores is then taken, and individuals who score in the upper 50% are considered strong handed while individuals who score in the lower 50% are considered mixed handed. If there is an uneven number of mixed and strong handers, participants with a score equal median score are allocated to one of the two groups on the basis of which allocation gives the experimenter the most even split possible. Data from the WHQ did not factor into the main analysis, but was collected for exploratory reasons unrelated to the present study.

After five minutes of working on the handedness questionnaires, participants were given an additional five minutes to write down as many details of the story as they could remember. They were told that they could list details or write in paragraph format. After five minutes, participants were given an additional two minutes, during which they were
instructed to attempt to remember additional details. However, participants in the burglar condition were told to try to think about the story as though they had been homebuyers, participants in the homebuyer condition were told to think about the story as though they had been burglars, and participants in the control were told to think about the story as though they had been either burglars or homebuyers. The purpose of the second memory test was to explore the possibility that the real interaction between handedness and context would occur when people were asked to switch perspectives.

**Analytic Plan and Predicted Results**

The number of critical items was tallied for each participant’s written response. The correct responses were then divided into details relevant to a burglar, details relevant to homebuyers, and neutral details. Percentages were be used instead of raw scores in order to make across item comparisons more meaningful. A 2 (Sex: male vs. female) x 2 (Handedness: mixed vs. strong) x 3 (Condition: burglar condition vs. homebuyer condition vs. control) x 3 (Item type: burglar relevant vs. homebuyer relevant vs. neutral) mixed-design analysis of variance was used in two analyses: one of the original recall items and a second of the post-shift recall performance. Partial eta squared and $d$ are the reported effect sizes. When required, pair-wise comparisons, one way ANOVAs, and $t$-tests were used for post hoc testing and exploring simple effects.

It was predicted that there would be a main effect of handedness with mixed handers remembering more items than strong handers. Since tentative prior evidence that episodic memory tasks may sometimes yield sex differences, sex was included as a variable in the analyses. Given the perspective manipulation, it was further predicted that there would be an item type by condition interaction with subjects remembering more
burglar relevant items in the burglar condition and homebuyer relevant items in the homebuyer condition. Finally, it was hypothesized that if mixed handers are more sensitive to context, then they would remember more relevant items in the perspective conditions than in the control condition. However, it was also predicted that they would also remember less non-perspective relevant items relative to the control. This is because sensitivity to context should increase concentration on perspective relevant items, which means less attention and cognitive resources will be allocated to the recognition and retention of non-perspective relevant items.

While there were no specific hypotheses for the post shift items, there were several interesting empirical questions. The second analysis was intended to explore the possibility that the real difference between handedness groups would occur when participants were asked to switch perspectives. If mixed handers were more sensitive to perspective, they might either have more difficulty switching from the original perspective or an easier completely assuming the new perspective. Because the original hypotheses do not distinguish between these two possibilities, the second test was felt to be necessary.
Chapter Three

Analysis and Results

The main hypotheses were tested using a 2 (Sex: male vs female) x 2 (Handedness: mixed vs strong) x 3 (Condition: burglar vs. homebuyer vs. control) x 3 (Item Type: burglar relevant vs. homebuyer relevant vs. neutral items) mixed-design analysis of variance. Item type was the within subjects factor, while sex, handedness, and condition were the between subjects factors.

An analysis of the within subjects effects revealed a main effect of item type, $F(2, 276) = 35.71, p < .001, \eta_{\text{partial}}^2 = .206$. Pairwise comparisons revealed that participants remembered a significantly higher percentage of burglar items ($M = 32.84, SE = 1.30$) than either homebuyer items ($M = 20.87, SE = 1.14$), $p < .001$, or neutral items ($M = 20.57, SE = 1.00$), $p < .001$. However, this effect was qualified by two significant interactions. First, there was a significant sex by item type interaction, $F(2, 276) = 3.43, p = .034, \eta_{\text{partial}}^2 = .024$ [Figure 1, Table 1]. Males remembered a higher percentage of burglar items ($M = 38.15, SE = 2.62$) than women ($M = 31.17, SE = 1.46$), $t = 2.33, p = .021, d = .45$. There was also a significant condition by item type interaction, $F(4, 276) = 6.40, p < .001, \eta_{\text{partial}}^2 = .085$ [Figure 2, Table 2]. This interaction was broken down by conducting one way ANOVAs and follow up Tukey Honest Significant Difference (HSD) tests using condition as the between subjects factor and percentages for each item type as dependent variables. The first ANOVA and follow up Tukey HSD revealed that a significantly higher percentage of burglar items were recalled by participants in the burglar condition ($M = 38.00, SE = 2.52$) and participants in the homebuyer condition ($M = 34.00, SE = 2.05$) than participants in the control condition ($M = 26.53, SE = 1.84$),
$F(2, 147) = 7.28, p = .001, \eta_{\text{partial}}^2 = .09$. The second set of tests revealed that participants in the homebuyer condition remembered a higher percentage of homebuyer relevant items ($M = 25.54, SE = 2.00$) than subjects in either the burglar condition ($M = 18.00, SE = 2.05$) or the neutral condition ($M = 19.08, SE = 1.75$), $F(2, 147) = 4.43, p = .01, \eta_{\text{partial}}^2 = .057$. The third set of tests revealed no difference between conditions when comparing the percentages of neutral items remembered ($F < 1$). There were no other significant within subjects effects or interactions.

There were two notable between subjects main effects. When the data were collapsed across condition and item type, there was a main effect of handedness, $F(1, 138) = 5.41, p = .021, \eta_{\text{partial}}^2 = .038$ [Figure 3]. Mixed handers remembered a higher percentage of each type of item ($M = 26.32, SE = 1.06$) than strong handers ($M = 22.84, SE = .99$). There was also marginally significant effect of sex, $F(1, 138) = 3.20, p = .076, \eta_{\text{partial}}^2 = .023$. Men remembered a higher percentage of each type of item ($M = 26.97, SE = 1.48$) than women ($M = 24.07, SE = .86$). There were no other significant between subjects effects or interactions.

Figure 1. Sex by Item Type Interaction.
Table 1

*Sex by Item Type Cell Means*

<table>
<thead>
<tr>
<th></th>
<th>Burglar Items</th>
<th>Home Buyer Items</th>
<th>Neutral Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>$M = 38.15$, $SE = 2.62$</td>
<td>$M = 20.73$, $SE = 2.41$</td>
<td>$M = 22.02$, $SE = 2.18$</td>
</tr>
<tr>
<td>Female</td>
<td>$M = 31.17$, $SE = 1.46$</td>
<td>$M = 20.92$, $SE = 1.31$</td>
<td>$M = 20.11$, $SE = 1.14$</td>
</tr>
</tbody>
</table>

*Figure 2. Condition by Item Type Interaction*

Table 2

*Condition by Item Type Cell Means*

<table>
<thead>
<tr>
<th></th>
<th>Burglar Items</th>
<th>Home Buyer Items</th>
<th>Neutral Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burglar Condition</td>
<td>$M = 38.00$, $SE = 2.52$</td>
<td>$M = 18.00$, $SE = 2.05$</td>
<td>$M = 19.00$, $SE = 1.98$</td>
</tr>
<tr>
<td>Homebuyer Condition</td>
<td>$M = 34.00$, $SE = 2.05$</td>
<td>$M = 25.54$, $SE = 2.01$</td>
<td>$M = 20.57$, $SE = 1.67$</td>
</tr>
<tr>
<td>Neutral Condition</td>
<td>$M = 26.53$, $SE = 1.84$</td>
<td>$M = 19.08$, $SE = 1.75$</td>
<td>$M = 22.14$, $SE = 1.53$</td>
</tr>
</tbody>
</table>
An exploratory analysis was conducted on the post shift items in order to explore the effects of making participants attempt to remember additional items with a new perspective. As with the main analysis, the exploratory analysis was conducted using a 2 (Sex: male vs female) x 2 (Handedness: mixed vs strong) x 3 (Condition: burglar vs. homebuyer vs. control) x 3 (Item Type: burglar relevant vs. homebuyer relevant vs. neutral items) mixed-design analysis of variance.

The test of within subjects effect revealed a main effect of item type, $F(2, 276) = 12.80, p < .001, \eta_{\text{partial}}^2 = .085$. A pairwise comparison reveals that participants remembered a significantly lower percentage of additional neutral items ($M = .95, SE = .27$) than either burglar ($M = 3.51, SE = .48$) or homebuyer ($M = 3.38, SE = .54$) items. There was not a significant difference between the percentage of additional burglar and homebuyer items recalled. This main effect was qualified by three interactions. The first was a sex by item type interaction, $F(2, 276) = 4.59, p = .01$ [Figure 4], $\eta_{\text{partial}}^2 = .032$.

None of the post hoc tests revealed significant differences. Descriptively, however, males remembered a higher percentage of homebuyer items ($M = 4.7, SE = 1.48$) than females ($M = 2.97, SE = .54$), $d = .24$. Furthermore, females remembered a higher percentage of additional neutral items ($M = 1.13, SE = .33$) than males ($M = .40, SE = .40$), $d = .25$. The
second interaction was a condition by item type interaction, $F(4, 276) = 8.66, p < .001, \eta_{\text{partial}}^2 = .112$ [Figure 5]. These interactions were further qualified by a three way sex by condition by item type interaction, $F(4, 276) = 2.46, p = .046, \eta_{\text{partial}}^2 = .034$. This interaction was driven by the fact that men in the burglar condition remembered a significantly higher percentage of homebuyer items ($M = 13.84, SE = 5.23$) than women in the burglar condition ($M = 5.00, SE = 1.22$), $t(48) = 2.24, p = .03, d = .75$. There were no other significant effects.

![Figure 4. Sex by Item Type Interaction II.](image1)

![Figure 5. Condition by Item Type Interaction II.](image2)
Chapter Four

Discussion

The reported study replicated two findings from the memory literature. Of lesser importance to the hypotheses of interest, the basic pattern of Pitchert and Anderson (1977) technical report was replicated. Participants who took the perspective of a burglar remembered a higher percentage of burglar relevant items, participants who took the perspective of a homebuyer remembered a higher percentage of homebuyer items, and participants remembered a higher percentage of burglar items collapsed across conditions.

More importantly for present purposes is the main effect of handedness. Mixed handers remembered a higher percentage of items when the data were collapsed across condition and item type. This is consistent with what one would predict given the literature (Propper & Christman, 2010) and replicates the Prichard and Christman finding (2012) that mixed handers seem to recall more from fictional prose passages. The finding was replicated using different stimulus materials, which were designed by different experimenters, and using a slightly different means of assessing the dependent variable. Prichard and Christman asked questions about the passage used in their study. The present study asked participants to free recall as much information as possible.

Although both the expected main effects were obtained, handedness and the context manipulation did not interact. Certainly this does not falsify the hypothesis that the right hemisphere is essential for processing context. Nonetheless, it raises questions about how context was operationalized and manipulated in the study, and what future directions may lead to better tests of the hypothesis. For example, it was assumed that
giving participants a perspective may function like giving them a passage with written title and selectively activate the RH, thus increasing hemispheric activity. However, this assumption may have been flawed. It is possible that had the study included titles like “What a Burglar Saw One Thursday” or “What a Homebuyer Saw One Thursday,” the results have been different.

It is also important to note that the brain areas of interest in the Tulving et al. (1994) studies were the pre-frontal cortices, while the area of the RH identified as playing an important role in the processing of context while reading prose level materials is the right temporal lobe (Jung-Beeman, 2005; Vigneau, Beaucousin, Herve, Jobard, Petit, Crivello, Mellet, Zago, Mazoyer, & Tzourio-Mazoyer, 2011). It is possible that mixed handedness is more highly correlated with callosal density in the genu of the corpus callosum, while individual differences in anterior commissure connectivity might be more predictive of differences in tasks that selectively activate the right temporal lobe. It is also possible that the manipulation didn’t interact with handedness because it occurred at encoding. Tulving et al. found that the left hemisphere is active at encoding. Since both mixed and strong handers had more active left hemispheres at encoding, it is possible that perspective affected what was encoded equally for both mixed and strong handers. Since episodic recall is a right hemisphere activity, perhaps the perspective manipulation should have been implemented only at recall. Future research should attempt to a recall only perspective manipulation.

Finally, it should be noted that the brain damaged patients mentioned by Ornstein (1997) had trouble understanding jokes which relied on the use of words with multiple meanings. This raises the possibility that context processing effects might be more likely
to be obtained using ambiguous reading materials and DV’s other than memory. It might well be that the ability of mixed handers to recall information is quite independent of their ability to hold multiple ambiguous meanings for words. Along these lines, Sontam and Christman (2012) found that mixed handers have an easier time remembering the so-called weak associates of ambiguous stimulus words. Furthermore, Jung-Beeman (2005) notes that RH damaged patients have trouble recounting the gist of stories. Perhaps if participants were asked to paraphrase a passage before judges blind to their handedness, mixed handers would demonstrate a greater ability to accurately paraphrase the passage, even when control for the relative proportion of material accurately recalled.

In conclusion, insofar as mixed handers remember more material from prose passage than strong handers, the findings of this report should be of interest to cognitive and educational psychologists who study reading. However, little was cleared up regarding whether or not mixed handers process the context of a prose passage any more efficiently than strong handers. To the extent that verbally asking a participant to take a perspective is an appropriate context manipulation, context does not currently seem to differentially affect what mixed and strong handers recall. However, future research should look investigate other DVs related to interpreting ambiguity in and accurately recalling the gist of prose level materials before any strong conclusions are offered on the matter.
References


Appendix A

Stimulus Materials

The two boys ran until they came to the driveway. "See, I told you today was good for skipping school," said Mark. "Mom is never home on Thursday," he added. Tall hedges hid the house from the road so the pair strolled across the finely landscaped yard. "I never knew your place was so big," said Pete. "Yeah, but it's nicer now than it used to be since Dad had the new stone siding put on and added the fireplace."

There were front and back doors and a side door which led to the garage which was empty except for three parked 10-speed bikes. They went in the side door, Mark explaining that it was always open in case his younger sisters got home earlier than their mother.

Pete wanted to see the house so Mark started with the living room. It, like the rest of the downstairs, was newly painted. Mark turned on the stereo, the noise of which worried Pete. "Don't worry, the nearest house is a quarter of a mile away," Mark shouted. Pete felt more comfortable observing that no houses could be seen in any direction beyond the huge yard.

The dining room, with all the china, silver and cut glass, was no place to play so the boys moved into the kitchen where they made sandwiches. Mark said they wouldn't go to the basement because it had been damp and musty ever since the new plumbing had been installed.

"This is where my Dad keeps his famous paintings and his coin collection," Mark said as they peered into the den. Mark bragged that he could get spending money whenever he needed it since he'd discovered that his Dad kept a lot in the desk drawer.
There were three upstairs bedrooms. Mark showed Pete his mother's closet which was filled with furs and the locked box which held her jewels. His sisters' room was uninteresting except for the color TV which Mark carried to his room. Mark bragged that the bathroom in the hall was his since one had been added to his sisters' room for their use. The big highlight in his room, though, was a leak in the ceiling where the old roof had finally rotted.
Appendix B

Scoring Units

Burglar Units

1. Tall hedges hide house.
2. Mom not home (on Thursday.)
3. Garage empty except for (3-10 speed) bikes.
4. Side door unlocked (in case sisters get home early).
5. There is a stereo
6. The nearest house is (1/4 mile) away Or there are no nearby houses.
7. There is china.
8. There is silver.
9. There is cut glass.
10. (The den has) paintings.
11. (The den has) a coin collection.
12. (Dad keeps) cash in his desk.
13. (Mom has a box with) Jewels
14. Mom has fine furs.
15. There is a (color) T.V.

Homebuyer Units

1. The yard is finely landscaped.
2. The house is big.
3. There is new stone siding.
4. There is a new fireplace.
5. The downstairs area is newly painted.
6. The basement is damp.
7. The basement is musty/smells
8. The basement has new plumbing
9. There are three bedrooms
10. (The sisters’ room has) a new bathroom.
11. There is a hall bathroom/There are two bathrooms.
12. There is a leak in Marks ceiling
13. The roof has rotted.

Neutral Units

1. The boys ran to the driveway.
2. The boys are skipping school.
3. One boy is named Mark.
4. One boy is named Pete.
5. Mark gives Pete a tour of the house.
6. Mark shows Pete the living room.
7. The boys listen to the stereo/Pete’s worried about the stereo’s noise.
8. Marks shows Pete the dining room.
9. The boys make sandwiches (in the Kitchen).
10. Mark shows Pete the kitchen.
11. Mark shows Pete the den.
12. Mark shows Pete the Parents’ room.
13. Mark’s sisters’ room is boring.
14. Mark took the TV from his sisters’ room.