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Aging and the Truth Effect in Validity Judgment

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AGING AND THE TRUTH EFFECT
IN VALIDITY JUDGMENT

A Thesis
Presented to
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Western Kentucky University
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In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
Sue Ellen Lindsey
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AGING AND THE TRUTH EFFECT
IN VALIDITY JUDGMENT

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AGING AND THE TRUTH EFFECT IN VALIDITY JUDGMENT

Sue Ellen Lindsey May, 1994 60 Pages
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Abstract

It is sometimes necessary to make validity judgments about information with which we are unfamiliar, because we have no factual knowledge about the event. Under these circumstances, subjective evidence, such as whether the statement has been seen or heard in the past, may be used to judge validity. Previous research has shown that the repetition of unfamiliar, but plausible statements increases the judged validity of the statements. In other words, the more one hears a particular statement, the more one believes it to be true. The present study has been designed to explore this "truth effect." The first experiment examined the influence of increasing age on the truth effect and recognition of repeated statements. Younger and older adults were asked to rate a series of statements for validity. Two weeks later, the subjects rated a similar list containing some new statements along with statements repeated from the first session. Subjects were also given a task to assess their recognition of repeated statements. The results indicated that older adults demonstrated the truth effect to a greater extent than younger adults, despite the fact that their recognition scores were much less accurate. These results indicate that repetition and recognition have independent influences on perceived validity.

A second experiment was conducted to examine the effect of feedback on the truth effect and recognition judgments. It was proposed that ratings for repeated items in the second session would increase in judged validity due to the unintentional influence of familiarity. If feedback information was deliberately recollected, this misattribution of familiarity to credibility could be checked for false statements. Subjects were asked to rate statements for validity, and feedback as to the actual truth value of some of the items
was given in the first session. Subjects rated repeated and new items in the second session for validity, as well as performing a source recognition task. The results of the second experiment showed that, again, both young and older adults demonstrate the truth effect. For young subjects, true statements were rated the truest, followed by non-feedback, non-repeated, and false statements. The same pattern was found for older subjects, except that the false and non-repeated statements were rated similarly. As in the first experiment, older subjects were less accurate than young subjects at recognizing the source of repeated statements. Again, repetition and recognition were found to influence the truth effect independently. The results of this study indicate that the effects of repetition may influence older adults more than young adults, due to their less efficient memory for source. This deficit in source memory would serve to make older individuals less skeptical about the credibility of their knowledge, and thus more susceptible to false beliefs.
Chapter 1

Introduction

People are frequently called upon to judge the validity of referential statements, (e.g., Andorra lies between France and Spain). Under some circumstances, the statement may sound plausible, but factual evidence confirming or disconfirming the fact may not be available in memory. Because of the lack of supporting factual evidence, the judgment of validity may be made on a more subjective basis, such as whether or not the statement was heard before on the radio or whether it was read in a book or newspaper. Previous research results have revealed that the repetition of statements which are unfamiliar, but sound plausible, leads to an increase in judged validity of the statements (Arkes, Boehm & Xu, 1991; Arkes, Hackett & Boehm, 1989; Bacon, 1979; Begg & Armour, 1991; Begg, Armour & Kerr, 1985; Begg, Anas & Farinacci, 1992; Hasher, Goldstein & Toppino, 1977; Schwartz, 1982).

The purpose of the first experiment presented here was to investigate the influence of increasing age on the truth effect. Differing views on the cause of this "truth effect" have been voiced. It has been proposed that the increase in rated truth with repetition is mediated by a basic attribute of memory such as automatic frequency processing (Hasher & Zacks, 1984; Hasher et al., 1977). A second view proposes that the truth effect is seen only when the repetition of a statement is explicitly recognized (Bacon, 1979). Another theory proposes that the truth effect is mediated by two independent factors: the unintentional misattribution of familiarity, which increases automatically with repetition, to credibility and the deliberate or controlled recollection of source (Begg et al., 1992). In this view, the unintentional use of familiarity information always leads to an increase in
perceived validity. Deliberate source recollection serves to either increase or decrease the 
misattribution of familiarity to credibility, depending on the credibility of the remembered 
source. This misattribution of familiarity seems to be the most reasonable explanation for 
the truth effect.

Previous research results on aging have shown that older adults suffer declines in 
performance on tests of explicit memory, where deliberate recollection of an event is 
required. Such tests would include tests of recognition and recall. However, tests of 
implicit memory do not require deliberate recollection of a past event. On these tests, 
such as perceptual identification tasks or judgment of item frequency, older adults show 
less decline in performance (Hasher & Zacks, 1984; Light & Singh, 1987; Dywan & 
Jacoby, 1990). If explicit recognition of repetition is necessary in order for the truth effect 
to be seen, then older adults' validity judgments of repeated items should not increase as 
much as those of younger adults because they may not recognize the repeated statements 
as being repeated. Conversely, if the truth effect is due to the implicit retrieval of 
frequency information or the unintentional influence of familiarity, then older adults' 
validity judgments should increase as much as those of younger adults, even though they 
may not explicitly recognize the repeated statements as being repeated.
Chapter 2

Review of the Literature

Several studies have demonstrated that repeated statements of uncertain truth value are judged to be truer than non-repeated statements (Arkes, Boehm & Xu, 1991; Arkes, Hackett & Boehm, 1989; Bacon, 1979; Begg & Armour, 1991; Begg, Armour & Kerr, 1985; Begg, Anas & Farinacci, 1992; Hasher, Goldstein & Toppino, 1977; Schwartz, 1982). In one of the first studies on this "truth effect," Hasher, Goldstein and Toppino (1977) examined the processing of information which has referential validity, i.e., information which refers to a specific event in the real world, and which can be verified. In this study, stimulus statements were given which were plausible but obscure enough that most subjects would be uncertain if they were true or false. College undergraduates were given sets of statements on three successive occasions separated by two week intervals. Each set of statements contained new statements along with statements that were repeated in all three sessions. The subjects were asked to rate the validity of the statements on a seven-point scale from "definitely false" to "definitely true." The results of this study indicated that repeated statements were rated as more true than non-repeated statements. In addition, the average validity ratings given to repeated items increased across successive sessions, while the ratings for non-repeated items did not change. This positive effect of repetition on validity ratings was seen for both true and false statements. Hasher et al. (1977) concluded that a person's belief in the truth of a plausible statement increases as the statement is repeated.

Bacon (1979) conducted a similar study exploring the influence of repetition on validity judgments and also examined the relationship between recognition and rated truth
by having subjects give recognition judgments as well as truth value ratings in the second session. As in the study by Hasher et al. (1977), subjects rated the validity of each statement on multiple occasions. However, in the second session of this study, half of the subjects were asked to rate the validity of the items as they had done in the first session. The remaining subjects were asked to rate the validity of the items and to indicate whether they recognized the items as being repeated from the first session by circling a "yes" or "no" by each item prior to rating the item's validity.

The study replicated the repetition effect found by Hasher et al. (1977), i.e., repeated statements were rated as more true than non-repeated statements. However, it was also found that statements that were correctly classified as being repeated were rated as more true in the second session than in the first. In contrast, ratings of repeated statements that were incorrectly judged to be new did not change significantly between sessions. The results indicated that judged repetition status of the items had more of an influence on truth ratings than the actual status of the statements. Items that were judged to be repeated were rated as more true than those judged to be new, regardless of the actual repetition status of the items. Thus, Bacon concluded that the explicit recognition of items as being repeated has a greater influence on truth ratings than the actual repetition of the items.

**Generality of the Truth Effect**

Schwartz (1982) explored the generality of the truth effect. She demonstrated that the truth effect does not depend on a long time interval between successive exposures to statements. Repeated statements were rated as truer than non-repeated statements, even when the exposures were separated only by a few minutes. She also found that the repetition of the judgment task is not required for the truth effect. The effect was seen when exposure to the items was repeated, but the actual validity rating task was not given until the second session. In addition, she demonstrated that the truth effect is not modality-specific, because she found the effect using a visual presentation throughout the
Schwartz also investigated whether the truth effect was limited to repeated statements seen only in combination with non-repeated statements. Subjects were asked to rate the same list of statements twice, with only a short interval between ratings. Thus, all statements were repeated. The results indicated that the truth effect is not dependent upon a mixed-list design, because a significant truth effect was seen for the lists solely containing repeated items. On the basis of these experiments, Schwartz (1982) helped to establish the truth effect under a wide variety of conditions.

Two additional studies investigated whether the truth effect was dependent upon the exact repetition of the stimulus statements. Begg, Armour and Kerr (1985) presented subjects with phrases such as "hen's body temperature" and then tested them on judged validity of statements such as "The temperature of a hen's body is about 104 degrees Fahrenheit." Begg et al. found that the repetition of the phrase in the statement led to increased validity ratings for that statement. In a similar study, Arkes, Boehm and Xu (1991) found that hearing unrelated information about a topic leads to increased judged validity of specific information regarding the topic. Arkes and his colleagues read general sentences about China to half of their subjects, while the remaining subjects heard sentences pertaining to other information. One week later, subjects were asked to rate the validity of different statements pertaining to China. The results showed that hearing unrelated passages about China led to an increase in judged validity for the test statements regarding China. These two studies suggest that exact repetition of a statement is not necessary for the truth effect to be seen. Simply being familiar with a topic can lead to an increase in perceived validity of that topic at a later time.

These earlier studies all focused on the truth effect in relation to trivia statements of unknown truth value. Arkes, Hackett and Boehm (1989) explored the truth effect with regard to opinion statements and statements which were known to be true or false. In this study, subjects rated statements in three categories: factually true, factually false and opinions. Within each of these categories, a third of the statements were deemed by pilot
subjects to be true, false or of uncertain truth value. Approximately one third of the statements were rated again in the second session along with new statements. The results of this study extended the robustness of the truth effect. For all three types of statements, (true, false and opinions), the repeated statements increased in rated validity compared to the non-repeated statements. In addition, a similar truth effect was seen for items that were initially perceived to be true or false, as well as for those of uncertain truth value. Thus, the increase in judged validity due to repetition is proposed to be a robust and general phenomenon.

Explanations for the Truth Effect

Several explanations for the influence of repetition on validity judgments have been proposed. According to Underwood (1969), memory is a collection of attributes. The differences among these attributes serve to distinguish between memories and function as retrieval mechanisms for specific memories. Underwood proposed that frequency is one such attribute. Frequency is encoded directly and automatically and allows old and new events to be differentiated (Underwood, 1969). Hasher et al. (1977) have suggested that this frequency encoding is the underlying mechanism driving the truth effect. They proposed that subjects automatically encode the frequency of occurrence of the statements and use that frequency estimation as a basis for rating the validity of the items.

Another explanation for the truth effect proposes that frequency is not directly encoded but is inferred from other information in memory, such as the number of memory traces of an event (Hintzman & Block, 1971). Bacon (1979) proposed that both probable truth and frequency are directly inferred from the recognition of repeated statements. He argued that it is not the direct encoding of event frequency that serves as the "criterion for certitude" in the truth ratings, but rather the subjects' detection that the items are being repeated. Under these circumstances, only repeated statements that are recognized as being repeated should increase in rated truth. This hypothesis was confirmed in his study.
Bacon concluded that the truth effect is not due to the actual repetition of items but rather to the recognition, correct or incorrect, that the items are repeated.

A similar study on judged validity supported this finding, (Arkes et al., 1989). In this study, subjects rated statements for validity and were also asked to give the source of the statements. Arkes and his colleagues found that the actual repetition of the statements had no effect on judged validity, but the perceived source did have an effect. Despite their actual repetition status, items judged to have been heard from a source outside the experiment were rated truer than items judged to have been heard in the experiment. Items judged not to have been heard before were given the lowest ratings. Thus, Arkes concluded that the recognition of the source of a statement had a substantial effect on the judged validity of that statement.

However, one study did not confirm this finding. Begg, Anas and Farinacci (1992) proposed that credibility ratings are based on both the unintentional use of familiarity information and intentional source recollection and that these two influences are independent of each other. They proposed that familiarity increases automatically with repetition and that its influence on rated truth is unintentional. In contrast, the source of familiarity is not necessarily spontaneously monitored or used when rating truth.

These researchers paired statements with male and female sources at study, and subjects were cued as to which type of source was credible. At test, the repeated true and false statements, without the sources, were rated along with new statements. It was proposed that the true statements would be rated as most true due to both familiarity and source recollection. The false statements, however, would be rated falser than the new statements if the sources of the statements were recollected. If the sources were not remembered, then the false statements would be rated truer than the new statements because of the enhanced familiarity due to repetition. Begg and his colleagues found that the true statements were rated truer than the false statements, which were rated truer than the new statements. Under certain circumstances, such as divided attention at study,
memory for statements and their sources was impaired, but the truth effect was still seen. Begg and his colleagues suggested that intentional recollection of a statement is not necessary for demonstrating the truth effect because the effect can be seen in its absence. It appears that unintentional familiarity always leads to an increase in perceived truth and that this judgment of truth can either be increased or decreased by the recollection of the credibility of source.

**Aging and Automatic and Controlled Memory Processes**

The purpose of this study is to investigate the influence of aging on the truth effect. At least three areas of research on aging memory are related to this topic. As mentioned earlier, one explanation for the truth effect is that the frequency of the statements is encoded automatically. Hasher and Zacks (1979) proposed a distinction between automatic and controlled processes. They proposed that encoding processes differ in their demands on attentional capacity. Automatic processes make minimal demands for limited attentional capacity and occur without intention or awareness. The occurrence of these automatic processes does not interfere with the performance of other cognitive processes. Spatial, temporal, and frequency-of-occurrence information are thought to be encoded through automatic processes. In contrast, controlled processes require great capacity and interfere with other ongoing cognitive processes (Hasher & Zacks, 1979; 1984). These processes are intentional and require awareness. Examples of effortful encoding processes include mnemonic techniques, such as elaboration, organization, imagery and rehearsal, as well as recognition and recall.

It has been suggested that automatic processes show no change as a function of age, while effortful processes do. In comparing older with younger adults, several studies have found no age differences when automatic encoding processes are used (Hasher & Zacks, 1979; Attig & Hasher, 1980; Kausler & Puckett, 1980). All three studies used a frequency estimation task after presentation of a study list of words, with critical items presented at varying frequencies. These studies showed that older adults were just as
sensitive to the frequency information as younger adults and that their frequency estimations were just as accurate as those of younger adults.

Similar to these studies on automatic processes, other studies have demonstrated that older adults do not show a decline in performance on implicit memory tests (Light & Singh, 1987). An implicit memory test is one that shows change in performance as a result of prior experience, but does not require intentional recollection of the experience. Thus, the method used to investigate the truth effect is a test of implicit memory because subjects were not told that some of the items in the second session were repeated from the first session. In contrast, item or source recognition is an explicit memory test because it requires intentional recollection of the previous experience.

A dissociation in age-related performance has been shown using implicit and explicit tests (Light & Singh, 1987). These investigators studied repetition priming effects in word completion and perceptual identification tasks (implicit memory tests), as well as giving free recall, cued recall and recognition tasks (explicit memory tests) to older and younger adults. The results showed that older adults performed as well as younger adults on the word completion and perceptual identification tasks but that their performance was significantly worse than that of younger subjects when asked to recall or recognize the stimulus words. Light and Singh (1987) suggested that older adults show a decline in performance on tasks that require intentional recollection. However, memory performance on implicit tests does not decline with age.

One explanation for this dissociation is the decline in memory for source with increasing age, (Cohen & Faulkner, 1989; Dywan & Jacoby, 1990; Hashtroudi, Johnson & Chrosniak, 1989; Jacoby, Kelley, Brown & Jasechko, 1989; Jacoby, Woloshyn & Kelley, 1989; McIntyre & Craik, 1987). Studies have indicated that older adults forget the source, but not the content, of information more often than younger adults. For example, McIntyre and Craik (1987) presented young and older subjects with actual and made-up facts about Canada. One week later, the subjects were asked to recall the facts and
remember their source, i.e., where they had heard the facts. Older subjects exhibited
greater prevalence of source amnesia. They could remember the facts but not the source.

Source amnesia has also been demonstrated in experiments involving susceptibility
to false fame, (Dywan & Jacoby, 1990; Jacoby et al., 1989). In these experiments,
subjects were read a list of names and told that the names were of nonfamous people. On
a subsequent fame judgment task, these old nonfamous names were presented along with
new nonfamous and famous names. If subjects remembered the source of the names, they
would call the old names "nonfamous". However, if subjects made their decisions based
on familiarity, then the old names would be judged to be "famous". These researchers
found that older subjects were more likely to judge the old nonfamous names as famous at
test and less likely to deliberately recollect the source of this familiarity. In agreement
with Begg, (Begg et al., 1992), Jacoby and his colleagues suggested that the old
nonfamous names are misjudged as famous because they seem more familiar due to prior
presentation in the experiment. They suggest that the repeated names are processed more
fluently and that this higher degree of fluent processing is misattributed to truth. These
researchers propose that the influence of familiarity on fame ratings is automatic and
unintentional. They propose that younger subjects judged the old nonfamous names to be
nonfamous because they remembered hearing them in the experiment, thus remembering
their source and fame value.

In another study, Jacoby and his colleagues further explored the dissociation
between recollection and familiarity and their influences on rated fame (Jacoby, Woloshyn,
and Kelley, 1989). In this experiment, divided attention tasks were used both at the time
of study and the time of test, thus impairing both the initial encoding of the stimuli and the
recollection of the stimuli at a later time. Despite the impaired recollection of the studied
stimuli, the false fame effect was intact, with old nonfamous names being judged as
famous. Thus the influence of dividing attention is similar to the influence of aging in that
a decline is seen in tasks requiring intentional recollection, but automatic processes are spared.

To summarize, the increase in judged validity due to repetition has been shown to be a robust and general phenomenon when tested on young adults. It has been suggested that this truth effect is influenced by both the unintentional use of familiarity information and the deliberate recollection of source (Begg et al., 1992). It is well documented that automatic processes such as frequency estimation show no decline with increasing age while intentional controlled processes such as recognition do show an age deficit. The purpose of the first experiment in the present study was to investigate the influence of age on the truth effect. The method was a replication of the method used by Hasher et al. (1977), using both younger and older subjects. Older and younger adults were given a set of statements and were asked to rate them on a seven-point scale of validity ranging from "definitely false" to "definitely true." Two weeks later, subjects were asked to rate another list of statements containing some statements repeated from the first session along with new statements. In this session, subjects were also asked to indicate whether they recognized the statements from the previous session. Due to the results of previous research, it was hypothesized that the truth effect relies on automatic or unintentional memory processes. Consequently, there should be no age difference in this effect. The validity ratings of both young and older adults should increase with repetition. In contrast, it was expected that older adults' recognition of the source of the statements should be less accurate than recognition scores of younger subjects.
Chapter 3
Experiment I

Method

Subjects

Forty students (mean age = 19.4) who were enrolled in an introductory psychology course participated in this experiment and received extra credit points for their participation. Forty older subjects (mean age = 66.9) came from a pool of healthy volunteers 60 years of age or over, obtained through advertising in the local newspaper and senior centers. Older subjects were paid $15.00 for their participation.

Demographic data were obtained on all subjects through use of a biographical questionnaire. Mean years of education for younger subjects was 12.8, compared to 15.4 for older subjects, and this difference was significant (p<.0001). Mean scores on subtests of the WAIS-R revealed older subjects perform slightly better than young subjects. Older subjects scored an average of 22.3 on the Information subtest, compared to 16.9 for younger subjects. Mean scores on the Vocabulary subtest were 55.3 and 41.1 for older and younger subjects, respectively. Group differences on both of these subtests were significant (p<.0001). Both groups of subjects were healthy, as assessed by self-report. No subjects in either group reported having a stroke or kidney disease. Only one older subject reported having a neurological problem. Less than 10% of older subjects and 3% of younger subjects reported having heart problems. Older subjects were more prone to report high blood pressure (33%) than were younger subjects (5%).
Materials

Item selection. A pilot study like that performed by Bacon (1979) was conducted to select statements that were plausible but of uncertain truth value. This preliminary study was done to determine whether two different lists of items would be needed due to possible variations in the content of general knowledge for young and older adults. A total of 436 true statements were selected from trivia books, encyclopedias and almanacs (e.g., Austria and Italy are linked by the Brenner Pass). A false version of each statement was generated by altering some detail of the original statement (e.g., Switzerland and Austria are linked by the Brenner Pass). Statements were then divided into four lists, with each list containing an equal number of true and false statements but not both versions of any one statement. Each list was presented to five young (Age, M = 19.1; Years of Education, M = 13.4) and five older subjects (Age, M = 68.8; Years of Education, M = 14.9) who were asked to decide whether each statement was true or false. Statements in each list were shown one at a time on a computer monitor, and subjects' responses were self-paced. Subjects read a statement and then informed the experimenter whether the statement was true or false. The experimenter recorded the response and then the subject proceeded to read the next statement. For each age group, a statement was retained if both true and false versions were judged to be true by two or three of the five subjects. This procedure produced pairs of statements that were plausible but not specifically known by the subjects.

Two hundred critical statements were retained, with 47 of these common to both age groups. Due to different knowledge bases between age groups, a complete set of statements common to both age groups could not be obtained. Statement pairs could be sorted into five broad categories: history, geography, science, art and religion, and general trivia. However, due to the item selection procedure, there was not an equal number of items from each category. Eighty additional statement pairs were used for buffer items in the test lists and were not included in any analyses.
List construction. For each age group, 45 true and 45 false items were selected from the pool of statement pairs. These items were divided into three sets of 15 items each. One set became the repeated items. A second set of fifteen true and fifteen false items was used as non-repeated items for the first presentation list. The third set of fifteen true and fifteen false items was used as non-repeated items for the second presentation list.

The first ten and last ten positions in each list contained non-repeated buffer items. These items were randomly arranged with half of them true and the remaining half false. These items were used as primacy and recency buffers because they are the items most likely to be remembered and researched by the subjects. The middle sixty positions in the first presentation list contained the thirty to-be-repeated items and thirty non-repeated items, randomly arranged. The middle sixty positions of the second session list contained the thirty repeated items and thirty new non-repeated items, randomly arranged.

Truth value rating test booklets consisted of eighty consecutively numbered seven-point rating scales. The number seven indicated "definitely true", number four was "undecided" and number one indicated "definitely false." Recognition test booklets contained the eighty consecutively numbered statements presented in the second session, along with the words "yes" and "no" beside each statement.

Procedure

Upon entry into the laboratory, subjects were asked to read and sign an informed consent form, and to complete a questionnaire asking general biographical information. Subjects were then informed that they were participating in a study to design a test of general knowledge for different age groups and that they would be required to participate in two sessions, separated by a two week interval. Testing was conducted in groups of two to five subjects. Subjects were instructed that they would hear a series of taped statements that might be true or might be false and that each statement should be rated for validity using the seven-point rating scale in the test booklet. The items were presented via audio tape, with seven seconds between the end of one statement and the beginning of
the next statement. Subjects were instructed to rate each item immediately after it occurred and prior to the next item. These instructions for the truth value ratings were given in both testing sessions.

Instructions for the recognition test were given in the second session after the validity ratings were completed. Subjects were informed that the test booklet contained the statements that they had just rated for truth value, and that some of those statements had also been presented in the first session. Subjects were asked to circle "yes" if they had heard an item in both sessions and to circle "no" if they had heard the item in the last session only. Following the truth value and recognition ratings in the second session, a questionnaire on judgment and decision-making processes was administered. This questionnaire is given to subjects in all studies run in the Cognition Laboratory as part of an ongoing study. Data from this questionnaire will not be used in this project.

Vocabulary and Information subtests of the Wechsler Adult Intelligence Test - Revised were then administered according to the protocol in the WAIS-R manual. These tests are used as a means of comparison between the two groups on verbal ability and general knowledge. A full debriefing discussing the objectives of the study followed these procedures.

Results and Discussion

All effects reported as reliable were significant at the .05 level or better.

Validity Ratings

The dependent measures for both groups were the mean validity ratings for true and false repeated and non-repeated statements in both sessions. Age was the between subjects factor; all others were within subjects. A preliminary analysis was conducted on ratings for repeated and non-repeated items in the first session and non-repeated items in the second session to determine whether the actual truth value of the statements had a systematic effect on subjects' ratings. These first ratings for all items were analyzed by a 2 (age: young, old) x 2 (truth value: true, false) analysis of variance. Neither the main effect
of age, \( F(1,78)=3.32, \text{MSE}=1.12, p=.07 \), nor the age by truth value interaction, 
\( F(1,78)<1.00, \text{MSE}=0.005 \), was significant. However, a main effect of truth value was found, 
\( F(1,78)=6.16, \text{MSE}=38 \). Subjects rated the false statements to be more credible than the true statements (\( M=4.32 \ vs. \ 4.22 \)), and the overall ratings were close to the midrange of the rating scale. These results indicated that the item selection in the pilot study succeeded in selecting plausible items of uncertain truth value. Therefore, validity ratings were combined across truth value for the subsequent analyses.

In order to examine the effects of age and repetition on judged validity, ratings were next analyzed by a 2 (age: young, old) x 2 (session: 1, 2) x 2 (status: repeated, non-repeated) analysis of variance. Regardless of status, mean validity ratings significantly increased between sessions, from 4.27 in session 1 to 4.45 in session 2, \( F(1,78)=17.16, \text{MSE}=2.75 \). The main effect of status was also significant, \( F(1,78)=19.39, \text{MSE}=1.75 \), with mean ratings of repeated statements at 4.44 compared to 4.29 for non-repeated statements.

There was a significant session x status interaction, \( F(1,78)=33.60, \text{MSE}=2.12 \). Across age groups, repeated items increased in rated truth from 4.26 in session 1 to 4.61 in session 2, while non-repeated items only increased between sessions from 4.28 to 4.30.

When age was included in the analysis, a significant session x status x age interaction was obtained, \( F(1,70)=3.98, \text{MSE}=0.25 \). As seen in Table 1, both young and older subjects demonstrated the truth effect. Validity ratings for repeated items were higher than ratings for non-repeated statements. This interaction between session and status was examined separately for each age group and can be seen in Figure 1. For young subjects, main effects of session, \( F(1,39)=11.45, \text{MSE}=1.43 \), and status, \( F(1,39)=6.13, \text{MSE}=0.72 \), were found. A significant session by status interaction was also seen, \( F(1,39)=7.78, \text{MSE}=0.46 \), with ratings for the repeated items increasing more between sessions, compared to ratings for non-repeated items. The same pattern of results was seen for older subjects. Both main effects of session, \( F(1,39)=6.73, \text{MSE}=1.32 \), and
status, F(1,39)=16.65, MSe=1.05, were again found. The session by status interaction was also significant for older subjects, F(1,39)=28.25, MSe=1.89. Mean validity ratings for repeated items increased between sessions, while the mean ratings for non-repeated items did not. These results indicate that the both younger and older adults demonstrate the truth effect.

Table 1

**Younger and Older Subjects’ Mean Validity Ratings (standard deviations in parentheses) for Repeated and Non-repeated Items in Sessions One and Two of Experiment I.**

<table>
<thead>
<tr>
<th></th>
<th>Session</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One</td>
<td>Two</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>Repeated</td>
<td>Non-repeated</td>
<td>Repeated</td>
<td>Non-repeated</td>
<td></td>
</tr>
<tr>
<td>Younger</td>
<td>4.20 (19)</td>
<td>4.17 (.40)</td>
<td>4.49 (.49)</td>
<td>4.25 (.42)</td>
<td></td>
</tr>
<tr>
<td>Older</td>
<td>4.33 (.54)</td>
<td>4.39 (.51)</td>
<td>4.73 (.52)</td>
<td>4.35 (.58)</td>
<td></td>
</tr>
</tbody>
</table>

In order to explore the truth effect further, a 2 (age) × 2 (status: repeated, non-repeated) analysis of variance was conducted solely on second session ratings. The main effect of age was not significant, F(1,78)=2.85, MSe=1.21. Across groups, a main effect of status was found, F(1,78)=42.79, MSe=3.86, with ratings for repeated items (M=4.61) higher than ratings for non-repeated items (M=4.30). The age by status interaction was
not significant, $F(1,78)=2.23$, $MSe=.20$. Again, the truth effect was seen for both younger and older subjects.

**Recognition Scores**

Mean recognition scores for repeated and non-repeated items are presented in Table 2. The results indicated that older adults' recognition performance for the statements was lower than that of younger adults. There was a significant group difference in hit rates for repeated items, $F(1,78)=24.70$, $MSe=.06$, and false alarm rates for non-repeated items did not differ between the two groups, $F(1,78)=2.40$, $MSe=.04$. In addition, younger subjects showed significantly higher corrected recognition scores [$P(hit) - P(false alarm)/1 - P(false alarm)$], $F(1,78)=20.59$, $MSe=.07$, and $d'$ scores, $F(1,78)=9.24$, $MSe=.42$, than older subjects. The criterion for recognition, $\beta$, was assessed as a measure of cautiousness. Older and younger adults differed in their values of $\beta$, $F(1,78)=7.32$, $MSe=2.22$. The older subjects were more cautious than young subjects in choosing their criterion for recognition, as seen by their higher $\beta$ values. Thus, older subjects made fewer hits and equal false alarms compared to young subjects. Despite the fact that older subjects demonstrated the truth effect in their validity judgments, their deliberate recollection of the statements was not accurate. Thus, it appears that automatic judgments based on familiarity do not show the decline with age that is seen in tasks requiring deliberate recollection.
Table 2

**Younger and Older Subjects' Mean Scores (standard deviations in parentheses) for Hits, False Alarms, Corrected Recognition, d' and β Measures in Experiment I.**

<table>
<thead>
<tr>
<th>Group</th>
<th>Hits</th>
<th>False Alarms</th>
<th>Correct Recog.</th>
<th>d'</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Younger</td>
<td>.77 (.14)</td>
<td>.32 (.20)</td>
<td>.65 (.22)</td>
<td>1.35 (.66)</td>
<td>.98 (.51)</td>
</tr>
<tr>
<td>Older</td>
<td>.50 (.30)</td>
<td>.25 (.23)</td>
<td>.38 (.30)</td>
<td>.89 (.64)</td>
<td>1.88 (2.04)</td>
</tr>
</tbody>
</table>

**Validity Ratings as a Function of Recognition**

The results thus far indicate that older adults do not show a decline in the truth effect but do often make their validity judgments in the absence of recollection, implying that recollection is not necessary for an increase in perceived truth to be seen. To examine the effect of repetition (repeated or non-repeated) and recognition (heard or not heard in the previous session) on perceived truth, each subject's session 2 ratings were partitioned into four divisions: (1) repeated, yes; (2) repeated, no; (3) non-repeated, yes and (4) non-repeated, no. Means and cell sizes for these sets are given in Table 3. A 2 (age) x 2 (repetition) x 2 (recognition: yes, no) analysis of variance was conducted on these data. Main effects of repetition, F(1,71)=22.52, MSe=.29, and recognition, F(1,71)=3.95, MSe=.41, were found. Across age groups, repeated statements (M=4.55) were rated higher than non-repeated statements (M=4.25), regardless of whether or not they were recognized as repeated. Regardless of actual repetition status, ratings for items reported as repeated from the first session (M=4.47) were rated higher than items reported as never heard before for both age groups. No other main effects or interactions were significant,
F's <1.00. These results indicate that, for both younger and older subjects, repetition and recognition served to increase perceived truth independently. This is in accord with the findings of Begg et al. (1992), who proposed that both unintentional familiarity and deliberate recollection have independent effects on the truth effect.

Table 3
Means and Cell Sizes for Conditional Analysis in Experiment I.

<table>
<thead>
<tr>
<th>Status</th>
<th>Repeated</th>
<th>Non-repeated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Younger</td>
<td>4.48</td>
<td>4.46</td>
</tr>
<tr>
<td>Older</td>
<td>4.79</td>
<td>4.47</td>
</tr>
</tbody>
</table>

Cell sizes: Young = 39; Old = 34.

The results of this experiment indicated that the influence of repetition on validity judgments is similar for younger and older adults. However, older adults' accuracy of recognition for these repeated statements was reduced. These results are in line with the theories proposed by Begg, (Begg et al., 1992) and Jacoby (Dywan & Jacoby, 1990; Jacoby et al., 1989) on the basis for the truth effect. These researchers propose that the repetition of statements leads to more fluent processing of these statements. The more fluent the processing, the more familiar the statements become, and this unintentional familiarity is misattributed to truth. However, this truth bias due to familiarity can be held in check if the subject can deliberately remember the statement and evaluate the credibility of its source. The results presented here indicate that individuals do not spontaneously
engage in source recollection in order to evaluate the validity of statements. It is suggested that familiarity and source recollection are separate bases for perceived truth.
Chapter 4

Experiment II

The results of Experiment I suggested that the truth effect is independently mediated by both the automatic and unintentional misattribution of familiarity to credibility and the explicit recognition of source for both young and older adults. While the truth effect was invariant with age, source recollection did show an age effect. Older adults showed a deficit in recognition of repeated statements, compared to younger adults. It would be interesting to explore what effects feedback, or bias, at the time of study have on the truth effect and source memory of younger and older adults. The purpose of Experiment II is to examine the effects of feedback on validity and recognition ratings.

The effects of source credibility have been explored through studies involving biasing comments. Two studies investigated the effects of biasing comments on the truth effect (Begg & Armour, 1991; Begg, Armour & Kerr, 1985). Here, statements were initially studied under affirmative (It is well known that...) or negative (Few people believe that...) biases. These statements, without their biasing comments, were repeated at test and were rated for truth along with new statements. If the initial biases are remembered, then the statements presented under affirmative biases should be rated as truer than new statements, and those presented under negative biases should be rated as falser than new statements. The results revealed that both affirmatively and negatively biased statements were rated truer than new statements. Because the negatively biased statements were rated truer than new statements, it appears that the subjects did not remember the bias.

Begg and his colleagues propose that the effect of bias is to alter the likelihood that details will be encoded into memory. Statements presented under either bias are more...
likely than are new statements to contain familiar topics and facts. Affirmative biases increase the likelihood that factual information is encoded, while negative biases decrease this probability. Thus, repeated statements studied under an affirmative bias are rated truer than those studied under a negative bias. Begg concluded that the truth effect was attenuated by the use of negative biases, but not altogether reversed, since the old negatives were still rated truer than the new statements. These results also indicate that the initial biases were not remembered, since old negatives were not rated falser than new statements.

Begg and his colleagues (Begg et al., 1992) have proposed that the sleeper effect may be the reason that repeated negatively biased statements are rated truer than new statements. The sleeper effect occurs when the association between a message and its source is lost over time. Begg suggested that the truth ratings may be made on the basis of the familiarity of the statement because there is no associated source that would bring to mind the negative bias. Begg proposed that the message and its source or bias are not dissociated but are independent. The source information may remain associated with the factual information but may have no effect on the judgments of truth. It is proposed that the unintentional influence of familiarity serves to increase the rated truth of repeated statements, while intentional recollection of the credibility of the source can either increase or decrease judged validity.

The influence of the perceived source of the statements on judged validity will also be investigated in this experiment. In a study by Arkes, Hackett & Boehm (1989), subjects were asked to perform a recognition task on the items in the second session, following the validity ratings. Subjects were to give each statement a rating of "1" if they had not heard the statement before, "2" if they had heard the statement before in the previous session of the experiment, or "3" if they had heard the statement before but not in the experiment (from a friend, television, book or newspaper). When validity ratings were analyzed as a function of recognition, Arkes et al. found that statements rated as being
seen before outside of the experiment were given higher ratings than those thought to have been seen before in the experiment, and that statements that were not recognized at all received the lowest ratings. It seems that the statements were dissociated from their real source (the experiment) and misattributed to a source outside the experiment. Arkes and his colleagues suggested that this finding may be due to the perceived higher credibility of sources outside the experiment, such as radio or newspapers. Statements are seen as more valid when they come from high credibility sources. The recognition task in this experiment will be designed to assess the source of the remembered items, as in the study by Arkes et al. (1989).

The purpose of Experiment II was to explore the influence of feedback information on the truth effect for young and older adults. Feedback was given as to the actual validity of some of the statements. If the truth effect is solely due to the unintentional misattribution of familiarity to truth, then the repeated statements should increase in rated truth, no matter what type of feedback is given. Both true and false items, as well as non-feedback items, should be rated higher in the second session than non-repeated statements. However, if the deliberate recollection of source also influences the truth effect, then the second session validity judgments of both young and older subjects should reflect the feedback information. Specifically, repeated true statements should be rated as more true than new items in the second session (the truth effect), whereas repeated false statements should be rated as more false than new items in the second session for both age groups. Because of previous results indicating that younger adults recognize the repeated statements more accurately than older adults, the case may be that only young subjects may show these changes in validity judgments because of their more efficient memory. For older adults, who may not remember the feedback information from the first session to the second, the typical truth effect should be seen, with both true and false repeated items rated truer than non-repeated items.
Method

Subjects

Forty young (age <30) and forty older (age >60) adults were used as subjects in this second experiment. College undergraduates were recruited from a university wide pool of subjects in a variety of major fields of study, including psychology. Those student participants recruited from psychology classes received extra credit points for their participation. Students recruited from outside the psychology department were paid for their participation. Older subjects were recruited from the community through the use of advertisements and contact letters. These subjects were paid for their participation.

Demographic data were obtained on all subjects through the use of a biographical questionnaire. The mean age of adults in the older group was 70.63, compared to 19.83 years of age for the younger adults. In the younger group, 62.5% of the subjects were female; of the older subjects 60% were female. Five subjects (12.5%) in the younger group were black, with the remaining 87.5% Caucasian. All of the older adults were Caucasian. The majority of subjects in both groups reported being in the middle socio-economic class.

Mean years of education for younger subjects was 13.45, compared to 15.68 for the older subjects, and this group difference was significant, p<.0001. Mean scores on subtests of the WAIS-R revealed older subjects to perform better than younger subjects. Older subjects scored an average of 21.60 on the Information subtest, compared to 16.88 for younger subjects. Mean scores on the Vocabulary subtest were 51.38 and 44.40 for older and younger subjects, respectively. Group differences on both WAIS-R subtests were significant, p<.003.

Both groups of subjects were healthy, as assessed by self-report. No subjects in the younger group reported having had a stroke, heart or kidney disease. Three subjects (7.5%) in the older group reported having had a stroke or heart disease. Two older subjects (5%) reported having kidney disease. Older subjects were more prone to report
having high blood pressure (42.5%) than were younger subjects (2.5%). No subjects in either group reported having a neurological disease or head injury in the five years prior to this study.

Materials

The same statements used in the first experiment were used in this experiment. Buffer statements remained the same for each list. The middle sixty statements in the first session list were divided into three groups: Group A consisted of twenty true items, Group B consisted of twenty false items, and Group C contained ten true and ten false items. These sixty statements in the middle positions of the list were randomly arranged.

In the first session, subjects listened to a list of 80 statements and rated each statement on the seven-point scale of validity. After hearing and rating each statement, subjects heard a feedback word pertaining to that statement. Feedback as to the actual truth value of the statements in Groups A and B were presented as either the word "true" or the word "false" after the statement was rated, but prior to the presentation of the next statement. Following the statements in Group C, the word "blank" was presented, indicating that no feedback as to the actual truth value of those statements would be given. Feedback on randomly selected buffer items was also given.

A subset of the original statements (sixteen per group) was randomly chosen to be the repeated statements in the second session in order to approximate the length of the second session list with that of the first session list. Twenty non-repeated items, ten true and ten false, also appeared in the second session and comprised Group D. All items were randomly arranged within the list.

Validity judgment booklets for this study were identical to those used in the first experiment with one exception: the second session booklet contained 88 rating scales instead of 80. Recognition judgment booklets were changed to reflect the design used by Arkes et al. (1989). Beside each of the 88 items presented in the second session was a space for subjects to enter the number of the recognition category appropriate for that
statement. The alternatives were as follows: (1) the subject has never heard the statement before, (2) the subject heard the statement in the previous session of the study, or (3) the subject has heard the statement from a source outside the study, such as a book, television or the newspaper.

Procedure

The procedure for the present study was identical to that of the first experiment with the following exceptions. Subjects were informed that they would hear a series of consecutively numbered statements which might be true or false. The statements were presented auditorally, with 7 seconds between the end of one statement and the feedback word for that statement. After hearing each statement, they were to rate it on the seven-point scale of validity. Subjects were asked to make their validity ratings as quickly as possible because they only had a short time to do so before the presentation of feedback. They were told that they would hear a feedback word pertaining to the statement which they just rated, and that the word would either be "true," "false," or "blank." Subjects were informed that a statement's actual validity was given if the feedback word was "true" or "false." When "blank" was heard after a statement, it meant that the actual truth value of that statement was not being revealed. Subjects were instructed to rate each item before they received feedback on that item and that ratings could not be changed after receiving the feedback. A two second interval elapsed between presentation of the feedback word and the beginning of the next statement.

In the second session, subjects rated the validity of the statements as they had done previously, but they received no feedback pertaining to the items. Statements were presented with a seven second interval between the end of one statement and the beginning of the next. A source memory task was then presented. Booklets for this task contained the statements which were presented in the second session along with a blank beside each statement. Subjects were informed that the booklet contained the items which they had just rated for validity. They were asked to place a number in the blank beside
each statement indicating whether they had (1) never heard the statement before the
second session of the study, (2) heard the statement in the first session of the study, or (3)
heard the statement before, but not in the study (from an outside source, such as a book,
television, newspaper, radio, etc.).

Results and Discussion

All effects reported as reliable were significant at the .05 level or better.

Validity Ratings

The dependent measures for both groups were the mean truth value ratings for
ture, false and non-feedback repeated items in both sessions and nonrepeated items in the
second session. An analysis of validity ratings for repeated statements presented in the
first session and non-repeated statements presented in the second session was conducted
in order to confirm the absence of group or truth value effects. These effects would not
be expected due to the selection of items in the pilot study. A 2 (age: young, old) x 2
(truth value: true, false) analysis of variance was performed on the first ratings for all
items. Age was the between subjects factor and truth value was the within subjects factor.
Neither the main effect of age, F(1,78)=3.50, MSe=1.13, nor the main effect of truth
value, F(1,78)<1.00, was significant. Validity ratings for both true and false statements
were close to the midrange of the scale (true: M=4.27, false: M=4.31). In addition, the
age by truth value interaction was also non-significant, F(1,78)=1.42, MSe=.09. These
results show that the pilot study was again successful in selecting items of uncertain truth
value.

The influence of item condition on the truth effect was then assessed for both
groups. Mean validity ratings for statements presented in the second session were
analyzed in a 2 (age) x 4 (item condition: true, false, no feedback, non-repeated) analysis
of variance. Age was the between subjects factor and item condition was the within
subjects factor. The main effect of age was not significant, F(1,78)=1.84, MSe=1.69.
However, a significant main effect of item condition was found, F(3,234)=50.48,
MSe=14.60. True statements were rated the highest (M=5.06), compared to non-feedback items (M=4.69), non-repeated items (M=4.32), and false items (M=4.09).

The age by item condition interaction was also significant, F(3,234)=2.84, MSe=.82. These data are presented in Table 4. To examine this interaction further, the effect of item condition was analyzed separately for each group. A significant main effect of item condition was found for young subjects, F(3,117)=34.08, Mse=9.82. Contrasts revealed that true, false and non-feedback items were significantly different from the non-repeated items. True items were rated highest, followed by no feedback, non-repeated, and false items. This pattern of results was not found for the older subjects, however. A main effect of item condition was also found for older subjects, F(3,117)=19.31, MSe=5.60. Contrasts showed that both true and non-feedback items were significantly different from non-repeated items, while the false and non-repeated items were rated similarly. True items were again rated the highest, followed by no feedback items. The non-repeated and false items were together rated the lowest. These results indicate that both young and older subjects may have rated the true statements highest due to the recollection of the feedback, as well as enhanced familiarity. The non-feedback items increased in rated validity primarily due to familiarity caused by repetition. It appears that the younger subjects remembered the feedback of the false statements, rating them lowest on the scale. However, older subjects rated the false items equal in truth to the new items, but lower than the no feedback items, indicating that the older subjects had some memory of the false items, but not to the same degree as the younger subjects.
Table 4

**Younger and Older Subjects' Mean Validity Ratings (standard deviations in parentheses)**

for True, False, Non-feedback, and Non-repeated Items in Session Two of Experiment II.

<table>
<thead>
<tr>
<th>Item Condition</th>
<th>Group</th>
<th>True</th>
<th>False</th>
<th>Non-feedback</th>
<th>Non-repeated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Younger</td>
<td>5.17</td>
<td>4.01</td>
<td>4.81</td>
<td>4.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.60)</td>
<td>(.62)</td>
<td>(.57)</td>
<td>(.48)</td>
</tr>
<tr>
<td></td>
<td>Older</td>
<td>4.96</td>
<td>4.17</td>
<td>4.56</td>
<td>4.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.79)</td>
<td>(.94)</td>
<td>(.69)</td>
<td>(.53)</td>
</tr>
</tbody>
</table>

Age and repetition were next analyzed for each type of feedback, using separate 2 (age) x 2 (status: repeated, non-repeated) analyses of variance. The age by status interaction effects are shown in Figure 2. For the non-feedback statements, both the main effects of age, F(1,78)=5.41, MSe=2.78, and status, F(1,78)=38.76, MSe=5.53, were significant. Young subjects' validity ratings were higher, with a mean rating of 4.63, compared to 4.37 for older subjects. The truth effect was also seen across groups, with repeated items (M=4.69) rated higher than non-repeated items (M=4.32). The age by status interaction was not significant, F(1,78)<1.00. Thus, for no feedback statements, both groups of subjects demonstrated the standard truth effect. This finding is in accord with the results of Experiment I.

For true items, both main effects of age, F(1,78)=4.48, MSe=2.34, and status, F(1,78)=98.81, MSe=22.22, were found. Regardless of repetition, young subjects' validity ratings (M=4.81) were significantly higher than those for older subjects (M=4.57), and across groups, repeated items (M=5.06) were rated to be truer than non-repeated items (M=4.32). The age by status interaction was not significant, F(1,78)<1.00. Thus, for true statements, the truth effect was seen for both young and older subjects.
However, the pattern of results was different for false items. The main effect of age was not significant, $F(1,78)<1.00$. As with the true and no feedback items, a main effect of status was found, $F(1,78)=6.50$, $MSe=2.07$. Across age groups, the non-repeated false statements ($M=4.32$) were rated as truer than the repeated false statements ($M=4.09$). In addition, a significant age by status interaction was found, $F(1,78)=5.77$, $MSe=1.84$. For young subjects, the mean rating for non-repeated statements was 4.45, compared to 4.01 for repeated statements. However, older subjects ratings for non-repeated ($M=4.18$) and repeated ($M=4.17$) false statements were similar. Thus, this interaction is driven by the fact that young subjects rate the repeated false items to be significantly lower in the second session, while the older subjects do not. Again, it appears that the younger subjects remembered the feedback for the false items, while the older subjects did not.

Difference scores were obtained by comparing mean ratings for true, false and non-feedback items to mean ratings for non-repeated items for both young and older subjects. Histograms showing the frequencies of these difference scores are shown in Figure 3. The distributions for these difference scores are relatively normal. Thus, large individual differences were not found in the effects of age and repetition for each type of feedback.

Recognition Scores

Source misattributions were examined in order to assess recognition accuracy. For a repeated statement, source would be misattributed if the statement was judged as never
heard before or heard outside of the experiment. In the case of a non-repeated statement, judging the item as seen in the experiment would be a misattribution of source. Source misattributions, or $1-p(\text{hit})$, were analyzed in a 2 (age) x 3 (feedback: true, false, no feedback) analysis of variance. This analysis revealed a main effect of age, $F(1,78)=5.56$, $MSe=1.14$, with younger subjects' source misattribution rates ($M=.24$) significantly lower than those for older subjects ($M=.38$). A main effect of feedback type was also found, $F(2,156)=4.07$, $MSe=.04$. Means comparisons revealed that source misattribution rates for true items ($M=.29$) were significantly lower than those for false items ($M=.32$), which did not differ significantly from misattribution rates for no feedback items ($M=.33$). The age by feedback interaction was not significant, $F(2,156)<1.00$. Thus, across age groups, source misattribution rates for no feedback and false items were the highest, while the lowest rates of source misattribution rates were seen for true items. These results indicate that younger subjects were more accurate than older subjects at recognizing repeated items and that true items were more often attributed to a correct source, compared to false and no feedback items.

Recognition accuracy was also assessed by analysis of the frequency with which younger and older subjects placed items into the three recognition categories. Recognition frequencies for each of the three categories were entered into Pearson chi-square analyses. First, young and older groups were analyzed separately to determine whether there was a relationship between feedback and source recognition. For young subjects, the Pearson chi-square probability was not significant, $\chi^2 (4) =5.76$, indicating that there was no relationship between feedback and recognition category. The same analysis was done with older subjects, and a relationship was found between feedback and source recognition, $\chi^2 (4) = 13.41$. An analysis of standardized residuals revealed that older subjects were more likely than chance to judge true items as heard from a source outside the experiment. These results are in line with Arkes' finding that more credible items are judged to have been heard from an outside source, (Arkes et al., 1989). In order
to further examine the effect of age on source memory, the remaining analyses were conducted with recognition category frequencies collapsed across feedback.

An analysis of recognition category frequencies for repeated items by group was then conducted. A significant Pearson chi-square was found, $\chi^2 (2) = 94.64$, indicating a relationship between age and recognition category. An analysis of standardized residuals revealed that compared to chance, younger subjects were more likely to report that a statement was heard in the experiment and less likely to report that a statement was never heard or heard from an outside source. In contrast, older subjects were more likely than chance to report a statement was never heard or heard outside the experiment, while they were less likely to report that a statement was heard in the experiment. These results indicate that younger subjects are more accurate in categorizing the source of repeated stimulus statements.

A similar recognition category frequency analysis was conducted on the non-repeated items in the second session. Again, a significant Pearson chi-square was found, $\chi^2 (2) = 31.65$, indicating that there was a relationship between age and source recognition. An analysis of standardized residuals revealed that older subjects were more likely, compared to chance, to inaccurately report that a non-repeated statement was heard inside the experiment, while younger subjects were more likely, compared to chance, to accurately report that a non-repeated statement was never heard before. Again, it appears that younger subjects are more accurate in this recognition task, compared to older subjects.

The effect of age was then analyzed within each type of feedback. For non-feedback items, a significant Pearson chi-square was found, $\chi^2 (2) = 25.98$, indicating that there was a relationship between age and source recognition. An analysis of standardized residuals indicated that young subjects were more likely, compared to chance, to judge a non-feedback item as heard in the study, while older subjects were more likely, compared to chance, to judge non-feedback items as never heard or heard from an outside source.
A similar pattern was seen for true feedback items. A significant chi-square was found, $\chi^2 (2) = 46.90$, again indicating a relationship between age and source recognition. Younger subjects were more likely than chance to judge true items as heard in the study, while older subjects were more likely than chance to judge true items as heard from an outside source. Again, young subjects were more accurate than older subjects at indicating the source of where items were heard.

For false items which received feedback, a relationship between age and source recognition was also found, $\chi^2 (2) = 25.17$. Young subjects were more likely than chance to recognize a false item as heard in the study, while older subjects were more likely than chance to judge a false statement as never heard before. Again, young subjects were more accurate in recognizing the source of statements.

Thus, it seems that not only are older subjects less accurate at recognition of repeated items compared to younger subjects but they are also more likely to forget or misattribute the source of the statements. Of course, the subjects might have actually heard the statements from an outside source before they participated in the experiment. However, it is unlikely that these subjects heard the statements before, because the truth value analyses in both experiments have shown that the statements are obscure. A more probable explanation is that the older subjects misattributed the source of items heard in the experiment to a source outside of the experiment.

**Validity Ratings As a Function of Recognition Response**

An attempt was made to analyze the validity ratings according to the perceived source of each statement obtained through the recognition task. These scores would be analyzed in a 2 (group) x 3 (status: repeated, non-repeated) x 3 (recognition response: never heard, heard in experiment, heard outside experiment) analysis of variance. However, only 4 young subjects and 5 older subjects remained in the analysis after partitioning the data, due to the fact that the majority of subjects did not use the third recognition category (heard outside experiment). In light of this, it was decided to analyze
the data using only the first two recognition categories. A 2 (age) x 4 (item condition: true, false, no feedback, non-repeated) x 2 (source: never heard, heard in experiment) analysis of variance was conducted for each age group. It is noted that the results of these analyses may not be representative of the entire population, due to the fact that portions of the data were excluded from the analyses.

For young subjects, main effects of source, $F(1,27)=8.44$, $MSe=7.74$, and item condition, $F(3,81)=9.05$, $MSe=8.07$, were found. Regardless of item condition, items reported to have been heard in the experiment ($M=4.64$) were rated truer than items reported as never heard before ($M=4.26$). This finding is in line with the results of the first experiment. Across sources, true items were given the highest mean rating ($M=4.88$), followed by ratings for non-feedback ($M=4.57$), non-repeated ($M=4.38$) and false items ($M=3.97$).

In addition, the source by item condition interaction was also significant for young subjects, $F(3,81)=2.65$, $MSe=1.38$. These data are presented in Table 5 and Figure 4. Contrasts revealed that, for items reported as never heard before, item condition had no effect. True, false and non-feedback items were rated the same as non-repeated items. Neither the truth effect, nor evidence of source memory was seen for these items. Apparently, if young subjects did not recognize a statement, they rated it low regardless of item condition. However, a different pattern was found for items reported to have been heard in the experiment. Contrasts revealed that ratings for true and false items were significantly different from ratings for non-repeated items, while the non-feedback and non-repeated items were rated similarly. True items were given the highest ratings, while false items were rated the lowest. Thus, it appears that younger subjects relied primarily on source memory in making validity ratings for items reported to have been heard in the experiment.
Table 5

Younger Subjects' Mean Validity Ratings (standard deviations in parentheses) for True, False, Non-feedback and Non-repeated Items as a function of Recognition in Experiment II.

<table>
<thead>
<tr>
<th>Item Condition</th>
<th>Category</th>
<th>True</th>
<th>False</th>
<th>Non-feedback</th>
<th>Non-repeated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never Heard</td>
<td>4.52 (1.13)</td>
<td>3.98 (1.20)</td>
<td>4.32 (1.10)</td>
<td>4.24 (.53)</td>
</tr>
<tr>
<td></td>
<td>Heard in Exp.</td>
<td>5.24 (.68)</td>
<td>3.96 (.70)</td>
<td>4.82 (.73)</td>
<td>4.52 (1.01)</td>
</tr>
</tbody>
</table>

The analysis for older subjects also showed main a effect of source, F(1,22)=6.00, MSe=6.84. As with the young subjects, older subjects' ratings of items heard in the experiment (M=4.56) were higher than ratings for items reported as never heard before (M=4.18). A main effect of item condition was also found, F(3,66)=3.28, MSe=2.82. Contrasts revealed that both true and non-feedback items were rated higher than non-repeated items. False and non-repeated items were rated similarly. In contrast to the younger subjects, the source by item condition interaction for the older subjects was not significant, F(3,66)=1.57, MSe=1.63. Thus, it appears that older adults relied more on familiarity, than on source recollection, in making judgments of validity.
Chapter 5

General Discussion

Together, these two experiments have examined the influence of increasing age on the truth effect. The truth effect, which has been repeatedly found in young adults, is seen when repeated statements are judged to be more true than non-repeated statements. In addition, this effect has been shown with a variety of stimuli, such as opinion statements, phrases, and statements originally judged to be false, as well as under a variety of conditions, such as divided-attention and short retention intervals. The experiments presented here advanced the generality of the truth effect by examining its existence in the elderly population.

Experiments I and II found the truth effect in the validity ratings of both young and older adults. Both experiments also determined that the accuracy for recognition of repeated statements was higher for younger than for older subjects. The repetition of items served to increase the validity ratings of the older subjects, despite their failure to recollect these repeated statements.

The results of these experiments are in line with those reported by Begg (Begg et al., 1992). Begg and his colleagues suggested that there are two influences on the truth effect: the unintentional enhanced familiarity due to repetition and deliberate source recollection. Statement familiarity is automatically increased by exposure, and repeated statements are processed more fluently. This enhanced familiarity can be misattributed to truth if the credibility of the source of the information is not spontaneously recollected. If source is remembered, then true statements will increase in perceived validity, while false statements will decrease. This theory provides a reasonable explanation for the present
In Experiment II, feedback as to the actual validity of some of the statements was given in the first session. The results indicated that for both young and older subjects, true items were rated the highest, followed by non-feedback items. For younger subjects, non-repeated items were rated truer than false statements, while these two types of statements were rated similarly by older subjects. These results can also be explained according to the theory proposed by Begg et al. (1992), that both familiarity and source recollection have separate influences on the truth effect. First, if only the unintentional influence of familiarity was driving the truth effect, then it would be expected that all three types of repeated statements (true, false, and non-feedback) would show an increase in rated validity in the second session, compared to non-repeated statements. This pattern of results was not found. For both groups, true and no feedback items were rated higher in the second session, but false items were rated lower or equal to their ratings in the first session. For both groups, ratings for true items were higher than ratings for non-feedback items in the second session. For young subjects, ratings for false items were lower than ratings for non-feedback items in the second session, while older subjects rated false and non-feedback items similarly, indicating that young subjects may have been influenced by some other factor.

Separate from the influence of familiarity, deliberate recollection of the feedback information could also be influencing the validity ratings in the second session. If that is the case, then the true feedback items would increase and the false feedback items would decrease in rated credibility between sessions. Again, the non-feedback items would show a standard truth effect and increase due to familiarity. These data support this explanation. The differences in the ratings for the non-feedback items and the true and false items show the effect of source memory. Both young and older subjects show evidence of memory for source. However, the young subjects' spontaneous source recollection may be more efficient than that of older subjects. It seems that there may be
something unique about the true feedback items which makes them more familiar and/or more memorable for both young and older subjects. This idea would support the findings of Begg and his colleagues (Begg & Armour, 1991; Begg et al., 1985), who found that statements studied under an affirmative bias were rated the truest of all statements. These researchers also found that the truth effect was attenuated with statements studied under a negative bias. This finding would also be supported by the present data for false items. Thus, it seems that both the unintentional misattribution of familiarity to credibility and the deliberate recollection of source may be the bases for the influence of feedback information on the truth effect.

Bacon (1979) proposed that the truth effect was due primarily to the explicit recognition of repeated statements. Items judged to have been repeated were given the highest validity ratings, regardless of whether they were actually repeated or new. The results of these experiments are more in line with the findings of Begg et al. (1992), in that repetition and recognition influenced the truth effect independently. The unintentional misattribution of familiarity to credibility led to an increase in perceived validity for the repeated statements. The deliberate recollection of source augmented the influence of familiarity for true statements, and attenuated the influence of familiarity for false statements. It is suggested that Bacon (1979) may have found enhanced effects of recognition due to the fact that subjects were asked to perform the recognition task before rating the validity of items in the second session. This sequence of tasks may have influenced subjects to give higher validity ratings to statements which they recognized as being repeated, and thus enhance the influence of recognition on the truth effect.

When validity ratings were analyzed as a function of recognition, the results of Experiment II were different for young and older adults. It appears that young subjects were influenced primarily by source recollection in making their judgments of validity. For items recognized as repeated, true items were rated as more true and false items were rated as more false, compared to non-repeated items. However, item condition had no
effect on validity ratings if statements were reported as never heard before. These results indicate that if an item was remembered from the first session, young subjects also remembered the source credibility for that item and used that information in rating validity. However, older subjects' ratings were primarily influenced by familiarity. True and non-feedback items were as more true than non-repeated items, while false and non-repeated items were rated similarly. However, true, non-feedback and false items were given similar ratings. Thus, familiarity seems to be the driving force behind the truth effect for older adults.

The results of these experiments indicate that there is something special about the notion of truth. Why is it that individuals, in general, seem predisposed to believe in the truth of propositions. This question can be explored by examining two theories regarding how mental systems believe (Gilbert, 1991). In order for a proposition to be believed, its meaning must be represented in a mental system, and then assessed for a positive relation between the idea and other information which already exists in the system. Thus, believing has two components: comprehension and assessment.

These two components of belief have been associated differently in the past. Descartes (cited in Gilbert, 1991) proposed that comprehension precedes and is separate from assessment. In the Cartesian system, comprehension is a passive, or automatic, process where ideas impress themselves upon the mind. The process of assessment occurs subsequent to comprehension. According to Descartes, assessment is an active or controlled process where the comprehended idea is either accepted or rejected.

A contrasting view of belief was proposed by Spinoza (cited in Gilbert, 1991). Spinoza believed that, in order to comprehend an idea, it had to be implicitly accepted. The Spinozan view suggests that comprehension and acceptance are one and the same operation. Subsequent to this stage, an idea can be deliberately assessed in order to certify or unaccept the belief. The Cartesian and Spinozan systems are presented in Table 6.
Table 6

Two Stages of the Cartesian and Spinozan Belief Systems.

<table>
<thead>
<tr>
<th></th>
<th>Cartesian System</th>
<th>Spinozan System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representation Stage</td>
<td>Comprehension</td>
<td>Comprehension &amp; Acceptance</td>
</tr>
<tr>
<td>Assessment Stage</td>
<td>Acceptance or Rejection</td>
<td>Certification or Unacceptance</td>
</tr>
</tbody>
</table>

These two systems of belief can be contrasted further when system breakdown due to stress is examined. These belief systems are represented as modular systems which pass information from one stage to the next and which have multiple sites for information to exit the system. When these systems are stressed, such as by limiting the processing capacity, the result is premature output. In other words, if a system is stressed, the output may be a representation of the idea without going through the subsequent stage of assessment.

A breakdown such as this would effect the Cartesian and Spinozan systems differently. If resources are limited in the Cartesian system, a breakdown would prevent the system from either accepting or rejecting the comprehended idea. Thus, the Cartesian system would be uncertain of the veracity of the idea. In the case of a Spinozan system, the stress of depleted processing resources would serve to prevent the system from certifying or unaccepting the idea it already comprehends and accepts as true.

It is suggested that the Spinozan belief system may be the underlying force behind the truth effect. According to this view, a statement is presented to a subject, and this statement is automatically comprehended and accepted as true. The subject then must rate the statement for its validity. This act forces the subject to perform the second stage of
assessment. If there is no information on the actual truth value of the item, then the subject will certify that the statement is true. If the truth of a statement cannot be disconfirmed, then it must be confirmed by default. Thus, the Spinozan belief system provides a reasonable explanation for the truth effect.

In the Spinozan system, all ideas are comprehended as true; they are then deliberately assessed at a later time, if the system does not break down. The results of Experiment II indicated that the direct recollection of source influenced the validity ratings of true, but not false, statements for the older subjects. It may be that processing a false statement requires additional resources that older adults do not have.

Horn (1989) proposed that affirmative statements are directly about facts, while negative statements are about positive statements. In order to comprehend a false statement, one must first comprehend the basic assertion and then reject it. It may be that it is less difficult to encode and remember a true statement than it is to encode and remember a false statement. It is usually assumed that the information one holds in memory is true and requires no tag indicating that it is true information. However, a false statement must be encoded and recollected as two related but separate pieces of information: the fact itself and the tag indicating that the statement is false.

The possible dissociation of factual and source information can also be seen in the "sleeper effect." This effect is seen when a persuasive argument has a greater delayed than immediate effect on attitudes (Gruder, Cook, Hennigan, Flay, Alessis & Halamaj, 1978; Pratkanis, Greenwald, Leippe & Baumgardner, 1988). When an argument is first encountered, people retain both the message and the source of the message. According to the discounting-cue hypothesis, the sleeper effect occurs when the association between the message and its source is lost over time. In other words, a person may remember the message of the argument but may not remember its source or whether the source was a credible one. The fact and the tag indicating that the fact is false may become dissociated over time.
Thus, there may be two complementary explanations for the fact that older subjects' validity ratings of true statements were influenced by the deliberate recollection of source information, while their ratings for false items were not. Older subjects may have failed to encode statements as false at study, due to the added load of having to encode two pieces of information for the false statements. This deficit in encoding false statements would result in a breakdown of the Spinozan system, with all items remaining accepted as true. Another explanation is that the association between a statement and its tag indicating that the statement is false could become lost over time, such as seen with the sleeper effect. If this is the case, the fact might be brought to memory, but the "false" tag or credibility of the source might not be remembered. Thus, the false statements would not be recollected as false, which was the case with the older subjects in the second experiment. The younger subjects, who have more cognitive resources and a more efficient memory for the source and credibility of statements, did rate the false items to be more false, compared to non-repeated statements.

The results Experiment II may have bearings upon another area of research in source memory. Several studies have been done exploring a phenomenon known as hindsight bias, or the "knew-it-all-along" effect (Fischhoff, 1975, 1977; Fischhoff & Beyth, 1975; Hasher, Attig & Alba, 1981; Powell, 1988; Wasserman, Lempert & Hastie, 1991; Wood, 1978). One of the first studies of this effect was done by Fischhoff (1975). Subjects were asked to make probability judgments regarding an event both before and after they had the outcome information of the event. It was found that the probability estimates were much larger when made after the event when compared to estimates made before the event. Fischhoff suggested that the outcome information is automatically assimilated into the existing knowledge base which the subject has regarding the event. In this way, the subjects are unaware of the effect that the outcome knowledge has on their behavior (Fischhoff, 1977). Wood (1978) found that subjects were unable to ignore the outcome information, even when told explicitly to do so.
However, a similar study by Hasher, Attig and Alba (1981) found conflicting results. In this study, subjects gave validity ratings for statements for which they had been given discredited feedback. If feedback is automatically assimilated, then the last ratings should reflect the discrediting feedback manipulation. However, if subjects can disregard the discredited feedback, then their last ratings should look like the ratings in the first session before feedback was given. These results were found by Hasher and her colleagues. The hindsight bias was disrupted and the subjects were able to discount all feedback and give ratings similar to those given in the first session. Thus Hasher et al. (1981) concluded that, under some circumstances, feedback information is not always automatically assimilated into preexisting knowledge.

This area of research could be explored along with studies of the truth effect. It was proposed that the results seen in the present study indicate the independent influences of familiarity and source recollection on ratings of validity. However, according to theories of hindsight bias, these findings could also be reasonably explained by the automatic assimilation of true and false feedback information. The effect of feedback on the truth and hindsight effects could be examined by informing subjects of the repetition of statements and asking them to rate the statements as they had before the feedback was given. Thus, the truth effect could be examined, as well as the automatic assimilation of feedback information.

As a whole, the results of this study support the previous research on automatic and controlled processes (Hasher & Zacks, 1979; Attig & Hasher, 1980), as well as research on implicit and explicit tests of memory (Light & Singh, 1987). The influence of familiarity on validity ratings is unintentional and automatic and is seen in the absence of deliberate recollection. Similar to other automatic processes, this increase in rated truth due to familiarity does not show an age-related decline for older adults. In contrast, the recollection of source is a deliberate and controlled process. Older adults do demonstrate an age-related deficit in performance on this test of explicit memory. Thus, the results of
the experiments presented here add to the present knowledge of the dissociation between automatic and controlled processes in aging research.

In summary, the results of these experiment indicate that both young and older adults are sensitive to the influence of repetition on judgments of credibility. The existence of the truth effect does have applications in "real world" situations. Consistent repetition is the means by which many forms of advertising and propaganda have their influence on individuals. According to the truth effect, it seems as though the more information is repeated, the more likely people are to believe it, especially if no information about the credibility of the source is available to memory. The findings presented here suggest that this effect of repetition may influence older adults more than younger adults, due to their less effective memory for source, serving to make older individuals less skeptical about the credibility of their knowledge, and thus more susceptible to deception and false beliefs.
References


Figure Captions

**Figure 1.** Session by status interaction for young and older subjects in Experiment I.

**Figure 2.** Age by status interactions for true, false and non-feedback items in Experiment II.

**Figure 3.** Histograms of difference score data for young and older subjects in Experiment II.

**Figure 4.** Source by item condition interaction for young subjects in Experiment II.
Session x Status Interaction for Young Ss

Session x Status Interaction for Old Ss

Figure 1
Age x Status Interaction for True Items

Age x Status Interaction for False Items

Figure 2
Age x Status Interaction for Non-feedback Items

Figure 2
Figure 2

True - NR for Young Ss

False - NR for Young Ss
Figure 3
Figure 3

True - NR for Older Ss

False - NR for Older Ss
Figure 3

None - NR for Older Ss

Count

None-NR

-0.75  -0.5  -0.25  0  0.25  0.5  0.75  1  1.25  1.5  1.75

None-NR
Figure 2

Source x Item Condition For Young Ss

Mean Validity Ratings

Never Heard
Heard in Exp.

Statement Type

True False Non-feedback Non-repeated

Figure 4

Item Condition x Source for Young Ss

Mean Validity Ratings

True False Non-feedback Non-repeated

Source

Never Heard Heard in Exp.