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Aging and the Effects of Prior Expectancies in Contingency Judgment

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AGING AND THE EFFECTS OF PRIOR EXPECTANCIES
IN CONTINGENCY JUDGMENT

A Thesis
Presented to
The Faculty of the Department of Psychology
Western Kentucky University
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In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts
By
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AGING AND THE EFFECTS OF PRIOR EXPECTANCIES
IN CONTINGENCY JUDGMENT

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This study examined how prior expectancies affect young and older adults' contingency judgments. Participants completed contingency problems representing all combinations of expectancy (positive, negative, unrelated, and unknown) and contingency (positive, negative, and zero). I originally predicted that the largest age differences would emerge when both the expectancy and the contingency were strong and incongruent, regardless of the nature of the expectancy. However, age differences in the effect of expectancy were strongest when the expectancy was positive and the contingency was incongruent, and older adults' judgments were more biased by this expectancy. Likewise, I predicted that there would be no age differences when the expectancy and the contingency were congruent, but young adults showed a greater confirmation effect than older adults when the expectancy was negative. The results may not have matched the predictions because they were based on the assumption that all types of expectancies would affect judgments in the same way. The findings of the current study suggest that this is not the case. Future research is needed to explain why certain types of expectancies affect young and older adults' contingency judgment differently.

Chapter 1

Introduction

The focus of this study is on the effect that prior expectancies have on the judgment processes of young and older adults. In particular, do older adults rely on expectancies more than younger adults when making contingency judgments? There has been very little research on this issue to date. However, research on the influences of schemas in memory and judgment is directly related to the question of how expectancies might influence older adults' contingency judgment.

An expectancy is a schema or cluster of knowledge on a given topic that aids in interpreting, storing, and retrieving information. People rely on schemas in memory at encoding and retrieval. "What schemas do is enable the perceiver to identify stimuli quickly, 'chunk' an appropriate unit, fill in information missing from the stimulus configuration, and select a strategy for obtaining further information, solving a problem, or reaching a goal" (Taylor & Crocker, 1981, p. 93). According to schema theory, we *make sense* of the world around us in relation to past experiences, which aids in perception, learning, and retrieval of new information. Likewise, schemas are used in making social judgments. When a cognitive representation of a target person is activated, judgments about this person will be based on the perceiver's schema and not on the current stimulus information (Hamilton, 1981). Schemas and expectancies also affect contingency judgments, which are assessments of the degree to which two events covary. Covariation can be defined by how events co-occur, or the degree to which one event occurs more often in the presence than the absence of another event (Alloy & Tabachnik, 1984).

To explain how expectancies affect contingency judgments, Alloy and Tabachnik (1984) created an interactional theoretical framework that could be used to explain contingency detection. The framework assumes that people acquire knowledge of event contingencies based on situational information and that these cognitive representations

interact with prior expectancies to influence contingency judgment (Goddard & Allan, 1988). For example, when the expectancy and the current situational information are congruent but are weak, the person making the judgment will either refrain from making any judgment or will do so with very little confidence. On the other hand, when the expectancy is strong and the current situational information is weak, the judgment will be made according to the person's expectancy. Likewise, if the expectancy is weak and the current situational information is strong, the judgment will reflect the situational information. When both the expectancy and the current situational information are strong, then one of two things could happen. First, if the two sources of information match or are congruent, the judgment will be consistent with this information. Secondly, if the expectancy and the current situational information are both strong, but do not match or are incongruent, the individual is faced with a cognitive dilemma and the judgment will be based on the relative strength of the two sources of information.

However, pre-existing beliefs or expectancies can distort contingency judgments. A key example of expectancy overshadowing situational information to bias judgment is illusory correlation. An illusory correlation is a systematic error in which a person believes that two events are related when in fact they may not be related, may be related to a lesser degree than believed, or may be related in the opposite direction (Chapman & Chapman, 1967). Research on expectancy-based illusory correlation illustrates the robustness of expectancies and the resistance of prior beliefs to change in the face of conflicting situational information (Chapman & Chapman, 1967; Golding & Rorer, 1972; Spears, Eiser, & Van Der Plight, 1987).

The literature on expectancies and judgments in older adults is sparse, but a large body of age-related research on schematic influences on memory and judgment is directly related to expectancies and judgment. Hess (1990) concluded that the supportive functions of schemas are clearly more important in determining memory performance in older adults compared to young adults. Likewise, in social judgment, Hess and Follett

(1994) showed that older adults relied more on schematic factors in making behavior prediction judgments, although young adults' judgments reflected the current situational information. Also, it has been shown that older adults are more likely to make social judgments consistent with their expectancies even after they have been presented with additional expectancy inconsistent information (Hess & Pullen, 1994; Hess, Vandermaas, Donley, & Snyder, 1987).

In a similar vein, Mutter and Pliske (1994) found that both young and older adults were just as likely to make illusory correlations. However, when presented with evidence disconfirming their expectancies, young adults modified their judgments thereby reducing the illusory correlation, but older adults' judgments stayed the same. Likewise, older adults' memory for expectancy confirming evidence was more accurate than their memory for disconfirming evidence, but young adults' memory for these two types of evidence showed no differences.

These findings lead us to believe that the influence of expectancies on judgment may vary as a function of age. However, Mutter and Pliske's (1994) study on illusory correlation and aging only examined judgments when both the expectancy and situational information were strong and incongruent and when the expectancy was strong but the situational information was weak. Thus, it is unknown whether these age-related differences will disappear when situational information and expectancy are both strong and congruent, or when the expectancy is weak but the situational information is strong. Therefore the current study examined all possible expectancy and current information interactions proposed in the framework by Alloy and Tabachnik (1984).

The most prominent difference between young and older adults' judgments was expected to occur when both prior expectancy and situational information were strong and incongruent. In contrast, age-related differences should disappear when both the expectancy and situational information are strong and congruent. Similarly, no age-related differences were expected when the expectancy was strong but the situational

information was weak. In all the interactions of situational information and prior expectancy, young adults were expected to be more accurate in their judgments when compared to older adults (Mutter & Pliske, 1996).

Chapter 2

Review of Literature

The influence of schemas on cognition has been studied in a vast array of contexts and academic domains for nearly a century. A schema is a cluster of knowledge on a given topic that aides interpretation, storage, and retrieval of information. Hastie (1981) concluded that the term schema is analogous to expectations, abstract hypotheses, prototypes, organizing principles, frames, scripts, plans, or any other term used to describe abstract mental organizing systems or memory structures. Thus, for the remainder of this paper the terms prior expectancy, expectancy, and schema will be used interchangeably.

Frederick Bartlett was a pioneer in research on schemas, and his theory underlies most experiments on how these memory representations influence cognition. Bartlett (1932) referred to a schema as an active organization of past reactions or experiences that operate to form a new response. He stated that behavior seems to be dominated by past events placed into memory in relation to new associated events. According to schema theory, we make sense of the world around us in relation to past experiences which aide in perception, learning, and retrieval of new information. When presented with a new event that shares attributes of a schema stored in memory, we perceive the new experiences in terms of the schema and react based on our past experiences. According to Bartlett, interpretation by schemata is the primary way we are influenced by past reactions and experiences.

One of the main contributions of Bartlett's (1932) concept of schemas in memory was his emphasis on both accurate and inaccurate reproductions in narrative recall (Hastie, 1981). For example, in Bartlett's experiments on repeated reproduction, participants' schemas led to inaccurate recall of story information. Participants first read a folk story and were asked twenty hours later to recall the story verbatim. They frequently remembered only the main structure, simplified events, and transformed the

story into familiar detail. For example, in the story *The War of the Ghosts*, participants often replaced the word 'canoe' with 'boat' transforming the story into language more commonly used by the individuals in the participant pool. Bartlett noted that these transformations or individual adaptations of detail were remembered more often and given more emphasis than the actual content of the story. By adapting the folk story to fit a pre-existing schema, the transformations facilitated remembering. In addition, these alterations to memory were more prevalent when the retention interval was long. According to schema theory, these findings are not surprising. The transformation of material into familiar detail exemplifies one way that prior knowledge interferes with new information.

Sulin and Dooling (1974) extended Bartlett's studies to test the influence of schemas or prior knowledge in the retention of prose. They manipulated the intrusion of prior schematic knowledge by having participants read short paragraphs detailing the life of either a famous (Helen Keller or Adolph Hitler) or fictitious (Carol Harris or Gerald Martin) main character. Half the participants were given a recognition test after a five-minute retention interval and the other half were given the test one week later. In the first experiment, the recognition test consisted of seven sentences from the original paragraph and one foil sentence that had either a high or low thematic relation to the original context. Participants were asked to judge whether these sentences were exactly the same, slightly different, or very different from the original story and to give a confidence rating for their judgment. Both recognition accuracy and confidence were combined to create a total score such that the higher the accuracy and confidence the higher the total score. Inaccurate recognition responses matched with high confidence were given the lowest possible total score. Overall, total scores were higher after a short retention interval than after a longer retention interval, and in both conditions participants were more likely to falsely recognize the high-thematic foil sentence when the main character was famous.

The greater occurrence of false positive recognition errors confirmed Bartlett's (1932) theory that people rely on pre-existing knowledge in memory (Sulin & Dooling, 1974).

In Sulin and Dooling's (1974) second experiment, the procedure was the same as before but the recognition test was altered to manipulate the degree of semantic relatedness in schematic intrusions. This recognition test consisted of seven of the original sentences and seven new sentences (the foil used in the previous experiment, one medium and one low thematically-related foil, and four neutral foils). The medium and the low thematically-related foils were added to reduce any novelty associated with the foil used in the previous experiment and to represent different degrees of semantic relatedness to the schema. Participants were asked to give a yes-no recognition judgment for all 14 sentences. Participants with the famous main character had a greater tendency to falsely recognize the high-thematic foil sentence, and this effect was more prominent in the one-week retention interval confirming Bartlett's (1932) observation that thematic influence increases with the passage of time.

Dooling and Christiaansen (1977) subsequently investigated the point at which schemas are most likely to interfere with remembering. In particular, they manipulated when they disclosed that the main character was famous. Participants were told either before, immediately after, or a week after reading the passage that the main character was either Helen Keller or Adolph Hitler. A recognition test was given after a one-week retention interval to all participants. Those who were told immediately after reading the passage made the most false recognition errors regardless of thematic relatedness. Thus, the immediately-after group had more difficulty differentiating between the passage they had just read and their schema for the passage content during the recognition task. Likewise, a significant difference in the number of false positive errors between the immediately-after and week-after groups in thematic performance demonstrated that directly after the initial comprehension of the passage was when constructive memory retrieval processing was most susceptible to schematic intrusions.

Social Judgment

It is clear that people rely on schemas in memory. Schemas are also used in making judgments. The influence of expectancies in judgment has been studied predominately in social judgment. Social judgment research focuses on judgments about people, social events, and social roles. When prior knowledge about a person, group, or event exists, then judgments are more likely to be made according to this knowledge than current situational information (Wyer & Carlston, 1994). In terms of schema theory, when a cognitive representation of a target person is activated, judgments about this person will be based on the perceiver's schema and not on the current situational information (Hamilton, 1981).

Stereotypes are one of the most studied forms of social schemas. A stereotype is a mental representation of an attribute or value believed to be representative of all members of a social group. Stereotypes act as expectancies that guide the processing of information about social groups and their members. Stereotypes can be formed directly through first hand experience or indirectly through societal impressions. Through these experiences and impressions, a person first develops beliefs about the attributes or characteristics of the target group and then, based on these beliefs, distinguishes the target group and its members from other groups (Hamilton & Sherman, 1994).

Stereotypes do not have to be consciously activated to influence judgments, but can be automatically activated and used to aid impression formation of target group members. A series of studies by Kunda, Davies, Adams, and Spencer (2002) showed that stereotypes are automatically activated by mere exposure to a target group member, but this activation quickly dissipates and the stereotype is not reactivated or explicitly applied unless the target member and the perceiver are in disagreement of opinion. For example, when Caucasian participants were exposed to an African American target, there was a greater activation for stereotypic words in a lexical decision task than when the participants were shown a target of the same race. Yet participants did not explicitly

apply the stereotype when evaluating the target in a trait characteristic checklist even when the target individual had prompted the stereotype activation.

To see if participants would implicitly apply the stereotype to the target individual, Kunda et al. (2002) followed the same procedure as before but added a predictive judgment task. The logic of the predictive judgment task is as follows. If Caucasian participants observed a target of the *same* race with disagreeing opinions, they would use this new information when predicting the opinion of a new target of the same race. However, if Caucasian participants observed a target of a *different* race with disagreeing opinions, they would dismiss this target's reaction because of his or her ethnicity and regard the new information as irrelevant when predicting the opinion of a new Caucasian target. The predictive judgment task revealed that Caucasian participants' impressions of the African American target were in fact formed by his or her ethnicity, even though the explicit measures did not detect any stereotype application (Kunda et al., 2002).

Stereotypes can be helpful cognitive tools for quickly perceiving individuals, making social judgments, and recalling social information (Bodenhausen & Wyer, 1985; Sherman, 1996) but excessive reliance on stereotypes can have many negative consequences. For instance, initial impressions are not always correct, stereotypes are usually not validated, and prejudices and biases may emerge leading to misperceptions on the part of both the target member and the perceiver. Bartlett (1932) said that for schemas to be useful, "man must be able to turn round upon his own schemata— for he learns how to utilize the constituents of his own schemes, instead of being determined to action by the schemes themselves, functioning as unbroken units," (p. 301). Stereotypes should be used in the same way, as an interpretive guide not as a determining factor. However research shows that this usage rarely occurs.

Contingency Judgment

Schemas and expectancies also affect contingency judgments, which are assessments of the degree to which two events co-vary. In much of the research on contingency judgment, the terms covariation and co-occurrence are interchangeable. Co-occurrence refers to the degree that one event occurs more often in the presence than the absence of another event which, in turn, can be used to define how the events covary (Alloy & Tabachnik, 1984). A contingency can be positive (the occurrence of one event indicates that the second event will occur), negative (the occurrence of one event indicates that the second event will not occur), or zero (the occurrence of one event is unrelated to the occurrence of the second event). The strength of the contingency is determined by how close the contingency is to the absolute value of one; that is, a perfect positive contingency would be 1.0, a perfect negative contingency would be -1.0, and the absence of a contingency would be zero. The contingency between two events is determined by the frequencies of event co-occurrences in a 2 x 2 contingency table.

Figure 1 is an example of a contingency table in which cell A represents the number of times both the cue and the outcome occurred, cell B represents the number of times the cue occurred but the outcome was absent, cell C represents the number of times the cue was absent but the outcome occurred, and cell D represents the number of times both the cue and outcome were absent (see Appendix A for more examples of contingency tables). The actual contingency can be found by using the following formula: $(A / (A+B)) - (C / (C+D))$ or $\Delta P = P(\text{cue}/\text{outcome}) - P(\text{cue}/\text{no outcome})$.

Cue	Outcome	
	O	~O
C	A	B
~C	C	D

Figure 1. Example of a 2 x 2 contingency table.

Alloy and Tabachnik (1984) created an interactional theoretical framework to explain how prior expectancies affect contingency judgments. According to Alloy and Tabachnik's model, one of five things may occur when a person is required to make a judgment for which he or she has some pre-existing belief or prior expectancy. If both the expectancy and the current situational information are weak, the person making the judgment will either abstain from making any assessment of covariation or will do so with very little confidence. When the expectancy is strong and the current situational information is weak, the judgment will be made in line with the person's expectancy. Likewise, if the expectancy is weak and the current situational information is strong, the judgment will reflect the situational information. However, when the expectancy and the current situational information are both strong, one of two things could happen. First, if the two sources of information match or are congruent, the judgment made will be consistent with this information and will be made with high confidence. In contrast, when the expectancy and the current situational information do not match or are incongruent, the individual is faced with a cognitive dilemma. When this occurs the individual's judgment will be based on the comparative strengths of the conflicting information sources. For example, if the person's expectancy is strong, but he or she does not feel that the incongruent current situational information comes from a reliable source, the judgment will be made in line with the expectancy. Whereas, if the person believes that the current source of information is more reliable than the expectancy, the judgment will be made in accordance to the current situational information. The relative strength of both the expectancy and the current situational information interact in the

same way, whether the actual contingency is positive, negative, or zero (Alloy & Tabachnik, 1984).

This model implies that when a person is faced with a cognitive dilemma, the individual will often try to resolve this dilemma by making the judgment in the direction of his or her prior expectancies. In this way, contingency assessments can be distorted based on pre-existing beliefs or expectancies. A key example of expectancy-based distortions in contingency judgment is a bias known as illusory correlation. Specifically, illusory correlation is a systematic error in which a person judges two events to be related when in fact they may not be related, may be related to a lesser degree than believed, or may be related in the opposite direction (Chapman & Chapman, 1967).

Chapman and Chapman (1967) conducted several studies of illusory correlation after they observed that clinicians continued to maintain the belief that certain symptoms were related to performance on the Draw-a-Person Test even when research had failed to substantiate these beliefs. For instance, clinicians would often conclude that a drawing depicting a person with a small head implied low intelligence or a picture with enlarged eyes indicated paranoia even when empirical data did not support these associations. To see if untrained individuals would make the same erroneous judgments, Chapman and Chapman asked college students' to review the Draw-a-Person Test under various conditions. They found that illusory correlation persisted even after repeated exposure to stimulus materials under conditions designed to maximize motivation, and the stability of the illusory correlation seemed to be consistent for both clinicians and college students. Starr and Katkin (1969) also observed that both untrained individuals and clinicians showed an illusory correlation bias on the Rotter Incomplete Sentence Blank.

Golding and Rorer (1972) conducted an illusory correlation study similar to Chapman and Chapman (1967) except they used Rorschach cards in order to examine the illusory correlation for the associations of homosexual behavior with anal response. The illusory correlation bias was measured both before and after training in which no relationship between homosexual behavior and anal response existed. The training sessions varied based on the manipulation of simultaneous or prediction feedback, the inclusion of all possible event pair contingencies, and varying the direction and magnitude of the actual contingencies based on the symptom base-rate presentation. The experimenters predicted that the illusory correlation between homosexual behavior and anal response would disappear or be reduced after training with predictive feedback, when different behavior-response pairs had a stronger contingency than the expected pair, and when the base rates were equal for the occurrence of all symptoms. Although, the illusory correlation was reduced, it did not significantly change between pre- and post-training in any condition. Golding and Rorer concluded that even though participants slightly revised their judgments post training, the illusory correlation was still present and relatively resistant to change.

Although much of the early research on illusory correlation focused on projective tests, illusory correlations have also been linked to stereotypic judgments. When an illusory correlation is based on negatively valued traits, it is usually referred to as a prejudice; when an illusory correlation is based on positively valued social traits, it is referred to as the halo effect (Chapman, 1967). For example, Spears, Eiser, and Van Der Pligt (1987) showed the stereotypic belief that smaller towns would be more opposed to nuclear power than larger towns biased a perceiver's judgments about the relationship

between town size and nuclear power when no actual relationship between these variables existed. They concluded that expectation-based illusory correlation biases in judgment reveal the resistance of prior beliefs to change in the face of actual conflicting data.

Aging and Expectancy

The research reviewed in the previous sections has focused on the influence of schemas and prior expectancies in the memory and judgment processes of young adults. There is also a large body of research on the influence of schematic knowledge in older adults' cognition.

In a review of schematic influences on the memory of older adults, Hess (1990) concluded that the supportive functions of schemas are more important in determining memory performance in older adults compared to young adults. More specifically, the performance differences between young and older adults' memory are particularly pronounced in situations that rely on data-driven processing for current situational information and minimal in situations that depend more on schema driven processing (Hess, 1990). For example, in Hess and Slaughter's (1990) studies on the influence of schemas in memory for scenes, older adults' accuracy for to-be-remembered items was more dependent on available schematic structure than that of young adults.

Yet, not all studies agree with Hess's (1990) conclusions that schemas impact older adults' memory more than that of young adults. Light and Anderson (1983) found no age-related differences in reliance on scripts in memory. Scripts are schemas for ordinary sequential steps taken in common activities. They tested both young and older adults to see if there would be discrepancies in memory for typical scripted activities.

Although older adults' memory in general was poorer than young adults, older adults had little difficulty integrating this new information with prior knowledge.

Hess (1985) attributed the differences between his studies on aging and schema reliance and the findings of Light and Anderson (1983) to the low reliability of the memory measure used in the Light and Anderson study and to the fact that the older population used in the study was highly educated. In addition, the new information used in the Light and Anderson study matched the expectancy held by both young and older adults. Thus, the Light and Anderson results can be generalized only to situations in which expectancy and current situational information are congruent.

Older adults also show a greater dependence on schemas to make social judgments. Hess and Follett (1994) examined the effects of aging on social judgments concerning the reliance on new information versus schematic information. Participants read a short vignette about a fictitious person. They then were shown a series of traits that were used by others to describe the fictitious person and afterwards were asked to give frequency estimates of the traits that they had just observed. Finally, they were asked to rate the likelihood that the person would perform certain trait consistent or inconsistent behaviors and to give a character judgment of the person. They found that both young and older adults relied on previously activated schematic information when making character judgments. Likewise, no age-related differences or schema-related intrusion effects were found for memory recall of frequency estimates of trait presentations. However, when participants were asked to make behavior predictions based on the previously viewed trait information, older adults relied more on schematic factors and younger adults relied on the actual frequency of the current information.

The interesting aspect of Hess and Follett's (1994) study is that age differences in recall of the situational information and the influence of schemas on recall were almost nonexistent, but older adults inevitably based their judgments on schematic information. Older adults could accurately remember the frequencies of the trait information presented but apparently did not use this information when making judgments. Other studies have shown that older adults are more likely to make social judgments consistent with their expectancies even after they have been presented with additional inconsistent information (Hess & Pullen, 1994; Hess, et al., 1987). Hess (1994) concluded that an age-related decline in cognitive ability (e.g., encoding operations, cognitive resources, situational constraints, and inhibition processes) limits the information used in judgment to that which is easily accessed in memory.

Aging and Contingency Judgment

If Hess's (1990) conclusion that older adults rely more on schematic knowledge in memory and social judgments is correct, older adults should also be more susceptible to illusory correlation in contingency judgment. This is in fact what Mutter and Pliske (1994) found when they compared young and older adults' judgment performance in an illusory correlation study similar to those of Chapman and Chapman (1967) and Golding and Rorer (1972). They matched four behaviors (homosexual, paranoid, inferiority feelings, or depression) with four Rorschach card responses (monstrous, food, anal, or geography). In baseline co-occurrence judgments both young and older adults judged that homosexual behavior and anal responses were related. Participants were then shown a series of event pairs in which the homosexual-anal behavior-response pair was not correlated (Exp. 1) or a series of event pairs in which this behavior was related to a

different response (Exp. 2). Both young and older adults' judgments after the event pair presentation showed an illusory correlation existed, illustrating the robustness of the illusory correlation bias in the face of disconfirming situational information. However, when the target-behavior was paired with an unexpected-response and presented as having a salient contingency, young adults modified their judgment reducing the illusory correlation while older adults' judgments showed less change (Exp. 2). In addition, older adults' memory for expectancy confirming evidence (i.e., homosexual behavior and anal response) was more accurate than their memory for disconfirming evidence (i.e., homosexual behavior and monstrous response), but young adults showed no differences in memory. Thus it seems that older adults are more inclined to illusory correlation biases and are less likely to revise their judgments in the face of disconfirming information regardless of the salience of the new evidence (Mutter & Pliske, 1994).

Current Study

Mutter and Pliske's (1994) findings suggest older adults may rely on prior expectancies more than young adults when making judgments and may be less likely to adjust their judgments based on current situational information. However, their study of aging and illusory correlation only examined differences in young and older adults' judgments under conditions of cognitive dilemmas, or when prior expectancy and situational information conflict, and when the expectancy was strong and the current situational information was weak. To date, it is unknown how aging will affect judgment in conditions in which both expectancy and current situational information are weak, when both expectancy and current situational information are strong, or when expectancy is weak but current situational information is strong. The purpose of the current study

therefore was to examine age differences in contingency judgment for all possible expectancy and current information interactions proposed in the framework by Alloy and Tabachnik (1984).

Two studies with young adults have looked at some of these interactions. Trolier and Hamilton (1986) tested young adults' judgment accuracy when the form of stimulus information, the actual contingency, and the prior expectancy of contingency were manipulated. The stimulus information or event pairs to be judged were either in continuous form (continuous condition), binary or categorical form (binary condition), or in continuous form but treated as categorical (mixed condition). The actual contingency of the event pairs was either highly positive (0.73) or near zero (0.06). Three expectancy conditions were manipulated using event pairs expected to be highly related and meaningful (i.e., height and weight), unrelated and meaningful (i.e., age and size of residing town), or abstract and having no prior expectancy (i.e., pairs of two- or three-digit numbers). To ensure that the expectancy of the meaningful event pairs was universally perceived as related in the appropriate direction, 18 event pairs were piloted. An independent sample of young adults was asked to give estimates of contingency for the event pairs on a scale ranging from positive 1.00 to negative 1.00 and to rate their confidence of these estimates on a 10-point scale. The event pairs were selected for use based on achievement of the appropriate median expected contingency and accompanying high confidence ratings.

For their experiment, participants were given brief instructions on the general nature of contingencies and were then shown a series of sentences containing information on the correlation between the events pairs. After viewing this information, participants

were asked to give a direct estimate of contingency, frequency estimates for each event pair in the 2 x 2 contingency table, and a confidence rating of their estimates. The participants' frequency estimates were placed in a 2 x 2 contingency table, a phi coefficient was calculated and transformed into a Fisher's Z score, and the resulting value was used as a derived estimate of contingency. Direct and derived measures of estimated contingency were used in order to compare each measure's sensitivity to the effects of expectancy and current situational information on judgment.

As might be expected, direct and derived measures of contingency were significantly higher for pairs expected to be related than for pairs not expected to be related and were lowest for problems that had no associated prior expectancy (Troler & Hamilton, 1986). Likewise, if an expectancy was present, participants rated their estimates on those problems with more confidence. In addition, when current situational information and expectancy were incongruent, participants were more likely to rate the event pairs as related than in cases where no expectancy existed. Clearly judgments were affected by expectancy. However, Troler and Hamilton did not look at negative expectancies and negative contingency. Also, in the "don't know" expectancy condition, the variables were not meaningful and thus could not be directly compared to the other expectancy conditions.

These problems were eliminated in a study by Billman, Bornstein, and Richards (1992) by combining positive, negative, unrelated, and unknown expectancies of meaningful event pairs with actual positive, negative, and zero contingency. They used piloting procedures similar to those of Troler and Hamilton (1986) to ensure that participants commonly held the co-occurrence expectancies of the event pairs chosen.

They then arranged these event pairs in such a way that 15 observations of the event pairs represented either a positive 0.50, negative 0.50, or zero contingency. Participants first gave a baseline estimate of contingency to confirm that they held the expectancy in the direction intended by the experimenters. Then the event pair co-occurrences were shown in two different data sets, one data set always represented a 0.00 contingency and was paired with a data set with either a -0.50 or 0.50 contingency. After the participants were shown the two data sets they were asked half of the time to give a contingency estimate for each data set and for the other half of the time were asked to choose which of the two data sets showed a stronger contingency.

Overall, the results were similar to past studies in that the nature of the prior belief altered the participants' assessment of the current situational information in the expected direction. For example, participants judged the events as being more positively related when the expectancy was positive and more negatively related when the expectancy was negative, relative to the judgments in the unrelated or unknown expectancy (Billman et al., 1992). The most biasing expectancy was a belief that the events were unrelated, because it attenuated all estimates towards zero when the contingency was actually positive 0.50 or negative 0.50. Thus, not all expectancies affect judgment in the same way; having an unknown expectancy between independently meaningful variables provided the most accurate judgments, while the belief in no relation affects covariation assessment the most.

The procedures used in the Troler and Hamilton (1986) and Billman et al. (1992) studies were combined in the current study to examine the effects of prior expectancies on young and older adults' contingency judgments. The co-occurring event pairs

selected for use were presented in the same manner as those in Trolier and Hamilton and represented either a negative 0.50, a zero, or a positive 0.50 contingency. As in Billman et al., four different expectancy types (positive, negative, unrelated, and unknown) and three different contingencies (negative, zero, and positive) were fully crossed to examine age differences in judgment for all combinations of expectancy and situational information in Alloy and Tabachnik's (1984) interactional theoretical model. For example, strong (belief in positive, negative, or unrelated) and weak (unknown belief) expectancies were examined when the current situational information was either strong (positive 0.50 or negative 0.50 contingency) or weak (0.00 contingency).

To measure the interaction of expectancy and current situational information, both young and older adults were asked to give an initial baseline contingency estimate for each event pair and rate their confidence of this judgment. They were then asked to make a second contingency estimate and confidence rating after viewing statements representing the four types of event pair combinations in the 2 x 2 contingency table. Lastly, the participants were asked to estimate the frequency of occurrence of the event pair combinations shown during the statement presentation. The frequency estimates were used to calculate a derived estimate of contingency. Derived contingency estimates may be more accurate than direct estimates of contingency because derived estimates are based on the simpler task of giving frequency estimates.

In terms of Alloy and Tabachnik's (1984) theoretical framework, the most prominent age difference in contingency judgment was expected to occur when both expectancy and current situational information were strong and incongruent. As in the illusory correlation study by Mutter and Pliske (1994), when faced with a cognitive

dilemma, older adults should be more likely to bias their judgments in the direction of their expectancy and less likely to revise this judgment when presented with incongruent situational information. On the other hand, Mutter and Pliske (1994) found no age-related differences when the expectancy was strong but the current situational information was weak. Age-related differences were predicted to disappear when expectancy and situational information were both congruent, as in the Light and Anderson (1983) study. Likewise, young and older adults' judgments were not expected to differ when the expectancy was weak but the current situational information was strong. In all conditions young adults were expected to be more accurate in their judgments when compared to older adults (Mutter & Pliske, 1996)

Chapter 3

Method

Participants

Twenty-four young adults with ages ranging from 18 to 30 years old were recruited from psychology classes. Twenty-four older adults, 60 years of age or older, were recruited from the community via mass mail-outs and advertisements. The young adults received course credit and a gift certificate to the university bookstore for their participation. The older adults were paid a monetary stipend for their participation. Biographical data (age, race, gender, years of education, and marital status) and cognitive ability (verbal knowledge, perceptual speed, and working memory executive functioning) data were collected for both age groups as shown in Table 1. As is typical in aging research, younger adults showed significantly greater perceptual speed (digit symbol) and working memory executive functioning (reading span) than older adults.

Participants who reported current use of medications known to affect cognitive ability or who suffered from any neurological or psychological impairment were excluded from the study. As a result, three young adults and two older adults were not permitted to complete the study because of reported usage of medications known to affect cognitive ability.

Table 1.

Participant Characteristics

Characteristic	Young Adults	Older Adults
Age ^a	19.21 (1.53)	71.54 (5.32)
Race	1 African American 23 Caucasians	2 African Americans 22 Caucasians
Gender	9 males; 15 females	7 males; 17 females
Education ^a	13.33 (1.58)	13.63 (3.06)
Marital Status	23 single; 1 married	16 married; 4 divorced; 4 widowed
Vocabulary ^b	30.04 (6.03)	33.45 (9.41)
Digit Symbol ^{b***}	88.13 (11.44)	52.48 (11.59)
Reading Span ^{b***}	3.04 (1.61)	1.61 (0.89)

Note. Values enclosed in parentheses represent mean square errors. ^aAge and Education represent average years. ^bVocabulary, Digit Symbol, and Reading Span represent average test score. *** $p \leq .001$

Design and Materials

A 2 (Age: Young vs. Old) x 4 (Expectancy: Positive vs. Negative vs. Unknown vs. Unrelated) x 3 (Contingency: -0.50 vs. 0.00 vs. +0.50) mixed factorial design with repeated measures on expectancy and contingency was used. To control for order effects, variables were counterbalanced by actual contingency, contingency table data set, expectancy, and expectancy context using the randomized Latin-square design shown in Appendix B. Two participants from each age group were randomly assigned to each counterbalancing order. Participants completed twelve contingency judgment problems representing all combinations of expectancy and contingency.

Three different event pair contexts for each expectancy and four different data sets for each contingency were used because these variables were measured using a within-subject design. For each of the three contingency values, four contingency table data sets were randomly selected from all possible 2 x 2 contingency tables (with marginal outcome totals of 6 and 18, 8 and 16, and 12 and 12). See Appendix A for a list of the contingency tables selected for each contingency.

Event pair contexts for each expectancy were obtained by pilot testing for both age groups to determine the direction and magnitude of various event relationships. The pilot test procedures were modeled after those used by Troler and Hamilton (1986). Twenty young and 20 older adults were shown 76 different event pairs, which experimenters believed represented either a positive, negative, unrelated, or unknown expectancy. Some of the event pairs selected were originally used in the study conducted by Billman et al. (1992) and the experimenters generated the others. The participants were asked to estimate the contingency for the event pairs using a scale ranging from +100 to -100. They were also asked to rate their confidence in their estimates on a scale ranging from 1 (not very confident) to 10 (very confident). The pairs were then rank ordered based on the median estimates of contingency and mean confidence estimates for each age group. The top three event pairs for each expectancy were selected. Median contingency and mean confidence estimates in both age groups for the pairs selected can be seen in Table 2.

Table 2.

Median Contingency Estimates and Mean Confidence Ratings for Event Pairs Selected

Event Pair	Young Adult Estimate	Young Adult Confidence	Older Adult Estimate	Older Adult Confidence
Smoking cigarettes and lung cancer	0.8	8.9	0.8	9.3
Caloric intake and body weight	0.7	8.5	0.9	9.0
Number of credit cards and amount of credit debt	0.6	7.7	0.6	8.3
Height and college grade point average	0.0	8.9	0.0	8.3
Number of movies attended and red meat consumption	0.0	8.0	0.0	8.3
Finger length and sexual orientation	0.0	7.9	0.0	7.5
Percent of body fat and red blood cell count	0.0	6.2	0.0	6.3
Daily calcium intake and average resting pulse	0.0	6.1	0.0	6.7
Silicon content and rock density	0.0	3.8	0.0	5.4
Anger and compassion	-0.4	7.0	-0.4	7.6
Church attendance and prison sentence	-0.5	7.2	-0.3	7.4
Amount of television watched and number of books read	-0.6	7.6	-0.6	8.0

Based on the pilot data, it was concluded that both young and older adults hold similar expectancies of contingency between the event pairs selected. The positive, negative, and unrelated expectancy conditions contained pairs of meaningful variables in

which subjects had a specific expectation about the nature of the relationship; the unknown expectancy variables were independently meaningful but subjects were uncertain about whether the event pairs were related (Billman, Bornstein, & Richards, 1992).

Procedure

Participants were tested individually in two, three-hour sessions, which were completed within seven days of each other. All testing was conducted in the Cognition Laboratory or similar experimental room. Some tasks were completed on a Macintosh computer and some were completed using a pencil and paper. The procedure for young and older adults was the same.

Participants first completed an informed consent form and filled out a biographical and health questionnaire. Before any testing began, participants were given an opportunity to ask questions or voice concerns. They were then seated in front of the computer and asked to read general instructions concerning the nature of contingency and how example events were related in strength and direction. Participants then completed an example problem followed by the 12 contingency judgment problems. For each problem, participants were shown a short vignette introducing the two events to be judged. They were asked to give a baseline judgment of the relationship between the events using a scale ranging from zero (no relationship) to 100 (perfect relationship) and to check the corresponding direction (positive or negative). They then rated the confidence of their estimate on a scale ranging from 1 (not at all confident) to 10 (very confident). After completing the baseline measures participants were shown 24 statements, each of which presented one of the four event pair combinations in the 2 x 2

contingency table (i.e., XY is a smoker and does have lung cancer; XY is a nonsmoker and does have lung cancer; XY is a smoker and does not have lung cancer; or XY is a nonsmoker and does not have lung cancer). These statements provided current situational information about the co-occurrence of the two events, which were either a negative 0.50, a zero, or a positive 0.50 contingency. Statements were presented at the rate of one statement every four seconds.

After viewing all of the statements, participants were required to make a second estimate of the event pair relationship and confidence rating using the same scales as before. However, it was emphasized that this estimate should be based solely on the information provided by the statements that had just been seen. Lastly, they were asked to estimate the frequency of occurrence for each of the four event pair combinations seen during the statement presentation.

Once the participants completed the example problem, the experimenter provided the correct answers to the example questions and clarified any remaining questions concerning the procedure. Participants then completed the 12 contingency judgment problems in the order determined by the counterbalancing procedures. For the purpose of measuring individual differences, participants were then given additional tasks measuring verbal knowledge (Mill Hill Vocabulary Test), perceptual speed [WAIS-III Digit Symbol (Wechsler, 1997)], and working memory executive functioning [Reading Span (Salthouse & Babcock, 1991)]. After completing the cognitive ability tasks, participants were debriefed, given the opportunity to ask questions, and compensated for their time.

Chapter 4

Results

The following dependent measures were collected for all 12 contingency problems: baseline estimates of contingency, direct estimates of contingency, confidence ratings for both baseline and direct contingency estimates, and frequency estimates for each cell in the 2 x 2 contingency table. These frequency estimates were used to compute a derived estimate of contingency based on the formula for contingency [$\Delta P = P(O/C) - P(O/\sim C)$]. Factorial analyses of variance (ANOVA) for age, expectancy, and contingency were conducted for each dependent measure. All effects reported as significant reached a criterion of $p \leq .05$ or better, unless otherwise noted.

Despite the piloting procedures used to ensure that young and older adults' baseline expectancies for the contingency problems were the same and that these expectancies were in the direction intended by the experimenters, 10.4% of the reported baseline estimates of contingency across both age groups did not follow the direction intended by the experimenters. However, young (4% positive, 8% negative, 15%, unrelated, and 17% unknown) and older (3% positive, 10% negative, 10%, unrelated, and 17% unknown) adults' baseline estimates were similarly miscategorized for each expectancy. Moreover, no single event pair stood out as being miscategorized more than any of the others. The miscategorized baseline estimates were lower in these data than reported by Billman, Bornstein, and Richards (1992), who found that 31% of their participants' overall baseline estimates differed from the direction intended. They handled this discrepancy by recoding the participants' baseline estimate of contingency to match their expectancy. I also recoded the data so that the participants' reported

expectancy corresponded with the expectancy condition. Specifically, any baseline estimates deviating from the following criteria were recoded: positive expectancy – event pairs with an estimated contingency greater than zero; negative expectancy – event pairs with an estimated contingency less than or equal to 0.30; unrelated expectancy – event pairs with an estimated contingency between -0.20 and $+0.20$; and unknown expectancy – event pairs with an estimated contingency at or between -0.50 and $+0.50$. By recoding the data I, in turn, had to change the design from a mixed factorial design with repeated measures on expectancy and contingency to a between subjects design for age, expectancy, and contingency to avoid having to drop a large part of the data.

Baseline Estimates of Contingency and Confidence Ratings

Mean baseline contingency estimates and confidence ratings can be seen in Table 3 for each of the four expectancy conditions: positive, negative, unrelated, and unknown. A $2(\text{Age}) \times 4(\text{Expectancy}) \times 3(\text{Contingency})$ ANOVA for the baseline estimates was conducted to determine if, after recoding, these estimates were in the direction of the expectancy and to assure that these estimates were not different for young and older adults. There was a main effect of expectancy, $F(3, 552) = 742.968$, $MSE = .053$, $\eta^2 = .802$, indicating that the type of expectancy affected baseline estimates of contingency. The main effects of age, $F(1, 552) = .437$, $\eta^2 = .001$, and contingency, $F(2, 552) = .689$, $\eta^2 = .002$, were not significant, nor were the interactions between age and expectancy, $F(3, 552) = .783$, $\eta^2 = .004$, age and contingency, $F(2, 552) = .583$, $\eta^2 = .002$, expectancy and contingency, $F(6, 552) = .1268$, $\eta^2 = .014$, and age, expectancy, and contingency, $F(6, 552) = .756$, $\eta^2 = .008$.

To explore the impact of expectancy on the baseline estimates, planned comparisons were conducted for each of the following expectancy combinations: positive vs. unknown, negative vs. unknown, and unrelated vs. unknown. These analyses revealed that overall contingency estimates were significantly greater when the expectancy was positive ($M = .731, SE = .002$) than estimates when the expectancy was unknown ($M = -.002, SE = .003$), $F(1, 552) = 698.301, MSE = .053$. Overall estimates were significantly lower when the expectancy was negative ($M = -.461, SE = .004$) than estimates when the expectancy was unknown, $F(1, 552) = 284.019, MSE = .053$. However, overall estimates were not different when the expectancy was unrelated ($M = 0.00, SE = .000$) than estimates when the expectancy was unknown, $F(1, 552) = 0.091, MSE = .053$.

As expected, both young and older adults' baseline estimates were higher when the expectancy was positive, lowest when the expectancy was negative, and close to zero when the expectancy was unrelated or unknown. There was little or no difference between the baseline estimates of contingency of young and older adults. Thus, young and older adults had similar expectancies, and this outcome was the same across contingency. Likewise, the baseline mean estimate for each expectancy was very close to the pilot data mean estimate for each expectancy.

A 2(Age) x 4(Expectancy) x 3(Contingency) factorial ANOVA was conducted for the confidence ratings for baseline contingency estimates. The main effect of age was significant, $F(1, 552) = 45.303, MSE = 6.086, \eta^2 = .076$, revealing that older adults' ($M = 7.188, SE = .172$) baseline confidence ratings were significantly higher than young adults' ratings ($M = 5.774, SE = .137$). There was also a main effect of expectancy, $F(3,$

552) = 31.016, $\eta^2 = .144$, and post hoc analyses, collapsed across and contingency, showed that when the expectancy was positive ($M = 8.154$, $SE = .225$) confidence ratings were significantly higher than ratings when the expectancies were negative ($M = 7.200$, $SE = .300$) and unknown ($M = 5.458$, $SE = .432$) but were similar to ratings when the expectancy was unrelated ($M = 7.474$, $SE = .388$); ratings for negative expectancies were significantly higher than ratings for unknown expectancies but were similar to ratings for unrelated expectancies; and ratings for unrelated expectancies were significantly higher than ratings for unknown expectancies (Tukey's HSD, $p \leq .05$). As expected, the main effect of contingency was not significant, $F(2, 552) = 1.647$, $\eta^2 = .00$, nor were the interactions between age and expectancy, $F(3, 552) = .236$, $\eta^2 = .001$, age and contingency, $F(2, 552) = .661$, $\eta^2 = .002$, expectancy and contingency, $F(6, 552) = 1.238$, $\eta^2 = .013$, and age, expectancy, and contingency, $F(6, 552) = .134$, $\eta^2 = .001$. Thus, older adults were generally more confident than young adults, and neither group was very confident in their estimates when they did not know the relationship.

Table 3.

Mean Baseline Estimates of Contingency and Confidence Ratings

Expectancy	Young Adults Estimate	Young Adults Confidence	Older Adults Estimate	Older Adults Confidence
Positive	.691 (.021)	6.66 (.193)	.731 (.021)	8.15 (.225)
Negative	-.494 (.033)	5.66 (.234)	-.461 (.044)	7.20 (.300)
Unrelated	.000 (.007)	6.40 (.330)	-.000 (.002)	7.47 (.388)
Unknown	.008 (.031)	3.97 (.258)	-.024 (.027)	5.46 (.432)

**Note.* Values enclosed in parentheses represent mean square errors.

Direct Estimates of Contingency and Confidence Ratings

A 2(Age) x 4(Expectancy) x 3(Contingency) factorial ANOVA was conducted for the direct estimates of contingency. These data can be seen in Figure 2. There were significant main effects of: age, $F(1, 552) = 11.583$, $MSE = .20$, $\eta^2 = .021$, showing that overall older adults' estimates were greater than young adults' estimates; expectancy, $F(3, 552) = 34.747$, $\eta^2 = .159$, indicating that the type of expectancy affected estimates differently; and contingency, $F(2, 552) = 51.951$, $\eta^2 = .158$, showing that estimates varied by contingency. The interaction between expectancy and contingency was not significant, $F(6, 552) = .935$, $\eta^2 = .010$, but there were significant two-way interactions between age and expectancy, $F(3, 552) = 5.295$, $\eta^2 = .028$, and age and contingency, $F(2, 552) = 4.733$, $\eta^2 = .017$, showing that the effects of expectancy and contingency on direct estimates varied for young and older adults. Moreover, these two-way interactions were qualified by a significant three-way interaction between age, expectancy, and contingency, $F(6, 552) = 2.090$, $\eta^2 = .022$.

To allow me to compare my findings with Billman et al. (1992), I first analyzed this three-way interaction by examining the simple interaction of expectancy and contingency for each age group (Keppel, 1991). For young adults, the main effects of expectancy, $F(3, 552) = 9.485$, $MSE = .20$, and contingency, $F(2, 552) = 43.435$, were significant. Polynomial contrast revealed that there was a significant linear trend of contingency, such that estimates were lowest when the contingency was negative ($M = -.3057$, $SE = .004$), closer to zero when the contingency was zero ($M = .106$, $SE = .005$), and highest when the contingency was positive ($M = .327$, $SE = .005$). There was also a significant interaction between expectancy and contingency, $F(6, 552) = 2.635$.

To explore the impact of expectancy on young adults' estimates of contingency, interaction contrasts were conducted for each of the following expectancy combinations: positive vs. unknown, negative vs. unknown, and unrelated vs. unknown. When the expectancy was positive, there were significant main effects of expectancy, $F(1, 552) = 11.64$, $MSE = 0.20$, and contingency, $F(2, 552) = 29.51$, and these effects were qualified by a significant interaction between expectancy and contingency, $F(2, 552) = 3.345$. Analysis of the simple effects of expectancy showed that the positive expectancy did not affect estimates when the contingency was negative, $F(1, 552) = .019$, $MSE = 0.20$. However, estimates were significantly affected by the positive expectancy when the contingency was zero, $F(1, 552) = 9.26$, $MSE = 0.20$, and when it was positive, $F(1, 552) = 8.89$, $MSE = 0.20$. Thus, estimates were higher for the zero and positive contingency when the expectancy was positive than when there was no expectancy.

When the expectancy was negative, the main effect of expectancy was not significant, $F(1, 552) = 1.285$, $MSE = 0.20$, but there was a significant main effect of contingency, $F(2, 552) = 19.71$, and a marginally significant interaction between expectancy and contingency, $F(2, 552) = 2.53$, $p \leq 0.10$. Analysis of the simple effects of expectancy for each contingency indicated that the negative expectancy affected young adults' estimates when the contingency was negative, $F(1, 552) = 4.545$, $MSE = 0.20$, such that estimates were lower when the expectancy was negative than when the expectancy was unknown. Thus, estimates changed in the direction of the expectancy when the contingency confirmed the expectancy. Estimates were not affected by the negative expectancy when the contingency was zero, $F(1, 552) = 1.03$, $MSE = 0.20$, or when it was positive, $F(1, 552) = 0.62$, $MSE = 0.20$.

Finally, when the expectancy was unrelated, there was a main effect of expectancy, $F(1, 552) = 4.28$, $MSE = 0.20$, indicating that overall estimates were higher when the expectancy was unrelated than when it was unknown. There was also a significant main effect of contingency, $F(3, 552) = 8.915$, such that estimates were highest when the contingency was positive and lowest when the contingency was negative. The event pairs for the unrelated expectancy were perceived as more positive than the event pairs for the unknown expectancy, but because of the nature of the unrelated expectancy, this effect cannot be attributed to an expectancy effect. Only a significant interaction between expectancy and contingency would indicate an unrelated expectancy effect. Specifically, an effect of the unrelated expectancy would produce lower estimates when the contingency is positive and higher estimates when the contingency is negative. This effect did not occur, as the interaction between expectancy and contingency was not significant, $F(2, 552) = .695$.

Young adults' estimates of contingency were significantly different when an expectancy existed than when there was no expectancy. Specifically, when the expectancy was positive, estimates were higher when the contingency confirmed the expectancy and were biased in direction of the expectancy when the contingency was zero, but were not affected by expectancy when the contingency was negative. When the expectancy was negative, estimates were lower when the contingency confirmed the expectancy, but estimates were not affected by expectancy when the contingency and the expectancy were incongruent. In general, estimates were higher when the expectancy was unrelated, but these effects cannot be attributed to the effect of expectancy because the interaction between expectancy and contingency was not significant.

For older adults, there were significant main effects of expectancy, $F(3, 552) = 30.26$, $MSE = .20$, and contingency, $F(2, 552) = 12.985$; however, the interaction between expectancy and contingency was not significant, $F(6, 552) = .429$. Polynomial contrasts for the contingency effect revealed a significant linear trend of contingency such that estimates were lowest when the contingency was negative ($M = -.003$, $SE = .055$) and highest when the contingency was positive ($M = .305$, $SE = .047$). To explore the impact of expectancy on older adults' direct estimates of contingency, planned comparisons were conducted for each of the following expectancy combinations: positive vs. unknown, negative vs. unknown, unrelated vs. unknown. These analyses revealed that across contingency, estimates were significantly greater when the expectancy was positive ($M = .551$, $SE = .046$) than estimates when the expectancy was unknown ($M = .129$, $SE = .059$), $F(1, 552) = 31.53$, $MSE = .20$. Estimates were significantly lower when the expectancy was negative ($M = -.091$, $SE = .068$) than estimates when the expectancy was unknown, $F(1, 552) = 8.105$, $MSE = .20$. Estimates were not different when the expectancy was unrelated ($M = 0.083$, $SE = .047$) than estimates when the expectancy was unknown, $F(1, 552) = 0.341$, $MSE = .20$. These results show that older adults exhibited an expectancy effect for both the positive and negative expectancies but not for the unrelated expectancy. Moreover, effects of expectancy were consistent across the three contingencies.

To further explore the age differences in the effect of expectancy, I examined the simple interaction of age by expectancy for each contingency. When the contingency was negative, there were significant main effects of age, $F(1, 552) = 17.45$, $MSE = .20$, and expectancy, $F(3, 552) = 10.595$. However, these main effects were qualified by a

significant interaction between age and expectancy, $F(3, 552) = 6.33$. Comparisons of the age effect for each expectancy showed that older adults' negative contingency estimates were significantly higher than young adults' estimates when the expectancy was positive, $F(1, 552) = 35.805$, $MSE = .20$, and when it was negative, $F(1, 552) = 5.525$, $MSE = .20$, but their estimates were not different from young adults' estimates when the expectancy was unrelated, $F(1, 552) = .161$, $MSE = .20$, or unknown, $F(1, 552) = 1.30$, $MSE = .20$. Thus older adults' estimates were more biased by the positive expectancy than young adults' estimates and although their estimates showed a significant overall effect of the negative expectancy, they lacked the strong confirmation effect for the negative expectancy that young adults exhibited.

When the contingency was zero, the main effect of age was not significant, $F(1, 552) = 3.40$, $MSE = .20$, but the main effect of expectancy was significant, $F(3, 552) = 11.75$, as was the interaction between age and expectancy, $F(3, 552) = 3.02$.

Comparisons of the age effect for each expectancy showed that older adults' estimates were again significantly higher than young adults' when the expectancy was positive, $F(1, 552) = 5.955$, $MSE = .20$, and when it was unknown, $F(1, 552) = 5.35$, $MSE = .20$, but their estimates were not different from young adults when the expectancy was negative, $F(1, 552) = 1.485$, $MSE = .20$, or unrelated, $F(1, 552) = .068$, $MSE = .20$.

Therefore, older adults showed a greater positive expectancy bias than young adults, and their estimates were generally greater than young adults' estimates when the expectancy was unknown.

Finally, when the contingency was positive, neither the main effect of age, $F(1, 552) = .022$, $MSE = .20$, nor the interaction between age and expectancy, $F(3, 552) =$

.249, $\eta^2 = .004$, was significant. However, the main effect of expectancy was significant, $F(3, 552) = 14.04$. To explore the impact of expectancy on young and older adults' direct estimates when the contingency was positive, planned comparisons were conducted for each of the following expectancy combinations: positive vs. unknown, negative vs. unknown, and unrelated vs. unknown. These analyses revealed that across age and contingency, estimates were significantly greater when the expectancy was positive, $F(1, 552) = 18.785$, $MSE = .20$, than estimates when the expectancy was unknown, but estimates were not different when the expectancy was negative, $F(1, 552) = 2.045$, $MSE = .20$, or unrelated, $F(1, 552) = 0.035$, $MSE = .20$, from estimates when the expectancy was unknown. Young and older adults showed similar expectancy effects, such that estimates for the positive contingency were higher when the expectancy was positive. Neither young or older adults showed an expectancy effect when the expectancies were negative or unrelated.

Overall, older adults' direct estimates of contingency were more affected by the positive expectancy than young adults because their estimates were greater across contingency. However when the expectancy was negative, both young and older adults' estimates showed a similar effect of expectancy, such that estimates were lower when the expectancy was negative than estimates when the expectancy was unknown. Young adults showed a marginally greater confirmation effect than older adults when the negative expectancy and the negative contingency matched. Regardless of contingency, young and older adults' estimates were not different when the expectancy was unrelated.

Table 4.

Mean Confidence Ratings for Direct Estimates of Contingency

Expectancy	Young Adults	Older Adults
Positive	6.904 (.204)	7.420 (.230)
Negative	6.474 (.239)	7.007 (.262)
Unrelated	6.040 (.267)	6.670 (.364)
Unknown	5.775 (.267)	5.450 (.387)

**Note.* Values enclosed in parentheses represent mean square errors.

A 2(Age) x 4(Expectancy) x 3(Contingency) factorial ANOVA was conducted for the confidence ratings for the direct contingency estimates. The main effects of age, $F(1, 552) = 2.748$, $MSE = 5.360$, $\eta^2 = .005$, and contingency, $F(2, 552) = .382$, $\eta^2 = .001$, were not significant, indicating that estimates did not vary across age or contingency.

However, as in the baseline confidence ratings, there was a significant main effect of expectancy, $F(3, 552) = 11.657$, $\eta^2 = .060$, and post hoc analyses revealed that when the expectancy was positive, confidence ratings were significantly higher than ratings when the expectancy was unrelated, or unknown, but were similar to ratings when the expectancy was negative; ratings were also significantly higher when the expectancy was negative than when it was unknown, but were not different from ratings when the expectancy was unrelated; and finally, ratings were higher when the expectancy was unrelated than when it was unknown (Tukey's HSD, $p \leq .05$). Interactions between age and expectancy, $F(3, 552) = 1.118$, $\eta^2 = .006$, age and contingency, $F(2, 552) = .009$, $\eta^2 = .00$, expectancy and contingency, $F(6, 552) = 2.001$, $\eta^2 = .021$, and age, expectancy, and contingency, $F(6, 552) = .921$, $\eta^2 = .010$, were not significant. Overall, people were

again more confident of their estimates when they had an expectancy than when they did not. These confidence ratings therefore resemble the baseline confidence ratings with the exception that older adults' ratings were no longer greater than those of young adults.

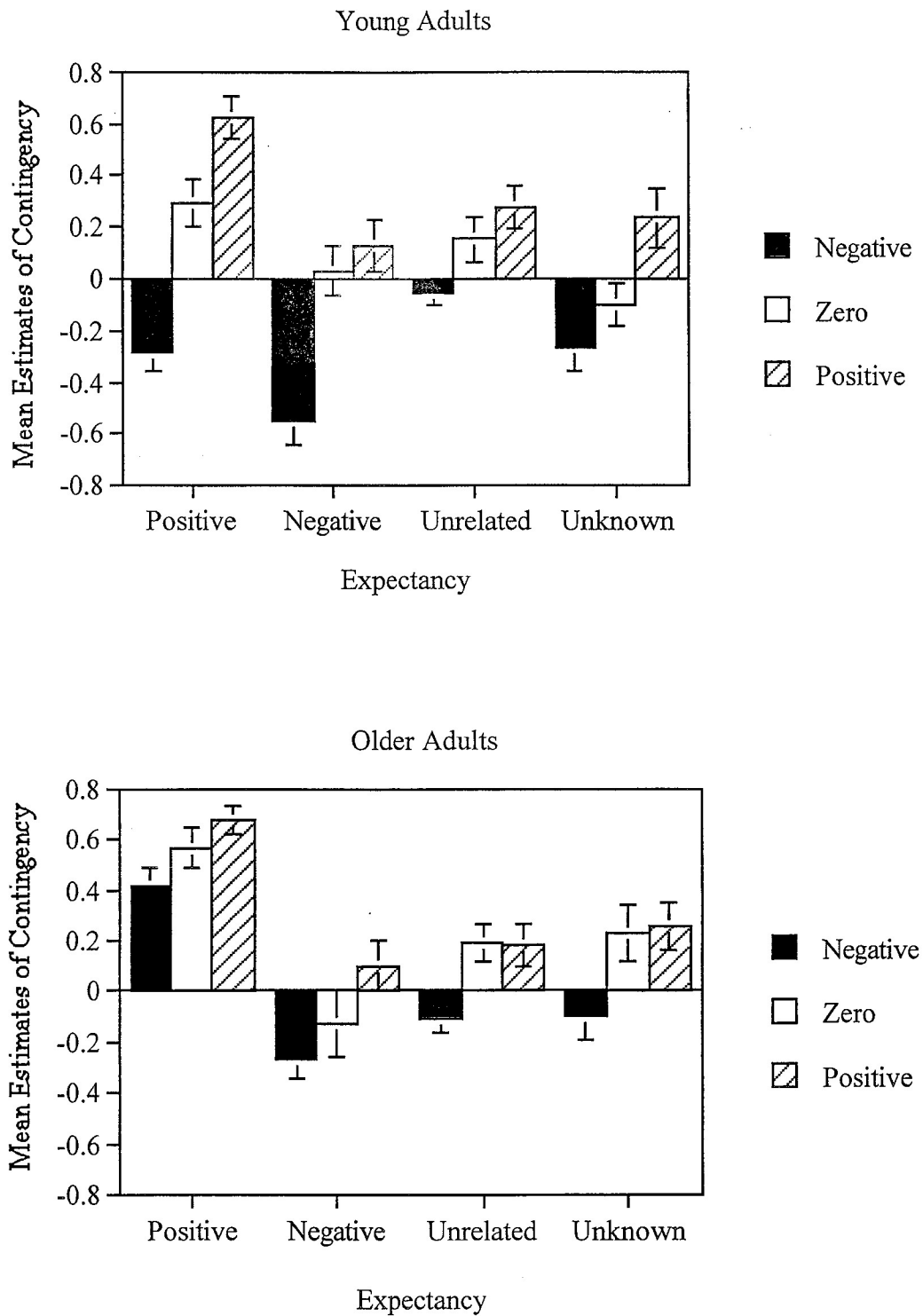


Figure 2. Mean estimates of contingency for young and older adults for each contingency and expectancy. Note that the actual contingency was -0.50, 0.00, or +0.50.

Derived Estimates of Contingency

For each contingency problem, participants reported frequency estimates of the event pair combinations in the 2 x 2 contingency table. These frequency estimates were then used to compute conditional probabilities based on the following formula: $P(O/C) = CO/(CO+C\sim O)$ and $P(O/\sim C) = \sim CO/(\sim CO + \sim C\sim O)$. The derived estimate of contingency was the difference between these two conditional probabilities [$\Delta P = P(O/C) - P(O/\sim C)$]. These data can be seen in Figure 3.

A 2(Age) x 4(Expectancy) x 3(Contingency) factorial ANOVA was conducted for the derived estimates of contingency. The main effect of age was not significant, $F(1, 550) = .125$, $MSE = .052$, $\eta^2 = .00$; however, there was a significant main effect of expectancy, $F(3, 550) = 9.558$, $\eta^2 = .050$, indicating that estimates were affected by expectancy, as well as a significant main effect of contingency, $F(2, 550) = 214.417$, $\eta^2 = .438$, indicating that estimates varied by contingency. The interaction between expectancy and contingency was not significant, $F(6, 550) = .1724$, $\eta^2 = .018$, but there was a significant interaction between age and expectancy, $F(3, 550) = 7.660$, $\eta^2 = .042$, as well as a significant interaction between age and contingency, $F(2, 550) = 31.863$, $MSE = .052$. The three-way interaction of age, expectancy, and contingency was not significant, $F(6, 550) = .830$.

To explore the two-way interaction between age and contingency, analyses of the simple effects of contingency were conducted for young and older adults. For young adults, there was an effect of contingency, $F(2, 550) = 216.885$, $MSE = .052$, and polynomial contrasts revealed that there was a significant linear trend of contingency. Specifically, young adults' estimates were lowest when the contingency was negative

($M = -.290$, $SE = .024$), close to zero when the contingency was zero ($M = -.003$, $SE = .024$), and highest when the contingency was positive ($M = .379$, $SE = .023$). Likewise, there was an effect of contingency for older adults, $F(2, 550) = 42.73$, $MSE = .052$, and polynomial contrast revealed that there was a significant linear trend of contingency. Specifically, older adults' estimates were lowest when the contingency was negative ($M = -.120$, $SE = .023$), close to zero when the contingency was zero ($M = .045$, $SE = .024$), and highest when the contingency was positive ($M = .181$, $SE = .023$). However, the slope of the linear trend for young adults ($R^2 = 0.598$) was steeper than the older adults' slope ($R^2 = 0.212$), showing that young adults derived estimates of contingency were more accurate.

To explore the interaction between age and expectancy, simple effects of expectancy were examined for young and older adults. For young adults, there was a significant effect of expectancy, $F(3, 550) = 6.269$, $MSE = .052$, indicating that young adults' estimates were affected by expectancy. To determine where this expectancy effect had occurred, planned comparisons comparing expectancy conditions (positive, negative, unrelated) with the unknown expectancy condition were conducted. These analyses revealed that expectancy did not affect the young adults' estimates when the expectancy was positive, $F(1, 550) = .027$, $MSE = .052$, or when it was negative, $F(1, 550) = .528$, $MSE = .052$. However, when the expectancy was unrelated, young adults' estimates were affected by expectancy, $F(1, 550) = 9.50$, $MSE = .052$, such that estimates were greater when the expectancy was unrelated than estimates when the expectancy was unknown. Again, this effect cannot be attributed to the unrelated expectancy because the interaction between expectancy and contingency was not significant. As seen in the

young adults' direct estimates, the derived estimates were significantly higher when the expectancy was unrelated than when there was no expectancy.

For older adults, there was a significant effect of expectancy, $F(3, 550) = 12.577$, $MSE = .052$, indicating that older adults' estimates were affected by expectancy. To determine where this expectancy effect occurred, planned comparisons of each expectancy condition (positive, negative, unrelated) with the unknown expectancy condition were conducted. These analyses revealed that expectancy did not affect the older adults' estimates when the expectancy was positive, $F(1, 550) = 1.43$, $MSE = .052$, or unrelated, $F(1, 550) = 3.615$, $MSE = .052$. However, older adults' estimates were affected by the negative expectancy, $F(1, 550) = 9.50$, $MSE = .052$. Specifically, their estimates were significantly lower when the expectancy was negative ($M = -.079$, $SE = .028$) than when there was no expectancy ($M = .085$, $SE = .038$).

The direct estimates of contingency were more sensitive to expectancy effects than derived estimates of contingency. In young adults' derived estimates of contingency, only the unrelated expectancy differed from the unknown expectancy. Again this finding is not an effect of the unrelated expectancy because the interaction between the unrelated expectancy and contingency was not significant. Therefore, young adults' derived estimates of contingency were not affected by expectancy, but their direct estimates of contingency were affected by the positive and negative expectancies. Likewise, the positive expectancy no longer affected older adults' estimates of derived contingency the way it had their direct estimates of contingency. However, the negative expectancy still affected both their direct and derived estimates of contingency.

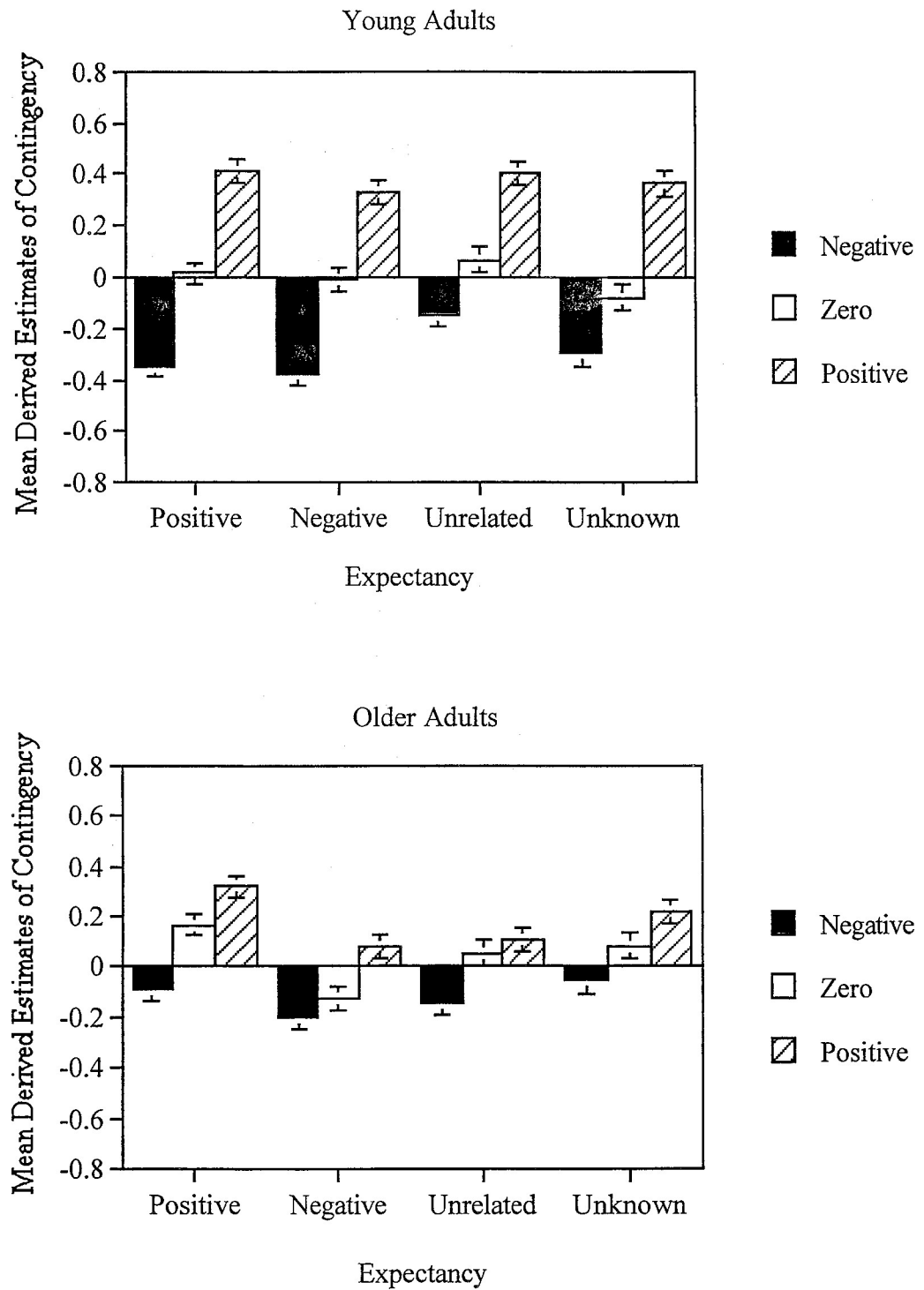


Figure 3. Mean derived estimates of contingency for young and older adults for each contingency and expectancy. Note that the derived estimates of contingency were based on the participants' frequency estimates.

Chapter 5

Discussion

The purpose of the current study was to examine age differences in contingency judgment for all possible interactions between expectancy and current situational information proposed in the framework by Alloy and Tabachnik (1984). The most prominent age difference in judgment was expected to occur when both expectancy and current situational information were strong and incongruent. As in the illusory correlation study by Mutter and Pliske (1994), older adults were expected to bias their judgments in the direction of their expectancy and be less likely to revise this judgment when presented with incongruent situational information. However, no age-related differences were expected when the expectancy was strong but the current situational information was weak. Likewise, age-related differences were predicted to disappear when expectancy and situational information were both congruent, regardless of the strength of the two sources of information, and when the expectancy was weak but the current situational information was strong. In all conditions, young adults were expected to be more accurate in their judgments when compared to older adults (Mutter & Pliske, 1996)

Overall, older adults' estimates of contingency were not as accurate as young adults' estimates of contingency. Nearly all contingency estimates reflected an effect of expectancy, but not all expectancies affected contingency estimates the same way, nor did they affect young and older adults in the same way. For instance, young adults' direct estimates of contingency were affected by positive and negative expectancies, but these expectancy effects varied across contingency. Specifically, the positive expectancy

affected estimates only when the contingency was zero and positive, and the negative expectancy affected estimates only when the contingency was negative. Older adults' direct estimates of contingency were affected only by positive and negative expectancies, but these effects were evident across all of the contingencies. When directly compared, young and older adults' direct estimates of contingency were affected differently by expectancy when the expectancy was positive and the contingency was incongruent or did not match. Specifically, older adults' estimates showed a greater positive expectancy bias than did young adults' estimates. Likewise, young adults showed a marginally greater confirmation effect than did older adults when the negative expectancy and the negative contingency matched, such that young adults' estimates were lower than older adults' estimates.

The results for young adults' direct estimates of contingency mirrored those of Billman et al. (1992), but my interpretation of these results is very different. Specifically, like Billman et al., I found significant effects of contingency and expectancy and a significant interaction between expectancy and contingency. However, Billman, et al. concluded that the unrelated expectancy had the greatest biasing effect on their young adults' direct estimates of contingency because these estimates were compressed towards zero thereby showing the least amount of contingency discrimination. However, in the case of positive and negative expectancies, estimates can be strongly affected by the expectancy but still show contingency discrimination. For example, a positive expectancy could inflate all estimates in the direction of the expectancy but still preserve differences among contingencies. Likewise, a negative expectancy could lower all estimates in the direction of the expectancy but still show differences among

contingencies. Comparing the estimates of contingency made under an expectancy with estimates of contingency made with no expectancy is a better assessment of the effects of expectancy. In particular, expectancy effects are indicated by higher estimates when the expectancy is positive compared to estimates when the expectancy is unknown, and lower estimates when the expectancy is negative compared to estimates when the expectancy is unknown. For the unrelated expectancy, an effect of expectancy would be indicated by a significant interaction between expectancy and contingency, such that estimates are lower when the contingency is positive and higher when the contingency is negative compared to estimates in the corresponding contingencies when the expectancy is unknown.

Billman et al. did not report whether the estimates showed an effect of expectancy across contingency, nor did they perform any type of analyses to determine exactly where these effects occurred. Because their reported results are similar to mine, I suspect that expectancy effects also selectively affected certain contingencies based on the type of expectancy. Furthermore, they reported that their primary analysis was a repeated-measures ANOVA of estimates of contingency with expectancy, actual contingency, and subjects as factors; however, based on their way recoding the baseline estimates, the number of participants and the reported degrees of freedom, it is highly unlikely that this analysis is the one they used. Due to these issues, it is difficult to determine whether the present results actually parallel those of Billman et al. However, their basic design served as a good model for investigating the effects of expectancy on contingency judgments.

In general, the results from my analyses paralleled the findings of other age related studies. As in prior studies showing that older adults are more likely to make social judgments consistent with their expectancies even after being presented with additional incongruent information (Hess & Follet, 1994; Hess & Pullen, 1994; Hess et al., 1987), the current study showed an effect of expectancy on older adults' judgments after being presented with incongruent expectancy information. Likewise, the current results replicated Mutter and Pliske's (1994) findings that older adults' contingency estimates showed a greater expectancy effect than young adults' estimates for positive expectancies. The current study extended these findings by adding negative and unrelated expectancies and found that young adults' estimates showed a greater confirmation effect than older adults' estimates when the expectancy was negative, but young and older adults' estimates were not different when the expectancy was unrelated.

The overall goal of the current study was to examine all possible combinations of expectancy and current situational information proposed in Alloy and Tabachnik's (1984) interactional theoretical framework for contingency judgment. The main premise of Alloy and Tabachnik's theoretical framework is that judgments will be based on the interaction of the relative strength of expectancies and current information. Based on this framework, I originally predicted that the largest age differences would emerge when the expectancy and the contingency were both strong and incongruent and that older adults would show a greater expectancy bias than would young adults. However, this bias was the strongest when the expectancy was positive and the contingency was incongruent, and it occurred regardless of the strength of the contingency. Likewise, I predicted that there would be no age differences when the expectancy and the contingency were

congruent, but young adults showed a greater confirmation effect than did older adults when the expectancy was negative. The results may not have matched the predictions because Alloy and Tabachnik's framework assumes that all types of expectancies will affect judgments in the same way. The results of the current study suggest that this is not the case. Estimates of contingency were affected differently based on the type of expectancy, such that the positive expectancy produced the strongest biasing effect, especially for older adults; the negative expectancy produced the strongest confirmation effect, especially for young adults; and the unrelated expectancy did not appear to affect estimates of contingency, for young or older adults. However, it is also important to note that the effects of expectancy on contingency estimates may have been underrepresented for the negative expectancy because this expectancy was not as strong as the positive expectancy. Therefore, future research is needed to determine if Alloy and Tabachnik's framework would have held true had the general negative expectancy been stronger.

In addition, the effects of expectancy varied for direct and derived estimates of contingency, and these effects were not consistent across age. Troiler and Hamilton (1986) concluded that direct and derived estimates of contingency were functionally equivalent measures of assessing contingency detection. However, in the current study, the patterns of results for the direct estimates of contingency suggest that this is not the case. In particular, the direct estimates of contingency were more sensitive to expectancy effects. For example, the young adults' direct estimates of contingency reflected several expectancy effects. In contrast, their derived estimates of contingency were affected only by unrelated expectancy and as explained previously this outcome was not a true effect of expectancy. Likewise, older adults' derived estimates of contingency appeared to be

affected only when the expectancy was negative, unlike their direct estimates, which showed an expectancy effect for both positive and negative expectancies.

Of greater interest, were the age differences in the accuracy of direct and derived estimates of contingency. Even though both young and older adults' direct and derived estimates showed a significant linear trend of contingency, young adults' derived estimates more accurately reflected the actual contingencies. In contrast, the accuracy of older adults' direct and derived estimates did not differ. These age differences for direct and derived estimates of contingency may be due to the fact that the derived estimates of contingency were based on recall of frequency information. Recalling frequency information requires less cognitive effort than recalling frequency information and integrating this information to give a direct estimate of contingency. Young adults' derived estimates of contingency may have been more accurate than their direct estimates because they had little difficulty recalling the frequency information but had difficulty integrating this information into an estimate of contingency. Older adults appeared to have problems both recalling and integrating the frequency information. As several previous studies have pointed out, recalling and integrating frequency information that is expectancy incongruent becomes less efficient with age. Therefore, older adults' greater reliance on expectancies in judgment is likely to be due to diminished cognitive resources (Hess, 1994; Mutter, 2000; Mutter & Pliske, 1994, 1996).

It should be noted that the conditions in this experiment were highly optimal for making contingency estimates. Participants were explicitly told to pay close attention to the information presented because they were going to be asked to make a direct estimate of contingency, and very little time passed between the statement presentation and the

judgment process. In contrast, in the “real-world,” expectancies are developed and strengthened over a long period of time, conflicting information is infrequent and seldomly attended to, and people are rarely asked to quantify their judgments. Therefore, the expectancy biases exhibited in this experiment may have been smaller because judgments were made under optimal conditions.

Conclusion

Almost all judgments were affected by expectancy in some way. However, different expectancies did not affect judgment in the same way, nor did they affect young and older adults in the same manner. Only when the expectancy was positive and the contingency information was incongruent did older adults show a greater biasing effect of expectancy than young adults. Moreover, when the expectancy was negative, young adults showed a greater confirmation effect of expectancy than older adults. Future research is needed to explain why certain types of expectancies affect young and older adults’ estimates of contingency differently.

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Appendix A

Contingency Tables

Contingency -0.50.

Data Set One (DS1)

		<u>Outcome</u>		
		O	\sim O	Total
<u>Cue</u>	C	3	15	18
	\sim C	4	2	6

Data Set Two (DS2)

		<u>Outcome</u>		
		O	\sim O	Total
<u>Cue</u>	C	1	5	6
	\sim C	12	6	18

Data Set Three (DS3)

		<u>Outcome</u>		
		O	\sim O	Total
<u>Cue</u>	C	6	10	16
	\sim C	7	1	8

Data Set Four (DS4)

		<u>Outcome</u>		
		O	~O	Total
<u>Cue</u>	C	1	11	12
	~C	7	5	12

Contingency 0.00.

Data Set One (DS1)

		<u>Outcome</u>		
		O	~O	Total
<u>Cue</u>	C	6	12	18
	~C	2	4	6

Data Set Two (DS2)

		<u>Outcome</u>		
		O	~O	Total
<u>Cue</u>	C	12	4	16
	~C	6	2	8

Data Set Three (DS3)

		<u>Outcome</u>		
		O	\sim O	Total
<u>Cue</u>	C	14	2	16
	\sim C	7	1	8

Data Set Four (DS4)

		<u>Outcome</u>		
		O	\sim O	Total
<u>Cue</u>	C	6	6	12
	\sim C	6	6	12

Contingency 0.50.

Data Set One (DS1)

		<u>Outcome</u>		
		O	\sim O	Total
<u>Cue</u>	C	4	2	6
	\sim C	3	15	18

Data Set Two (DS2)

		<u>Outcome</u>		
		O	~O	Total
<u>Cue</u>	C	7	1	8
	~C	6	10	16

Data Set Three (DS3)

		<u>Outcome</u>		
		O	~O	Total
<u>Cue</u>	C	10	6	16
	~C	1	7	8

Data Set Four (DS4)

		<u>Outcome</u>		
		O	~O	Total
<u>Cue</u>	C	11	1	12
	~C	5	7	12

Appendix B

Counterbalancing Order Abbreviation Key

Actual contingency (-0.50, 0.00, +0.50), contingency table data set, expectancy, and expectancy context were counterbalanced using a randomized Latin-square design to create 12 different problem orders. See Appendix B for detailed contingency table data set information.

DS1-DS4: First through fourth contingency table data set for each actual contingency

P1: First positive expectancy	Caloric intake and body weight
P2: Second positive expectancy	Smoking cigarettes and lung cancer
P3: Third positive expectancy	Number of credit cards and amount of credit debt
N1: First negative expectancy	Anger and compassion
N2: Second negative expectancy	Amount of television watched and number of books read
N3: Third negative expectancy	Church attendance and prison sentence
UK1: First unknown expectancy	Silicon content and rock density
UK2: Second unknown expectancy	Daily calcium intake and average resting pulse
UK3: Third unknown expectancy	Percent of body fat and red blood cell count
UR1: First unrelated expectancy	Number of movies attended and red meat consumption
UR2: Second unrelated expectancy	Finger length and sexual orientation
UR3: Third unrelated expectancy	Height and grade point average

Counterbalancing Order

	P1	N1	UK1	UR1	N2	P2	UR2	UK2	UR3	P3	UK3	N3
1	0.5	0.0	-0.5	0.5	0.5	0.0	-0.5	0.0	0.0	-0.5	0.5	-0.5
	DS1	DS1	DS1	DS2	DS3	DS2	DS2	DS3	DS4	DS3	DS4	DS4
2	0.0	-0.5	0.5	-0.5	0.0	-0.5	0.5	-0.5	0.0	0.5	0.0	0.5
	DS1	DS1	DS1	DS2	DS2	DS3	DS2	DS4	DS3	DS3	DS4	DS4
3	-0.5	0.5	0.0	0.0	-0.5	0.5	-0.5	0.5	0.5	0.0	-0.5	0.0
	DS1	DS1	DS1	DS2	DS2	DS2	DS3	DS3	DS4	DS3	DS4	DS4
	UK1	P1	UR1	N1	P2	UK2	N2	UR2	N3	UK3	UR3	P3
4	0.5	0.0	-0.5	0.5	0.5	0.0	-0.5	0.0	0.0	-0.5	0.5	-0.5
	DS2	DS2	DS2	DS3	DS4	DS3	DS3	DS4	DS1	DS4	DS1	DS1
5	0.0	-0.5	0.5	-0.5	0.0	-0.5	0.5	-0.5	0.0	0.5	0.0	0.5
	DS2	DS2	DS2	DS3	DS3	DS4	DS3	DS1	DS4	DS4	DS1	DS1
6	-0.5	0.5	0.0	0.0	-0.5	0.5	-0.5	0.5	0.5	0.0	-0.5	0.0
	DS2	DS2	DS2	DS3	DS3	DS3	DS4	DS4	DS1	DS4	DS1	DS1
	N1	UR1	P1	UK1	UR2	N2	UK2	P2	UK3	N3	P3	UR3
7	.5	0.0	-0.5	0.5	0.5	0.0	-0.5	0.0	0.0	-0.5	0.5	-0.5
	DS3	DS3	DS3	DS4	DS1	DS4	DS4	DS1	DS2	DS1	DS2	DS2
8	0.0	-0.5	0.5	-0.5	0.0	-0.5	0.5	-0.5	0.0	0.5	0.0	0.5
	DS3	DS3	DS3	DS4	DS4	DS1	DS4	DS2	DS1	DS1	DS2	DS2
9	-0.5	0.5	0.0	0.0	-0.5	0.5	-0.5	0.5	0.5	0.0	-0.5	0.0
	DS3	DS3	DS3	DS4	DS4	DS4	DS1	DS1	DS2	DS1	DS2	DS2
	UR1	UK1	N1	P1	UK2	UR2	P2	N2	P3	UR3	N3	UK3
10	0.5	0.0	-0.5	0.5	0.5	0.0	-0.5	0.0	0.0	-0.5	0.5	-0.5
	DS4	DS4	DS4	DS1	DS2	DS1	DS1	DS2	DS3	DS2	DS3	DS3
11	0.0	-0.5	0.5	-0.5	0.0	-0.5	0.5	-0.5	0.0	0.5	0.0	0.5
	DS4	DS4	DS4	DS1	DS1	DS2	DS1	DS3	DS2	DS2	DS3	DS3
12	-0.5	0.5	0.0	0.0	-0.5	0.5	-0.5	0.5	0.5	0.0	-0.5	0.0
	DS4	DS4	DS4	DS1	DS1	DS1	DS2	DS2	DS3	DS2	DS3	DS3

Appendix C

General Instructions

For this part of the session, we will be asking you to make judgments about the contingency or relationship between two events. When there is a relationship between two events, the strength of the relationship might be perfect, strong, or weak. The relationship is ***PERFECT*** when the first event always predicts the second event. The relationship is ***STRONG*** when the first event frequently predicts the second event. The relationship is ***WEAK*** when the first event occasionally predicts the second event. On the other hand, there may be no relationship between the two events at all. There is ***NO*** relationship when the first event does not predict the second event.

The direction of a contingency relationship can be positive or negative. A contingency is ***POSITIVE*** when the second event occurs more often in the presence of the first event than in its absence; a contingency is ***NEGATIVE*** when the second event occurs more often in the absence of the first event than in its presence.

Here are some examples of contingency relationships of various strengths and directions:

- 100 **Perfect negative** contingency; e.g., The degree to which total darkness prevents sight.
- 70 **Strong negative** contingency: e.g., The degree to which helmets prevent serious head injuries.
- 30 **Weak negative** contingency: e.g., The degree to which exercise prevents heart disease.
- 0 **No relationship:** e.g., The degree to which a day of rain causes the stock market to rise.
- +30 **Weak positive** contingency: e.g., The degree to which getting wet causes a cold.
- +70 **Strong positive** contingency: e.g., The degree to which being exposed to a virus causes the flu.
- +100 **Perfect positive** contingency: e.g., The degree to which rain causes the ground to be wet.

You will be given 12 different problem scenarios in which you will be asked to estimate the strength and the direction of the contingency relationship between two events. For each scenario, you will first be asked to make an estimate based on your current beliefs about the relationship between the two events. You will then see a set of cases that provide new information or data about the relationship between the events and you will be asked to estimate the contingency relationship based on this information. Do you have any questions about the general procedure for this task?

Appendix D

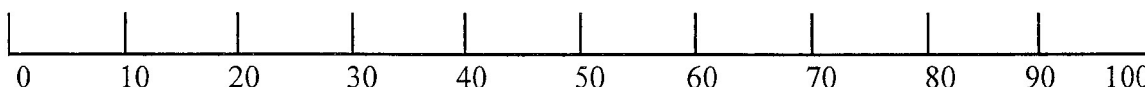
Example of Specific Instructions

Smoking and Lung Cancer

The Surgeon General of the United States has stated that smoking may be harmful to a person's health. For many years medical researchers have studied whether smoking cigarettes is related to lung cancer. It may be the case that smoking is related to lung cancer; i.e., smoking predicts lung cancer. Alternatively, it may be the case that smoking is unrelated to lung cancer; i.e., smoking does not predict lung cancer.

Using the scale below, indicate your estimate of the strength of the relationship between smoking and lung cancer.

Note that the scale ranges from 0 to 100. The value 0 indicates that a relationship does not exist. In other words, smoking does not predict lung cancer. The value 100 indicates that a perfect relationship exist. In other words, smoking perfectly predicts lung cancer. Scores between 0 and 100 indicate different degrees of strength for the relationship. To make your estimate, place a slash mark (/) on the scale at the point you believe is most representative of the relationship between smoking and lung cancer. Then indicate the numerical value of your estimate in the blank.



Numerical Value: _____

If you think a relationship does exist between smoking and lung cancer (i.e., your rating is not 0), is the direction of the relationship positive or negative? Please check the appropriate direction.

Note that the relationship would be positive if lung cancer tends to be present in smokers and the relationship would be negative if lung cancer tends to be absent in smokers.

_____ Positive

_____ Negative

Using the scale below indicate how confident you are in your estimate.

Note that the scale ranges from 1 to 10. The value of 1 indicates that you are not at all confident in your estimate. The value of 10 indicates that you are extremely confident in your estimate. Scores between 1 and 10 indicate different degrees of confidence in your estimate. To rate your confidence, place a slash mark (/) on the scale at the point you believe is most representative of your confidence in your estimate. Then indicate the numerical value of your rating in the blank.



Numerical Value: _____

Smoking and Lung Cancer

You will now see new data on the relationship between smoking and lung cancer that was collected recently by medical researchers. The data will be presented on a series of screens. Each screen contains information about a different person. In each case, the person will be either a smoker or a non-smoker and either will have lung cancer or will not have lung cancer. Thus, four types of cases are possible:

The person is a SMOKER and HAS lung cancer.

The person is a SMOKER and DOES NOT HAVE lung cancer.

The person is a NONSMOKER and HAS lung cancer.

The person is a NONSMOKER and DOES NOT HAVE lung cancer.

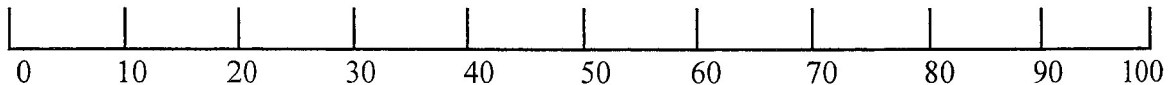
I would like you to carefully study the information on each slide. After you have seen all of the slides, you will be asked to use this information to estimate the relationship between smoking and lung cancer.

Smoking and Lung Cancer

We would now like to know what you have learned about the relationship between smoking and lung cancer from the data you have just observed. Using this information, answer the following questions to the best of your ability.

Using the scale below, indicate your estimate of the strength of the relationship between smoking and lung cancer.

Again, note that the scale ranges from 0 to 100. The value 0 indicates that a relationship does not exist, the value 100 indicates that a perfect relationship exists and scores between 0 and 100 indicate different degrees of strength for the relationship. To make your estimate, place a slash mark (/) on the scale at the point you believe is most representative of the relationship between smoking and lung cancer. Then indicate the numerical value of your estimate in the blank.



Numerical Value: _____

If you think a relationship does exist between smoking and lung cancer (i.e., your rating is not 0), is the direction of the relationship positive or negative? Please check the appropriate direction.

Again, note that the relationship would be positive if lung cancer tends to be present in smokers and the relationship would be negative if lung cancer tends to be absent in smokers.

_____ Positive

_____ Negative

Using the scale below indicate how confident you are in your estimate.

Note that the scale ranges from 1 to 10. The value of 1 indicates that you are not at all confident in your estimate. The value of 10 indicates that you are extremely confident in your estimate. Scores between 1 and 10 indicate different degrees of confidence in your estimate. To rate your confidence, place a slash mark (/) on the scale at the point you believe is most representative of your confidence in your estimate. Then indicate the numerical value of your rating in the blank.



Numerical Value: _____

Based on the twenty-four cases you just observed, estimate the number of cases in which the person was a:

a SMOKER and HAD lung cancer: _____

a SMOKER and DID NOT HAVE lung cancer: _____

a NONSMOKER and HAD lung cancer: _____

a NONSMOKER and DID NOT HAVE lung cancer: _____

Your estimates must total to: 24 Cases