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The Effect of Local and Global Visual Cues on the Tilt Illusion

The tilt illusion (TI) is an illusion of orientation where a vertical line appears to be rotated away from slanted inducing lines. The apparent divergence of the 2 lines is called angle expansion. We hypothesize the TI is the sum of 2 mechanisms, one producing angle expansion which is limited to local cues, and the other angle contraction which is affected by global cues. Participants made judgments about the horizontal alignment of 2 dots presented in the gap between 2 fields of slanted lines. We varied the slope of the lines and the gap size. As predicted, by reducing local cues by introducing a blank gap between the fields of slanted lines, we found a TI characterized by angle contraction.

Visual illusions have attracted research for many decades. Illusions such as the rod and frame illusion (e.g., Daini, Wenderoth & Smith, 2003) and the Ponzo illusion (e.g. Prinzmetal, Shimamura, & Mikolinski, 2001) show how easily people can have misperceptions in everyday situations. Such illusions occur when there are inconsistencies between physical events and the perception of those events.

The research presented here is based on Gibson and Radner’s (1937) work on the tilt illusion (TI). The TI is an illusion of orientation where a vertical line appears to be rotated away from nearby, slanted inducing, or background lines (see Figure 1). Gibson and Radner also studied the tilt after effect (TAE), where inducing lines that are tilted from the vertical axis are shown to the participant for a brief period of time and then the stimulus is removed. The tilted lines are replaced with a single line that they must adjust to the vertical axis. The TAE is observed when the subject’s line adjustment consistently deviates from the vertical in the same direction as the previously shown inducing lines. For both the TI and the TAE, direct and indirect effects can occur. Direct (contrast) effects occur when the test line appears to be rotated away from the inducing lines and can be found when the angular separation between the test and inducing lines are in the range of 0–50°. In a direct effect, the acute angle appears to expand. An indirect (assimilation) effect, on the other hand, occurs when the test line appears to be rotated towards the inducing line and can be found when the angular separation is greater than 50°. In an indirect effect, the acute angle appears to contract.

Gibson and Radner (1937) explained the TAE illusions by a process they called normalization. Through normalization, Gibson and Radner hypothesized that the TAE occurred because prolonged assessment of the tilted inducing stimulus lines resulted in adapting the tilted lines to local cues. Thus, inducing lines that are tilted 15° from vertical will seem less tilted after inspection. Because the whole visual field appears to be tilted towards the vertical axis, an objectively vertical line will appear to be tilted in the opposite direction. This theory is not well supported by the data (Wenderoth & Johnstone, 1988). The normalization theory predicts that the direct and indirect TI should be symmetrical, changing from direct to indi-
rect as the angle increases beyond 45º. However, the direct TI is effective over a wider range of angles than is the indirect effect. In addition, the direct TI is a much stronger illusion.

The lateral inhibition theory (e.g., Blakemore & Tobin, 1972) is another attempt to explain the tilt illusion. When a bar or contour is presented in the visual field, certain neurons that are tuned to detect orientation are stimulated. This theory proposes that there are thousands of orientation-selective neurons (Virsu & Taskinen, 1975) within the cortex, each programmed to recognize only specific line orientations. However, what happens when two different bars or contours are detected simultaneously? Researchers (e.g., Virsu & Taskinen, 1975; Wenderoth & Johnstone, 1987) hypothesized that the two activated neurons will inhibit each other, thereby activating two different neurons that are attuned to more extreme orientations.

The process of lateral inhibition can explain angle expansion but cannot explain angle contraction. Thus, lateral inhibition cannot explain the indirect TI, which is characterized by angle contraction. Wenderoth and Johnstone (1988) evaluated the effects of a variety of factors known to affect the magnitude of the direct TI. Wenderoth and Johnstone (1988) sought to investigate the possible role of lateral inhibition on the TI with inducing lines that produced the direct TI (15º) and the indirect TI (75º). In a series of experiments, they manipulated variables that were known to reduce lateral inhibition, (e.g., increased spatial separation between the test and inducing lines). They found that each variable decreased the direct TI, while leaving the indirect TI unchanged. They concluded that there are different underlying mechanisms for the direct and indirect TI.

Kitaoka and Ishihara (2000) reported a series of studies trying to understand the differences between the Zöllner illusion and the TI. The Zöllner illusion (see Figure 2) is when horizontal lines do not appear to be parallel when the horizontal lines contain short, slanted, inducing lines. They noted that the Zöllner illusion showed acute angle expansion between 0º and 90º, while the TI resulted in apparent angle expansion from 0º to 50º, and apparent angle contraction from 50º to 90º. They concluded that the Zöllner illusion was produced by the sum of two mechanisms: an expansion and a contraction mechanism. The expansion mechanism, produced by reciprocal inhibition, results from local cues and is effective over a relatively smaller range of angles (0º–50º). Local cues are stimuli that are near to the focal point of interest. Further, the expansion mechanism is hypothesized to produce stronger illusory effects than the contraction mechanism. On the other hand, the contraction mechanism is probably attributable to higher processes. The contraction mechanism is hypothesized to be caused by global cues, cues anywhere in the visual field, and is equally effective over a broad range of acute angles.

Kitaoka and Ishihara’s (2000) third experiment is of particular interest in that indirect effects are observed where there is a small acute angle (27º) between the inducing lines and the test line. Ordinarily, strong direct effects would be observed under these conditions. Their participants viewed a vertical line superimposed on ten inducing lines slanted 27º from vertical. In the no gap condition, the inducing lines...
were continuous with the vertical test line in the center. For three other groups, the center portion of the inducing lines was removed resulting in .5º, 1.0º, and 2.0º gaps (measured in degrees of visual angle), and the test line was in the center of the gap. They observed angle expansion in the no gap condition which is the typical finding. However, they found equal apparent angle contraction in the three gap conditions. According to their model, as the gap increases, local cues are reduced leaving only global cues. Thus for the no gap condition, both local and global cues are present and both the expansion and contraction mechanism are active. Since the expansion mechanism is stronger, the observed effect is apparent angle expansion. As the local cues are removed, we should expect less contribution of the expansion mechanism. The net result should be stronger apparent angle contraction with larger gap size.

Kitaoka and Ishihara (2000) were not able to explain their finding of equal angle contraction for the three gap conditions. We suggest that their method of producing a gap by “erasing” the center of the lines confounds gap size with line length. In their second experiment, they demonstrated that the indirect TI increases with increased line length. In the present experiment, we examined the effect of the size of the gap between two fields of inducing lines while keeping line length constant.

We used a different method of measuring the size of illusion than the one used by Kitaoka and Ishihara (2000). To evaluate the illusory effects, their participants compared the test line with a comparison line located to one side of the display. We were concerned about the possibility that both the test line and the comparison line could be influenced by the inducing lines. When the participants shifted their eyes from the test line to the comparison line, there could be the possibility of a TAE. In the following experiment, we asked participants to make judgments about the horizontal alignment of two dots presented on a computer monitor. Shimamura and Prinzmetal (1999) used this technique to assess the TI with dots superimposed on a field of slanted inducing lines. They found the direct TI to be greatest with inducing lines that were tilted 15º–20º from the axis of judgment. In our experiment, two rectangular fields of slanted inducing lines were displayed above and below the dots. We varied the size of the gap between the fields of inducing lines as well as the slopes of the inducing lines.

Based on Kitaoka and Ishihara’s (2000) two-process model, the gap between the inducing lines and the dots should reduce the local cues and result in angle contraction and an indirect TI. Further, we predicted that as the gap size increases there would be fewer local cues and the relative contribution of the direct effects should become smaller compared to the indirect effect. Specifically, we predict the magnitude of the indirect effects will increase with gap size.

Method

Participants
The participants were students from Introduction to Psychology classes at the University of Wisconsin–Stevens Point who volunteered as one of the ways to satisfy a course requirement. Three data sets had to be discarded when these students failed to follow the instructions, leaving 27 students, 6 men and 21 women.

Apparatus and Stimuli
The Cognition Laboratory consists of four computer workstations in adjoining 3.7 by 5.5 m cubicles. Each workstation includes a Gateway® computer with 17-inch monitors and standard keyboard. The resolution for each screen was 1024 pixels by 768 pixels (one pixel = approximately .22 mm). The participants were directed to sit a comfortable distance (about 65 cm) away from the computer screen. The overhead lights were dimmed.

The dimensions of stimulus elements were presented in degrees of visual angle (1.22º, 2.19º, and 3.15º) assuming a viewing distance of 65 cm. All stimulus elements were displayed in white on a black background. Each display consisted of two dots (.19º in diameter) located equidistant from the horizontal center of the screen with a horizontal distance of 8.9º between centers (see Figure 3). The left dot was sta-
tionary and was centered vertically. The initial position of the right dot was either above or below the center of the screen, and its vertical position would change after the participant’s response. The two dots were presented in the midst of two fields of parallel lines located above and below the dots. Each field (25.2º wide by 2.2º high) was horizontally centered and consisted of slanted lines .2º apart.

**Procedure**

Each student came into the computer lab and was seated at one of the computer workstations. The students read instructions about the experiment that were displayed on the computer screen. They were informed that they would be presented with two dots in the center of the screen. The students were instructed to indicate whether the right dot was above or below the left dot by pressing the up and down arrow key, respectively. After they made a response, the right dot would disappear briefly. They were told that when the dot reappeared they should make a new judgment, above or below. After about 20 to 30 judgments, the screen was cleared to black for about 4 s. Then they saw a new display and made another series of judgments.

Each series of judgments used a double randomly interleaved stair step technique (Wetherill & Levitt, 1965) to determine the point of subjective horizon (PSH). One stair step was ascending and the other descending. The vertical starting location for the right dot in the ascending and descending series varied randomly for 20 to 40 pixels below and above the true horizon, respectively. On the descending series, the student would respond to the dot by pressing the up or down arrow key. The right dot would disappear for 200 ms. If they pressed the up arrow key, the dot would reappear 8 pixels lower on the screen. When the student changed their response, pressing the down key, the dot would reverse and move up by 8 pixels. For the next pair of reversals, the dot would move 2 pixels for each stair step. For the remaining 4 pairs of reversals the dot would move by a single pixel. Since the ascending and descending stair steps were randomly interleaved the student could not discern the stair step pattern. The PSH was calculated by averaging the peaks and valleys for the last 6 pairs of

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**FIGURE 4**

Magnitude of tilt-induced illusion as a function of line slope and gap width. Positive values of the magnitude of TI indicate angle expansion, while negative values indicate angle contraction.
reversals for both ascending and descending series. These measurements were then expressed as the slope of the imaginary line connecting the two dots with respect to the horizon. The sign of the slope was positive if it was in the same direction as the inducing lines, indicating angle expansion, and a negative sign indicated angle contraction.

Each student made PSH judgments for 24 experimental conditions and 1 control condition. For the control condition, there were no inducing lines. The first of three independent variables was the size of the gap separating the fields of slanting lines (1.22°, 2.19°, and 3.15° of visual angle). In addition, we varied the absolute slope of the inducing lines (5°, 15°, 25°, and 35°) and the direction of slope, clockwise (CW) and counterclockwise (CCW).

Results

To evaluate group bias in making horizontal judgments, the mean of the PSH judgments for the control condition was not found to be significantly different from zero: the mean was -.129° (a small CW departure from the horizon), t(26) = .95, p = .349. Because no bias was detected, no bias adjustment was made for the experimental trials.

The magnitude of the TI in degrees was calculated for each observation. The sign of the magnitude of the TI is positive when the PSH tilts in the same direction as the background lines, showing angle expansion. When the sign is negative, it indicates angle contraction. The magnitude of TI was submitted to a within-participants analysis of variance with gap size (1.22°, 2.19°, and 3.15° of visual angle), absolute slope (5°, 15°, 25°, and 35°), and direction of slope (CW, CCW) as factors. The critical values for the F’s were adjusted using Huynh-Feldt’s Epsilon (Oehlert, 2000). Figure 4 presents the magnitude of the tilt illusion plotted against the absolute slope of the background lines for the three gap sizes. There was a significant main effect of absolute slope, F(3, 78) = 20.89, MSE = .55, p < .01. Figure 4 shows little or no illusion for the 5° slope condition and a maximum TI showing angle contraction with the 15° inducing lines. The magnitude of the TI gradually declines with greater slope of the inducing lines. The means of the magnitude of the illusion for the 15°, 25°, and 35° absolute slope conditions (-.46°, -.35°, and -.15°, respectively) were all significantly different from zero, t(26) = -5.51, p < .01; t(26) = -7.49, p < .01; and t(26) = -5.2, p < .01, respectively. The mean illusion for the 5° absolute slope condition (.15°) was not significantly different from zero, t(26) = 1.99, p = .06.

Although the main effect of gap is not significant, F(6, 156) = 4.12, MSE = .22, p < .01. The data were separated into four groups by slope to perform a simple main effects analysis for each gap. The only significant simple main effects analysis of gap was at the 15° slope, F(2, 52) = 17.70, MSE = .14, p < .01. Figure 4 shows that the TI increased (with negative values indicating angle contraction) with gap size for the 15° slope, but there was little effect of gap for the other absolute slopes. The slope functions show a stronger downward bow with larger gap sizes.

The magnitude of the illusion did not differ for the CW (-.205°) and CCW (-.200°) orientation of the inducing lines, F < 1. This was evidence that the illusion was the same in both orientations. There was, however, a significant direction X absolute slope interaction, F(3, 78) = 2.86, MSE = .19, p = .04. None of the other two way or three way interactions were significant.

Discussion

Our hypothesis that peripherally located inducing lines would produce an angle contraction was confirmed. In addition, the angle contraction became stronger with increasing gap size for the 15° inducing lines. These findings are consistent with the results from Kitaoka and Ishihara’s (2000) third experiment. Using a very different procedure, Kitaoka and Ishihara’s participants viewed a central vertical line with 27° inducing lines. Their participants inspected a comparison line that was located to the right of the display and selected the comparison line that appeared to match the orientation of the target line. They found a direct TI when there was no gap, however, as they erased the inducing lines in the middle of the display to produce a gap, they observed an indirect TI.

Kitaoka and Ishihara (2000) proposed a model that includes an expansion mechanism that is the result of local stimulation and a contraction mechanism that is sensitive to global stimulation. Although our results are generally consistent with this proposal, there are some details from our study’s results that are inconsistent. For example, Kitaoka and Ishihara proposed that the angle contraction mechanism should produce a similar level of angle contraction over a wide range of line slopes. In contrast, we found that angle contraction strongly varied with the absolute line slope with the largest TI at 15°.

An alternate explanation for the indirect effects of the peripherally located inducing lines has its origin in our incidental observation that the entire field of lines appears to tilt in the opposite direction of the lines themselves. The implicit lines that are formed by the ends of the inducing lines that are nearest the dots are objectively horizontal, but they appear to tilt...
in the opposite direction of the inducing lines. Thus the inducing lines and the implicit boundary lines should have an opposite effect on the target dots. The inducing lines should produce angle expansion and the implicit lines should result in angle contraction. The observed TI should be the net sum of these two mechanisms.

Our greatest indirect TIs were observed for inducing lines in the 15º–25º range. In the direct TI, where the dots are superimposed onto the field of inducing lines, Shimamura and Prinzmetal (1999) found the largest direct TIs in the 15º–20º range. We should expect the rectangular frame to appear to tilt the most when they contain lines with slopes in that range. Thus, we should expect that the indirect effects of the implicit boundary lines should be maximal when the lines themselves have a slope of 15º–20º.

Why should the implicit lines provide a stronger influence than the lines themselves? Shimamura and Prinzmetal’s (1999) Orientation Framing Theory stated that orientation frames were driven by local cues. We argue that the implicit lines would have a greater influence because of their close proximity to the dots. As the gap gets wider, the relative importance of the implicit lines in relation to the inducing lines increases.

References
We frequently encounter situations in which we are prompted to remember information, but we are unable to access a correct response at that moment; in such cases, we would report that we have forgotten the to-be-remembered information. Often, however, if we attempt retrieval at a later time, the information becomes accessible and we are able to provide an accurate reply. This common experience is referred to as reminiscence and can be defined as the process of remembering “forgotten” material in the absence of relearning (Ballard, 1913). Experimentally, reminiscence can be revealed through the retrieval of items on later tests that were not recalled on initial tests. When there is an overall increase in retrieval performance across experimental tests, hypermnesia is present (Madigan & Lawrence, 1980; Payne, 1987; Roediger & Challis, 1989). That is, hypermnesia occurs when intertest recovery (reminiscence) is greater than interest forgetting.

Generally, repeated testing experiments involve participants remembering a list of items (e.g., words, sketches, pictures) for subsequent recall tests (Erdelyi & Becker, 1974; Erdelyi & Stein, 1981; Madigan & Lawrence, 1980). Participants are typically shown a large collection of items (e.g., 40–80 items) and are instructed to remember all of the material. A sizeable quantity of items is used to prevent ceiling effects and to provide opportunity for recall performance to increase—a requirement for hypermnesia. Participants are usually told to expect one memory test so that they are surprised when they receive at least two more tests on the same material. On average, each test is 7 minutes in length and all three tests occur successively. Typically, researchers examine how performance changes from Test 1 to Test 2 (early tests) and from Test 2 to Test 3 (late tests).

Early studies of reminiscence and hypermnesia examined whether the type of to-be-remembered material affected performance in a repeated testing paradigm. Cumulative recall levels have consistently been shown to be greater with pictures than with words (Madigan & Lawrence, 1980; Payne, 1986). For exam-

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ple, in an experiment conducted by Payne, participants viewed either a series of 55 sketches of common objects, or the names of those objects typed in lowercase. After the participants had completed three successive free-recall tests, Payne found that although both pictures and words produced reliable reminiscence and hypermnesia, picture stimuli yielded higher cumulative recall and greater hypermnesia. In a second experiment, Payne discovered that even after equating cumulative recall levels, pictures produced a significantly larger hypermnesic effect. Furthermore, pictures have produced less intertest forgetting, and generally lead to hypermnesia levels that typically exceed that of words (Erdelyi & Kleinbard, 1978; Madigan & Lawrence, 1980; Payne, 1986).

Recent studies have expanded their exploration of reminiscence and hypermnesia beyond basic laboratory stimuli (pictures and words) and have examined memory for real life events (Bluck, Levine, & Laulhere, 1999). In the Bluck et al. study, participants who had viewed the O. J. Simpson trial verdict announcement were questioned regarding the event. In a series of three interviews occurring within an hour-long experimental session, participants were asked to recall information regarding the verdict. They were assessed on their recall of two different types of information regarding the verdict announcement: events occurring on the television (TV aspect) and memories of their reactions (personal aspect). As with standard to-be-remembered materials, both types of real-life events yielded both hypermnesia and reminiscence.

In addition to varying the to-be-remembered stimuli, researchers have manipulated the type of processing that participants are instructed to use while encoding the presented items (McDaniel, Moore, & Whiteman, 1998; Otani & St. Louis, 1995; Otani & Whiteman, 1994). For example, Otani and Whiteman examined the influence of item-specific and relational processing on repeated recall performance. Item-specific processing focuses upon characteristics of the to-be-remembered material that are unique to those particular items (e.g., thinking about the meaning or pleasantness of a target item). Conversely, relational processing centers upon finding associations among items, which promotes recall of item sets (e.g., categories, such as body parts, animals, etc.). In their study, participants were randomly assigned to one of these two processing conditions. Participants engaging in item-specific processing were asked to rate the pleasantness of the 36 word pairs, whereas those assigned to relational processing sorted the pairs according to their category affiliation. This study, as well as numerous others, found greater recall and hypermnesia across early tests with relational processing, whereas item-specific processing produced greater recall and hypermnesia on later tests (McDaniel et al., 1998; Otani & St. Louis, 1995; Otani & Whiteman, 1994).

Researchers have also examined the influence of retrieval variables on repeated testing performance (Otani & Whiteman, 1994; Payne, Hembrooke, & Anastasi, 1993; Payne & Roediger, 1987). One important retrieval variable that has received a great amount of attention is the type of test administered to the participants. Reminiscence and hypermnesia have regularly been found through the use of free-recall (Erdelyi & Becker, 1974; Roediger & Payne, 1982) and cued-recall tests (Otani & Hodge, 1991; Otani & Whiteman, 1994). In a free recall test, participants are asked to remember as many of the target items as possible without any assistance, whereas in a cued recall test participants are given cues (e.g., category names) to help them recall the target items. Alternatively, recognition tests, in which participants have to distinguish target items from foils, have generally led to reminiscence without the presence of hypermnesia (Otani & Hodge, 1991; Payne & Roediger, 1987).

Although an abundance of research has explored the influence of type of test, most of the studies have been limited to examining memory for item information (how many new items were recalled on Test 2 that were not recalled on Test 1?). Indeed, the tests of recognition, free recall, and cued recall are typically described as being tests of item information (Healy, 1974). Until recently, memory for the order of events had not been examined experimentally. Typically, memory for order is tested by using either a reconstruction of order test or a serial-recall test. In a reconstruction test, participants are presented with each of the target items in a new random order and must place the items back into their original ordinal positions, whereas in a serial-recall test, participants must both recall the target items and subsequently place them in their appropriate ordinal positions.

Kelley and Nairne (2003) conducted a series of experiments to investigate the role of repeated testing on memory for order. Their methodology replicated classic procedures, as participants viewed a set of either 25 words or pictures and were subsequently given three consecutive memory tests. Half of the participants received free-recall tests (in an attempt to replicate standard findings) and the remaining half received reconstruction of order tests. In their study, Kelley and Nairne replicated the standard findings in free recall as hypermnesia was found for both words and pictures. Interestingly, the reconstruction of order tests yielded a different pattern of performance: reminiscence was present across tests but hypermnesia
was not. These findings revealed disparate effects of item and order information, with respect to overall performance, as free recall yielded an increase in performance, whereas reconstruction performance decreased across tests. However, in regards to reminiscence, additional item and order information was remembered across successive tests for free recall and reconstruction, respectively. That is, participants recovered additional items across tests, but intertest forgetting exceeded intertest recovery. Kelley and Nairne’s research provided the foundation for the current investigation, which further explored the effects of repeated testing on memory for order.

Theories of Reminiscence and Hypermnesia

Currently, two separate theories have attempted to account for the findings in the reminiscence and hypermnesia literature. The cumulative recall hypothesis (e.g., Payne, 1986; Roediger & Payne, 1982) suggests that hypermnesia is due to the relationship between initial test performance and the asymptotic level of recall. The theory posits that hypermnesia will be present when first-test recall is significantly lower than the asymptotic (ceiling) level of recall, so that during subsequent tests, there is sufficient room for recall improvement. Hypermnesia is thought to occur when initial test item recovery does not limit potential recall on later tests and as result, recovery of additional items on subsequent tests is feasible.

Alternatively, the retrieval dynamics account of hypermnesia (e.g., Payne et al., 1993) focuses upon shifts in retrieval processes over time and suggests that reminiscence and hypermnesia are the direct results of (a) an incrementing process and (b) the presence of alternate retrieval routes. Payne et al. suggested each time that an item is successfully retrieved, an incrementing process increases both the strength of the retrieved item, as well as the strength of the association between the item and its retrieval cues. Typically, this process is displayed through the increase in relative speed of individual item recovery during each additional test. Payne et al. also suggested that the presence of additional retrieval routes plays an important role. The idea is that those items not recalled with initial retrieval cues may be recalled on later tests if the cues are modified (e.g., presence of alternative associations that serve as additional cues for remembering the forgotten items, such as “red,” “fruit,” “Newton” for the target word “apple”).

Although these theories can successfully account for much of the reminiscence and hypermnesia data, neither of these theories has clearly addressed memory for order retention, and thus they are currently incomplete. Before a complete and unified theory of reminiscence and hypermnesia can be established, more research must explore the effects of repeated testing on order retention.

The current experiment was designed to assess the effects of repeated testing on serial-recall performance as compared to free recall. In the experiment, participants watched a video depicting a series of 20 actions commonly seen while visiting a park. Following the final action, participants completed either a series of three successive free-recall or serial-recall tests. The free-recall tests were scored using standard free-recall scoring criteria, where an action is marked as correct if it appeared anywhere in the video. The serial-recall tests were scored using three different methods (see Methods for detailed descriptions) that allowed the experimenters to examine order retention using a fine-grained analysis (strict-order criteria), a medium-grained analysis (relative-order criteria), and a coarse-grained analysis (lenient-free).

Based upon research that has shown hypermnesia with to-be-remembered material consisting of a video of real-life events (Bluck et al., 1999), it is expected that hypermnesia will be present within the free-recall condition of this experiment. Expanding upon the research of Kelley and Nairne (2003), if we assume that serial recall and reconstruction engage similar mnemonic processes to access order information, then we might expect no hypermnesia and an overall decline in performance across the serial-recall tests. Of course, one could argue that serial recall contains elements of both free recall (need to remember items) that usually produces hypermnesia and reconstruction (need to remember order) that usually produces overall reduction in performance. Thus, in this hybrid conception, the positive and negative hypermnesic effects might balance one another and produce no overall change in performance across tests.

Method

Participants

Participants were 48 Lake Forest College undergraduates who participated for extra credit in an introductory psychology course. Groups of 20 or fewer participants were tested together in a classroom in sessions lasting approximately 35 minutes.

Materials and Design

The experiment employed a 2 (test type: free-recall vs. serial-recall) x 3 (test number: 1, 2, 3) mixed-factor design, in which test type was varied between-subjects test number was varied within-subjects. Participants were randomly assigned to one of two experimental conditions (free-recall or serial-recall).
In all, there were 24 participants assigned to each of the two conditions. In both conditions, participants viewed a video of 20 actions that could occur while in a park (e.g., reading a newspaper, throwing a Frisbee, listening to music). To ensure generality, two random orders of the actions were created and were used in each of the two conditions. Following the video presentation, all participants received the same recall test sheet, which consisted of a column of 20 blanks (numbered 1 through 20, located on the left margin). Stimuli were presented and controlled with an IBM-compatible computer and a standard VCR.

Procedure
Participants were asked to remember 20 actions in a video for a subsequent memory recall task. They were instructed about the exact nature of the memory test (free- or serial-recall) prior to list presentation, but they only expected one test. The stimuli were projected onto a screen at a rate of one action every 5 seconds. Participants were instructed to pay close attention to each action as it was presented and to think of the actions in terms of short statements (e.g., reading a newspaper, throwing a Frisbee). Following the final item, participants in the free recall condition received the first test sheet and were asked to place the actions on any of the blank spaces. Participants in the serial-recall condition received the first test sheet and were asked to place the actions back into their original order of appearance by writing the action in its appropriate ordinal position along the numbered column. Participants were given 7 minutes to complete the test. Immediately following the first test, the recall sheets were collected and Test 2 was administered, following the same procedures as Test 1; Test 3 occurred immediately after Test 2.

Scoring Criteria
The free-recall tests were scored using a standard free recall scoring. The actions were marked as correct, regardless of their order, if they had been included during the presentation. The serial-recall tests were scored according to three different methods (strict-order, relative-order, and lenient-free). According to the strict-order method, the words were marked as correct if they were recorded in their appropriate ordinal position (if bronze had been the second word presented, it would be scored as correct if it were written in the second column of the first row). For relative-order scoring, the words were marked as correct if the words immediately preceding and immediately following were presented relatively before and after (for bronze to be scored as correct, the word given directly before must have been presented sometime before 'bronze' and the word directly after must have been presented sometime after bronze). For lenient-free scoring, the words were scored using standard free-recall criteria; that is, an item was scored as correct if it was written down anywhere on the list. In addition, for all of the scoring methods, the experimenter allowed minor variations in the desired responses to be scored as correct. For example, if the action was “throwing a Frisbee,” responses such as “tossing a Frisbee,” and “throwing a disc” were also scored as correct; to ensure consistent scoring, these instances of acceptable responses were recorded by the experimenter.

Results
Table 1 displays the net recall levels for each test and scoring criterion. Separate 2 (test type: free-recall vs. serial-recall) X 3 (test number: 1, 2, 3) mixed-factor analysis of variance (ANOVA) tests were performed for each of the three separate scoring criteria for serial recall.

As expected, with strict-order scoring, the ANOVA revealed a significant main effect of test type, $F(1, 46) = 233.90, p < .01$, where free recall yielded greater performance than serial recall. A significant main effect of test number was present, $F(2, 92) = 4.50, p < .05$, as was a significant interaction between test type and test number, $F(2, 92) = 3.40, p < .05$. A series of Newman-Keuls post-hoc tests revealed significant positive hypermnnesia for free recall ($[T2=T3] > T1$) and no change in performance across tests for serial recall ($T1=T2=T3$).

With relative-order scoring, the ANOVA revealed a main effect of test type, $F(1, 46) = 161.40, p < .01$, where free-recall performance exceeded that of serial recall. No main effect of test number was present $F(2, 92) = 1.42, p > .05$. However, the interaction between

<table>
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<th>TABLE 1</th>
<th>Net Recall Levels Following Test 1 and Test 3 as a Function of Recall Task and Scoring Criterion for Actions</th>
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<tr>
<td></td>
<td>Test 1</td>
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<td>Free Recall</td>
<td>.68</td>
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test type and test number was statistically significant, \( F(1, 46) = 5.79, p < .01 \). As with strict-order scoring, a series of Newman-Keuls post-hoc tests revealed significant positive hypermnesia for free recall ([T2=\( T3 > T1 \)]) and no change in performance across tests for serial recall (T1=\( T2 = T3 \)).

With lenient-free scoring, both the main effect of test type \( F(1, 46) = 4.64, p < .05 \) and of test number, \( F(2, 92) = 9.49, p < .05 \) were significant. Although the interaction between test type and test number was not statistically significant, \( F(2, 92) = 1.31; p > .05 \), a series of Newman-Keuls post-hoc tests revealed significant positive hypermnesia for free recall ([T2=\( T3 > T1 \)]) and no change in performance for serial recall (T1=\( T2 = T3 \)).

The experiment revealed several important findings. First, with all three scoring criteria, free-recall performance exceeded that of serial recall, which is the standard result (Healy, 1974). It is important to note that although the same scoring criteria were used in the free-recall condition as in the serial recall with lenient-free scoring condition, the mental processes involved these two conditions were completely different; participants in the serial-recall condition were instructed to order their recall, whereas participants in the free-recall condition did not receive this constraint. Second, reliable interactions were obtained using the strict- and relative-scoring criteria. Although the lenient-scoring interaction failed to reach significance, the post-hoc tests revealed a similar pattern of performance across all three scoring conditions—positive hypermnesia in free recall and no change in performance for serial recall. The lack of hypermnesia following serial recall provides some evidence for the assertion that serial recall may engage processes similar to both free recall (which produces positive hypermnesia) and reconstruction (which produces negative hypermnesia). When these positive and negative processes are combined, the net result is no overall change in performance.

**Discussion**

Prior the current experiment, no published research has examined how repeated testing affects performance in a serial-recall task. The present results revealed that free-recall performance exceeded that of serial recall across all experimental conditions. The lower performance of serial recall is likely due to the additional retrieval demands associated with recalling ordinal information. Consistent with standard hypermnesia research (e.g., Payne, 1987; Roediger & Challis, 1989), we also anticipated that hypermnesia would be present in free recall and this finding was replicated, as free-recall performance improved across successive tests.

The present research also established that participants’ net order retention remained stable across successive tests. These results suggest that serial recall may utilize a combination of free recall and reconstruction processes. In other words, the experiment provided some evidence for a hybrid explanation of serial recall, where the positive hypermnesia of free recall balances out with the negative hypermnesia of reconstruction. As a result, serial recall performance displays no overall change across successive tests.

The current findings have several important implications for real-world situations, specifically related to eyewitness testimony. When a person witnesses a crime and is later questioned about the details of that crime, the questioning process closely resembles serial recall in that eyewitnesses are repeatedly questioned regarding both the events observed and their order of occurrence. In the present experiment, we discovered that serial-recall performance does not improve across successive tests. Indeed, if serial recall is a hybrid of free recall and reconstruction, then one might expect a person to remember more details across repeated tests but the order or sequence of those details may become less accurate. This implies that repeated interrogation may not be the most effective way of obtaining additional information about witnessed crimes; the benefit of remembering more details may be balanced by the loss of order accuracy. Additional research should be dedicated to investigating the effects of repeated testing on serial recall for video of real events and further for the observation of live events.

In summary, the current experiment replicated past findings (e.g., Payne, 1987) and provided new data that will significantly influence our understanding of serial recall and repeated testing. These new findings will need to be taken into account when revising the current theories of hypermnesia (e.g., Payne et al., 1993; Roediger & Payne, 1982) or when developing a new comprehensive theory of reminiscence and hypermnesia. In regards to future research, it is imperative that more ecologically valid stimuli and procedures be used to investigate the effects of repeated testing on serial recall. In doing so, data can be collected and analyzed that more closely resembles real-world situations, thus leading to more reliable and influential findings.

**References**


Age Differences in Eating Disordered Behavior and Its Correlates

Eating disorders threaten the physical and mental health of an alarming number of people today. Eating disorders are serious and can be life threatening, therefore it is imperative that researchers investigate factors that may contribute to body image dissatisfaction and eating disordered behavior. The goals of this study were to determine whether there are significant differences in the level of eating disorders and body dissatisfaction between different age groups and whether different age groups have different factors contributing to disordered eating and body dissatisfaction. Results indicate that older groups are just as vulnerable to disordered eating and body dissatisfaction as are younger groups. In addition, different factors, including mass media, self-esteem, perfectionism, negative affect, anxiety, and self-focus, relate to disordered eating and body dissatisfaction in different age groups.

The eating disorders anorexia nervosa and bulimia nervosa currently threaten the physical and mental health of an alarming number of people today. Anorexia nervosa is characterized by maintenance of weight below 15% of normal for age and height, an intense fear of gaining weight, and eventual amenorrhea (American Psychiatric Association [APA], 2002). Bulimia nervosa is identified by a pattern of bingeing followed by compensation for the excessive caloric intake by vomiting, laxative use, fasting, or overexercising (APA). The prevalence of eating disorders has increased in recent years (Kitsantas, Gilligan, & Kamanta, 2003). Precise estimates of incidence and prevalence vary but tend to range from about 3% to 10% of women 15–29 years of age (Polivy & Herman, 2002) and about 2.4% for men (Espina, Ortego, Ochoa, Aleman, & Juaniz, 2002). Concern over body shape is even more prevalent, with research indicating 32% of women and 8.9% of men being affected (Espina et al., 2002).

Virtually all conceptualizations of eating disorders, including the criteria in the DSM-IV-TR (American Psychiatric Association, 2002), make reference to body image (Polivy & Herman, 2002). Body image has been characteristically defined as self-appraisals and emotional experiences about one’s physical appearance (Braitman & Ramanaiah, 1999) and body dissatisfaction has been defined as negative feelings about the body (Polivy & Herman, 2002).

Factors Related to Disordered Eating and Body Dissatisfaction

Eating disorders are serious and can be life threatening. Medical risks include electrolyte imbalances, cardiac arrhythmias, and the female athlete triad (Petrie & Rogers, 2001; Thompson, 1996). The female athlete triad is defined as a combination of an eating disorder, osteoporosis, and amenorrhea all at the same time. Therefore, it is imperative that researchers investigate factors that may contribute to body image dissatisfaction and eating disordered behavior. The present work explored the relation between eating disorders and several well-documented factors including mass media, self-esteem, perfectionism, negative affect, anxiety, self-focus, and age.

Mass Media

In recent years, a great deal of research has examined the influence of exposure to media images on the development of eating disorders. Evidence has
shown that media may play a powerful role in the formation of eating and body image disturbances (Thompson & Heinberg, 1999). The Western thin-ideal and the body dissatisfaction associated with it have been shown to be important risk factors for eating pathology (Twinley, 1999). In a sample of undergraduate women, one study found that how often individuals view media, particularly media believed to promote thinness, predicts body dissatisfaction and disordered-eating symptomatology (Harrison & Cantor, 1997). Hawkins, Richards, Granley, and Stein (2004) found that for women, media exposure predicted disordered eating symptomatology, drive for thinness, and body dissatisfaction. For men, media use predicted approval of personal thinness, dieting, and select attitudes in favor of thinness and dieting for women. Also, men exposed to ideal image advertisements became significantly more depressed and had higher levels of muscle dissatisfaction than men exposed to neutral ads (Agliata & Tantleff-Dunn, 2004). Exposure to certain media appears to be associated with a subsequent increase in eating disordered symptomatology. Exposure to thin-ideal media image may contribute to the development of eating disorders by causing body dissatisfaction, negative moods, low self-esteem and eating disorder symptoms in women (Hawkins et al., 2004).

**Self-Esteem**

In addition to the influence of media exposure, self-esteem appears to play a large role in the development of eating disordered behaviors. Self-esteem was found to predict body satisfaction in both men and women (Green & Pritchard, 2003). Furthermore in nonclinical samples, self-esteem negatively correlates to disordered eating symptoms (Granillo, Jones-Rodriguez, & Carvajal, 2005) and a decrease in self-esteem contributes to poorer body image (Abell & Richards, 1996; Gleason, Alexander, & Somers, 2000) and bulimic symptoms (Vohs, Bardone, Joiner, Abramson, & Heatherton, 1999). Finally, cross-sectional research has shown that the most important variables in emergent bulimic symptoms included body dissatisfaction, self-esteem, depression, and dieting. In addition, all these symptoms play a role in eating disorder through various pathways (Mora-Giral, Raich-Escursell, Segues, Torras-Claraso, & Huon, 2004).

**Perfectionism**

Perfectionism was linked to eating disturbances in several studies. It was shown that disordered eating attitudes increased with perfectionism (Hopkinson & Lock, 2004). Research indicates that perfectionism is associated with body dissatisfaction and shows that stress can trigger abnormal eating and even eating disorders in individuals with perfectionistic personalities (Ruggiero, Levi, Giuna, & Sassaroli, 2003). In a case study, perfectionism contributed to the maintenance of a person’s eating disorder, and on this basis it was predicted that reducing clinical perfectionism would improve eating disorder psychopathology. As predicted, eating disorder psychopathology was improved after reducing clinical perfectionism (Shafran, Lee, & Fairburn, 2004). Finally, women who were high in perfectionism and who considered themselves overweight were more likely to experience bulimic symptoms (Vohs et al., 1999).

**Negative Affect/Mood**

Numerous studies have examined the contribution of positive and negative affectivity to disordered eating and body dissatisfaction. Presnell, Bearman, and Stice (2004) found that negative affectivity predicted increases in body dissatisfaction. The results of a 3- to 4-year prospective study demonstrated that negative affect/attitudes at the beginning of the study strongly predicted later disordered eating (Leon, Fulkerson, Perry, Keel, & Klump, 1999). Kitsantas et al. (2003) examined the self-regulatory and subjective well-being of students diagnosed with eating disorders, at-risk students, and individuals without eating disorders. They found that students with eating disorders scored significantly lower on the life satisfaction and positive affect scales than did those students at risk of eating disorders or students without eating disorders. Also, both the groups with eating disorders and the at-risk students scored significantly higher on negative affect than did the groups without eating disorders.

**Anxiety**

The link between eating disorders and mood disorders has been well-documented in the literature, and research has begun to consider anxiety as a potential precursor to the development of eating disorders. Specifically, certain features of social anxiety may play an important role in the development and maintenance of eating disorders. Clinical groups report higher levels of social anxiety than do nonclinical groups, and social anxiety is associated with higher levels of bulimic symptomatology (Hinrichsen, Wright, Waller, & Meyer, 2003). In another study, individuals with anorexia nervosa and bulimia nervosa were examined to establish the rate of anxiety disorders in that population. Results indicated that approximately two-thirds of the individuals with eating disorders had at least one anxiety disorder, and a majority reported experiencing the anxiety symptoms before they developed the eating disorder. Even those people who had
an eating disorder but no anxiety disorder tended to be anxious, perfectionistic, and harm avoidant (Kaye, Bulik, Thorton, Barbarich, & Masters, 2004).

Self-Focus

There is no research specifically on self-focus as a risk factor for eating disordered behavior. However, self-focus has been shown to be related to several risk factors of eating disorders, suggesting self-focus may play a role in eating disordered behavior. Self-focused attention refers to the direction of attentional resources towards one's own thoughts and feelings rather than towards objects in the external environment (Carver & Scheier, 1981). Self-focus has been shown to lead to perfectionism and anxiety (Ingram, 1990), which are two well-documented risk factors for disordered eating. Ingram found that people with clinical levels of social anxiety appear to have a heightened level of self-focus. The relation between mood and self-focus has also been examined. Research in which mood states are induced shows that self-focus increases with negative mood and decreases with positive mood (Green, Sedikides, Saltzberg, Wood, & Foranzo, 2003). Because many known risk factors of eating disorders are linked to self-focus, we found it important that self-focus be examined to determine its relation with disordered eating.

Age

The vast majority of eating disorder literature focuses on adolescents and traditional college-age students. Research conducted on adults is sparse. One study, however, did examine some risk factors in adults and found that media influence had a strong relation to body image dissatisfaction in adult women, and self-esteem predicted body dissatisfaction in both adult men and women (Green & Pritchard, 2003). Another study examined the differences between adolescents and adults in clinical presentation of eating disorders and found that adolescents (age 9-19) were more likely than adults (age 20-46) to have lower global severity scores, greater denial, and less desire for help. Adolescents in this study also displayed more weight loss, lower original and maximum weights, history of fasting, and elimination of junk food from their diets (Fisher, Schneider, Burns, Symons, & Mandel, 2001). It has also been shown that adolescents are more responsive to fashion magazines and report higher body dissatisfaction after viewing fashion magazines than do adults (Shaw, 1995).

Present Study

Though these studies are very beneficial, in all of them age is only categorized as child, adolescent, or adult. Currently, there are no documented studies that break age down in a more sensitive manor, such as by decade. Thus, the goal of this study was to break down age by decade and identify possible risk factors leading different groups to develop disordered eating. Two issues were investigated. First, are there significant differences in the level of eating disorders between different decades? Second, do different age groups have different factors contributing to disordered eating?

Method

Participants

Participants of this study were 272 undergraduates (67% female) at a large western state university. Approximately 90% of participants were White. They were all students of Introductory Psychology and received course credit for their participation in this study. The ages ranged from 17 to 68 ($M = 22.17, SD = 7.14$).

Measures

Body image dissatisfaction. Body image was assessed using the Body Shape Questionnaire (Cooper, Taylor, Cooper, & Fairburn, 1987; see Cooper et al. for discussion on validity and reliability) which contained various questions on how participants feel about certain aspects of their body (e.g., “Have you pinched areas of your body to see how much fat is?”). Responses were rated on a 6-point scale (1 = never, 6 = always), with higher scores indicating greater body dissatisfaction (Cronbach’s $\alpha = .94$).

Disordered Eating. Eating disturbances were assessed using questions from the Eating Attitudes Test (EAT-26) related to a preoccupation with food, eating, and weight (Garner & Garfinkel, 1979; Cronbach’s $\alpha = .94$). Twenty-six questions (e.g., “I am terrified about being overweight”) were scored on a 6-point Likert scale (1 = never, 6 = always). The EAT-26 was used in the present study because of its wide use and accuracy in self-reported testing for nonclinical populations (Mintz & O’Halloran, 2000).

Mass Media. The influence of societal pressures on body image was assessed by the Mass Media Influence Subscale of the Socialization Factors Questionnaire (Passino, Grant, & Vartanian, 2000). This 10-item scale inquires about the influence of magazine, TV, and models on individuals’ perceptions of themselves (e.g., “I feel bad about my own body after seeing attractive models in magazines and on TV.”). Participants responded on a 5-point scale (1 = strongly agree, 5 = strongly disagree). Questions were averaged to create a mass media influence scale (Cronbach’s $\alpha = .88$).
Self-Esteem. Levels of self-esteem were measured using the Rosenberg Self-Esteem Scale (Rosenberg, 1965), which has been shown to be both valid and reliable.

This scale uses a variety of questions assessing personal feelings about oneself as well as positive and negative emotions (e.g., “I feel I have a number of good qualities.”). Responses were measured on a 4-point scale (1 = strongly agree, 4 = strongly disagree, α = .89).

Perfectionism. Perfectionistic tendencies were assessed by asking participants various questions about their performance levels in activities such as school and the influence of the expectations of others (e.g., family, teachers, parents; “Only outstanding performance is good enough in my family.”). Responses were rated on a 6-point scale (1 = never, 6 = always). This measure is a subscale of the Eating Disorders Inventory (Garner, Olmstead, & Polivy, 1983) and demonstrated adequate reliability in this sample (α = .87).

Mood. To measure psychological adaptation, students responded to a 30-item short version of the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1981). This measure has been used successfully with adolescent populations (Lira, White, & Finch, 1977). The POMS is divided into six 5-item subscales and assesses tension, depression, anger, vigor, confusion, and fatigue. Responses were measured on a 5-point scale (1 = not at all, 5 = extremely). Responses were summed for each subscale, with higher scores indicating more of that symptom. In addition, we created an overall negative affect score (see McNair et al. for scoring information, as well as reliability and validity).

Anxiety. The State-Trait Anxiety Inventory (STAI) measures anxiety in adults (Spielberger, Gorsuch, & Lushene, 1969). It is a self-report assessment device that includes separate measures of state and trait anxiety. We were only interested in “trait anxiety” (via the T-Anxiety scale) which is more general and long-standing anxiety than the temporary condition of “state anxiety.” The T-Anxiety scale consists of 20 statements that assess how respondents feel “generally” (α = .92) and were rated on a 4-point scale (1 = almost never, 4 = almost always).

Self-Focus. Self-focus was measured using a self-focus temperament scale (Spievak, Kerr, & Callahan, 2005). Twenty-six items were rated on a five-point scale (1 = extremely uncharacteristic, 5 = extremely characteristic) as to how well they described the participants (e.g., “I think about myself a lot”). Items were summed with higher scores indicating higher levels of self-focus (α = .89).

Procedures
All participants were given the survey in a classroom environment and were allowed 50 minutes to complete the survey.

Results
We first examined age differences in eating disorders and body dissatisfaction in our population using an analysis of variance (ANOVA). As displayed in Table 1, there were statistically significant age differences in disordered eating and in body dissatisfaction. An LSD post hoc analysis revealed that participants in their teens reported higher disordered eating than participants in their 20s (MD = 2.45, SE = .97), whereas participants in their 40s or older reported higher disordered eating symptomatology than participants in their 20s (MD = -5.73, SE = 2.13). We did not find significant differences between the teens and the 30s group (MD = 1.16, SE = 2.03), the teens and the 40s and older group (MD = -3.28, SE = 2.09), the 20s and the 30s groups (MD = -1.16, SE = 2.08), or between the 30s and the 40s and older groups (MD = -4.44, SE = 2.78). For body dissatisfaction, participants in the teens were more dissatisfied than those in their 20s (MD = -.30, SE = .12), participants in their 30s were more dissatisfied than those in their 20s (MD = -.74, SE = .26), and the 40s and older participants were also

### Table 1

<table>
<thead>
<tr>
<th>Age Group</th>
<th>BSQ Mean (SD)</th>
<th>EAT-26 Mean (SD)</th>
<th>F</th>
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<tbody>
<tr>
<td>Teens</td>
<td>2.77 (1.03)</td>
<td>8.60 (8.9)</td>
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<tr>
<td>20s</td>
<td>2.47 (1.06)</td>
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</tr>
<tr>
<td>30s</td>
<td>3.21 (0.79)</td>
<td>7.44 (9.09)</td>
<td>4.35**</td>
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<tr>
<td>40s+</td>
<td>3.06 (1.05)</td>
<td>11.88 (8.77)</td>
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Note: *p < .05, **p < .01
more dissatisfied than the 20s group (MD = -.59, SE = .27). There were no significant differences found between the teens and the 30s group (MD = -.45, SE = .26), the teens and the 40s and older participants (MD = -.29, SE = .26), or between the 30s and the 40s and older groups (MD = .15, SE = .35).

To examine whether the relation between our risk factors and disordered eating and body dissatisfaction would be the same for the different age groups, we ran Pearson’s correlations for each age group, between each age group, and the EAT-26 and BSQ. These correlations are shown in Table 2. There was a significant negative correlation between body dissatisfaction and self-esteem in all age groups. Media was very strongly positively correlated to both body dissatisfaction and disordered eating in the teens and 20s groups, but correlated only to disordered eating in the 30s group and body dissatisfaction in the 40s and older group.

A significant negative correlation between disordered eating and self-esteem was found for the teens and participants in their 30s, but not for participants in their 20s or 40s and older group. Perfectionism was significantly positively correlated to body dissatisfaction for participants in their teens and participants in their 40s and older, but not for participants in their 20s or 30s. Perfectionism was significantly positively correlated to disordered eating for all age groups. Significant positive correlations were found between mood and both body dissatisfaction and disordered eating in the teens and 20s groups. Conversely, there were no significant correlations between mood and either body dissatisfaction or disordered eating for participants in their 30s or 40s and older.

Anxiety was also found to be positively correlated to both body dissatisfaction and disordered eating for the teens, those in their 20s and participants in their 40s and older, and correlated with disordered eating and not body dissatisfaction for participants in their 30s. Lastly, self-focus was positively correlated to disordered eating but not body dissatisfaction for the teens. Self-focus was also positively correlated to both body dissatisfaction and disordered eating for participants in their 20s, and it was also found to be correlated with body dissatisfaction and not disordered eating for the 30s group. There were no significant correlations between self-focus and the 40s and older group for either body dissatisfaction or disordered eating.

**Discussion**

Due to a paucity of literature on disordered eating and body image dissatisfaction in discrete age groups, the goals of this study were to break down age by decade and identify possible risk factors correlated to disordered eating and body dissatisfaction in the different age groups. The main issues investigated were whether there are significant differences in the level of eating disorders between different decades and whether different age groups have different factors contributing to disordered eating.

### TABLE 2

<table>
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<tr>
<th></th>
<th>Self-esteem</th>
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Note: *p < .05, **p < .01
Our results on the prevalence of eating disorders for age groups were somewhat surprising. Our results showed that body dissatisfaction is actually highest for persons in their 30s, and lowest for persons in their 20s. Statistically, participants in their 20s scored significantly lower on the BSQ than did participants in any of the other three age groups. As for disordered eating, participants in their 40s scored the highest. As with body dissatisfaction, participants in their 20s scored the lowest. Much of the literature on disordered eating and body dissatisfaction focuses on adolescents and teens because they are at a higher risk (Fisher et al., 2001). Our findings, however, indicated that older groups may be just as vulnerable as younger groups because body dissatisfaction and disordered eating were actually higher in the older groups in our study. Also, our research showed that participants in their 20s were less susceptible to both disordered eating and body dissatisfaction indicating that something about being in this age group may lessen these disturbances. Below we will discuss possible reasons for these differences.

**Mass Media**

Consistent with the literature (Hawkins et al., 2004; Thompson & Heinberg, 1999), we found that media strongly correlated to both body dissatisfaction and disordered eating in the teens and 20s group, but only correlated with disordered eating in the 30s group and body dissatisfaction in the 40s and older group. These data showed a correlation between media exposure and body dissatisfaction and disordered eating in all age groups, although the two younger age groups displayed higher correlations than did the older age groups. Previous research shows adolescents to be more responsive to fashion magazines and reporting higher body dissatisfaction than adults after viewing such materials (Shaw, 1995). Our results suggest that this decrease in the negative relationship between media viewing and disordered eating and body image may decrease throughout adulthood as well.

**Self-Esteem**

Similar to previous studies (Green & Pritchard, 2003), we found a significant negative correlation between body dissatisfaction and self-esteem in all age groups. Previous studies have also shown that low self-esteem is positively correlated with disordered eating (Granillo et al., 2005). Our data, however, only found this correlation for participants in their teens and participants in their 30s. Because self-esteem predicted body image dissatisfaction in all age groups and only predicted disordered eating for two of the age groups, it appears that self-esteem is a stronger predictor of body dissatisfaction than it is for disordered eating. We hypothesize that people with low self-esteem almost always have high body dissatisfaction, but only some of these people with low self-esteem develop disordered eating, and this may relate to their age.

**Perfectionism**

Research indicates that perfectionism is associated with body dissatisfaction (Ruggiero et al., 2003) and our data partially supports this conclusion. We found perfectionism was significantly positively correlated to body dissatisfaction for participants in their teens and participants in their 40s and older, but not for participants in their 20s or 30s. This may have to do with the fact that perfectionism seems to peak in teens (Amanat, 1994) and in middle aged adults (Christain, 1969). Previous studies have also shown that disordered eating attitudes increased with perfectionism (Hopkinson & Lock, 2004). Our data support these findings in all of the age groups. Our findings on perfectionism indicate that participants with disordered eating are very perfectionistic, but not all participants with body dissatisfaction are highly perfectionistic. Therefore, people who are highly perfectionistic may develop disordered eating but not necessarily have body dissatisfaction. It may be their drive for perfection and control causing the eating disorder rather than being dissatisfied with their bodies.

**Negative Affect/Mood**

Previous research indicates that negative affect is a risk factor for both body dissatisfaction (Presnell et al., 2004) and disordered eating (Leon et al., 1999). Our data support these findings, but only for the teens and the 20s groups. Conversely, we did not find associations between mood and body dissatisfaction or disordered eating for participants in their 30s or 40s and older. These findings suggest that negative affect is a stronger risk factor for body dissatisfaction and disordered eating in younger age groups and may not be a risk factor for people in older age groups. The literature shows that negative affect increases with age and positive affect decreases with age (Pinquart, 2001). This pattern of results may make negative affect less predictive of disordered eating and body dissatisfaction in the older age groups as more people are affected.

**Anxiety**

Our study confirmed research showing a correlation between anxiety symptoms and disordered eating (Kaye et al., 2004). We found anxiety was positively correlated with both body dissatisfaction and disordered eating for the teens, participants in their 20s
and participants in their 40s and older. Anxiety was correlated with disordered eating but not body dissatisfaction for participants in their 30s. These results indicate anxiety is related to disordered eating and body dissatisfaction regardless of age.

**Self-Focus**

To date, there is no research on self-focus as a risk factor for disordered eating. Our findings show self-focus was positively correlated with disordered eating, but not body dissatisfaction for the teens. Self-focus was also positively correlated with both body dissatisfaction and disordered eating for participants in their 20s and was also positively correlated to body dissatisfaction and not disordered eating for the 30s group. There were no significant findings for self-focus and the 40s and older group for either body dissatisfaction or disordered eating. These results indicate that participants in their 20s with high self-focus may also be at a high risk for both disordered eating and body dissatisfaction. Although participants in their 20s were at the lowest risk for disordered eating and body dissatisfaction, those participants who did have disordered eating and body dissatisfaction also had the highest levels of self-focus. It appears that self-focus plays a unique role in the development of symptoms of eating disorders and body dissatisfaction.

**Limitations**

This study examined disordered eating and body image dissatisfaction in very discrete age categories and found several promising results. This study, however, is not without limitations. One possible shortcoming of our research is the small sample size in the 30s and 40s age groups. This small sample size was due to the research being conducted at a university in which most students are of traditional college age. Another drawback of our study is that all participants are college students enrolled in an introduction to psychology course. Finally, the questionnaire was quite lengthy and all participants received the questions in the same order, which may have lead to participant fatigue toward the end of the survey. All of these factors limit the generalizability of our findings.

**Conclusion**

Our prospective findings provide additional information on the risk factors for both disordered eating and body dissatisfaction. We add to the literature by investigating differences in risk factors for different decades. Our findings warrant further study of age differences in risk factors of disordered eating and body dissatisfaction. Future studies should examine these variables utilizing more participants in the 30s and 40s age groups.

**References**


Age Differences in Eating Disordered Behavior □ Elgin and Pritchard


Passino, R. M., Grant, C. L., & Vartanian, L. R. (2000). “To be thin or buff?” Relations among appearance-related feedback and the body image concerns of females and males. Poster session presented at the annual meeting of the Midwestern Psychological Association, Chicago, IL.


Personality disorders are characterized in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; American Psychiatric Association [APA], 1994) as a continuing pattern of inner experience and behavior that varies from the expectations of one’s culture, is pervasive and inflexible, has an onset on adolescence or early childhood, is rigid over time, and causes distress and or damage. The DSM-IV lists 10 categories of personality disorders: (a) paranoid personality disorder (characterized by a pattern of distrust and suspiciousness); (b) schizoid personality disorder (defined by detachment from social relations and a limited variety of emotional expression); (c) schizotypal personality disorder (defined as having a pattern of severe discomfort in close relationships, cognitive or perceptual misrepresentation, and idiosyncrasy of behavior); (d) antisocial personality disorder (defined as a disregard for, and violation of, the other’s rights); (e) borderline personality disorder (defined by a pattern of unstable interpersonal relationships, self-image, and affects); (f) histrionic personality disorder (characterized by the pattern of extreme emotionality and attention seeking); (g) narcissistic personality disorder (characterized by grandiosity, need for acceptance, and lack of empathy); (h) avoidant personality disorder (defined as a pattern of social constraint, feeling of insufficiency, and excessive sensitivity to negative evaluation); (i) dependent personality disorder (defined by an extreme need to be taken care of); (j) obsessive-compulsive personality disorder (characterized by a preoccupation with orderliness, perfectionism, and control). Two other personality disorders are discussed in the DSM-IV as being provisional in nature: depressive personality disorders (characterized by a pervasive pattern of depressive cognitions and behaviors) and passive-aggressive personality disorder (characterized by negativistic attitudes and passive resistance to demands for adequate performance in social and occupational situations).

In order to assess personality disorders, a variety of techniques have been used, including clinical interviews and self-report questionnaires. Clinical interviewing for personality disorders involves a process of...
initial observation and screening, the identification of symptom clustering, and then a diagnosis-specific inquiry (Fong, 1995). Among the most widely used interview techniques for assessing personality disorders is the Personality Disorder Examination (PDE; Loranger, Susman, Oldham, & Russakoff, 1987). The PDE consists of 126 items designed to provide both dimensional scores and personality diagnoses based on the DSM-III-R criteria. Research by Hunt and Andrew (1992) provided evidence for the reliability of PDE for the diagnosis of personality disorders. Another widely used interview technique for measuring personality disorders is the Structured Clinical Interview (SCID; Spitzer, Williams, Gibbon, & First, 1992), a semi-structured clinical interview designed to assess DSM-III-R personality disorders.

In addition to interview techniques for assessing personality disorders, several objective self-report questionnaires have also been developed to assess the DSM personality disorders. The Millon Clinical Multiaxial Inventory (MCMI; Millon, 1994) was designed to assess the DSM-III personality disorders. The MCMI is a 175-item, true-false self-report inventory that contains 20 clinical scales and one validity scale. In his review of the MCMI, Craig (1999) reported that most of the scales seemed sufficiently reliable over reasonable test-retest intervals with the possible exceptions of the dependent, passive-aggressive, borderline, and paranoid scales.

Another self-report instrument that has been developed to assess personality disorders is the Personality Diagnostic Questionnaire (PDQ; Hyler, Rieder, & Williams, J. B. W., 1983), which contains 163 true-false items that assess the personality disorders described in the original DSM. The Personality Diagnostic Questionnaire-Revised (PDQ-R; Hyler & Rieder, 1987) is an updated version of the PDQ, based on the DSM-III-R criteria for the Axis II personality disorders. Later on, when the DSM-IV was developed, the PDQ-R was further updated and relabeled as the Personality Diagnostic Questionnaire-4+ (PDQ-4+; Hyler, 1994). The PDQ-4+ assesses the 10 DSM-IV personality disorders, plus the additional passive-aggressive and depressive personality disorders that are included in Appendix B of DSM-IV. Johnson, Bornstein, and Sherman (1996) concluded that self-report personality disorder questionnaires like the PDQ-4+ can provide valuable prognostic information in both nonclinical as well as clinical samples.

One of the goals of the present research was to examine the relationship between personality disorders and the gender roles of university students, especially given that the various versions of the DSM indicate that there are sex differences in certain personality disorders (APA, 1987). More specifically, these versions of the DSM indicate that men tend to be diagnosed with antisocial, obsessive-compulsive, and paranoid personality disorders, whereas women tend to be diagnosed as having borderline, dependent, and histrionic personality disorders. Consistent with the DSM criteria, several studies have reported that antisocial personality disorder was more common among men than among women (Dahl, 1986; Golomb, Fava, Abraham, & Rosenbaum, 1995; Kass, Spitzer, & Williams, 1983; Robins et al., 1984). Bodlund, Ekselius, and Lindstrom (1993) have also shown that men tend to be diagnosed with paranoid, schizoid, schizotypal, antisocial and obsessive-compulsive personality disorders, and that borderline and histrionic personality disorders were more often diagnosed among women than men. Similarly, Swartz, Blazer, George, and Winfield (1990) found that women were diagnosed more often with borderline personality disorder than men in a community sample. In addition, Grilo et al. (1996) found that borderline personality disorder was diagnosed more often in women, while narcissistic personality disorder was diagnosed more often in men. Furthermore, Reich (1987) reported that men were more often diagnosed as having paranoid and obsessive-compulsive personality disorders. Recently, Ekselius, Bodlund, von Knorring, Lindstrom, and Kullgren (1996) have reported that women were diagnosed more often with self-defeating personality disorder, while men were diagnosed more often with antisocial personality disorder.

A number of scholars have begun to speculate about the nature of these gender patterns in personality disorders. Gove (1978) reviewed the literature on gender and disorders and has argued that because women occupy a more frustrating and less rewarding position in society than do men, that they would be more likely to experience certain types of disorders. Later, Gove and Tudor (1973) posited an alternate rationale that men may overly express their hostility as compared to women, who tend to direct their hostility inwardly, which in turn leads them to develop certain types of psychological disorders.

The purpose of the present investigation was to examine whether several gender role tendencies would be associated with different personality disorder symptomology. In order to measure several different gender role tendencies, the present research used the Personal Attributes Questionnaire (PAQ; Spence & Helmreich, 1978), the Masculine Behavior Scale (MBS; Snell, 1989), and the Multidimensional Gender Consciousness Questionnaire (MGCQ; Snell & Johnson, 2004). The PAQ was designed to assess two gender role tendencies: self-assertive, instrumental traits (PAQ-I scale) that tend to be associated more often with men than women, and desirable socially
oriented, expressive traits (PAQ-E scale) that tend to be associated more often with women than men.

The Masculine Behavior Scale (MBS; Snell, 1989) is another instrument designed to assess gender role tendencies. More specifically, the MBS is designed to measure success dedication (defined as being excessively dedicated to the pursuit of success in one’s life), restrictive emotionality (defined as the public restriction of one’s privately felt emotions), inhibited affection (defined as the inhibition of one’s personal feelings of love and tenderness for others), and exaggerated self-reliance (defined as the tendency to be preoccupied with self-reliant and independence control over one’s life). The Multidimensional Gender Consciousness Questionnaire (MGCQ; Snell & Johnson, 2004) was developed as an additional measure of gender role tendencies. In particular, the MGCQ was intended to measure two aspects of gender consciousness: public gender consciousness and private gender consciousness. Public gender consciousness involves the tendency to be aware of people’s reactions to one’s own particular gender-related behavior, whereas private gender consciousness is defined as the tendency to be personally aware of gender-related phenomena about oneself and society.

**Hypotheses**

It was anticipated that higher levels of symptomology associated with both schizoid and schizotypal personality disorder would be associated with more traditional/conventional male gender role tendencies. More specifically, it was predicted that those individuals who score higher on the PDQ-4+ measures of schizoid personality disorder (those with greater schizoid personality disorder symptomatology) and schizotypal personality disorder (those with greater schizotypal personality disorder symptomatology) would be more likely to describe themselves as emotionally restricted and as affectively inhibited, as assessed by the Masculine Behavior Scale (MBS; Snell, 1989). These predictions were based on the rationale that men are more likely than women to develop schizoid personality and schizotypal personality disorder (cf. Bodlund et al., 1993) because of the restrictive emotionality and inhibited affection that characterizes the traditional masculine gender role (Snell, 1989).

**Method**

**Participants**

The participants in the present research sample were drawn from several lower division psychology courses at a small Midwestern university. The sample consisted of 62 participants (34 men; 28 women) who were assessed during the spring of 2005. The participants volunteered to participate in the research projects as one way to partially fulfill requirements in their course. Approximately 77% of the participants were lower-division students, and the remainder were upper division students (n = 12). About 89% of the participants reported that they had never been married, and the others were either currently in their first marriage (n = 4) or else divorced (n = 3). Approximately 89% of the participants reported having no children, and the others had between one child and three children (n = 7). Approximately 39% of the participants reported an income of less than $15,000, and the remainder of the participants reported incomes of more than $15,000 (n = 38). About 87% of the participants were White-Non-Hispanic American (n = 54), and the others were either African-American (n = 6) or Hispanic-American (n = 2). Approximately 66% of the participants reported that they were between 16 to 20 years old (no 16 or 17 year olds were actually in the sample), and others were over 21 years old (n = 21).

**Measure**

**Personality Diagnostic Questionnaire-4+ (PDQ-4+).** The Personality Diagnostic Questionnaire-4+ (PDQ-4+; Hyler, 1994) is a self-administered, forced-choice, true-false diagnostic instrument that measures all 12 DSM-IV Axis II personality disorders (Hyler, 1994). In responding to the PDQ-4+, the participants were asked to indicate how much each statement was generally true or generally false for them. A 2-point true and false scale was used to collect data on the participant’s responses, with true responses being scored a 1, and false responses being scored a 0. Hyler, Skodol, Kellman, Oldham, and Rosnick (1990) found that the Personality Diagnostic Questionnaire showed adequate test-retest reliability for many of the DSM-III personality disorders, and Trull and Larson (1994) found that the PDQ-R was significantly correlated with scales similar to those of the SCID, thus providing evidence for the validity of the PDQ.

**Personal Attributes Questionnaire.** The Personal Attributes Questionnaire (PAQ; Spence, 1993) was designed to measure the socially desirable aspects of instrumentality and expressiveness. The PAQ instrumentality scale is composed of self-assertive traits that were judged to be more characteristic of men than women; the PAQ expressiveness scale is composed of desirable, socially-oriented expressive traits that were judged to be more characteristic of women than men. In responding to the PAQ, the participants were asked to select a response that best described them. Each PAQ question consisted of two opposing characteristics, with the letters A to E in between them. Spence (1993) found that t tests comparing the means of men
and women on the two PAQ scales indicated that men scored higher on the PAQ-E scale and lower on the PAQ-I scale than women \( (p < .01) \). In addition, Spence and Helmreich (1978) reported that reliability for the PAQ subscales were .85 and .82, for PAQ-I and PAQ-E, respectively.

**Masculine Behavior Scale.** The Masculine Behavior Scale (MBS; Snell, 1989) was designed to measure four behavioral tendencies stereotypically imputed more to men versus women: restrictive emotionality (defined as inability to display privately felt emotions in public); inhibited affection (defined as the inhibition of affection and love towards loved ones); success dedication (defined as being excessively dedicated to the pursuit of success); and exaggerated self-reliance (defined as being preoccupied with self-reliance and control of one's life). In responding to the MBS, the participants were asked to indicate how much they agreed-disagreed with that statement. A 5-point Likert scale was used to collect data on the participant's responses, with each item being scored from +2 to -2: **agree** (+2); **slightly agree** (+1); **neither agree nor disagree** (0); **slightly disagree** (-1); and **disagree** (-2). Subscale scores were computed by summing the responses to the items assigned to each individual subscale. Negative (positive) scores indicated that the participants described themselves as not engaging (as engaging) in the stereotypically masculine behaviors measured by the MBS. Snell (1989) investigated the psychometric properties of the MBS by using reliability analyses and factor analysis. He reported that the internal reliabilities for the MBS subscales ranged from a low of .69 to a high of .89. In addition, he showed that factor analysis predicted the MBS's four factor structure.

**Multidimensional Gender Consciousness Questionnaire.** The Multidimensional Gender Consciousness Questionnaire (MGCQ; Snell & Johnson, 2004) was designed to measure several aspects of gender consciousness: public gender consciousness and **private** gender consciousness. Public gender consciousness is the tendency to be aware of other's reactions to aspects of one's own particular gender. By contrast, private gender consciousness involves the tendency to be personally aware of gender-related phenomena about oneself and society. Participant responses were measured on a 5-point Likert scale, with items being scored from 0 (Not at all characteristic of me) to 4 (Very characteristic of me). In order to create subscale scores, the items on each subscale were summed. Higher scores thus corresponded to greater public gender consciousness and private gender consciousness, respectively. Reliability scores for the Multidimensional Gender Consciousness Questionnaire were found to be acceptable.

**Procedure**

After the participants arrived at a testing room, they were briefly introduced to the study and were asked to read and sign an informed consent form. They were guaranteed complete anonymity and were assured that their responses would be kept in complete confidentiality. All participants who signed up for the experiment agreed to participate. Then, each participant received a questionnaire booklet containing the various measures (the presentation order was as shown above). After the completion of the measures, the participants received a written debriefing form that explained the purpose of the study. The questionnaire took approximately 50-55 minutes to complete. Small same gender groups of up to 17 participants were tested during each of the seven separate sessions.

**Data Analysis**

A multivariate procedure was used to analyze the data. Specifically, canonical correlation examined the hypotheses associated with the two groups of variables—the personality disorders measures and the gender role measures.

**Results**

The canonical correlation results for the personality disorders measures and the gender role measures are shown in Table 1. This canonical correlational procedure produced only one significant canonical solution. As an inspection of Table 1 shows, the results indicated that those respondents who reported greater paranoid, schizotypal, antisocial, borderline, histrionic, narcissistic, negativistic, and depressive personality disorder symptoms were more likely to describe themselves as having greater inhibited affection, exaggerated self-reliance, and private gender consciousness.

**Discussion**

The present study examined whether the personality disorders listed in the DSM-IV would be associated with people's gender role tendencies, as assessed by a variety of instruments measuring multidimensional aspects of gender roles. Previous research has demonstrated that specific personality disorders are associated more with men than women. Based on these findings, it was speculated in this study that people with more traditional/conventional masculine gender role tendencies would more likely to report greater schizoid and schizotypal personality disorder symptomology. More specifically, it was predicted that those individuals who score higher on the PDQ-4+ measures of schizoid and schizotypal personality disorder would be more likely to describe themselves as emo-
tionally restricted and affectively inhibited, as measured by the Masculine Behavior Scale (MBS; Snell, 1989). Because the instrument that assessed the personality disorders consisted of 12 separate subscales and because the group of gender role measures consisted of 8 separate subscales, a multivariate statistical procedure (i.e., canonical correlation) was used to examine this hypothesis.

The canonical correlation results provided partial evidence supporting this prediction, in that inhibited affection was found to be associated with a group of personality disorders that included schizotypal personality disorders. In particular, the canonical correlation results showed that a group of personality disorder symptoms—including those associated with not only schizotypal personality disorder, but also with paranoid, antisocial, borderline, histrionic, narcissistic, negativistic, and depressive personality disorder—were directly associated with the following cluster of gender role tendencies: inhibited affection, exaggerated self-reliance, and private gender consciousness. One possible explanation of this overall pattern of findings is that people with a variety of personality disorder symptoms, including the symptoms associated with schizotypal personality disorder, may have problems interacting socially with others. That is, people characterized by such a pattern of diverse personality disorder symptoms may be that way, in part, because they are unable to express their feelings of love and affection for others, to be excessively reliant upon themselves (versus perhaps seeking social support from others), and overly attuned to gender-related phenomena in themselves and society. Such a cluster of personality disorder symptoms seems to be uniquely associated with a pattern of gender role tendencies; wherein people separate them from others (via inhibited affection and exaggerated self-reliance) and that leads them to be extremely self-aware of their own gender-related behavior and gender-role issues in society (i.e., they have greater private gender consciousness).

The present results associated with the Masculine Behavior Scale (MBS; Snell, 1989) were congruent with previous research findings. In previous research, Snell (1989) has shown that the masculine gender role—gender roles that are more often attributed to men than to women—is strongly associated with restricted emotionality and inhibited affection. Somewhat similarly, the present research showed that the inhibited affection aspect of the traditional masculine gender role was directly related to several personality disorders that seem to be diagnosed more often among men than women (e.g., schizotypal and antisocial personality disorder). The present findings were also partially consistent with previous research reported by Bodlund et al. (1993), who discovered that male patients were more likely to report the personality pathologies of paranoid, schizoid, schizotypal, antisocial and obsessive-compulsive DSM-IV personality disorders. In the present study, there was evidence that some of these personality disorders were associated with two of the MBS subscales and with one subscale on the MGCQ. This would seem to imply that masculine rather than feminine gender role phenomena may explain in part why people are more often diagnosed with certain personality disorders.

<table>
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<td>Private Gender Consciousness (PrGC)</td>
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**Canonical Correlation Statistics:**

- Canonical Correlation: .73
- $F$: 1.65
- $p$: .001

Note: $N = 62$. Canonical loadings greater than |.30| are shown in bold. Higher scores on the PDQ-4+ correspond to greater amounts of the symptoms associated with each of the DSM-IV personality disorders. Higher scores on the gender role measures correspond to greater traditional gender role ideology, instrumentality, and expressiveness.
That is, there would seem to be a personality disorder vulnerability for those individuals characterized by extreme inhibited affection and exaggerated self-reliance. Future research needs to be conducted to confirm these ideas.

Given the results of the present study, it might be important for universities to monitor those students who score at extremely high levels on the MBS (i.e., those with extremely high restrictive emotionality, inhibited affection, and/or exaggerated self-reliance). In this manner, universities might be able to offer some type of supportive treatment to such students so that it would be possible to decrease any likelihood of their developing a personality disorder. Additionally, society itself may need to rethink some of the supposed advantages of traditional masculine gender role behavior. Such behavior may have more unintended personal consequences than anticipated. The tendency to inhibit the public expression of one’s love and affection for others might lead, for example, to social isolation and loss of one’s social network.

The present research includes several limitations, including the sample size, a restricted age range, and a limited type of individuals in the sample. Given the limitations of the present research, future research needs to include a greater number and a broader age range of individuals. In addition, a psychiatric population needs to be assessed to see if such individuals would be characterized by a pattern similar to the present university sample. In summary, the present research represents an initial study of the impact of gender role tendencies on personality disorder symptomology.

References
Gove, W. R. (1978). Sex differences in mental illness among adult men and women: An evaluation of four questions raised regarding the evidence on the higher rates of women. Social Science and Medicine, 12, 187-198.
A recent mass e-mail circulating online claimed that the correctness of letter order in a word did not matter and stated that as long as the first and last letters were in their original position, one could read it with no problems (personal communication, October, 2003).

This email did not operationally define “no problem,” resulting in confusion about what problematic was intended to mean. The concept that letter scrambling did not matter was demonstrated with a sample paragraph consisting of 79 simple words, most of which consisted of two to three syllables. This e-mail also suggests that people do not actually look at each individual letter in every word, but rather decode a word as a whole (personal communication, October, 2003).

This explained how an individual could read scrambled words as long as the first and last letters were in their original position. Because the original paragraph contained only simple words, this study questioned the likelihood that the lack of difficulty in reading scrambled words in a paragraph would broadly generalize to other reading samples.

Similar studies of letter order and word manipulation found that reading time and comprehension worsened due to the manipulation of letters in words (Jordan, Thomas, Patching, & Scott-Brown, 2003). Jordan et al. manipulated approximately 1 in every 10 words to one of three settings: initial, exterior, and interior pairs. Using the word castle as an example, the study showed that reading time and comprehension improved when the letters were in their original order. However, this research did not address the issue of whether the first and last letters of a word were properly placed.

Can You Read This Scramped Message? Testing a Mass E-mail Assertion

This research examined the effects of reading a passage when the letters in words were scrambled. It was conducted as a class project in response to an anonymous mass e-mail that claimed there was no effect on reading as long as the first and last letters of a word were properly placed (i.e., placed). The hypotheses of this experiment were that the scrambling of letters in words would: (a) increase latency, (b) increase frustration, (c) decrease comfort, and (d) reduce comprehension (perceived and actual). Participants read 1 of 4 paragraphs that varied in length and whether they were scrambled, then completed a short survey. The findings suggested that scrambling a word influenced reading latency, frustration, and comfort with the message, but not comprehension. Theoretical implications of these findings were discussed.

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We would like to acknowledge that the experimenters were students in a research methods class who conducted the project as part of their course requirements. A group of these students presented the findings at Tri-State, an undergraduate research conference (Stover, Nelson, Curtis, McCrimmon, Weck, & Arreola, 2003).

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the first two letters of the words were placed in their original location (caetls), the first and last letters were placed in their original location (claste), or the middle two letters were placed in their original location (lestac) respectively. They asserted that by pairing letters of a word together, the human mind could identify the entire word (Jordan et al., 2003).

Results of this study demonstrated that all combinations of pairs were equally important. In fact, it was not the pairing of the letters that mattered as much as the actual letter included in the pairing. Common letters such as “e” were harder to use to identify the word; whereas, words beginning with uncommon letters such as “q” were easier to identify (Jordan et al., 2003). This meant that the ability to decode a word was dependent on the letters in the word. If a scrambled word contained many common letters or began with a common letter, it would take longer to decode that word. This was especially true for most scrambled words consisting of more than one vowel. Thus, one could not assume a person’s ability to decode scrambled letters to be the same from one word to the next.

Another problem arose when letters had the possibility of more than one pronunciations. When reading a word containing a letter that has multiple pronunciations (such as vowels), a person must spend a longer amount of time decoding the word (Balota, Cortese, Sergent-Marshall, Spieler, & Yap, 2004). Balota et al. (2004) found that when presented with words such as pint, the reader must first realize the pronunciation of the “i,” then decode the rest of the word. Given that it is a common word, one would not need to use much cognitive effort to decipher the sound made by the vowel. However, in some scrambled words, readers did not always know what word was being presented to them. When a reader was decoding the scrambled word and came across letters with multiple sounds, it affected latency, comprehension, and frustration. Through the past two studies, every letter played an important role in a person’s ability to decode words. When researchers presented any part of a word incorrectly, problems occurred in a person’s capability to adequately read and comprehend the word.

A comparable study examined the influence of one-letter cues in a word on solving anagrams (Witte & Freund, 2001). The purpose was to identify which letter cue was most useful in decoding anagrams. The three cues included the first letter, middle letter, and last letter in the word. The first letter cue was the most helpful in figuring out the anagram. Though letter placement was critical for word retrieval, this research still demonstrated that any cue was better than no cue at all. Individuals receiving no cue took longer to identify the word than individuals with any cue (Witte & Freund, 2001). This suggests that a scrambled word would be easier to decode if the first and last letters are in the original position (by acting as cues). However, it would not result in the same level of reading comprehension as when the entire word is in an unscrambled form.

Studies using similar methods with shorter anagrams showed less dependency on cues. According to previous studies, the longer (or more complex) a scrambled word, the more need there was for information cues to accompany the word (Dominowski, 1968; Muray & Mastronardi, 1975). Scrambled words, despite certain letters remaining in their original position, would have a longer latency and result in less comprehension than unscrambled words. Witte and Freund (2001) also found that people typically assumed a consonant as the first letter of a word rather than a vowel. Thus, if given the middle or last letter cue, most people sorted through the consonants first and then moved on to the vowels after exhausting the other options. When this occurred, people reacted with more frustration because it took more effort to read the words.

The English language is read from left to right, yet it is debatable whether words are processed as a whole word or as individual letters read from left to right. Kwantes and Mewhort (1999) studied this by finding the orthographic uniqueness point (OUP), which is the letter at which the word becomes that word and only that. For example in “act,” the third letter is the OUP whereas in “actress,” the fourth letter is the OUP. They presented participants with words having different OUPs on a screen for varying lengths of time. The idea was that if people processed words from left to right, then it would take longer to process the words with later OUPs compared to the words with early OUPs. If this was true, then people need every letter in its correct place in order to decode and comprehend words accurately and at their optimal level. Their study found that retrieving a word involved sequential processing (Kwantes & Mewhort, 1999). In other words, people read words letter by letter, from left to right. If letters in a word were out of place, there would no longer be an OUP defining the word. With no useful OUP, the participants’ brains had to spend more time and effort decoding the word resulting in a longer reading latency and often more frustration.

Given past research identifying differences when reading words due to abnormal letter variations, the present study challenged the anonymous e-mail claim that scrambling letters within a word would cause “no
problems” when reading. Given that the e-mail was brief and contained relatively short words, it was hypothesized that the assumption that scrambling would not impact reading was false, because every individual letter is vital to the reading process. As such, an experiment was devised to test this assertion by comparing reading performances for the e-mail paragraph and for a more complex paragraph.

The study measured difficulties that readers may experience while reading a paragraph with scrambled words including reading latency, frustration, comfort, and comprehension. It was hypothesized that scrambling letters within words would impact these variables negatively leading to increased latency, frustration, decreased comfort, and comprehension (both perceived and actual). Additionally, reading a more complex paragraph would increase these effects.

**Method**

**Participants**

Experimenters selected participants for the study from various settings including malls, schools, and grocery stores. Each experimenter completed the study with one participant in each of four conditions. All participants were over 18 years of age and spoke English as their first language. The researchers set these characteristics as requirements for participants before the experiment began. Any of the participants not meeting these criteria were still able to participate, but their data were not included in the analyses. A total of 114 individuals participated, with 50 men and 61 women, 3 who did not report gender, and 8 individuals did not complete the experiment. Participants' level of education ranged from high school diploma to doctoral degree. Participants ranged from 18 to 74 years in age.

**Materials**

**Paragraphs.** The study used five different paragraphs. One paragraph was used as a control and four paragraphs were used in the experiment condition. The experimental paragraphs were either complex or simple and used either scrambled or unscrambled words.

The control paragraph, employed as a covariate, contained 95 words ($M = 5.08$ letters per word). The control paragraph measured participants’ reading ability. This paragraph remained unscrambled and all participants read it.

The remaining paragraphs served to present the difficulty and scrambling manipulations. The first experimental paragraph was the original mass e-mail that sparked interest in the question. This paragraph was defined as simple due to the length of the words ($M = 4.10$ characters) and the paragraph ($N = 79$ words) being shorter and more common.1 When scrambled, the paragraph contained words reordered in the following manner: The first and last letters of the words remained in the original positions, while the remaining letters of each word were randomly scrambled. Words with three letters or less retained their original placement.

The third passage was the complex paragraph and was from a practice American College Test (ACT, 2003) website. This was defined as complex by the length of the words ($M = 4.89$ characters) in the passage ($N = 297$ words) as well as the inclusion of less common vocabulary. For this passage, scrambling occurred in the same manner as the simple paragraph.

**Questionnaire.** Participants recorded levels of comfort, frustration, and perceived comprehension on a brief questionnaire. All items used 7-point Likert scales where higher numbers represented more of the target variable. When reading the complex paragraph, participants also completed a five question, multiple-choice questionnaire taken from a sample ACT to measure comprehension (ACT, 2003). There was no measure used to report actual comprehension for the simple paragraph. The participants also recorded their age and level of education.

**Procedure**

Participants were randomly selected from several public areas including malls, libraries, dormitories, and parking lots. Each participant read two paragraphs: the control paragraph and one of the four experimental paragraphs (chosen randomly by the experimenter). The participant first read the control paragraph and then read the experimental paragraph. Experimenters timed participants from the first word of the paragraph spoken until the participant was completely finished with the paragraph, then recorded the time for each of the two paragraphs individually. Following the paragraph reading, participants completed the questionnaire. Participants in the complex condition completed an additional comprehension measure.

**Results**

The hypotheses were tested using a 2 (complexity of paragraph) X 2 (scrambling of words) between-subjects analysis of covariance (ANCOVA). The control

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1 The Dolch Words determined the commonality of the words in each paragraph (Harris, 2003). The Dolch Words are a list of 220 words that generally make up 50-75% of the works that students read. A complexity ratio was computed by dividing the number of uncommon words in the paragraph by the number of total words. The complex paragraph contained more uncommon words than the simple paragraph, having ratios of .51 and .39 respectively.
paragraph, read before the manipulated paragraph, accounted for individual reading differences among the participants. All participants read this paragraph prior to reading the paragraph assigned to their condition. The control paragraph accounted for significant variance in the dependent variable for the following dependent variables: latency, F(1, 100) = 16.34, p < .01, r^2 = .14; comfort, F(1, 100) = 9.34, p < .01, r^2 = .09; and actual comprehension, F(1, 51) = 3.58, p < .06, r^2 = .05. This was not true for frustration, F(1, 100) = 1.41, p < .24, r^2 = .01; and perceived comprehension, F(1, 98) = .72, p = .40, r^2 = .01.

To test the hypotheses that latency increased with the complexity of the paragraph and with the degree to which the words were scrambled, an ANCOVA was conducted on reading times. Reading latency was longer for the scrambled paragraphs (M=120.13, SD=99.19) in comparison to the unscrambled paragraphs (M=80.91, SD=62.33), F(1, 100) = 35.96, p < .01, r^2 = .26. Also, reading latency was longer for the complex paragraphs (M=165.83, SD=66.28) than the simple paragraphs (M=30.98, SD=26.23), F(1, 100) = 293.98, p < .01, r^2 = .75. Additionally, a 2-way interaction existed between scrambling and the complexity of the paragraph. This interaction emerged because the difference between the scrambled (M=203.25) and the unscrambled latency (M=130.26) was greater for the complex paragraph than the difference between the scrambled (M=41.37) and the unscrambled (M=18.61) for the simple paragraph, F(1, 100) = 9.58, p < .01, r^2 = .09 (See Figure 1). The effects on latency may have been due to the length of the paragraph and not the complexity. Experimenters conducted a corrected test4 and the results for all three effects were still significant.

The ANCOVA for frustration revealed that frustration was greater with the scrambled paragraph (M = 3.67, SD = 2.12) than the unscrambled paragraph (M = 2.38, SD = 1.81), F(1, 100) = 26.13, p < .01, r^2 = .21. Frustration was higher when reading the complex paragraph (M = 4.33, SD = 1.85) than the simple paragraph (M = 1.63, SD = 1.18), F(1, 100) = 101.01, p < .01, r^2 = .50. There was no interaction between scrambling and complexity with respect to frustration, F(1, 100) = .89, p < .35, r^2 = .01.

A similar analysis conducted on reported comfort levels revealed that comfort was lower with the scrambled paragraph (M = 4.35, SD = 1.85) than with the unscrambled paragraph (M = 5.32, SD = 1.92), F(1, 100) = 16.97, p < .01, r^2 = .15. Comfort levels were also lower with the complex paragraph (M = 3.80, SD = 1.68) than with the simple paragraph (M = 5.94, SD = 1.55), F(1, 100) = 58.66, p < .01, r^2 = .37. No interaction was found between the degree to which the paragraph was scrambled and complexity when looking at comfort.

This study measured two types of comprehension—perceived and actual. All participants reported perceived comprehension. No effect for scrambling emerged for perceived comprehension, F(1, 98) = .78, p < .38, r^2 = .01. However, perceived comprehension was lower for the complex paragraph (M = 3.19, SD = 1.65) than for the simple paragraph (M = 6.29, SD = 1.21), F(1, 98) = 119.82, p < .01, r^2 = .55. There was no interaction between scrambling and complexity in regards to perceived comprehension, F(1, 98) = 3.04, p < .08, r^2 = .03. Actual comprehension was measured only in participants in the complex (the paragraph taken from the practice ACT) conditions. No main effect was found for actual comprehension, F(1, 51) = .87, p < .36, r^2 = .01.

**Discussion**

The data supported the first hypothesis that complexity and scrambling of a paragraph would affect latency in reading time, and that scrambling a complex paragraph would amplify this effect. This suggests that the assertion that there will be "no problems" reading a scrambled message was false. Scrambling the letters of a word did affect how one reads it, demon-

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4For the corrected test, the number of words in the complex paragraph was divided by the number of words in the simple paragraph to compute a ratio (3.76) that would correct for length. Then, researchers multiplied the latencies for the simple paragraph by this ratio. There was still a main effect for complexity, F(1, 100) = 31.13, p < .01; scrambling of letters, F(1, 100) = 22.24, p < .01, and an interaction F(1, 100) = 5.17, p < .05.
strated by the fact that it took longer to read. These results supported past research that showed an increase in latency due to the changing of words (Balota et al., 2004; Kwantes & Mewhort, 1999). Even with the correction for length, there was still a difference in latency between paragraphs (whether they were scrambled) and an increased effect when the complex paragraph was scrambled. This demonstrated that it was the complexity of the paragraph, not the length, which impacted the reading time.

The data also supported the second and third hypotheses. Participants experienced an increase in frustration and a decrease in comfort due to both the complexity of the paragraph and the scrambling of words within it. Participants became more frustrated and less comfortable with a scrambled message compared to an unscrambled one and with a complex message rather than a simple one. There was no interaction between complexity and scrambling. This illustrates that the effect of scrambling was equal across levels of complexity. Once again, this demonstrates that participants cannot read a scrambled message without problems, as the e-mail claimed.

The data partially supported the fourth hypothesis. Participants reported difficulty in comprehending the complex paragraph in comparison to the simple paragraph. However, there was no significant difference in the perceived or actual comprehension levels in regards to scrambling. Although this supports the e-mail claim, the significance could have been lost due to the complexity of the paragraph. The average comprehension was quite low suggesting that the paragraph may have been too complex. Although these results support the e-mail’s claim, the results may suggest a floor effect in comprehension from using a paragraph that participants did not understand even when unscrambled. Therefore, participants could not exhibit less understanding when the passage was scrambled. Another possible explanation for why there was no difference in actual comprehension could be that because the participants in the scrambled condition took longer to read the paragraph, they were just taking longer in order to better comprehend the paragraph. If this is true, than perhaps a time restriction while reading the paragraph would have yield more of a difference in comprehension.3 Finally, we must concede that these results might reveal that the email assertion was correct in regards to comprehension. While scrambling clearly impacted reading latency, frustration and comfort, perhaps the one area of reading that scrambling the words did not impact was comprehension.

Familiarity

The effects due to paragraph complexity may have been due to the familiarity of readers with the words themselves. According to Perfetti and Roth (1981), the more familiar a word, the easier it is to recognize and comprehend. Based on a list of Dolch Words (Harris, 2003), the complex paragraph contained more uncommon words. Participants easily recognized words in the simple paragraph even in the scrambled condition because of repetitive, past exposure, and familiarity to the words. Participants did not easily understand the experimental paragraph regardless of whether it was scrambled or not, which is demonstrated by lack of an effect for the perceived or actual comprehension measures.

Context and Positioning

The study also demonstrated the importance of context and correct positioning of letters when encountering new words. According to Nicholson, Bailey, and McArthur (1991), people comprehend more when provided contextual cues than when no contextual cues are provided. Within the scrambling condition, there are no contextual cues present resulting in poor comprehension. Also, when presented with a complex, scrambled word, the majority of participants became frustrated, resulting from decreased cognitive functioning.

Length

The length of the paragraphs may account for some of the effects. The length correction demonstrated that the difference in latency was not due to the length of the paragraph itself, but it did not rule out an effect from length on the other variables. It is likely that an increase in length could reduce perceived comprehension because the longer paragraph would include more ideas than the shorter paragraph. Length may have also influenced comfort and frustration as a person may be more likely to feel comfortable with a shorter paragraph.

Scrambling

Scrambling produced an effect on latency. This demonstrates that while people can read a scrambled message, they will not read it as quickly as an unscrambled one. Having to read a scrambled paragraph also increases frustration. When unscrambling the words, an individual’s cognitive processes are required to decode the words while attempting to comprehend their meaning, resulting in a decrease of comfort and  

3Experimenters wish to thank an anonymous reviewer for this contribution to the paper.
an increase in frustration. When a sentence contains many complex words, the process becomes more difficult and the effects are magnified. The results found by earlier research demonstrated increased frustration of participants when presented with altered words (Jordan et al., 2003). The increase of frustration with length of paragraph demonstrated a lack of whole-word recognition while reading the larger, unrecognizable words in the experimental paragraph. Thus, the assertions of the e-mail do not apply when words are complex and/or unfamiliar.

Limitations
The simple paragraph contained fewer scrambled words (47%) than the complex paragraph (58%). Because a large portion of this study examined how scrambling affected reading between simple and complex paragraphs, this could be a possible confound. If scrambling the words affects latency, frustration, and comfort, the results could be due to the unequal percentage of scrambled words.

Another limitation to this study was the style of writing. In this study, the simple paragraph was informal while the complex paragraph was formal. This could affect the variables because people may comprehend one style better than another style. In future studies, researchers should control for writing style by using only one type, or study it by making the style of writing another independent variable.

This was a class activity resulting in a team of researchers testing participants. The large number of experimenters may have caused errors in the study. Errors could have emerged in the measuring and reporting of latency and in differences in reading the protocol to participants. The way that researchers approached the participants and read the protocol (in a friendly manner versus in a disinterested one) also could have affected the person’s comfort levels. The comfort that the data represents could be due to the situation rather than with the paragraphs. Because we did not ask about the comfort before reading, we see an overall effect, rather than a change.

The large variability of environment may have had an effect on how the participants performed the task. For instance, some participants read the paragraphs at shopping malls while others were in an academic setting. Someone tested while in a classroom may be more likely to read with the intent of understanding the material, which would affect his or her comprehension. However, these limitations should cause an effect to be harder to find. Because the researchers found an effect, these limitations are assumed to be minimal.

Future Directions
Future studies should look at variables such as gender and level of education with larger sample sizes. They should also test participants in a controlled, experimental setting, limit the number of experimenters, and make sure all participants are previously unknown to the experimenters. In addition, experimenters should use pretests on how the participants would comprehend an unscrambled paragraph, to eliminate a floor effect. There could also be pretests within the study for comfort and frustration to demonstrate an actual change.

Additionally, experimenters should control for complexity versus familiarity by including a passage with complex but recognizable words. For instance, words could be included that are characterized by having more than two syllables but are familiar to those with a limited vocabulary. Examples of such words include “dinosaur,” “characteristics,” and “medication.” This would test if the effect is due to the complexity of the word or the participants’ familiarity with it.

Further research could also examine special populations such as individuals with reading disabilities. People with reading disabilities may also already be accustomed to the difficulty of fighting through a hard paragraph and thus, when reading a complex paragraph, their level of frustration would be less than that of a typical person. Comparing individuals with reading disabilities to those with normal reading capabilities would help further this research, as well as the health field.

Conclusions
This research has important implications. For example, the e-mail seems logical is possibly correct in regards to comprehension. However, the broad assertion is not correct due to ambiguities of its claim. When processing a word, people often use knowledge of consonant/vowel pairings, beginning (prefixes), and ending (suffixes) letter arrangement. As a result, simply leaving only the first and last letter is typically not enough information for one to recognize and comprehend an unfamiliar word. The context of the phrase or sentence is essential for comprehension in such instances.

These results suggest that changes in letter order influence people’s reading of words. One must then be cautious in making extreme spelling errors, especially when using an extensive or specialized vocabulary. While these results illustrated that reading a scrambled message did not affect comprehension, the e-mail’s assertion seems to be incorrectly generalized for all aspects of reading messages.
References
Students regularly experience difficulty writing papers in psychology classes. A primary source of difficulty is a lack of mastery of American Psychological Association (APA) style. We intend this article as a guide both for instructors grading student adherence to APA style and for students and researchers writing in APA style.

This article presents several common deviations from APA style. We compiled this list based on several years of teaching courses with extensive APA style writing requirements. This article is not a checklist for correct format or an exhaustive listing of all possible APA formatting errors; rather, it compiles what we view as the most commonly misunderstood elements of APA style and the most commonly committed stylistic errors.

Benefits and Use of APA Style

APA style is central to student socialization into the discipline of psychology and is the standard formatting style used in many disciplines outside psychology (Madigan, Johnson, & Linton, 1995). For professionals, deviation from APA style results in a reduced likelihood of acceptance of papers (Smaby, Crews, & Downing, 1999), although there is considerable variability in the importance of correct format across journals (Brewer, Scherzer, Van Raalte, Petitpas, & Anderson, 2001). For students, deviations from APA style tend to lead to lower grades on papers.

For the most part, undergraduate research methods courses in psychology introduce students to the elements of APA style (Smith & Eggleston, 2001). Coverage of APA style comprises over 10% of the material in psychology research methods textbooks (Jackson, Lugo, & Griggs, 2001). Despite the centrality of APA style to psychological writing, many students struggle with aspects of the format. For those faculty teaching the basics of APA style, there are many guides (e.g., Gelfand & Walker, 2001), techniques (e.g., Ault, 1991; Ware, Badura, & Davis, 2002), and checklists (e.g., Dunn et al., 2001) available. This article does not provide guidance in the basics of the format as these other sources do. Rather, we focus on common mistakes, with the goal of eliminating these errors and moving...

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stylistic adherence from good to excellent. Before discussing errors, we define several terms that appear in the APA manual. In our experience, many students are unfamiliar with some of the terminology that the manual uses, resulting in misunderstandings that promote stylistic deviation.

**Basic Definitions**

**Body**
The body of the paper refers to text starting at the introduction and running to the end of the discussion section.

**Character**
A character is a single typed space. For example, the heading titled Basic Definitions includes 17 characters: the 16 letters plus the space between them. APA style limits the number of characters used in manuscripts, both to promote conciseness and to save journal space. Most word processors can count characters. Correct use of APA style eliminates extra spaces or lines between sentences or paragraphs.

**Header**
A header (or page header) is a short title that consists of the first two or three words of the title and appears in the upper right hand corner of every page. By placing a short title and page number on each page, the pages can be easily put together in order if they become separated.

**Heading**
Headings denote the beginning of a section or subsection of the paper; each of the terms in italics on this page denotes a heading (or subheading) as does the centered item titled Basic Definitions.

**Pagination**
Pagination refers to page numbering, usually either by issue or volume.

**Running Head**
The running head is a short title that appears on the first page of the document. When published, the running head would reflect the title printed at the top of the pages of the article.

**Title Page Errors**

**Headers and Running Head**
A common running head error is a failure to capitalize the entire running head. An acceptable running head for this article is REFINING USE OF APA STYLE.

Students commonly commit several errors related to headers and running heads. The first common error is typing the header on each page manually. Although this strategy may initially produce a document that appears correct, additions or deletions to the body of the paper cause manually-typed headers to move, requiring constant reformatting. Instead, authors should use a word processor's header/footer option to create the header. The word processor will then automatically reproduce it on each page. The second common header error is failure to include the page number with the header. A word processor can automatically create the page number within the header. Also, there must be five spaces between the final letter in the header and the page number (or, alternately, the page number must be right-aligned and one line down). Another error is failing to double-space the header. Most word processors single space the header by default, so writers need to change it to double-spaced.

**Introduction**

**Titling the Introduction**
The introduction begins on the third page of the paper. Often students title the introduction section as Introduction. This section should have the same title as the paper itself, centered at the top of the page, followed immediately by the main body of the text.

**Method**

**Titling the Method Section**
Often students title the method section Methods. The correct title is Method and should be centered.

**People are Participants Not Subjects**
In most cases, use the term participants rather than subjects to refer to individuals who take part in research, because the term participant acknowledges the consent to participate in the study (APA, 2001). Use the term subjects only when referring to nonhuman animals and statistics (e.g., within-subjects ANOVA).

**Results**

**Effect Sizes**
“For the reader to fully understand the importance of your findings, it is almost always necessary to include some index of effect size or strength of relationship in your Results section” (APA, 2001, p. 25). Despite a call from the APA to include effect size measures alongside significance test results and some progress in the field in this regard, there remain examples that do not include measures of effect. For example, the APA Publication Manual’s sample paper and a prominent style guide (Szuchman, 2005) do not incorporate this information. These omissions sug-
suggest a failure to systematically follow through on effect size recommendations (Fidler, 2002). More practically, the lack of clear examples confuses students who may look to examples first for guidance. We present an example but encourage the reader to consult other resources on effect sizes (e.g., Kirk, 1996).

Incorrect presentation: Type of processor was found to be significant, \( F(1, 28) = 5.70, p = .02 \).

Correct presentation: Type of processor was found to be significant, \( F(1, 28) = 5.70, p = .02, \eta^2 = .20 \).

Decimal Places

Students often present results using too many decimal places. Statistical packages often report results to several decimal places but all of these decimals may not be meaningful. For example, imagine you measured the self-esteem of 100 participants on a scale with scores ranging from 0 to 100. Your calculations yielded \( M = 70.5245 \) for scores on the self-esteem scale. Many students present this value as it was computed - to four decimals. Does stating \( M = 70.5245 \) transmit more meaningful information than reporting \( M = 70.5 \)? In most cases, use of one or two decimal places is sufficient to provide needed information without sacrificing meaning. In most cases, statistical values reflecting correlations, inferential statistics (e.g., \( t, F, \) and \( \chi^2 \)), and probabilities should be rounded two decimal places.

Probability Values

The primary error we have observed regarding probabilities involves presentation of very small \( p \) values as \( p < .001 \). Several statistical packages report probability values to three decimal places. For a very small \( p \) value, statistical packages may round to \( p < .000 \). Reporting \( p < .000 \) suggests that drawing the observed sample from a population reflecting the null hypothesis is not just unlikely, but impossible. Instead, report these values as \( p < .01 \).

Format of Body of the Paper

Common formatting problems include beginning the method, results, and discussion sections on new pages; adding blank spaces between sections; or italicizing, bolding, or underlining the names of major section headings (e.g., Method, Results). Each of these sections should immediately follow the preceding section. For example, place the heading Results on the line immediately after the method section ends (of course, everything is still double spaced). Do not start a new page for each new section or add extra blank lines between sections.

Figures and Tables

Titles

Figures and tables require descriptive titles that indicate their content in detail, often including the independent and dependent variables. For example, a title of "Means, Standard Deviations, and Correlations" does not indicate the variables in the table. A better title would be "Means, Standard Deviations, and Correlations for Attitudes Toward Driving Drunk as a Function of Gender."

Italics, Placement, and Special Rules for Figure Pages

For tables, the title of the table appears in italics and one line below the term Table X, in which X refers to the table number; Table X is not italicized. Table titles use capitals for each major word, but figure titles have only the first word and proper nouns capitalized. Tables appear on a new page after the reference section of the paper with each table on its own page. For figure captions, the term Figure X appears in italics along with the title, which is not italicized and immediately follows Figure X. The rule for figures is the opposite of the format for tables. When using figures, the title for each figure goes on a page titled "Figure Captions" with the figures following on the next pages, one figure per page. This section begins on a new page after all tables. The page header and number appears on all tables and the captions page. The header and page numbers should, however, not appear on pages containing Figures. To identify the figure, on the back of the page, print by hand the word "Top" to indicate orientation, and the header and page number. Write the figure number in pencil on both the front and back of the figure.

Correct presentation of table title: Table 1

Means, Standard Deviations, and Correlations for Attitudes Toward Driving Drunk as a Function of Gender

Correct presentation of figure caption: Figure 1. Plot of attitudes toward driving drunk as a function of age.

References and Citations

References often contain more errors than any other section. Before discussing specific issues, we note that students often mimic the printed format of references found in academic journals. APA style is for manuscripts; journals and books may or may not follow that format and may deviate from APA style prescriptions. Journals can use their own styles; authors
of manuscripts should not deviate unless told otherwise by their editor or instructor. Thus, following APA style is important to avoid duplicating formats that are inconsistent with APA style.

Use of et al. With Multiple Author Papers

APA style requires use of et al. to designate authorship for studies with three or more authors. There are two basic rules. First, for in-text citations to sources with three to five authors, cite all authors the first time you cite the source (e.g., Schultz, Shriver, Tabanico, & Khazian, 2004), but cite only the lead author’s name followed by et al. for subsequent citations (e.g., Schultz et al., 2004). When a source has six or more authors, the correct format is to use the lead author’s name followed by et al. for all in-text citations. For example, the correct citation for an article by Grusky, Marelich, Erger, Mann, Roberts, Steers, and Damesyn (2003) is Grusky et al. (2003) for all in-text citations. This rule applies only to in-text citations; list the first six authors and use et al. to represent the seventh and subsequent authors in the References section.

Direct Quotes

We recommend limiting the use of direct quotes because using too many quotes tends to indicate a lack of synthesis of the quoted materials. To aid interested readers in finding the source of quotations, a page number must accompany each quotation.

Example: "The interaction between group valence and legality begs for future investigation, especially as it relates to immigration attitudes" (Short & Magaña, 2002, p. 709).

Spacing, Commas, and Capitalization in the References Section

The references section is very particular in regard to spacing, punctuation, and capitalization. A general rule to remember is that a single blank space must follow every period or comma (this rule applies to the main body of text as well). Regarding capitalization, capitalize the first word in an article or book title but not the remaining words unless they are proper nouns or follow a colon or dash. Capitalize the first letter of each word in a periodical title, except “small” words (e.g., for, and, of). Regarding author names, a comma appears after each name (and after each author’s initials) cited except for the final author’s initials, which are followed by a period.

Issue Numbers in References

A common format error involves inclusion or exclusion of issue numbers. Include the issue number only if each issue of the journal begins with page 1 (i.e., is paginated by issue). Do not include the issue number if the journal is paginated by volume. If needed, the issue number appears in parentheses (but not in italics) after the volume number (which is in italics). In general, the issue number is not necessary, because it provides superfluous information. Pagination by issue is rare in psychology, but it is the writer’s responsibility to determine whether this is in fact the case for a particular source.

Improper Format for References

Students often cut and paste citations from databases such as PsychInfo or PsychArticles directly into the References section. These citations tend to deviate from APA style and should be retyped in proper APA style.

Reference Examples

We provide two sample references. Note that for the first reference, there is a comma after the first author’s initial. The comma is necessary even when there are only two authors. Nothing in the title of either article is capitalized except for the first word in the title, the first word after a colon, and proper nouns. All words in the journal titles (except the small word “of”) are capitalized. The journal title and volume number are in italics. The references do not provide issue numbers, because both journals are paginated by volume. In the second reference, there is a single space after each period, including those between initials (e.g., W. D.).


Writing Style

Grammar

There are numerous grammatical and editorial suggestions included in the current APA publication manual. Please see Chapters 2 and 3 of the APA publication manual (APA, 2001) for a full explication of these rules. We suggest Bem (2004) for an excellent discussion of writing style and common grammar errors.

Capitalization

There are several rules regarding what to capitalize and what not to capitalize. Most commonly, students incorrectly capitalize the names of theories and
use capital letters to add emphasis. Generally speaking, capitalize only the first word in a sentence, headings, the first word after a colon, and proper nouns.

**Spaces**

In APA style, there should be a single space following commas, periods, semicolons, and colons. There is no place in the text of a paper where more than one space should appear between characters.

**Bold, Underlining, and Italic**

Student should never use bold or underlining font styles. Italic have designated uses in APA style, primarily for section subheadings, statistics (e.g., \( F \), \( t \), \( p \)), titles of books or periodicals, and volume numbers; avoid using italics for emphasis in the text.

**Numbers Expressed as Words or as Figures**

There are a surprising number of rules regarding whether to write out a number or use a figure (numeral) to express a value. The most common error is using figures instead of words to represent values under 10 (e.g., 4 conditions rather than four conditions). In most cases, use words to represent values under 10 and numbers to represent values of 10 and above. An exception occurs when a sentence begins with a number; always spell a number if it is the first word in a sentence. Another exception is that all numbers in the abstract are presented as figures. Try to avoid beginning sentences with numbers. Another exception occurs when presenting two or more values that represent precise measurements, only one of which is less than 10. In such cases, use all numbers (e.g., 4 dogs and 12 horses). Of course, always present statistical results as numbers and never as words.

**Abbreviations**

APA style limits use of abbreviations to specific scientific terms in common use and for terms used throughout a manuscript; for terms used only sparingly, or that are not in common use, it is probably best not to use an abbreviation. For example, a paper about affirmative action may use AA in places to save space. When using abbreviations, present the abbreviation in parentheses immediately after its first presentation, and thereafter always use the abbreviation, not the full term. Never use “vs.” to replace “versus” or “&” to replace “and” (except in direct quotes and in the References section), and avoid use of the term “etc.”

Correct abbreviation example: Rapid eye movement (REM) sleep is known to... Incorrect abbreviation example: REM (rapid eye movement) sleep is known to...

**Passive and Active Voice**

Passive voice refers to divorcing the verb (the action) from the subject (the actor). We view reducing passive voice as the best way to improve the clarity of writing, and APA style advocates active over passive voice whenever possible. Most word processors’ grammar and spelling checkers check for passive voice.

Passive sentence example: Participants were provided with a pencil and a notebook.

Active sentence example: We gave participants a pencil and a notebook.

Note that the active sentence makes clear who is carrying out the action, whereas the passive sentence does not.

**Tense**

Because research papers represent completed research studies, the past tense is correct for most of a research paper. Exceptions include suggestions for future research or papers that serve as research proposals rather than final reports.

**Final Comments**

In this article, we presented several common student errors. We believe that attention to these errors will improve student adherence to APA style. However, we caution students, instructors, and other writers and readers that this list of errors is not a substitute for use of primary materials such as the APA publication manual (APA, 2001). Rather, the most effective use of this article is in conjunction with that reference manual, and we hope that the combined use of these resources leads to clearer and more effective writing.

**References**


Sincere appreciation is expressed for the hard work on the part of the following individuals who served as reviewers for articles processed October to December, 2005. Without the assistance of such dedicated professionals, the Psi Chi Journal would not be able to function.

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Psi Chi Research Awards and Grants

Psi Chi annually sponsors national undergraduate and graduate research award competitions, as well as research awards for members submitting the best research for the regional and national paper/poster sessions. In addition, Psi Chi also sponsors grant programs to fund student and faculty research. Psi Chi’s award and grant programs now provide up to $250,000 to members annually. Descriptions of the award/grant competitions follow. Further information and submission forms may be obtained from the Psi Chi website (www.psichi.org).

Guilford Awards

All Psi Chi undergraduate members are eligible to submit their research for the Psi Chi/J. P. Guilford Undergraduate Research Awards. Cash awards are $1,000 for first place, $650 for second place, and $350 for third place. In addition, all winners and their faculty research advisors receive award certificates. The abstracts of the winning papers, as well as photographs and brief biographies of the top three winners, are published in Eye on Psi Chi. The deadline for this award is May 1.

Allyn & Bacon Awards

The Psi Chi/Allyn & Bacon Psychology Awards, sponsored by Allyn & Bacon Publishers, are open to all undergraduate Psi Chi members and are awarded to those who submit the best overall empirical research papers. The awards are $1,000 for first place, $650 for second place, and $350 for third place. In addition, all winners and their faculty research advisors receive award certificates. The abstracts of the winning papers, as well as photographs and brief biographies of the top three winners, are published in Eye on Psi Chi. The deadline for this award is May 1.

Erlbaum Awards

The Psi Chi/Erlbaum Awards in Cognitive Science, sponsored by publisher Lawrence Erlbaum Associates, Inc., are open to all Psi Chi undergraduate and graduate Psi Chi members and are awarded to those who submit the best overall empirical studies in the area of cognitive science. The awards are $500 for the first-place graduate student and $500 for the first-place undergraduate student. In addition, the winners and their faculty research advisors receive award certificates. The abstracts of the winning papers, as well as photographs and brief biographies of the top two winners, are published in Eye on Psi Chi. The deadline for this award is May 1.

Newman Graduate Award

All psychology graduate students are eligible to submit their research for the Psi Chi/APA Edwin B. Newman Graduate Research Award. The winner receives the following: (1) travel expenses to attend the APA/Psi Chi National Convention to receive the award, (2) a three-year subscription to an APA journal of the winner’s choice, and (3) two engraved plaques, one for the winner and one for the winner’s psychology department as a permanent honor to the winner. In addition, the abstract of the winning paper, as well as a photograph and brief biography of the winner, is published in Eye on Psi Chi. This award is presented during the prestigious APA/APF Awards ceremony at the APA/Psi Chi National Convention in August. The deadline for this award is February 1.

Bandura Graduate Award

All psychology graduate students who are Psi Chi members and graduate student affiliates of the American Psychological Society (APS) are eligible to submit their research for the Psi Chi/APS Albert Bandura Graduate Research Award. The winner receives the following: (1) travel expenses to attend the APS National Convention to receive the award, (2) a three-year membership in APS, including subscriptions to all APS journals, and (3) two engraved plaques, one for the winner and one for the winner’s psychology department as a permanent honor to the winner. This award is presented during the APS opening ceremony at the APS National Convention. The deadline for this award is February 1.

Regional Research Awards

All Psi Chi members (undergraduate and graduate) are eligible to submit their research for the Regional Research Awards. Cash awards of $300 each are presented to students submitting the best research papers to Psi Chi sessions at regional conventions. The number of awards in each region varies based on the size of the region; a total of 78 awards of $300 each are available for the academic year. Award monies are distributed at the conventions following the presentations. The Psi Chi regional vice-presidents each send a Call for Papers and a letter to the Psi Chi chapters in their respective regions during the fall. These letters include information about the Regional Research Awards, the regional conventions, and submission deadlines for Psi Chi programs. Deadlines for submissions vary according to region; check your fall regional mailing or the Psi Chi website (www.psichi.org) for details.
National Convention Research Awards

All Psi Chi members (undergraduate and graduate) are eligible to submit their research for the National Convention Research Awards. Cash awards of $300 for undergraduate and $500 for graduate are presented to students submitting the best research for Psi Chi sessions at the APA and APS national conventions. Up to 16 awards are given: eight for the APA Convention and eight for the APS Convention. Award monies are distributed at the conventions following the presentations. The deadline for submissions to the Psi Chi student sessions at both the APA and APS conventions is December 1.

Undergraduate Research Grants

All undergraduate Psi Chi members are eligible to apply for these undergraduate research grants. The purpose of this program is to provide funds for members to defray the cost of conducting a research project. Applicants may request up to $1,500 for each project. A total of $45,000 has been allotted for this student grant program. The deadline for this grant program is October 1.

Summer Research Grants

All undergraduate Psi Chi members are eligible to apply for these summer research grants (research must be conducted while still an undergraduate, not after graduation). The purpose of this program is to provide funds for members to conduct summer research at nationally recognized research institutions. During the academic year, Psi Chi will award 10 grants of $3,500 (a stipend of $2,500 to the Psi Chi student plus $1,000 to the sponsoring faculty member at the research institution). The deadline for this grant program is March 30.

NSF/REU Grants

All undergraduate Psi Chi members are eligible to apply for these summer research grants, which are offered by Psi Chi in conjunction with the Research Experiences for Undergraduates (REU) program sponsored by the National Science Foundation (NSF). The purpose of this program is to provide funds for members to conduct summer research at nationally recognized research institutions that have been identified by NSF as REU sites. This research must be conducted while still an undergraduate, not after graduation. Psi Chi will award a total of six grants to fund Psi Chi members who qualify for an NSF/REU grant during the academic year. A total of $30,000 has been allotted for this grant program. The deadline for this grant program is spring (check Psi Chi website for further details at www.psichi.org).

Faculty Advisor Research Grants

All current faculty advisors and coadvisors who have served an active Psi Chi chapter for at least one year are eligible to apply for these faculty advisor research grants. The purpose of this program is to provide funds for advisors to defray the direct costs of conducting a research project (no stipends included). Two grants will be awarded annually within each of Psi Chi’s six regions, for a total of 12 grants. The maximum amount of each grant will be $2,000. The deadline for this grant program is June 1.

Hunt Research Grants

All Psi Chi student and faculty members are eligible to apply for a Thelma Hunt Research Grant. Up to three grants of up to $3,000 each are presented annually to enable members to complete empirical research that addresses a question directly related to Psi Chi. Unlike other national Psi Chi award/grant programs, the Hunt Grants focus on research directly related to the mission of Psi Chi. The deadline for this grant program is October 1.

Undergraduate Psychology Research Conference Grants

The purpose of this program is to provide funds for local/regional undergraduate psychology research conferences. Funding is intended for conferences that will invite student research presenters from at least three schools in the area and will notify all Psi Chi chapters in the geographic area of the conference. Funding is not available for conferences intended for students from a single school. If a single school organizes the conference (and invites other schools), the school submitting an application must have a Psi Chi chapter. If a consortium of schools organizes the conference, at least one member of the consortium must have a Psi Chi chapter in order to be eligible to apply. The maximum grant for each conference is $1,000. The deadline for this grant program is October 1.

SuperLab Research Grants

All undergraduate and graduate Psi Chi members are eligible to apply for these research grants. The purpose of this program is to provide annual grants to aid one undergraduate and one graduate student in conducting computer-based research. Grant winners receive a copy of SuperLab experimental lab software and a response pad from Cedrus®. The deadline for this grant program is October 1.
The Psi Chi Journal of Undergraduate Research is a national, fully reviewed, quarterly journal dedicated to the publication of undergraduate student research. All active Psi Chi chapters receive one complimentary subscription to the journal. We encourage each chapter to see that an additional subscription is obtained for the school library and that other organizations and interested individuals are made aware of its availability. Every effort has been made to provide a high-quality publication and yet offer the journal at affordable subscription rates to ensure its availability to all interested students, faculty members, and institutions. Back issues and bulk orders for classroom use are also available.

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