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AP Psychology

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### Fitts' Law: Improving Human Movement

I chose Paul Fitts' Information Capacity of Human Motor Systems in Controlling the Amplitude of Movement because I discovered Fitts' Law in Jensen Harris blog post about the new user interface for Microsoft Office 2007. Jensen was explaining how Microsoft was using Fitts' Law to make Microsoft Office 2007 easier to use. Fitts' Law basically states that the speed of movement is a function of the size of the destination and the distance from the current position. Later research has proved that Fitts' Law applies to computers, especially when using a mouse to click on a button. Jensen explained in the blog post that the "Mini Toolbar" was created to sharply decrease the distance from the cursor to commonly used formatting commands, especially with large monitors.

However Paul Fitts did his work long before computer mice were created in 1954, on a contract with the Air Force. The article was originally printed in the *Journal of Experimental Psychology*, 47, 381-391. His research was conducted in 3 experiments. The first one instructed a collage-aged subject using a stylus to touch an area on one side of the table and then the other as fast as the subject could. The experiment varied the size of the "goal" area and the distance between the two. Another experiment asked the subject to move rings from one peg to another. The experiment varied the difference between the size of the peg and the hole in the disk as well as the distance between pegs. A final experiment asked subjects to move pegs from one rack to

another. The experiment varied the tolerance between the size of the hole and the size of the peg as well as the distance between the racks of pegs.

Fitts found that “the rate of performance for all tasks studied increased uniformly as movement amplitude was decreased and as tolerance limits were extended” ([Reprint] 266). Fitts also found that movements become difficult when there was a low tolerance and that movement was inefficient with a large tolerance and small amplitude. I would agree with his results and I believe that they make common sense.

As mentioned earlier, the results also match the user experience on a computer using a mouse or touch screen (Jensen).

Fitts’ report was only the beginning of research. Many researchers have worked on and extended his ideas (Jensen). Thus the original report written by Fitts does not provide a comprehensive introduction to Fitts’ Law which has been subsequently far more extensively researched. However Fitts’ research must have been convincing, since many people have worked on and built upon it.

Fitts’ goal was to investigate human motor skills under an Air Force contract. He was looking for a unified theory of motor capacity related to information gathered. I felt that he did not clearly explain how information was related to movement. He invented an index of difficulty and formula to create it. I however, do not see what the index of difficulty is trying to show. Also how does “information” relate to movement? I think that the information component should have been better explained or left out completely and the report should have focused on the time component.

I do not think that Fitts was biased or even could have been. Who has anything to gain by slanting research about human motor skills?

After reading Fitts' report I am wondering about how the information component affects results or even how that could be tested. I am also wondering what his index of difficulty explains.

Fitts states that his research was unique because it attempted to find a unifying theory reconciling the amplitude, duration, and variability of movements (262). He did this by proposing a formula which takes into account all of these factors.

This is a scholarly report because it is terse and does not clearly summarize the importance of this new research. Also it is published in a scholarly journal and lays out the experiments in detail.

Fitts cited 25 sources in his paper. The majority of the sources were other scholarly papers printed in similar journals.

Fitts' report broke new ground in 1954 by creating a unified theory reconciling the amplitude, duration, and variability of movements of the human motor system. His research was later built upon and confirmed by many substituent researchers. His law has been proven to be very important in the computer industry since it also applies to moving a mouse along the screen. Fitts' Law was used in creating Microsoft Office 2007 to make buttons easier to hit.

Works Cited

Harris, Jensen. "Giving You Fitts." Jensen Harris: An Office User Interface Blog. 22 Aug 2006.

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Fitts, Paul M. "Information Capacity of Human Motor Systems in Controlling the Amplitude of Movement." Journal of Experimental Psychology. 47 (1954) 381-391.

Author

Full title

date

Publisher

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What impresses you? →

What did you learn?

3 functions

Describe content

Evaluate article

Subjective Reflections

Criticism needs

Pg #s

1. Writer's goal in preparing work? Achieved?
2. Convincing? Comprehensive? Neglect anything?
3. Biased?
4. Intellectual Qv in mind raises
5. Unique aspects
6. Popular or scholarly
7. Cited sources? primary or secondary

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## Writing and article assignment for AP Psychology

Task: Using the laptops in the class room, you are to go and find three professional journal articles. Once you have found these articles, print them out. After printing, gloss each and then refer to your article review format.

<http://siggyappsy.pbwiki.com/f/instructions+for+written+reports.pdf>

### List of Approved Journals

- American Behavioral Scientist
- American Psychologist
- Child Development
- Day Care and Early Education
- Environment and Behavior
- Exceptional Children
- Journal Abnormal Psychology
- Journal of Applied Psychology
- Journal of Counseling and Clinical Psychology
- Journal of Counseling Psychology
- Journal of Exceptional Psychology
- Journal of Social Issues
- Journal of General Psychology
- Any other journal, please ask the teacher.

Place your work into some type of folder.

You will be graded on how well you complete the guidelines for reviews. I will choose one out of the three to grade.

Due Date:



# The Information Capacity of the Human Motor System in Controlling the Amplitude of Movement

Paul M. Fitts  
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Information theory has recently been employed to specify more precisely than has hitherto been possible man's capacity in certain sensory, perceptual, and perceptual-motor functions (5, 10, 13, 15, 17, 18). The experiments reported in the present paper extend the theory to the human motor system. The applicability of only the basic concepts, *amount of information, noise, channel capacity, and rate of information transmission*, will be examined at this time. General familiarity with these concepts as formulated by recent writers (4, 11, 20, 22) is assumed.

Strictly speaking, we cannot study man's motor system at the behavioral level in isolation from its associated sensory mechanisms. We can only analyze the behavior of the entire receptor-neural-effector system. However, by asking *S* to make rapid and uniform responses that have been highly overlearned, and by holding all relevant stimulus conditions constant with the exception of those resulting from *S*'s own movements, we can create an experimental situation in which it is reasonable to assume that performance is limited primarily by the capacity of the motor system. The motor system in the present case is defined as including the visual and proprioceptive feedback loops that permit *S* to monitor his own activity.

The information capacity of the motor system is specified by its ability to produce consistently one class of movement from among several alternative movement classes. The greater the number of alternative classes, the greater is the information capacity of a particular type of response. Since measurable aspects of motor responses, such as their force, direction, and amplitude, are continuous variables, their information capacity is limited only by the amount of statistical variability, or noise, that is characteristic of repeated efforts to produce the same response. The information capacity of the motor

system, therefore, can be inferred from measures of the variability of successive responses that *S* attempts to make uniform.

It is possible to determine experimentally the noise associated with each category of response amplitude and rate, and to infer the average information capacity per response and the maximum average rate of information transmission from the ratio of the magnitude of this noise to the magnitude of the possible range of responses. This line of reasoning agrees with Miller's (20) suggestion that the concept of information capacity can be interpreted as a sort of modern version of the traditional Weber-fraction and is consistent with Theorem 17 in Shannon (22).<sup>1</sup>

The present experiments are limited to motor tasks in which *S* is asked to make successive responses having a specified amplitude of movement. The information in which we are interested is generated in discrete increments, an increment being added by each successive "response." The relations to be studied are those holding among (a) the average amplitude, (b) the average duration, and (c) the distribution of successive amplitudes (variability) of a series of rapid movements that *S* attempts to produce with uniform amplitude. The thesis to be examined is that the channel capacity of the motor system, in a task involving a particular limb, a particular set of muscles, and a particular type of motor behavior (within limits), is independent of average amplitude and of specified permissible variability (movement tolerance).

The need for a unifying concept of motor capacity is indicated by the apparent difficulty of reconciling many of the facts reported in the literature on motor skill. These difficulties have in large measure stemmed from failure to recognize that the amplitude, the duration, and the variability of movements are interrelated.

Early investigators were interested chiefly in activities such as running, tapping with a telegraph key, writing longhand, and keeping time with a baton in which visual monitoring of

*Editor's Note.* This article is a reprint of an original work published in 1954 in the *Journal of Experimental Psychology*, 47, 381-391.

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Charles Kelly, Robert Silverman, and Charlotte Christner assisted in collecting the data here reported.

<sup>1</sup> Theorem 17 states that "the capacity of a channel of band *W* perturbed by white thermal noise of power *N* when the average transmitter power is limited to *P* is given by

$$C = W \log \frac{P+N}{N} \quad (22, \text{ p. } 67).$$

*W* is in cycles per second and takes the form of the reciprocal of some value of time. The power of a band of noise is equivalent to the variance of its amplitude distribution around its mean value.

Amplitude = distance

successive movement is minimal and in which successive movements do not have to be terminated precisely. The duration of this type of movement is essentially independent of its extent. Bryan (2), for example, reported that tapping rate varied only from 4.6 to 6 cps over an amplitude range from 1 to 40 mm. Noting that his results confirmed earlier experiments by Von Kries, he concluded that when movements are made at maximum rate "... the rate varies slightly with different muscles; increases with practice; but is not affected by variations of the amplitude of motion within wide limits, a certain medium amplitude requiring less time than longer or shorter distances" (2, p. 138). Freeman (9) studied handwriting movement and found little variation in the total time required to write letters as their size was varied. Stetson and McDill state categorically that "since the duration of the rapid movement is fixed, there can be but two variables, extent and force" (23, p. 25), and Hartson (12) makes fixed duration the basic characteristic of the ballistic movement.

Recent investigators (1, 3, 14, 21), studying tasks that require *S* to exercise precise control of movement amplitude but rely on his subjective standard of acceptable movement precision, have reported results that are contrary to those cited in the preceding paragraph. An example of such a task is moving a control quickly so as to realign a spot and a cross hair on an oscilloscope after the spot is suddenly displaced. Typically *S* is instructed to make an "exact" adjustment by the use of vision. The findings for this type of task indicate that the duration of quick corrective movements is a monotonically increasing function of amplitude. Studies of eye movements (6, 24) reveal a similar increase of movement duration with an increase in amplitude.

Although it has been known for many years that the accuracy of quick movements decreases with amplitude, the close relation of speed, amplitude, and accuracy often has been lost sight of. One of the earliest workers to emphasize the importance of their interrelation was Woodworth (25). Studying a variety of simple motor tasks performed with and without visual monitoring, he found that for quick, visually controlled movements variable error increases both with amplitude and with speed. Industrial engineers (19) also have consistently advocated that small-amplitude movements be used whenever possible in assembly work, on the grounds that the time required to complete a unit of work increases as a function of its amplitude as well as of the precision demanded by the task.

The concept of a fixed information-transmission capacity of the motor system not only accounts for such divergent results but also suggests a way of relating quantitatively the amplitude, duration, and variability of motor responses. The concept leads to the expectation that if repetitive movements of a fixed average amplitude are speeded up, then on the average each movement can provide less information, and movement variability will increase by a specified amount. Similarly, it suggests that if average movement amplitude should be increased then variability and/or average duration will also increase. The thesis can be tested experimentally in several ways.

An accepted method for estimating channel capacity in the case of a continuous signal requires a determination of the

average power of the noise associated with the output signal. An experimental determination of the channel capacity of the human motor system by this method would require that the average amplitude and duration (or frequency) of movements be controlled by *E* and that the amplitude variability of *S*'s movements be measured by procedures similar to those used by Woodworth (25). However, the recording and measurement of successive movement amplitudes are laborious. Fortunately for the present purpose man has remarkably good ability to adjust his average rate of performance to meet the demands of a particular task, such as the requirement that his movements fall within some specified tolerance range. Thus it is possible to assess the tenability of the thesis of fixed information capacity by means of a test of the following specific hypothesis: *If the amplitude and tolerance limits of a task are controlled by E, and S is instructed to work at his maximum rate, then the average time per response will be directly proportional to the minimum average amount of information per response demanded by the particular conditions of amplitude and tolerance.*

In performing a given task *S* may actually use movements that are less variable, i.e., which generate more information, than the minimum demanded by the task. When only the limits of variability are specified, the minimum information condition is met if all amplitudes within the tolerance range are used equally often, i.e., when responses are distributed rectilinearly over the tolerance range, whereas the actual dispersion of response terminations is an approximate Gaussian distribution. The rate at which *S* makes successive responses in a given task, therefore, must be interpreted as the rate at which he can generate, on the average, at least as much information per response as that demanded by the task. This restriction on the interpretation that can be given to results obtained with the present procedure is more than compensated for by the fact that the procedure makes it feasible to study a wide variety of task conditions with relatively large samples of *S*s and responses.

### Experiment I: Reciprocal Tapping

In the first experiment two closely related reciprocal tapping tasks were studied. The *S*s were asked to tap two rectangular metal plates alternately with a stylus. Movement tolerance and amplitude were controlled by fixing the width of the plates and the distance between them. The task was accomplished primarily by movements of the lower arm.

### Method

*Apparatus and procedure.* A schematic drawing of the apparatus is shown in Fig. 1. The target plates were 6 in. long and of four different widths (2, 1, .5, and .25 in.). The widths of the plates (hereafter referred to as  $W_s$ ) established the tolerance limits within which movements had to be terminated in amplitude. An additional error plate was mounted on either side of each target plate. The error plates were wide enough to catch all overshoots and undershoots. Six counters, activated by thyatron circuits through the plates and stylus, provided an automatic record of hits, overshoots, and undershoots for each set of three plates. After one of the counters in each group



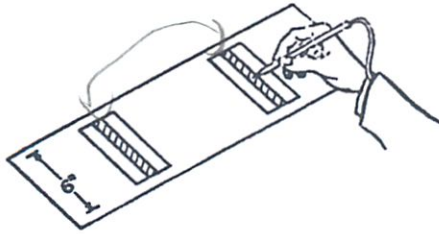


Figure 1. Reciprocal tapping apparatus. The task was to hit the center plate in each group alternately without touching either side (error) plate.

of three had recorded, none of the counters in that group would score again until one of the opposite set of plates had been touched. Thus the first plate touched on either side was always the one scored.

Four center-to-center distances between the target plates were studied (2, 4, 8, and 16 in.) giving a total of 16 combinations of amplitude ( $A$ ) and target size. (For  $A = 2$  in. and  $W_s = 2$  in. no undershoot errors were possible.)

Two metal-tipped styluses were used. One weighed 1 oz. and was about the size of a pencil. The other weighed 1 lb. and was slightly larger. The use of one or the other of these two styluses permitted the amount of work to be varied without otherwise changing the task.

The  $S$  sat with his right arm midway between the plates, which were located at a convenient height and angle. Each trial lasted 15 sec. and was followed by a 55-sec. rest period.

The following instructions were read to each  $S$ :

"Strike these two target plates alternately. Score as many hits as you can. If you hit either of the side plates an error will be recorded. You will be given a 2-sec. warning before a trial. Place your hand here and start tapping as soon as you hear the buzzer. *Emphasize accuracy rather than speed.* At the end of each trial I shall tell you if you have made any errors."

Subjects. Sixteen right-handed college men serves as  $S$ s.

Sequence of trials. Each  $S$  was tested at each of the 16 conditions. A different random sequence of conditions was used for each  $S$  with the restriction that for the entire group of 16  $S$ s each condition occur once on each trial. The experiment was replicated on the same day by retesting each  $S$  on each condition in a reversal sequence.

Each  $S$  participated in the experiment for two days. The lighter stylus was used on the first day, the heavier on the second day. All other procedures on the two days were the same. No attempt was made to equalize practice effects between the lighter and heavier styluses, because  $E$  was interested chiefly in the effects of amplitude and tolerance changes within each variation of the task.

Stylus height  
Δ

Results

The time and error data for the two variations of the tapping task are included in Table 1. The data are expressed as the average time ( $t$ ), in seconds, between taps (i.e., the time for each right-left or left-right movement) and as the percentage of errors (i.e., movements that were either too long or too short). Percentages are based on from 613 to 2,669 movements per condition.

The average number of errors made in this task was small, only 1.2% with the lighter stylus and 1.3% with the heavier one. The low incidence of errors indicates that  $S$ s successfully adjusted their rate of performance to meet changed task conditions.

The largest proportion of errors, 3.6% with the lighter stylus and 4.1% with the heavier stylus, was made at the most difficult task condition ( $W_s = 1/4$  in.,  $A = 16$  in.). At each amplitude step the percentage of errors for more exacting tolerances was consistently slightly larger than for less exacting tolerances; this indicated that  $S$ s did not slow down their movements quite as much as necessary to effect the required accuracy at the more exacting conditions. Nor were the errors

distance  
Δ  
accuracy

TABLE 1  
TASK CONDITIONS AND PERFORMANCE DATA FOR 16 VARIATIONS OF A  
RECIPROCAL TAPPING TASK  
( $N =$  the same 16  $S$ s at each condition)

Tolerance and Amplitude Conditions			1-oz. Stylus				1-lb. Stylus			
$W_s$	$A$	$I_d$	$t$	Errors (%)	$I_p$	Rank	$t$	Errors (%)	$I_p$	Rank
.25	2	4	.392	3.35	10.20	11	.406	3.80	9.85	7
.25	4	5	.484	3.41	10.33	9	.510	3.83	9.80	8
.25	8	6	.580	2.78	10.34	8	.649	4.04	9.24	13
.25	16	7	.731	3.65	9.58	14	.781	4.08	8.96	15
.50	2	3	.281	1.99	10.68	5	.281	0.88	10.68	4
.50	4	4	.372	2.72	10.75	3.5	.370	2.16	10.81	2
.50	8	5	.469	2.05	10.66	6	.485	2.32	10.31	6
.50	16	6	.595	2.73	10.08	12	.641	2.27	9.36	11
1.00	2	2	.212	0.44	9.43	15	.215	0.13	9.30	12
1.00	4	3	.260	1.09	11.54	1	.273	0.85	10.99	1
1.00	8	4	.357	2.38	11.20	2	.373	1.17	10.72	3
1.00	16	5	.481	1.30	10.40	7	.526	1.32	9.50	10
2.00	2	1	.180	0.00	5.56	16	.182	0.00	5.49	16
2.00	4	2	.203	0.08	9.85	13	.219	0.09	9.13	14
2.00	8	3	.279	0.87	10.75	3.5	.284	0.65	10.56	5
2.00	16	4	.388	0.65	10.31	10	.413	1.72	9.68	9

more accurate ↓

Note.— $W_s$  is the width in inches of the target plate.  $A$  is the distance in inches between the centers of the two plates.  $t$  is the average time in seconds for a movement from one plate to the other. The performance index,  $I_p$ , is discussed in the text.

symmetrically distributed over the error plates. The *Ss* were uniformly more accurate in terminating flexor than extensor movements. With the lighter stylus over- and undershoot errors were equally frequent, but with the heavier stylus undershoots were about twice as frequent. However, in spite of such consistent trends, the relatively small incidence of errors justifies an analysis of the data in terms of the total number of movements made under the various task conditions.

Practice led to relatively small improvement in performance. The mean time per movement for all *Ss* and all task conditions decreased by 3% from the first to the second block of trials with the light stylus, and by 5% with the 1-lb. stylus. The total number of errors made by all *Ss* was almost exactly the same for the first as for the second block of trials.

For each category of  $W_s$ , movement time increased progressively as movement amplitude (*A*) increased. Likewise for each amplitude, movement time increased progressively as tolerance was decreased. The relations among the various conditions for the lighter and heavier styluses were similar.

### Experiment II: Disc Transfer

The second task was to transfer plastic washers from one pin to another. Again, the amplitude and tolerance of the positioning movements were varied through a series of geometric steps, and the rate of performance was measured. This task differed from the previous one in that no errors were permitted. Some amount of finger activity was involved in grasping a washer by the edges before removing it from the pin.

#### Method

*Apparatus and procedure.* A schematic drawing of the apparatus is shown in Fig. 2. Round plastic discs, 1/8 in. thick and 1.5 in. in diameter, were drilled with four sizes of holes. Eight discs of uniform size were placed over a 1/8 in. pin. The task was to transfer the discs, one at a time, to another pin. The transfer of eight discs constituted a trial.

The difference between the diameter of the pins and the diameter of the center hole of the discs was varied in four geometric steps (1/2, 1/4, 1/8, and 1/16 in.). Four amplitudes of movement (4, 8, 16, and 32 in.) were used, making a total of 16 conditions. The *S* touched a switch plate beside the empty pin as he began the task. This started a 1/100-sec. timer. The *S* touched the switch plate as soon as he had transferred the last disc. This stopped the timer. Discs were always moved from right to left.

*Subjects.* Sixteen right-handed college men served as *Ss*. They were different *Ss* from those used in Exp. I.

*Sequence of trials.* Each *S* worked at all 16 task conditions in a restricted randomized sequence corresponding to that used in the previous experiment. The entire procedure was then replicated on a second day using a different sequence of trials for each *S*.

#### Results

The transfer of a disc involves a transport-empty plus a transport-loaded movement, and the times given are an average of these two aspects of each transfer cycle. There was a small (6%) decrease in time per movement on the second set

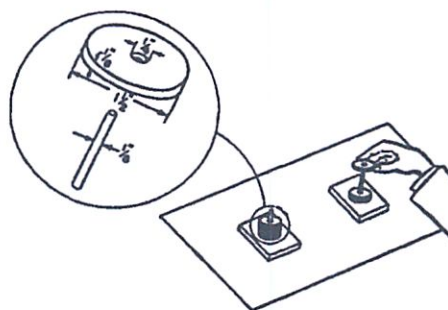


Figure 2. Disc transfer apparatus. The task was to transfer eight washers one at a time from the right to the left pin. The inset gives the dimensions for the  $W_s = 1/8$  in. condition.

of 16 trials. The average times per movement for each condition, averaged over all 16 *Ss* and over both days, are given in Table 2 in the column labeled *t*. The variations in movement time with increase in movement amplitude and changes in tolerance correspond to those found in Exp. I.

### Experiment III: Pin Transfer

The third task was to transfer pins from one set of holes to another. Grasping and releasing movements of the fingers were required in addition to arm movements. No errors were permitted. The task was varied in four geometric steps of movement tolerance and in five geometric steps of amplitude. The time for completing a series of eight responses was recorded. The data for this task are somewhat more extensive,

TABLE 2  
TASK CONDITIONS AND PERFORMANCE DATA  
FOR 16 VARIATIONS OF A  
DISC-TRANSFER TASK  
(*N* = the same 16 *Ss* at each condition)

Tolerance and Amplitude Conditions			Performance		
$W_s$	<i>A</i>	<i>I<sub>d</sub></i>	<i>t</i>	<i>I<sub>p</sub></i>	Rank
.0625	4	7	.697	10.04	2.5
.0625	8	8	.771	10.38	1
.0625	16	9	.896	10.04	2.5
.0625	32	10	1.096	9.12	7
.125	4	6	.649	9.24	6
.125	8	7	.734	9.54	4
.125	16	8	.844	9.48	5
.125	32	9	1.028	8.75	10
.25	4	5	.607	8.24	12
.25	8	6	.672	8.93	9
.25	16	7	.771	9.08	8
.25	32	8	.975	8.20	13
.5	4	4	.535	7.47	16
.5	8	5	.623	8.02	14
.5	16	6	.724	8.29	11
.5	32	7	.902	7.76	15

Note.— $W_s$  is the difference in inches between the diameter of the post and the diameter of the center hole of the disc. *A* is the center-to-center distance between the two posts. *t* is the average time in seconds for a movement between two posts.

diameter  
Δhole  
distance  
Δ

and somewhat more practice was given on this task than in the two preceding experiments.

### Method

**Apparatus and procedure.** The pin transfer apparatus is shown in Fig. 3. Four sizes of pins ( $1/4$ ,  $1/8$ ,  $1/16$ , and  $1/32$  in. in diameter) and five amplitudes of movement (1, 2, 4, 8, and 16 in.) were employed, thus making a total of 20 task conditions. Each set of pins was used with a set of holes whose diameter was twice that of the pins. The difference between the two diameters determined the tolerance ( $W_s$ ) required in transferring a pin from one hole to another. The tips of the pins were tapered to one-half their diameter as shown in the inset of Fig. 3.

The *S* started and stopped a timer as in the preceding task, in order to record the over-all time for making eight transport-empty plus eight transport-loaded movements. A trial consisted of the transfer of eight pins from one side to the other followed after a short rest by the transfer of the same pins in the opposite direction.

The instructions were similar to those employed in the preceding experiments.

**Subjects.** Twenty college students, ten men and ten women, severed as *Ss*. These were different *Ss* from those serving in Exp. I and II.

**Sequence of trials.** Each *S* served under all task conditions. The sequence of conditions was randomized, with the restriction that for the group of 20 *Ss* each condition occur once on each trial and once for each *S*. The experiment was repeated three times with the same *Ss* on three separate days. The sequence of trials for each *S* was different each day.

### Results

There was some improvement in the rate of task performance from the first to the second day, but little further improvement on the third day. The over-all means for the three days were .613, .585, and .578 sec. per movement, respectively. The average movement times computed for the combined trials of the second and third replications of the experiment are given in Table 3 in the column labeled  $t$ . The relations among the data corresponded closely to those found in the previous experiments. Movement times increased progressively as the tolerance requirement was made more stringent and as amplitude was increased.

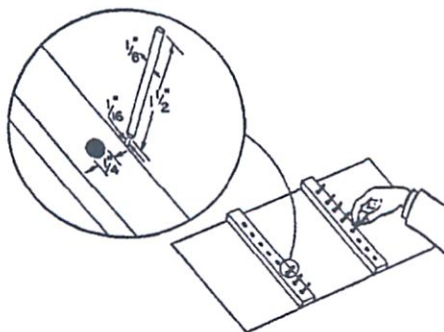


Figure 3. Pin transfer apparatus. The task was to transfer eight pins one at a time from one set of holes to the other. The inset gives the dimensions of pins and holes for the  $W_s = 1/8$  in. condition.

TABLE 3  
TASK CONDITIONS AND PERFORMANCE DATA  
FOR 20 VARIATIONS OF A PIN-  
TRANSFER TASK  
( $N =$  the same 20 *Ss* at each condition)

Tolerance and Amplitude Conditions			Performance		
$W_s$	$A$	$I_d$	$t$	$I_p$	Rank
.03125	1	6	.673	8.92	20
.03125	2	7	.705	9.93	18
.03125	4	8	.766	10.44	14
.03125	8	9	.825	10.91	13
.03125	16	10	.959	10.43	15
.0625	1	5	.484	10.33	16
.0625	2	6	.518	11.58	11
.0625	4	7	.580	12.07	6
.0625	8	8	.644	12.42	2
.0625	16	9	.768	11.72	9
.125	1	4	.388	10.31	17
.125	2	5	.431	11.60	10
.125	4	6	.496	12.10	5
.125	8	7	.557	12.57	1
.125	16	8	.668	11.98	7
.25	1	3	.326	9.20	19
.25	2	4	.357	11.20	12
.25	4	5	.411	12.16	4
.25	8	6	.486	12.34	3
.25	16	7	.592	11.82	8

Note.— $W_s$  is the difference in inches between the diameter of the pins and the diameter of the hole into which they were inserted.  $A$  is the center-to-center distance between the holes.  $t$  is the average time in seconds for a single movement.

### Information Analysis

The rate of performance of all the tasks studied increased uniformly as movement amplitude was decreased and as tolerance limits were extended. These results agree qualitatively with the predictions from the hypothesis.

In order to test the results against a quantitative prediction that the information output of the human motor system in any particular type of task is relatively constant over a range of amplitude and accuracy requirements, a difficulty index is needed that will specify the minimum information required on the average for controlling or organizing each movement.

The rational basis for this estimate of task difficulty is the maximum relative uncertainty that can be tolerated for a "correct" movement in a series having a specified average amplitude.<sup>2</sup> Thus the minimum organization required of a particular movement is defined by the specification of one from among  $k$  possible categories of amplitude within which the movement is to terminate.

If we follow the above reasoning and conventional information notation, a binary index of difficulty ( $I_d$ ) is defined as

$$I_d = -\log_2 \frac{W_s}{2A} \text{ bits/response}, \quad (1)$$

<sup>2</sup> Although only amplitude is considered here, the present rationale can be extended to the question of the rate of information involved in the selection of the direction, the force, or the duration of movements.

where  $W_s$  is the tolerance range in inches and  $A$  is the average amplitude of the particular class of movements. The choice of the denominator for this index is arbitrary since the range of possible amplitudes must be inferred. The use of  $2A$  rather than  $A$  is indicated by both logical and practical considerations. Its use insures that the index will be greater than zero for all practical situations and has the effect of adding one bit ( $-\log_2 1/2$ ) per response to the difficulty index. The use of  $2A$  makes the index correspond rationally to the number of successive fractionations required to specify the tolerance range out of a total range extending from the point of initiation of a movement to a point equidistant on the opposite side of the target.

The index of difficulty ( $I_d$ ) is given in Tables 1, 2, and 3 for each of the tasks. Since the index takes into account only the information necessary to specify the amplitude of a movement, it is insensitive to the weight of the stylus used in the first experiment and hence to the physical work required by the task. In its present form, the index is also insensitive to the information required for specifying the direction of a movement, or for specifying additional manipulatory acts such as the finger movements required to grasp and release objects.

Also shown in Tables 1, 2, and 3 is a binary index of performance ( $I_p$ ), which expresses the results as a performance rate. For a task in which  $W_s$  and  $A$  are fixed for a series of movements,  $I_p$  is defined as

$$I_p = -\frac{1}{t} \log_2 \frac{W_s}{2A} \text{ bits/sec.} \quad (2)$$

where  $t$  is the average time in seconds per movement. This index has some resemblance to one by Goldman (11, p. 157, Formula 29) for maximum information rate, although Goldman's criterion for determining the number of possible categories is based on a mean square criterion.

We want to test the hypothesis that movement times varies with task difficulty in such a way that  $I_p$  is constant over a wide range of movement amplitudes and tolerances. It is apparent from the data in Tables 1, 2, and 3 that even though the index is not precisely constant, the hypothesis is substantially confirmed.

For the eight best (out of the 16) conditions of tapping with the light weight stylus, the rate of performance varied between 10.3 and 11.5 bits/sec., a range of only 1.2 bits. Performance fell off markedly only for the least exacting bits/sec., condition studied ( $A = 2$  in.,  $W_s = 2$  in.).

Performance rate with the 1-lb. stylus also was relatively stable over a comparable range of amplitudes and tolerances. The rate at all but two conditions was reduced slightly by the added work, and the region of maximum performance was shifted toward smaller amplitudes of movement. The Pearsonian correlation between the 16  $I_p$  values for the two variations in the tapping task was large however ( $r = .97$ ).

For the 16 conditions of the disc-transfer task, on which the difficulty index ranged from 4 to 10 bits/response, the rate of performance varied from 7.5 to 10.4 bits/sec. Over the eight best conditions the range was only 1.3 bits/sec.

Performance on the pin-transfer task varied from 8.9 to 12.6 bits/sec. for the 20 conditions studied, but the range of variability was only 1.0 bit/sec. over the ten best conditions.

In all tasks it was found that movement amplitudes and tolerances could be varied within limits without much effect on performance rate, but that performance began to fall off outside these limits. This is readily apparent from an inspection of Fig. 4, which is a three-dimensional representation of the performance data for the pin-transfer task. Movements of 1- and 2-in. amplitude were consistently less efficient than movements of 4 to 8 in. In the pin-transfer task in particular, both the smallest amplitude (1 in.) and the smallest tolerance (1/32 in.) resulted in relatively low rates of performance. In most cases performance rate also fell off at the largest amplitudes and tolerances. Throughout all the tasks, movement amplitudes of 4 to 8 in. were more consistently associated with good performance than was any particular tolerance or any particular difficulty index.

Discussion

Although the four tasks thus far analyzed are a small sample of perceptual-motor activities, the results are sufficiently uniform to indicate that the hypothesized relation between speed, amplitude, and tolerance may be a general one. It is not surprising to find that performance, measured in information units, is relatively constant over a central range of amplitude and accuracy conditions and falls off outside these limits. Such a relation holds for most perceptual and motor activities and has recently been found (16) in a study of the optimum relation between the amplitude of lever movement and observed display movement.

The absolute level of capacity of the motor system probably varies considerably for different movements, limbs, and muscle groups. For example, the arm, which in the present experiments was asked to generate information only in respect to successive movement amplitudes, may have a lower information capacity than the hand. Using all of his fingers singly

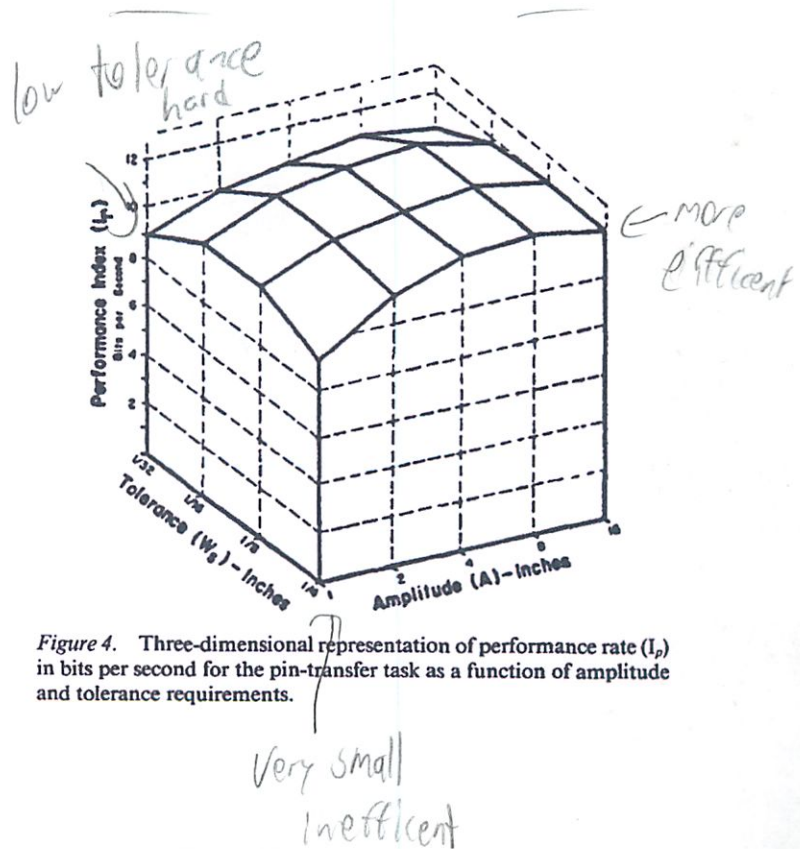


Figure 4. Three-dimensional representation of performance rate ( $I_p$ ) in bits per second for the pin-transfer task as a function of amplitude and tolerance requirements.



and in combinations,  $S$  can produce one bit of information per response per finger. Quite likely he can sustain higher level performance by using finger rather than arm movements. More complex movement patterns than those studied may also have a higher information capacity since in this case information can be generated along several dimensions simultaneously.

The estimates of information capacity arrived at by the present procedures give lower values than would be obtained by other and perhaps equally tenable assumptions regarding the number of possible categories. However, the estimates are of similar magnitude, in fact slightly higher, than the figures reported for the average  $S$  in a perceptual-motor task, such as pressing keys in response to flashing lights (18), in which responses to a series of discrete stimuli have been studied.

The present index of difficulty can be applied to a wide range of motor tasks. For example the three stick and rudder control movements necessary to make a single match on the Complex Coordination Test (Model E) require one bit of information to specify each of the three directions of movement and 3.9 bits to specify each of the three amplitudes (a total of 14.7 bits); this assumes that  $S$  starts his adjustments with the controls in the neutral position.

Ellson (7) has raised the question of the linearity of motor responses, using the superposition theorem as the criterion of linearity. This theorem demands that movement duration remain constant as amplitude increases. We have noted that many recent data violate this requirement. However, the present results indicate that over the range in which performance is optimum, movements of differing amplitude but of equal difficulty in terms of information tend to be of approximately equal duration. Man differs from a linear electronic or mechanical system, however, in that he sometimes carries his standard of relative precision for a movement at the same time as he varies its amplitude; unless relative precision remains constant, movement time will vary with amplitude.

The basis for the uniformity of motor performance perhaps is to be found in the time taken for central organizing processes. Fenn has pointed out that in reciprocal movements made at maximum rate and without any visual control the muscles work at a level far below their physical capacity. Since maximum rate of performance in this case is not limited by the muscles, he has proposed that the maximum rate is limited by "... the speed with which excitation and inhibition can be made to alternate in the central nervous system without at the same time losing precise control of the magnitude of the force" (8, p. 174). This concept of central organizing time is entirely consistent with an information point of view. The finding that relatively small differences in performance result from the change in stylus weight, and the validity of predictions of performance rate from the index of task difficulty lend support to the basic thesis of this paper, that it is the degree of control required over the organization of a response, i.e., the amount of information required to specify a response, which is the major factor limiting the rate of motor performance.

### Summary

The present paper attempts to relate the traditional Weber function (variability of a response as a function of its ampli-

tude) to the parallel phenomena of variability as a function of response duration, using certain concepts of information theory.

An index of the difficulty of a movement is proposed on the assumption that the average amplitude, the average duration, and the amplitude variability of successive movements are related in a manner suggested by information theory. The basic rationale is that the minimum amount of information required to produce a movement having a particular average amplitude plus or minus a specified tolerance (variable error) is proportional to the logarithm of the ratio of the tolerance to the possible amplitude range is arbitrary and has been set at twice the average amplitude. The average rate of information generated by a series of movements is the average information per movement divided by the time per movement.

Three experiments are reported which were designed to test the following hypothesis: If the amplitude and tolerance limits of a task are fixed and the  $S$  is instructed to work at his maximum rate, then the average duration of responses will be directly proportional to the minimum average amount of information per response (i.e., the degree of behavior organization) demanded by the task conditions. The conditions studied covered the range from 1 to 10 bits/response.

The results indicate that rate of performance in a given type of task is approximately constant over a considerable range of movement amplitudes and tolerance limits, but falls off outside this optimum range. The level of optimum performance was found to vary slightly among the three tasks in the range between about 10 to 12 bits/sec. The consistency of these results supports the basic thesis that the performance capacity of the human motor system plus its associated visual and proprioceptive feedback mechanisms, when measured in information units, is relatively constant over a considerable range of task conditions. This thesis offers a plausible way of accounting for what otherwise appear to be conflicting data on the durations of different types of movements.

The author feels that the fixed information handling capacity of the motor system probably reflects a fixed capacity of central mechanisms for monitoring the results of the ongoing motor activity while at the same time maintaining the necessary degree of organization with respect to the magnitude and timing of successive movements.

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### P&C Board Appoints Editor for New Journal: *Experimental and Clinical Psychopharmacology*

In the fall of 1993, APA will begin publishing a new journal, *Experimental and Clinical Psychopharmacology*. Charles R. Schuster, PhD, has been appointed as editor. Starting immediately, manuscripts should be submitted to

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*Experimental and Clinical Psychopharmacology* seeks to promote the discipline of psychopharmacology in its fullest diversity. Psychopharmacology necessarily involves behavioral changes, psychological processes, or their physiological substrates as one central variable and psychopharmacological agents as a second central variable. Such agents will include drugs, medications, and chemicals encountered in the workplace or environment. One goal of *Experimental and Clinical Psychopharmacology* is to foster basic research and the development of theory in psychopharmacology. Another is to encourage the integration of basic and applied research, the development of better treatments for drug abuse, and more effective pharmacotherapeutics. To this end, the journal publishes original empirical research involving animals or humans that spans from (a) behavioral pharmacology research on social, behavioral, cognitive, emotional, physiological, and neurochemical mechanisms of drug- or chemical-behavior interaction and behavioral toxicity; to (b) descriptive and experimental studies of drug abuse including its etiology, progression, adverse effects, and behavioral and pharmacological treatment; to (c) controlled clinical trials that, in addition to improving the effectiveness, range, or depth of application, will also increase our understanding of psychological functions or their drug modulation. The journal also publishes theoretical and integrative analyses and reviews that promote our understanding and further systematic research in psychopharmacology. Although case studies are not appropriate, occasional small-sample experiments with special populations may be considered. The journal is intended to be informative and useful to both basic and applied researchers and to practitioners operating in varied settings. *Experimental and Clinical Psychopharmacology* seeks to be the vehicle for the best research and ideas integrating pharmacology and behavior.

# Fitts's law

From Wikipedia, the free encyclopedia  
(Redirected from Fitts' law)

In ergonomics, **Fitts's law** (often cited as **Fitts' law**) is a model of human movement which predicts the time required to rapidly move to a target area, as a function of the distance to the target and the size of the target.

Fitts's law is used to model the act of *pointing*, both in the real world (e.g., with a hand or finger) and on computers (e.g., with a mouse). It was published by Paul Fitts in 1954.

## Contents

- 1 The model
- 2 Success and implications of Fitts's law
- 3 Some mathematical details
- 4 A derivation of Fitts's law
- 5 See also
- 6 References
- 7 External links

## The model

Mathematically, Fitts's law has been formulated in several different ways. One common form is the Shannon formulation (proposed by Scott MacKenzie, professor of York University, and named for its resemblance to the Shannon-Hartley theorem) for movement along a single dimension:

$$T = a + b \log_2 \left( \frac{D}{W} + 1 \right)$$

where

- *T* is the average time taken to complete the movement. (Traditionally, researchers have used the symbol *MT* for this, to mean *movement time*.)
- *a* represents the start/stop time of the device and *b* stands for the inherent speed of the device. These constants can be determined experimentally by fitting a straight line to measured data.
- *D* is the distance from the starting point to the center of the target. (Traditionally, researchers have used the symbol *A* for this, to mean the *amplitude* of the movement.)
- *W* is the width of the target measured along the axis of motion. *W* can also be thought of as the allowed error tolerance in the final position, since the final point of the motion must fall within  $\pm W/2$  of the target's centre.

From the equation, we see a *speed-accuracy* tradeoff associated with pointing, whereby targets that are smaller and/or further away require more time to acquire.

## Success and implications of Fitts's law

Fitts's law is an unusually successful and well-studied model. Experiments that reproduce Fitts's results and/or that demonstrate the applicability of Fitts's law in somewhat different situations are not difficult to perform. The measured data in such experiments often fit a straight line with a correlation coefficient of 0.95 or higher, a sign that the model is very accurate.

Although Fitts only published two articles on his law (Fitts 1954, Fitts and Peterson 1964), there are hundreds of subsequent



studies related to it in the human-computer interaction (HCI) literature, and quite possibly thousands of studies published in the larger psychomovement literature. The first HCI application of Fitts's law was by Card, English, and Burr (1978), who used the index of performance (*IP*), defined as  $1/b$ , to compare performance of different input devices, with the mouse coming out on top. (This early work, according to Stuart Card's biography, "was a major factor leading to the mouse's commercial introduction by Xerox" [1] (<http://www.bcs-hci.org.uk/interfaces/interfaces50.pdf>) .) Fitts's law has been shown to apply under a variety of conditions, with many different limbs (hands, feet, head-mounted sights, eye gaze), manipulanda (input devices), physical environments (including underwater), and user populations (young, old, special educational needs, and drugged participants). Note that the constants  $a$ ,  $b$ , *IP* have different values under each of these conditions.

Since the advent of graphical user interfaces, Fitts's law has been applied to tasks where the user must position the mouse cursor over an on-screen target, such as a button or other widget. Fitts's law can model both point-and-click and drag-and-drop actions. (Note that dragging has a lower *IP* associated with it, because the increased muscle tension makes pointing more difficult.) Despite the model's appeal, it should be remembered that in its original and strictest form:

- It applies only to movement in a single dimension and not to movement in two dimensions (though it is successfully extended to two dimensions in the Accot-Zhai steering law);
- It describes simple motor response of, say, the human hand, failing to account for software acceleration usually implemented for a mouse cursor;
- It describes untrained movements, not movements that are executed after months or years of practice (though some argue that Fitts's law models behaviour that is so low level that extensive training doesn't make much difference).

If, as generally claimed, the law does hold true for pointing with the mouse, some consequences for user-interface design include:

- Buttons and other GUI controls should be a reasonable size; it is relatively difficult to click on small ones.
- Edges (e.g. the menubar in Mac OS) and corners of the computer display (e.g. "Start" button in Windows XP) are particularly easy to acquire because the pointer remains at the screen edge regardless of how much further the mouse is moved, thus can be considered as having infinite width.
- Popup menus can usually be opened faster than pull-down menus, since the user avoids travel.
- Pie menu items typically are selected faster and have a lower error rate than linear menu items, for two reasons: because pie menu items are all the same, small distance from the centre of the menu; and because their wedge-shaped target areas (which usually extend to the edge of the screen) are very large.

Fitts's law remains one of the few hard, reliable human-computer interaction predictive models, joined more recently by the Accot-Zhai steering law, which is derived from Fitts's law.

## Some mathematical details

The logarithm in Fitts's law is called the index of difficulty *ID* for the target, and has units of bits. We can rewrite the law as

$$T = a + bID,$$

where

$$ID = \log_2 \left( \frac{D}{W} + 1 \right)$$

Thus, the units for  $b$  are time/bit, e.g. milliseconds/bit. The constant  $a$  can be thought of as incorporating reaction time and/or the time required to click a button.

The values for  $a$  and  $b$  change as the conditions under which pointing is done are changed. For example, a mouse and stylus may both be used for pointing, but have different constants  $a$  and  $b$  associated with them.

An index of performance *IP* (also called throughput *TP*), in bits/time, can be defined to characterize how quickly pointing can be done, independent of the particular targets involved. There are two conventions for defining *IP*: one is  $IP = 1/b$  (which has the disadvantage of ignoring the effect of  $a$ ), the other is  $IP = ID_{average}/MT_{average}$  (which has the disadvantage of depending on an arbitrarily chosen "average" *ID*). For a discussion of these two conventions, see Zhai (2002). Whatever definition is used, measuring the *IP* of different input devices allows the devices to be compared with respect to their pointing capability.

Slightly different from the Shannon formulation is the original formulation by Fitts:

$$ID = \log_2 \left( \frac{2D}{W} \right)$$

The factor of 2 here is not particularly important; this form of the *ID* can be rewritten with the factor of 2 absorbed as changes in the constants *a*, *b*. The "+1" in the Shannon form, however, does make it different from Fitts's original form, especially for low values of the ratio *D*/*W*. The Shannon form has the advantage that the *ID* is always non-negative, and has been shown to better fit measured data.

## A derivation of Fitts's law

Fitts's law can be derived from various models of motion. A very simple model, involving discrete, deterministic responses, is considered here. Although this model is overly simplistic, it provides some intuition for Fitts's law.

Assume that the user moves toward the target in a sequence of submovements. Each submovement requires a constant time *t* to execute, and moves a constant fraction *1-r* of the remaining distance to the centre of the target, where  $0 < r < 1$ . Thus, if the user is initially at a distance *D* from the target, the remaining distance after the first submovement is *rD*, and the remaining distance after the *n*th submovement is *r<sup>n</sup>D*. (In other words, the distance left to the target's centre is a function that decays exponentially over time.) Let *N* be the (possibly fractional) number of submovements required to fall within the target. Then,

$$r^N D = \frac{W}{2}$$

Solving for *N*:

$$\begin{aligned} N &= \log_r \frac{W}{2D} \\ &= \frac{1}{\log_2 r} \log_2 \frac{W}{2D} \quad (\text{because } \log_x y = (\log_2 y) / (\log_2 x)) \\ &= \frac{1}{\log_2 1/r} \log_2 \frac{2D}{W} \quad (\text{because } \log_x y = -\log_x 1/y) \end{aligned}$$

The time required for all submovements is:

$$T = Nt = \frac{t}{\log_2 1/r} \log_2 \frac{2D}{W}$$

By defining appropriate constants *a* and *b*, this can be rewritten as

$$T = a + b \log_2 \frac{D}{W}$$

The above derivation is similar to one given in Card, Moran, and Newell (1983). For a critique of the deterministic iterative-corrections model, see Meyer et al. (1990).

## See also

- Hick's law
- Point and click
- Accot-Zhai steering law
- Crossing Based Interfaces

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## External links

- Fitts' Law (<http://ei.cs.vt.edu/~cs5724/g1/>) at CS Dept. NSF-Supported Education Infrastructure Project
- Fitts' Law: Modeling Movement Time in HCI (<http://www.cs.umd.edu/class/fall2002/cmcs838s/tichi/fitts.html>)
- Bibliography of Fitts' Law Research ([http://www.yorku.ca/mack/RN-Fitts\\_bib.htm](http://www.yorku.ca/mack/RN-Fitts_bib.htm)) compiled by I. Scott MacKenzie
- Fitts' Law in Microsoft Office User Interface (<http://blogs.msdn.com/jensenh/archive/2006/08/22/711808.aspx>) by Jensen Harris
- Visualizing Fitts's Law (<http://particletree.com/features/visualizing-fittss-law/>) by Kevin Hale

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Michael Plasmeier

Siegerman

AP Psychology

26 Mar 2008

One-to-One Contact's Effects on Enhancing Self-Efficacy in Becoming a Union Steward

In The Potency of One-to-One Contact With Union Leaders: Enhancing Self-Efficacy to Become a Union Steward, Steven Mellor et al. try to identify the importance of 4 enhancers to self-efficacy (self-confidence). Mellor and others built upon the work of P.A. Roby's 1995 report which first identified the importance of one-to-one contact with a union steward to become union stewards themselves (403).

When I first saw the title I thought that this article was not going to be very ground breaking. After reading the article my suspicions were confirmed. Much of it is common sense, but I suppose there is not much research remaining the field of labor organization. It seems common sense that increasing a potential steward's self confidence would help them do a better job. At the end the paper advocates training for stewards to increase self confidence. I thought the self confidence training is already a key component of almost every self-help and leadership training programs. For example, the "GO" program for 9<sup>th</sup> graders at Haverford High School attempts to increase self confidence.

However the paper did also point out some of the free-response reasons of why people became stewards, including personal growth, the ability to stand up to management, and because their dislike of the previous steward.

The authors found that 82% of stewards became stewards because someone had asked them to, with 58% of them receiving encouragement from the union leader.

I suppose that the writers' goal in producing this paper was "publish or perish." Many universities pressure their professors to conduct research and publish papers. It seems to me that all of the substantive research in this field has already been completed. However, I think that the author did achieve their goal of confirming the obvious. However, the sample size of 44 mail-in surveys was inexcusably small especially when broken down into subgroups for race and gender. Since the survey was mail in – it should have been very easy to distribute more surveys.

The authors did convincingly and comprehensively confirm their hypotheses however their survey size was way too small. They did not neglect anything besides a large sample.

I do not believe that this article was biased in its writing. However their sample was 70% women, while union officials reported that 48% of stewards were women. This is slanted especially when coupled with the small survey size.

I enjoyed how the authors broke down the 4 "modes" which enhance self confidence. I also found it interesting that women and people of color were more likely to receive a personal invitation to become a steward than white men (417). Women and people of color were historically unrepresented and underrepresented in leadership positions. However it should be noted that 70% of respondents to the survey were women. Are women more likely to respond to mail-in surveys about their jobs?

Unique aspects of this research include the above findings about the importance of race and gender in affecting what it takes to become a union steward. However, the findings are marred by the small sample size.

This is a scholarly article because it was published in a scholarly journal. It also makes use of statistical techniques to make sure the findings are not simply due to chance. A popular article would not mention these necessary steps.

The article mentions 24 sources, the majority being from reputable journals. These sources are believed to be primary sources since journals usually publish unique material.

In summation the article was primarily common sense, however there were sections of non-obvious material, for example that most stewards are asked to serve by another steward, not their coworkers they will represent. In addition I found some of the non-invitation reasons interesting, such as 'I wanted to confront management about what was really going on' (413). However the statistical sections were hampered by the small sample size.

Works Cited

Mellor, Steven, Carrie A. Bulger, and Lisa M. Kath. "The Potency of One-to-One Contact With Union Leaders: Enhancing Self-Efficacy to Become a Union Steward." Journal of Psychology. 141.4 (July 2007): 403-422.



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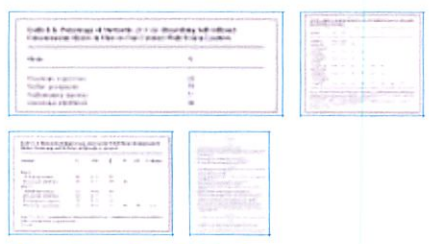
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**Abstract:**    Finding ways to encourage union members to become union leaders is a perennial problem for unions. P. A. Roby (1995) originally found the importance of one-to-one contact with union leaders in becoming a union steward. In this study, the authors examined stewards' descriptions of their one-to-one contact with a union leader before becoming a steward. They sought to (a) replicate and strengthen Roby's findings, (b) explore one-to-one contact as a self-efficacy (i.e., confidence) enhancing experience, and (c) identify self-efficacy enhancement modes to strengthen the potency of the contact experience. The results from a mostly open-ended questionnaire of 44 stewards mirrored Roby's findings. The results indicated that self-efficacy enhancement modes were present in the one-to-one contact experience and that the enhancement modes were related to self-efficacy to become a steward. Two of the modes, verbal encouragement and emotional inhibition, were independently related to self-efficacy. The authors suggest how leaders could increase the potency of their contact with members as a means of encouraging members to become stewards. [ABSTRACT FROM AUTHOR]

*Questionnaire*

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Gender	Attending full-time	Not attending full-time
Male	10	90
Female	10	90

TABLE 1.

Gender	Attending	Not Attending
Male	10	90
Female	10	90

TABLE 2.

Gender	Attending	Not Attending
Male	10	90
Female	10	90

TABLE 3.

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## The Potency of One-to-One Contact With Union Leaders: Enhancing Self-Efficacy to Become a Union Steward

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ABSTRACT. Finding ways to encourage union members to become union leaders is a perennial problem for unions. P. A. Roby (1995) originally found the importance of one-to-one contact with union leaders in becoming a union steward. In this study, the authors examined stewards' descriptions of their one-to-one contact with a union leader before becoming a steward. They sought to (a) replicate and strengthen Roby's findings, (b) explore one-to-one contact as a self-efficacy (i.e., confidence) enhancing experience, and (c) identify self-efficacy enhancement modes to strengthen the potency of the contact experience. The results from a mostly open-ended questionnaire of 44 stewards mirrored Roby's findings. The results indicated that self-efficacy enhancement modes were present in the one-to-one contact experience and that the enhancement modes were related to self-efficacy to become a steward. Two of the modes, verbal encouragement and emotional inhibition, were independently related to self-efficacy. The authors suggest how leaders could increase the potency of their contact with members as a means of encouraging members to become stewards.

Keywords: self-efficacy, union leaders, union members

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WHAT MOTIVATES UNION MEMBERS TO BECOME ACTIVE as union leaders? In Roby's (1995) seminal study on how members became shop stewards, she found that stewards often described the importance of presteward experiences with people who had encouraged them to lead. She asked stewards to recount these experiences and found that most of them had been encouraged

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to lead by someone in particular and that the most important encouragement had come from a union leader who had maintained one-to-one contact.

As we read the descriptions of contact in Roby's (1995) study, we were struck by the idea that prospective stewards had drawn their beliefs about their ability to perform successfully as a steward from the contact experience. This is not surprising, given our background in social cognitive theory (Bandura 1977, 1997) and our efforts to apply this theory to explain how members are encouraged to become leaders in union settings. The central construct of the theory is self-efficacy. As defined by Bandura (1986), *self-efficacy* refers to belief in one's ability to execute a specific behavior or take a specific course of action. In Bulger and Mellor (1997), we defined *self-efficacy to become a steward* as beliefs in one's ability to perform successfully as a steward. We found that members with stronger steward efficacy beliefs were more likely to become stewards than were members with weaker steward efficacy beliefs. In Mellor, Barclay, Bulger, and Kath (2006), we found that members with stronger steward efficacy beliefs had received more verbal encouragement from their stewards to lead and that the influence of this encouragement was stronger for members with same-gender stewards (e.g., women with women stewards).<sup>1</sup>

In the present study, we sought to show that the importance of one-to-one contact with a union leader is the result of the self-efficacy enhancement of the experience. We think that the contact experience is important to prospective stewards because the experience acts as a source of self-efficacy to become a steward. Our research goals were threefold. The first was to replicate and strengthen Roby's (1995) findings. To strengthen Roby's findings, we used survey methodology to test statistically whether stewards' descriptions of one-to-one contact with union leaders were significantly different from what would be expected by chance. Our second goal was to examine stewards' descriptions of contact with union leaders for the presence of self-efficacy enhancement modes, such as verbal persuasion. Our third goal was to identify particular enhancement modes in the descriptions that may be used by union leaders to enhance the potency of their contact as a means of encouraging members to lead. Before discussing our study in greater detail, we offer a summary of Roby's findings and an overview of self-efficacy enhancement.

### *Roby's Study*

Roby (1995) asked 124 stewards from 10 industrial and service unions to provide verbal responses to open-ended questions about "their experiences, attitudes, goals, and perspectives freely and at length" (p. 73). Because women and people of color were and remain underrepresented in union leadership, Roby oversampled these subpopulations to examine "how workers become stewards and the influence of gender and race in this process" (p. 65). In Roby's study, stewards reported tenure in office from 1 month to 25 years, with an average

Confidence

Can I do it?  
Why else would you want to do it?

tenure of 5.5 years. About half of the stewards reported being elected to office as opposed to being appointed. Sixty-seven percent of men reported being elected to office, in contrast with 50% of women.

Roby (1995) presented an analysis of responses in terms of percentages, with comparative percentages for gender and ethnicity. She also presented quotations from responses. She did not code responses for statistical analysis. We were interested in responses about who first encouraged stewards to lead, who provided the most important encouragement, and how stewards had become active in the union.

Although the most frequent response to who first encouraged stewards to lead was parents or grandparents, the most frequent response to who provided the most important encouragement was union leaders or members. Thirty-two percent of men reported parents and grandparents as first to encourage, in contrast with 24% of women. Eighteen percent of women reported leaders or members as first to encourage, in contrast with 10% of men. By gender and ethnicity, 40% of women of color and 34% of White women reported that leaders or members provided the most important encouragement, in contrast with 26% of White men and 7% of men of color.

When asked by Roby (1995) to describe how the person who most encouraged them to lead had done so, stewards talked about one-to-one contact with a union leader who encouraged them to lead. This encouragement included verbal feedback about how well they communicated with others and how well their coworkers regarded them. When stewards were asked how they had become active in the union, the most frequent response was that a union leader had extended a personal invitation. Stewards described the invitation as coming from a leader they had known for some time and who had treated them with respect. By gender and ethnicity, 59% of men of color, 54% of women of color, and 38% of White women reported receiving an invitation, in contrast with 18% of White men.

The second most frequent response to how they had become active in the union came from stewards who said they volunteered to become active because they felt a need for personal growth or achievement, stating that they needed to realize their potential or that they could do a better job than the current steward. By gender and ethnicity, 43% of White men reported seeking to become active on their own, in contrast with 18% of all other stewards.

#### *Self-Efficacy Enhancement*

With few exceptions, researchers have found that self-efficacy is important for motivating people to expend effort in completing tasks or pursuing activities, persist longer in expending effort, and expend more effort when faced with actual or perceived barriers (Bandura, 1986, 1997).<sup>2</sup> Bandura's (1977, 1986) identification of four self-efficacy enhancement modes has led to much interest

First family  
Important:  
Other Stewards

Umm  
duh

→

in understanding and applying these modes in a variety of settings. Accordingly, these enhancement modes are thought to act as natural sources of self-efficacy (natural in the sense of occurring in the everyday lives of people). The goal of any study then becomes to identify modes that may be particularly potent in a given setting. Once identified, these modes can be adapted for training purposes to enhance efficacy beliefs in that setting.

*Performance mastery* is a self-efficacy enhancement mode that involves a person having performed successfully in a particular setting. For example, a member may have successfully helped a coworker file a grievance, a task that is integral to performing as a steward. The member's successful experience may strengthen the member's efficacy beliefs about performing successfully as a steward and, as a result, enhance the member's self-efficacy to become a steward.

*Vicarious experience*, which is sometimes called modeling, is an enhancement mode in which efficacy beliefs are enhanced when a person observes another person (a model) performing successfully in a particular situation. In a union setting, a member's self-efficacy to become a steward may be strengthened by observing a leader's successful performance as a steward.

→ *Verbal persuasion*, a third enhancement mode, strengthens efficacy beliefs when a model informs a person that the person has skills or abilities to perform successfully in a particular setting. This may occur in a union setting wherein a member's efficacy beliefs about becoming a steward may be strengthened by receiving verbal encouragement from a leader who has observed the member's successful performance in a leadership situation.

→ *Emotional inhibition* is an enhancement mode that involves a person's anticipation of negative reactions from others as a result of performing successfully in a situation. Efficacy beliefs are strengthened when the person anticipates low negative reactions. In the case of a prospective steward, respect from a leader may assure a member that reactions to leadership success will be positive and, as a result, enhance the member's efficacy beliefs about becoming a steward.

#### *One-to-One Contact and Self-Efficacy Enhancement*

We think that the descriptions of one-to-one contact with union leaders in Roby's (1995) study show the presence of the self-efficacy enhancement modes. Further, we think that the importance of this contact experience lies with the presence of these enhancement modes and with their influence on efficacy beliefs about becoming a steward. As such, we think that an examination of stewards' descriptions of one-to-one contact with leaders will reveal the presence of the enhancement modes and that the modes will be related to self-efficacy to become a steward.

We also think that two of the self-efficacy enhancement modes, verbal persuasion and emotional inhibition, will show particularly strong links to efficacy beliefs about becoming a steward vis-à-vis the contact experience. Consistent with Bandura's (1986) identification of these enhancement modes, unlike per-

formance mastery and vicarious experience, verbal persuasion requires actual contact with a model who provides encouragement, and emotional inhibition requires actual contact with a model over time. For emotional inhibition to be effective, a model must be seen as a reliable and trustworthy source of information about people's reactions to success.

We think that all four enhancement modes will show links to self-efficacy to become a steward. However, we think the links for verbal persuasion and emotional inhibition will be particularly strong and that verbal persuasion and emotional inhibition will be independently related to self-efficacy. The strength of these modes is evident in almost every description of one-to-one contact reported in Roby's (1995) study. Almost all of the stewards who said that a union leader encouraged them to lead indicated that encouragement in the context of verbal feedback. Most stewards who spoke about receiving a personal invitation from a leader to become active indicated that the leader had gained their respect and was someone whose judgment they could trust.

In addition, Roby (1995) found that a higher percentage of women and people of color said that they had received a personal invitation from a leader to become active. This is particularly striking to us given the dominance of White men in union leadership. We think that emotional inhibition—wherein people are assured that reactions to their success will be less negative than anticipated—will be particularly encouraging to women and people of color.

To meet our first goal of replicating and extending Roby's (1995) findings, we extracted questions from Roby's article and reformatted them for a self-report questionnaire. We added questions that could be coded for statistical analysis to determine whether patterns of responses were different from what may be expected by chance. Next, to meet our goal of examining stewards' descriptions of one-to-one contact with union leaders for the presence of self-efficacy enhancement modes, we included questions that could be coded and analyzed on the basis of whether responses indicated the presence of performance mastery, vicarious experience, verbal persuasion, and emotional inhibition. Last, to meet our goal of identifying specific enhancement modes that may be used by leaders to strengthen the potency of their contact with members as a means of encouraging members to lead, we tested the following hypothesis: When the four self-efficacy enhancement modes are considered together in relation to self-efficacy to become a steward, verbal persuasion and emotional inhibition will be independently related to self-efficacy.

## Method

### *Sample and Procedure*

Stewards from a service union affiliated with the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) completed anony-

mous mail-in questionnaires requested by union officials. Questionnaires were distributed at worksites. Of the 68 distributed, 44 were returned (65%).

700 → Seventy percent of responding stewards were women. For gender, we coded men as 1 and women as 2. Twenty-three percent were people of color: 14% were African American and 9% were Latino American. For ethnicity, we coded White participants as 1 and people of color as 2. Ages ranged from 24–78 years ( $M = 43.41$  years,  $SD = 10.72$  years).

Union officials indicated that 48% of stewards in the union were women. We did not deliberately oversample women, but, as in Roby's (1995) study, women were overrepresented in our sample. Information was not available about the ethnicity of stewards in the union. Stewards' tenure in office ranged from 1–20 years ( $M = 6.43$  years,  $SD = 5.96$  years). Fifty-two percent of stewards were appointed as opposed to elected to office. Sixty-two percent of men were elected to office, in contrast with 42% of women. Fifty percent of people of color and 47% of White participants were elected.

#### *Coding of Responses*

We recruited two researchers to code responses to open-ended questions. The first author trained the coders to code responses for self-efficacy enhancement modes and responses for self-efficacy. Coding order was counterbalanced, such that one coder assigned codes for enhancement modes before codes for self-efficacy, and the other coder assigned codes for self-efficacy before codes for enhancement modes. The coders assigned codes independently and were naive to expected results.

To ensure that coders were interpreting the open-ended responses similarly, we estimated intercoder agreement by dividing the number of times they agreed on a code by the total number of codes assigned. The initial estimate of intercoder agreement for all response codes was 91%. After they discussed the codes on which they initially disagreed, the corrected intercoder agreement was 100%.

#### *Survey Design and Measures*

We worded the questions to encourage stewards to write about their pre-steward experiences. We used this retrospective emphasis to replicate Roby's (1995) questions. Questions were open-ended, but some questions were designed for yes–no responses or for checking responses from a list. We formatted the questions to mirror Roby's questions so that stewards could freely indicate their experience. This is an important point. We did not want to limit or direct stewards' recollections of their experiences. Although we expected that self-efficacy enhancement modes would emerge in responses about one-to-one contact with a union leader, we did not want to steer stewards toward making such responses.

*Self-efficacy enhancement modes.* We used responses to six open-ended questions about one-to-one contact with union leaders to assess self-efficacy enhancement modes (questions 4, 5, 7, 8, 19, and 21 in the Appendix). For each question, codes were assigned for the presence of performance mastery, vicarious experience, verbal persuasion, and emotional inhibition (1 = absent, 2 = present). For example, the responses "You already are doing the job of a steward" and "Someone with your knowledge of the contract should be a steward" were coded for the presence of performance mastery; the responses "I saw her being a strong leader and this made me want to do it" and "I listened to her talk to management and learned how to do it" were coded for the presence of vicarious experience; the responses "She said we need a steward. You would make a good one. Please consider being one" and "She talked to me and she urged me to be a steward" were coded for the presence of verbal persuasion; and the responses "You aren't going to be everybody's friend, but people will listen to you" and "People look up to you and think you can keep management in line" were coded for the presence of emotional inhibition.

After correction for intercoder disagreement, we used the phi coefficient ( $\phi$ ; an application of the Pearson  $r$  formula) to estimate intercoder reliability for the enhancement mode codes. The average  $\phi$  for the codes was 0.85. After discussion for disagreement, the average  $\phi$  was 1.00.

We computed scores for enhancement modes by averaging codes across questions for each mode. Scores for the enhancement modes ranged from 1–2 (performance mastery,  $M = 1.57$ ,  $SD = 0.50$ ; vicarious experience,  $M = 1.68$ ,  $SD = 0.49$ ; verbal persuasion,  $M = 1.59$ ,  $SD = 0.51$ ; emotional inhibition,  $M = 1.36$ ,  $SD = 0.44$ ). Higher scores indicated greater presence of a mode. The average alpha ( $\alpha$ ) estimate of internal consistency for the enhancement mode measures was .84.

*Self-efficacy to become a steward.* We used responses to three open-ended questions to assess self-efficacy to become a steward. Following the lead phrase, "When you became a steward . . .," the three questions were (a) "what was the biggest obstacle you had to overcome?" (b) "what was your greatest fear?" and (c) "what was the first thing you had to learn?" (questions 9, 10, and 11 in the Appendix). For each question, codes were assigned for confidence to perform as a steward (1 = low confidence, 2 = moderate confidence, 3 = high confidence). For example, for the question about one's greatest fear, the responses "That I was not qualified" and "That I would fail" were coded for low confidence; the responses "Not presenting a case properly" and "I would not hear everything being said" were coded for moderate confidence; and the responses "There was no fear" and "That I would try to do too much" were coded for high confidence. After correction for intercoder disagreement, the average  $\phi$  for the self-efficacy codes was 0.96. After discussion for disagreement, the average  $\phi$  was 1.00.

We computed scores for self-efficacy by averaging codes across questions. Scores for the self-efficacy measure ranged from 1–3 ( $M = 1.95$ ,  $SD = 0.65$ ).



Higher scores indicated stronger self-efficacy. The  $\alpha$  estimate of internal consistency for the self-efficacy measure was .82.<sup>3</sup>

*Other questions.* The questionnaire included yes–no questions and a Likert-type question (wherein response options were arrayed from more to less) to facilitate statistical testing (see the Appendix for a complete list of questions). Unless otherwise indicated, a “no” response was coded as 1 and a “yes” response was coded as 2.

## Results

### *Replicating and Strengthening Roby's Findings*

*Becoming a steward.* Most stewards (82%) reported that someone had encouraged them to become a steward. Through statistical analysis, we found that the percentage of stewards reporting encouragement from someone was statistically different from chance and therefore indicated a significant pattern,  $\chi^2(1, N = 44) = 17.82, p < .01$ . This result indicated that it was more likely than not that a steward received encouragement to become a steward. Most of those who received encouragement (58%) wrote that it had come from a union leader, such as a steward or staff organizer. All others who received encouragement wrote that it had come from a coworker.

To further understand who had received encouragement to become a steward from a union leader, we divided the responses by gender and ethnicity. We found that 68% of women who received encouragement reported that it had come from a union leader, in contrast with 45% of men who received encouragement. Further breakdown showed that 75% of women of color, 67% of men of color, and 62% of White women who received encouragement reported that it had come from a union leader, in contrast with 38% of White men.

In addition to asking stewards about the source of encouragement to become a steward, we asked how important that encouragement had been. Eighty-one percent of stewards who received encouragement from a union leader indicated that it had been important or very important, with not at all important and somewhat important as alternative response options. No steward reported that the encouragement had been not at all important. Our statistical analysis showed that the percentage of stewards who reported that the encouragement from a union leader was important or very important versus somewhat important indicated a significant pattern,  $\chi^2(1, N = 21) = 8.05, p < .01$ . This result indicated that the encouragement from a leader was more likely to have been important or very important than somewhat important.

Next, we asked stewards to report what the person who had encouraged them to become a steward had said. Stewards who cited encouragement from a coworker wrote about the wants and wishes of coworkers, such as “I want you to

represent us," "I know you will fight for us," "You will keep us informed," and "I want you to speak for us." In contrast, stewards who cited encouragement from a union leader wrote about the leader's recognition of their abilities to lead, such as "You are articulate and easy to talk to," "There is no question you could be a steward here," "You listen to people, you hear what people say," and "You are good with management."

We also asked stewards to describe the person who had encouraged them to become a steward and explain why the encouragement was important. Most stewards who cited a coworker as a source of encouragement wrote about the needs of coworkers and friendships as important. In contrast, most stewards who cited a union leader as a source of encouragement wrote about how contact had evolved over time, the respectful tone of the leader, and the leader's ability to lead. These themes were similar to those reported by stewards in Roby's (1995) study about the contact experience. Notable descriptions of leaders who encouraged our stewards included:

She could be loud. She could be pushy. I learned a lot from her.

She listened to me. I listened back. We got to know each other.

He taught me about the contract and how to handle problems with it.

I liked her style. She always had something to say. Always telling me to speak up.

She showed me a lot of respect. Treated me well. She earned my respect.

Every day he gave me his endorsement.

He was a very honest person, someone who really cared for the underdog.

He was definitely in control. He was bright and had an aura of professionalism.

Smart, strong-willed, no one could pull the wool over her eyes.

*Becoming active.* We asked stewards to write about how they had become active in the union and how their activism came about. Nearly three fourths of stewards (73%) indicated that a union leader had encouraged their activism. We found that this pattern of responses was statistically different from chance alone,  $\chi^2(1, N = 44) = 9.09, p < .01$ . This result indicated that it was more likely than not that a steward received encouragement to become active from a leader. Broken down by gender, 77% of women reported receiving encouragement from a leader to become active, in contrast with 62% of men. By gender and ethnicity, 83% of men of color, 78% of White women, and 75% of women of color reported receiving encouragement from a leader to become active, in contrast with 43% of White men.

We asked stewards to indicate who provided the most important support for their activism. Fifty-two percent of stewards indicated that a ~~union leader~~ had provided the most important support, in contrast with a coworker (36%) or family and friends (11%). This pattern of responses was statistically different from chance,  $\chi^2(2, N = 44) = 11.23, p < .01$ . This result indicated that a leader was more likely than was a coworker or family or friends to provide the most important support for their activism. Fifty-eight percent of women reported that a union leader provided the most important support for their activism. In contrast, 62% of men reported that a coworker or family and friends provided the most important support for their activism.

When asked to indicate in what ways a union leader, coworker, or family and friends had provided the most important support for their activism, most stewards who cited a coworker or family and friends wrote about the loyalty and solidarity of supporters: "Because she gave me her support," "Because he stood by me," "Because these people I work with daily," and "I knew they were behind me." In contrast, most stewards who cited a leader as the most important support for their activism wrote about how the leader had kept in contact, the leader's recognition of their activism, and the leader's validation of their abilities to lead. Example descriptions of leaders who provided the most important support and what the leaders said included:

Because he kept in touch. He helped me to get involved.

He asked me to go to meetings and encouraged me to speak up.

She needed people to be involved. She convinced me I could make a difference.

I saw her trying to be strong. It gave me the courage to do it also.

Because the official had faith in me and he knew I was strong.

She said, "People see you are strong and will stand up for them."

She said I was a helper. The union is a helper. Why don't we work together?

"You are a leader. Be a leader for the union."

He said, "You're doing my job. Why don't you do it full time?"

*Personal invitation to become active.* When asked whether they had received a personal invitation to become active in the union, 68% of stewards indicated yes. This was a statistically significant pattern of responses not due to chance alone,  $\chi^2(1, N = 44) = 5.82, p < .05$ . This result indicated that stewards who had become active were more likely than not to have received a personal invitation. This result is in line with Roby's (1995) finding about the importance of receiving a personal invitation.

Women - Union  
leaders more  
likely

When asked who had personally invited them to become active, 70% of stewards who had been invited reported that it had come from a union leader, in contrast with the remaining percentage of stewards who reported that it had come from a coworker. We found that this was a significant pattern of responses,  $\chi^2(1, N = 30) = 4.80, p < .05$ . This result indicated that a personal invitation was more likely to come from a leader than from a coworker. Broken down by gender, 83% of women who had been invited to become active reported receiving an invitation from a leader, in contrast with 50% of men. This is a statistically significant pattern of responses not expected by chance,  $\chi^2(1, N = 30) = 5.40, p < .05$ . This result indicated that women were more likely than were men to have received an invitation from a leader to become active. By gender and ethnicity, 100% of women of color, 79% of White women, and 67% of men of color reported receiving an invitation from a leader, in contrast with 33% of White men.

We also asked stewards to indicate whether a reason or event had influenced their becoming a steward and why this had been an influence. Stewards who reported not receiving a personal invitation from a union leader to become active wrote about their need for personal growth or achievement. This is in line with Roby's (1995) findings about the need for growth or achievement as a reason for becoming a steward.<sup>4</sup> All men who reported not receiving a personal invitation from a leader wrote about growth needs or achievement, in contrast with 63% of women who reported not being invited. Notable reasons for becoming a steward despite not having received an invitation from a leader included:

- I wanted to be informed about my job and the union.
- Just to be able to confront management about what was really going on.
- I thought I could use my knowledge to improve our wages.
- I wanted to have some say in the new contract.
- I wanted to be in control of my future.
- I knew it would be different than anything else I was doing.
- I thought I would learn more about my rights as a steward.
- I thought I could do a better job than the steward we had.
- I decided to do something about my dissatisfaction with the steward.

#### *Presence of Self-Efficacy Enhancement in One-to-One Contact*

Table 1 shows the percentage of stewards who indicated the presence of self-efficacy enhancement modes in their descriptions of one-to-one contact

**TABLE 1. Percentage of Stewards ( $N = 44$ ) Describing Self-Efficacy Enhancement Modes in One-to-One Contact With Union Leaders**

Mode	%
Vicarious experience	68
Verbal persuasion	59
Performance mastery	57
Emotional inhibition	36

with union leaders. Although the percentage of stewards who indicated the presence of a particular enhancement mode varied from a high of 68% for vicarious experience to a low of 36% for emotional inhibition, all stewards indicated the presence of at least two modes ( $M = 2.20$ ,  $SD = 0.41$ ). These results are consistent with our expectation about the presence of enhancement modes in stewards' descriptions of their contact experience with leaders.

Table 2 shows the correlations for gender, ethnicity, self-efficacy enhancement modes, and self-efficacy to become a steward. Gender and ethnicity were

**TABLE 2. Means, Standard Deviations, and Correlations Among Demographic and Self-Efficacy Variables**

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1. Gender <sup>a</sup>	1.70	0.46	—						
2. Ethnicity <sup>b</sup>	1.23	0.42	-.36*	—					
3. Performance mastery <sup>c</sup>	1.57	0.50	-.11	.05	—				
4. Vicarious experience <sup>c</sup>	1.68	0.49	-.08	.18	.41**	—			
5. Verbal persuasion <sup>c</sup>	1.59	0.51	-.25	.11	.55**	.28	—		
6. Emotional inhibition <sup>c</sup>	1.36	0.44	.14	.31*	.42**	.32*	.37**	—	
7. Self-efficacy to become a steward <sup>d</sup>	1.95	0.65	-.08	.00	.57**	.44**	.64**	.57**	—

Note.  $N = 44$ . All correlations are Pearson correlations ( $r$ ), with the following exceptions: the correlation between Gender and Ethnicity is a phi coefficient ( $\phi$ ); the remaining correlations under headings 1 and 2 are point-biserial correlations ( $r_{pb}$ ).

<sup>a</sup>1 = men, 2 = women. <sup>b</sup>1 = White participants, 2 = minority participants. <sup>c</sup>1 = absent, 2 = present. <sup>d</sup>1 = low, 2 = moderate, 3 = high.

\* $p < .05$ . \*\* $p < .01$ .

significantly related, as were ethnicity and emotional inhibition. The relation between gender and ethnicity described a characteristic of our sample: that men were more likely than were women to be people of color. The relation between ethnicity and emotional inhibition indicated something about how people of color were encouraged to lead. That people of color were more likely than were White people to indicate the presence of emotional inhibition in their descriptions of one-to-one contact with leaders suggests several possibilities. Among them are that people of color are more sensitive to this mode of encouragement in contact with leaders or that leaders are more inclined to include this mode in contact with people of color. This result is consistent with our expectation about the importance of emotional inhibition in encouraging people of color to lead.

Also of note in Table 2, with the exception of vicarious experience and verbal persuasion, the self-efficacy enhancement modes were significantly related. These results are relevant in the statistical analysis of our hypothesis about whether verbal persuasion and emotional inhibition would be independently related to self-efficacy to become a steward.

#### *Predicting Self-Efficacy to Become a Steward*

The correlations in Table 2 suggest that the self-efficacy enhancement modes were significantly related to self-efficacy to become a steward. When considered separately, each enhancement mode was related to self-efficacy. These results indicated that the presence of any enhancement mode in descriptions of contact with a union leader was related to stronger efficacy beliefs. This is consistent with our expectation about the link between one-to-one contact with a leader as a self-efficacy enhancing experience and self-efficacy to become a steward.

To analyze our hypothesis about whether verbal persuasion and emotional inhibition would be independently related to self-efficacy to become a steward, we used hierarchical regression analysis. This statistical technique allows a researcher to examine multiple predictors of an outcome variable and examine which predictors are independently related to the outcome variable by entering variables in separate steps. In our study, predictors that we expected to show particularly strong links to the outcome variable were given early entry into the equation. In building the equation, verbal persuasion and emotional inhibition were entered first as a block of variables. These were the Step 1 predictors. Next, with Step 1 variables entered, performance mastery and vicarious experience were entered as a second block of variables. These were the Step 2 predictors.

After Step 1, information is gained about the extent to which Step 1 variables predict the outcome variable (squared multiple correlation or  $R^2$ ) and the extent to which Step 1 variables independently contribute to the prediction (regression coefficients or  $\beta$ s). After Step 2, information is provided about the extent to which Step 2 variables add to the prediction of the outcome variable (change in

$R^2$  or  $\Delta R^2$ ) and the extent to which Step 1 and Step 2 variables independently contribute to the prediction ( $\beta$ s in the final equation).

Our hypothesis would be fully supported if Step 1 predictors, verbal persuasion and emotional inhibition, produced a significant  $R^2$  after Step 1 and significant  $\beta$ s after Step 1 and Step 2, and if Step 2 predictors, performance mastery and vicarious experience, produced a nonsignificant  $\Delta R^2$  ( $F$  change is not significantly different from chance) and nonsignificant  $\beta$ s in the final equation.

Table 3 shows this pattern of significant and nonsignificant results. These results fully supported our hypothesis and indicated that when the four self-efficacy enhancement modes were considered together in relation to self-efficacy to become a steward, only verbal persuasion and emotional inhibition were independently related to (i.e., contributed to the prediction of) self-efficacy. This result is consistent with our goal of identifying specific enhancement modes that may strengthen the potency of the one-to-one contact experience.

### Discussion

Roby (1995) concluded that "the most important factor influencing new union constituencies to become stewards that is within the control of local union leaders is one-to-one contact with members" (p. 81). We agree: Our results replicate Roby's core findings and strengthen those findings by suggesting that the pattern of results is not due to chance alone. In particular, we can conclude that most stewards received encouragement to become a steward and that, for most, encouragement from a union leader was important in becoming a steward. We can also conclude that most stewards had received encouragement to become

**TABLE 3. Hierarchical Regression Analysis for Self-Efficacy Enhancement Modes Predicting Self-Efficacy to Become a Steward**

Variable	<i>B</i>	<i>SEB</i>	$\beta$	$R^2$	$\Delta R^2$	<i>F</i> change
Step 1						
Verbal persuasion	.63	0.15	.50*			
Emotional inhibition	.58	0.17	.39*	.54*		
Step 2						
Verbal persuasion	.50	0.16	.39*			
Emotional inhibition	.46	0.17	.31*			
Performance mastery	.20	0.17	.16			
Vicarious experience	.22	0.15	.17	.59*	.05	2.41

Note.  $N = 44$ . *B* = unstandardized regression coefficient;  $\beta$  = standardized regression coefficient; *SEB* = standard error of measurement.

\* $p < .01$ .

active in the union from a leader and that, for most, a leader provided the most important support to become active. Our findings also strengthened Roby's findings about the importance of a personal invitation to become active. We can conclude that most stewards received an invitation to become active and that the invitation had come from a leader.

The written descriptions by stewards in our study of their presteward experiences with union leaders showed the same themes as those found in the descriptions voiced by Roby's (1995) stewards. In these descriptions, stewards who had one-to-one contact with a leader often indicated that the contact had extended over time, the tone of the contact had been respectful, and the contact had produced a sense of validation of skills and abilities to lead.

We also found support for Roby's (1995) conclusion that "the one-to-one contact was more important for women and people of color than for [W]hite men" (p. 81). In contrast with White men, women and people of color in our study received more encouragement to become a steward from a union leader. They also received more encouragement to become active in the union from a leader and more often received a personal invitation to become active from a leader. Also, in terms of our statistical tests, we can conclude that women in contrast with men more often received an invitation from a leader to become active.

With our background in social cognitive theory (Bandura, 1977, 1997), we thought that the descriptions of one-to-one contact in Roby's (1995) study suggested the presence of performance mastery, vicarious experience, verbal persuasion, and emotional inhibition. In our study, we found the presence of these self-efficacy enhancement modes. Although the descriptions varied in the presence of particular enhancement modes, every steward described at least two modes. This result speaks to the prevalence of the enhancement modes in the contact experience of prospective stewards.

Emotional inhibition was the only enhancement mode related to ethnicity. People of color may have written about this enhancement mode more because they were more concerned about negative reactions to their leadership success. Union leaders, sensing this concern, may have provided more assurance to people of color that such reactions would be less than anticipated. Our point in generating these theories is to suggest that a self-efficacy enhancement focus may enable future researchers to explain the importance of emotional inhibition in the contact experience for people of color, members who Roby (1995) indicated "still see relatively few people like themselves in high level union offices but frequently experience discrimination in organizations, including unions" (p. 81).

Self-efficacy enhancement modes were present in stewards' descriptions of their contact experience with union leaders, and these enhancement modes were related to their self-efficacy about becoming a steward. Self-efficacy enhancement may be so important to prospective stewards because performing successfully as a steward requires particularly strong self-efficacy. Consider the match between what is required for successful performance as a steward and what is known about people

Women +  
People of color  
need personal  
invitation more



with strong efficacy beliefs: They tend to expend more effort in completing tasks or pursuing activities, they tend to persist longer in expending effort, and when faced with barriers or obstacles, they tend to expend further effort (Bandura, 1986).

In our effort to identify particular self-efficacy enhancement modes that may be used to increase the potency of the contact experience, we found that when enhancement modes are considered together, verbal persuasion and emotional inhibition were independently related to self-efficacy to become a steward. Union leaders should note this result. We can imagine self-efficacy enhancement awareness programs for union leaders in which leaders are trained to be more aware of the importance of one-to-one contact with members and to be more aware of the influence of the four enhancement modes as sources of beliefs about leadership success. The importance of our results for training is that the independence of verbal persuasion and emotional inhibition should not be overlooked in any program. As our results suggest, more than one enhancement mode can be present in the contact experience. However, no matter how many modes are present, verbally encouraging members to lead and helping members anticipate reactions to their success are potent but not interchangeable ways of encouraging members to become stewards.

There are limitations to this study. Our sample size was small. As such, future researchers should confirm our results with larger samples and with samples from other unions. Future researchers should confirm the implied sequence of self-efficacy enhancement modes in the contact experience followed by efficacy beliefs about becoming a steward. Such researchers should use repeated measures for enhancement modes and self-efficacy before and after becoming a steward, with between-group comparisons of prospective and nonprospective stewards. Also, as a caution, future researchers should conduct program evaluation studies to confirm the effectiveness of any self-efficacy awareness program before implementation.

#### AUTHOR NOTES

**Steven Mellor** is an industrial/organizational psychologist with a PhD from Wayne State University. His primary research focus is organizational behavior in the context of union-management psychology. **Carrie A. Bulger** is an industrial/organizational psychologist with a PhD from the University of Connecticut. Her primary research interests involve worker attitudes and well being, including labor union participation. **Lisa M. Kath** is an industrial/organizational psychologist with a PhD from the University of Connecticut. Her research interests include worker motivation and workplace training effectiveness.

#### NOTES

1. Few researchers have examined relations between self-efficacy and becoming active in the union. Exceptions include Cole and Latham (1997) and Skarlicki and Latham (1996), wherein self-efficacy was partialled out to better isolate perceived justice effects, and Markowitz (1998), wherein self-efficacy was discussed in reference to union organizing effects.

← doesn't everyone do this already

You can say that again!

2. Because we sought to show an application of self-efficacy in a union setting, a general literature review of self-efficacy studies is not included in this article. However, we can provide a guide to the literature for scholars keyed to relevant topics, issues, and controversies: (a) for conceptual reviews of self-efficacy studies in organizational settings, see Bandura (1991), Gist (1987), Gist and Mitchell (1992), and Harrison, Rainer, Hochwarter, and Thompson (1997); (b) for reviews of studies that show relations between self-efficacy and vocational interest, see Bandura, Adams, Hardy, and Howells (1980), Lent, Brown, and Hackett (1994), and Schunk (1995); (c) for a meta-analysis of self-efficacy and work-related performance, see Stajkovic and Luthans (1998); (d) for reviews of studies that show the effect of attribute similarity between observers and models on self-efficacy, see Bussey and Bandura (1999), Jaina and Tyson (2004), and Mellor et al. (2006); and (e) for conceptualizations of generalized self-efficacy as a core self-evaluation trait, see Judge, Bono, Erez, Locke, and Thoresen (2002) and Judge, Van Vianen, and DePater (2004).

3. Our open-ended measure of self-efficacy avoids two sources of measurement error often associated with established self-report measures (cf. Forsyth & Carey, 1998; O'Brien, 2003). First, our measure reduced ceiling effects by providing a contextual cue for each self-efficacy question. This was accomplished with the stem, "When you became a steward . . ." Responses to self-efficacy questions that lack contextual cues can produce efficacy beliefs about performance in best-case scenarios, resulting in abnormal or negatively skewed distributions of scores. Such distributions can reduce the sensitivity of the measure. Our measure produced a normal distribution of scores, lacking in skewness (skewness = .00). Second, our measure reduced response bias (e.g., socially desirable responding) by providing an anonymous, nonevaluative format for responses. Stewards were instructed not to provide their names or the names of others in their union, and were informed that (a) their responses would be summarized with the responses of other stewards and (b) the response information would be used to "help the union learn what the experience is like for new shop stewards." Measures that lack anonymity and assurance of nonevaluation can produce overreporting of positive efficacy beliefs or underreporting of negative efficacy beliefs. Our measure produced an equal number of positive and negative efficacy beliefs (i.e., low and high self-efficacy scores had an equal proportion of .21).

4. Another reason for interest in becoming active in the union may be perceived injustice (Mellor, Barnes-Farrell, & Stanton, 1999). In response to our open-ended question about whether there was a specific event or reason that influenced their becoming a steward, 20% of stewards wrote about injustice perceptions. This percentage of response is sufficient to suggest that future researchers should focus on relations between need to redress injustice and interest in becoming active. Notable injustice responses to the question included, "I didn't like the way our company treated some of the help while playing favorites to others," "My manager was harassing me on the job," and "The managers were picking on this one man who came to work every day and did his work, and it was not fair."

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**APPENDIX**  
**Survey Questions About Becoming a Union Steward**

No.	Question
<i>Yes-No</i>	
1.	Did anyone encourage you to become a steward?
6.	Was there a specific event or reason that influenced you to become a steward?
12.	Before you became a steward, were you personally asked to participate in union activities?
14.	Did your coworkers encourage your union activities?
16.	Did your family or friends encourage your union activities?
18.	Did your union leaders encourage your union activities?
<i>Open-ended</i>	
2.	Who encouraged you (no names, give the person's title, such as "a coworker," "my staff organizer," or "my steward")?
4.	What was it that he or she said?
5.	Tell us about this person: what is he or she like? Why was the encouragement so important to you?
7.	Tell us about the event or reason. What was the situation?
8.	Why did it make you want to become a steward?
9.	When you became a steward, what was the biggest obstacle you had to overcome?
10.	When you became a steward, what was your greatest fear?
11.	When you became a steward, what was the first thing you had to learn?
13.	Who asked you to participate in these activities (no names, give the person's title, such as "a coworker," "my staff organizer," or "my steward")?
15.	In what ways did your coworkers encourage your union activities?
17.	In what ways did your family or friends encourage your union activities?
19.	In what ways did your union leaders encourage your union activities?
21.	Explain why the support of your coworkers, family, friends, or union leaders was important to you.
<i>Likert-type</i>	
3.	How important was this person's encouragement in your becoming a steward?
<i>Other</i>	
20.	All support is important, but which of the following gave you the most important support: coworkers, family and friends, or union leaders?

*Note.* Questions are numbered in the order in which they were presented to respondents.

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AP Psychology

26 Mar 2008

### September 11<sup>th</sup>'s Indirect Perceived Benefits

Rhonda Swickert et al. tried to see if there were any perceived benefits in people who were indirectly affected by the traumatic event of September 11<sup>th</sup>. This research emerges in a crowded field of 9/11 research, more than 1,000 psychology articles in the authors' own admissions (574). In Response to the September 11, 2001, Terrorist Attacks: Experience of an Indirect Traumatic Event and Its Relationship with Perceived Benefits, the authors use a variety of tests to see how participants respond how they are feeling 2 weeks and 2 months after September 11<sup>th</sup>. They primarily used the Perceived Benefits Scales (PBS) to measure 8 types of perceived benefits people feel.

I do not remember September 11<sup>th</sup> that well since I was in 5<sup>th</sup> grade when those terrorist attacks happened. However I do remember that afterwards there was a lot of Patriotic feelings and flag waving. From what I remember people seemed to come together as a community after 9/11 and had increased connections with their families. The findings of the report confirm this. The report also found that these feelings decay over time. There was a 9% drop in total scale points 2 months after 9/11 rather than 2 weeks (573).

The authors also found that the perceived benefits were higher in people who reported the most trauma symptoms (573).

The authors' goal in preparing this report was to do more research about 9/11. Other researchers have already proved that exposure to traumatic events can cause people to rekindle

their sense of community. As stated before there are many psychology articles concerning 9/11. This report merely seems to link the two findings in a way which it seems that they would be connected. I also have the suspicion that this article was created from further mining survey data done immediately after 9/11. However, I feel that the authors did link the perceived benefits of indirect traumatic stress to September 11<sup>th</sup>.

I think that the article should have included copies of the tests administered to the subjects. I think the experimenters should also have asked the subject to describe benefits in an open ended area.

I do not think the article was biased, however it would be hard to say that the events of 9/11 were good or did not affect America. The authors do correctly point out how tragedy can bring people together.

As I was reading this I wondered what questions were asked of the subjects. I also was wondering what the results would be a year, 2 years, 5 years after 9/11. Would the decay continue?

The unique aspect of this paper was that it talked about the positive perceived effects of 9/11. As stated above, there has been a lot of research into 9/11. This attempts to provide a different look at data collected during that event.

It is scholarly article since it was written in a scholarly paper and cites a lot of sources. In addition, it would not have made a very good popular article.

The article cites 38 sources mostly from other scholarly papers.

Overall this paper merely linked existing research about the benefits of indirect traumatic stress with September 11<sup>th</sup>.

Works Cited

Swickert, Rhonda, James B. Hittner, Virginia de Roma, and Conway Saylor. "Response to the September 11, 2001, Terrorist Attacks: Experience of an Indirect Traumatic Event and Its Relationship with Perceived Benefits." Journal of Psychology. 140.6 (Nov 2006): 565-577.



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**Abstract:** Little is known about how people might benefit from an indirectly experienced traumatic event. The authors examined the relationship between perception of benefit and trauma symptoms in response to a relatively severe, but indirectly experienced, traumatic event. The authors sampled from 2 colleges located in the southeastern United States (N = 136). Individuals responded to questionnaires that assessed perceived benefits and trauma symptoms 1-2 weeks after the terrorist attacks of September 11, 2001, and again approximately 10 weeks later. Participants did perceive benefits from witnessing this event, although their perception of benefit declined over time. Level of trauma symptoms correlated positively with perception of benefit, and experiencing a previous trauma also correlated positively with perceived benefits. Additional analysis indicated that level of trauma symptoms mediated the relationship between previous trauma and perception of benefit. These findings help to elucidate understanding of the development of perceived benefits in response to indirectly experienced events. [ABSTRACT FROM AUTHOR]

*fast moving*

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## Responses to the September 11, 2001, Terrorist Attacks: Experience of an Indirect Traumatic Event and Its Relationship With Perceived Benefits

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**ABSTRACT.** Little is known about how people might benefit from an indirectly experienced traumatic event. The authors examined the relationship between perception of benefit and trauma symptoms in response to a relatively severe, but indirectly experienced, traumatic event. The authors sampled from 2 colleges located in the southeastern United States ( $N = 136$ ). Individuals responded to questionnaires that assessed perceived benefits and trauma symptoms 1-2 weeks after the terrorist attacks of September 11, 2001, and again approximately 10 weeks later. Participants did perceive benefits from witnessing this event, although their perception of benefit declined over time. Level of trauma symptoms correlated positively with perception of benefit, and experiencing a previous trauma also correlated positively with perceived benefits. Additional analysis indicated that level of trauma symptoms mediated the relationship between previous trauma and perception of benefit. These findings help to elucidate understanding of the development of perceived benefits in response to indirectly experienced events.

Key words: indirect trauma, perceived benefit, previous trauma, posttraumatic growth

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THE LITERATURE ON POST-TRAUMATIC STRESS DISORDER suggests that individuals do not need to experience a traumatic event directly to be affected by it. Rather, witnessing such an event may leave the individual as vulnerable to trauma symptomatology as those who directly experienced it (Lerias & Byrne, 2003; Nader, 2002; Silva et al., 2000). Given this assertion, it is not surprising that terrorist activities on September 11, 2001, adversely affected many people. After

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these attacks, phone calls to the National Mental Health Association increased by one third, and the American Red Cross reported over 15,000 contacts by individuals across the United States seeking psychological services (Galloro, 2001). A national survey in the United States indicated that up to 90% of the individuals sampled reported at least one stress symptom in response to their indirect exposure to this event (Schuster et al., 2001). The negative effects of indirect exposure to the traumatic events of September 11 have been documented in both children (Phillips, Shantay, & Schiebulhut, 2004) and adults (Liverant, Hofmann, & Litz, 2004; Schuster et al.). Whereas the negative psychological consequences of witnessing the events of September 11 have been documented by researchers (Ahern, Galea, Resnick, & Vlahov, 2004; Blanchard et al., 2004; Cardenas, Williams, Wilson, Fanouraki, & Singh, 2003; Liverant et al., 2004), much less is known about positive outcomes that might result from indirect exposure to such an event. We set out to examine this issue in this study.

Our focus reflects interest in investigating the possibility that individuals may grow or benefit from aversive experiences (Calhoun & Tedeschi, 2001; Linley & Joseph, 2004; McMillen, 1999). Posttraumatic growth occurs when fundamental assumptions about the self, others, and the future are challenged. In response to this challenge, traumatized individuals may try to find meaning from their experience (Tedeschi & Calhoun, 2003). Thus, individuals often discover that they have benefited from the traumatic event (McMillen & Fisher, 1998).

McMillen (1999) identified several benefits that people often perceive as arising from their traumatic experiences. First, individuals frequently report a change in their self-perceptions. They often describe increased feelings of self-reliance and self-efficacy. For instance, research with bereaved elderly women found that those women who had played a traditional role as wife during marriage learned that they could perform tasks (e.g., handling financial matters) that had been designated exclusively to their husbands (Lund, Caserta, & Dimond, 1993). Another form of perceived benefit that people often describe after a traumatic event is a change in their relationships with others. In coping with a traumatic event, an individual may need a great deal of emotional or tangible support from others. If provided, this support may lead the individual to view others more positively. After coping with a traumatic event, people often report that they feel closer to significant others, engage in personal disclosure more often, and are more compassionate and empathic when responding to others (McMillen). Last, a third form of perceived benefit is a change in life structure or philosophy. Upon experiencing a traumatic event, individuals recognize the vulnerability of life and therefore develop a greater appreciation for it. People report that they now live each day to its fullest and do not take life for granted (Affleck & Tennen, 1996). Individuals may also reevaluate their spiritual lives, and for many people, this reevaluation leads to a strengthening of religious beliefs (Meisenhelder, 2002; Tedeschi & Calhoun, 1995).

Research indicates that individuals indirectly affected by the events of September 11 did experience significant positive changes in the wake of this tragedy.

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Peterson and Seligman (2003) demonstrated that several character strengths (gratitude, hope, kindness, leadership, love, spirituality, and teamwork) significantly increased, as reported by online respondents after the events of September 11. Additionally, a study conducted with Canadian respondents approximately 3 months after September 11 found that the character strengths of hope and spiritual meaning were negatively associated with both depression and anxiety in response to this event. Furthermore, when responding to open-ended questions, participants indicated both positive and negative changes in the self in response to the events of September 11 (Ai, Cascio, Santangelo, & Evans-Campbell, 2005). Individuals surveyed in the United Kingdom similarly indicated that they experienced both positive and negative changes in response to their indirect exposure to the events (Linley, Joseph, Cooper, Harris, & Meyer, 2003). These researchers found general positive growth and changes within individuals, but to date, little is known about the specific self-perceived positive benefits that come from indirectly experiencing a traumatic event. We wanted to investigate how individuals indirectly exposed to the terrorist attacks of September 11 might have benefited from these events. To address this issue, we administered the Perceived Benefit Scales (PBS; McMillen & Fisher, 1998), which assess eight types of perceived benefits: community closeness, compassion, faith in people, family closeness, self-efficacy, lifestyle changes, material gain, and spirituality.

Using a longitudinal design, we asked participants to indicate how they might have benefited from the events of September 11. This information allowed us to address several questions related to perceiving benefits from an indirectly experienced traumatic event. The first question was whether participants would report benefits from this experience and, if they did, if their perception of benefit would change over time. In a recent review of the adversarial growth literature, Linley and Joseph (2004) indicated that the period between 2 weeks and 2 months accounted for the most increases in posttraumatic growth. After this 2-month period, levels of growth tend to remain stable through at least 1 year. We first surveyed participants within the first 2 weeks following the events of September 11 and again 2 months later. This time frame allowed us to capitalize upon the period of greatest changes in growth, and we expected that significant increases in the perception of benefits would occur across these time periods.

We also studied whether greater levels of trauma symptoms would be associated with perceived benefits. Theorists agree that one must be adversely affected by a traumatic event to benefit from it (Calhoun & Tedeschi, 2001; Linley & Joseph, 2004). To perceive benefits from a negative event, one must ruminate and actively think about the event. In most cases, individuals may not put forth the cognitive effort to do this unless the event is sufficiently stressful. Park, Cohen, and Murch (1996) showed that higher levels of distress following a traumatic event predicted higher levels of stress-related growth, and other researchers have reported similar findings (Calhoun & Tedeschi; Linley & Joseph; McMillen, Smith, & Fisher, 1997). This association also has been found among people who

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indirectly experience a traumatic event. Davis and Macdonald (2004) assessed the responses of individuals who indirectly experienced the events of September 11 and found that individuals who experienced greater emotional stress immediately following the event also experienced greater positive life changes 11 months later. They took only a gross measurement of positive life changes, so only general conclusions could be made regarding the relationship between distress and perceived benefits. In the current study, we measured 8 types of perceived benefits (using the PBS), which allowed for a comprehensive examination of the relationship between distress and perception of benefits. On the basis of findings from previous work, we predicted that individuals who reported greater levels of trauma symptoms would also report greater levels of perceived benefits.

Last, we investigated whether previous traumatic experience was associated with reported levels of perceived benefit in response to the events of September 11. Little is known about the impact of previous trauma on how people perceive benefits from exposure to a subsequent traumatic event. Brewin, Andrews, and Valentine (2000) and Doukessa and Byrne (2003) found that previous exposure to trauma is associated with greater distress to a subsequent trauma. Also, Park and colleagues (1996) and other researchers (Calhoun & Tedeschi, 2001; Linley & Joseph, 2004; McMillen et al., 1997) found that greater distress often prompts greater levels of posttraumatic growth. Therefore, it is reasonable to assume that previous trauma has an indirect effect on perception of benefits through the mediating influence of current distress. Our final goal in this study was to investigate this hypothesized model.

In summary, we investigated the following research questions:

1. Do participants report perceiving benefits from indirectly experiencing the events of September 11, and, if so, does their perception of benefits increase over time?
2. Are greater levels of trauma symptoms associated with perceived benefits?
3. Is experiencing a previous trauma associated with reported levels of perceived benefits from the events of September 11, and, if so, does level of current trauma symptoms mediate this relationship?

## Method

### *Participants*

We recruited participants ( $N = 136$ ) from a small military college and a medium-sized liberal arts college in the southeastern United States. Women comprised 34% of the sample, and the mean age was 21 years ( $SD = 2.6$ ). Regarding the ethnic distribution of the sample, 8% were African American, 6% were Asian American, 77% were Caucasian, 4% were Hispanic, and 5% classified themselves as belonging to a different ethnic group. We recruited participants from

undergraduate political science and psychology classes. Their participation was entirely voluntary, and they received extra credit for completing the study when this opportunity was available.

### *Materials*

The Perceived Benefit Scales (PBS; McMillen & Fisher, 1998) is used to assess the perception of positive personal changes that occur following exposure to a traumatic event. Participants respond to items addressing the positive benefits of a traumatic event using a 5-point Likert scale ranging from 0 (*not at all like my experience*) to 4 (*very much like my experience*). The PBS comprises 8 subscales: Enhanced Self-Efficacy (ES), Increased Community Closeness (ICC), Increased Spirituality (IS), Increased Compassion (IC), Increased Faith in People (IFP), Lifestyle Changes (LC), Enhanced Family Closeness (EFC), and Material Gain (MG). The subscales are summed to make a total scale score. Higher scores on each of the subscales and on the total scale score of the PBS indicate greater perceived benefits. In this study, alphas for all but one of the subscales ranged from .78 to .93. Because of the Material Gain scale's low internal consistency ( $\alpha = .58$ ), we did not include it in inferential statistical analyses. The total scale was highly internally consistent ( $\alpha = .96$ ). Information about convergent and criterion validity of the PBS can be found in McMillen and Fisher.

With the publisher's permission, we used an abbreviated version of the Davidson Trauma Scale (DTS; Davidson et al., 1997) to assess trauma symptoms. We created the abbreviated DTS by deleting five items that were unrelated to an indirect traumatic stressor. In the final version of the DTS, participants reported whether they experienced any of 12 trauma symptoms. Higher scores on the DTS are associated with greater trauma symptom severity. Test-retest reliability of the DTS has been found to be adequate ( $r = .86$ ; Davidson et al.). In the current study, internal consistency was acceptable ( $\alpha = .79$ ). Information regarding the validity of this scale can be found in Davidson and colleagues.

The Past Trauma Experiences Scale (PTES) is a 9-item measure designed for this study to assess number and type of prior traumas. Type of traumas ranged from direct victimization to loss of someone close. Participants responded to each item by indicating whether they had or had not experienced the traumatic event.

### *Procedure*

We asked individuals to participate in the study between 7 and 15 days after the events of September 11, 2001 (Phase 1). We obtained informed consent and assigned participants a code number, and we asked them to complete the DTS, the PBS, and the PTES. We contacted participants a second time approximately 10 weeks after September 11 (Phase 2). During the second phase of the study, we obtained informed consent again and were asked participants to complete the

understand the potential sources and psychological classes. Their participation was entirely voluntary, and they received extra credit for completing the study when the opportunity was available.

## Measures

The Revised Brief Symptom Inventory (BSI; McMillin & Fisher, 1998) is used to assess the presence of positive personal changes that occur following exposure to a traumatic event. Participants respond to items addressing the positive sense of a traumatic event using a 5-point Likert scale ranging from 0 (not at all) to 4 (very much like my experience). The BSI comprises 8 subscales: enhanced self-efficacy (ESE), increased Community Closeness (ICC), increased Spirituality (IS), increased Compassion (IC), increased Faith in People (IFP), Increased Change (IC), Enhanced Family Closeness (EFC), and Altered Core Values (ACV). The subscales are summed to make a total scale score. Higher scores on 7 of the subscales and on the total score of the BSI indicate positive personal benefits. In this study, ratings for all but one of the subscales ranged from 28 to 93. Because of the Altered Core Values' low internal reliability ( $\alpha = .52$ ), we did not include it in internal statistical analyses. The total scale was highly internally consistent ( $\alpha = .96$ ). Information about convergent and discriminant validity of the BSI can be found in McMillin and Fisher (1998).

When the publisher's permission was used an abbreviated version of the Davidson Trauma Scale (DTS; Davidson et al., 1997) to assess trauma symptoms. We used the abbreviated DTS by deleting the items that were unrelated to an indirect trauma's stressor. In the final version of the DTS, participants reported whether they experienced any of 13 trauma symptoms. Higher scores on the DTS are associated with greater trauma symptom severity. Test-retest reliability of the DTS has been found to be adequate ( $r = .86$ ; Davidson et al., 1997). In the current study, internal consistency was acceptable ( $\alpha = .75$ ). Information regarding the validity of this scale can be found in Davidson and colleagues (1997).

The Post-Traumatic Experiences Scale (PTES) is a 9-item measure designed for this study to assess number and type of prior traumas. Type of traumas ranged from direct experiences to loss of someone close. Participants responded to each item by indicating whether they had or had not experienced the traumatic event.

## Procedure

We asked individuals to participate in the study between 7 and 15 days after the event of September 11, 2001 (Phase 1). We obtained informed consent and assigned participants a code number, and we asked them to complete the DTS, the BSI, and the PTES. We contacted participants a second time approximately 10 weeks after September 11 (Phase 2). During the second phase of the study, we obtained informed consent again and were asked participants to complete the

DTS and the PBS. We also administered questionnaires assessing coping processes and just world beliefs at this time, but we did not examine data from these instruments in this study. Using the assigned participant code number, we paired the data participants provided during Phase 1 of the study with the data they provided during Phase 2. At the time of data collection, we told the participants that mental health referrals were available if they felt that they were having difficulty coping with the event.

### Results

First, we examined distributions of all variables for departures from normality and transformed variables that were highly skewed or kurtotic. Next, because we collected the data from two different institutions, we tested whether the relationships among the variables differed across the two schools by calculating correlation matrices for each institution. If the two matrices are nonsignificantly different (i.e., equivalent), then the data from the two institutions can be pooled. We conducted the test for the equivalence of correlation matrices using the Analysis of Moment Structures (AMOS) structural equation modeling program. In addition to examining the  $\chi^2$  and  $\chi^2/df$  ratio, we also calculated the following fit indexes: the Tucker-Lewis index (TLI; Tucker & Lewis, 1973), Bollen's incremental fit index (IFI; 1989), Bentler's comparative fit index (CFI; 1990), and Steiger and Lind's root-mean-square error of approximation (RMSEA; 1980) accompanied by the corresponding upper and lower bounds of the 90% confidence interval. We examined these indexes because recent Monte Carlo simulation research indicated that these measures of model fit performed well under a variety of conditions (Hu & Bentler, 1998). The results of the equivalence test indicated the following fit indexes:  $\chi^2(6) = 3.079$ ,  $p = .80$ ,  $\chi^2/df = .513$ , TLI = 1.005, IFI = 1.003, CFI = 1.000, RMSEA = 0.000 (90% confidence interval [CI]: 0.00–0.051). These values meet Hu and Bentler's cutoff criteria for a good model fit (i.e., TLI, IFI and CFI are 0.95 or greater and RMSEA is less than 0.06). These findings support the hypothesis of equivalent correlation matrixes across institutions, so we pooled the data from the two universities and conducted all analyses on the combined sample.

Because research suggests that men and women differ in their reactions to trauma (Brewin et al., 2000) and in their tendency to perceive benefits from trauma (McMillen & Fisher, 1998), we also conducted a test of the equivalence correlation matrices across men and women. The correlation matrices were equivalent across gender,  $\chi^2(6) = 2.355$ ,  $p = .88$ ,  $\chi^2/df = .393$ , TLI = 1.004, IFI = 1.002, CFI = 1.000, RMSEA = 0.000 (90% CI: 0.000–0.030), so we pooled the data from men and women as well.

To address the first question of the study, we computed means and standard deviations for the PBS total scale as well as for the subscales. These means and standard deviations are shown in Table 1. To examine whether the means for each



PBS changed over time, we computed paired-sample *t* tests. Results indicated that the mean for each variable was consistently higher during Phase 1, as compared with Phase 2, of the study (see Table 1).

To address the second question of the study, we examined the means for trauma symptoms measured during Phase 1 and Phase 2 to establish whether the participants experienced trauma in response to the events of September 11. On average, the participants endorsed 25% of the trauma symptom items during Phase 1 ( $M = 3.07$ ) and 13% of the items during Phase 2 ( $M = 1.58$ ). We performed a correlational analysis to examine whether level of trauma symptoms was associated with perceived benefits in response to the events of September 11. Trauma symptoms measured during Phase 1 of the study served as the predictor variable, and the PBS total scale score measured during Phase 2 of the study served as the criterion variable. We found a significant positive correlation between these two variables ( $r = .40, p = .0001$ ). To control for the possibility that current trauma symptoms confounded this association, we computed a partial correlation controlling for Phase 2 trauma symptoms. Although the association was weakened, the correlation remained significant ( $r = .20, p = .02$ ).

To address the final question of this study, we computed correlations to test the association between experiencing a previous trauma and perception of benefit. Previous trauma served as the predictor variable, and PBS total scores measured during Phase 1 and 2 served as the criterion variables. Previous trauma was not associated with perceived benefits measured initially after September 11 (Phase 1), but it was significantly associated with perceived benefits assessed during Phase 2 ( $r = .21, p = .02$ ). This finding indicates that a greater number of previous traumas was associated with higher levels of perceived benefit. This association

**TABLE 1. Paired Sample *t* Tests of Differences in Means for Each Variable Across Phase 1 and Phase 2 of the Study**

Variable	Phase 1		Phase 2		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Perceived Benefits Scale total	44.60	24.80	33.47	26.16	6.09**
Enhanced self-efficacy	6.70	5.81	5.25	5.54	3.34*
Increased community closeness	5.98	4.27	4.08	3.72	5.49**
Increased spirituality	4.39	4.17	3.11	3.79	4.55**
Increased compassion	7.94	4.30	6.43	4.69	4.75**
Increased faith in people	8.37	4.22	6.85	4.60	4.56**
Lifestyle changes	4.73	4.11	3.64	4.04	3.64**
Enhanced family closeness	5.76	3.83	3.90	3.64	6.86**

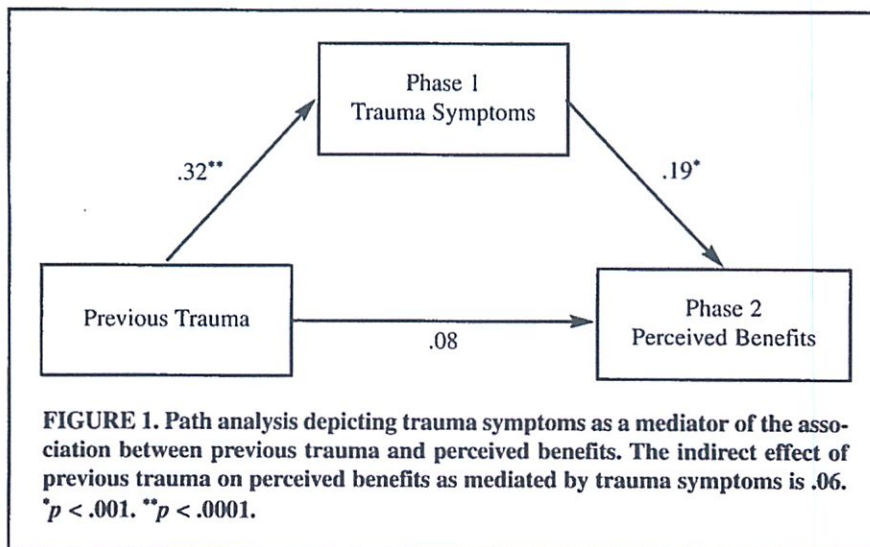
\* $p < .001$ . \*\* $p < .0001$ .



remained significant even when we controlled for the variable of perceived benefits measured during Phase 1 ( $r = .21, p = .02$ ). To explore further the association between these two variables, we conducted a path analysis to determine whether the relationship between previous trauma and Phase 2 perceived benefits was mediated by Phase 1 trauma symptoms. To be considered a viable mediator, the proposed variable must correlate with both the predictor variable (previous trauma) and the criterion variable (PBS total measured during Phase 2; Baron & Kenny, 1986). This condition was met because Phase 1 trauma symptoms were significantly correlated with both total previous trauma ( $r = .32, p < .01$ ) and the PBS total score measured during Phase 2 ( $r = .40, p < .01$ ). We obtained path analysis findings through simultaneous multiple regression analyses, and the path coefficients are represented by beta weights ( $\beta$ ). To arrive at these path coefficients, we computed two types of regression equations: (a) we entered previous trauma into the equation to predict Phase 1 trauma symptoms and (b) we simultaneously entered previous trauma and Phase 1 trauma symptoms (preceded by PBS total score measured during Phase 1) into the equation to predict Phase 2 PBS total score. Figure 1 shows the results of these analyses. When we included the mediator in the model, previous trauma was no longer significantly associated with Phase 2 perceived benefits ( $p = .36$ ). These findings indicate that Phase 1 trauma symptoms partially mediated the association between these two variables.

### Discussion

We had three purposes in this study. First, we wanted to determine whether individuals who were indirectly affected by the events of September 11 would



report perceiving benefits in response to the event. Overall, the participants in this study did report perceiving benefits from their experiences. The mean total PBS score for Phase 1 of the study was 44.60, compared with and 33.47 for Phase 2. This scale ranges from 0–120, which means that participants earned, on average, 37% and 28% of the total scale points for Phase 1 and 2 of the study, respectively. Linley and Joseph (2004) suggested that, as early as 2 weeks post-trauma, individuals may report increased feelings of growth and benefit. Our results support these findings: Participants reported substantial perceived benefits approximately 2 weeks after the events of September 11.

Linley and Joseph (2004) also found that the greatest increase in feelings of growth and benefit occurs from 2 weeks to 2 months following a traumatic event. Our findings are not consistent with this trend: Participants' reports of perceived benefits significantly decreased from Phase 1 to Phase 2 of the study for all subscales of the PBS, as well as for the total scale score. Previous work documenting the temporal course of growth and benefit has included almost entirely individuals who have directly experienced a traumatic event (Linley & Joseph). Participants in our study were observers of the events of September 11 and, therefore, were indirectly exposed to this event. The temporal course of perceiving growth and benefit from experiencing a traumatic event may differ depending on whether the event was directly or indirectly experienced. Additional research is needed to clarify this issue. In particular, researchers should investigate whether long-standing growth occurs when a stressor is experienced indirectly. Our findings suggest that people continue to perceive benefit from witnessing a traumatic event 2 months after its occurrence. However, participants' self-reported perception of benefit dropped significantly from 2 weeks posttrauma to 2 months posttrauma. It is unclear whether participants eventually return to baseline and perceive no benefit from their experience or whether the perception of benefit stabilizes at 2 months and plateaus for an extended period, as is the case for directly experienced trauma (Linley & Joseph).

Regarding our second research question, participants did experience trauma in response to the events of September 11. On average, individuals endorsed 25% of the trauma symptom items we measured during the initial assessment. Furthermore, level of trauma symptoms measured during this phase of the study (i.e., 2 weeks after the events of September 11) predicted individuals' PBS total scores 2 months later. This effect remained even after we controlled for trauma symptoms measured during Phase 2. This result is consistent with the idea that one must experience a sufficient level of trauma to perceive some benefit from the experience. This finding has been demonstrated repeatedly with victims who have experienced a trauma directly (McMillen et al., 1997; Park et al., 1996; Tedeschi & Calhoun, 1995). Less is known about whether this process operates when the trauma is experienced indirectly. Certainly, research has shown that people can benefit from experiencing trauma indirectly. For example, husbands of women treated for breast cancer perceive benefits from going through the

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experience with their wives (Manne et al., 2004; Weiss, 2002). However, less is known about the factors that enable people who are indirectly traumatized to perceive benefits from their experiences. Our findings indicate that level of distress in response to the event is one factor that influences perception of benefit.

The final issue we addressed in this study concerns the manner in which the experience of previous trauma might influence the perception of benefit. To address this issue, we examined whether experiencing a previous trauma was associated with participants' self-reported levels of perceived benefits. We found a significant association between previous trauma and PBS total score measured during Phase 2. Individuals who reported experiencing higher levels of previous trauma also reported greater perception of benefits (PBS total score). In accounting for this relationship, we examined whether level of distress mediates the relationship. Brewin and colleagues (2000) found that individuals who have been previously traumatized and then experienced another traumatic event showed a greater stress response to the subsequent traumatic event. This heightened distress might motivate the individual to grow and see benefit from a subsequent traumatic experience. To the best of our knowledge, we are among the first researchers to examine how previous trauma influences perception of benefit. Path analysis results indicated that level of distress (as measured by trauma symptoms during Phase 1) mediated the relationship between previous trauma and perceived benefits. However, many questions remain regarding the associations among previous trauma, distress, and perceived benefits. For example, recentness of the previous trauma might affect the level of distress an individual experiences when confronting an additional traumatic event. What does this mean for the individual in terms of growth and perception of benefit in response to the current trauma? Future researchers should examine the relationships among previous trauma, trauma symptoms, and perception of benefit, which may have important implications for clinicians working with individuals with a history of trauma and victimization.

Although this study makes an important contribution concerning the relationship between an indirectly experienced traumatic event and the perception of benefit, an important issue should be considered regarding the generalizability of these findings. Our findings are referenced to an unprecedented event in U.S. history, and perhaps the world: the terrorist attacks of September 11, 2001. Examining documents of the culture gives evidence to the importance and the impact of the events of September 11 on U.S. citizens. Since this date, thousands of newspaper articles have been written about the events, and over 10,000 magazine articles have covered this topic. In comparison, roughly 160 newspaper articles and magazine reports discussed the bombing of the USS Cole, where 17 U.S. service members were killed and 40 were wounded. In addition, over 1,000 records exist on *PsycInfo* from a key word search of "September 11." Much of this work documents the broad effects of this traumatic event on people who both directly and indirectly experienced it (Galea & Resnick, 2005; Grieger, Waldrep, Lovasz,

& Ursano, 2005; Holmes, 2005). Because of the uniqueness of this event, we should proceed cautiously when generalizing these results. Our findings need to be replicated and extended by examining individuals' responses to other types of indirectly experienced traumatic events. McMillen and Fisher (1998) showed that different types of traumatic events are associated with different patterns of perceived benefits. For instance, experience of a natural disaster (e.g., tornado) may yield a different response than does experience of a technological disaster (e.g., plane crash; McMillen et al., 1997). However, McMillen's work is based on directly experienced traumatic events. Thus, future researchers should determine whether this pattern holds true for indirectly experienced traumatic events.

In summary, we found that individuals who have been indirectly traumatized can perceive benefits from the trauma, although this perception of benefit appears to decline over time. Level of trauma symptoms was positively associated with perceived benefits over time, even after we controlled for concurrent level of distress. People who reported experiencing previous trauma seem to be more likely to perceive benefits from September 11 than are people who indicated experiencing little to no previous trauma. Previously traumatized individuals reported greater trauma symptoms to the events of September 11, and level of trauma symptoms mediated the relationship between previous trauma and perception of benefits. These results are based on a sample of young adults, so the issues addressed in this study should be examined with other age groups as well. Nevertheless, our findings help elucidate the nature of the relationship between indirect trauma and perception of benefits.

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