

COMPARING THE REY-OSTERRIETH AND TAYLOR COMPLEX FIGURES: EMPIRICAL DATA AND META-ANALYSIS

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We investigated whether performance (copy, immediate, and 30-min delayed recall) on the Rey-Osterrieth Figure differed from the Taylor Figure performance in a sample of healthy adults ($N = 200$). The copy trials showed comparable scores. Immediate and delayed recall showed significantly higher scores for the Taylor Figure. A meta-analysis on studies comparing both figures is in agreement with these findings. Age significantly contributed to the estimation of Rey-Osterrieth and Taylor recall. Rey-Osterrieth recall was also influenced by education. Women outperformed men on the Taylor copy and men performed better than women on the Rey-Osterrieth delayed recall. We conclude that the memory trials of both figures are not of equivalent difficulty, with the Taylor Figure being more easily remembered. Performance on both figures is differentially influenced by demographic factors.

The Rey-Osterrieth Complex Figure was originally published by Rey (1941), subsequently normed by Osterrieth (1944), and is currently used to investigate perceptual organization and visual memory in brain-damaged adults (Corwin & Bylsma, 1993; Lezak, 1995). The Taylor Figure was created to serve as an alternative version of the Rey-Osterrieth Figure (Taylor, 1969). The assumption that the Rey-Osterrieth and Taylor Figures are of equivalent difficulty is based on the fact that each figure contains equal numbers of elements and that the elements in each figure are of equal complexity. Initial data showed similar test-retest memory scores (Lezak, 1983). In recent work the difference in recall performance between the figures is minimized (Lezak, 1995).

Other research suggested that the memory trials of the Rey-Osterrieth and Taylor Complex Figures are not of equivalent difficulty. Although the copy performance of the two figures showed a comparable performance in young healthy adults, the recall of the Rey-Osterrieth Figure appeared about 5 points harder than the recall of the Taylor Figure (Strauss & Spreen, 1990). In another study (Berry, Allen, & Schmitt, 1991) approximately half of 54 older adults received the Rey-Osterrieth Figure in the morning session, followed by the Taylor Figure in the afternoon session. The remaining subjects received the tests in the reverse order. The two forms resulted in generally comparable

scores. Statistical analysis revealed that only the immediate recall score was significantly higher for the Taylor Figure ($p < .05$). The authors concluded that both figures can be used as a matched form, although the moderate correlation between the alternate figures (copy: $r = .50$; immediate recall: $r = .76$; delayed recall: $r = .69$) suggests some caution.

Tombaugh and Hubley (1991) specifically addressed the comparability of the Rey-Osterrieth and Taylor Figures under various administration procedures in young healthy adults. Subjects received either the Rey-Osterrieth ($n = 33$) or the Taylor Figure ($n = 34$). Results showed significantly higher scores of about 5 points on immediate recall, after a 20-min delay, and after a 30-day delay for the Taylor Figure. The authors also found higher scores for the Taylor Figure in two types of learning paradigms (incidental and intentional). In each experiment the copy performance of both figures yielded equivalent scores. In a test-retest experiment with 63 adults similar findings were obtained regardless of the order in which the figures were presented (Tombaugh, Faulkner, & Hubley, 1992).

Delaney and colleagues (1992) investigated the comparability of both figures in 42 normal subjects in a test-(1 month)retest paradigm. The authors found comparable copy scores, but subjects performed significantly better on immediate and delayed recall of the Taylor Complex Figure. Similar results were obtained by Kuehn and Snow (1992) for the percent recall scores of 38 patients referred for neuropsychological assessment.

Developing explicit scoring criteria for the Rey-Osterrieth and Taylor Complex Figures, Duley and colleagues found the Taylor Figure to be more easily remembered than the Rey-Osterrieth Figure, calling their interchangeability into question (Duley, Wilkins, Hamby, Hopkins, Burwell, & Barry, 1993). A sample of HIV-infected individuals received either the Rey-Osterrieth Figure ($n = 59$) or the Taylor Figure ($n = 42$). Copy scores between the two forms were not significantly different, but 30-min recall scores were significantly higher for the Taylor Figure than those on the Rey-Osterrieth Figure ($p < .001$).

Finally, Peirson and Jansen (1997) randomly assigned 40 healthy volunteers to either the Rey-Osterrieth or Taylor condition. The results showed comparable copy scores, but significantly higher recall accuracy scores were produced by the subjects in the Taylor condition. The authors also found that the Taylor group differed significantly on copy organizational quality scores and required copy time. The Taylor Figure could be copied faster, yet higher organizational quality and recall accuracy scores were produced despite less time spent on organization and incidental learning, questioning the comparability of the two figures as tasks of visuoconstruction ability.

Research on the influence of demographic factors of the Rey-Osterrieth Figure performance in healthy individuals has shown that age has the most

robust influence on copy and delayed recall (Ardila & Rosselli, 1989; Bennett-Levy, 1984; Boone, Lesser, Hill-Gutierrez, Berman, & D'Elia, 1993; Chiulli, Haaland, LaRue, & Garry, 1995; Rosselli & Ardila, 1989; Tombaugh, Faulkner, & Hubley, 1992; Visser, 1985). The differences in Rey-Osterrieth performance across the sexes have generally been nonsignificant (Berry et al., 1991; Boone et al., 1993; Chiulli et al., 1995; Janowsky & Thomas-Trapp, 1993). Other investigators reported that men outperformed women on copy and recall trials of the Rey-Osterrieth Figure (Ardila & Rosselli, 1989; Ardila, Rosselli, & Rosas, 1989; Rosselli & Ardila, 1991). Still other research reported similar gender differences for the memory trials only (Bennet-Levy, 1984; Casey, Winner, Hurwitz, & DaSilva, 1991). Poorer Rey-Osterrieth performance for both copy and recall trials in subjects of lower educational level has also been reported (Ardila & Rosselli, 1989; Ardila et al., 1989). Other research found significant correlations between education and immediate and delayed memory trials only (Berry et al., 1991).

The literature provides ample information on the influence of demographic factors on the Taylor Complex Figure. Tombaugh, Schmidt, and Faulkner (1992), used a revised intentional learning paradigm and administered the Taylor Complex Figure in healthy volunteers ($N = 407$). Age significantly influenced the copy and memory performance of the subjects. Gender and education level did not influence the Taylor scores. In contrast with their findings for the Rey-Osterrieth Figure, Casey et al. (1991) found no significant effect of sex for the Taylor Complex Figure on the recall trials.

The purpose of the present study is to provide information regarding the comparability between the copy and memory performance of the Rey-Osterrieth and Taylor Complex Figures in healthy adults. Both new empirical data and a meta-analysis of the existing studies will be provided. In addition the (differential) influence and relative importance of demographic factors on test performance will be investigated.

Methods

Subjects

Two-hundred normal healthy subjects, aged 18 - 74 ($M = 42$, $SD = 15$), were recruited for voluntary participation in a Flemish normative study for neuropsychological tests. The subjects were required to be in good health, to have no history of cardiovascular, neurological, or psychiatric disease, and to be taking no psychoactive medication. They were screened for these requirements through a standardized interview at the start of the session.

Procedure

All participants were assessed individually by one of the authors or by students who were trained by the authors to administer these tests. The students recorded their test sessions on audiotapes that were later reviewed by one of the authors to ensure a correct assessment. Participants were shown either the Taylor Figure ($n = 64$) or the Rey-Osterrieth Figure ($n = 136$) and were asked to copy the figure on a white sheet of paper as best he or she could. After the subject indicated that the copy was complete, both the stimulus and the copy were removed and the subject was given a new sheet of paper. Without having been previously warned (incidental learning paradigm), the subject was asked to draw from memory the figure which he/she had just copied (immediate recall). The next 30 minutes were filled with other visual and verbal neuropsychological tests. Then the subjects were again asked to draw the complex figure from memory (delayed recall).

The complex figure protocols were rated according to the scoring procedures described in Spreen and Strauss (1991). All protocols were rated by the same author (EL).

Meta-analysis

A meta-analysis was performed to integrate and organize the results of studies reporting data about the comparability of the Rey and Taylor Complex Figure Tests. A meta-analysis is a statistical procedure that permits the researcher to combine and compare the results of independent studies so they may be more easily viewed and understood. Our goal was to provide answers to the following questions:

- Is copy accuracy for the Rey Figure significantly different from copy accuracy for the Taylor Figure?
- Is immediate recall for the Rey Figure significantly different from immediate recall for the Taylor Figure?
- Is delayed recall for the Rey Figure significantly different from delayed recall for the Taylor Figure?

Literature search. The first step of the meta-analysis involved a systematic search of the psychological and medical literature (Psychlit/Medline/Eric [database for computer literature search]) for the years 1990- 1998 in order to identify every (published or unpublished) article relating to the comparability of the Rey and Taylor Complex Figure tests. The following key words were used: Rey and Taylor, Complex Figure Test, Complex Figures. The bibliography of the articles identified in the search provided further sources of references.

In the case of the computerized literature searches, abstracts were printed for

each citation. The abstracts were inspected, and citations that did not promise to yield relevant data were excluded. All relevant articles were investigated. It is possible to obtain several independent effect sizes from a single article if, for example, data from several studies are reported. These studies can be regarded as separate samples. The result was 7 usable sources, yielding 4 independent effect sizes for the variable 'immediate recall accuracy', 8 independent effect sizes for the variable 'copy accuracy' and 9 independent effect sizes for the variable 'delayed recall'. This represents the testing of 415, 634 and 697 subjects, respectively.

Coding the studies. For each study, the following information was recorded:

- (a) all statistics on differences in performance measures on the Rey and Taylor Complex Figures Test, including means and standard deviations or *t*, *F* and *df*.
- (b) the number of subjects that were administered the Rey or Taylor Figure
- (c) the mean age(s) of the subjects
- (d) population sample
- (e) the paradigm used (incidental or intentional learning)

Statistical analysis. When means, standard deviations, and the number of subjects that were administered the Rey or Taylor Figure were reported, the weighted effect size *d* was obtained by dividing the difference between the mean scores for the Rey and Taylor Figure Test by the pooled within figure standard deviation (Hunter, Schmidt, Jackson, 1982). Otherwise, the effect size was derived from the results of significance tests (*t* or *F* ratios) by use of the conversion formulas provided by Rosenthal (1991). All effect sizes were computed by one researcher (MW).

Results

Empirical Data: Effect of Figure

We found no significant differences in gender distribution, age, and years of education between the subjects tested with the Rey-Osterrieth and subjects tested with the Taylor complex Figure (Table 1). Table 1 also lists the copy and recall scores. The results of the copy trial show comparable scores between the two figures. Both immediate and delayed recall show a significantly better performance (of about 2 points) for the Taylor figure.

Table 1. *Demographic Data and Average Scores of the Subjects Receiving the Rey-Osterrieth or Taylor Complex Figure Test: M(SD)*

	Rey-Osterrieth Figure	Taylor Figure	df	Significance
n	136	64		
Male/Female	76/60	30/34	1	1.42
Age	47.7 (15.4)	43.3 (15.1)	198	-.68
Education	13.1 (2.9)	12.8 (2.6)	198	.61
Copy	33.8 (3.2)	33.9 (1.9)	198	-.31
Immediate recall	24.8 (5.8)	26.9 (4.9)	198	-2.43 *
Delayed recall	24.2 (6.0)	26.3 (6.1)	198	-2.23 *

* $p < .05$ Table 2. *Meta-Analysis: Listing of All Studies With Effect Sizes*

Article	Subjects	Mean age	N Taylor	N Rey	Population	d-copy accuracy	d-immediate recall	d-delayed recall
Duley, Wilkins, Hamby, Burwell, & Barry, 1993	101	33.9	42	59	HIV+ ^a	-0.131	-	-0.774
Peirson & Jansen, 1997	40	20.9	20	20	N ^b	-0.398	-	-1.280
Tombaugh & Hubley, 1991	64	-	33	31	N/S ^c	0.110	-0.645	-0.597
Tombaugh & Hubley, 1991	67	-	34	33	N/S	-0.363	-0.775	-0.800
Kuehn & Snow, 1992	38	46.7	19	19	P ^d	0.156	-	-0.498
Strauss & Spreen, 1990	40	24.7	20	20	N	0.025	-0.715	-0.974
Delaney, Prevey, Cramer, & Mattson, 1992	84	45.8	42	42	N	0.093	-	-0.644
Hamby, Wilkins, & Barry, 1993	63	33.7	-	-	HIV+	-	-	-0.678
Vingerhoets, Lannoo, & Wolters, 1998	200	42.5	64	136	N	-0.035	-0.380	-0.348

^aHIV+ : HIV infected individuals, ^bN : normal individuals, ^cS : students, ^dP : patients referred for neuropsychological assessmentTable 3. *Stepwise Regression Results for Rey-Osterrieth and Taylor Complex Figure Scores*

Score	Variable(s)	Coefficient	St. Error Coeff.	Increase in R ²	Total R
<i>Rey-Osterrieth Figure</i>					
Copy	none				
Immediate recall	education	.941	.152	.226	
	age	-.109	.032	.063	.289
Delayed recall	education	1.071	.151	.273	
	age	-.099	.032	.049	
	gender	-1.847	.850	.023	.345
<i>Taylor Figure</i>					
Copy	gender	1.540	.441	.164	
	age	-.034	.014	.072	.236
Immediate recall	age	-.163	.036		.249
Delayed recall	age	-.201	.045		.245

Meta-analysis: Effect of Figure

The complete listing of all studies, with effect sizes, is provided in table 2. Negative effect size values indicate that scores on the Taylor Figure were higher than scores on the Rey Figure. Positive effect size values indicate that scores on the Rey Figure were higher than scores on the Taylor Figure. The effect sizes were cumulated and the variance was corrected for sampling error.

According to Cohen (1977), effect sizes of .20, .50 and .80 indicate small, medium, and large effects, respectively. These criteria were used to assess the magnitude of the differences between the scores on the different complex figures.

The magnitude of differences in copy accuracy scores for the RCF-TCF was averaged over 8 independent effect sizes. The mean effect size was -0.06, reflecting equivalent performance on the Taylor and Rey Complex Figure Test. There was no variation in the study population effect sizes.

Four observations were used to estimate the magnitude of differences in immediate recall scores for the RCF-TCF. The mean effect size was -0.56, reflecting superior performance on the Taylor Complex Figure Test. There was no variation in the study population effect sizes.

The magnitude of differences in delayed recall scores for the RCF-TCF was averaged over 9 effect sizes. The mean effect size was -0.58, reflecting superior performance on the Taylor Complex Figure Test. There was no variation in the study population effect sizes.

Empirical Data: Relationship to Age, Education, and Gender

The relative contributions of age, education, and gender on the copy and memory trials of the Rey-Osterrieth and Taylor Complex Figures were examined using a stepwise linear regression analysis (Table 3). We used a p-value of .05 or less as a criterion for inclusion in the regression model. Age accounted for a significant proportion of the variance of the memory trials of both figures. Increased age results in poorer complex figure performance. Education appeared a significant contributor to the performance on the Rey-Osterrieth Figure recall trials, but not for the Taylor Figure. A higher educational level results in higher Rey-Osterrieth recall. Finally, gender contributed significantly to the estimated proportion of variance of the Taylor copy trial and the Rey-Osterrieth delayed recall. Women perform significantly better than men on the Taylor Figure copy trial, $t(62)=-3.49$, $p=.001$. Men outperform women on the Rey-Osterrieth Figure delayed recall, $t(134)=2.20$, $p=.029$.

Discussion

The results of the empirical study indicate that healthy adults show a significantly better memory performance on the Taylor Figure than on the Rey-Osterrieth Figure. This is in agreement with a meta-analysis of studies comparing both figures that provided much support for the global conclusion that immediate and delayed recall performance on the Rey and Taylor CFT differs significantly, with generally higher scores for the Taylor Figure. Performance on the copy tasks is equivalent for both figures.

If both figures contain an equal number of elements of similar complexity, leading to very similar scoring methods of high interrater reliability (Berry et al., 1991; Duley, et al., 1993; Tombaugh, Faulkner, & Schmidt, 1992), why then is the Taylor Figure easier to remember?

An interesting hypothesis to explain the difference in recall difficulty between both figures refers to the degree in which the figures lend themselves to verbal and visual processing styles (Casey, Winner, Hurwitz, & DaSilva, 1991). It appears that individuals differ in terms of preference for a verbal strategy or a visual strategy for the processing of visuo-spatial information. Individuals preferring a verbal strategy encode visuo-spatial images part by part, using verbal descriptions to identify and to locate the different components of the figure. Individuals preferring a visual strategy construct a mental picture of the figure and use this visual image to recall the various components of the figure. Dividing college students according to the preferred processing style in verbalizers ($n = 219$), visualizers ($n = 171$), and partial visualizers ($n = 125$), Casey and colleagues (1991) found that visualizers performed significantly better than verbalizers on the memory trials of the Rey-Osterrieth Figure. No effect of processing style was obtained for the Taylor Figure. All visualizers and approximately 80% of the verbalizers used a visual strategy to encode the Rey-Osterrieth Figure. For the Taylor Figure 43% of the verbalizers used their preferred verbal strategy and 82% of the visualizers used a visual strategy. These findings suggest that (a) there is a differential relationship between processing style and memory performance for the two figures, and that (b) the figures are not identical in the way a specific (visual) processing style can be elicited since the Taylor Figure can be more easily verbalized than the Rey-Osterrieth Figure. Based on the qualitative differences between the figures, Casey and colleagues concluded that the Rey-Osterrieth and Taylor Figures cannot be used interchangeably because deficits to the visual imagery system may be more easily circumvented by using a verbal strategy in the Taylor Figure. This conclusion was, however, weakened by the fact that the authors found no quantitative difference in average total recall scores between the figures.

Evaluating a new scoring system for organizational quality on the Rey-

Osterrieth and Taylor Complex Figure Tests, Hamby, Wilkins, and Barry (1993) found that the Taylor Figure was easier to organize and recall than the Rey-Osterrieth Figure. The authors argued that the reason for this difference lies with the basic organization of the two figures. The simpler structure of the Taylor Figure leads to an easier quadrant-by-quadrant approach that is more difficult to apply in the Rey-Osterrieth Figure. Indeed, subjects subjectively perceive the Rey-Osterrieth Figure to be significantly more difficult than the Taylor Figure (Tombaugh, Faulkner, & Hubley, 1992). Peirson and Jansen (1997) found that the Taylor Figure could be copied faster yet showed higher organizational quality with less time spent on organization.

In view of the hypothesis that the Taylor Figure requires less organizational and visuoconstructive skills, and is therefore more amenable to verbal mediation, the influence of gender on the Taylor copy trial (women outperforming men) reported in this study is a noteworthy finding. In general there is a male advantage in spatial skills, and a female advantage in language skills (Kolb & Whishaw, 1985; Vingerhoets, Lannoo, & Bauwens, 1996). Although several studies reported that men outperformed women on the Rey-Osterrieth copy trials, the lower spatial demands of the Taylor Figure and the fact that the Taylor Figure can be more easily verbalized, may lead to a female advantage in the Taylor copy trial.

In agreement with most research on the influence of demographic factors, age significantly contributed to Rey-Osterrieth and Taylor Complex Figure recall. Education contributed to the estimation of Rey-Osterrieth recall scores only. The less clear-cut influence of gender on Rey-Osterrieth performance described in the literature (with men performing better than women) was reflected in our study by a small but significant effect in the expected direction on delayed recall only.

The greater ease of recall for the Taylor Figure has important research and clinical implications. In pre-post test research settings the order of administration should be randomized. For diagnostic purposes the memory performance on the Taylor Figure should be evaluated against normative data that are specific for this figure, and its memory scores should never be compared against normative data for the Rey-Osterrieth Figure. When both figures are used as alternative figures for the evaluation of therapeutic progress it should be kept in mind that the Rey-Osterrieth Figure is more sensitive to the presence of visual memory deficits because it is more difficult to recall.

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