

The Rey-Osterrieth Complex Figure

Background and description

The Rey-Osterrieth Complex Figure (ROCF) is one of the most widely used neuropsychological assessments, created by André Rey (Rey, 1941; cited in Strauss et al. 2006, p. 811) and later standardized by Osterrieth (Osterrieth, 1944; Strauss, Sherman & Spreen, 2006). It is a pen and paper task which measures a range of cognitive processes including: visual perceptual organization, non-verbal memory, planning, problem solving and motor function (Osterrieth, 1944) and is valid for use in individuals aged between six and 93 years old (Strauss, Sherman & Spreen, 2006).

Participants are required to copy a complex figure (see Figure 1). As the test was originally developed to assess both visual spatial coherence and visual memory in patients with brain lesions, the traditional task also involves asking participants to recall the figure without prior warning after a time interval, varying according to study design. When assessing central coherence abilities it is the copy aspect of the task which is of interest and it is this which our team focuses upon.

Materials

Two blank A4 sheets of paper, 10 coloured pencils, a video camera, a score sheet, and the stimulus card depicting the Rey Figure are required. The Rey figure (see figure 1) is reproduced so that the base rectangle, measuring 8 x 5.5 cm, is printed in black and presented on a white A4 card (21 x 29.7 cm) in landscape orientation.

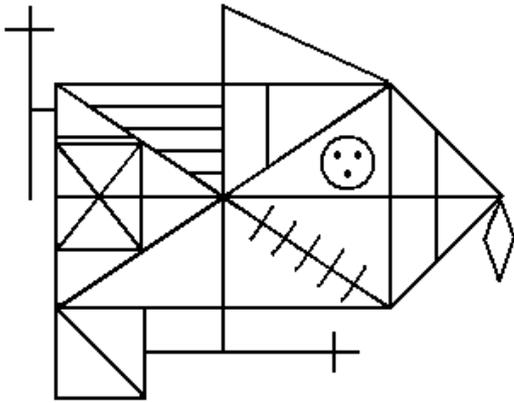


Figure 1. The Rey Complex Figure (Osterrieth, 1944).

Procedure

In the copy trial, participants are provided with a blank A4 sheet of paper, in the same orientation as the stimulus card, and coloured pencils. When the stimulus card depicting the figure is presented, they are asked to copy the figure as carefully as they can. They are also told that the experimenter will change the pencils as they are drawing and that the process will be video-taped.

The experimenter sequentially changes the coloured pencils each time one element of the figure is completed or when the participant moves on to draw another part of the figure. Colours are always given in the following order: black, green, purple, brown, blue, pink, light blue, red, yellow, orange. This method is one of the variants detailed by Lezak to record the procedure (Lezak, Howieson & Loring, 2004) and introduces only minimum disruption to the individual's process of drawing (Strauss, Sherman & Spreen, 2006).

The experimenter should instruct the participant to avoid rotating the stimulus card. If the participant says they have made an error in their drawing, the experimenter should encourage the participant to cross it out and then continue. The use of a ruler or an eraser is not permitted. Also, no time limit is imposed on the copy trial (Booth, 2006). The figure is available to the participant at all times during the task.

Scoring

There are a number of scoring systems developed to address different aspects of cognitive processing using the Rey Figure (Spreen & Strauss, 1998; Strauss, Sherman & Spreen, 2006). In terms of assessing central coherence, the primary interest is the *process* of drawing which may reveal non-verbal aspects of coherence through the drawing style utilised by the individual. This is assessed using *central coherence indices*.

Central coherence indices

Coherence of drawing style is measured using two independent indices following Booth's development of the task (2006): order of construction index (order in which the elements of the figure are drawn) and style index (continuity of drawing). A central coherence index is also derived and consists of a composite score of these two indices, ranging from 0 (most detailed approach) to 2 (most coherent approach), where higher scores mean a more coherent drawing style (Booth, 2006; Lopez et al, 2008a). The figure is divided into 18 separate numbered units which correspond with specific details of the figure, based upon the standard scoring system adapted by Taylor Spreen & Strauss, 1998; Strauss, Sherman & Spreen, 2006).

a) Order of Construction Index

The order of the elements drawn is taken from the colour coding recorded by the experimenter and the video recording. The outcome of interest is the relative number of global elements as opposed to local elements drawn in the initial stage of construction. This is determined by the **first six elements completely drawn**. Each of the 18 elements are categorised as either global external elements (score = 4), global internal elements (score = 3), local perimeter elements (score = 1) or local internal elements (score = 0).

It is important to note that no score is given to partially drawn elements and that once an element is completed a score is given even if the element was constructed with a fragmented style. Details of these four hierarchical categories are described in Appendix 2.

The mean score across these six elements is calculated, giving a score between 0 and 3.2. This score is then divided by 3.2 to give a weighted order index which ranges from 0 to 1. A higher score is indicative of the first stage of the drawing involving global features rather than detail.

b) Style Index

This assesses whether six key global elements of the figure are drawn in a continuous or fragmented way (see Appendix 3). These components are shown in Figure 3 and consist of the large rectangle (element 2), the diagonal cross (element 3), the extended horizontal line (elements 4 and 16), the extended vertical midline (element 5 plus one segment above or below the rectangle), the sides of the large triangle (element 13), and the small rectangle (element 6).

Each of these components are rated on a three-point (0, 1, 2) scale based on the lines of the component present. A score of zero indicates a highly fragmented element with two or more interruptions in its completion. A score of 1 indicates a partially fragmented element (i.e. drawn with one interruption). A score of two indicates a coherent, continuously drawn element. If a participant omits an element, this element is not scored. The mean of these six ratings yields a score between 0 and 2 which is then divided by 2 to create a weighted score. This is added to the weighted order index to give the central coherence index.

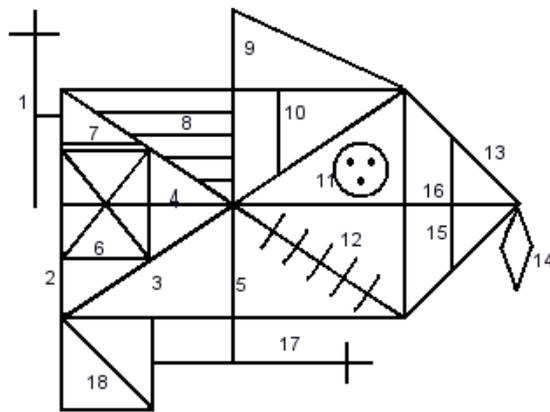


Figure 2. Elements of the Rey Figure (Strauss, Sherman & Spreen, 2006)

Other outcomes of interest

Although these are the outcome measures which our team focuses upon in assessing central coherence using the Rey, other outcomes of interest may include *accuracy* and *organisational strategy*.

Accuracy

A standard and valid method to score *accuracy* was developed by Osterrieth (Osterrieth, 1944) and modified later by Taylor into its current form (Spreeen & Strauss, 1998; Strauss, Sherman & Spreeen, 2006). Accuracy of the drawing is scored following Taylor's scoring procedure based on the drawing of 18 elements of the figure, which are awarded a 0 to 2 quality score (Spreeen & Strauss, 1998). Two points are given if the unit is correctly placed and accurately drawn. One point is given if the element was drawn incorrectly but placed correctly; or was accurately drawn but placed incorrectly. Finally, if the element is recognisable, but not drawn or placed correctly, a score of 0.5 is assigned. If the element is omitted no points are awarded. Higher scores indicate better accuracy (range 0-36).

Organisational Strategy

Thought to be related to executive functioning, a scoring system was developed by Savage and collaborators (Savage *et al*, 1999). Although not directly relevant for the central coherence hypothesis, it may be considered interesting due to the hypothesised relationship between central coherence account and executive functions. This scoring procedure examines organisational strategies used in the five main components of the figure (elements 2, 3, 4, 5 & 13). In this method, the elements are awarded with 1 point if they are drawn as an unfragmented unit with the exception of element 2 (large rectangle) which, due to its relevance to the fundamental organisation of the figure, is awarded 2 points if unfragmented. Fragmented elements receive 0 points. In case of fragmented units no score is given. The total organisational strategy score therefore ranges from 0 to 6. Higher scores indicate better organisational strategies.

Appendix 1. Accuracy criteria

	Element	Description
1	Vertical Cross	The cross must come down to horizontal midline, and extend above the large rectangle; the line that joins cross to rectangle must be approximately in the middle of the cross, and must come between detail 7 and the top of the large rectangle
2	Large Rectangle	The horizontal dimensions must not be greater than twice the vertical dimensions of the rectangle; score 1 if rectangle is not complete in any way (or is a definite square shape)
3	Diagonal Cross	The diagonal cross must touch each of the four corners of the rectangle and intersect in the middle of the large rectangle
4	Horizontal Midline of Large Rectangle	The line must clearly go from midpoint of the left side of the large rectangle to the midpoint of the right side of the large rectangle in one straight line
5	Vertical Midline of Large Rectangle	The line must start at the midpoint of the bottom of the rectangle and go through in one straight line to the midpoint at the top of the rectangle
6	Small Rectangle	The top of the small rectangle must come between lines 2 and 3 of detail 8; the width should be approximately a quarter of the width of the large rectangle; the inside cross must come from the four corners of the rectangle, and intersect at the midpoint of the rectangle (on detail 4)
7	Small Horizontal Line above Small Rectangle	The line must be shorter than the horizontal aspect of detail 6, and should fall between the top of detail 6 and the 2nd line of detail 8
8	Four Parallel Lines	Each line should be parallel with the spaces between them approximately equal
9	Small Triangle above Large Rectangle	The slope of the triangle should not be the same as the slope of triangle 13; the height of the triangle should not be greater than its base.
10	Small Vertical Line within Large Rectangle	The line should be clearly shifted to the left
11	Circle with Three Dots	The circle must not touch any of the sides; two dots above and one dot below.
12	Five Parallel Lines	The lines must not touch any sides and should be in approximately equal distance from each other
13	Sides of Large	The height of the triangle must not be greater than half of the

	Triangle attached to Large Rectangle	horizontal midline of the rectangle
14	Diamond	The element should be diamond in shape; attached to the end of 13 and not extend below the bottom of the large rectangle
15	Vertical Line within Sides of Large Triangle	The line must be parallel to side of large rectangle; must be shifted to the left within detail 13; must be in one line
16	Horizontal Line within Sides of Large Triangle	must come from the midpoint of the right side of the large triangle and extend to the top of triangle 13
17	Horizontal Cross	the right side of the cross must be clearly longer than the left side of the cross, but not extend beyond the large rectangle; should start at the midpoint of the right side of the square (18)
18	Square attached to Large Rectangle	Must clearly be a square; sides should be the same width as detail 6; therefore a quarter of main rectangle

Appendix 2. Order

Only the FIRST SIX elements of the figure that have been drawn by the participant (once they have been completed) are scored according the following 4 hierarchical categories.

Category	Element	Description
Global external element	2	Large Rectangle
(score = 4)	13	Sides of Large Triangle attached to Large Rectangle
Global internal element	3	Diagonal Cross
(score = 3)	4	Horizontal Midline of Large Rectangle
	5	Vertical Midline of Large Rectangle
	16	Horizontal Line within Sides of Large Triangle

Local perimeter

element	1	Vertical Cross
(score = 1)	9	Small Triangle above Large Rectangle
	14	Diamond
	17	Horizontal Cross
	18	Square attached to Large Rectangle

Local internal

element	6	Small Rectangle
(score = 0)	7	Small Horizontal Line above Small Rectangle
	15	Vertical Line within Sides of Large Triangle
	8	Four Parallel Lines
	10	Small Vertical Line within Large Rectangle
	11	Circle with Three Dots
	12	Five Parallel Lines

Appendix 3. Style

Score	"Goodness" of procedure
2	Continuous, or mostly continuous (drawn consecutively)
1	Partially fragmented (e.g., in two pieces, drawn separately)
0	Fragmented (e.g., in three separate pieces)
ND	Not drawn or recognisable

Useful References from our group using this scoring system:

Harrison, A., Tchanturia, K., & Treasure, J. (2011). Measuring state trait properties of detail processing and global integration ability in eating disorders. *World Journal of Biological Psychiatry*, 12(6), 462-472.

Lopez, C., Tchanturia, K., Stahl, D., Treasure, J. (2008) Central coherence in eating disorders: a systematic review. *Psychological Medicine*, 38(10):1393-404

Lopez, C., Tchanturia, K., Stahl, D., Happe, F., Booth, R., Holliday, J., Treasure, J. (2008). An Examination of Central Coherence in Women with Anorexia Nervosa *International Journal of Eating Disorders*, 41(2):143-52

Lopez, C., Stahl, D., & Tchanturia, K. (2010). Estimated IQ in anorexia: A systematic review of the literature. *Annals of General Psychiatry*, 23; 9 (1):40

Roberts, M., Tchanturia, K., & Treasure, J. (2013). Is attention to detail a similarly strong candidate endophenotype for anorexia and bulimia nervosa? *World Journal of Biological Psychiatry*, 14 (6) 452-463; doi:10.3109/15622975.2011.639804

Tchanturia, K., Davies, H., Lopez, C., Schmidt, U., Treasure, J., & Wykes, T. (2008). Neuropsychological task performance before and after cognitive remediation in anorexia nervosa: A pilot case series. *Psychological Medicine*, 38(9):1371-3