Left handed simple, recognition and choice reaction times.

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الخلاصة

في هذة الدراسة 27 متبرع من مستخدمي اليد اليسرى (12 ذكر و 15 أنثى) تتراوح أعمارهم بين 18 و 23 سنة تم شملهم باختبار زمن الاستجابة (RT). والذي يتضمن زمن الاستجابة البسيط (SRT) وزمن الاستجابة التمييزي (RRT) وزمن الاستجابة الاختياري (CRT).

ظهر من خلال النتائج، SRT للألوان التي تظهر في المركز أقل من الرؤية الجانبية على خلفية بيضاء أو سوداء. قابلية الشخص في تمييز الألوان تعتمد على تمايز هذه الألوان مع لون الخلفية، وكلما يزداد التمايز تزداد قابلية الشخص في الاستجابة. التكرار غير المباشر (Two-back) للأهداف في RRT يحتاج زمن أكثر مقارنة بحالة التكرار لمرة واحدة (One-back) لهذه الأهداف. استخدام اليدين سوية في CRT ينتج عنة زمن استجابة أسرع مقارنة باستخدام يد واحده.

Abstract

In this study, 27 left handed healthy volunteers (12 male and 15 female) aged between 18 and 23 yrs were included in reaction time (RT) test that include simple reaction time (SRT), Recognition reaction time (RRT) and Choice reaction time (CRT).

It's appeared from the results that, SRT for the central target colors was less than for the peripheral on white and black background. The individual ability in recognizing the colored targets depends on the contrast of these colors with the background, when the contrast increased the individual ability to response increase. Two back targets RRT for individuals were longer than one back targets. Using the two hands together for individuals produces a faster CRT than using one hand only.

Introduction

The main types of reaction times were Simple reaction time (SRT), Recognition reaction time (RRT), and Choice reaction time (CRT) (1). Each type can be affected by many factors (2,3).

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The individuals reacted quicker to light straight in front of them (nearly 100 msec faster) compared to light in their peripheral vision. The researcher gave several reasons for this; one of them is the anatomy of the eye itself. In addition, the possibility that cones in the retina (central vision) may react quicker than rods (peripheral vision) can not excluded (4).

The background color affects the discriminability and appearance of color stimuli. The mean response times tended to decrease as the target and distracter chromaticities were moved away from the chromaticity of the background. When contrast effects occur, the color appearance of the stimulus is shifted away from the background color (5).
Variation in reaction time between four peripheral colors (red, blue, green, and yellow) was small. This is because the individual is reacting to the light than to the color itself (6).

Color is extremely subjective and objective. To deduce the color objectively we can use the following formula that used to calculate the contrast of the color with the background (7):

Contrast (Ct) = $\dfrac{Max.L - Min.L}{Max.L + Min.L}$

Where: Max. L: Maximum luminance, Min. L: Minimum luminance.
For obtaining the luminance for each color, The following formula was used (8):
$L = 0.299R + 0.587G + 0.114B$
Where: R, G, B represents the basic colors.
Also the range between the color and the background can be measured with the following formula (7):
Range (R) = Max. L – Min. L

Materials and Methods
Twenty seven left handed healthy individuals were involved in this study, most of the participants were students in the college of medicine, University of Al-Qadisiya in Al- Diwaniya city, Iraq (The place of the study), and the others are from other colleges.

Personal Computer was with XP Windows's operating system software. Reaction time was measured by using "DirectRT v2004" software after modification was done for suit each task of the study by using Excel software.

Colors Chart software was used to aid in deducing the colors contrast and range objectively. Paint Software was used for preparing the targets to the Direct RT. Also, stand with a chin base for head fixation are used to perform the study.

The following process was adopted:

1. Simple reaction time (SRT):

Before the test was carried out, The volunteer was sit down on a chair in front of the computer monitor with a comfortable distance and each volunteer was trained on one demo trial.

In central SRT, the volunteer was press a space bare when he see one of the colors (red, yellow, and green) on black background at the center of the screen. After each press, RT was automatically calculated in msec. RT for each color was repeated six times and the mean was measured for each color.

Td was changed during the test. (Td: is the time between vanish of the target and the appearance of the next one). While Δt (the time of the remaining of the target visual to the individual) was selected 500 msec. It was selected experimentally because its give enough time to the individual to response. Td and Δt can be changed by using the options of the software itself. The same above procedure was repeated on white background.

In peripheral SRT, the volunteer was put his head on chin base for head fixation and asked to close the left eye at a distance from the center of the monitor screen. The volunteer was press the "Enter" key when he see one of the color (red, yellow, and green) on the right margins view of the black screen while the volunteer was centering his vision on a white central square. Immediately after the individual press Enter key, the target and the white square will disappear.

The mean RT was computed for each color. The same mentioned procedure was repeated on white background, but the central square was black.

The color and the range between the color and the background was computed objectively by using the equations mentioned in the introduction. In addition to that, Colors Chart software was used for the measurement of the color luminance.

2. Recognition reaction time (RRT):

In One-back target test, there was only one target appears in the center of the screen in each time and the volunteer was press the space bare when he see the target repeated itself directly. There was three targets will be repeated in each run, so there were three responses. Td was constant and Δt used as in the above test. The mean RT was computed for three RT result in this test.

In the two-back target test, this was done as mentioned in one-back target test, but the volunteer here was press the space bare when he see the target repeated itself while a different target appear between them.

3. Choice reaction time (CRT)

When using the right hand only, the volunteer was use two adjacent fingers of his right hand to press on two adjacent keys in the key board. The middle finger was chosen when he see the red circle while the index finger was chosen when he see the green rectangle. There was one target appears in the center of the screen each time. This test was repeated three times. There were three mean values that were considered in the results. The average of these mean values was computed. Td was constant and Δt used as in the above test.

When use the left hand only, the test was carried out as in choice reaction time for the right hand except that the volunteer was use his left hand and the middle finger was used when he see the red rectangle while the index finger was used when he see the green circle.

While when use two hands together, this test was the same as followed in the choice RT using the right hand except that the volunteer was use the index fingers of the right and left hands when he see the green circle and the red rectangle respectively.

Results

1. **Simple reaction time (SRT):**

When the background was black, SRT for central red target was more than for yellow and green colors (Fig.1). Also, there was a significant difference between red and yellow targets (0.002) and high significant difference between red and green target (0.000). There was no significant difference between yellow and green target.

While when the background was white, the SRT for central red target was less than for yellow and green colors (Fig. 2). Also, there was a significant difference between red and yellow targets (0.008) and high significant difference between yellow and green target (0.000). There was no significant difference between red and green target.

SRT for peripheral red target on BBG (Fig. 3) was more than for yellow and green colors .Also, there was a significant difference between red and green targets (0.001), and there was a significant difference between red and yellow target. But there was no significant difference between yellow and green target.

While when use WBG for peripheral view (Fig. 4), the SRT for red target was less than for yellow and green colors. Also, there was a highly significant difference between red and yellow targets (0.000), and a significant difference between yellow and green target (0.001). There was no significant difference between red and green target.

2. **Recognition reaction time (RRT)**

Figure (5) shows that RRT for One-back target was significantly less than Two-back targets, there was highly significant difference between them (0.000).

3. **Choice reaction time (CRT)**

Figure (6) shows that CRT for two hands was significantly less than SRT for right or left hand (when using it separately) , and the significant difference between them equal to (0.006). There was no significant difference between right hand and left hand when test it separately.
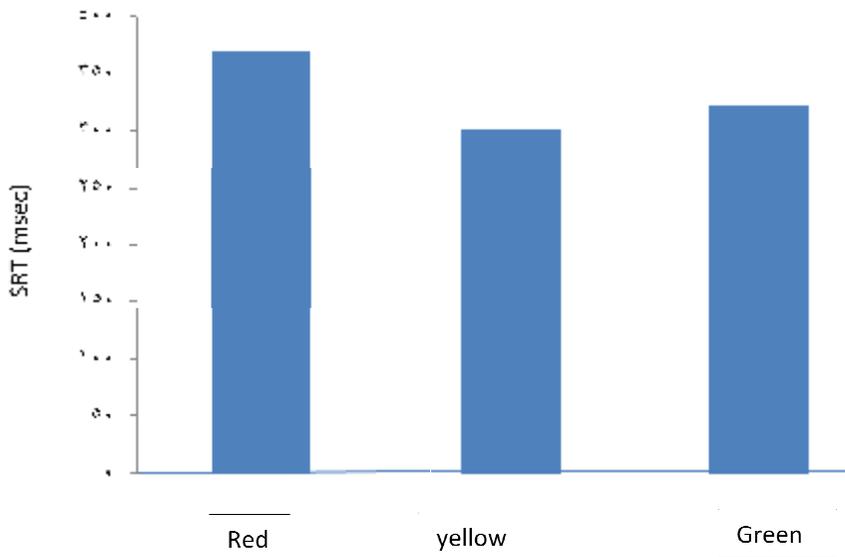
Fig.1: SRT for central targets (the three colors) on BBG for left handed individuals.
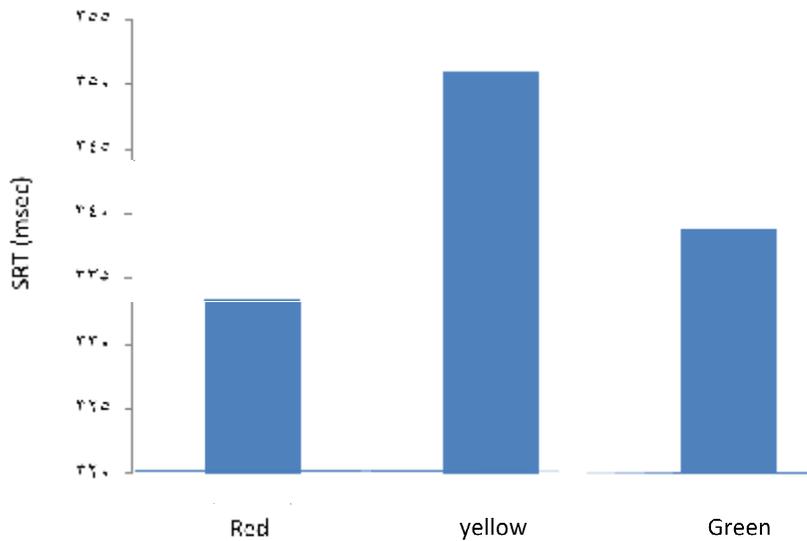

Fig.2: SRT for central targets (the three colors) on WBG for left handed individuals.
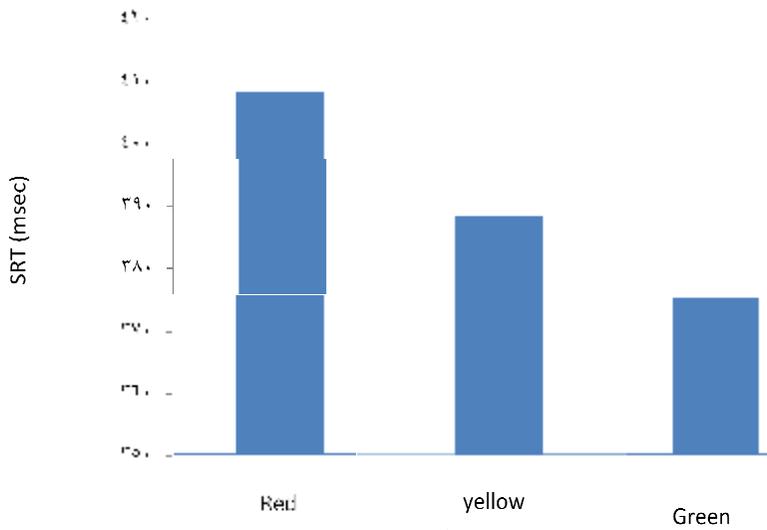
Fig.3: SRT for peripheral targets (the three colors) on BBG for left handed individuals.
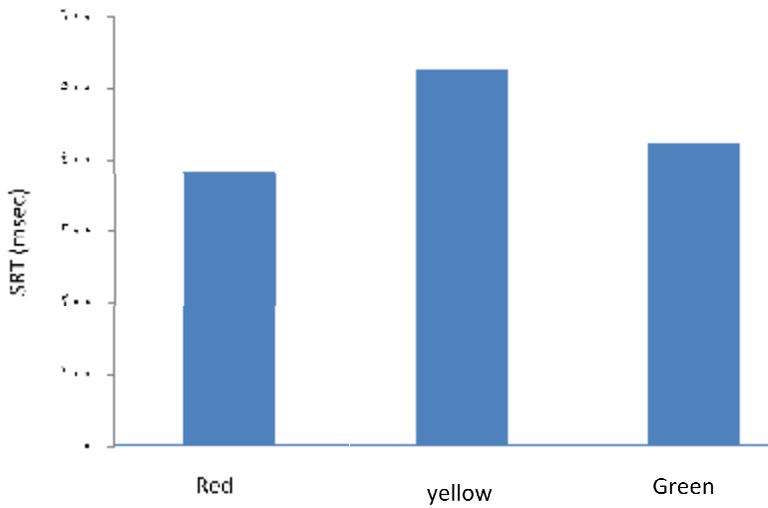

Fig.4: SRT for peripheral targets (the three colors) on WBG for left handed individuals.
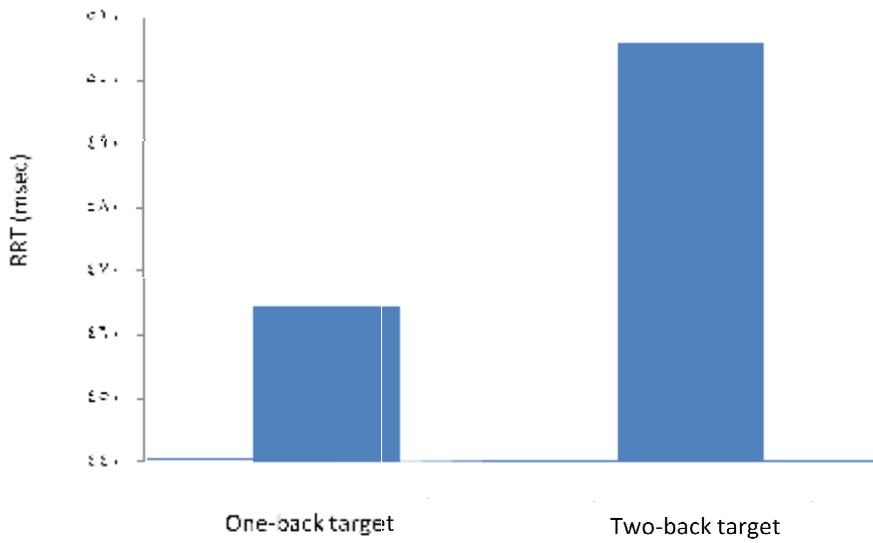
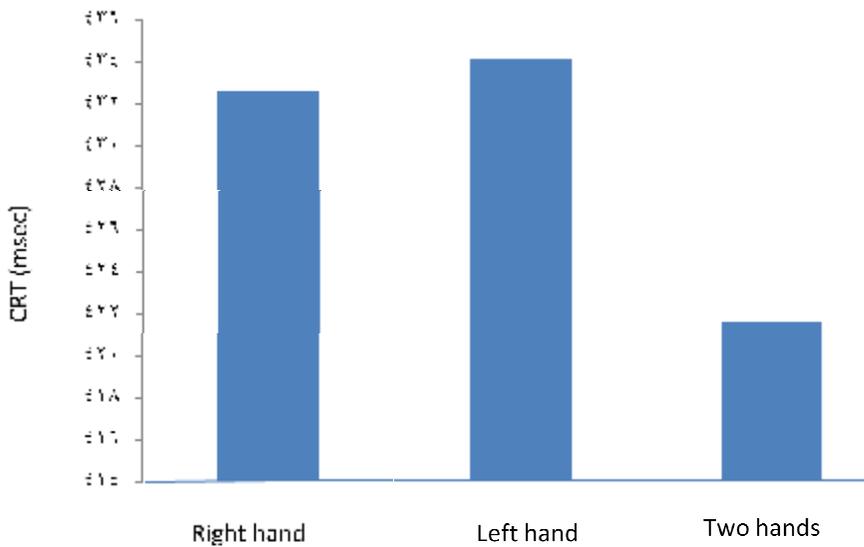**Fig.5: One- back and two- back targets RRT for left handed individuals.**

Fig.6: CRT for the right, left and two hands for left handed individuals.

Discussion and Conclusions:
1. Simple reaction time (SRT)
    The back ground and the color of the target will play an important roll in effecting the contrast and so effect RT. In this study, the SRT for the yellow central target (that has high contrast on BBG) became shorter and approached the SRT for the green color on BBG (Fig. 1).

    While the red central target (that has a low contrast) on the same background has a longer RT as compared with yellow and green targets. That was agree with the objective measurement that done by using Color Chart software and three equations in the introduction that give proportional increasing of the range with contrast.

    In figure (2), SRT for yellow central target will be longer than red and green color targets on WBG with high significant difference and with no significant difference between the two later targets. This is because the low contrast of the yellow target with WBG. That has acceptance with the relation between the contrast and range that computed objectively.

    The site of the view will alter the SRT in black or white background. SRT for red peripheral target was long than yellow and green peripheral targets on BBG (Fig.3). When comparing peripheral view with central view for same color targets (Fig.1), we can find that the peripheral targets need more time to react than central targets.

        The yellow peripheral target has a long SRT than red and green peripheral targets on WBG (Fig.4) due to the low contrast of this color with the background. That show the same dependence that shown for central targets on the same background (Fig.2), but the peripheral targets has along time for reaction than central targets. This finding agrees with what reported in (3) revealed that if the stimulus is picked by rods (peripheral vision) the reaction is slower (in term of increasing the RT).

        In addition, Hundreds of the rods which are responsible for the peripheral vision have to send their information to the same nerve fiber. This means that the ability to resolve two close sources

of light in peripheral vision is poor and consequently lower stimulus intensity (9). This possibly may give another explanation of a longer SRT for the peripheral target over that of SRT for the central target.

In surprising finding, changing the background did not affect the central and peripheral SRT for the green color. We suppose this related to the nature of this color that has contrast between the red and yellow colors that found in the objective calculations.

2. Recognition Reaction Time (RRT)

Increasing the number of the items in the memory set, leading to increasing the volunteer's RRT and that can be seen in the figure (5) where the two back targets for left handed healthy volunteers need more time than one back target. This has acceptance with (3) who reported that as the number of items in the memory set increase, the reaction time rises proportionately.

3. Choice Reaction Time (CRT)

Using the two hands together need less time to react than using the right or the left hand only. The significant difference between the two hands and the right hand from a side and the significant difference between the two hand and the left hand from the another side consist on this fact.

In surprising finding, there was no significant difference between the left and right hand for the left handed volunteers. This disagree with (10) revealed that using a computer mouse, the right handed people were faster with their right hand, and he suggest that the preferred hand was generally faster.

It was appeared in this study for left handed healthy volunteers that the mean value of SRT was less than mean value of RRT and the mean value of CRT will be between them. This has acceptance with (3).

A demo trial was made for each part of RT test, to reduce the error in measuring RT caused by the volunteers. This opinion was in accordance with (3).

The results obtained from this study, show similar dependence in RT with results obtained from previous study done for healthy right handed people (11).

From this study, it can be conclude that, the individual response was effected widely by the color, site of the view of the target and the color of the background (the contrast). The individuals training causes increasing in the individual response, so the RT enhancement.

Recommendations

Build healthy and unhealthy individuals RT data in order to see the effect of disease like myopathy or neuropathy in RT and that may give a map for the effect of such disease in individuals response and so on used in driving test.

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