EMDA: Treatment procedure for lateral Eye Movement Desensitization

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Summary

To investigate the (putative) affect-reducing effect of the clinical method lateral eye movement (EMDR) an experimental treatment was performed by means of EMDA. Assuming that arousal reduction and mood elevation compared to other types of distractions are significant, an emotionally colored arousal was generated, followed by lateral eye movement and two variants of distraction. Results from EMDA *treatment* suggest an effect in arousal reduction compared to *distraction* conditions.

Statement of need

The method of *Eye Movement Desensitization and Reprocessing* (EMDR) was developed by Francine Shapiro in 1989 to treat Post-Traumatic Stress Disorder (PTSD), see GDP & APA (2019) or Merians et al. (2023). According to DSM (APA, 2013) PTSD is defined by (a) constant reliving of a traumatic experience, (b) avoidance of thoughts about that situation and (c) an associated *increased level of arousal*.

Shapiro (1989) describes the process of treating PTSD with EMDR as follows: At the beginning, the client should visualize the traumatic event as vividly and in as much detail as possible. Then the therapist moves his finger rhythmically from right to left at a distance of $d = 30$ cm from the client's head and with a deflection of again $d = 30$ cm, with a pendulum movement per second. During the imagining of the traumatic event, the patient generally follows the therapist's finger with his eyes until the imaginings become *bearable*. The length of such a set is given as $n = 15$ to $n = 25$ lateral eye movements. A stable effect was reported in a follow-up after three months.

As possible neurophysiological explanation, Shapiro refers to the fact that experiencing a traumatic event disturbs the balance between excitation and inhibition in the brain (Pavlov, 1927), lateral eye movements should be able to *restore this balance*. However, a full explanation of the underlying physiological mechanisms is yet to come, for further approaches see e.g. Stickgold (2002), Söndergaard & Elofsson (2008), Pierce & Black (2021) or Fernandez & Solomon (2023).

The advantage of the method is clearly due to the fact that treatments are rather short and so clients are not exposed to intense fear for a longer period of time (Shapiro, 1996). Vaughan et al. (1994) first examined the effect of EMDR on the major symptom groups of PTSD and found that all three categories of PTSD as well as depression were significantly improved.

Meanwhile, the value of Shapiro's method has received broad confirmation and acceptance. In a meta-analysis (Yunitri et al., 2023), EMDR proved itself to be most effective in the treatment of PTSD compared to several other forms of therapy, see e.g. Shapiro & Maxfield (2002), Greenwald & Shapiro (2010), Oren & Solomon (2012), Brown et al. (2016) or Laliotis & Shapiro (2022). For an overview and outlook regarding the method, see Luber & Shapiro (2009) or Valiente-Gómez et al. (2017).

The aim of the research by means of EMDA procedure (Schrausser, 2023a) was to *produce* an emotionally colored arousal to *treat* it with EMDR. Arousal was accomplished by placing subjects in a situation that elicited evaluation anxiety, as the latter was found to be significantly positively correlated with arousal levels, e.g. Guerin (1983). It was investigated whether lateral eye movement induced by EMDA rendering reduces this *kind of arousal* more than (a) fixing an inert target or (b) a different kind of distraction, see Schrausser et al. (2022).

EMDA Treatment

A horizontal *moving* bar was rendered on a monitor to generate eye movements imperceptible to the subjects (figure 1). Additionally a tripod-mounted video camera was placed to the left of the subjects to *maintain* an anxiety-provoking situation.

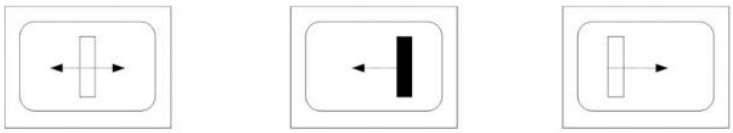

Figure 1: EMDA Treatment 1, lateral eye movement.

The moving bar changed color from green to blue with a probability of $p_1 = 0.125$ per pass. Each blue bar was to be reported as *blue*. One run from left to right and back lasted for $t_1 = 3$ seconds each of $n_1 = 60$ runs, resulting in a $t_1 = 3$ minute treatment duration and $n = 60 \times 0.125 = 7.5$ expected events e_1.

Calculation of the pseudo random variable *g* for the color representation of the bar:

```
FOR s% = 1 TO dur
  aa = 1: bb = 640: fa1 = 10: x1 = 0: x2 = 30: st = 1
  RANDOMIZE zf
  zfa = RND(2)
  IF s% > 1 AND zfa >= .87 THEN g = -1 ELSE g = 0
  GOSUB emd
NEXT
```

Main loop for treatment 1 rendering. *STEP* implies velocity of moving bar depending on the the hardware:

```
emd:
  FOR r% = 1 TO 2
    FOR i% = aa TO bb STEP 7 * st
      LINE (i% - x1, 150)-(i% + x2, 40), fa1 - g, BF
      LINE (i% - x2, 150)-(i% + x1, 40), 0, BF
    NEXT
    SWAP aa, bb: SWAP x1, x2: st = -1
  NEXT
RETURN
```

In order to fix the central object, four *non-moving* rectangles were rendered on the screen (figure 2). These rectangles appeared either blue or green every $t_2 = 3$ seconds ($p = 0.5$). Once all four rectangles displayed the same color ($p_2 = 2 \times 0.5^4 = 0.125$), subjects had to react (*blue* or *green*). Duration of the procedure again was $t_2 = 3$ minutes with $n = 7.5$ expected events e_2.

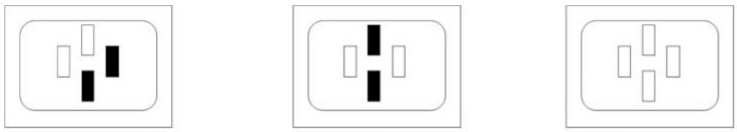

Figure 2: EMDA Treatment 2, fix target.

Function to calculate pseudo-random variable *g* to display rectangles:

```
RESTORE
 FOR i = 1 TO 4
    RANDOMIZE zf
    zfa = RND(2)
    IF zfa < .5 THEN g = 1 ELSE g = 0
    GOSUB abla
 NEXT
```

Main function via efficient *DATA READ* definition of coordinate points for treatment 2 rendering:

```
abla:
    READ x, y, x1, y1
    DATA 0,-45,0,-40,0,40,0,45,-80,0,-80,0,80,0,80,0
    LINE (300 + x, 120 + y)-(340 + x1, 80 + y1), 10 - g, BF
RETURN
```

Software

EMDA is implemented in QBasic for Microsoft DOS 6.0 to perform treatment procedures and timing. Further programs EMDapk (Schrausser, 2023b) for handheld Android operation systems versions 4.0 or later and EMDscr (Schrausser, 2023c) as screensaver or executable for Windows platforms are created. Both applications performing treatment part 1 described above, that is the moving bar to induce the EMDR, this with selectabe speed usable in the field. For related works see e.g. Alulema Flores et al. (2014), Goga et al. (2020) or Shakeel et al. (2022). Early commercial approaches give e.g. SAVYN TECH (2019).

Conclusion

Considering the proven and broadly confirmed positive effects of EMDR, EMDA represents a useful basis for further development and adaptation, both in the experimental field and in the area of application. This applies for the latter in particular to the extractions EMDapk and EMDscr, which are not only useful for a quick and comfortable treatment or therapeutic application but may be even more appropriate for further development and integration of the source-code. The simple structure of the syntax as well as the generally easy to understand programming language should be of not inconsiderable advantage for uncomplicated and broad elaboration.

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