

Emotra EDOR®

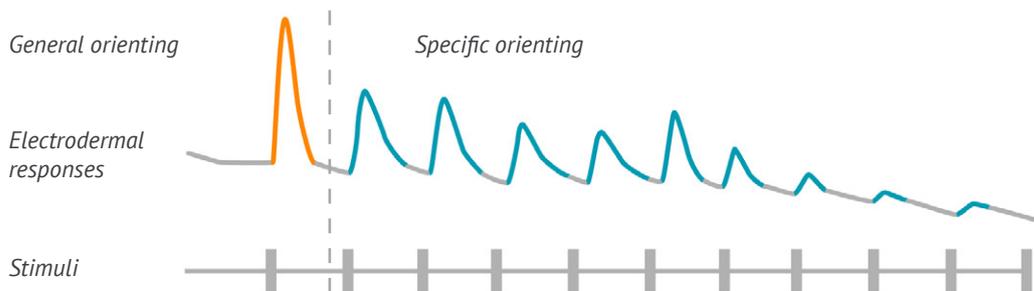
**Orienting responses, habituation
and what the EDOR Test tells us**



ORIENTING RESPONSES AND THEIR HABITUATION

Unexpected events evoke orienting responses. This was first described by Ivan Pavlov¹ who named them “What is it? reflexes” and called the psychological process behind it as curiosity. This reaction alerts the brain for orienting towards the unexpected event, sharpened sensory signal intake, information processing, and decision for proper action. It was named a general orienting response by Sokolov². The general orienting response has an obvious immediate survival value and is necessary from an evolutionary perspective, securing that individuals react quickly and preparing it for correct decisions and immediate actions^{1,2}.

When an unexpected neutral event occurs again and again, another type of orienting response is evoked called the specific orienting response by Sokolov³. The Russian scientist Evgeny Sokolov and his group, including professor Olga Vinogradova, studied these responses from the 1950s and onwards. When an event is repeated, a memory model of the event begins to be developed and it will be more and more complete every time the event occurs again³. This learning process can be followed since the specific orienting responses are expressed as electrodermal responses until the model conforms to the real event. When the model is complete, there is no more need to react and the organism has habituated.



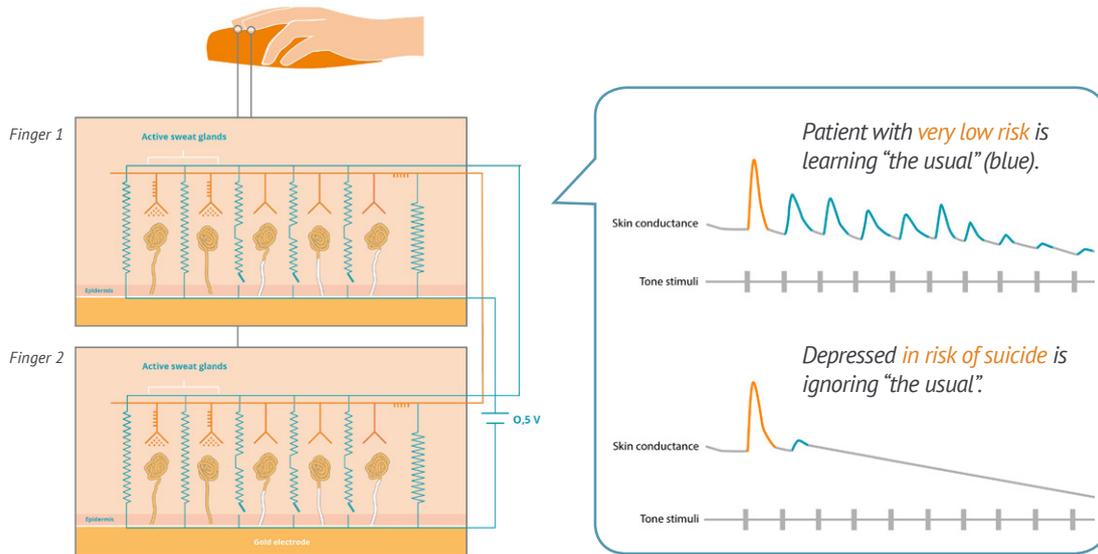
Habituation is a necessary mechanism filtering sensory information, freeing up resources for the brain. The specific orienting responses have a strong survival value. When the neural model of the event finally is complete, the sharper, the better, and the easier the neutral stimulus will be ignored when other things are important and request attention. This process is fundamental, and most often an unconscious process. Examples from everyday life of habituation are to become accustomed to odours, or that one stops hearing repeated neutral sounds after some time.

HABITUATION AND HYPOREACTIVITY

The term hyporeactive or hyporeactivity in biology or medicine means having or showing abnormally low sensitivity or reactions to stimuli. The EDOR[®] Test is designed to analyse patterns of specific orienting responses in the sudomotor system, i.e. sweating, system. In the EDOR Test, the stimuli form a series of neutral sound signals and the responses are recorded as skin conductance (electrodermal) and heart rate (pulse) responses⁵.

One of the specific properties of the EDOR Test⁶ is that it is designed to increase the resolution of the habituation score to identify fast habituators. It is also constructed to increase the resolution of the scores among subjects who habituate very late, or who do not habituate at all. These aims were successfully reached without prolonging the test duration, so it can be used in a clinical setting.

Electrodermal reactivity Example of an electrical model



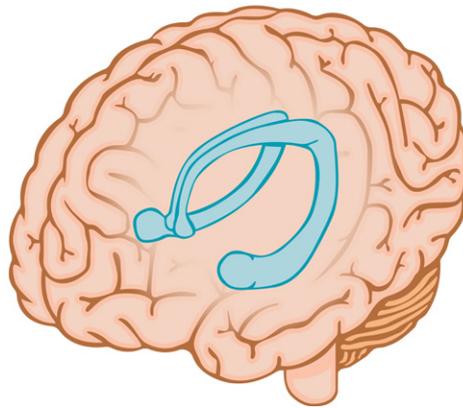
Individuals who only show the general one or two electrodermal responses, are classified as hyporeactive, while subjects showing specific electrodermal orienting reactions are reactive. Those who do not habituate during the test may reflect an impaired or lost learning process, describing a more diffuse over-alerting reaction when suffering from anxiety or other over-arousal⁵.

HYPOREACTIVITY AND HIPPOCAMPUS

It is not clear exactly where in the brain orienting reactions originate from, but most of the evidence point to hippocampus as having a central role.

Hippocampus is an extremely well-arranged structure with close contacts with most of the structures of the brain. It has a large amount of functions, among others, to sort out and evaluate unexpected events if they are attractive, harmful or insignificant. Immediately (within a part of a second) after sorting, it initiates relevant actions in the central and autonomous nervous systems, for example, fight or flight or and learning and remembering significant as well as insignificant events³. Another function, for example, is that it also constructs maps of, and keeps track of, the geographical space around the organism⁷.

Animal studies made by professor Olga Vinogradova has systematically searched for single neurons with orienting and habituation properties. Her results point out that certain neurons of the hippocampal CA3 areas of rabbit respond to unexpected stimuli and cease to fire after repetition of neutral stimuli³. Thus, these neurons act as generators of (a) the general orienting response and (b) the specific responses.



In searching of possible factors that could impair hippocampal function, there are a few candidates:

- It is known from many studies⁸ that stress with high levels of corticosteroids over an extended time-period have a harmful impact on hippocampus. This has repeatedly been found in suicide victims and attempters
- Recent research⁹ shows that inflammation in the brain can cause damages that affect the plasticity of the neurons in hippocampus among other structures, which was found by the authors in suicide attempters
- Childhood trauma and neglect can lead to epigenetic changes affecting the function of hippocampus according to Perroud and co-workers (2008)

Thus, stress, inflammatory processes in brain and childhood trauma are some of the possible causes of electrodermal hyporeactivity and there are probably more factors currently unknown.

WHAT DO THE RESULTS FROM THE EDOR TEST TELL US?

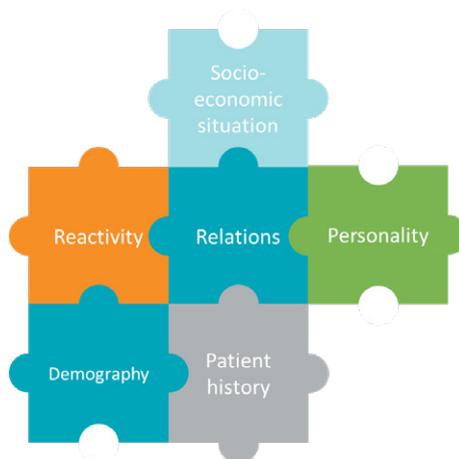
The EDOR Test is a psychophysiological test, carrying important information for the clinician as a part of the puzzle to the overall risk assessment. In a practical and clinical sense, the test provides two answers: Hyporeactive, as a high-risk group and reactive as a low-risk group relative to the average clinical risk for suicide among patients with primary depression.

Hyporeactivity as a test result for patients with a primary diagnosis of depression describes a risk factor for suicide in depressed patients. It is independent of age, gender, symptoms of depression or depth of depressive state, state anxiety and serotonin activity in brain (5-HIAA in liquor, Edman et al., 1986).

In a fresh, not yet published report by Thorell and Wahlin, the risk of suicide among hyporeactive was found to be 25 times higher (odds ratio), relative to reactive depressed patients. It should also be remembered, that the risk described for hyporeactives is both imminent as well as long-term. This is a clear and direct information to clinicians to use when planning depression treatment and suicide preventive measures for patients.

Reactivity as a test result in depressed patients is hypothesized in the light of the partly empirically backed up assumption that reactivity is an indicator of normal hippocampal functions, working as a protective factor against suicide.

An EDOR Test provides a vital part of the puzzle to the overall risk assessment, where several aspects need to be considered:



However, just as the person meeting the patient cannot diagnose hyporeactivity on its own, the EDOR Test has no background regarding the patient’s situation. Therefore, regardless of the EDOR Test result, other risk factors need to be placed in context to the test result. Patient history, social situation, demography, general and individual support structures surrounding the patient all moderate the overall risk. A thorough and structured clinical interview is not only necessary to make the risk assessment complete, it also holds the keys to a successful treatment of the depression.

TREATMENT

For the time being, there is no researched and validated treatment that is specific for hyporeactivity. This question is open for hypotheses and will probably have a renewed focus as the EDOR Test is used routinely in clinics. Due to this, focus should be to restore the patient from the depressive mood and to protect the individual from suicide acts.

Irrespective of the test result, both will require treatment of the primary depression, each group with a different risk profile.

It is advised to use well-known and validated treatment programs for depression already in place today. There are different approaches to treat suicidal adults (see Wasserman & Wasserman 2009, chapters 54 – 60¹¹). That is, the contact with the hyporeactive must be kept very good without long waiting time until next contact.

REFERENCES

- 1, Pavlov IP: Conditioned reflexes. An investigation of the physiological activity of the cerebral cortex. Oxford: Oxford University Press; 1927.
- 2, Sokolov EN: Perception and the conditioned reflex. Oxford: Pergamon Press; 1963.
- 3, Sokolov, E. N., Spinks, J. A., Näätänen, R., Lyytinen, H. (2002). The orienting response in information processing. Mahwah, New Jersey: Lawrence Erlbaum Associates.
- 4, Öhman, A. (1979). The orienting response, attention, and learning: An information-processing perspective; in Kimmel, H. D., van Olst, E. H., Orlebeke, J. F. (Eds.): The orienting reflex in humans. Hillsday, New Jersey: Lawrence Erlbaum Associates. Pp. 443–471.
- 5, Boucsein, W. (2012). Electrodermal activity. New York: Plenum Press, 2012.
- 6, Thorell, L. H. (1987). Electrodermal activity in depressive patients. Its relationships to symptomatology, suicidal behaviour, cortisol dysregulation, and clinical recovery. Linköping: Linköping University Theses Nr. 249.
- 7, <https://www.ntnu.edu/kavli/research/moser>
- 8, Dwivedi, Y. (Ed.) The neurobiological Basis of Suicide. Front Neurosci. Boca Raton: CRC Press, 2012.
- 9, Erhardt, S., Lim, C. K., Linderholm, K. R., Janelidze, S., Lindqvist, D., Samuelsson, M., Lundberg, K., Postolache, T.T., Träskman-Bendz, L., Guillemin, G.J., Brundin, L. (2013). Connecting inflammation with glutamate agonism in suicidality. *Neuropsychopharmacology*, 38, 743-752.
- 10, Perroud N, Courtet P, Vincze I, Jaussent I, Jollant F, Bellivier F, Leboyer M, Baud P, Buresi C, Malafosse A. Interaction between BDNF Val66Met and childhood trauma on adult's violent suicide attempt. *Genes Brain Behav.* 2008;7:314-322.
- 11, Wasserman & Wasserman Oxford Textbook of Suicidology and Suicide Prevention. A Global Perspective. Oxford University Press, Oxford and NY.