

EMotra EDOR[®]

**Orienting responses and
hyporeactivity**



Orienting Responses

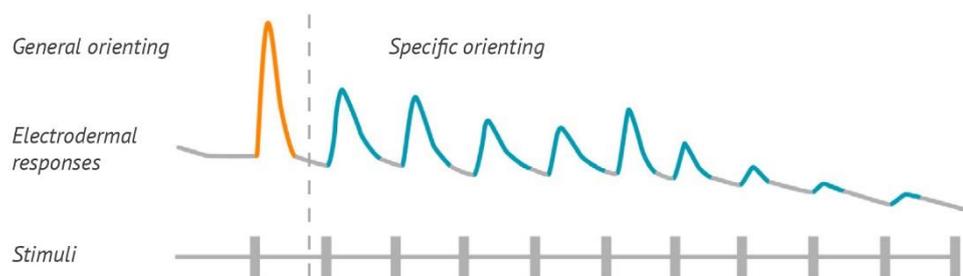
Unexpected events evoke orienting responses. This was first described by Ivan Pavlov¹ who named them “What is it? reflexes” and called the psychological process behind it as curiosity. This reaction alerts the brain for orienting towards the unexpected event, with sharpened sensory signal intake, information processing, and preparation for proper action.

This response was named 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 localized (specific) orienting responses. The Russian scientist Evgeny Sokolov³ 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 orienting responses are expressed as electrodermal responses. When the model conforms to the real event, there is no more need to react and the organism has habituated.

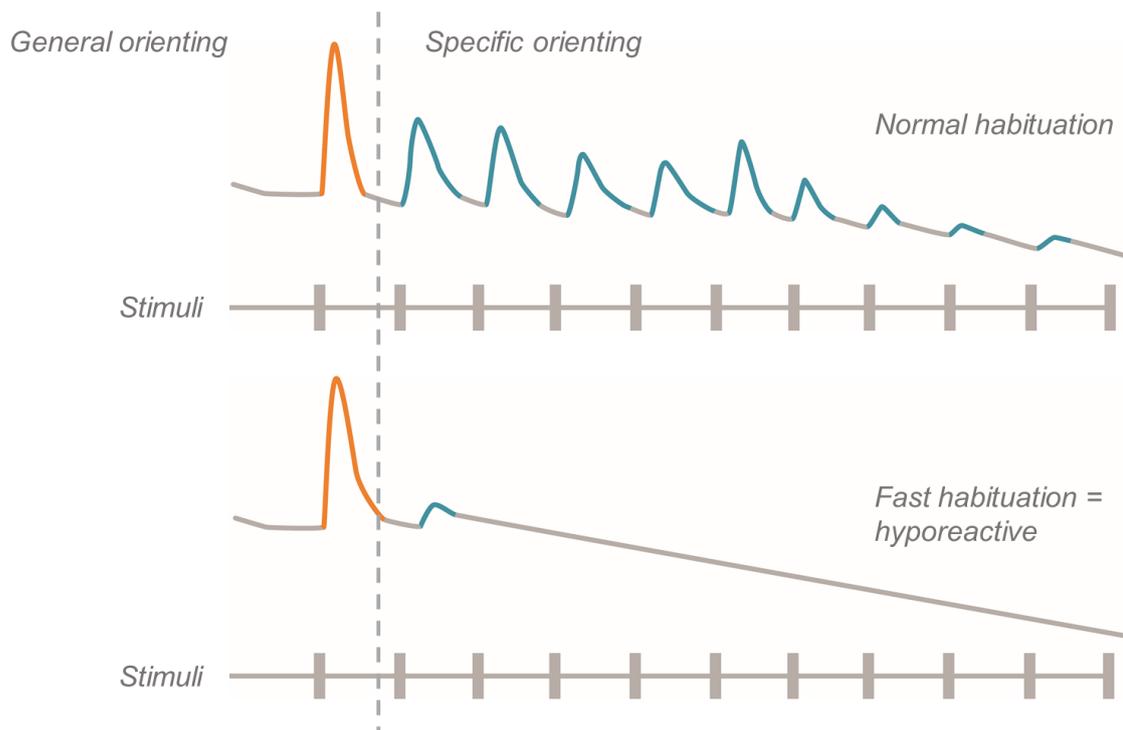
In the image below, these responses are shown in a stylistic fashion using a series of neutral audio tones as stimuli in the EDOR test. The analysis and classification of results are made on the presence or absence of specific orienting reactions in the sudomotor (sweating) system recorded as skin conductance (electrodermal) responses⁴.



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 neuronal model of the event finally is complete, the sharper, the better, and the easier the neutral stimulus will be ignored when other events require attention. This process is fundamental, and an unconscious process at this level.

Habituation and hyporeactivity

The term hyporeactive or hyporeactivity in biology or medicine means having or showing abnormally few or small reactions to stimuli. One of the specific properties of the EDOR test⁵ is that it is designed to optimise the resolution of the habituation score to identify fast habituators. It is also constructed to optimise the resolution of the scores among subjects who habituate very late, or who do not habituate at all.

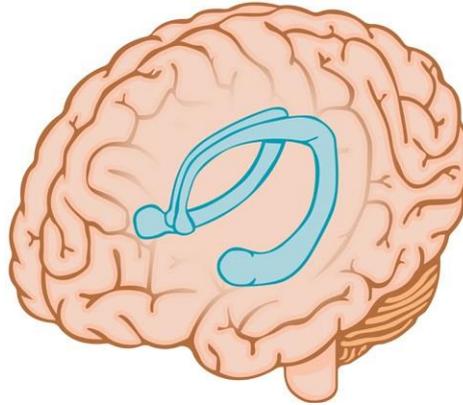


For a smaller share of patients, typically 10-20%, specific orienting reactions are non-existent. This latter group is classified as hyporeactive, where the lack of responses to specific orienting reactions reflects an impaired or lost learning process.

The biological underpinnings of hyporeactivity

Hippocampus is an extremely well-arranged structure with close contacts with most of the structures of the brain. It governs a large amount of functions, for instance sorting out and evaluating 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.

Examples of relevant actions are preparation for fight, flight and approach, and learning and remembering significant as well as insignificant events³. Another function is that it also constructs maps of and keeps track of the geographical space around the organism⁶.



Animal studies made by Professor Olga Vinogradova has systematically searched for single neurons with orienting and habituation properties. Her results point out that specialized neurons of the hippocampal CA3 regions respond to unexpected stimuli and cease to fire after repetition of that stimulus³. Thus, these neurons act as generators of the general and specific orienting responses.

A loss of orienting responses in the EDOR test reveals a loss of neuronal orienting functions, a damage, in this area of hippocampus. New hippocampal neurons continue to be generated throughout life, providing this region of the hippocampus with exceptional structural plasticity⁷. The CA3 regions can be affected by long-term stress with high levels of stress hormones since hippocampus is one of the regions that has the highest density of receptors for glucocorticoids.

One plausible mechanism behind hyporeactivity may be that long-term stress causes neuronal atrophy, neuronal death and/or prevention of neuronal growth in hippocampus to the extent that its function is compromised, visible as hyporeactivity in the EDOR test. There are several factors that can affect the plasticity of hippocampal neurons in individuals, such as:

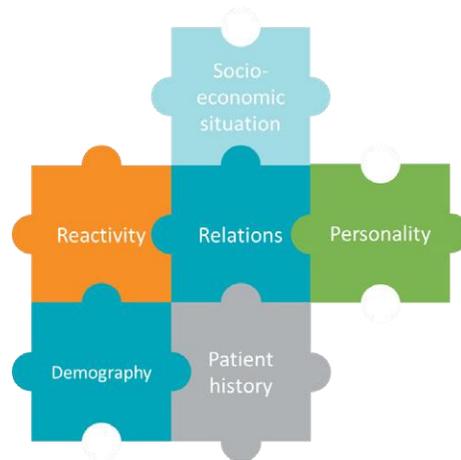
- Recurrent and chronic depression
- Physical illness, such as chronic pain
- Inflammation in the brain causing damages⁹ that affect the plasticity of the neurons in hippocampus
- Childhood trauma and neglect, leading to epigenetic changes affecting the function of hippocampus^{8,9}

What do the results from the EDOR test tell us?

The EDOR test identifies hyporeactivity, a state associated with risks in depression. As such, it adds biological information to the overall clinical assessment, like a biomarker.

However, just as the clinician meeting the patient cannot diagnose hyporeactivity, the EDOR test uses no background information 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.



In a practical and clinical sense, the test provides two answers: *Hyporeactivity*, identifying a high-risk group, and *reactivity* identifying a low-risk group. An EDOR test provides a vital part of the puzzle to the overall risk assessment, where several aspects need to be considered.

References

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