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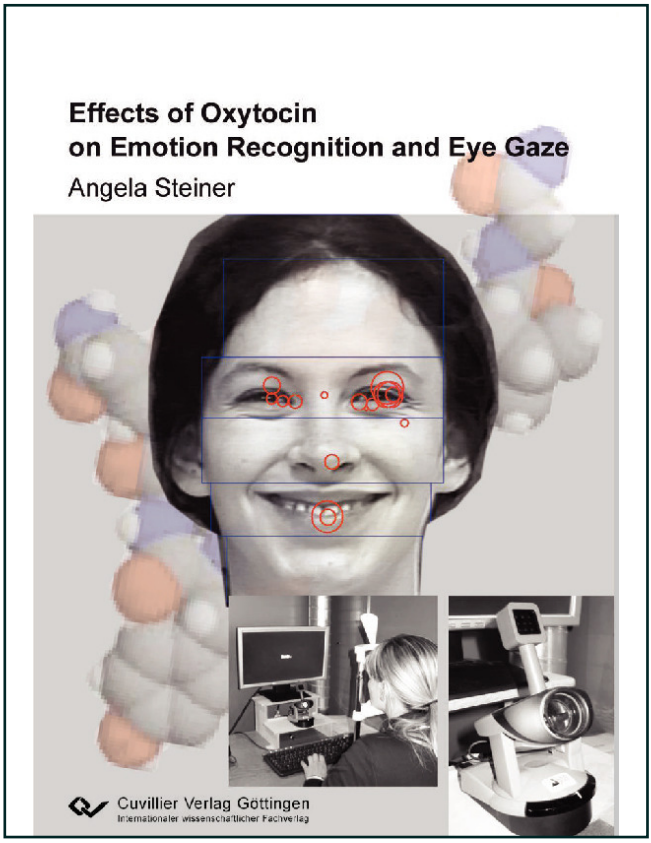
Effects of Oxytocin



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1. Introduction

The aim of the presented research project was to combine knowledge on emotions, facial expressions of emotions, their role in mediating social interactions and the neuropeptide oxytocin, which is known for its beneficial effects on human social behavior such as trust, “mind-reading” and social support. The project consisted of the following two parts: first, we examined the possible clinical relevance of the beneficial effects of a single dose of intranasal oxytocin in individuals with selective difficulties in recognizing and describing emotions in an emotion recognition task. The second part comprised the effects of oxytocin on fixations and the duration of these fixations when viewing videos of emotional facial expressions.

Emotions have been studied with great interest for decades. This attention has been given to emotions for good reason: There is no doubt that emotions serve numerous functions, such as an evolutionary function, a decision-making function and a social and communicative function, among others (Amstadter, 2008). Facial expressions are important visual signals, which provide information about an individual’s gender, age, and familiarity, and more importantly, they offer significant cues as to the intentions and mental states of others. Therefore, the ability to recognize these cues and to respond accordingly plays a crucial role in human social life. Deficits in face perception and a consequent deficit in facial affect recognition are apparent in many disorders with social deficits (autism, schizophrenia, social phobia, etc). To understand these difficulties, the most direct method is to record the visual scanpaths, the pattern of eye movements that occur when an individual processes facial expressions.

In particular, individuals with alexithymia have distinct difficulties in recognizing emotions. Alexithymia is a psychological concept defined by difficulties in understanding and regulating emotions. These include difficulties in recognizing,

identifying, distinguishing, and describing emotions. In the literature, alexithymia is thought of as a personality trait that differs among people, and about 10% of the normal population show poor expressiveness of emotional states (Berthoz et al., 2002). The current project focused on healthy participants, who were divided into a subclinical “high”- and “low”-alexithymia group using a median split with the sum score of the TAS-20 (Toronto alexithymia scale; Bach et al., 1996) in order to avoid influences of comorbid psychological disorders on the ability to recognize facial expressions (Taylor, 2000). The four groups, consisting of 19 subjects with OT and 13 subjects with PL in the “high”-alexithymia group and 14 subjects with OT and 19 subjects with PL in the “low”-alexithymia group, did not differ significantly in any relevant baseline measurements, such as psychopathological symptoms or trait characteristics. General well-being, and mood as well as heart rate were repeatedly measured. Subjects were required to be non-smokers, who were medically healthy and not receiving any pharmacological treatment in order to exclude possible interruption in the emotion recognition task. The results within the “high”-alexithymia group revealed that 24 IU oxytocin before the emotion recognition task was sufficient to enhance answer correctness in all emotional stimuli and especially in those emotions that were difficult to detect. In the “low”-alexithymia group, no such effect was found. Further, no group differences were observed regarding the reaction time.

Previous studies on the recognition of emotion from facial expressions have shown that the viewing of faces is associated with longer fixations compared with natural scenes and is typically accompanied by a stereotypical eye scanning pattern (Guo, 2007). Specifically, the eye region in neutral or expressive faces is often the first destination of the saccade and attracts the highest proportion of fixations compared with other facial features (Guo, Mahmoodi, Robertson, & Young, 2006).

Given that the eyes are often inspected first and for a longer time during face exploration, and in light of the results of a previous study by Guastella and colleagues (2007) showing that intranasal oxytocin increased fixations towards the eyes and the fixation duration towards the eyes when viewing neutral human faces, the second study examined the effects of a single dose of intranasal oxytocin on the ability to recognize facial expressions from video stimulus material (answer correctness and reaction time). Moreover, it also examined the effect on fixations as well as fixation time towards facial features such as eyes, nose, mouth, chin and front. Subjects had to fulfill the same criteria as in study one: They were required to be non-smokers, who were medically healthy and not receiving any pharmacological treatment in order to exclude possible interruption in the affect recognition task and in their visual scanpaths. The two groups, consisting of 30 subjects with oxytocin (OT) and 32 subjects with placebo (PL) did not differ in any baseline measurement assessing personality traits or psychopathologies. During the whole experiment, psychological (mood) and physiological (heart rate) parameters were repeatedly measured. The affect recognition task consisted of 36 video stimuli of facial expressions comprising 6 videos for each basic emotion (happiness, surprise, disgust, anger, fear, sadness). To assess eye movements non-invasively during the facial videos, an eye-tracking system was used during the experiment.

The results of the second study revealed that a single dose of oxytocin before viewing facial expressions led to more and longer fixations to the eyes independently of the valence of the emotion. Further, and again independently of the emotional valence, subjects with oxytocin spent less time on and gazed less towards the nose than the subjects of the placebo group. When analyzing each emotion category separately, we found that oxytocin significantly enhanced the number of fixations and the time spent fixating the eye region, in particular in happy facial expressions. When we considered the time sequence of the video stimuli and divided each of the 36 videos into three equal phases (early, middle and late face exploration), and doing so for each individual

participant, we found that in the early detection phase, oxytocin changes visual scanpaths of subjects significantly in that subjects with oxytocin made fewer fixations to the nose, but more into the eyes, and spent less time fixating to the nose but more to the eyes over all emotions. Again, this effect was highly significant for happy faces. Taken together, we were able to show that a single dose of oxytocin enhances the ability to recognize basic emotions in individuals with difficulties in recognizing emotions and that subjects with oxytocin gazed more at and spent more time fixating to the eyes, which provide us with the most socially relevant information within the face. Therefore, our results may have important clinical implications for patients with social deficits.