

## Extinction of Aversive Classically Conditioned Human Sexual Response

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### ABSTRACT

**Introduction.** Research has shown that acquired subjective likes and dislikes are quite resistant to extinction. Moreover, studies on female sexual response demonstrated that diminished genital arousal and positive affect toward erotic stimuli due to aversive classical conditioning did not extinguish during an extinction phase. Possible resistance to extinction of aversive conditioned sexual responses may have important clinical implications. However, resistance to extinction of aversive conditioned human sexual response has not been studied using extensive extinction trials.

**Aim.** This article aims to study resistance to extinction of aversive conditioned sexual responses in sexually functional men and women.

**Methods.** A differential conditioning experiment was conducted, with two erotic pictures as conditioned stimulus (CSs) and a painful stimulus as unconditioned stimuli (USs). Only one CS (the CS+) was followed by the US during the acquisition phase. Conditioned responses were assessed during the extinction phase.

**Main Outcome Measure.** Penile circumference and vaginal pulse amplitude were assessed, and ratings of affective value and subjective sexual arousal were obtained. Also, a stimulus response compatibility task was included to assess automatic approach and avoidance tendencies.

**Results.** Men and women rated the CS+ more negative as compared with the CS-. During the first trials of the extinction phase, vaginal pulse amplitude was lower in response to the CS+ than in response to the CS-, and on the first extinction trial women rated the CS+ as less sexually arousing. Intriguingly, men did not demonstrate attenuated genital and subjective sexual response.

**Conclusions.** Aversive conditioning, by means of painful stimuli, only affects sexual responses in women, whereas it does not in men. Although conditioned sexual likes and dislikes are relatively persistent, conditioned affect eventually does extinguish. **Brom M, Laan E, Everaerd W, Spinhoven P, and Both S. Extinction of aversive classically conditioned human sexual response. J Sex Med 2015;12:916–935.**

**Key Words.** Human Sexual Conditioning; Extinction; Sexual Response; Aversive Conditioning

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### Introduction

Lack of sexual interest is the most common sexual problem among women and is often accompanied by the experience of low sexual arousal [1,2]. Although low sexual interest is most common in women, it may also manifest itself in

men as psychogenic erectile dysfunction [3]. Disorders in sexual motivation, like hypoactive sexual desire disorder, are linked to complex interplay of psychological and biological factors and are generally considered as difficult to treat. Regrettably, empirically validated treatments are lacking [4]. Insight in the underlying mechanisms of sexual

motivation is essential to understand these disorders and may guide treatment thereof.

In the etiology of sexual dysfunction, basic learning processes like conditioning are hypothesized to play a pivotal role. Learning about sexual cues may encompass learning of positive expectations of pleasure and sexual reward, but may also include the learning of negative expectations [5]. According to incentive motivation models, sexual motivation is the result of the interplay of a sensitive internal sexual system with external motivational stimuli or the mental representation thereof. External stimuli that can promote motivation are called incentive stimuli [5,6]. Sexual incentives are stimuli that elicit sexual responses and approach behavior. Hence, sexual motivation may be investigated by studying responses within various response systems involved in sexual behavior [7,8]. Sexual arousal can be seen as an evolutionary preserved emotion [9], which is characterized by specific bodily reactions, like enhanced genital blood flow, by preparation of behavioral action [10] and by the experience of feelings of lust, excitement, and sexual desire. In addition, sexual arousal can eventually result in overt behavior such as approach and consumption [11]. Important to note is that in women, genital arousal is not per se accompanied by subjective desire or arousal [12–14]. However, the agreement between physiological sexual arousal and subjective report seems to increase as a function of the strength of the physiological response [14]. The incentive motivation model of sexual desire suggests that the experience of sexual desire may follow rather than precede sexual excitement and suggests that sexual desire emerges following sexual arousal initiated by a sexually meaningful stimulus [15].

The motivational valence of incentive stimuli can be unconditioned (primary) or conditioned (secondary) as a result of associative learning [16]. In associative learning processes like classical conditioning, a neutral stimulus (NS) is repeatedly paired with an unconditioned stimulus (US) [17], and eventually the NS is able to trigger the same reaction as the US [17,18]. The NS is now called the conditioned stimulus (CS), and the reaction to the CS is called the conditioned response (CR). It is suggested that as a result of aversive conditioned learning, sexual arousal may decrease after negative sexual experiences, such as sexual assault or repeated experiences with painful coitus [19,20]. Therefore, the role of aversive experiences and memories in sexual desire and arousal problems is likely to be important. However, there is only

limited empirical research on classical conditioning of sexual arousal in humans, while it is likely to yield important knowledge about mechanisms underlying sexual motivation and related disorders such as hyposexuality.

Despite its clinical relevance, studies on aversive sexual conditioning in humans are scarce in the literature [21–24]. In a study in women, making use of an erotic picture as the CS and a painful stimulus at the wrist as the US [25], diminished genital arousal and increased negative affect in response to the CS+ were observed. This was the first study that provided evidence for attenuation of sexual response in women by aversive conditioning. Generally, when the CS is repeatedly presented without the US, and the CS no longer predicts the aversive or appetitive outcome [26], this will yield in a loss of conditioned responding. Intriguing, in this study [25], conditioned genital responses and subjective affect did not diminish significantly during the extinction phase suggesting resistance to extinction. This *extinction* learning process has obvious clinical relevance, as it is thought to be the core mechanism for therapeutic interventions such as exposure therapy [27–29]. In such therapeutic protocols, CRs are lessened or inhibited by repeated or prolonged exposure to a cue (the CS) in absence of the event it used to predict (the US). This results in a decrease in the magnitude or frequency of the CR. This observation that conditioned subjective affect did not extinguish is in line with research on evaluative conditioning, which has shown that acquired subjective likes and dislikes are relatively resistant to extinction [30]. Research has demonstrated that exposure treatment is often unsuccessful in reducing feelings of dislike [31]. In classical conditioning, the CS elicits a US expectancy and CR (i.e., signal learning), whereas in evaluative learning, it is thought that the CS automatically evokes the representation of the US [32]. As a result, evaluative learning effects are difficult to modify through the procedure of extinction alone. Therefore, research on resistance to extinction of different measures of conditioned sexual responses is needed as it may have important clinical implications.

At present, it is unclear if gender differences in sexual conditionability and in resistance to extinction of aversive CRs do exist. Only few studies have addressed sexual conditioning in both men and women in appetitive paradigms [21,33,34], with mixed results, and none have examined aversive conditioning in both sexes. In addition, results from animal studies are also mixed. Some have demonstrated that intense electrical shock inhibits male

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