



Conditioning of Sexual Interests and Paraphilias in Humans Is Difficult to See, Virtually Impossible to Test, and Probably Exactly How It Happens: A Comment on Hsu and Bailey (2020)

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While reading Hsu and Bailey's (2020) reply to Grey (2020) about the role of conditioning explanations for sexual interests, two old aphorisms came to mind: "Absence of evidence is not evidence of absence" (e.g., Martin, 2007) and "Don't throw the baby out with the bathwater" (Murner, 1512, cited in Kirkpatrick, 1999). Of course, one reason we keep hammering away at difficult phenomena is to finally stumble across that fateful hypothesis that can be falsified but isn't, no matter how hard we try (Platt, 1964). And the etiology of human sexual interests is one particularly difficult set of phenomena to test. Aiming different hypotheses at those phenomena, especially from different levels of analysis, is likely to help bring cause and effect into clearer focus. Conditioning explanations, far from being poverty stricken (as Hsu and Bailey suggest), are actually quite rich in hypotheses to test.

Sexual interests span a continuum of preferences, from particular facial features, hair length and color, body shape, skin tone, ethnicity, age, etc., along with specific behavioral patterns, to fetishes and paraphilias, to sexual orientation based on anatomical sex and perceived gender (Money, 1984; Pfaus et al., 2012). All of these are surely represented "in the brain" though the role of experience relative to, if not overlaid upon, predisposition is still open to the same debate that Richard von Krafft-Ebing and Albert Binet had over a century ago (Money, 2003). This makes sexual interest extremely difficult to study because it is a mix of nature and nurture, with weighting coefficients that remain poorly understood and, for humans, politically explosive. Indeed, Hsu and Bailey (2020) posit erotic target identity inversions (ETIIs) as their explanation for the

type of paraphilic sexual arousal displayed by male furies relative to Grey's notion that such arousal is conditioned with furry experience. However, the epigenetic primacy of first experiences with sexual arousal, desire, pleasure, orgasm, and inhibition, at least in the present day, cannot be subjected to proper experimental manipulation for obvious ethical reasons. To make matters worse, these dimensions of the human sexual response all change across the lifespan with experience that initially imprints and then modulates, brain pathways, neurochemical systems, and molecular processes, associated with each (e.g., Aragona & Wang, 2009; Holley et al., 2018; Pfaus et al., 2012). And all are intertwined, both objectively and subjectively, in ways that are only beginning to be understood.

Hsu and Bailey (2020) found it puzzling that Grey (2020) did not provide more citations in favor of a conditioning explanation for fetish development beyond Rachman's (1966) now classic study showing that a woman's leather boot that had been paired previously with pictures of nude women came to elicit erections in men in the absence of the arousing pictures. Puzzling perhaps, but not surprising given that the effect of laboratory conditioning procedures in adult humans is rather weak compared to real life sexual experiences. Nevertheless, the effects are reliable. Rachman and Hodgson (1968) replicated and extended the original study, and McConaghy (1970, 1974) demonstrated conditioned erection in heterosexual and homosexual men elicited by colored circles or squares paired previously with erotic videotapes or still pictures. A particularly interesting study by Kantorowitz (1978) further examined the nature of association between the object and conditioned arousal induced by erotic pictures. For each male subject, three different neutral pictures were paired with the plateau, refractory, and resolution stages of masturbation. During subsequent testing, stimuli paired with the plateau phase produced an increase in penile erection, stimuli paired with the refractory phase produced a decrease in erection, and stimuli paired with the resolution phase had no effect.

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Remarkably these responses were still present after 3 months. Letourneau and O'Donohue (1997) exposed women to an amber light immediately before the presentation of erotic videos. Subsequent exposure to the light alone increased both subjective and objective (vaginal) arousal.

Hoffman, Janssen, and Turner (2004) compared heterosexual men's and women's genital arousal to a picture of an opposite sex abdomen versus a gun that were either paired or unpaired, subliminally or consciously, with subsequent exposure to an erotic video. When paired subliminally, the abdomen induced arousal in both men and women relative to the unpaired controls. However, when paired consciously, the abdomen increased genital arousal in men relative to the gun, but the gun increased arousal in women relative to the abdomen. In both cases, the stimulus that induced more general arousal was the one capable of consciously controlling genital arousal following its association with the erotic video. Both conscious and subliminal associations of neutral cues with sexual arousal have been replicated in women (e.g., Both et al., 2008; Both, Brauer, & Laan, 2011) and men (Klucken et al., 2009), with the latter study reporting greater brain activation with conscious, relative to subliminal, cue processing in the ventral striatum, orbitofrontal cortex, and occipital cortex in both men and women, but greater activation of the amygdala, thalamus, and brainstem in men relative to women. Conditioned sexual arousal in women and men shows extinction with nonreinforcement and spontaneous recovery in contexts where the conditioning originally occurred (Brom, Laan, Everaerd, Spinhoven, & Both, 2014b). Evidence of aversive conditioning has also been presented (Both, Brauer, Weijenberg, & Laan, 2017; Brom, Laan, Everaerd, Spinhoven, & Both, 2015).

At first glance, the results reviewed here are tantalizing. Human sexual arousal can come under the control of Pavlovian (stimulus–stimulus) associations, suggesting that inappropriate sexual arousal (whatever that means in a particular culture) could conceivably be extinguished under the right conditions. However, to reiterate Hsu and Bailey (2020), conditioned genital responses alone in humans do not even begin to approach the magnitude of real human fetishes, laden as they are with powerful fantasies, expectations, and naughty pleasures. Moreover, the human results are weak relative to the far more robust expression of conditioned arousal, desire, and preferences for places and partners associated with the post-ejaculatory period in male animals or a post-orgasm like reward state in females animals (e.g., Brom et al., 2014a; Georgiadis, Kringelbach, & Pfaus, 2012; Pfaus et al., 2012; Pfaus et al., 2016). Indeed, fetish-like arousal has been conditioned in male rats that had their first copulatory experiences wearing a rodent tethering jacket (Pfaus, Erickson, & Talianakis, 2013), and in male Japanese quail that had primary copulatory experiences with an inanimate object made of terrycloth (Köksal et al., 2004). Rather than taking this as

evidence that Pavlovian and operant (response–reinforcer) conditioning plays only minor roles in the development of human sexual behavior and sexual interests, it is far more likely that conditioning has already occurred at many levels of a human participant's sexual response and sexual interests when researchers try to condition them further.

In the animal learning literature, two Pavlovian phenomena come to mind as an explanation for the weak effects reported in adult human participants: sensory preexposure to either the unconditioned stimulus (US) or conditioned stimulus (CS). In the first case, if a male rat has had his first copulatory experience to ejaculation with an unscented, sexually receptive female rat, subsequent attempts to associate a neutral odor such as almond (the CS) with the opioid-dependent, post-ejaculatory reward state (the US) will be blunted or inhibited relative to males that had their first copulatory experience to ejaculation with almond-scented, sexually receptive females (Ismail, Girard-Bériault, Nakanishi, & Pfaus, 2009; Quintana, Guizar, Rassi, & Pfaus, 2018a; Quintana et al., 2019b). In the second case, often referred to as “latent inhibition,” preexposure to the almond odor CS alone (e.g., on a gauze pad) prior to a male rat's first sexual experiences to ejaculation with almond-scented, sexually receptive females delays or inhibits the ability of the male to make the CS–US association (Quintana, Jackson, Nasr, & Pfaus, 2018b). In the first case, the pleasurable reward state has been experienced without the odor present as part of the composite set of partner-related cues (or “Gestalt” as defined by Köhler, 1929). This makes the odor irrelevant as a predictor of the sexual reward state. In the second case, presentation of the odor alone prior to pairing reduces its associative strength as a predictor of the sexual reward state. In fact, it predicts “not the reward state” which is how it accrues its “latent” ability to delay or inhibit the CS–US association (Mackintosh, 1974; Pavlov, 1927). And remember that animal researchers can do what no human researcher can do: exert complete control over the context, partner features, and degree of stimulation and reward obtained during an animal's first sexual experience or first experiences of sexual reward (or sexual aversion). Thus, human sex researchers must deal with whatever associative strength is leftover to modify in their participants, who, as alluded to above, are presumably sexually experienced, active, and already biased toward their own preferences.

The animal learning literature has also shown us that some stimuli are prepotent in their ability to generate arousal, making the control of attention a vital parameter in theoretical models of conditioning (e.g., Harris, 2006; Mackintosh, 1965; McLaren & Mackintosh, 2000, 2002). Prepotency means that animals (and humans) pay attention differently to different cues, leading to potentially different outputs in what is learned as rewarding and how strong the association can be between a CS and US, or even between different CSs (for a review, see Vogel, Castro & Saavedra, 2004). Thus, some stimuli (e.g.,

physical features of a potential partner) can be “ignored” in the presence of prepotent stimuli. Furthermore, different cues appear to “belong” together, where certain CS–US associations are easier to establish than others (Garcia & Koelling, 1966; Seligman, 1970). For example, rats live in a largely olfactory world. Putative pheromones induce sexual arousal (e.g., erections in male rats) without conditioning, whereas odors require some CS–US pairings to become enacted as sexual CSs. In contrast, somatosensory cues, such as the sight or feel of a rodent tethering jacket on a partner, are relatively weaker as CSs (Quintana et al., 2019a). Humans live in a largely visual and/or auditory world, and if the popularity of erotic or pornographic visual stimuli throughout human history is any indication, the sight of particular human body parts comprising both primary and secondary sexual characteristics, and of sexual interactions with others, is all prepotent at activating sexual arousal and limbic brain structures (e.g., Childress et al., 2008). In fact, modern sex researchers depend on exactly this kind of prepotency, although people’s tastes in other associated visual and auditory features of erotica clearly change from generation to generation (e.g., Gabor, 1973).

Pavlov (1927) showed evidence that stimuli represented on adjacent cortical regions were easier to associate than cues represented on more distant regions. This becomes important when thinking about how certain fetishes might develop. Take a foot fetish for example. The somatosensory “homunculus” in the cortex is a distorted representation of each individual’s body, with more cortical area spent on more complex and integrated sensations (Penfield & Rasmussen, 1950). Notably, the feet and toes are represented in the medial folds of the primary somatosensory cortex immediately adjacent to the genitals (in Brodmann’s Area 2). The genital representation also shows significant overlap with the nipples and inner folds of the ear (Komisaruk et al., 2011), thus linking significant erogenous zones of the body to the genitals. In contrast, the lips are represented more distally on the lateral sides of the parietal lobes, near structures related to language. Accordingly, lip sensations can be neutral (when speaking), aversive (when getting bitten), or ticklish (with a feather) in non-sexual situations. Likewise, a kiss can be loving, sensual, or hateful, depending on the condition. Different feelings associated with lip stimulation are determined by the external context, which in turn activates pathways with associated structures that render a feeling or emotional response that can also be tagged at a conscious, cognitive level, and usually compared to a memory of similar situations. Thus, practicing a sensual kiss in front of the bathroom mirror likely does not induce sexual arousal, whereas that same kiss during a first date does. Now add fur. Wearing fur, feeling fur, and imagining oneself as a furry animal may well link important erectile tissues and erogenous zones of the body at once. And if these induce potent sexual arousal and result in sexual reward, then from a Pavlovian perspective fur will become enacted as a preferred cue. This is reminiscent of male rats that have had

their first multiejaculatory sexual experiences wearing a rodent tethering jacket (Pfaus et al., 2013). During subsequent testing with the jacket on, the males copulated proficiently with sexually receptive females. However, when tested with the jacket off, most of the males did not copulate and those that did were sluggish. Why? Simply because the associated CS that linked the sensation of the jacket to their genital arousal during a critical first experience with sexual reward was missing.

We do not take issue with Hsu and Bailey’s (2019, 2020) explanation of ETIIs as a potentially strong predisposition or cognitive bias in male furies. The “auto” in the philia may well be playing out with this and other biases as rudimentary causes. However, once a furry fetish is conditioned, it would be difficult to disentangle cause from effect, unless furies were particularly adept at keeping accurate and explicit diaries of all their sexual experiences from Day 1, including early genitally arousing fantasies involving animals, people dressed as animals, or of being an animal, that eventually led to masturbation during their precopulatory sexual experiences. We would predict from both an operant and a Pavlovian analysis that such autoerotic experiences would have led to masturbation with some kind of real furry somatosensory feedback, and eventually to experiences of extreme sexual arousal and reward with others as a furry and/or with other furies. However, we do take issue with the following: “We are not idiosyncratic in our skepticism about the power of conditioning to explain variation in sexual interests. Conditioning research persists in this area, but it is a minority taste” (p. 54). It is true that “minority tastes” are often off the beaten path and may take time to settle into the mainstream scientific map. But given the lack of consensus on how sexual interests, much less fetishes, develop, and the powerful way that both Pavlovian conditioning and operant conditioning have been shown to affect the expression of sexual behavior and sexual preferences in animals, perhaps it is time to rethink throwing the baby out with the bathwater. The absence of strong evidence is likely due to a poverty of current testing methods along with ethical constraints that make it impossible to manipulate, much less test, robust conditioning during critical sexual “firsts” that can occur any time across the lifespan.

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