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The Sensory Closed-Loop Model: A Neurobiological Framework for Paraphilic Autosexuality

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Abstract. In clinical psychology, Gender Dysphoria and Autogynephilia often present a diagnostic dilemma due to their phenomenological overlap. This paper proposes the Sensory Closed-Loop Model as a neurobiological framework to bridge the mechanistic gap between paraphilic attraction and identity inversion. The model posits a three-phase developmental trajectory: (1) the Devotee phase, driven by atypical dopamine distribution and incentive salience; (2) the Pretender phase, characterized by embodied simulation via the mirror neuron system; and (3) the Wannabe phase, where active inference is employed to eliminate persistent sensory prediction errors. By situating autogynephilia within a broader spectrum of paraphilic autosexuality (including acrotomophilia and autozoophilia), this framework explains the drive for extreme body modification as a hardware-level resolution to achieve somatic unification. The paper concludes by addressing the causality dilemma between body map defects and sexual triggers, calling for longitudinal research to distinguish paraphilic autosexuality from primary gender dysphoria.

Keywords: Autogynephilia, Paraphilic Autosexuality, Incentive Salience, Active Inference, Acrotomophilia

1. Introduction

In clinical and sexual psychology, *Gender Dysphoria* and *Autogynephilia* often present a diagnostic dilemma due to their phenomenological overlap.

Autogynephilia is a concept describing a paraphilia occurring in male (mostly heterosexual), who are sexually aroused through imagining oneself as female or regarding oneself as female [1]. It has inspired a trail of research to support the concept's reliability and to understand gender dysphoria, a psychological condition related to a strong desire to be of another gender, which may include desire to change primary and/or secondary sex characteristics [2-5].

With autogynephilia showing a strong intention to change natal sex through surgical methods, almost the same as gender dysphoria, this paper believes that it is driven by a different mechanism. As Freund and Blanchard assumed:

… for every class of sexual object, there will be small subgroups of men who develop fetishes for clothing associated with the desired object, who develop the erotic fantasy of being the desired object, and who develop the sustained wish to trans form their own bodies into facsimiles of the desired object [6].

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While autogynephilia may start with sexual attraction, gender dysphoria is more likely to be motivated by body schema mismatch. Besides, gender dysphoria is potentially identical to *body integrity identity disorder* (desire of limb amputation) [7]. Distinguishing between paraphilic autosexuality and body schema mismatch like gender dysphoria is critical for ensuring clinical accuracy and providing appropriate therapeutic interventions.

To address the current dilemma, this paper will try to categorize the autogynephilia to a paraphilic subgroup as paraphilic autosexuality of which identical symptoms may suggest a shared mechanism, such as running in the same family background, sharing similar patterns of brain activation or gene. And this paper will also raise a hypothesis of the development of paraphilic autosexuality to inspire the future direction of researching and distinguishing phenomena of autogynephilia and gender dysphoria.

2. Research literature

2.1. Paraphilic autosexuality

Autogynephilia is a concept describing a paraphilia occurring in male (mostly heterosexual), who are sexually aroused through imagining oneself as female or regarding oneself as female [2].

The classification of autogynephilia as paraphilic subtypes not only hasn't undergone sufficient research but also lacks academic consensus.

The theoretical framework is accused for conflating gender affirmation with sexual arousal. Scholars argue that Blanchard's theory suffers from confirmation bias, mislabeling the euphoria of gender affirmation as purely sexual. While this refutes Blanchard's overgeneralized conclusions, it does not preclude the existence of identity inversions driven by primary sexual impulses [8].

Subsequent research suggests that it is not necessarily to deny the existence of autosexual paraphilic phenomena, but to correct its over-generalization. Once primary gender dysphoria is distinguished, the existence of a paraphilic subtype remains a possibility.

Recent research suggests that autogynephilia is a manifestation of a broader class of paraphilias characterized by autosexual behaviors. *Autoandrophilia* was confirmed among females, as a paraphilia of sexually aroused as imagining oneself as male, indicating the internalization process crosses biological boundaries [9].

This autosexual pattern has been expanded with phenomena other than gender, such as men who wants to be amputated also attracted by amputee [5]. Examples of pedophilic males being aroused by fantasizing themselves as children suggest that the autosexual behaviors may be an identical inclination among some paraphilia [10].

the autosexual paraphilic behavior was extended and tested in three distinct paraphilic samples: *apotemnophilia* (sexual arousal by the idea of being an amputee), *autozoophilia* (sexual arousal by the idea of being an animal), *autolipophilia* (sexual arousal by the idea of being obese) [11]. In these cases, a high degree of internal sexual attraction (e.g., apotemnophilia) frequently correlates with an exclusive preference for specific sexual targets, often manifesting as a profound drive for extreme body modification.

Naming the subgroup which indicate an erotic fantasy being the desired object as *Paraphilic Autosexuality,* it originates with an external sexual attraction and end up with internalization, exhibiting an identical behavioral pattern. Adapting nomenclature from the acrotomophilia community, this developmental trajectory can be analyzed in three distinct phases: (a) *Devotee* is people who are sexually attracted to an external target with specific feature (e.g. amputee). (b) *Pretender* stage involves fantasizing the erotic target or using tools to imitate the erotic target. (c)

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Wannabe stage is the final stage, wishing to be erotic target and even trying literally modify body to literally own that feature through surgery [11].

Categorizing the development of paraphilic autosexuality into these three stages provides a robust framework for analyzing the psychological transition from external attraction to somatic internalization. The category in question is necessarily incomplete, but this article is hoped to inspire further research to test and fulfil it.

2.2. Core literature: Erotic Target Location Error and Erotic Target Identity Inversion

Some paraphilias which could be conceptualized as *erotic target location errors* and *erotic target identity inversions* have drawn attention but haven't undergone thorough research [6]. Erotic Target Location Error (ETLE) suggests that sexual interest is mislocated due to neurological dysfunction [6]. For instance, some heterosexual men mislocate their sexual attraction from women's primary and secondary sexual features onto non-sexual body parts such as feet or even more atypical ones like amputated limb. Erotic Target Identity Inversion (ETII) is a special form of ETLE, where the target error is the person oneself, a misdirection where external sexual orientation projects inward [6]. For example, *Autogynephilia* is a paraphilia where a male's paraphilic sexual arousal by the thought or image of himself as a female [2].

However, while ETLE and ETII provide a descriptive framework for these phenomena, current theory, including subsequent research, faces three significant theoretical limitations in explaining the underlying mechanisms.

Firstly, these theories fail to bridge the gap of the internalization of external object. They effectively describe the phenomenological shift from an external target to oneself but fail to elaborate the neurobiological or psychological pathways that facilitate this internalization. It is sufficient to believe that external sexual attraction is not able to cause an internalized sexual attraction alone, considering that most heterosexual male are not autogynephilic.

Second, there have been contradiction. For instance, only a small amount of *Adult Baby/Diaper Lovers (AB/DL*) are actually attracted to infants compared to the rates of them experiencing internal arousal [12]. This challenges that external attraction isn't always the trigger or maybe AB/DL simply doesn't belong to the paraphilic autosexuality subgroup, which might be caused by other mechanisms, since it lacks the external attraction motivation.

Besides, neither ETLE nor ETII could explain the primary origin of the external target preference itself. The specific neurological dysfunction or developmental factors resulting in preference for unconventional targets such as amputee or animal figures has remain unknown. Thus, the reason why paraphilic autosexuality is more easily detected among individuals with unconventional targets than autogynephilia and autoandrophilia lack explanation yet.

3. Hypothesis: Sensory Closed-Loop Model

Building upon these limitations, the *Sensory Closed-Loop Model* offers a potential neurobiological explanation for addressing the mechanistic gaps. This model tries to posit that the transition from external paraphilic attraction to internal identity inversion is driven by dysregulated reward processing and somatic redirection.

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3.1. Phase I: devotee by incentive salience

The Devotee, showing exclusive sexual fixations, may not be simply be motivated by preferences, but caused by atypical dopamine distribution. According to the *reward framework*, brain reward processing comprises three dissociable psychological components: learning (associations and predictions), incentive salience (the "wanting"), and hedonic impact (the "liking" or pleasure) [13]. It is hypothesized that paraphilic arousal is primarily driven by the mesolimbic dopamine system's attribution of pathological *incentive salience* to specific, object-related features, rather than mere sensory pleasure or cognitive expectation.

For individuals with paraphilias, specific stimuli (e.g., amputee characteristics or cross-gender traits) may function as supernormal stimuli, inducing an abnormally heightened neurobiological state within the reward circuitry. Under this condition, the paraphilic object becomes an irresistible attraction concentrating sexual impulses toward that specific target. Crucially, when access to these atypical targets is socially or physically restricted, the resulting wanting tension is forced into a somatic redirection, projecting the sexual impulse inward onto the self.

Despite this framework, the precise neurobiological precursors of this heightened incentive salience remain elusive. Whether the mechanisms by which the brain pre-categorizes specific features and links them to sexual arousal are innate or acquired through early age requires further investigation.

3.2. Phase II: pretender with embodied simulation

The pretender phase represents a critical transition where paraphilic desire shifts from external observation to physical internalization.

This paper proposes the development from devotee to pretender: The unachievable desire, will end up on the fantasizers themselves. Starting with roleplaying to strengthen their fantasy, faking a target to ease their need. Then the boundary between one and the fantasy target blurs under the simulation. Fantasizers may not be satisfied by simply admiring the outline of their target, but also want to understand target's inner feelings. This is where the sensory loop closed, fading the boundary between oneself and target in sex.

According to *Embodied Simulation* theory as literature support, the core mechanism of social cognition and the understanding of others is not abstract logical inference, but rather embodied simulation rooted in the *mirror mechanism*. The essence of this simulation is *reuse*: by reusing their own motor, visceral, and somatosensory representations, observers functionally map and experience the states of others [14].

Since the represented body is constrained by the physical anatomy, paraphilic autosexual individuals cannot achieve self-gratification or close the reward circuit through visual observation alone. To truly reuse and sensorially experience the object-related states they intensely desire, they must resort to physical embodied simulation, such as transvestites wearing cross-gender attire or devotees using wheelchairs. Through this physical enactment, individuals can activate their own proprioceptive and tactile feedback networks, attempting to use their own bodies as a medium to reconstruct the internal states of the object that remain inaccessible through external observation.

However, the mirror mechanism currently remains a compelling yet contested hypothesis. There exists a profound scalar gap between simulating a grasping action and simulating an entire anatomical structure (such as possessing a female body or missing a limb). Whether the *Mirror Neuron System* possesses the capacity to encode and reconstruct long-term, static anatomical body schemas remains an open question in neuroscience, with no definitive consensus as of yet.

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3.3. Phase III: wannabe to eliminate prediction error

Not all pretenders escalate to wannabes. Then why in some people, pretender stage will develop into surgical modification? Since pretending is temporary and cannot modify the fundamental body conditions, if the prediction error constantly happens, body schema mismatch cognition will result in physical modification to eliminate sensory discrepancy.

In the pretender stage, although individuals generate partial sensory input through enactment, an insurmountable chasm remains between their underlying, authentic anatomical structure (e.g., intact limbs, natal biological sex) and the extreme object-based predictive models generated in their brains. No matter how realistic the enactment, this physiological misalignment continuously produces intense proprioceptive and prediction errors. When these prediction errors cannot be resolved through mere cognitive updating or behavioral simulation, the brain's control system shifts toward *active inference* [15].

To completely eliminate the persistent sensory prediction errors arising from anatomical misalignment and to satisfy the unyielding incentive salience within the dopaminergic circuits, paraphilic autosexual individuals eventually develop an ultimate demand to alter their physical bodies. They yearn for extreme measures, such as amputation or gender reassignment surgery, to modify the sensory input source at the hardware level, thereby achieving a total sensory closed-loop and the unification of subject and object.

However, a critical caveat remains: the fundamental principle of active inference is that the brain adopts the most parsimonious action to eliminate error. For a system intensely desiring an object, the most economical way to resolve error is typically to acquire or possess that object, rather than becoming it. The precise mechanism that triggers this ego-projection of the object remains an unanswered question in current research. While the theoretical foundation of active inference may offer certain insights, its explanatory power appears weakened when confronted with high-magnitude errors such as transsexuality or body integrity identity disorder.

4. Conclusion

4.1. Does Autogynephilia/Autoandrophilia and other paraphilic autosexuality belongs to the same dimension

Autogynephilia/Autoandrophilia indicating a high similarity in the development of the sensory closed-loop mechanism with acrotomophilia, zoophilia and lipophilia, but since the original external target is ordinary female/male, whether the inner motivation is the same requires further discussion.

However, research data indicates that individuals with atypical external target, such as devotees, exhibits a significantly higher prevalence of paraphilic autosexuality compared to the general population [11]. This strongly suggests that paraphilic autosexuality may be a collateral neurocircuitry extension of ETLE. In other words, regardless of whether the external target is conventional or paraphilic, as long as the reward circuitry possesses the underlying susceptibility for internalized projection, the same embodied simulation mechanism may be triggered. This also suggests that ETLE and ETII may not be necessarily bonded. Future research must further investigate the comorbidity principles underlying paraphilic autosexuality and ETLE paraphilias.

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4.2. Causality dilemma

While the Sensory Closed-Loop Model proposed in this review effectively integrates the clinical features of autophilia, it faces a potential chicken-or-egg problem regarding causality. It is important to note that because autosexual paraphilic traits are influenced by a complex mix of social and biological factors, this theory cannot be applied to every case.

Both this model and traditional theories (like ETII) share a core assumption: that the atypical sexual preference (an extreme attraction to an external object) comes first, and the desire for identity change or body modification is a secondary result. However, existing neuroscience suggests a completely opposite path might be possible.

There is a possibility that self-cognition twists first, leading to a subsequent sexual preference as identity affirmation. Take acrotomophilia (attraction to amputees) and its overlap with body identity integrity disorder (BIID) (the desire to become an amputee) [16]. Research shows that individuals with BIID have reduced brain activity in the areas responsible for processing touch in specific limbs. If we view this glitch in the brain's internal body map as the primary driver, a competing hypothesis emerges: An individual is born with a brain map that misses a limb or other body features. In childhood, seeing an actual amputee creates a powerful neurological click, the external image finally matches their internal blueprint. During puberty, as the brain's reward and sexual systems develop, they latch onto this pre-existing neurological click, mistakenly turning a sense of belonging into sexual arousal.

Currently, the model raised in this paper cannot rule out this reverse causality. Whether the preference starts with mental simulation or a pre-existing brain map defect, the end result looks the same in adults: a mix of external attraction and a desire to change one's own body.

To solve this, future research must move beyond snapshots of adult brains and instead track neurological development over time. By studying the brain structures of adolescents before they reach sexual maturity, we may determine which comes first: the body map glitch or the sexual reward trigger. Besides, comorbidity is possible that paraphilic autosexuality and body schema mismatch co-exist on one individual.

4.3. The reason why wannabe want to be

While the brain typically adopts the most economical action to resolve prediction errors, usually by acquiring rather than becoming the desired object, paraphilic autosexuality presents a unique neurological exception. This paper proposes that the drive for body modification is not merely a reaction to social or physical barriers. Instead, it stems from a profound motivation, rooted in the pretender stage, to experience the target's internal sensory states. In this context, external possession is only a limited solution that fails to rectify the underlying body schema mismatch. What makes autogynephilia atypical is not that they cannot have sex with female, but they want to feel the women feel beyond the usage of penis. On neural level, where the boundary between self and object becomes blurry, permanent physical alteration emerges as the truly economical path, as it provides a hardware-level resolution to persistent sensory discrepancy and achieves a total, permanent sensory closed-loop.

4.4. Future directions

The sensory closed-loop model remains theory deduction on current circumstance. Though this hypothesis can effectively explain a variety of paraphilic autosexuality, it still lacks neurobiological

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data to directly support.

To further validate the proposed theories, future research should focus on two primary directions with biological methods applied: First, the priority of research should focus on the order of development of sexual attraction and self-transformation. This paper believes that there are more forms of paraphilic autosexuality to extend this category to find more data to deepen the research, like maiesiophilia (attraction to pregnant women) which hasn't been undergone much research yet. This would establish a clear chronological order that whether or not the paraphilia (attraction to others) precede the paraphilic autosexuality (attraction to self-transformation).

Second, future studies may pay more attention to the neural origin of ETLE. Applying biological methods such as fMRI, it is possible to detect how paraphilic individuals' brain is sexually more sensitive to certain atypical targets and what causes their inclination of ETII.

By monitoring the interaction between the mirror neuron system and the brain's reward networks, researchers may determine if there is a biological distinction between simply observing an object and the urge to become it. This would provide the concrete evidence needed to map the evolutionary path of these complex sexual preferences.

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