

Research Article

A Unified Theory of Addiction

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This paper examines whether a displacement mechanism could serve as the basis for a unified theory of addiction. Displacement activity represents a bio-behavioral process that allows an animal to deal with stress. Theoretically, the displacement activity mechanism rechannels an overflow of motivational energy built up in the brain's attempt to face or avoid a stressful situation. This energy is rechanneled to another drive (e.g., grooming); thus, the resulting behavior is out of context for the situation. Normally, this displacement mechanism is adaptive. However, it can become destructive, particularly if the displacement behavior is repetitive. For example, dogs and cats lick their fur to stay clean but also to displace stress. Repetitive licking may denude hair and damage the underlying skin. Similarly, in humans, the brain may not select a healthy displacement behavior; for example, a person may overeat or consume drugs to cope with stress. The displacement mechanism may be the link between stress and addiction and account for substance dependence. Furthermore, the displacement mechanism could explain the progression and perpetuation of addiction despite development of tolerance. An intervention based on the displacement mechanism, adaptable for any addiction, was developed. It involves 1) helping an individual identify problems/stressors that form the basis of surplus motivational energy and 2) implementing strategies to either avoid or resolve these problems/stressors. For sudden urges, an individual may willfully rechannel excess motivational energy to a benign behavior, such as taking deep breaths or squeezing the fists, to mitigate the urge while dealing with the source of displacement. A clinical trial using this intervention technique to treat eating addiction is currently underway. Trials on other addictions will be organized as well.

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1. Introduction

Addiction is defined as a process whereby a behavior, which can function both to produce pleasure and to provide escape from internal discomfort, is employed in a pattern characterized by a) recurrent failure to control the behavior and b) continuation of the behavior despite significant negative consequences^[1].

It may be possible to consolidate the causes of different addictions, such as to drugs/alcohol, gambling, smoking, food/eating, shopping, skin picking, and nail biting, and explain them using a single theory. Thus, a universal treatment for many addictions may be feasible.

Bindra^[2] examined a displacement mechanism utilized by psychologists to interpret *displacement activity*, an irrelevant response to situations that an animal cannot readily face or avoid—those involving uncertainty, confusion, conflict, and feeling trapped, threatened, or thwarted—defined here as *stress*. Displacement activity has been observed in birds, fish, mammals^[3], and fruit flies^[4]. Bindra^[2] deemed the displacement mechanism “vague and ad hoc.” However, the present paper defines it as the process that generates displacement activity or behavior. Accordingly, it is hypothesized that the displacement mechanism may serve as the basis for a unified theory of addiction.

2. Displacement Theory

2.1. Displacement Activity

Displacement activity constitutes behavior (e.g., preening or licking) that occurs out of context or is inappropriate for the situation at hand^[5]. A few examples are considered: Some tern species preen when alarmed by a potential predator. Skylarks engaged in furious combat suddenly peck at the ground as if feeding. Two gulls in a boundary dispute first face each other at the boundary; however, instead of assault, both vigorously pull up tufts of grass as if nest building^[6]. Sheep graze when threatened by a predator^[2]. Anxious dogs and cats repetitively lick their fur^[7]. Stressed parrots pluck their feathers^[8]. Tense horses whinny, shake their heads, and paw with their hooves^[9]. A dermatologist posited that, in humans, sucking the thumb, picking the skin, pulling out hair, and biting the nails may represent displacement activity^[10]; Bindra^[2] included repetitive behaviors such as tics to this list. With nail biting, skin picking, and hair pulling, the displacement seems to resolve to the grooming drive, as does acral lick disorder in socially isolated dogs^[11], in which the dog may lick its paws raw.

Displacement activity is triggered by peripheral stimuli or cues^[12], such as the sight of grass for grazing, dirt on fur or feathers for licking or preening, and hangnails for skin picking. Andrew^[13] stated, "...it seems probable that peripheral stimuli are of critical importance in the causation of some irrelevant behavior." Tinbergen^[6] noted that peripheral stimuli could determine the type of displacement activity. Although the same peripheral stimuli trigger normal behaviors such as licking and preening, the triggered displacement activity is irrelevant^[14].

Tinbergen^[6] further stated, "the occurrence of displacement activities is due to an excess of drive," when two drives (e.g., fight or flight) equally oppose each other^[15]. "Drive" is defined as an instinct (Sevenster, 1961) or a process "activating specific behavior patterns"^[15]. The resulting overflow of motivational energy is rechanneled or sparks over to another drive (e.g., grooming, feeding), which manifests as out-of-context behavior in the animal.

The fight-or-flight response is a cornerstone of stress research^[16]. Motivational energy accumulates in the brain to either deal with or avoid a stressful situation and this excess energy is "displaced" to another behavior (e.g., addictive behavior). Difficulty in coping with stress is significantly associated with addictive behaviors^{[17][18][19]}. The present paper hypothesizes that the displacement mechanism represents the link between stress and addiction.

Uncertainty is prevalent in precipitation of displacement activity. Anselme^[5] noted in this regard, "Uncertainty and anticipation of unpleasant events are crucial factors in the causation of displacement activities." Furthermore, Ingram^[3] stated, "movements which occur in the face of uncertainty... are irrational and purposeless." Intolerance to uncertainty has been implicated as a vulnerability factor for addictive disorders^[20].

Displacement activity seems to be irrepressible, as the behavior may oppose an animal's survival instincts. Displacement activity resembles addictive behavior, which is 1) irrepressible, such as engaging in a behavior despite significant adverse consequences; 2) contextually inappropriate, such as binge eating or drinking in response to a work-related altercation; and 3) triggered by cues, such as the memory of a pleasurable substance or driving past a drug dealer's location, alcohol store, or fast-food outlet. Hypersensitization to reward-associated cues is a characteristic of addiction development^[21].

Additionally, Tinbergen^[6] stated, "Displacement behavior is a form of defense... of the central nervous system, enabling it to 'get rid' of the surplus of motivational energy, which would otherwise damage it."

Pretlow and Glasner^[22] proposed that addiction is caused by the brain's displacement behavior mechanism "going rogue."

2.2. Displacement Activity Animal Model

Research on displacement activity in the laboratory rat has provided empirical evidence that addictive behaviors function through the displacement mechanism. Two behavioral manifestations in rats have been examined: tail-pinch behavior and scheduled-induced behavior.

2.3. Tail-pinch Behavior

Mildly placing a clamp on a rat's tail induces "irrelevant" eating, gnawing, and licking behavior in the presence of a food cue (rat chow). This is a remarkably repeatable phenomenon^[23]. Marques et al.^[24] stated, "TP [tail-pinch] behaviors may be examples of displacement activities (out-of-context)... caused by stress." Furthermore, mild tail pinches administered to rats several times daily in the presence of sweetened milk induced immediate hyperphagia and led to considerable weight gain^[25]. This may have implications for understanding eating addiction and obesity in humans.

2.4. Scheduled-induced Behavior

Falk^[26] found that food-restricted rats consumed large quantities of water where the delivery of food pellets was delayed at variable intervals. The polydipsic rats became severely overhydrated because of the substantially high ingestion rate^[27]. Schedule-induced polydipsia [SIP] is purportedly derived from thwarting conditions (sub-optimal food reinforcement rate)^[28]. Wuttke and Innis^[29] proposed that this thwarting of food consumption leads to secondary displacement activity.

Indeed, Ford^[30] stated, "SIP is one of several 'adjunctive' [or displacement] behaviors." SIP, which can generate an ethanol-dependent state and is an attractive model for studying an excessive ethanol drinking phenotype in rodents.

Wayner^[31] agreed that the Falk model of adjunctive behavior is clearly an adequate analogue of human alcoholism and can be applied to induce excessive ethanol consumption in humans. Human participants were provided ad libitum access to beer while playing a game that delivered slot machine rewards on a fixed interval schedule^[32]. Subjects exposed to a longer fixed-interval schedule drank significantly more

than those exposed to a shorter schedule, providing evidence that ethanol drinking in humans can be schedule-induced.

In this regard, Ford^[30] stated, “... consistent with the notion of adjunctive drinking as a displacement behavior, adjunctive ethanol drinking in humans suggests that humans engage in drinking as both displacement and escape behaviors and a coping strategy when faced with aversive environmental conditions.”

Similar to the model of schedule-induced ethanol consumption, schedule-induced self-injection of drugs has been demonstrated in rats^[33]. Furthermore, schedule-induced cigarette self-administration in humans has been reported^[34].

3. Examples of Addictive Displacement Activity

3.1. Smoking

With smoking, the brain may use the breathing or “sigh” drive to displace surplus motivational energy. Although smoke from burning tobacco can initially irritate the airway, taking a slow, deep breath in and out can be calming. The present paper hypothesizes that nicotine, which is addictive^[35], is a cue that suggests to the brain that slow, deep inhalation and exhalation of cigarette smoke will displace excess motivational energy. Vaping displaces in a similar manner^[36]; however, use of nicotine inhalers and lozenges does not. Accordingly, it is hypothesized that it is not the diaphragm or chest muscle movement but rather the brain’s focus on slowly and deeply inhaling, pausing, and exhaling in smoking that displaces surplus motivational energy.

A previous study has confirmed that smoking relieves stress^[37]. Furthermore, hand-to-mouth motion displacement occurs with smoking. Nicotine inhalers have the advantage of mimicking hand-to-mouth motion and double the cessation rates at 6 months compared with placebo (23% vs. 11%)^[38].

3.2. Heroin

A classic example of displacement is the experience of U.S. soldiers during the Vietnam War, in which one in five soldiers was addicted to heroin. It was feared that upon returning to the U.S., soldiers who were addicted would cause a huge heroin addiction epidemic. However, only 12% of these soldiers became re-addicted to heroin in the 3 years after leaving Vietnam^[39].

In Vietnam, the soldiers could not face the war, yet they could not avoid it. Once the soldiers were released from service, they could avoid the war; thus, their brains no longer needed to displace the situation and relentless overflow of motivational energy through heroin use. This example shows that it is not the properties of the chemical substance that causes addiction; rather, it is a combination of life situations and displacement activity.

3.3. Gambling

Gambling addiction^[40] appears to start when the thrill of a “win” or the intensity of a “near miss” suggests to the person’s brain that gambling could be used to displace excess motivational energy produced by life situations that the person cannot face or avoid. Buchanan et al.^[41], proposed that gambling is an “escape” from stress, with the cycle of gambling causing further stress. However, gambling as a displacement activity is more than an escape. Theoretically, it involves expending surplus motivational energy, which directly relieves stress. To break the gambling cycle, pathological gamblers must confront the underlying problematic situations in their lives and curb the sources of displacement.

3.4. Video Gaming

Polk^[42] proposed that video gaming may be addictive because many games involve hitting a target with a projectile and “super normal” cue stimuli. Many sports also require hitting a target with a projectile. Polk theorized that this may involve a primitive human hunting drive.

4. Implications of Displacement Theory

4.1. Addiction Compulsivity

Addictive displacement behavior, if not addressed, may become irrepressible or compulsive because: 1) addictive behavior is effective for relieving stress and thus is reinforced; 2) the stress and expended surplus motivational energy recurs if displacement is halted; 3) resisting addictive behavior is stressful, requiring more displacement; and 4) addictive behavior has significant negative consequences, which creates the additional need for displacement. These factors render addiction self-reinforcing and compulsive. Additionally, displacement activity appears to be irrepressible in animals.

4.2. Displacing the Displacement

Many authors^{[6][3][15]} have suggested that when a build-up of motivational energy that cannot discharge itself through the appropriate motor channels occurs, “such energy finds an outlet by discharging through whatever behavior is most readily available or most used in the animal’s repertoire”^[15]. Ingram^[3] stated, “hobbies... represent frustrated drives” and “hobbies can often show... the characteristics of displacement activity.” He lists human pastimes such as fishing, model making, gardening, and art creation as examples of displacement activity. Furthermore, deep breathing has been shown to decrease stress^[43]. In an animal model, wheel running has been found to attenuate intravenous cocaine self-administration in rats^[44]. Therefore, the present paper hypothesizes that if displacement behavior becomes destructive, the individual may willfully rechannel surplus motivational energy to an alternative non-destructive behavior, thereby effectively replacing the displacement. Examples include rechanneling to breathing behavior (taking slow, deep breaths), squeezing hands, and engaging in hobbies or other benign displacement activities^[3].

Participants (n = 43) in a weight loss study^[45] reported that creating distractions to help resist overeating was by far the most helpful aspect of the intervention. Upon re-examining the distraction input by the participants, the reason their distractions were so effective was that the vast majority (86%) were displacement activities that actively engaged the mind (e.g., drawing), compared with passive diversions (e.g., watching television).

4.3. Displacement Mechanism Equation

Pretlow and Glasner^[22] depicted the displacement behavior mechanism using a conceptual equation. An updated version is shown in Table 1, using examples of skin-picking and gambling addiction. In the updated equation units are included for the variables, and the source, cue, and medium terms are multiplied, as each must be nonzero to ignite the displacement mechanism. Displacement behavior involves an intense focus on the medium (e.g., skin and casinos) and peripheral cues (e.g., rough cuticles and slot machines). Ostensibly, intense focus is how the overflow of motivational energy is expended^[3].

Displacement = (Source x Cue x Medium)-Rechanneling Or, $D = (S \times C \times M) - R$		
Variable	Name	Explanation
D (behavior frequency)	Displacement	Amount of displacement behavior (e.g., degree of skin picking, excessiveness of gambling)
S (perceived stress scale)	Source	Source of displacement (e.g., stressful life situations, thwarting); acute versus chronic
C (cue-reactivity indices)	Cue	Stimuli triggering displacement (e.g., cuticle raggedness, hangnails; slot machine noise); sensitivity to cues is a factor
M (quantity, e.g., weight)	Medium	Displacement medium (e.g., skin, casinos)
R (redirection frequency)	Rechanneling	Rechanneling surplus motivational energy (e.g., deep breathing, squeezing fists, engaging in hobbies)

Table 1. Conceptual Equation of the Displacement Behavior Mechanism^[22]

Addressing displacement sources decreases the production of spillover motivational energy and causes desensitization to cues. Cue desensitization occurs because the cue term is multiplied by the source term, which is less when the displacement sources are addressed. Thus, the cue effect is reduced. Rechanneling can divert the brain's focus and surplus motivational energy to a non-destructive displacement (e.g., squeezed fists).

5. Comparison of the Displacement Mechanism Hypothesis with Existing Theories of Addiction

5.1. Reward Theories

Addiction is predominantly claimed to be caused by aberrance or hijacking of the brain's reward system (e.g., reward learning/reinforcement^[46] and reward deficiency syndrome;^[47]), particularly in substance addiction. Reward certainly is a central component underlying addictive behavior; however, the present paper hypothesizes that reward is rather the cue that triggers the displacement mechanism and addictive behavior. Moreover, hedonic pleasure only dampens the negative affect associated with stress^[48] and does not directly combat it (expend the buildup of nervous energy). Tolerance may be a faded cue response. Substance dependence may develop to supply displacement cues, particularly in the face of tolerance. Cravings may reflect the demand for cues. Furthermore, withdrawal symptoms may be due to an insufficient cue supply.

With increasing tolerance, the achievable high from an addictive behavior progressively fades. However, the displacement mechanism is reinforced with ongoing stress, which would augment and perpetuate the addiction. The displacement mechanism hypothesis thereby accounts for the progression and perpetuation of addiction despite development of tolerance. This is supported by a statement from Koob^[49]: "Addiction involves decreased brain reward and recruitment of brain stress systems." Furthermore, a popular model of alcohol use disorder (AUD) argues for a transition from reward-driven to stress-driven drinking^[20].

Addictive substances have cue effects of not only the environmental peripheral stimuli (e.g., liquor store and fast-food outlet) but also the sensation stimuli of the substance itself (e.g., alcohol "high," food taste) or the memory of it. This renders the substance cue significantly more powerful than cues in the natural environment (e.g., dirt on fur, hangnails) in triggering the displacement mechanism. Moreover, substance manufacturers concentrate cues (e.g., cocaine from coca leaves, sugar in foods). The displacement mechanism equation postulates that the displacement amount is directly proportional to cue strength and sensitivity. Therefore, stronger reward cues, such as with drugs or alcohol, are expected to amplify the cue effect and sensitivity, and trigger more severe addictive displacement behavior.

Hypersensitivity to cues develops because the displacement mechanism must expend the stress-produced overflow of motivational energy, and cue stimuli are critical for this. Hypersensitivity to cues

compensates for tolerance development. Amplification of the displacement effect by stronger cues and hypersensitivity to cues are likely additional reasons for the compulsive nature of using an addictive substance or engaging in an addictive behavior, even with tolerance occurrence.

Initially, the pleasure “high” signals to the brain that the associated behavior (e.g., gambling, drug use) might be utilized to displace stress-produced excess of drive. The displacement mechanism action then establishes the addictive behavior, along with hypersensitivity to cues, rather than the pleasure “high,” which diminishes due to tolerance development. Therefore, reward and reinforcement in addiction seem to be the release and relief of surplus motivational energy through the displacement mechanism rather than the chemical high.

The (irrepressible) displacement mechanism may explain why individuals feel compelled to binge eat or consume an alcoholic beverage for intoxication in the face of a rewarding cue yet feel substantial regret afterward. Regret would not seem to occur if it were simply a matter of reward. Thus, contrite displacement behavior appears to be responsible for regret^[22].

According to the displacement behavior equation (Table 1), particularly difficult or thwarting life situations may trigger the displacement mechanism with minimal reward cues—thereby resulting in the consumption of any readily available drug, alcoholic beverage, or food that may not be specifically sought^[45]. Similarly, highly pleasurable cues may trigger the displacement consumption of drugs, alcohol, or food in the presence of limited immediate stress. Nevertheless, displacement behavior occurs only when stress-produced overflow of motivational energy is expended. Furthermore, background stress is constantly present in modern life, including additional stress from the ravages of addictive behavior.

5.2. Incentive Sensitization Theory

The incentive sensitization theory (IST) posits that addictive substances produce long-lasting changes in the brain that cause addiction^[50]. However, whether these brain changes are the cause or the result of the addiction is unclear. Furthermore, if drugs change the brain, causing addiction, exposure would produce addiction in all individuals, which is not the case. A 2009–2011 study found that 90% of “excessive drinkers” did not qualify as having AUD, and only 1.3% of people who drink develop AUD^[51].

If long-lasting changes in the brain’s reward system perpetuate addiction vulnerability, then the soldiers of the Vietnam War would have relapsed into heroin addiction upon returning to the U.S., which largely

did not happen. Nevertheless, the hypothesis of the displacement of stress-produced motivational energy in the present paper does not fundamentally conflict with the IST regarding brain changes that cause addiction. In Vietnam veterans, avoidance of the war ended heroin addictive displacement behavior, yet knowledge of the effective displacement behavior persisted; thus, a new equivalent life stress could have resulted in relapse.

5.3. Dodes Theory

Dodes^[52] proposed that addictive behavior is a displacement of strong emotions such as helplessness. However, Dodes' concept of displacement was psychoanalytic, and he did not explore displacement activity or out-of-context behavior. Moreover, displacement activity occurs not from helplessness but rather from uncertainty regarding how to deal with a situation^{[3][5]}.

5.4. Prospero-Garcia Theory

Prospero-Garcia et al.^[53] postulated that changes in the brain caused by trauma may predispose individuals to addictive behaviors. A hypothesis in the present paper is that memories of trauma constitute a stressful life situation that may trigger the displacement mechanism and addictive behavior. Helping an individual change their perspective on the trauma memory could serve as a treatment.

6. Materials and Methods

Displacement activity occurs when opposing drives are in "exact equilibrium"^{[54][5]}. Therefore, moving the drives out of equilibrium by resolving or avoiding underlying problems or stressful situations should, theoretically, mitigate the displacement mechanism and addictive behavior. Individuals must also replace the addictive displacement activity with a non-destructive displacement activity and risk being overcome by the addictive urge if they do not give in.

An intervention was developed based on drive equilibrium theory that is adaptable to any addiction. The intervention involves 1) identification of problems or stressors that form the basis of opposing drives (displacement sources); 2) systematic problem-solving and implementation of action plans to either avoid or effectively resolve these problems or stressors; 3) rechanneling of excess motivational energy that would otherwise lead to a self-harming displacement by replacing it with benign displacement activities such as hobbies; and 4) avoidance of cues such as slot machine areas and hangnails. For sudden urges, excess of drive may be immediately rechanneled to a non-destructive behavior, such as deep breathing or

squeezing the hands, to mitigate the urge while the displacement source is identified, and a plan to address it is undertaken.

The intervention was implemented as a smartphone application. For each addiction type, only the medium (e.g., liquor, food, gambling games) and cues (e.g., liquor stores, fast food outlets, and slot machine lights) need to be changed. The app uses the mantra, “Face it... don’t displace it.” Participants enter their difficult life situations and action plans in their “dread list.” For sudden urges, the “rescue” button is available to help participants rechannel excess motivational energy while creating an action plan to deal with the precipitating situation.

6.1. Clinical Trial

A 4-month pilot trial^[55] of the smartphone app intervention is currently underway to treat eating addiction. Two standpoints are addressed:

1. Acute, substantial, eating urges associated with significantly stressful situations (e.g., bullying). Binge eating may result from this. For such urges, participants will use the rescue button.
2. Chronic, ongoing, “food noise”^[56], which is intrusive, unwanted thoughts about food. Food noise may be caused by displacement activity from background stress and is exacerbated by cues (e.g., going into the kitchen, driving past McDonald’s), which are to be avoided. Participants will identify stress sources (via their dread list), implement action plans, rechannel excess motivational energy (e.g., via walking, hobbies, etc.), and revisit their dread list and rechanneling daily.

Thirty-eight (38) youths (14–21 years old) with a body mass index (BMI) greater than the 85th percentile will be recruited through various sources (e.g., obesity clinic, flyers, and social media advertising) to participate in one of the two stages of the study: the beta testing stage or the trial stage. Participants will check in with the app daily and will receive supportive text messages and weekly phone calls from an undergraduate coach. Beta testing will enroll eight youths to test the app for three weeks. The trial stage will enroll 30 youths to participate in a four-month intervention. The study will examine engagement and satisfaction with the app, as well as the impact of the intervention on clinical outcome measures (weight and BMI and addictive behaviors related to eating). It is hypothesized that by using the app, participants will experience less food noise, cravings, and eating urges. They will decrease snacking, eat smaller portions, and lose weight without typically relying on willpower.

The study procedures were approved by the Institutional Review Board of the David Geffen School of Medicine at UCLA, Los Angeles. Written informed consent will be obtained from all the participants (and from one parent or guardian if the participant is a minor). Trials involving alcohol use disorder and smoking will follow.

The success of the intervention does not depend on completely resolving or avoiding problematic situations. It is necessary only to push the opposing drives off the exact center and initiate facing or escaping to disrupt the equilibrium.

Desensitization to cues occurs when displacement sources are addressed. Pretlow and Glasner^[22] reported that a 20-year-old woman with obesity was surprised that she was no longer tempted to turn into McDonald's or Taco Bell drive-throughs once she had created plans for addressing her difficult life situations before driving home from work. Abstinence or withdrawal from problem foods and other cues (e.g., fast-food outlets) further enhances cue desensitization^[45].

6.2. *Unlocking the Brain*

Detoxification or withdrawal from problem foods, nicotine, alcohol, and drugs is not complicated with medication assistance, although in some instances, such as during alcohol withdrawal, detoxification may be life-threatening. Nevertheless, cravings usually subside within a few days or weeks. Curbing addictive displacement behavior through problem-solving and rechanneling excess motivational energy, as described above, is also straightforward. However, reversing the brain's lock on an addictive displacement may be quite difficult because the brain never forgets an effective displacement behavior. An addiction aphorism is "You can't change a pickle back into a cucumber!"^[57]. Although ongoing vigilance in dealing with displacement sources and rechanneling surplus motivational energy can help prevent relapse, the brain's lock on the addictive displacement will persist.

For example, Pratt (personal communication, March 2024), a plastic surgeon, treated a patient with a severed thumb. Although challenging, the surgical reattachment of the thumb was a straightforward procedure; however, the patient was a heavy smoker. The surgeon informed the patient to stop smoking because it would impair the healing process. Nevertheless, the patient was unable to stop. Finally, the surgeon informed the patient that if smoking continued, there was a 100% chance that the thumb would be lost. Subsequently, the patient discontinued smoking. Therefore, to definitively unlock the brain from an addictive displacement, informing the person with absolute certainty that the displacement would not be feasible may be necessary.

One approach to unlocking the brain could be having the participant list the ways in which addiction is harmful to their life, listing the most harmful ones at the top. When an urge occurs, the participant would vividly focus on the list, or at least the top items. Over time, this could help unlock the brain from the addictive displacement or decrease its power.

6.3. *Glucagon-like Peptide-1 Receptor Agonists*

The new glucagon-like peptide-1 receptor agonists (GLP-1RAs) have been successfully used for the treatment of eating addiction and obesity^[58]. They have also been reported to decrease substance use disorders in several randomized trials^[59] and anecdotally to decrease problematic gambling, shopping addiction, nail biting, and skin picking^{[60][61][62][63]}. This implies a common etiology for these addictive behaviors. However, nail biting and skin picking are considered displacement activity^[10]. The common GLP-1RA response in nail biting, skin picking, and other addictions suggests that the etiology or a component of the other addictions may also be displacement activity.

The mechanism of action of GLP-1RAs is thought to be inhibition of the reward system of the brain^[64]. Thus, GLP-1RAs may desensitize reward cues and thereby inhibit the displacement mechanism. Also, GLP-1RAs quiet food noise, which again involves intrusive, unwanted thoughts about food. Intrusiveness is not characteristic of reward but is suggestive of displacement activity. Hence, GLP-1RAs may directly inhibit the displacement mechanism. If GLP-1RAs desensitize reward cues, quiet food noise, and inhibit the displacement mechanism, what happens if displacement is not allowed to function? An author who lost 42 pounds on a GLP-1RA^[65] stated, “I didn’t actually feel better in my emotions. If anything, I felt slightly worse. I realized how much of my eating was about the need to comfort myself — stuffing myself to calm myself. And I couldn’t do that when I was on Ozempic.”

The use of the displacement intervention app described in the Methods section of this paper, in conjunction with GLP-1RAs for the treatment of addiction, could enable 1) lower doses of GLP-1RA medications, 2) tapering off medications, and 3) treatment of non-responders. Ten (10) overweight youths on a GLP-1RA medication will be added to the eating addiction pilot trial to evaluate tapering off the medication. Participants will have a stable weight and dose for a minimum of 2 months, followed by addition of the app for 4 months, while weaning off the medication and monitoring weight.

6.4. Addiction Co-occurrence

In a study on addiction co-occurrence in a typical U.S. adult population, more than half (50.8%) of 6,000 respondents reported a problem with one or more of the examined substances or behaviors during the 12 months preceding the study. Furthermore, 21% reported problems with two or more substances or behaviors, and more than half of them reported three or more problematic behaviors^[66]. A universal treatment for addiction, as described in the present paper, would have a significant advantage as it could simultaneously treat co-occurring addictive disorders.

7. Discussion

This paper has presented evidence linking displacement activity, a behavioral response to stress observed in animals, to the mechanism underlying all forms of addiction. Addiction results from the displacement mechanism going rogue, where motivational energy from stress is redirected toward behaviors like substance abuse, gambling, eating, or nail-biting, rendering them compulsive and difficult to suppress. The displacement mechanism hypothesis accounts for the progression and perpetuation of addiction despite development of tolerance.

The displacement mechanism is triggered by reward cues, which may be items (e.g., slot machines, hangnails) or substances (e.g., drugs, junk food). Highly rewarding substances may amplify cue effect and sensitivity, displacement output, and addictive behavior. Substance dependence may develop to provide cues for the displacement mechanism.

If the displacement mechanism hypothesis is accurate and provides a unified theory of addiction, the distinction between substance-related and behavioral addictions, while still important, may be less significant. Only the cue type (e.g., substance, event) is different.

An intervention has been developed based on drive equilibrium theory, involving systematic problem-solving to curb the source of surplus motivational energy and rechannel the energy to non-destructive displacement activities. Further research is needed to a) unlock the brain from the memory of effective, albeit harmful, displacement behaviors; b) establish what constitutes healthy displacement activities; c) refine and validate the displacement mechanism equation; d) investigate human displacement activity; and e) study fMRI response to addictive images before and after a person addresses their stressful life situations.

8. Limitations

A succession of important descriptions and theoretical discussions on displacement activity, primarily in animals, appeared in the literature between 1950 and 1970^[5]. Subsequently, many studies have been conducted on animal models of displacement activity, such as tail-pinch and schedule-induced behavior in rodents. Several studies have also been conducted on schedule-induced displacement activity in humans, most notably on ethanol and cigarette use. However, much of the displacement activity literature is dated and empirical evidence is somewhat limited. Even though dated, the descriptions and discussions of displacement activity in the early literature are seminal and compelling. Researchers did not realize that displacement activity was potentially related to addiction.

9. Conclusion

Evidence supports the displacement mechanism as the basis for a unified theory of addiction. Theoretically, a universal treatment is feasible for many addictions. Perhaps the term “addiction” should be replaced by “dysfunctional displacement.” Other potential psychological repercussions of dysfunctional displacement should be investigated in the future.

Notes

Sage Author Services edited the manuscript.

Registration

The clinical trial described in the Materials and Methods section will be reported according to the Consolidated Standards of Reporting Trials (CONSORT) statement and was registered with ClinicalTrials.gov (NCT NCT05530538) on November 28, 2023.

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RP was the sole contributing author of the paper and is accountable for the content of the work.

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