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Heterogeneity in Choice Models of Addiction: The Role of Context

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Abstract

Theories of addiction guide scientific progress, funding priorities, and policy development and ultimately shape how people experiencing or recovering from addiction are perceived and treated. Choice theories of addiction are heterogenous, and different models have divergent implications. This breeds confusion among laypeople, scientists, practitioners, and policymakers and reduces the utility of robust findings that have the potential to reduce the global burden of addiction-associated harms. Here we differentiate classes of choice models and articulate a novel framing for a class of addiction models, called contextual models, which share as a first principle the influence of the environment and other contextual factors on behavior within discrete choice contexts. These models do not assume that all choice behaviors are voluntary, but instead that both proximal and distal characteristics of the choice environment--and particularly the benefits and costs of both drug use and non-drug alternatives--can influence behavior in ways that are outside of the awareness of the individual. From this perspective, addiction is neither the individual's moral failing nor an internal uncontrollable urge but rather is the result of environmental contingencies that reinforce the behavior. Contextual models have implications for guiding research, practice, and policy, including identification of novel target mechanisms while also improving existing interventions.

Theories of addiction guide scientific progress, funding priorities, and policy development. Theories ultimately influence how people experiencing or recovering from addiction are perceived and treated. Broadly, there are three predominant classes of models used to explain addiction: moral models, brain disease models, and choice models. In Western societies, moral models have been longstanding and common amongst laypeople. Moral models suggest that the ultimate responsibility for addiction is on the individual, who is in control of their actions but continues to choose the hedonism of drug taking at the expense of normative social behavior and societal contributions, and despite any harms that result from their addiction (Pickard, 2017). Brain disease models of addiction (BDMA) have been used by scientists and public health officials in part as an empirically testable alternative to the moral model, with the hopes that the stigmatization of addicted people would be reduced, and that support for research and medically informed treatment (e.g., through improved insurance coverage and reimbursement) would be increased. There are variations in terms of the psychological mechanism of action (Berridge & Robinson, 2016; Jentsch & Taylor, 1999; Koob & Le Moal, 2001; Wise & Bozarth, 1987). However, generally, the BDMA suggests that repeated drug use fundamentally and permanently changes the brain such that drug use becomes uncontrollable and compulsive (Heilig et al., 2021; Leshner, 1997). The moral and brain disease models are antithetical in that they conceptually differ on the ultimate responsibility of the addicted individual. The moral model suggests a failure of will that is assumed to be free and unconstrained, whereas the BDMA suggests a total loss of freedom of will. The BDMA suggestion that uncontrollable drug use is the result of neuroadaptations was intended to counter the notions that addicted individuals are freely choosing drug use, and by extension that they are “moral failures”.

Choice models refer to a broad collection of various theories that diverge in specifics but share the common axiomatic assumption that drug use is sensitive to principles of behaviorism. Although it is outside of the scope of the current paper to review all choice models of addiction,

choice models include those such as the Herrnstein-Prelec theory (Herrnstein & Prelec, 1992), the Becker-Murphy theory (Becker & Murphy, 1988), the Stigler-Becker theory (Stigler & Becker, 1977), relative addiction (Rachlin, 1997), Heyman's theory of choice (Heyman, 2009), molar theories of addiction (Vuchinich et al., 2023; Vuchinich & Tucker, 1983), the economon model of addiction (Negus, 2024), and modern behavioral economic theories such as reinforcer pathology (Bickel et al., 2014). Although such theories have common ancestors in the cardinal works of George Ainslie and Howard Rachlin (Ainslie, 1975; Heather & Segal, 2017; Rachlin, 1974) and are derived from behavioral theory, they vary in proposed mechanisms, assumptions, and implications. Although some variations are trivial, others mark major departures from a single cogent theory of choice.

Referring to diverse choice theories and assumptions under the banner of a single conceptual framework can breed confusion within the scientific community and among the general population. It can also impede the benefits of strong explanatory models from properly matriculating to fruition through intervention, treatment, and policy. Here, we suggest that some choice theories are contextual in nature in that the ultimate motivational forces are driven by the environmental context of behavior, rather than internal choice mechanisms or voluntary behavior. We therefore believe that they may be more usefully rebranded as contextual theories, rather than choice theories.

This rebranding of choice models to contextual choice models, with an explicit and concerted shift in emphasis, is not pedantic in nature. We argue that such a rebranding is needed, particularly as widely accepted models have been limited in terms of advancement of clinical breakthroughs, while choice models have yet to be widely and openly adopted in clinical settings despite providing the conceptual foundation for the majority of psychosocial approaches included in the suite of empirically based interventions and treatments for addiction. For example, although research has demonstrated that contingency management is efficacious and likely to reduce healthcare costs related to addiction treatment (Bolívar et al., 2021), there have

been barriers to implementation grounded in fears of fraud and misconduct (Office of Inspector General, 2020), in addition to a misunderstanding of contingency management grounded in stigma (i.e., “giving money to addicts”). Contingency management has only recently been accepted into more mainstream treatment arenas, such as the Veteran Health Affairs (DePhilippis et al., 2018), and yet barriers still persist (Scott et al., 2021).

To facilitate a discussion regarding the need for and implications of rebranding choice models as contextual choice models, we first provide an overview of various choice theories of addiction and delineate critical variations between them. We then introduce and consider a contextual approach to addiction, denote the key tenets that differentiate this approach from traditional choice models, and review research across the translational spectrum that supports this theoretical approach. Our proposed contextual classification emphasizes the role of externally contingent reinforcement processes already acknowledged in choice models but clarifies and centralizes critical nuances inherent in drug use and addiction processes that are often overlooked among laypeople, scientists, and clinicians. Finally, we discuss the scientific, clinical, and ethical benefits that may arise from reframing choice models of addiction as contextual models.

Choice Models of Addiction: Historical Perspective and Divergence

A cross-section of choice models may reveal important theoretical distinctions; however, a historical perspective illuminates that models are often nested and informed by one another and therefore share a genealogy and important commonalities. Broadly speaking, choice accounts of addiction are rooted in operant or Pavlovian behavioral conditioning traditions, particularly those that build on the matching law of molar behavioral allocation (Herrnstein, 1961, 1974). The matching law states that when an individual is faced with the choice between two or more different reinforcers, the proportion of choices for each reinforcer will be proportional to the reinforcement derived from it (Herrnstein, 1974). The matching law, though based in Skinnerian principles, was a departure from reflex-based analysis of behavior by

suggesting units of analysis are rates of behavior and reinforcement over time rather than individual acts and consequences (Herrnstein, 2000). The matching law has several important implications for addiction, including that resource allocation is useful as a measurement tool to quantify reinforcement, and that changes in reinforcement for one option in the “choice” context can influence the value of all other available options.

Over the ensuing decades following the delineation of the matching law, debate emerged amongst behavioral scientists about the behavioral processes that lead to addiction. Such debates included whether addiction occurred through local or global utility maximization (Becker & Murphy, 1988; Herrnstein & Prelec, 1992); how to explain shifts in preference (Rachlin, 1997; Stigler & Becker, 1977); and inelasticity versus elasticity of price (Rachlin, 1997; Stigler & Becker, 1977). Although the differences in the premises of these theories are interesting, we believe such theoretical disagreements have not fundamentally led to divergent *implications* as to the nature of addiction, and therefore we do not focus on such differences here. However, there are other not-so-subtle differences among these theories that do have divergent implications, as discussed below. Such differences include whether addiction is rational or irrational; voluntary or involuntary; automatic or nonautomatic.

Critical variations, inconsistencies, and points of emphasis amongst choice models have clinical implications, particularly as they pertain to interventions for substance use disorders. First, such inconsistencies can lead to a misrepresentation of approaches based in scientifically rigorous models of behaviorism as another form of the moral model. Given variation in the premises across models of choice behavior as applied to addiction, it is unsurprising that there are misunderstandings regarding the nature of choice and its role in drug use and addiction among the public, clinicians, and even among addiction scientists that do not study choice. “Choice” as a scientific term is often mistaken for choice understood colloquially. Yet, critical differences exist between scientific and colloquial definitions of choice. Colloquially, choice is an internally driven, volitional act taken to reflect free will. From a scientific perspective, choice

refers to a field of study grounded in behavioral science devoted to measuring and understanding decision making in the context of two or more options. As discussed, theories diverge in agreement across choice theories on volitional action, rational versus irrational decision making, and automatic or nonautomatic behavior. Choice models of addiction vary on a spectrum of consistency with the colloquial definition of choice. Whereas some may be more consistent, at least in the sense that addiction is considered voluntary (Heyman, 2009), others refer to a field of study grounded in behavioral science which suggests that behavior is not an internal volitional act but is strongly and systematically influenced by elements of the environment and which can take place over varying time courses (Hursh, 1984; Rachlin, 2017; Vuchinich et al., 2023).

Distinguishing A Contextual Model of Addiction

We posit that a clear delineation between “classic” choice models and models that place the emphasis on environmental determinants of volitional action, here described as contextual models, will provide clarity in classification, which will in turn lead to substantive scientific and clinical gains. Such a delineation would improve the utility of contextual models, or choice models that share contextualism as a first principle, as explanatory models of behavior related to drug taking and as the theoretical basis for clinical interventions wherein choice is subsumed as a part of the broader context. An added and important implication of this shift would be reduced moralizing about substance use and substance use disorders without needing to evoke neuropathology (brain disease) as both cause and consequence. To be clear, we are not suggesting a novel model based on novel findings, but rather are distinguishing a set of existing findings within choice models that may be best rebranded as contextual models to more effectively communicate their implications, which can be misrepresented when classified broadly as choice models by the general public.

Here we outline the central tenets of a contextual model of addiction. Behavior is systematically determined by external constraints, such as the costs and benefits of the

substance reinforcer and the presence, costs, and benefits of alternative, non-drug reinforcers (Acuff et al., 2023; Banks & Negus, 2017; Hursh, 1984; Negus, 2024; Vuchinich & Tucker, 1983). Addiction is a specific case in which local utility is maximized over global utility and therefore behavior is allocated toward the substance rather than alternatives. A contextual model articulates four mechanisms that increase the likelihood of drug use: (1) high drug reward, or “benefit”; (2) low drug constraints, or “cost”; (3) low access to/engagement with alternative, drug-free reward; and (4) high constraints on alternative, drug-free activities.

Whereas these findings supporting contextual influences are now generally accepted, early preclinical research found inconsistent associations between constraints and behavioral output. Hursh (1980, 1984) discovered that behavioral outcomes were influenced not only by cost constraints, but also through characteristics of the experimental design. For example, patterns of behavioral output for food differ when rats have access to food outside of experiential sessions compared to when food is only available during experimental sessions (Catania & Reynolds, 1968). The collection of characteristics of an environment that influence behavior are commonly known as the “economy”, which can be either open or closed depending on the level of independence between the schedule of reinforcement and consumption of the commodity (Hursh, 1984). In a perfectly closed economy, consumption of a commodity is a direct function of the organism’s interaction with the schedule of reinforcement; and receipt of the reward is only possible through engagement with the schedule of reinforcement. An open economy may be defined as experimental arrangements that provide a measure of independence between daily consumption and schedule of reinforcement for a single commodity. This may be accomplished by introducing a concurrently available reinforcer, in which case behavior is dependent upon the relationship between the two reinforcers. In a choice context with two reinforcers, commodities available concurrently can either be independent, or serve as either complements or substitutes. Commodities are independent when changes in the price of choice A has no influence on the price of choice B (e.g., alcohol

and ketchup). Two commodities are complements when consumption of choice B decreases as the price for choice A increases, and vice versa (e.g., coffee and creamer). Two commodities are substitutes when consumption of choice B increases as the price for choice A increases, and vice versa (e.g., coffee and tea). These are common forms of relationships between commodities when constraints on any one commodity are introduced. These models are useful for understanding decisions between using substances and engaging in other behaviors. For example, there may be some classes of activities that have complementary associations with alcohol use (spending time with friends, attending football games), other classes of activities that serve as substitutes for alcohol use (preparing for an exam or attending religious services), and other classes of activities that may have an independent association with alcohol use (reading, taking a shower).

Although the effect of various economies on behavior is not well studied, particularly among humans, the aforementioned data demonstrate a critical differentiation between *proximal causation* and *distal causation*. Proximal causation is analogous to causation as defined by David Hume in his Treatise of Human Nature, published in 1739 (Hume, 2000), where he argues three characteristics are necessary to achieve causation: (1) contiguity in space, (2) priority (the cause must come prior to the effect), and (3) constant conjunction (the same cause must always produce the same effect). Although useful and necessary, an analysis of proximal causation is unable to account for distal experimental arrangements that interact with behavioral allocation and would therefore provide only a partial truth as to the effect of a specific constraint on behavior. Distal causation requires an analysis of the characteristics of the economic system in addition to the pattern of the interaction of behavior and constraints over time.

Even though an individual's behavior is sensitive to constraints, that does not automatically equate to voluntary behavior and "rational" decision making, and in fact the effect of distal contextual influences on behavior supports an interpretation that behavior is not always voluntary. Although economic principles are useful for explaining addiction among humans, they

are equally useful at explaining behavior among pre-conscious animals, and therefore utility maximization by any account does not automatically imply conscious decision making or volition. This is in direct contradiction to other, recent choice models of addiction that are derived from the same research yet come to the conclusion that these systematic influences of the choice environment, even within animal models, are indicative of voluntary behavior (Heyman, 2009, 2021, 2023). We are in the camp of quiet determinists and we believe that the matching law suggests that external factors determine behavior, which is likely more consistent with the argument that at least some behavior is involuntary (Strickland & Smith, 2021). This does not mean that the involuntary nature of behavior should be attributed fully to the brain, but rather to the influence of the environment. This contextual framework of addiction is consistent with data spanning the translational spectrum, from basic animal and human science to intervention and public health level data, suggesting that behavior systematically changes because of variations in the choice context (Alexander et al., 1981; Augier et al., 2018; Carroll, 1996, 2021; Ginsburg & Lamb, 2018; Kristjansson et al., 2016; Lamb & Ginsburg, 2018; Vuchinich & Tucker, 1983). This framework is also consistent with the generally accepted notion that environmental contexts modulate the behavioral effects of drugs (Badiani & Robinson, 2004; Kelsey et al., 1990; Marchant et al., 2019; Robinson, 1998; Siegel, 1976; Siegel & MacRae, 1984).

By shifting the emphasis from choice to the context in which decision-making and behavior occur, there stands to be gained not only more scientific coherence across disciplines concerned with studying drug use and addiction, but also a more accurate public perception wherein choice is less likely to be conflated with morality and, ideally, more likely to be associated with environmental determinants of behavior and the outcomes of behavior. We suggest that a contextual choice model centralizes many of the benefits that the classical choice model offers while avoiding many of the disadvantages. A contextual model can demonstrate why addiction is neither the individual's moral failing nor an internal uncontrollable urge but

rather is the result of environmental contingencies that reinforce the behavior. These environmental contingencies are often not ones that people have the power to influence or change (e.g., the community one is born into). More optimistically, some environmental contingencies can be changed by policy and practices, therefore placing the onus on systems in which the individual interacts to create conditions that optimize the capacities needed for decision-making as well as maximizing the availability of non-drug choices. In this way, a contextual model retains the explanatory and predictive power of choice models, while placing greater emphasis on conditions that reinforce behavior.

We emphasize that a contextual model does not negate the influence of individual differences (e.g., genes, traits) or the neurobiological effects of chronic drug use on the likelihood of developing an addiction. In fact, these observations can be readily reconciled with a contextual model. For example, drug-induced neuroadaptations that increase the incentive value of the drug, or diminish enjoyment gained from non-drug reinforcement (see Heilig et al., 2021) would be expected to influence behavioral allocation. Similarly, individual differences that increase the risk for developing addiction have been identified across the translational spectrum (e.g., Augier et al., 2018; Zilverstand et al., 2018). But the extent to which these individual differences are expressed or can influence behavioral allocation is constrained by the environmental context, which determines what sources of drug and alternative reinforcement are immediately accessible or accessible in the future. We revisit this point below.

Individual and Societal Benefits of a Contextualized Model

Various conceptualizations of addiction have typically emphasized either the drug, the person (psychological state, genetics), or the environment as relevant to the disorder's emergence and persistence. We acknowledge the futility of cleanly and rigidly differentiating theories of addiction. In reality, and as discussed in recent papers surrounding updated conceptualizations of the BDMA, many factors, including biology, drug characteristics, and the environment, interact to create the phenomenon of addiction (Heilig et al., 2021). Yet, highly

simplified conceptualizations of addiction are typically what become communicated to the public and clinicians and, ultimately, to patients enrolled in drug treatment and their families. Such oversimplifications, which often emphasize the role of neuropathology, rather than the role of the environmental determinants, results in attributions of blame, responsibility, and chronic illness. In turn, this influences attitudes towards and treatment of people who use drugs, funding priorities, and targets for intervention. However else a patient may present, the now built-in assumption is that with respect to drug-taking despite adverse consequences, that the patient should be considered to have a chronic neurobiological disorder which would persist even in a drug-free environment.

It is our view that misunderstandings and misrepresentations of choice models weaken the impact of research that could improve clinical care and increase stigma associated with drug use and addiction (i.e., increasing individual blame). A contextual framing would ameliorate these issues and would be scientifically, clinically, and culturally superior, and we believe this consilient framework can generate top-down policy level interventions targeting epidemiological trends in addition to bottom-up person-level approaches that would reduce the burdens of substance use through intervention, treatment, or recovery support services. Complementary “trickle down” and “trickle up” approaches informed by the same framework may have additive or multiplicative effects on reducing the harms of addiction. Below we highlight some benefits of a contextual framing of choice models at both the level of the individual and society.

Benefits of a Contextualized Model at the Level of the Individual

At the level of the individual, a contextual model may enhance treatment and recovery support services in three ways. First, by evaluating existing strategies commonly used in treatment and recovery; second, by identifying the behavioral processes that interfere with treatment or recovery engagement; third, by identifying novel, untested treatment mechanisms and evaluating their efficacy. Most directly, a contextual model may be applied to the development or modification of interventions whose ultimate goal is to change behavior. It is

often easy to forget that at the most fundamental level, the prevention or treatment of addiction is grounded in an attempt to modify behavior within the context in which those behaviors occur.

As reviewed above, a contextual model scaffolds five malleable process-based mechanisms, typically at least one of which are targeted by existing approaches to treatment and recovery: (1) reduce the drug reward (benefit); (2) increase the drug constraints (cost); (3) increase the alternative, drug-free reward (benefit); (4) reduce the alternative, drug-free constraints (cost); and (5) manipulate characteristics of the economy. In theory, future mechanisms of behavior change research could be structured around this model with the intention to diminish the value of the substance while simultaneously increasing the value of alternatives (Banks & Negus, 2017). Whereas many established interventions focus on the first or second mechanism (particularly those approaches not derived from behavioral economics), the contextual model explicitly articulates a novel, evidence-based mechanism (i.e., the context) to reduce substance use. Importantly, intervention and treatment approaches do not exclusively influence one factor at a time, a point not often considered. For example, it is common to encourage patients to stay away from friends, locations, or activities that were formerly associated with substance use. The intention is to eliminate risky situations that may increase cue exposure and return to use. However, these friends, locations, or activities may also contain drug-free rewards. For example, drug-using partners may also be social supports, confidants, romantic partners, or childhood friends. Creating distance may reduce risky situations but may also reduce access to elements of the relationships, locations, or activities that represent important alternative reinforcement. Ultimately, these approaches may be less effective unless paired simultaneously with a strategy that also increases access to rewarding alternatives.

Another example, common among both counselors and families of those experiencing addiction, is the strategy of “tough love”. Those who use this approach refuse to “enable” the addicted individual by providing services or supports essential to recovery processes, in some cases housing, treatment, social contact, or emotional support. Such “tough love” can often be

accompanied by mandated treatment, or harsh and critical service provision often provided in the absence of informed consent (Smith, 2022; Walker et al., 2005). Acquisition of respect or essential resources is typically contingent upon fulfilling recovery milestones, often decided without input from the addicted individual. Oftentimes, the return of support is contingent on total abstinence. Although well meaning, a contextual theory would argue that in many cases this would be expected to backfire. This is because drug-related reinforcement is partially determined by the availability and enjoyment of alternative reinforcement, and the “tough love” approach diminishes reinforcement from non-drug sources, thereby inadvertently increasing the overall value of the drug reward. For example, an emerging adult who is kicked out of his home by his mother (who believes he “needs to hit rock bottom”, a common phrase among the advocates of “tough love”) may have no other place to sleep other than the couch of the friend whom he uses drugs with. Even among those ready to make a serious recovery attempt, this approach may harm more than it helps. Studies support non-drinking-specific social factors that appear to predict better recovery outcomes, including being part of a cohesive, active/recreational family unit that does not argue frequently, a strong marriage prior to treatment, and having relationships that, in general, communicate respect and worth to the individual (McCrady, 2004). At the level of the clinician, lack of care, respect, or support as perceived by the patient are among the most common reasons for discontinuing treatment (Laudet et al., 2009). Alternatively, patients are more likely to positively perceive treatment when clinicians are respectful, caring, available, and collaborative in the recovery process (Nordfjærn et al., 2010). Indeed, the therapeutic alliance is consistently among the strongest predictors of treatment engagement (Ilgen et al., 2006; Meier et al., 2005, 2006; van Benthem et al., 2020).

Consistent with recent addiction philosophy (Pickard, 2017), a contextual perspective taken in clinical practice may reduce blame and stigma while also increasing hope by introducing manipulable environmental factors. The moral model of addiction suggests that the individual retains full decision capability yet continues to use despite harms to self and others

because the individual has selfishly chosen hedonism. From the perspective of the moral model, the individual technically retains full blame, but also full agency over their behavior and may change whenever they choose. Many traditional choice conceptualizations, either in reality or as perceived by the lay public, also communicate this perspective. The BDMA was initially introduced, in part, to replace the dominant moral model and reduce the stigma of blame. From the perspective of the BDMA, drug use causes neurochemical changes in the brain that result in compulsive drug-seeking behavior that cannot be controlled by the individual. From this perspective, agency is lost, and addiction is viewed as a chronic neuropathology that can be managed, but not cured. Models of decision-making in addiction that are grounded in contextual models (e.g. Field et al., 2020) provide a useful alternative because they provide a mechanism that explains how contextual factors bias decision-making in favor of drug use. We have speculated that mechanisms of action of psychosocial treatments might include indirect targeting and compensation of these distortions in decision-making, ultimately equipping people with the skills needed to exert greater control over their drug use when allowed by the context (see Field et al., 2020).

Regarding stigma, research suggests that operationalizing drug-related impairment as a brain disease reduces stigma of blame, yet increases prognostic stigma, whereas referring to drug-related impairment as a drug problem resulted in higher perceived prognostic optimism and lower perceived danger, but greater stigma of blame (Kelly et al., 2021). This study importantly distinguishes different forms of stigma and demonstrates that our popular models of addiction may serve different goals. Such a perspective represents a major advancement in understanding models of stigma in addiction, yet no model tested could optimally reduce all stigma (Pickard, 2017, 2022).

However, the models tested in Kelly et al. (2021) are not the only options. Consider the following two factors on a continuum, illustrated in the 2 x 2 square in Figure 1 that illustrates

the interaction between mechanism of action (internal and external) and ultimate responsibility (voluntary and involuntary).

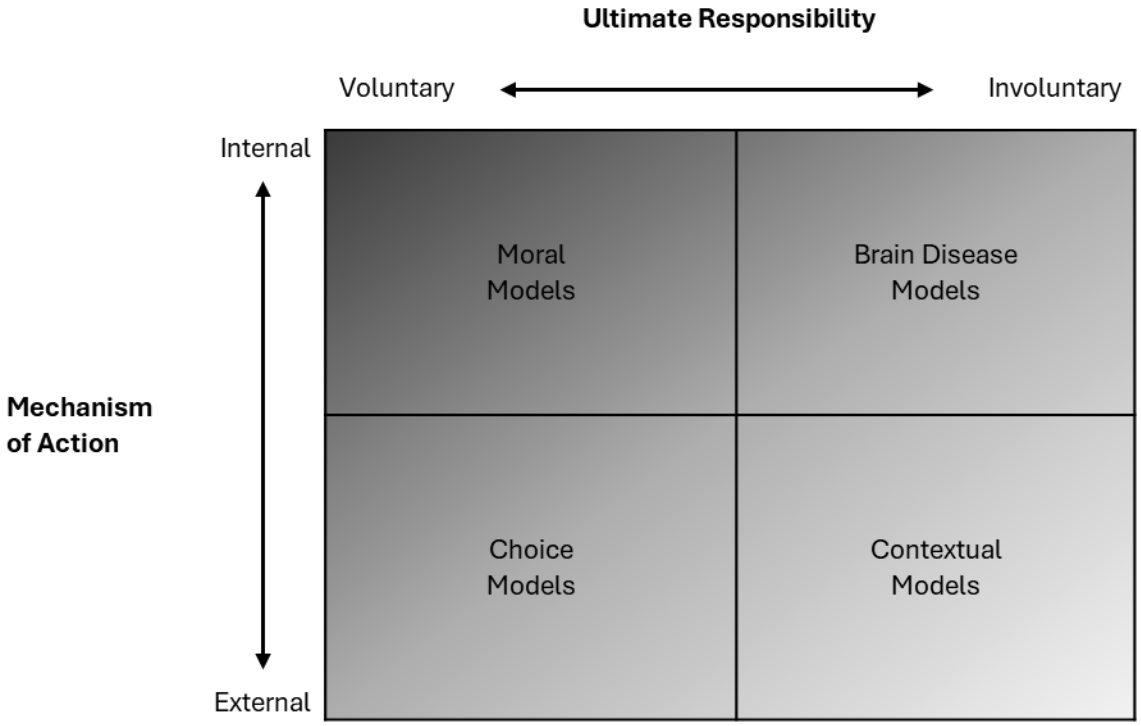

Figure 1. Models of addiction as approximately classified across the continuums of mechanism of action and ultimate responsibility.

The BDMA supports an internal, neurobiological mechanism leading to the conclusion that drug use is involuntary, given the neurobiological impact of persistent substance use resulting in compulsive, uncontrollable use. The moral model also claims an internal mechanism of action but claims drug use is voluntary. Some choice conceptualizations, as described earlier, use behaviorally grounded theory emphasizing environmental factors to explain drug use but also claim drug use is voluntary. By contrast, the contextual model suggests that external factors in the environment shape behavior and therefore drug use cannot be considered as fully "voluntary". The full factorial model has not been evaluated, but we hypothesize that the contextual model may be associated with both the lowest stigma of blame and prognostic stigma relative to other models.

Increased awareness of the contextual model may improve the uptake of existing evidence-based treatments. For example, contingency management is an evidence-based treatment underutilized partly due to the stigma of blame and “tough love” inherent in moral models. These approaches are also inadvertently undercut by investments made in BDMA framing to clinicians, patients, and the public rather than understanding drug use as a set of behaviors which can be modified through increasing the availability of nondrug rewards. Importantly, the contextual model may be implemented in tandem with pharmacotherapies, many of which may work by reducing the expected value of the addictive substance. Helping patients to understand how context influences choice and behavior may help to provide them with greater awareness of and insight into situations that contributed to the development of their addiction (cf. Field et al., 2020). Critically, such framing of addiction as contextual and dynamic, rather than as a chronic relapsing brain disease or a moral failing, permits the possibility that self-stigma can be decreased, and self-efficacy increased. Even in instances where a patient cannot control or change external factors implicated in their addiction, recognition of the influence of these environmental conditions may help to reduce shame, guilt, and other states which can contribute to negative affect and continued use. A contextual framing of addiction to patients can also readily underscore that change is possible in a way that is not offered in the BDMA.

Most addiction treatments tend to focus on reducing drug value, increasing awareness of the processes that lead to increases in drug value, or exerting self-control in moments in which drug value is elevated. However, the contextual model suggests that interventions that increase value of non-drug alternatives may be equally or more effective than interventions targeting the addictive substance. Several novel intervention approaches including the Substance-free Activity Session (SFAS; Murphy et al., 2019) and Life Enhancement Treatment for Substance Use (LETS ACT; Daughters et al., 2016) attempt to reduce substance use by introducing and bolstering competitive and meaningful alternative rewards. Pharmacological approaches could

likewise be used to target increasing non-drug rewards. To date, promising pharmacological interventions are marked by their ability to reduce drug-related indices of motivation and reward, such as craving or responding on drug self-administration assays or other measures of drug use motivation (e.g., drug purchase tasks). However, reward or engagement with non-drug alternatives independent of the impact on drug reward is seldom considered a valuable clinical endpoint. Pharmacotherapies focused on increasing non-drug, meaningful rewards may be a fruitful line of research in the future (Banks & Negus, 2017). Other behavioral treatments aiming to increase the automaticity of choice of non-drug rewards have also recently been developed and target similar mechanisms, consistent with contextual frameworks (Wiers et al., 2020). Other recent evidence suggests that indices relevant to non-drug reinforcement are robust predictors of return to use in early recovery, over and above other known and established predictors (Acuff et al., 2024). Incorporation of such measures into treatment programs may improve prediction of outcomes and guide treatment.

Finally, there is increasing interest in personalized medicine, which may deliver significant advances in clinical care. However, failing to account for the impact of the environment may reduce the efficacy and utility of such approaches. In other words, while studies begin to ask which interventions or pharmacotherapies works for whom, we must also recognize the relevance of when, where, and under which circumstances which interventions work for whom. This will become increasingly important as our interventions move from large-packaged treatment protocols to briefer, process-based treatments, and as we begin to consider momentary level interventions such as Just-In-Time Adaptive Interventions (JITAIs). The emergence and increased promotion of ambulatory JITAIs for behavioral change reflects the understanding that individual context is critical for determining risk probability and when to intervene (Perski et al., 2022). In other words, a contextual model for addiction is consistent with the trending technological zeitgeist.

In sum, we believe that a contextual model would result in messages from society and practitioners to people experiencing addiction that convey greater understanding, less inclination for punishing the individual, and greater inclination for adopting systems-level changes to the contexts in which addictions develop and persist. As a result, those experiencing addiction may be less stigmatized, but also less likely to internalize stigma and more likely to discuss their drug use and to seek treatment. They may also be more motivated to make changes to their environment, to the extent that they are able, if it can be conveyed that in doing so there is an improved prognosis. These are empirical questions that can be investigated and are falsifiable, and therefore provide heretofore unexplored avenues of scientific inquiry.

Benefits of a Contextual Model at the Level of the Society

As noted above, there are mezzo and macro factors affecting availability of alternatives (and, as a result, the relative value of drugs to the individual) such as those at the level of policy, that an individual cannot readily alter, nor can they radically influence the characteristics of their own choice economies. This also includes people in the micro environment who serve to support or discourage ongoing substance use or movement toward reduction and recovery (Negus, 2024). This top-down constraint on the availability of alternatives inevitably influences the relative value of a drug to an individual (Witkiewitz & Tucker, 2024). The contextual model asserts that some of the onus must be shifted off individuals and onto the societal policies responsible for the distribution of access to opportunities and available choices, including treatment. When scaled to consider its implications at the mezzo- or macro-level systems, a contextual model may improve addiction services by helping explain existing epidemiological trends and by guiding policy development. These have benefits at the level of the person and in the aggregate as reflected by a society which seeks to understand and foster the conditions necessary for improving choice economies (Negus, 2024).

Large-scale policy and socioecological factors influence prevalence rates of addiction across the population. Current models of addiction cannot explain such shifting epidemiological

trends in substance use, harm, and disorder prevalence. Although not explicitly guided by behavioral science, public health data support the contextual premise that greater availability and engagement in alternatives reduces the risk of harmful substance use. Research suggests that individuals who experience homelessness, poverty, unemployment, and/or lower educational attainment bear a disproportionate burden of alcohol-related health and social consequences, including alcohol-related mortality (Mulia et al., 2014, 2018; Probst et al., 2015). Although other factors are implicated, evidence supports the idea that economic and opportunistic scarcity (i.e., an environment lacking alternative reinforcers), are partly responsible. Individuals from lower SES backgrounds are more likely to work and reside in environments with fewer alternative sources of reward and resources to cope with stress, higher density of alcohol retail outlets, and aggressive alcohol advertising campaigns (Brenner et al., 2015; Hogarth, 2022; Romley et al., 2007). One large study of teens found that the longitudinal association between lower parental socioeconomic status and increased risk for drug use is mediated by lower levels of engagement in enjoyable substance-free activities (Lee et al., 2018). Other research on youth suggests that stress and poverty increase delayed reward discounting, in part via impairment in working memory, which may contribute to preference for drug-related rewards (Oshri et al., 2019). Indeed, neurocircuitry involved in motivational reward anticipation may be blunted among children living in neighborhoods with greater deprivation of natural rewards (Mullins et al., 2020). Economic and opportunistic scarcity has been particularly prevalent for Black/African American populations in the U.S., who are more vulnerable to the harms of drugs and alcohol (even after controlling for use) in part due to policies that segregate and impoverish the Black community (Rothstein, 2017), and, most notably, incarcerate Black males for drug-related crimes as part of the broader War on Drugs.

Variability in rates of county-level drug-related mortality provide another illustration of the public health implication of the importance of alternatives and demonstrate the impact of U.S. policy, in addition to economic recession, on drug and alcohol related harms. Data from the U.S.

Centers for Disease Control and Prevention Multiple-Cause of Death Files (2006–2015) suggest that drug-related deaths are not equally distributed across the U.S. but instead are regionally concentrated (Monnat, 2018). Drug overdose deaths from 2006-2015 were most likely in Appalachia, Oklahoma, the Northeast, and New Mexico, but less likely in the Midwest and the South (Knapp et al., 2019). Alcohol overdose deaths were more likely in the West, with rates particularly high among Native American/American Indian populations (Knapp et al., 2019).

Although drug supply is a factor, it does not explain the mortality in these counties. For example, counties with large Native American/American Indian populations in New Mexico and Oklahoma had greater overdose rates from 2006-2015 (Monnat, 2018), even though these counties often had comparable or lower rates of overprescribing to surrounding counties throughout the opioid epidemic (Center for Disease Control and Prevention, 2017). Although data suggest opioid prescribing rates are important, this between-county variability is further explained by economic and social characteristics associated with diminished access to reward and opportunity. Greater economic, housing, and family distress are associated with higher drug-related mortality, whereas a greater number of religious establishments is associated with the converse. The colonization and genocide of Native Americans during U.S. Western expansion, and present-day disenfranchisement of Native American peoples, has resulted in a systematic lack of educational and occupational opportunities, deprivation of alternative rewards, and, in many cases, the disintegration of traditional Native American culture. In the case of Appalachia and the Northeast, critical industries have recently seen a large decline that previously supported the regions economically. In many cases, this has led to a lack of availability of meaningful work and decreased financial resources to attain important critical resources, such as healthcare, in addition to alternative substance-free reinforcement that is not necessarily critical but life enhancing and which may make the difference in whether someone might use drugs (e.g., hobbies, outdoor green spaces, and travel/leisure). Surges in “deaths of despair” related to substance use among otherwise historically privileged populations (e.g.,

White males) exemplifies how much context, and changes in one's choice landscape, can influence the relative rewarding value of substances.

The contextual model provides clear recommendations for policy makers interested in reducing the burden of addiction. Funding devoted to increasing availability of alternatives on a large scale may be a fruitful avenue for prevention (Kristjansson et al., 2019). Further, widespread educational curriculum in public school settings and elsewhere could be revised to include a better understanding of contextual influences. Standard, punitive drug education approaches such as DARE are still predominant, yet peer reviewed, rigorous studies repeatedly refute their effectiveness (Lynam et al., 2009; Rosenbaum et al., 1994; West & O'Neal, 2004). Widespread educational programs founded on a contextual model would be more scientifically accurate and nuanced thus introducing opportunities for harm reduction approaches in addition to a focus on assisting youth in finding substance-free activities and values that matter to them.

Regarding treatment, approaches that target and change the contingencies in the environment, or that emphasize and increase substance-free alternatives, are also likely to be effective; yet some of these approaches are not reimbursed by insurance in the United States. In countries such as the United Kingdom, a novel approach coined "social prescribing" has been developed to link patients with sources of community support in order to improve health and well-being (South et al., 2008). Although more systematic research is necessary to determine clinical and cost effectiveness (Bickerdike et al., 2017), these creative ideas are aligned with the contextual approach and should be studied more closely. More generally, detailed policy analysis from the contextual perspective to specifically understand how policies impact the cost-benefit ratio of alternatives, or recovery-supportive activities or commodities, in addition to the cost-benefit ratio of substance use, may uncover more specific and situational recommendations that shift the cost-benefit analysis in favor of substance-free activity engagement.

Acknowledging that context matters as a determinant of behavior may also guide policy development that supports shifts in public perceptions of addiction away from those that reduce available opportunities of people experiencing addiction and that favor excessive punitive force. This framework would favor viewpoints maximizing recovery success by optimizing the balancing between costs of drugs and availability of valuable and competitive alternatives. In the U.S., increasing costs of drug use (financial in addition to other costs) through supply-side efforts has been the most common solution to reduce drug use on both a personal and public health level. Such increases, both through taxation and some forms of modest punitive punishment, appear to be associated with modest reduction in use. However, costs have also been increased by federally prohibiting use and distribution of illicit drugs, and the resulting punishment often directly interferes with access to the potential for robust alternative rewards that effectively compete with substance use. Those who have committed criminal offenses in the U.S. lose myriad rights and avenues to civic, economic, and social engagement, thus temporarily, if not permanently, limiting the landscape of available nondrug alternatives and a means to a conventional, fully franchised life. We recommend revisiting criminal justice practices to include the introduction of rewards to reinforce prosocial, recovery-oriented behaviors of people who are criminally justice involved and who use substances, and to adjust the criminal justice pipeline to facilitate greater social contact and exposure to alternative activities that scaffold a future as an engaging and productive member of society.

The tenability and success of more balanced approaches, which include both increasing costs of use as well as increasing the availability of nondrug alternatives, while also changing the broader environment, have been demonstrated through active policies over the past few decades. In the 1990s, Icelandic teenagers reported very high rates of substance misuse, with 42% of tenth graders reporting having been drunk within the past month (Sigfusdottir et al., 2008). Accordingly, Iceland implemented a population-level prevention approach to reduce substance misuse among youth (Kristjansson et al., 2019) that entailed increasing costs of

substance use (e.g., national media campaigns discouraging smoking; positive peer influence campaign to discourage smoking; national tobacco and alcohol advertising ban) while increasing access to alternatives (e.g., increased participation in organized youth activities) (Kristjansson et al., 2010). Rates of substance use among Icelandic teens plummeted from 1997 to 2014, while there were simultaneous increases in prevention factors targeted by the Icelandic Model, such as parental monitoring and engagement in organized sports (Kristjansson et al., 2016). As a result, Iceland was the only country among 36 European countries participating in the European School Survey Project on Alcohol and Other Drugs (ESPAD) that demonstrated consistent declines in substance use among teenagers (Hibell et al., 2012).

It is, in some ways, low-hanging fruit to develop such nuanced policies with respect to youth and prevention. Policies focused on youth may be most readily influenced by the contextual model in that they are less controversial (e.g., prevention rather than treatment) and targeted at youth not yet stigmatized as “addicts.” Such preventative policies with few barriers to public support are ideal places to begin demonstrating how context can shape substance use behaviors. We should be reminded that these are empirical questions, and the effectiveness of such policies can be measured. However, there must be a public willingness to develop and evaluate policies that seek to improve the environment in which all substance use decisions are made and in which interventions based on punishment and reward are developed to address addiction.

Ultimately, benefits of the contextual model at the level of the individual and at the level of society will only be realized if this approach is rigorously tested and refined. For scientists, we recommend continual development and refinement of methods to quantify access to, engagement in and valuation of substance-free reinforcement (Acuff et al., 2019), such as brief self-report measures (Acuff et al., 2024) or forced choice measures that yield data that can be modelled using computational models of value-based decision-making (Copeland et al., 2023). Further, research should continue to investigate ways to increase substance-free reinforcement,

in addition to quantifying effects of changes in substance-free reinforcement on substance use behavior. Scientists also have the responsibility to measure and test the effects of policy changes on epidemiological trends in substance use. Finally, scientists should test the hypothesis that the contextual framing will both reduce stigma and prognostic pessimism.

Rebranding choice models as contextual, we believe, will provide a scientific consilience for behavioral economic approaches to studying addiction, but also across disciplines concerned with studying drug use, addiction, and recovery processes. By placing the emphasis on context with this approach in studying, treating, and crafting policies for substance use and addiction, no explanatory power is lost; rather, what is gained is a more complete picture of choice and a more exculpatory one, in which the person choosing to use substances is not blamed or stigmatized for behaviors that can be explained by environmental contingencies. Importantly, and quite powerfully, these contingencies can be changed, if perhaps not always by the individual, by a collective recognition that context matters.

Conclusion

We reviewed how models of addiction shape funding priorities for research and clinical practice, and how they inform clinical and public perception of people experiencing addiction. Choice models, grounded in behavioral theories, are heterogeneous. Differences among such models have bred confusion that may prevent findings from translating into practice and greater cultural awareness. In some cases, choice models have been conflated with moral models, making them less appealing to those seeking to de-stigmatize addiction. In reviewing the heterogeneity of choice models and how they may be misunderstood, we determined that a contextual model can better highlight the external influence of the environment on choice behavior and explicate decisions related to drug-taking that otherwise are now largely explained in public and clinical discourse by the BDMA which, we posit, have unintended harms. The class of choice theories better classified as contextual in nature that we suggest should be adopted by

researchers and clinicians is differentiated from those choice theories that frame behavior as fully or consciously voluntary. With a contextual model, choice can be studied and intervened upon without gross oversimplifications inherent to moral or disease models and may also help shift the burden away from understanding addiction as only the problem of the individual. Rather, a contextual model forces researchers, clinicians, and policy makers to recognize that behavior is reinforced by the presence or absence of contingencies which can be manipulated if there is the collective will to do so.

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